Preschool Investment, Earnings Inequality and Social Mobility

Also Heckman and Raut[2013] and Raut[2003] results

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Disclaimer

- Dr. Lakshmi K. Raut is an Economist at the Social Security Administration (SSA). This paper is prepared at his personal time, and the analysis and conclusions expressed are those of the author and not necessarily those of SSA.

Outline

- First show stylized facts about growing inequality and low social mobility, high premium for college graduation in the labor market but children from poor SES lagging fails to complete college and have low earnings
- **Personality skills** such as Big Five including social, motivational and **cognitive skills** are important for school and labor market success
- Where are they produced? → Home, neighborhood → role of preschool inputs
- Draw from various studies including Neuroscience Approach to Brain Development, I will show how children of poor SES are adversely affected:
- I will then present the evidence from Heckman and Raut[2013, NBER] to show preschool has positive effect on reducing earnings inequality and improving social mobility.
- Providing quality Preschool to children of poor SES is important for Inequality, Social Mobility

Average disposable annual income of the bottom 10%, in US$ PPP and inflation adjusted, total population, 1985-2012 or closest
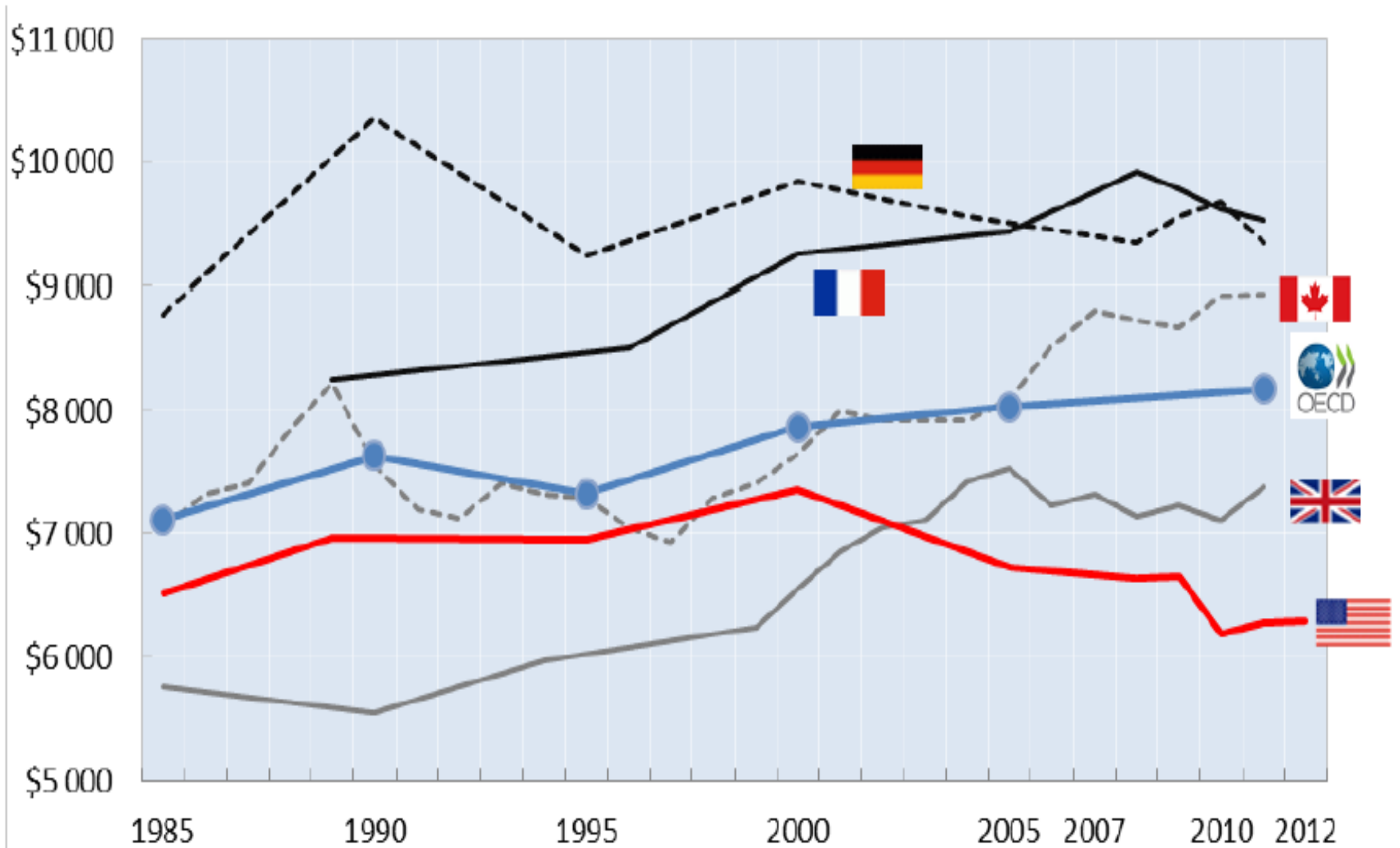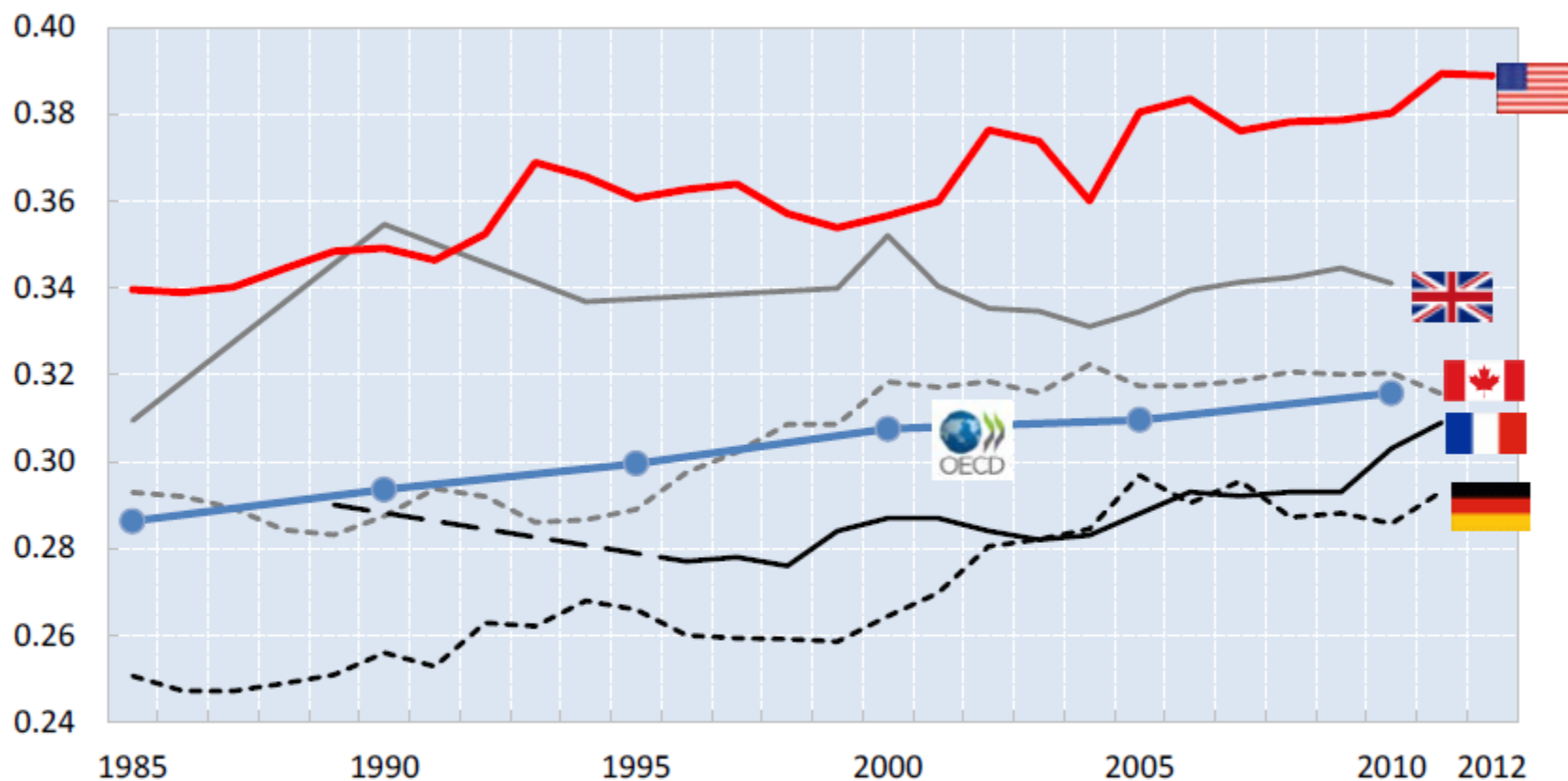
Figure 2. Income inequality has been rising over the past three decades

