

Child care costs and stagnating female labor force participation in the US

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Topic

(Referring to a family in Minnesota)

“Basic childcare for Jack and Henry costs more than their mortgage, and almost as much as a year at the University of Minnesota.”

Barack Obama

State of the Union address 2015

Research Question

- Motivation
 - very expensive child care price in the US
 - The mean full-time monthly costs are about \$1000
 - The costs seem *rising* (e.g., Child Care Aware of America)
 - The female labor force participation rate is now decreasing (69% in 1985 → 76% in 2000 → 73% in 2015)
- Questions
 - the basic trend of child care markets in the US?
 - driving force changing the child care market?
 - implications for female labor supply
 - evaluation of child care market policy?

Summary

- Fact finding: child care price \uparrow & hours \downarrow since the mid-1990s
- Significant impacts on the female labor supply (about 50% of \downarrow)
- A puzzle
 - expanding child care subsidies since the mid-1990s
 - positive demand effect \rightarrow price \downarrow , but price \uparrow ??
 - *Minnesota* style explanation of the child care subsidy
 - backfire: negative supply side effect
 - many childcare workers are also working mothers.
The childcare subsidies might distort their incentives

Outline

1. Facts: childcare market in the U.S.
2. childcare subsidy \rightarrow price \uparrow , evidence
3. childcare subsidy \rightarrow price \uparrow , simple model and numerical exercise

(optional)

4. price \uparrow \rightarrow household behavior, by life-cycle model
5. another factor: childcare regulation \rightarrow price, by diff-in-diff estimation

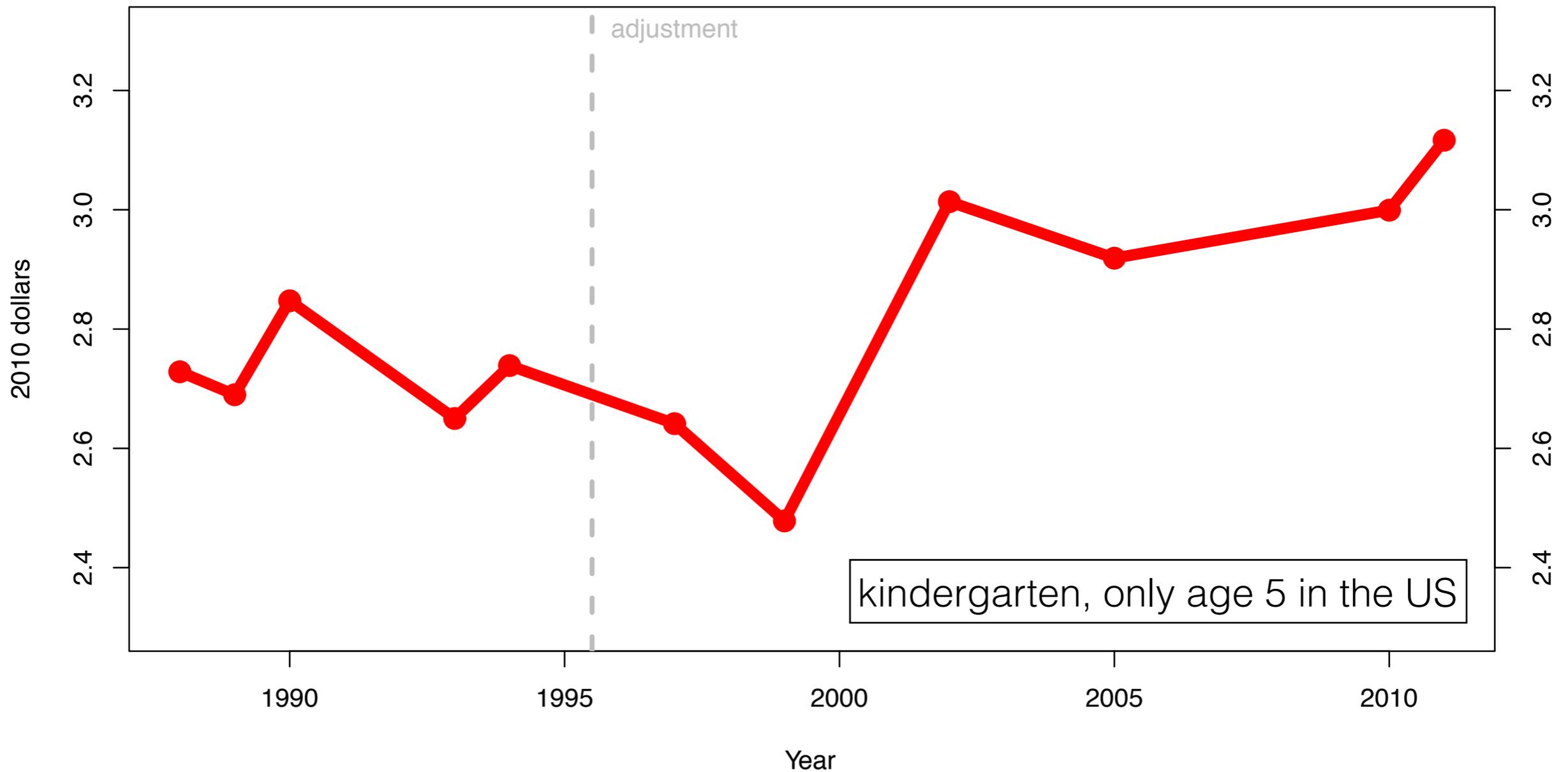
The trend of the childcare market

1. Facts

- Two existing studies: Census Bureau reports & Herbst (2015)
 - No estimates on quantity, hours of childcare
 - What I want: Hourly price = childcare expenditure / hours
- This paper: hourly price
- Survey of Income and Program Participation (SIPP), child care topical module
 - One survey per a few years, in 1988-2011.
 - About 1000 sample of working mothers with small children
- Inconsistency between 1994-1997 —> adjusted

Average real hourly child care price, age < 5

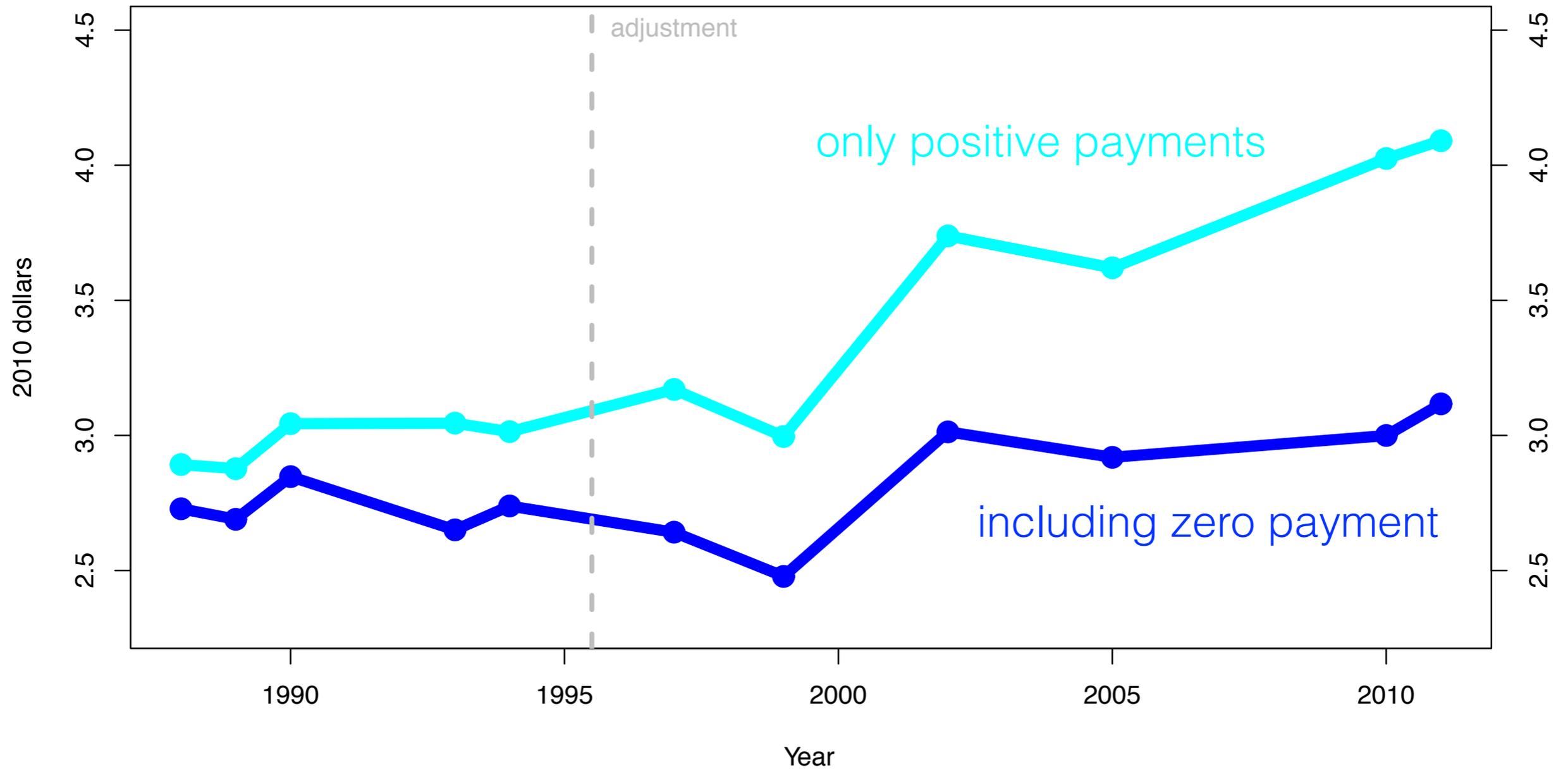
- Questionnaire: “How much did you pay?”
 - consumer (net) price



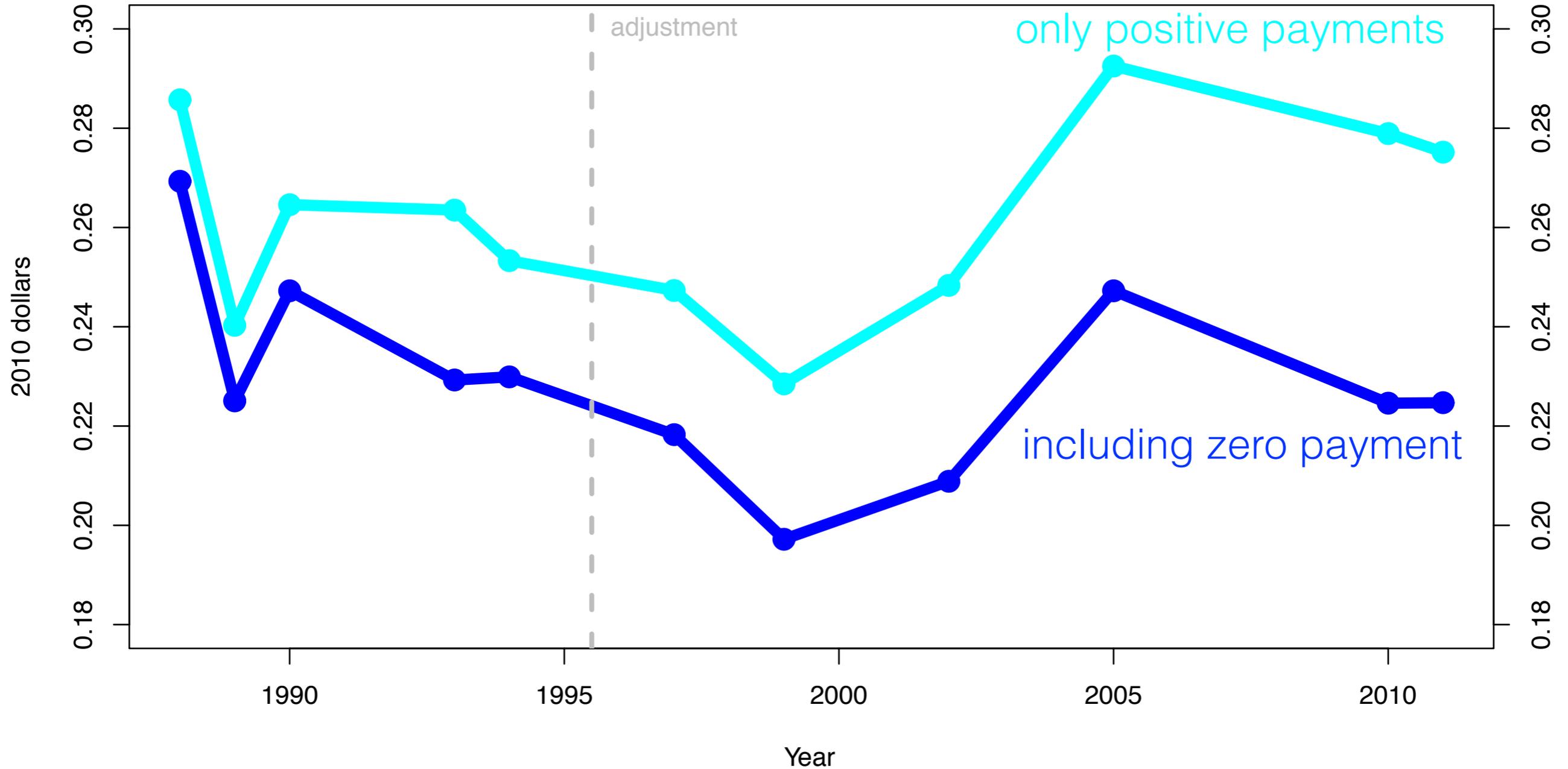
- Including: daycare, nursery/preschool, family day care, nanny and baby sitter.
- Excluding: kindergarten, before/after school, paid for family/relative

