The Effect of Universal Pre-kindergarten on Female Labor Force Participation - A Synthetic Control Approach

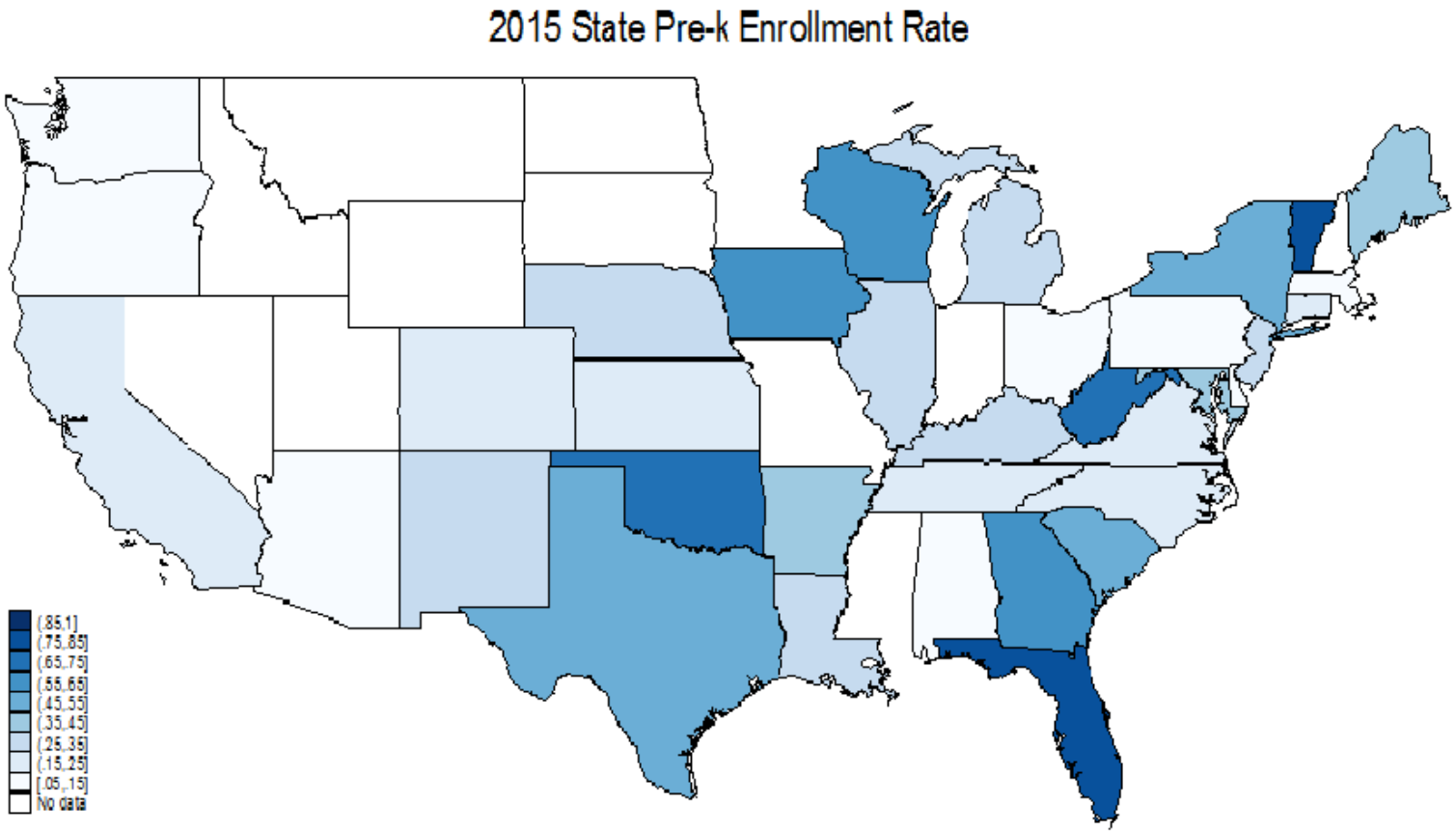
Hao Li

Southern Methodist University
Department of Economics

Background

- Universal Pre-k Policy
  - Free to all pre-k aged children
  - Pre-k age: 4 years old, or even younger
  - Early movement: Georgia (1995), Oklahoma (1998), Florida (2005), and Illinois (2006), etc.
- Oklahoma institutional background
  - Teachers are required to have college degrees and certificates in early education
  - Group size is set at 20 and child to staff ratio is 10 to 1
  - A total spend of $7,427 per child ($3,490 per child in Georgia)
  - High enrollment rate
- Research question: what is the effect of a high quality universal pre-k program on maternal labor market decisions?