Trends in inequality (Gini coefficient) 1985 – 2012, total population

Note: OECD average: un-weighted and based on 12 countries for which data are available at all points (Canada, Denmark, France, Germany, Israel, Italy, Netherlands, New Zealand, Spain, Sweden, United Kingdom and United States). Data for 2011 and 2012 are provisional.

Source: OECD Income Distribution Database (2013), www.oecd.org/social/income-distribution-database.htm

Income inequality and intergenerational earnings mobility, mid-2000s
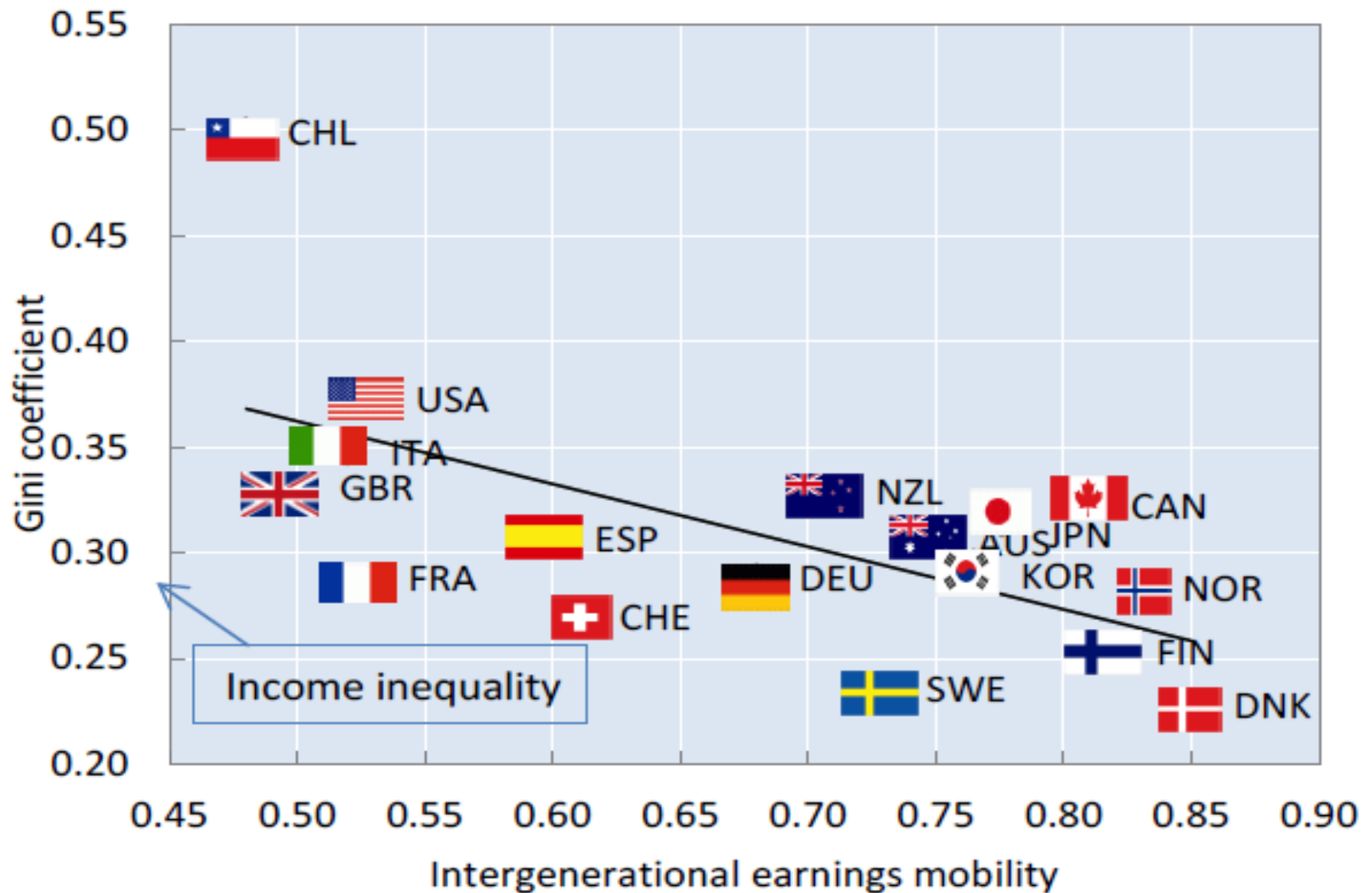
College/high school median annual earnings gap, 1979–2012
In constant 2012 dollars
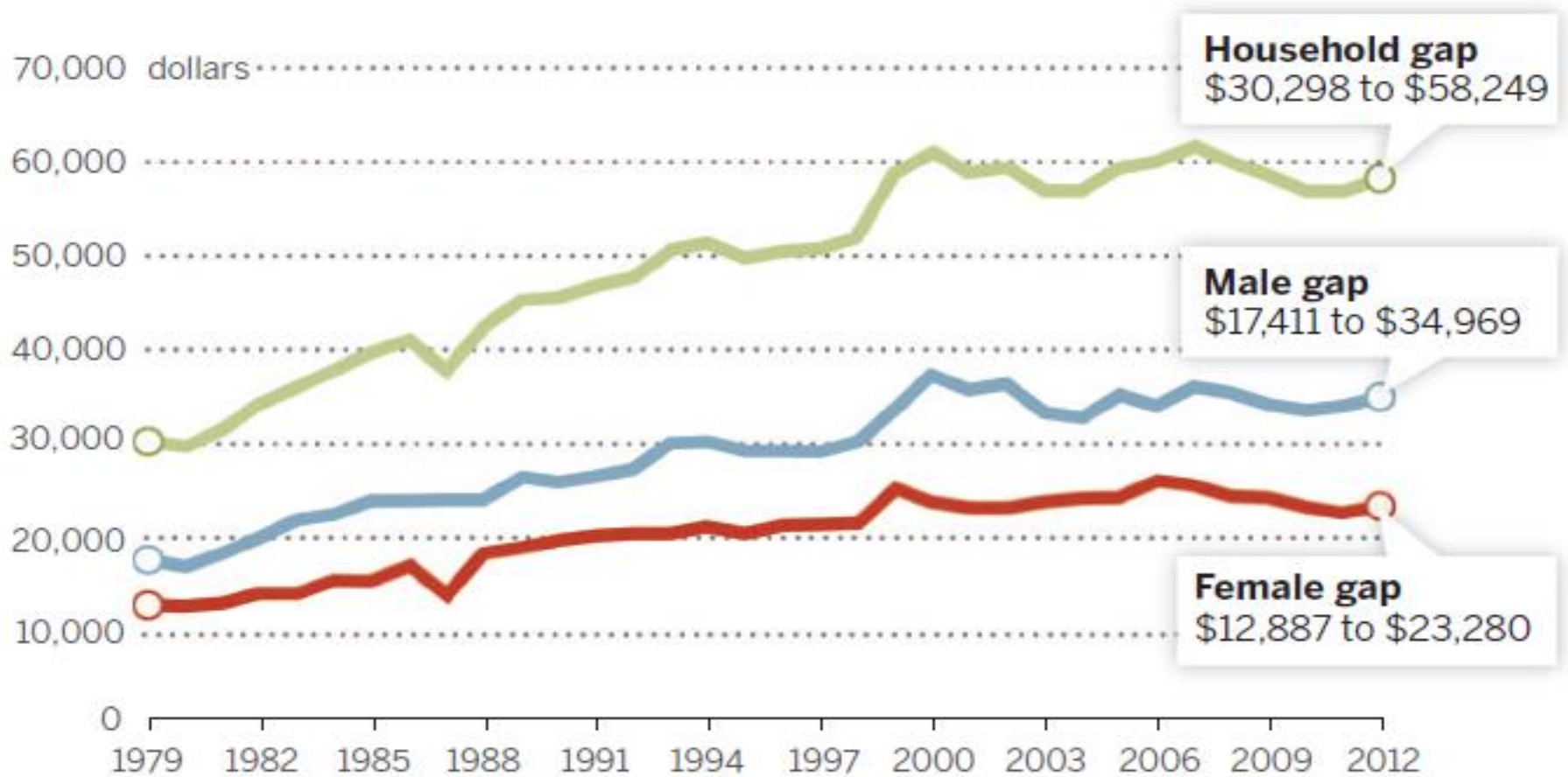
Source: Autor [2014, Science]