Real mean hourly child care price, age < 5

- Excluding no payment (close to the gross price)



Hourly costs / mother's hourly wage

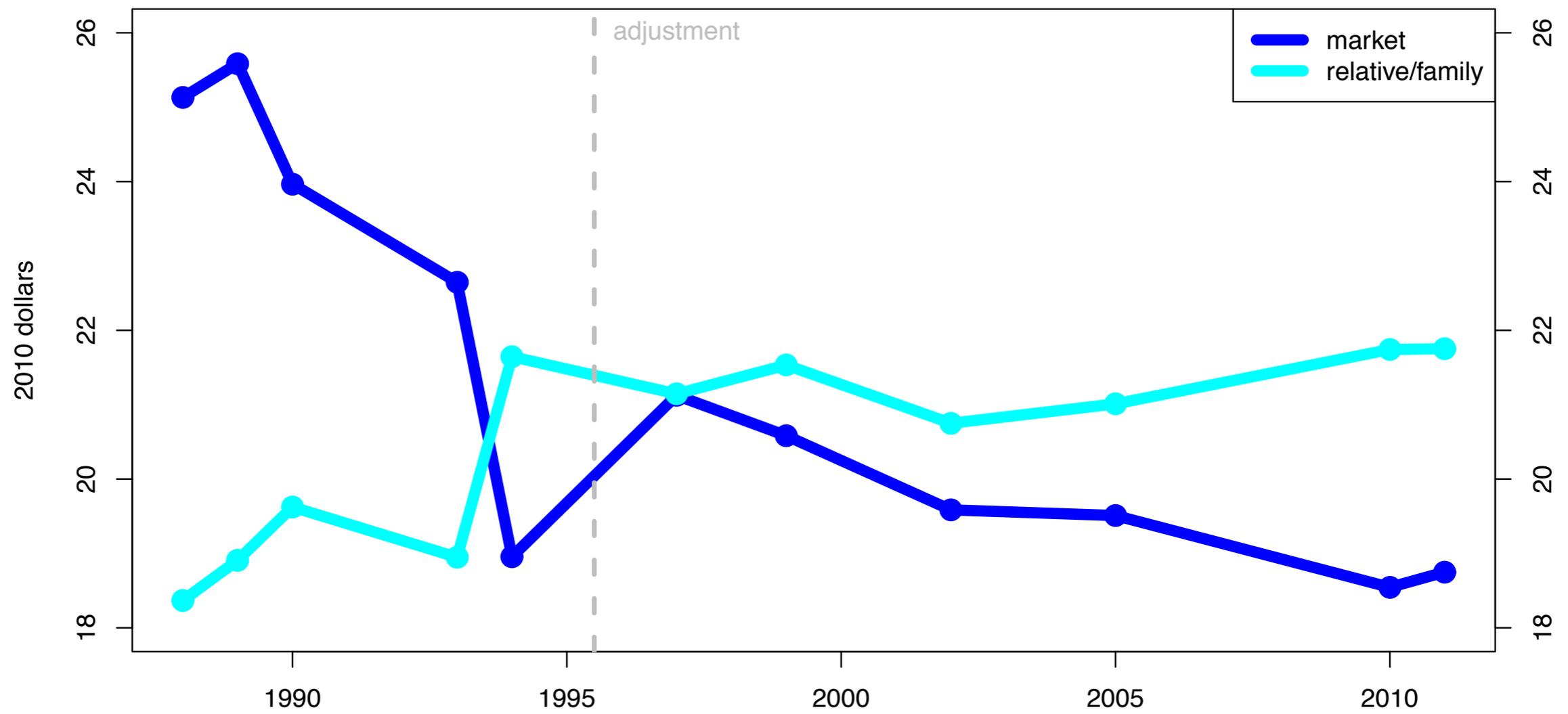


- Directly affect's mother's labor supply decisions
- U-shape: wage \uparrow first \rightarrow child care price \uparrow next

Mean weekly hours of child care

1. Facts

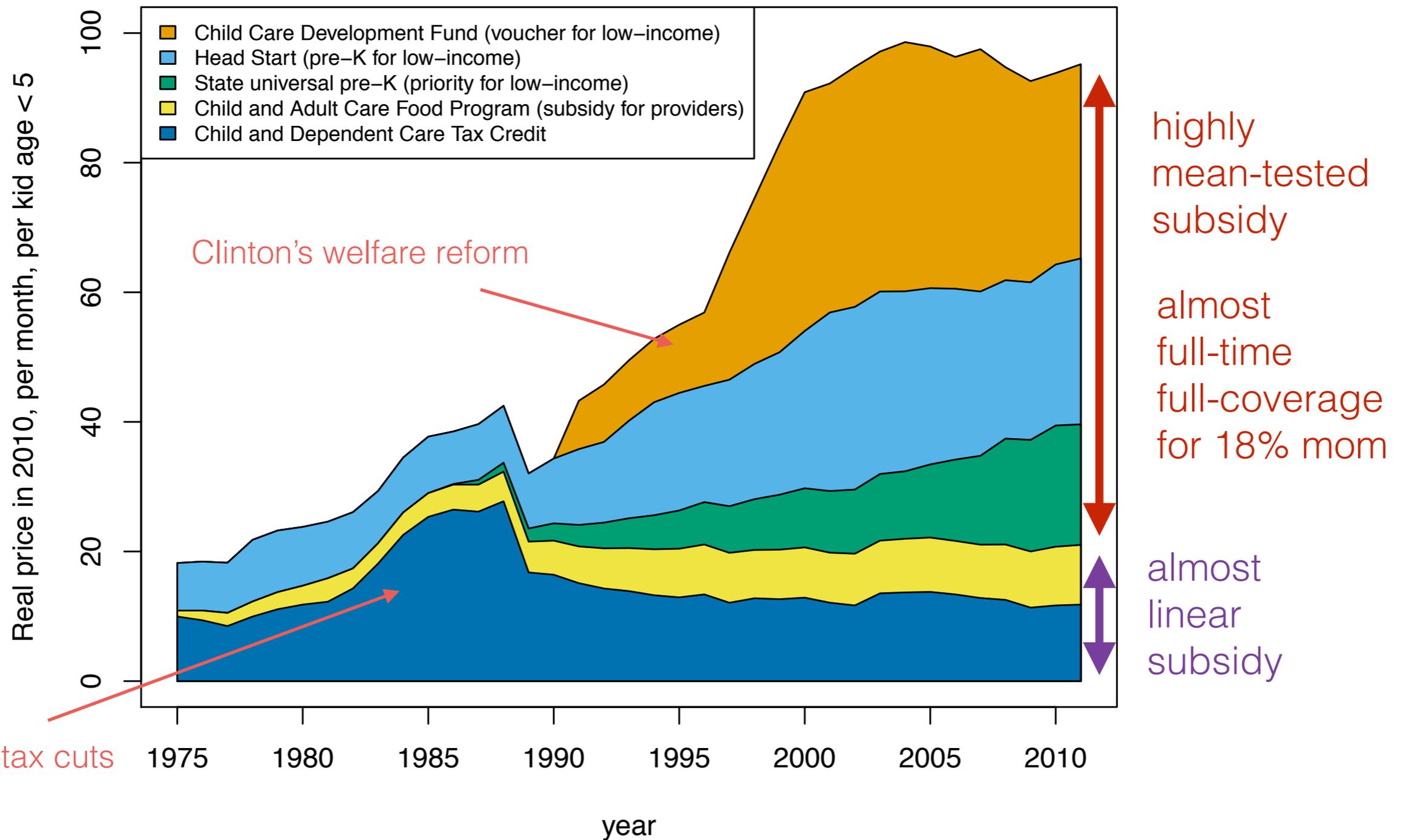
- Market care: paid care by daycare center or non-relative
- Non-market care: non-paid care by relative and family