Background



Data Source: National Institute for Early Education Research

Motivation

- Expansion of early childhood education policy
  - Traditional public pre-k $\rightarrow$ Universal pre-k
  - Previous evidence shows positive effects of the kindergarten expansion on maternal labor supply (Gelbach, 2002; Cascio, 2009)
- Childcare and maternal welfare
  - Decreasing maternal labor force participation rate in the recent decades (Cohany and Sok, 2007)
  - Existing literature focuses extensively on child outcomes (Heckman et. al., 2010; Gormley and Gayer, 2004; Fitzpatrick, 2008).
  - They generally find positive effects on child outcomes, but little is known about maternal labor supply.

Related Literature

- Universal childcare and maternal labor supply - mixed results
  - Postive effect: Canada (Gruber and Milligan, 2008); Israel (Schlosser, 2005)
  - Insignificant effect: Sweden (Lundin et al. 2008)
  - Conditionally significant: US (Cascio and Schanzenbach 2013; Fitzpatrick, 2010)
- This paper:
  - Focuses on high-quality universal pre-k
  - Examines multiple labor force participation outcomes
  - Improves on methodology by constructing a close counterfactural

Model

Suppose a mother maximizes her utility based on the following model,

$$\max_{X,H} \; U(X, Q, L) \tag{1}$$

$$s.t. \; X + P_m H = WH + Y \tag{2}$$

$$H + L = T \tag{3}$$

$$Q = \frac{H}{T} Q_m + \frac{T - H}{T} Q_h \tag{4}$$

Assumptions:

- Mothers spend all leisure time on childcare at home.
- Mothers have to send their children to childcare if they choose to work.
- $Q_m = \alpha Q_h$ and $0 < \alpha < 1$.

Notations:

- T - total time endowment; H - working hours; X - consumption
- Q - average childcare; $Q_m(Q_h)$ - quality of market (home) childcare
- P_m - price of market pre-k; W - wage rate; Y - non-labor income

Model

- Rewrite Equation (2), we have
$$X = (W - P_m)H + Y = \tilde{W}H + Y \tag{5}$$
where $\tilde{W}$ is the hourly wage rate net of market pre-k cost.
- Equation (4) follows Michalopoulos et al. (1992). Rewrite Equation (4), we have
$$\begin{aligned} Q &= \frac{H}{T}\alpha Q_h + \frac{T-H}{T}Q_h \\ &= [1-(1-\alpha)\frac{H}{T}]Q_h \end{aligned} \tag{6}$$
- Let D denote the working decision of the mother, where $D = 1$ if the mother chooses to work and $D = 0$ if the mother chooses to stay at home. Therefore we have,
$$D = \begin{cases} 1 & \text{if } U|_{H>0,X=X^*,Q=Q^*} - U|_{H=0,X=Y,Q=Q_m} > 0 \\ 0 & \text{otherwise} \end{cases}$$

Model Suggestions

- Extensive Margin
  - $P_m \downarrow \Rightarrow$ net wage rate $\tilde{W} \uparrow \Rightarrow \tilde{W} \geq$ reservation wage rate W^*
  - $Q_m \uparrow \Rightarrow \alpha \uparrow \Rightarrow MU_{Q_h} \downarrow \Rightarrow$ expected wage rate $W^* \downarrow \Rightarrow \tilde{W} \geq$ reservation wage rate W^*
- Intensive Margin
  - $P_m \downarrow \Rightarrow$ net wage rate $\tilde{W} \uparrow \Rightarrow$ substitution effect $+$ income effect $=$?
  - $Q_m \uparrow \Rightarrow \alpha \uparrow \Rightarrow MU_{Q_h} \downarrow \Rightarrow$ the mother will allocate more time to H

Empirical Strategy - The Synthetic Control Method

- The synthetic control method is an empirical strategy to construct a missing counterfactual that can closely match the treated unit in the pre-intervention period
  - Introduced by Abadie and Gardeazabal (2003) and developed by Abadie et al. (2010)
  - Similar to diff-in-diff but with weaker assumptions and only one treated observation
- The "synthetic" control group

$$\sum_{s=2}^{S+1} \omega_s Y_{st} = \delta_t + \theta_{\mathbf{t}} \sum_{s=2}^{S+1} \omega_s \mathbf{Z_s} + \lambda_{\mathbf{t}} \sum_{s=2}^{S+1} \omega_s \mu_{\mathbf{s}} + \sum_{s=2}^{S+1} \omega_s \varepsilon_{st}$$