Sources of Inequality

- Globalization,
- Skill biased technological change, knowledge based technology
- Policy induced,
  - China (Hukou and decentralization education financing
  - India, subsidies for Higher Education, encouraging education for the elite class that British created)
  - Poverty breeds poverty

Important Skills: Cognitive and Personality traits

- Cognitive Skills:
    - Intelligence, schooling level
- Big Five Personality skills :
    - Self-control, Executive Function (EF), Social and Motivational skills

- Evidence
    - Stanford Marshmallow Test (see Walter Mischel, 2014 book)
    - Perry Preschool (see Schweinhart, 2002,Online Res. Bulletin)
    - U.S.Census Bureau interviewed 3,000 employers (1 to 5 very important): skill crentials - 3.2, years of schooling - 2.9, scores on employer given test and academic performance- each 2.5, **attitude - 4.6 and communication - 4.2.**(see Bowles et al (2001, JEL)
    - The Mind Tools Program (see Diamond et al, 2007)
    - Evidence from NLSY, I present the findings from Raut[2003] and Heckman and Raut [2013] for Head Start see Currie and Thomas (1995)

Table 1: Determinants of earnings -- role of cognitive and non-cognitive skills

Table 1: Determinants of earnings — role of cognitive and non-cognitive skills (from the sample)

Variables	Basic	Extended	Augmented
Intercept	1.7137	2.3440	1.6978
	(28.22)	(36.36)	25.12
Grade*	0.1112	0.0694	0.0595
	(82.59)	(37.93)	(31.93)
Age	0.3363	0.3277	0.3279
	(82.66)	(77.00)	(76.77)
Age Square	-0.0040	-0.0039	-0.0039
	(60.79)	(56.45)	(56.30)
Mother's grade		-0.0022	-0.0050
		(1.61)	(3.59)
Father's Grade		0.0079	0.0065
		(7.00)	(5.67)
Dummy variable for Female		-0.5187	-0.5137
		(81.19)	(79.70)
Dummy Variable for non-Black and non-Hispanic		0.0545	0.0794
		(7.21)	(10.39)
τ : Revised AFQT Score		0.0059	0.0048
		(36.76)	(28.90)
s : Socialisation			0.0111
			(1.68)
μ : Motivation - Job Aspiration			0.0261
			(3.57)
η : Self-Esteem (Rosenberg Scale)			0.0193
			(18.24)
ϕ : Internal Self-Control (Pearlin Scale)			0.0251
			(22.97)
n	118,477	95,253	93,166
R^2	0.3083	0.3752	0.3839

Notes: Absolute values of t-statistics are in parentheses.

Table 2: Determinants of schooling

Variables	OLS model of years of completed schooling	Logit model of completing college
Intercept	9.1570	-7.9304
	(421.47)	(117.45)
Mother's grade	0.0817	0.1145
	(35.79)	(23.76)
Father's Grade	0.0430	0.0705
	(22.84)	(19.59)
Preschool	0.4999	0.5800
	(35.89)	(24.72)
τ : Revised AFQT Score	0.0384	0.0472
	(169.00)	(104.15)
σ : Socialisation	0.0776	0.1332
	(7.00)	(6.80)
μ : Motivation - Job Aspiration	0.4890	0.9446
	(40.69)	(34.09)
η : Self-Esteem (Rosenberg Scale)	0.3551	0.3781
	(21.39)	(14.66)
ϕ : Internal Self-Control (Pearlin scale)	0.4399	0.7299
	(31.32)	(20.62)
n	108,565	108,636
R^2 *	0.4263	0.3436

* Notes: The R^2 in the second column is the McFadden's-R^2.