- Mean hours, all working mothers, # kids not adjusted

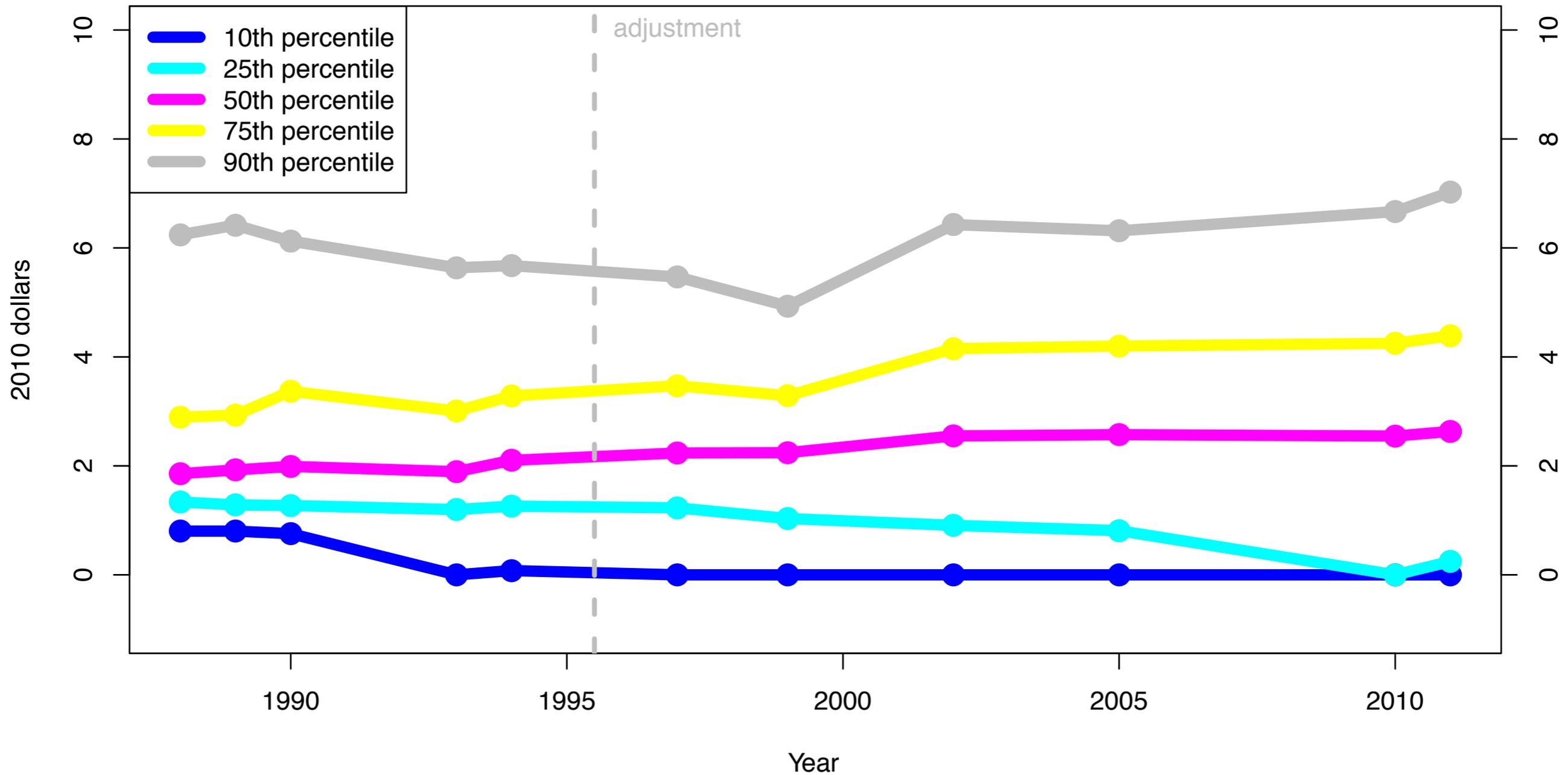
Expansion of child care subsidies

1. Facts

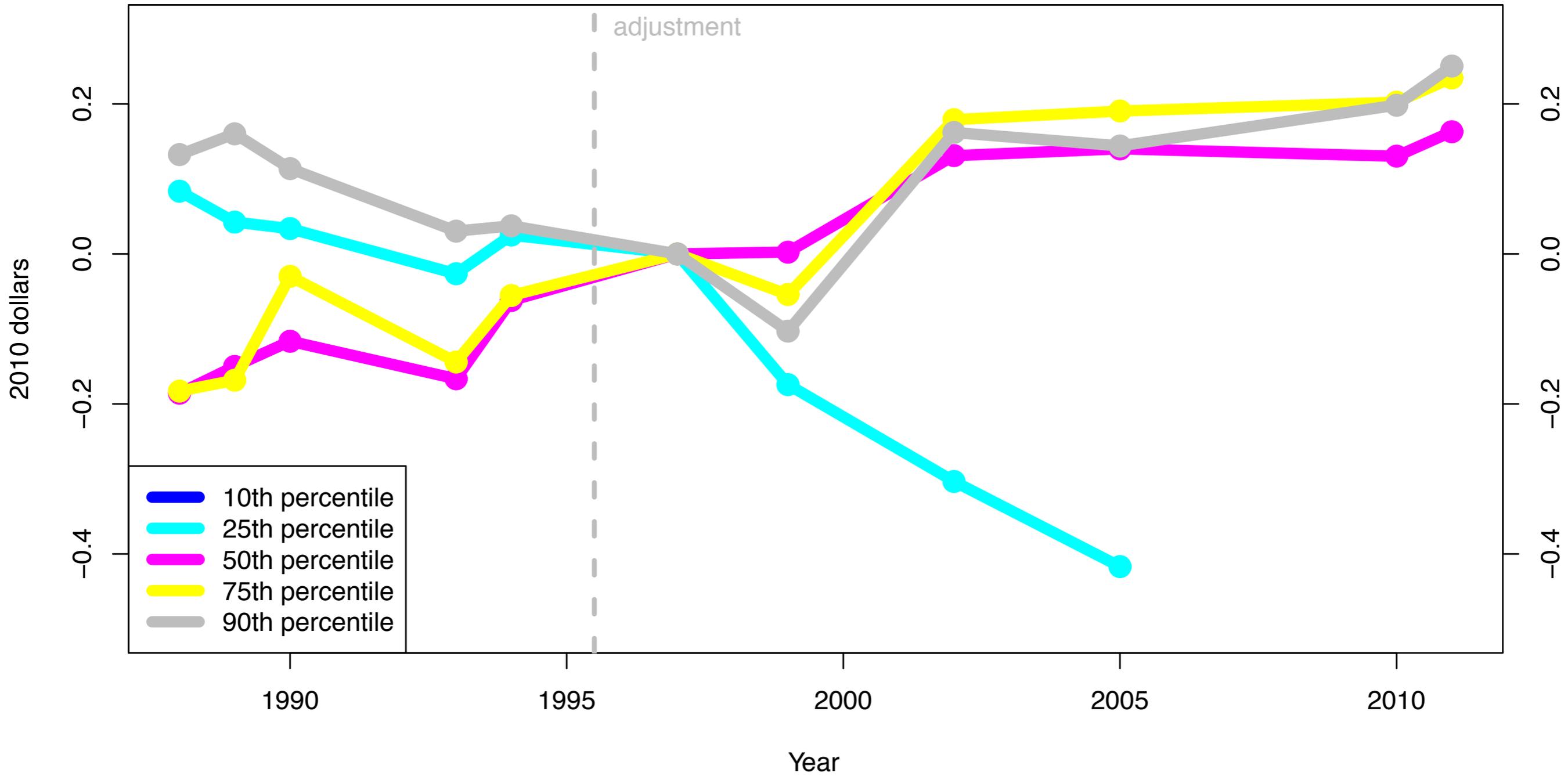


- child care price ↑ is a puzzle?