Empirical Strategy - The Synthetic Control Method

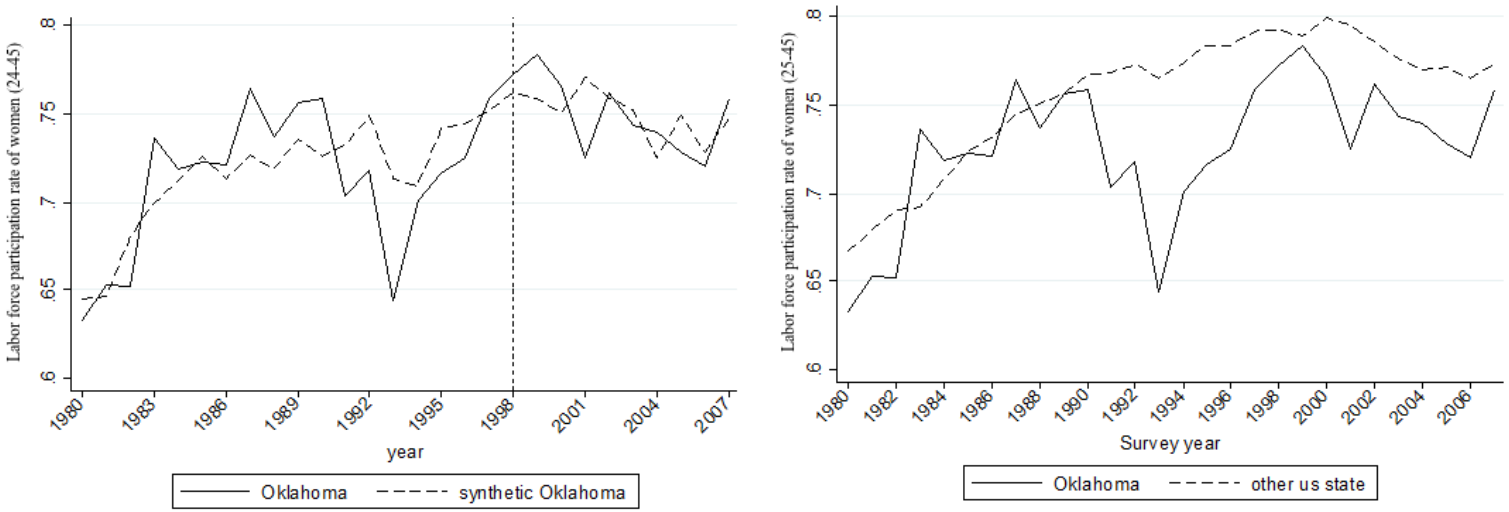
- Assumption 1 (A1): (No anticipation effects) The intervention has no effect on the outcome before the implementation period $t \in \{1, \ldots T_0\}$.
- Assumption 2 (A2): (No interference on untreated units) There is no interference between treated and untreated states, the outcomes of the untreated states are not affected by the intervention implemented in the treatment state.
- Let $\alpha_{it} = Y_{it}^I - Y_{it}^N$ denote the treatment effect for state i and year t, The observed outcome for state i is $Y_{it} = Y_{it}^N + \alpha_{it} D_{it}$, and I will estimate $(\alpha_{1\,T_0+1}, \ldots, \alpha_{1\,T})$.

Data

- Data Source: Current Population Survey (CPS) aggregated in state level
- Time Period: 1980-2007 (intervention year: 1998)
- Outcome of Interest: Labor statistics of women aged 25 to 45
- Set of explanatory variables
  - Economic characteristics: family income, education level, family size, marital status, etc.
  - Demographic characteristics : race, sex, age
  - State level characteristics: GDP (BEA), previous years' female labor force participation rates

Main Results

Figure: Synthetic Control Method vs. Simple Average of the Rest of the U.S. States