Table 3: Logit model of cognitive and non-cognitive skills.

Variables	τ'	σ'	μ'	η'	ϕ'	s
Intercept	-2.8005	-1.1219	-0.8990	-2.5222	-2.7063	-3.9698
	(41.76)	(20.80)	(17.02)	(32.42)	(32.61)	(33.60)
τ	1.4300	0.1508	-0.0713	-0.5082	-0.4989	2.1359
	(23.99)	(2.47)	(1.19)	(6.99)	(6.69)	(26.38)
τ'		0.9459	1.2590	0.2423	0.1800	
		(16.78)	(22.85)	(4.18)	(3.04)	
σ		0.2414	0.1940	0.1209	0.1044	0.3041
		(5.64)	(4.62)	(2.54)	(2.14)	(3.92)
μ		0.1005	-0.0211	-0.0449	-0.0312	0.7126
		(2.26)	(0.48)	(0.89)	(0.61)	(6.78)
η		0.2581	0.2577	0.2863	0.2542	0.5727
		(5.82)	(5.91)	(5.90)	(5.13)	(7.31)
ϕ		-0.0177	-0.0466	0.1294	0.1333	0.6198
		(0.41)	(1.11)	(2.66)	(2.68)	(7.72)
s	0.8456	0.5096	0.4588	1.5443	1.6694	1.4013
	(11.92)	(10.64)	(9.60)	21.21	(21.38)	(15.49)
a : Preschool	0.8766	0.7972	0.0496	-0.0731	-0.0647	0.6569
	(16.75)	(18.58)	(1.16)	(1.53)	(1.33)	(7.13)
n	11,428	11,428	11,428	11,428	11,428	7,732
McFadden's-R^2	0.109	0.0911	0.0623	0.0681	0.0705	0.2205

Notes: A variable x without a $'$ refers to the parent and with a $'$ refers to his child.

τ : Revised AFQT Score
σ : Socialisation
μ : Motivation - Job Aspiration
η : Self-Esteem (Rosenberg Scale)
ϕ : Internal Self-Control (Pearlin Scale)

Why Preschool? Mechanism of personality and cognitive skill formations: Neuroscience Research (see, Noble et al (2012, Developmental Science)

- Cognitive Neuroscience Approach to brain development:
- It is known that human brain develops between age 0-8 and almost at the speed of light between age 2-3. The stimulus that is given to a child during this time is most important for the child's later development.
- Brain Development is a dynamic process – Interaction of genetic programs and experience-dependent plasticity

fMRI shows effects of lang & stress on development of regions of prefrontal cortex
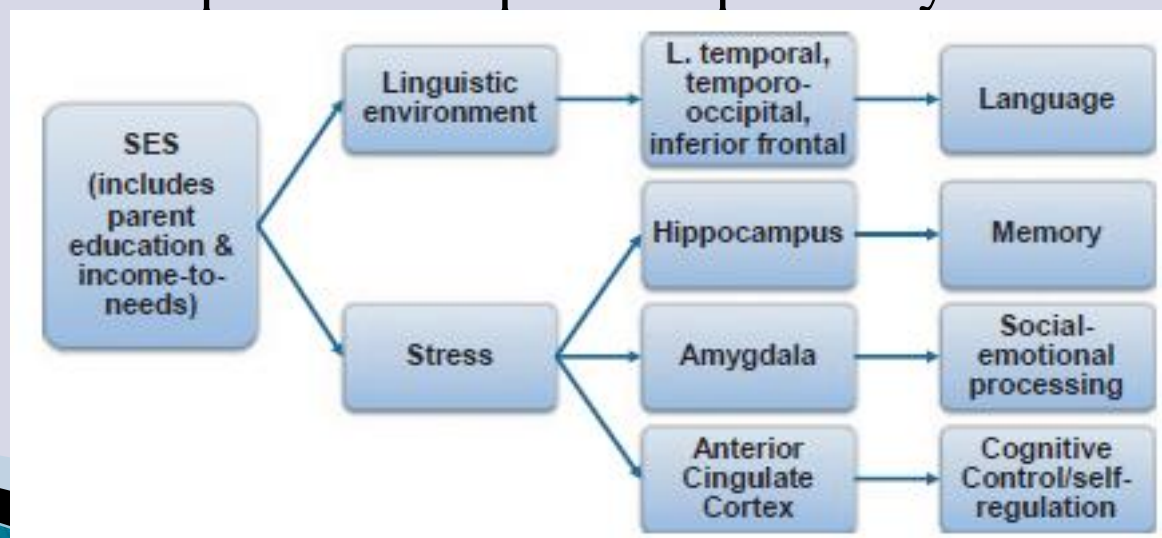
An altruistic Model of parental preschool investment, Raut[2003] and Heckman and Raut[2013]