The distribution of hourly child care price

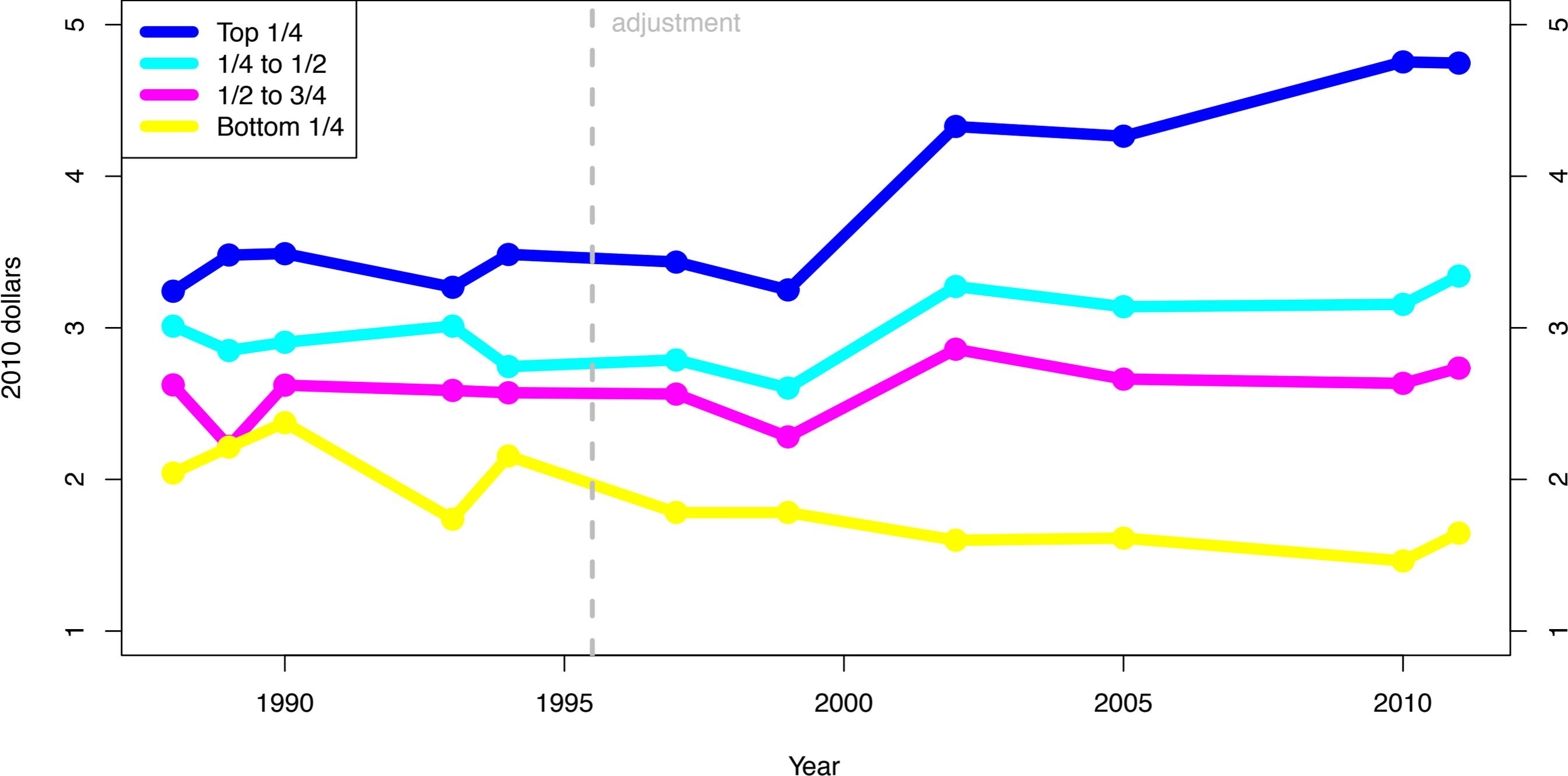


The distribution of hourly child care price



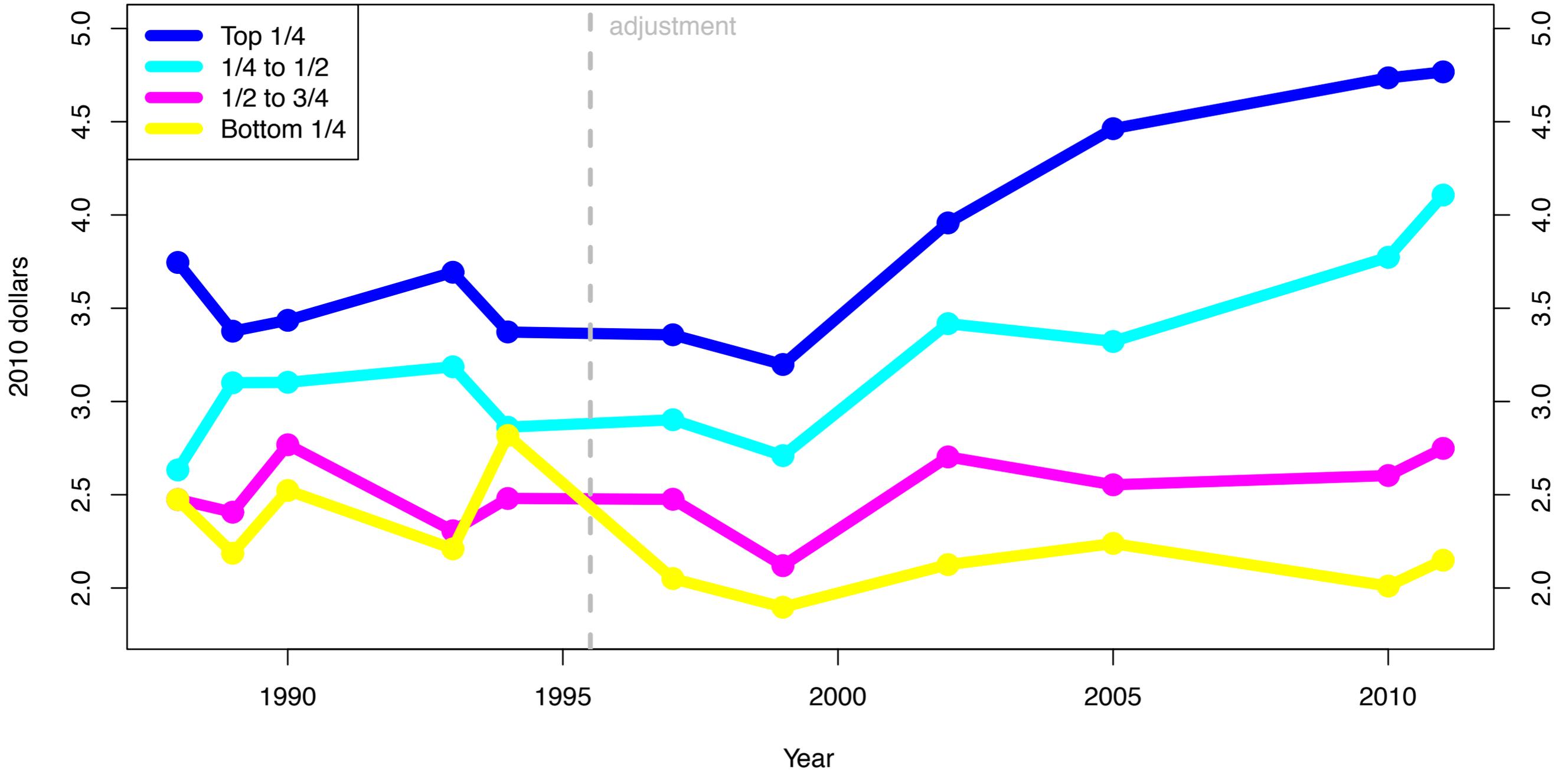
Mean price by family income

1. Facts



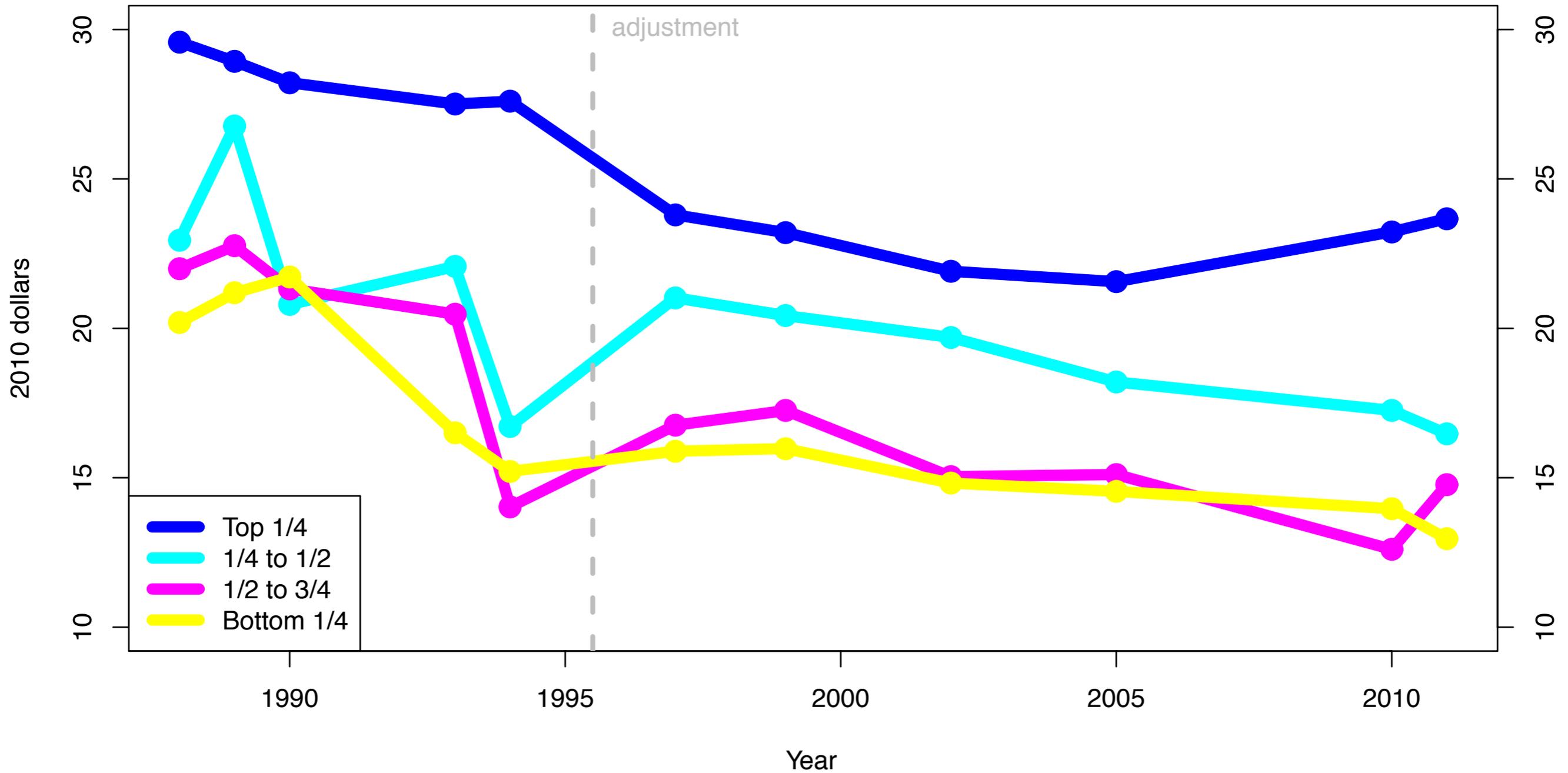
Mean price by mother's hourly wage

1. Facts

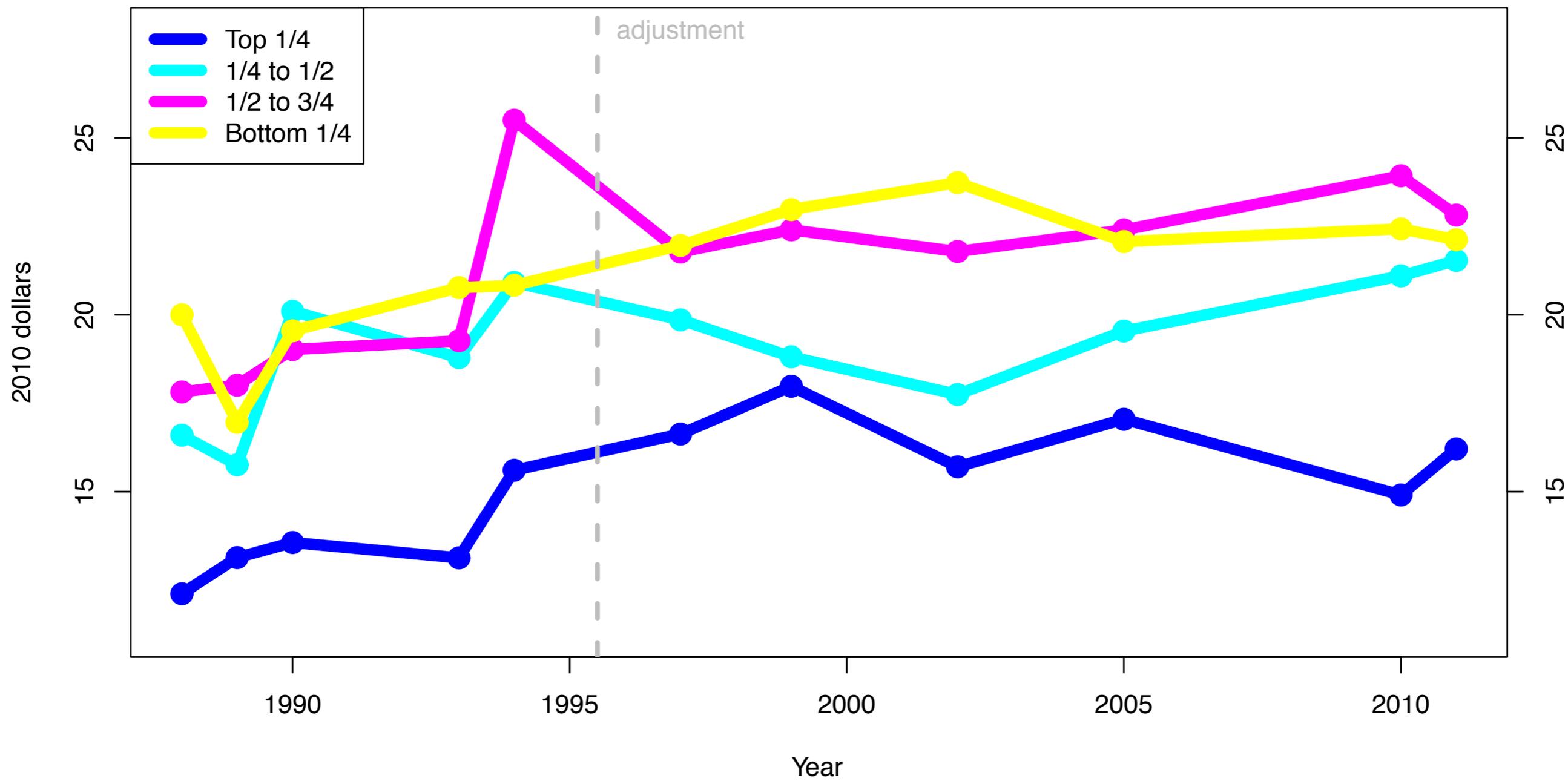


Mean hours of market care by family income

1. Facts



Mean hours of family/relative care by family income



Puzzle? child care subsidy ↑

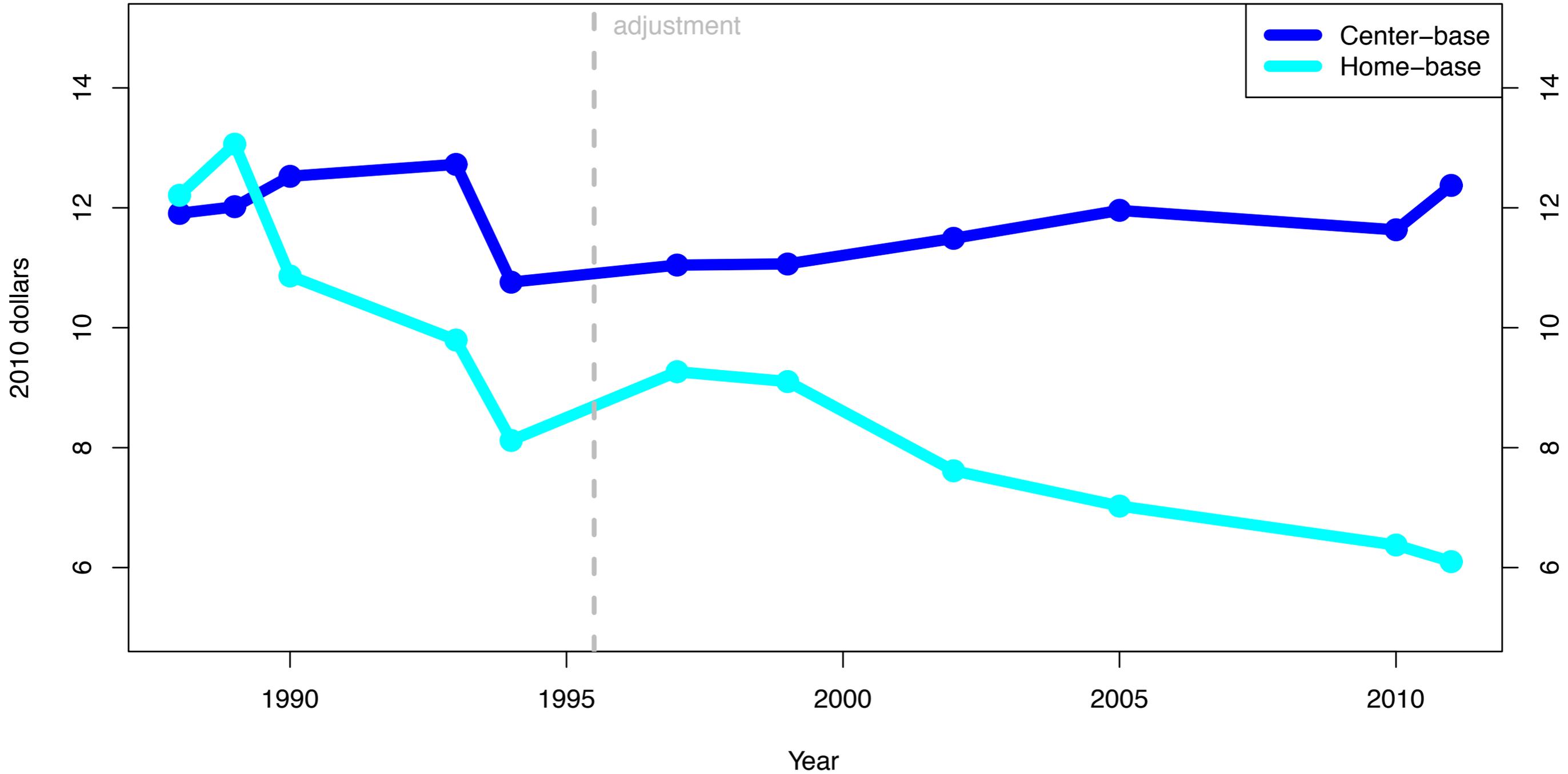
- Puzzle?
 - ECON 101: subsidy → consumer price ↓ & quantity ↑
 - US child care market: consumer price ↑ & quantity ↓
- Two types of child care
 - Center-based: preschool, nursery school, daycare center
 - Home-based: family daycare home, nanny, baby sitter
- *Main fact: Home-based childcare supply ↓*

Two types of market child care in the US

	Center-Based	Home-Based
Place	school-style facility	consumer or provider's home
Examples	Daycare center, Nursery school, Preschool, Head start	Family daycare home (83%), Baby sitter, Nanny
Number of workers, 1990	303,975	503,327
Market share, 1990 (hours by consumer)	51%	49%
Hourly wage, 1990 <small>(price level adjusted to 2010)</small>	\$7.4	\$5.5
% of mothers, 1990 (youngest kid's < 5)	17% (13% in all work mom)	34%

2. supply shock?

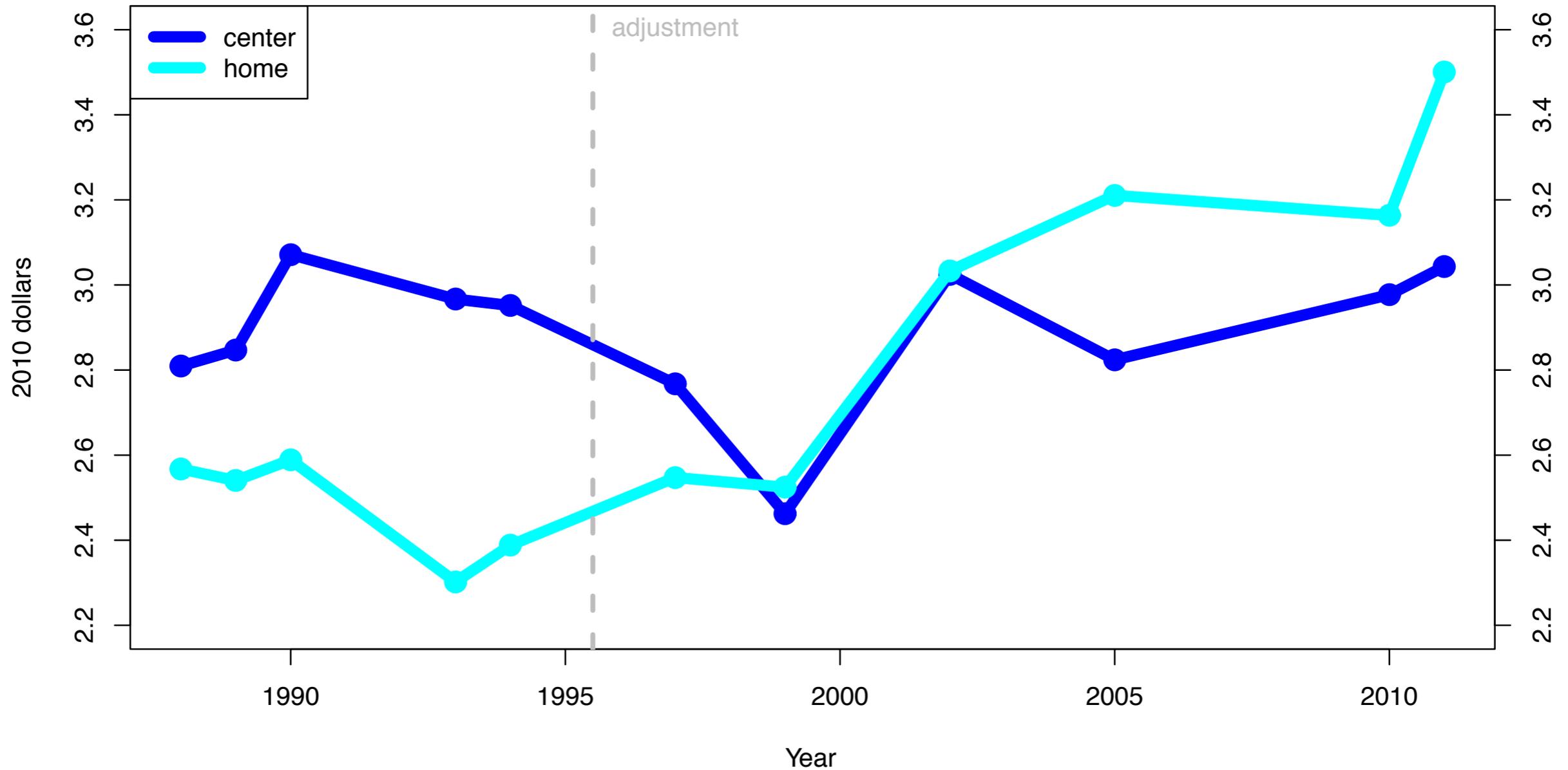
Consumer side 1: Weekly hours



- Decline only in home-based care

Consumer side 2: Hourly price

2. supply shock?

