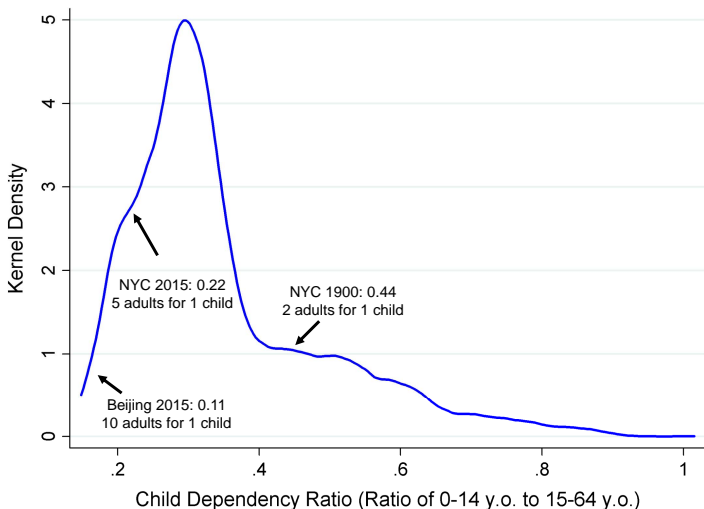
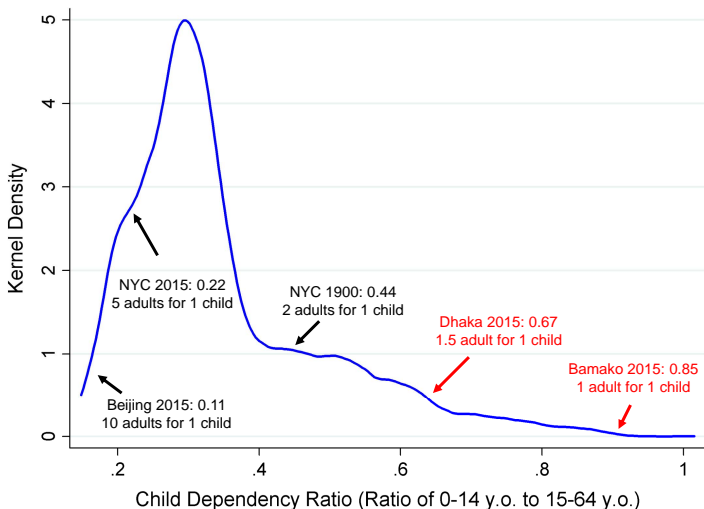


Distribution of city *child dependency ratios* (0-14 y.o./15-64 y.o.; N=4,907)Cities dramatically differ in their age structure: [Cities of Workers](#)

Distribution of city *child dependency ratios* (0-14 y.o./15-64 y.o.; N=4,907)

Cities dramatically differ in their age structure: **Cities of Children**



What We Do

1. Document the rise of **cities of children or seniors**:
 - ▶ Build a novel database on urban age structures.
 - ▶ Historically, *cities of workers* (low dependency ratios).
 - ▶ Now, some *cities of children or seniors* (high dependency ratios).
2. Investigate **economic consequences** for cities:
 - ▶ 351 mega-cities with age structure data ca. 1990 and night light intensity 1996-2011 as proxy for city economic development.
 - ▶ Evidence of agglomeration effects (population \rightarrow growth).
 - ▶ But cities with more children or seniors grow relatively slower.
 - ▶ The demographic composition of cities matters.

Conceptual Framework

- ▶ **Per capita income** can be represented as:

$$y = \omega_C h_C r_C + \omega_{W,H} h_{W,H} r_{W,H} + \omega_{W,NH} h_{W,NH} r_{W,NH} + \omega_S h_S r_S$$

C , W and S denote *children*, *working-age residents* and *seniors*.

Among working-age residents: *caregivers* (H) and *non-caregivers* (NH).

ω pop. share of each group; h hours worked; r output per hour.

- ▶ **Direct effects (negative):**

- ▶ Children and seniors work less, are less productive.

- ▶ **Indirect intra-household effects (ambiguous):**

- ▶ Children/seniors affect labor supply and productivity of caregivers.