- ▶ Observable states of an individual:

- ▶ $x = (\tau, \sigma, \mu, \eta, \varphi, s)$

  - ▶ τ : *talent*, σ : *socialization,*

  - ▶ μ : *motivation,*

  - ▶ η : *Self-esteem (Rosenberg measure),*

  - ▶ φ : *Internal self-control (Perlin measure)*

- ▶ $z = (x, \varepsilon)$, ε : *taste shifter and random factors affecting permanent income, school outcome given observable inputs.*
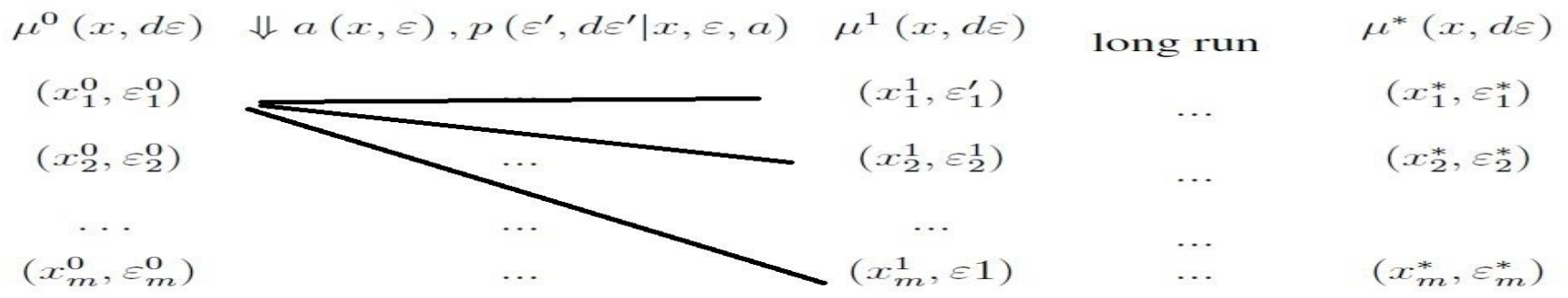
Structural Dynamic Programming Model

▶ Parent of type (x, ε), earns w (x, ε), decides preschool investment a *in* A(x). -> Determines

▶ Consumption c (w, a) = w - θ (a), utility: u(x, ε,a)

▶ Transition probability : p(x',dε'|x, ε,a)

▶ Bellman equation of the choice problem:

$$V(x,\varepsilon) = \max_{a \in A(x)} u(x,\varepsilon,a) + \beta \sum_{x' \in X} \int V(x',\varepsilon') p(x',d\varepsilon'|x,\varepsilon,a)$$

▶ *Structural Parameters*: $\zeta = \{u(.), \xi_p, \beta\}$ *where* ξ_p : parameters characterizing transition probabilities