The Synthetic Control Group

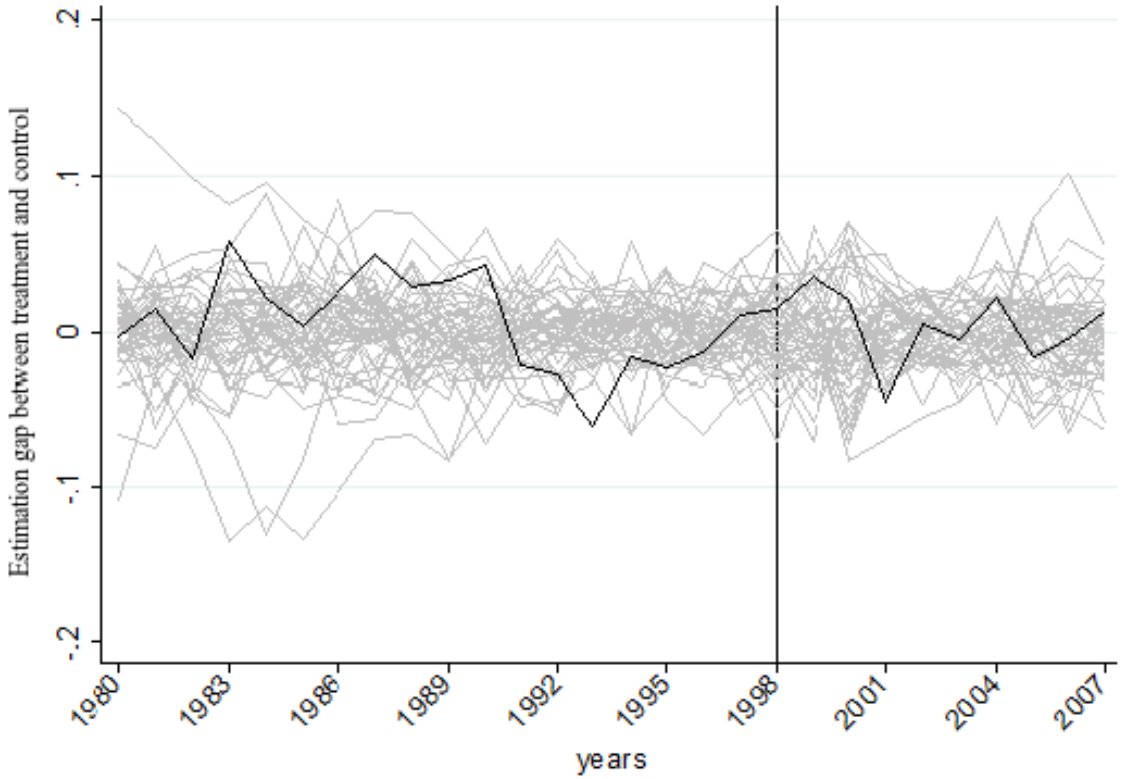
Table 3. Weights in the Synthetic Control Group

State	Weight	State	Weight
Alabama	0	Montana	0
Alaska	0	Nebraska	0
Arizona	0	Nevada	0.272
Arkansas	0	New Hampshire	0
California	0	New Jersey	0.071
Colorado	0	New Mexico	0.063
Connecticut	0	New York	0
Delaware	0	North Carolina	0
District of Columbia	0	North Dakota	0
Florida	0	Ohio	0
Hawaii	0	Oregon	0
Idaho	0	Pennsylvania	0
Illinois	0	Rhode Island	0
Indiana	0	South Carolina	0.114
Iowa	0	South Dakota	0
Kansas	0.043	Tennessee	0
Kentucky	0.087	Texas	0.05
Louisiana	0.297	Utah	0
Maine	0	Vermont	0
Maryland	0	Virginia	0
Massachusetts	0	Washington	0
Michigan	0	West Virginia	0
Minnesota	0	Wisconsin	0
Mississippi	0	Wyoming	0
Missouri	0		

Note: Georgia is not included in this table of weights. Since Georgia universal pre-k starts in 1995, including Georgia in this analysis violates Assumption 2 of the synthetic control framework.

Placebo Test

Figure: Placebo Test on Universal Pre-k Effect



Main Results & Explanations

- No statistically significant effects of universal pre-k on labor force participation rate, employment rate, working hours, proportion of full-time labor market participates
- The results are robust for mothers with 4-year-olds only
- Explanations
  - Utility loss from not staying with their young children is large.
  - Price elasticity of female labor supply is not as large as before (Blau and Kahn, 2007; Heim, 2007).
  - Most mothers from poor families work before universal pre-k (84%) because of the existence of other free public pre-k programs (e.g. Head Start).
  - Families may choose to have more children since the cost of childcare is much lower.

Heterogeneous Treatment Effects

- Is there any stronger effect on the "disadvantaged" mothers?
- What is the effect of universal pre-k policy on mothers from relatively richer families?
- Sub-sample:
  - Marital status: married & unmarried
  - Education: lower than high school & high school & college and above
  - Family income: below the poverty line & above the poverty line
  - Child age: younger than 5 years old & no younger than 5 years old
  - Race: White & Non-white
- Again, there is no statistically significant effect of universal pre-k on the sub-samples.

Conclusion

- The empirical findings suggest high-quality Oklahoma universal pre-k has little effect on labor force participation rates of women aged 25 to 45.
- No significant effects on employment rate, working hours and percentage of full-time labor participation.
- There is little long-run effect for sub-samples either.
- In conclusion, universal pre-k may have a strong effect on school performance of pre-k aged children, but not necessarily on mother's labor market decisions even for a high quality universal pre-k state.
- These results suggest further studies on the efficiency of universal pre-k policy.