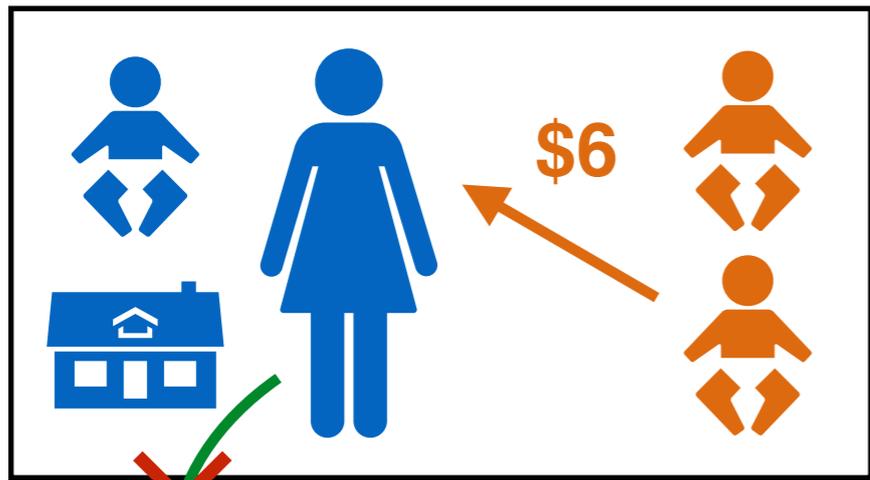


- Increase in hourly price

child care subsidy as a negative supply shock

- A mother, \$8 potential wage in office work, \$3 child care price

Home-based care, no subsidy

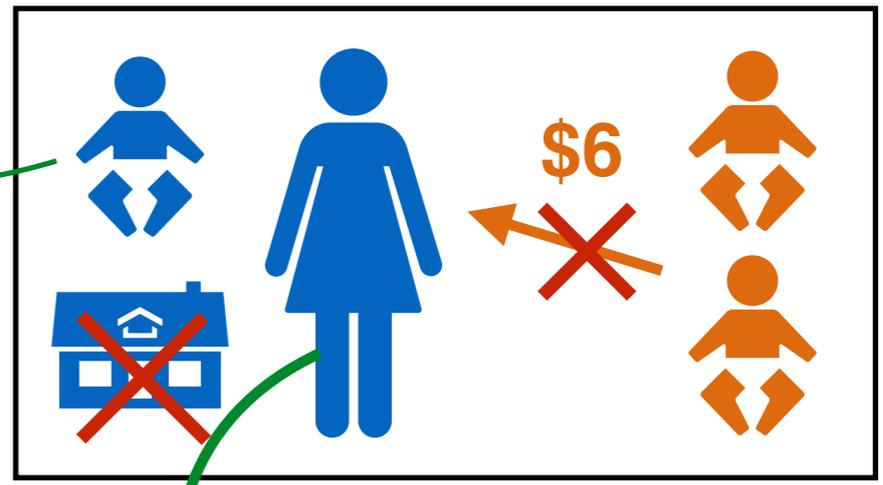


office work
net wage: $\$5 = 8 - 3$

with childcare subsidies

subsidised
child care

\$0



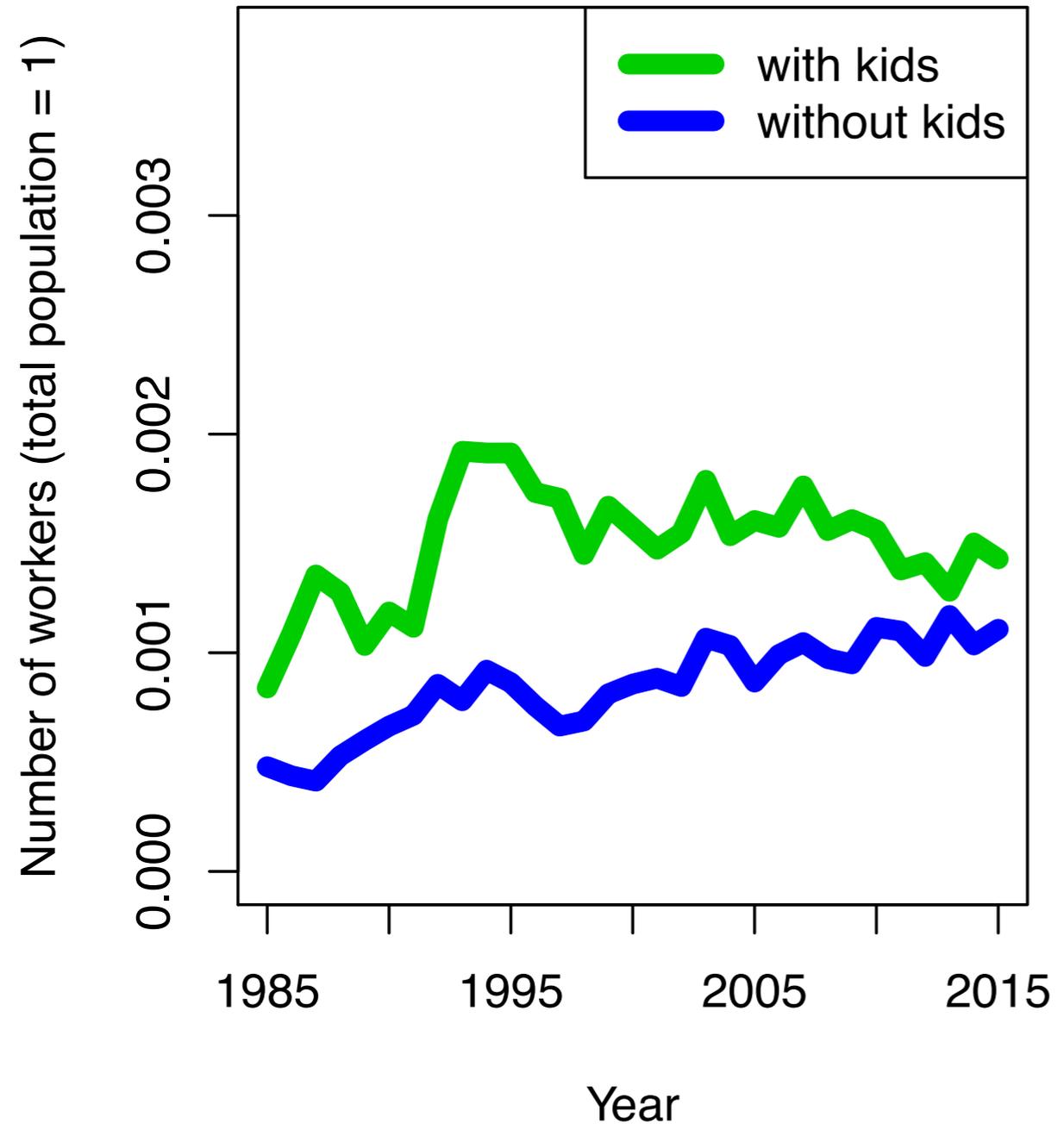
office work
net wage: $\$8 = 8 - 0$

childcare
supply ↓

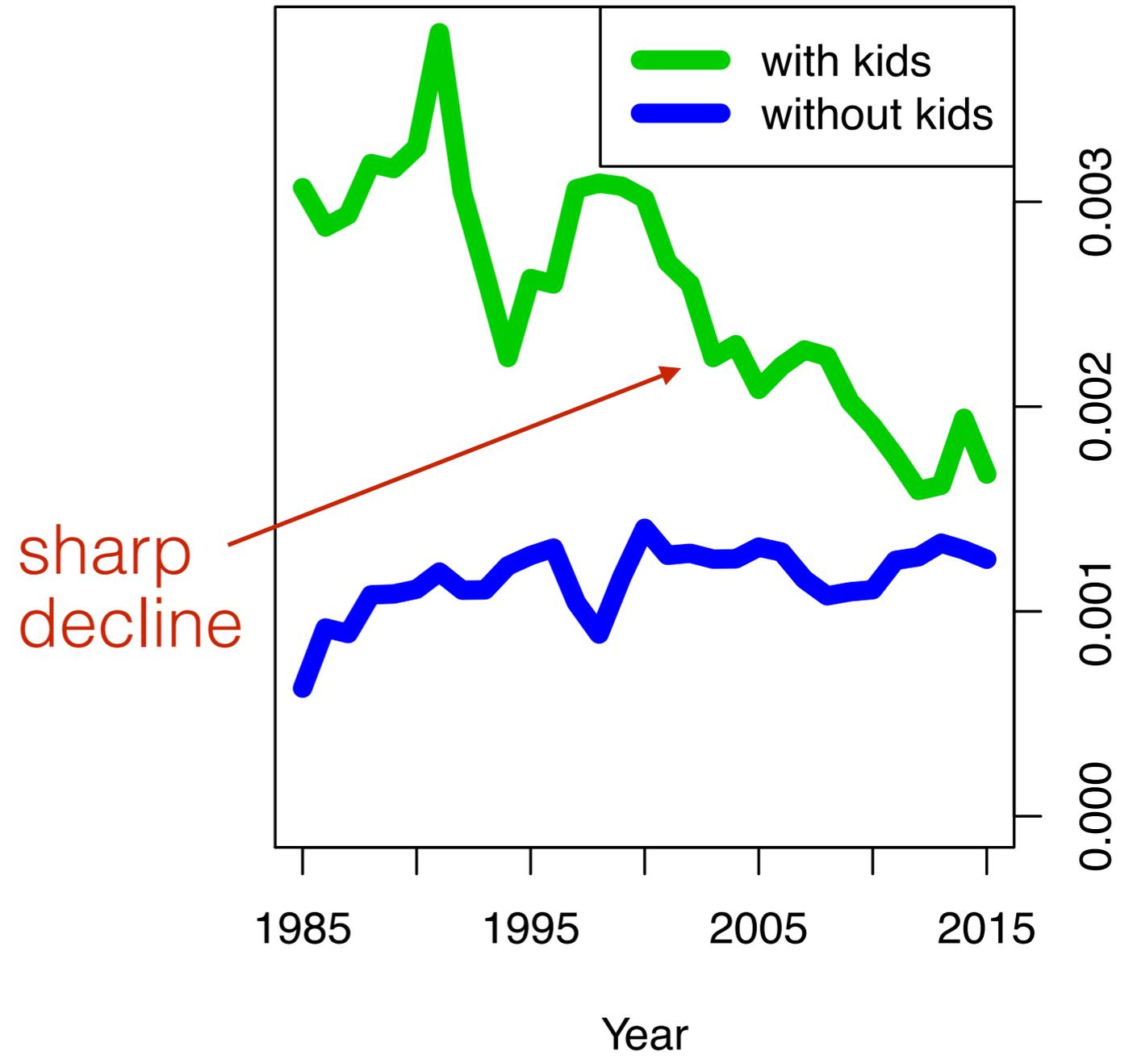
Overall child care price ↑

Worker side 1: labor supply

Center-based



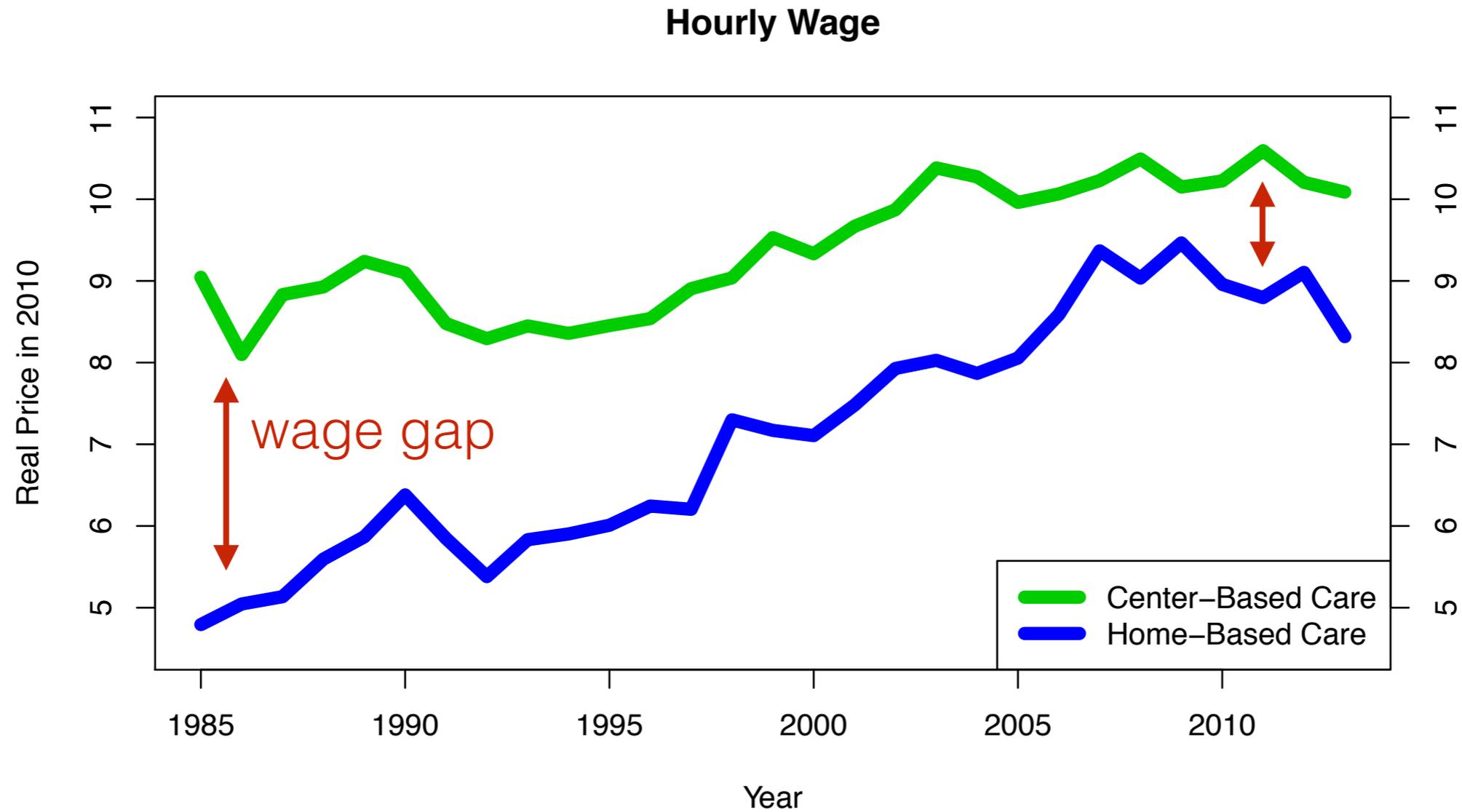
Home-based