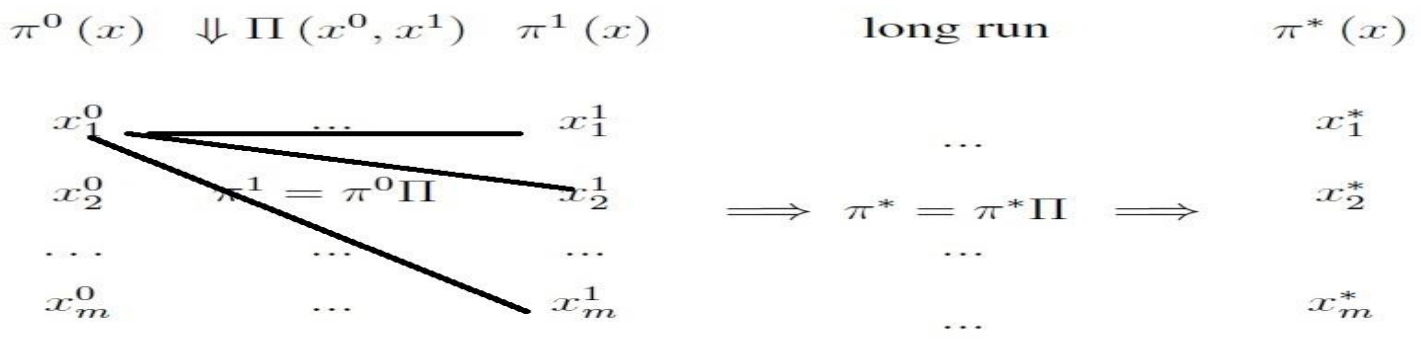▶ Data: $y = \{(x_i, x_i'), a_i\}_{i=1}^n$

Equilibrium Dynamics
Controlled Markov Process

$\mu^0(x, d\varepsilon)$	$\Downarrow a(x, \varepsilon), p(\varepsilon', d\varepsilon'\|x, \varepsilon, a)$	$\mu^1(x, d\varepsilon)$	long run	$\mu^*(x, d\varepsilon)$
(x_1^0, ε_1^0)		(x_1^1, ε_1')	...	(x_1^*, ε_1^*)
(x_2^0, ε_2^0)	...	(x_2^1, ε_2^1)	...	(x_2^*, ε_2^*)
...	...	...	...	
(x_m^0, ε_m^0)	...	$(x_m^1, \varepsilon 1)$	...	(x_m^*, ε_m^*)

optimal choice $a(x, \varepsilon)$ is the solution of the Bellman Equation:

$$V(x, \varepsilon) = \max_{a(x,\varepsilon)) \in A(x)} u(x, \varepsilon, a) + \beta \sum_{x' \in X} \int V(x', d\varepsilon') \, p(\varepsilon', d\varepsilon'|x, \varepsilon, a)$$

observavle states: $x = (\tau, \sigma, \mu, \eta, \phi, s)$, permanent income: $w(\tau, \sigma, \mu, \eta, \phi, s)$ and $s' = (\tau', \sigma', \mu', \eta', \phi', \varepsilon', a)$, $->$ Random utility model giving a Logit representation for optimal $a(x, \varepsilon)$ and can derive equilibrium dynamics over the observable states below:

$\pi^0(x)$	$\Downarrow \Pi(x^0, x^1)$	$\pi^1(x)$	long run	$\pi^*(x)$
x_1^0	...	x_1^1	...	x_1^*
x_2^0	$\pi^1 = \pi^0 \Pi$	x_2^1	$\implies \pi^* = \pi^*\Pi \implies$	x_2^*
...	...	...	...	
x_m^0	...	x_m^1	...	x_m^*

Intergenerational Effects of Free preschool to children of poor SES

▶ From estimated optimal transition probability matrix p(x'|x,a(x)), x in X, calculateed Intergenerational mobility measure: <u>1- $\lambda_{\max}$</u>: Invariant population distribution

▶ **College Mobility**:
  ▶ Before:

$$Q_b^s = \begin{bmatrix} 0.93287 & 0.06713 \\ 0.59380 & 0.40620 \end{bmatrix}, p_b^s = \begin{bmatrix} 0.8984 & 0.1016 \end{bmatrix}, 1 - \lambda_{\max,b}^s = 0.6609$$

  ▶ After Policy:

$$Q_a^s = \begin{bmatrix} 0.90553 & 0.09447 \\ 0.59184 & 0.40816 \end{bmatrix}, p_a^s = \begin{bmatrix} 0.8624 & 0.1376 \end{bmatrix}, 1 - \lambda_{\max,a}^s = 0.6863$$

▶ **Social mobility**:
  ▶ before the policy: 0.5945
  ▶ After the policy: 0.6465

▶ **Income Inequality (Gini Coefficient):**
  ▶ Before the policy:0.2363, percent in poor SES: 36 , w = 5622
  ▶ After the policy: 0.2335, percent in poor SES: 30, w = 5735

▶ **Tax Burden of the Social Contract**
  Per capita gain in average after tax earnings == $113

Thank you...