Data source is CPS. child status is classified by having kids age lower than 18

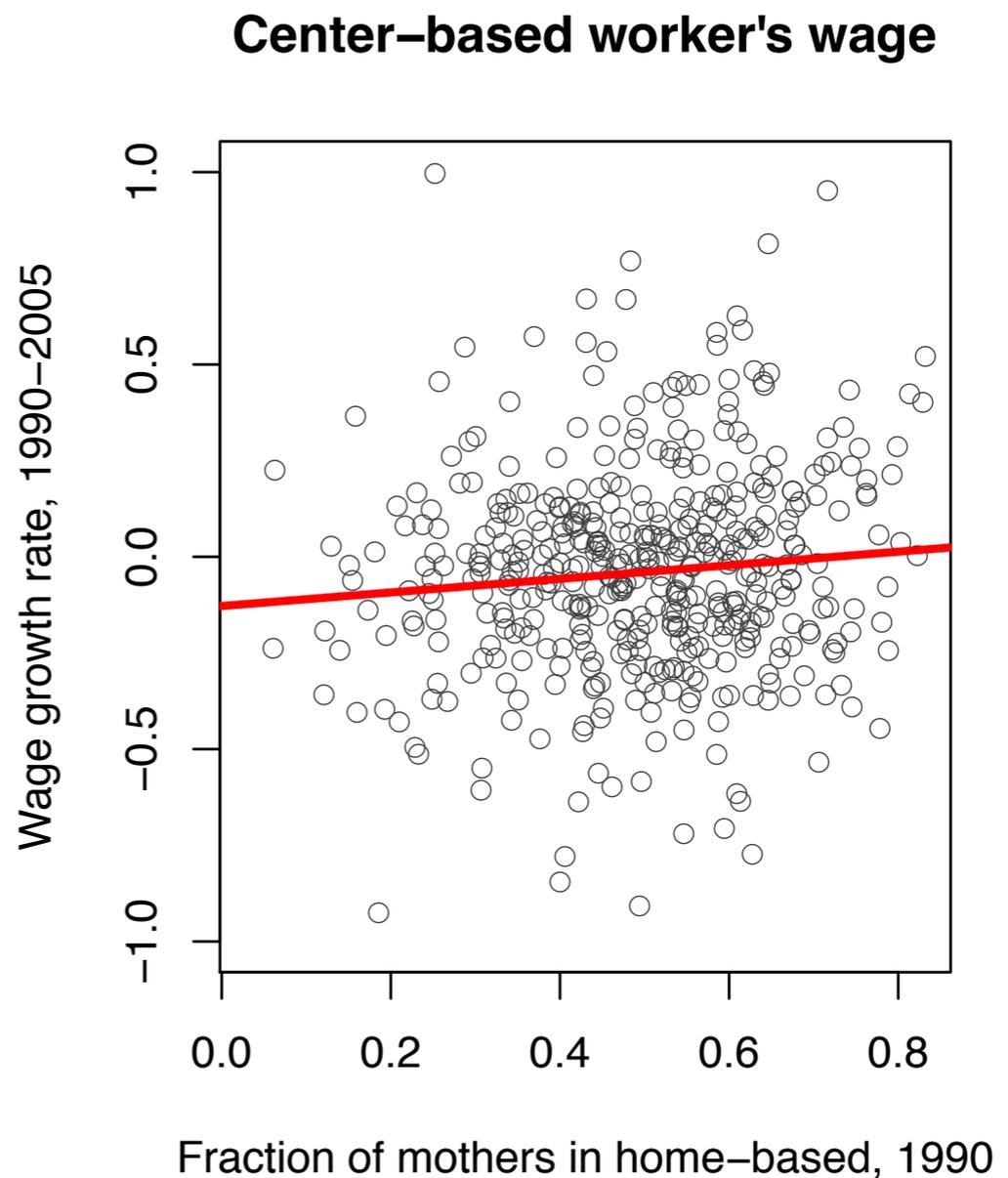
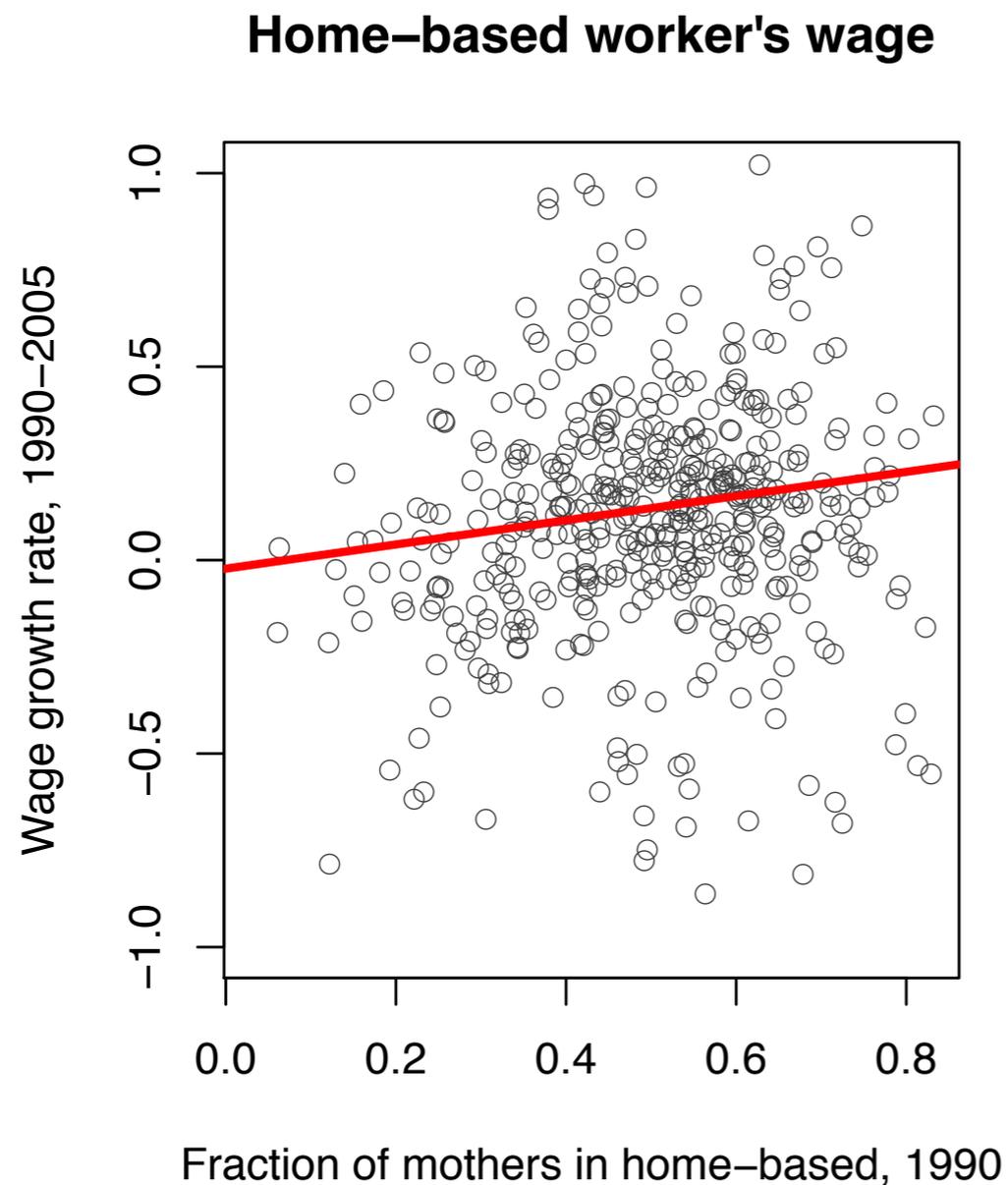
Worker side 2: wage

- wage gap between center and home
 - home-based worker's advantage on no child care payment
- The advantage disappears by subsidy —> the gap also shrank



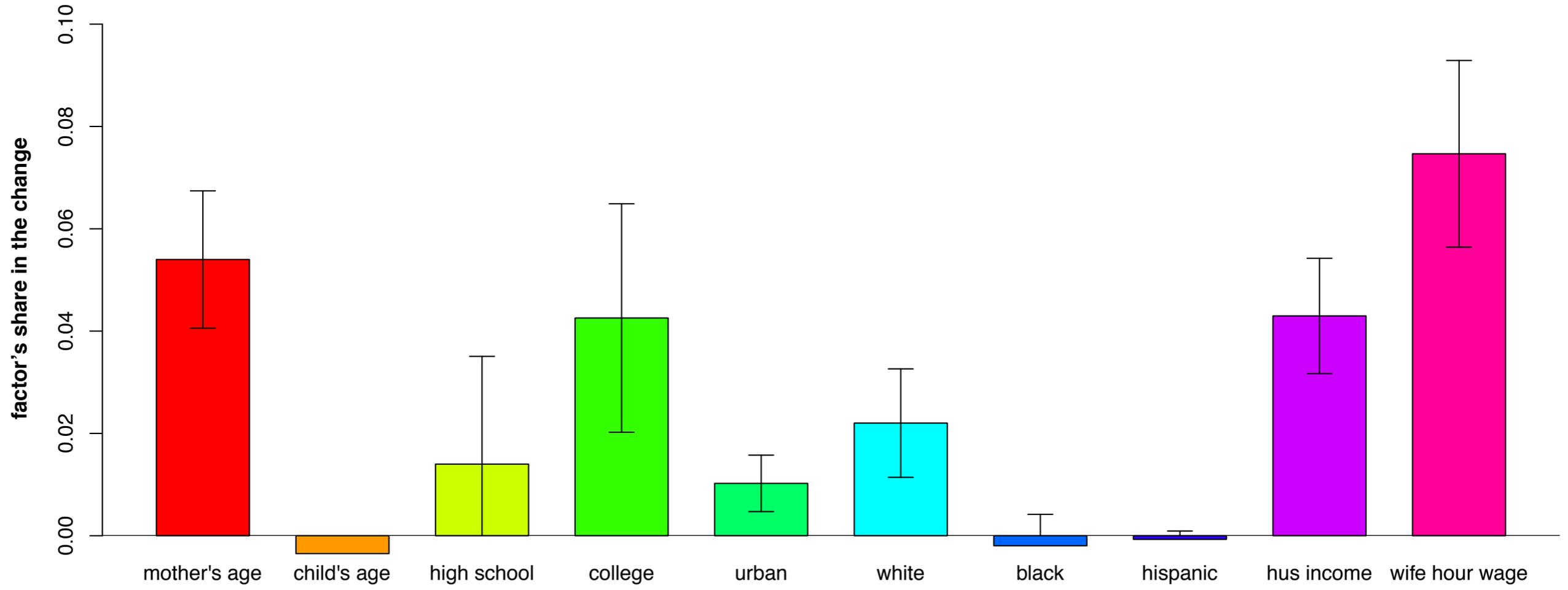
Worker side 3: wage growth by region

- Public Use Microdata Area (PUMA): 543 divisions of US
- More moms in home-based \rightarrow higher wage growth
- General equilibrium \rightarrow higher growth also in center-based sector



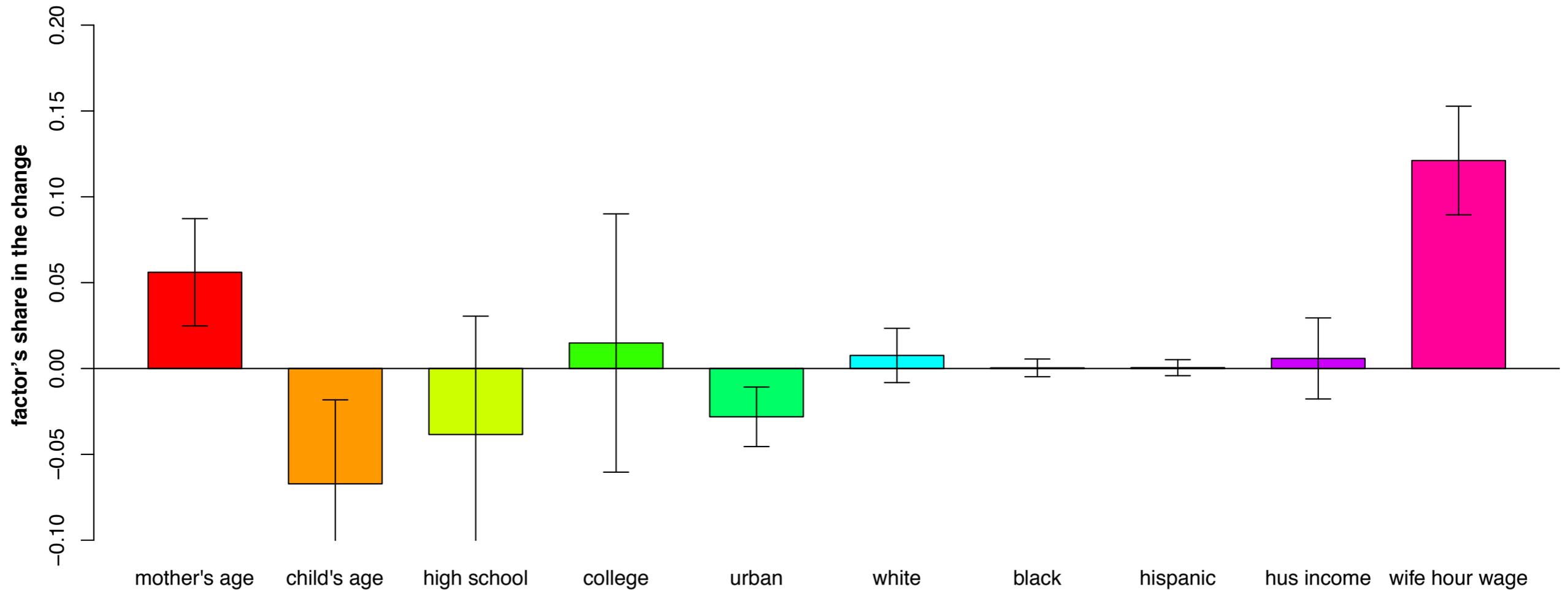
Price↑, other factors?

- Oaxaca decomposition, 1993 vs. 2010
- The increase in the increase in the hourly price child care.
- about 75% still remain unexplained.



Hours↓, other factors?

- Oaxaca decomposition: 1993 vs. 2010
- The decline in the weekly hours of mother child care.
- It even predicts an *increase in hours*



Simple model and numerical exercise

- Question: why supply effects dominate demand ones?
- Type A mothers: office work or non-employment

$$\max_{n \in \{0,1\}} c - \delta n \quad \text{s.t.} \quad c = \{w - [1 - \tau(w)]p\}n$$

$$n_A(w) = \begin{cases} 1 & \text{if } w - [1 - \tau(w)]p > \delta \\ 0 & \text{otherwise} \end{cases}$$

Distribution
 $w \sim f_A(w)$

- Type B mothers: office work or home-based child care
 - work anyway \rightarrow care only wage
 - home-based child care: care z children and her own kid

$$n_B(w) = \begin{cases} 1 & \text{if } w - [1 - \tau(w)]p > pz \\ 0 & \text{otherwise} \end{cases}$$

Distribution
 $w \sim f_B(w)$

Partial equilibrium with linear subsidy

- Equilibrium condition

$$\theta \int n_A(w) dF_A(w) + (1 - \theta) \int n_B(w) dF_B(w)$$

$$= (1 - \theta)z \int [1 - n_B(w)] dF_B(w) + \Theta$$

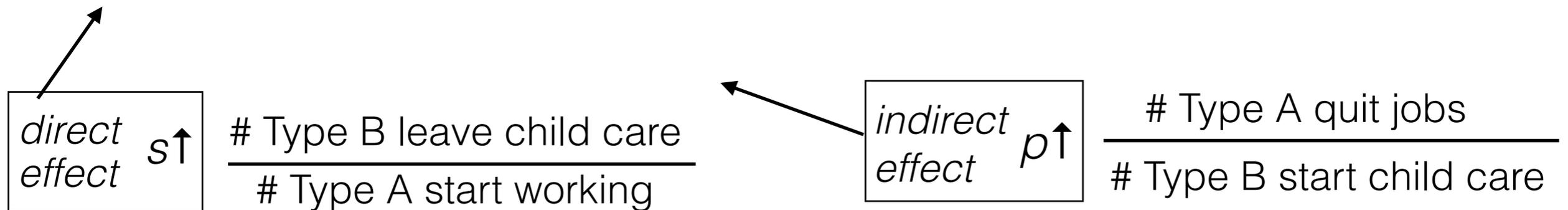
- θ is population of Type A
- Θ is fixed child care supply by the other child care workers
- **Case 1:** Linear subsidy: $\tau(w) = \tau$ for all w
- Proposition: subsidy rate $\tau \uparrow$, $(1-\tau)p \downarrow$ and supply \uparrow
 - demand effect > supply effect (as usual)

Partial equilibrium with mean-tested subsidy

$$\tau(w) = \begin{cases} 1 & \text{if } w \leq s \\ 0 & \text{if } w > s \end{cases}$$

- **Case 2:** Mean-tested subsidy:
- Proposition: $s \uparrow$ reduces the child care supply if

$$\frac{f_B(s)}{f_A(s)} > \frac{f_A(p+d)}{z f_B(pz) + (1+z)f_B((1+z)p)}$$

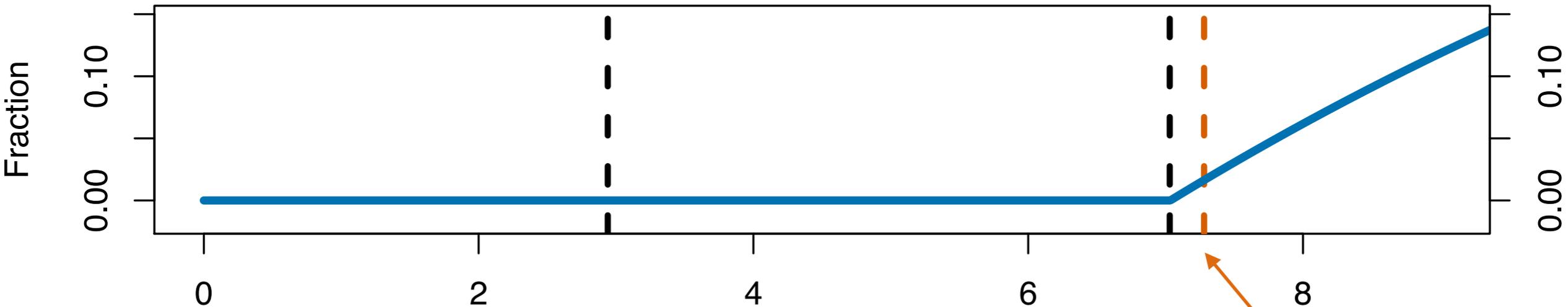


- Corollary: If $f_A(w), f_B(w)$ follow uniform distributions, child care supply \uparrow
- *Heterogeneity* may be necessary to cause the backfire
 - Non-linear subsidy
 - Non-uniform wage distribution

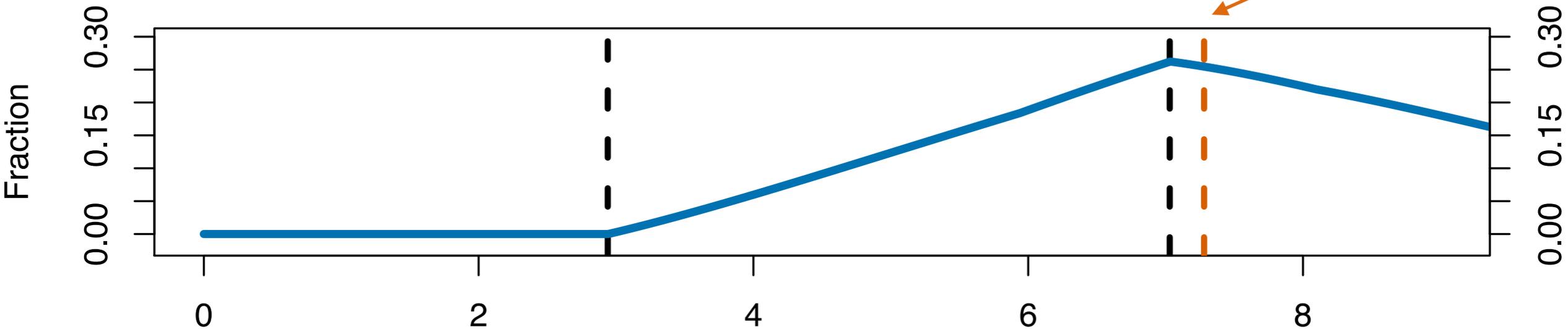
Numerical exercises

- Model parameters are matched to CPS 1985-1995 data
- $fA(w), fB(w)$ following log-normal by wage distribution
 - $fB(w)$: home-based child care “last year” and changed jobs
 - selection corrected by simulation
- $\delta, \theta, z, \Theta$ by other moments: emp rate, CC price, CC wage, HB share.

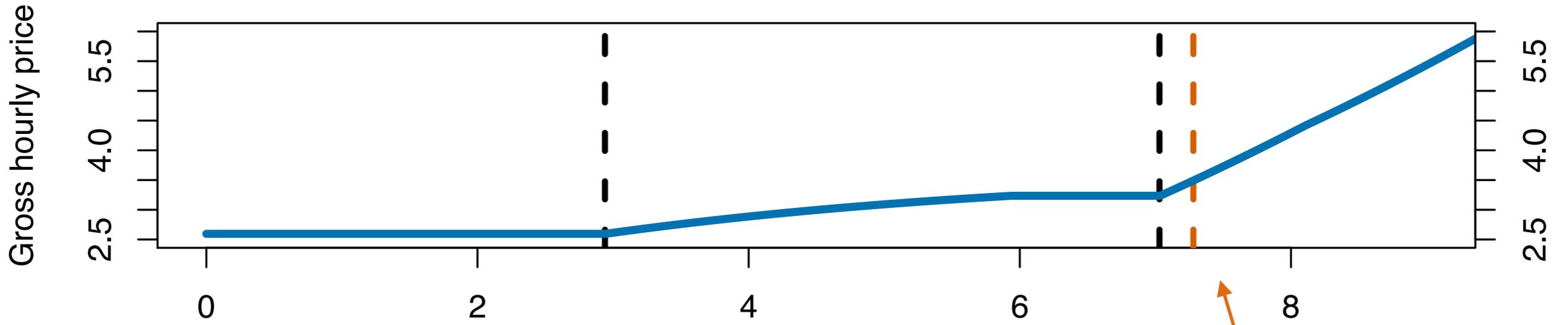
Fraction of Type A women who receive subsidy



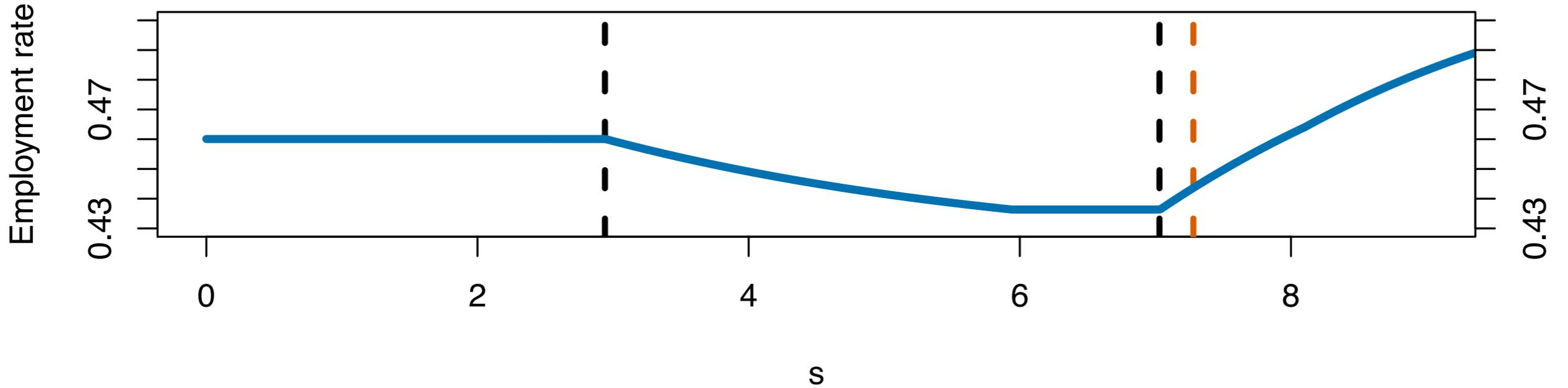
Fraction of Type B women who receive subsidy



Gross hourly price of child care



Employment rate of Type A



Numerical exercise

- Numerical Exercises
 - If subsidy cutoff is low
 - only potential childcare workers are eligible
 - less childcare supply \rightarrow high price \rightarrow low employment rate
 - Quantitatively consistent with the actual policy
- If the government used the same amount of money in different way?
 - linear subsidy to consumers: Emp rate: **46.3%**, Net price: **\$2.49**
 - linear subsidy to home-based: Emp rate: **48.0%**, Net price: **\$2.07**

Brief summary: Life-cycle model

- Question: price \uparrow , then labor supply? child care allocation?
- price \uparrow as exogenous shock \rightarrow household response
- Life-cycle decision model of married couples:
 - wife's full-time or part-time labor supply
 - child care arrangement: market vs. grandma care
- Simulation: calibration with 1990 data & add price \uparrow in 2010
 - Capture more than half deviation from trends in maternal labor supply
 - Human capital loss \rightarrow labor supply \downarrow in later life
 - Almost fully captures child care arrangement shifts.

Brief summary: Regulation

- Child care development Fund (CCDF) —> regulation ↑
- Less than half of home-based care were licensed
- CCDF —> license ↑ in home-based
 - required for operation and subsidy
 - regulation agency's budget ↑
- DDD estimation
 - time difference
 - state-level difference in licensed family daycare ↑
 - Home-based vs.Center-based Difference
- Result: Explains 4%↑ in child care price (wage)

Other factors?

- Quality Improvement?
 - Possible, but maybe a minor factor
 - If so, why hours of market child care decreased?
- Monopoly power in child care industry?
 - Herfindahl index has dropped down
 - Share of franchised providers have been constant at 4%
- Culture?
 - Tiger mom effect?
 - Unclear factor. Observed factor first.

wrap up!

Conclusion

- Research question: why female labor in the US ↓?
- New facts: rising child care price and decreasing its hours.
- Why child care costs ↑?
 - child care subsidies for low-income families
 - also for working mothers in home-based childcare
 - They send kids to subsidized care and change jobs
 - childcare supply ↓, unexpected subsidy's backfire
- Policy implication: encourage home-based child care supply
- Future research:
 - Quality adjustment?
 - Rich quantitative model and policy exercise

wrap up!

Price \uparrow \rightarrow household behavior?

Life-cycle model

- Question: price \uparrow , then labor supply? child care allocation?
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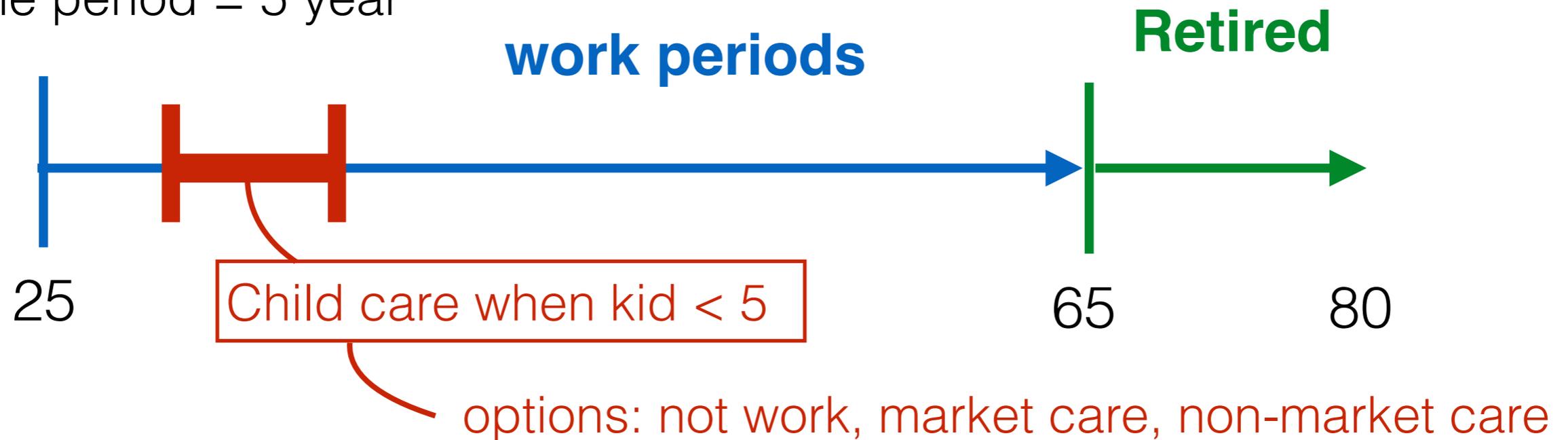
Life-cycle models of female labor supply

Papers	Saving	Human Capital	Intensive Margin	Non-market child care	Fertility	Marriage Divorce
Attanasio et al. (2008)	YES	YES				
Eckstein&Lifshitz (2011)		YES				
Fernandez&Wong (2014)	YES	YES				YES
Bick (2016)		YES	YES	YES	YES	
Guner et al. (unpublished)	YES	YES	YES			
My paper	YES	YES	YES	YES		

- My paper focuses more on child care and labor supply decision

Life-cycle model

One period = 5 year



- Heterogeneity: husband & Wife human capital: h_t^m, h_t^f
- Non-wage heterogeneity: z
 - Timing of child bearing: two children in 1st period (25-29), or in 2nd period (30-34)
 - non-market care availability: θ couples have access

Life-cycle model: Retired periods (age 65-80)

$$V_t(a_t) = \max_{c_t} \log(c_t/\psi_t) + \beta V_{t+1}(a_{t+1})$$
$$\text{s.t.} \quad c_t + \frac{a_{t+1}}{1+r} = a_t$$
$$a_t \geq -\bar{a}(t)$$

- Both husband and wife are retired
- ψ_t is OECD adjustment factor for family size
- natural borrowing limit on asset

Life-cycle model: working periods (age 25-64) without childcare

$$V_t^z(h_t^m, h_t^f, a_t) = \max_{c_t, n_t} \log(c_t/\psi_{t,z}) + d(t, z) \frac{(1 - n_t)^{1-1/\gamma}}{1 - 1/\gamma} + \beta V_{t+1}^z(h_{t+1}^m, h_{t+1}^f, a_{t+1})$$

$$\text{s.t. } n_t \in \{0, 0.2, 0.4\}$$

$$c_t + \frac{a_{t+1}}{1+r} = (1-\tau)[0.4wh_t^m + wh_t^f n] + a_t$$

$$a_t \geq -\bar{a}(t)$$

Human capital accumulation

- wife's labor supply: not-work, part-time, full-time
- husband always works in full-time
- $d(t, z)$ depends on child status, (0-4, 5-14, no child)

Life-cycle model: human capital accumulation

- Husband $\ln h_{t+1}^m = \ln h_t^m + g_{t+1} + v_{t+1}^m$
- Wife $\ln h_{t+1}^f = \ln h_t^f + \mathcal{I}(n_t > 0)g_{t+1} - \mu(n_t)\delta + v_{t+1}^f$
- Human capital depreciation $\mu(n_t) = \begin{cases} 0 & \text{if } n_t = 0.4 & \text{(full-time work)} \\ \bar{\mu} & \text{if } n_t = 0.2 & \text{(part-time work)} \\ 1 & \text{if } n_t = 0 & \text{(non-employment)} \end{cases}$
- Permanent shock $\begin{bmatrix} v_t^m \\ v_t^f \end{bmatrix} \sim N \left(\begin{bmatrix} -\sigma^2/2 \\ -\sigma^2/2 \end{bmatrix}, \begin{bmatrix} \sigma^2 & \sigma^2\rho \\ \sigma^2\rho & \sigma^2 \end{bmatrix} \right)$

Life-cycle model: childcare period (age 25-29 or 30-34)

$$V_t^z(h_t^m, h_t^f, a_t) = \max_{c_t, n_t, x_t, y_t} \log(c_t/\psi_t) + d(t, z) \frac{(1 - n_t)^{1-1/\gamma}}{1 - 1/\gamma} - d_y y_t + \beta V_{t+1}(h_{t+1}^m, h_{t+1}^f, a_{t+1})$$

$$\text{s.t. } n_t, x_t, y_t \in \{0, 0.2, 0.4\}$$

$$n_t = x_t + y_t$$

$$c_t + \frac{a_{t+1}}{1+r} = (1 - \tau)[0.4wh_t^m + wh_t^f n] - px_t + a_t$$

$$a_t \geq -\bar{a}(t)$$

Human capital accumulation

- market child care x_t requires monetary cost px_t
- non-market child care (care by relative/family) incurs utility costs $d_y y_t$

Calibration, rough summary

- Data: IPUMS Census 1990.
- It is cross-section data. A steady state is assumed.
- Human capital accumulation parameters
 - directly calculated from wage data by generation
 - depreciation & his-wife correlation are from existing studies
- Preference parameters and non-market care availability ^{θ}
 - 7 parameters --> 7 moments.

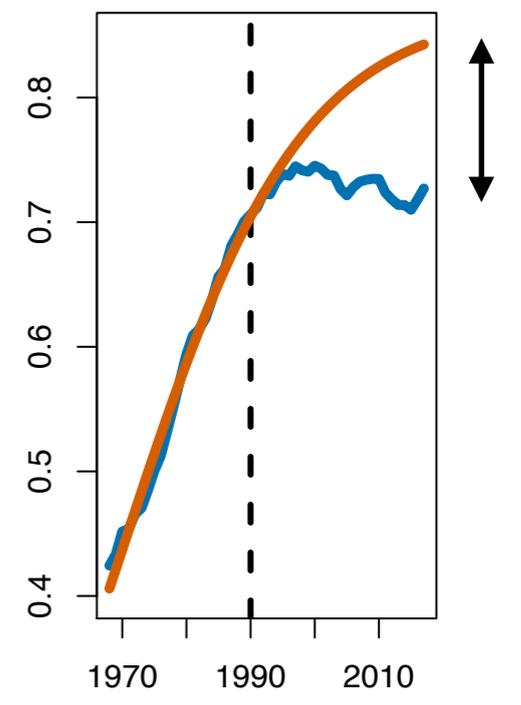
Calibration, parameters to match moments

Parameter	Explanation	Value
d_n^1	leisure with kids <5	0.3
d_n^2	leisure with kids 5-14	0.52
d_n^3	leisure without kids	0.26
γ	Frisch elasticity	0.64
d_y	disutility by non-market child care	0.3
θ	fraction, accessible to non-market child care	0.31
$\bar{\mu}$	Human capital depreciation, part-time job	0.37

Moment	Data	Simulation
LFPR, married women with kids <5	0.656	0.666
LFPR, married women with kids 5-14	0.74	0.715
LFPR, married women without kids <5	0.71	0.7
Fraction of part-time, with kids 0-14	0.206	0.18
Fraction of part-time, without kids	0.139	0.118
Non-Market child care share, income > median	0.406	0.38
Non-Market child care share, income < median	0.503	0.529

Main results

- Shock: child care costs ↑ by 32% between 1990-2010
- Comparison to each variable's deviation from the trend
 - Extrapolation by logistic function — data in 2010
 - Trend: if all the other factors are keep growing?



	Labor Force Particip.	Particip. kid<5	Particip. kid,5-14	Particip. no kids	Hours Worked	Non-market care
Change in Simulation	-0.054	-0.129	-0.046	-0.043	-2.38	0.152
Deviation from Trend	-0.090	-0.177	-0.086	-0.050	-7.28	0.210

(no trend adjustment)



One more factor: regulation

- Child care development Fund (CCDF) —> regulation ↑
- Less than half of home-based care were licensed
- CCDF —> license ↑ in home-based
 - required for operation and subsidy
 - regulation agency's budget ↑
- Diff-Diff-Diff estimation
 - time difference
 - state-level difference in licensed family daycare ↑
 - Home-based vs.Center-based Difference
- Result: Explains 4%↑ in child care price (wage)

Wage and labor supply before/after CCDF

	1990	2000	log diff
Real Wage, Center-Based	7.67	8.19	0.06
Real Wage, Family Daycare	5.34	6.85	0.24
# Center-Based Providers	86,212 (in 1991)	106,246	0.20
# All Family Daycare Home (only reporting income to IRS)	524,381 (in 1992)	559,639	0.06
# Licensed Family Daycare Home	220,867	304,958	0.32

Effect of licensing: Diff-in-Diff-in-Diff estimation

- **Licensed** family daycare $\uparrow \rightarrow$ wage
- DDD estimation
 - time difference
 - state-level difference in # licensed family daycare
 - “Family Daycare — Center” Difference
- Data source: census and family child care licensing report, 1990&2000

Effect of licensing: Diff-in-Diff-in-Diff estimation

$$\log(W_{it}) = \beta_0 + \beta_1 X_{ijt} + \beta_2 \tau_t + \beta_3 \delta_j + \beta_4 T_i \\ + \beta_5 (\tau_t \times \delta_j) + \beta_6 (\delta_j \times T_i) + \beta_7 (T_i \times \tau_t) + \beta_8 (\tau_t \times \delta_j \times T_i)$$

- Subscripts, i : individual, j : states, t : year (1990 or 2000)
- W_{it} : hourly wage (in baseline)
- X_{ijt} : individual characteristics
(age, marital status, part-time, education, race)
- τ_t : fixed year effect (dummy, $\tau_t = 1$ if year is 2000)
- δ_j : percentage increase in licensed (FCC) providers in each state
- T_i : treatment dummy (1 if FCC worker, 0 if other CC workers)

Effect of licensing: Diff-in-Diff-in-Diff estimation

- Why DDD?
 - To control the child care demand effect:
e.g., child care demand↑, wage↑, provider↑
- Why not each component of regulation?
 - too many. # licensed providers summarize them.
- Why wage instead of price?
 - childcare is labor intensive
 - small sample size in SIPP.
- Why compare 1990 and 2000?
 - Licensing report terminated in 2004.
 - large sample in census

Effect of licensing: Diff-in-Diff-in-Diff estimation

- Baseline case: $\beta_8 = \mathbf{0.045}$ with 5% significant level
- Quantitative effects
 - 8% ↓ in center/home wage difference
 - 3% ↑ in home-based childcare workers' wage
- Robustness
 - # per kid
 - control = all female workers
 - annual income, full-time workers
 - DD

Effect of licensing: Diff-in-Diff-in-Diff estimation

	(1)	(2)	(3)	(4)	(5)
W_{it}	Hourly Wage	Hourly Wage	Hourly Wage	Annual income	Hourly Wage
Sample	CC workers	CC workers	all female workers	Full-time CC workers	FCC workers
δ_j	log difference in licensed FCC btw 1990-2000	log difference in licensed FCC per child under 10 btw 1990-2000	log difference in licensed FCC btw 1990-2000	log difference in licensed FCC btw 1990-2000	log difference in licensed FCC btw 1990-2000
Method	DDD	DDD	DDD	DDD	DD
β_8	0.045** (0.022)	0.045** (0.019)	0.032*** (0.011)	0.070** (0.033)	0.058*** (0.019)
Note	Baseline	The level difference in FCC provider per child	The control group is all the other female workers	Hours of work per week is more than 35, Weeks of work per year is more than 50.	Diff-in-diff with only FCC workers

significant levels:
 *** 1%
 ** 5%
 * 10%