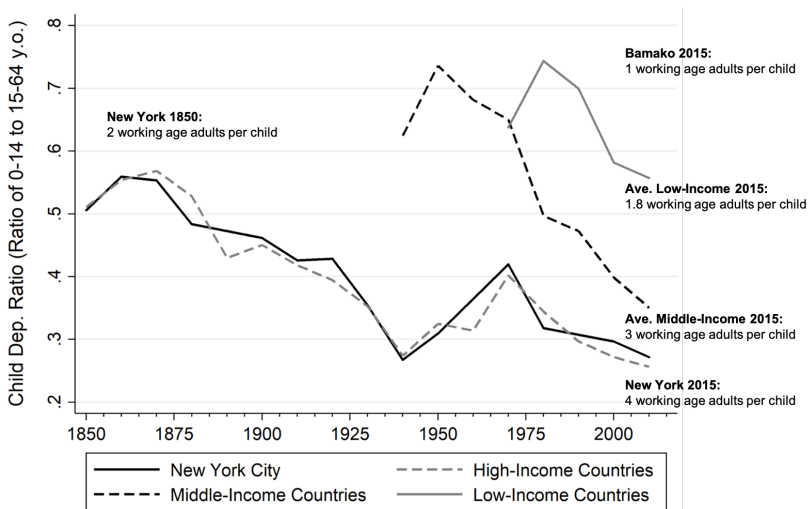
Conceptual Framework

- ▶ **Indirect city-wide effects (negative or ambiguous):**
 - ▶ **Human capital externality effects (negative):**
 - ▶ For any given conversation, the knowledge exchanged is likely to have less impact on the working-age resident's productivity.
 - ▶ **Crowding effects (negative or ambiguous):**
 - ▶ Children: Traffic congestion during "school run" hours.
 - ▶ Children: More crowded classrooms and pediatrician clinics.
 - ▶ Seniors: Crowding of health services, but less traffic congestion.
 - ▶ **Public expenditure effects (negative):**
 - ▶ Public expenditure not targeted to workers' productivity directly.

City-Specific Age Structure Dataset

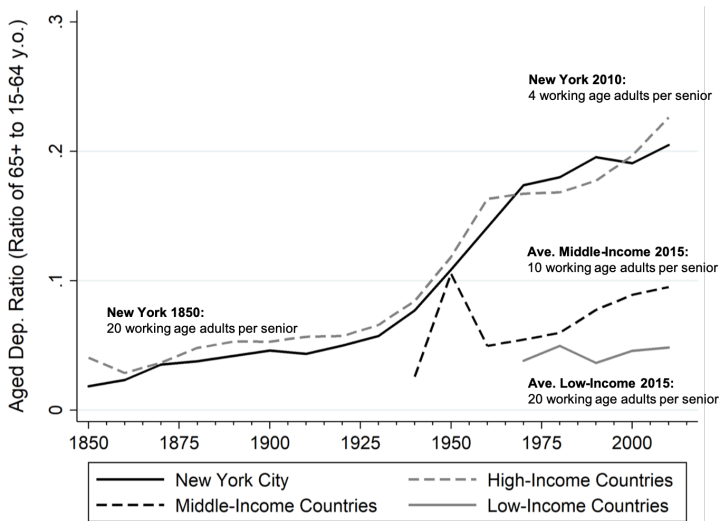
- ▶ Identified **list of 655 mega-cities** (UN, 2015)
- ▶ **Five main sources (census or surveys):**
 - ▶ *IPUMS* (1787-2011)
 - ▶ *Census Reports* (1920-1950)
 - ▶ *OECD Metropolitan Areas Database* (1990-2015)
 - ▶ *Demographic and Health Surveys* (1990-2014)
 - ▶ *I2D2: The International Income Distribution Database* (1990-2014)
 - ▶ *Other Sources* (1990-2014)
- ▶ For each megacity-year-source, obtain the number of residents in each age category: **0-4, 5-9, 10-14, ...**
- ▶ **Final sample:** 4,907 city-year-source observations.
- ▶ 139 countries, between 1787-2016.

Stylized Facts: Cities of Workers vs. Children



Notes: Evolution of the population-weighted mean child dependency ratio (ratio of 0-14 to 15-64 y.o.) for all mega-cities in high-income countries (N = 3,249 city-years), middle-income countries (N = 1,466) and low-income countries (N = 161). We use as weights the population of each mega-city in decade t .

Stylized Facts: Cities of Workers vs. Seniors



Notes: Evolution of the population-weighted mean aged dependency ratio (ratio of 0-14 to 15-64 y.o.) for all mega-cities in high-income countries (N = 3,249 city-years), middle-income countries (N = 1,466) and low-income countries (N = 161). We use as weights the population of each mega-city in decade t .

Data: Night Lights and Urban Boundaries

- ▶ **Sample: 351 mega-cities with age structure ca 1990.**

- ▶ **Night light intensity**, fine resolution, 1996-2011.

Source: Defense Meteorological Satellite Program (DMSP), in the National Geophysical Data Center (NGDC).

- ▶ **Urban extent boundaries** from GRUMP 1995.

Night light intensity aggregated up at agglomeration level.

- ▶ **Measure:** *Growth of mean night light intensity* 1996-2011.

Standard measure used in literature (Henderson et al 2012).

Main Specification

- ▶ **Long-difference regressions** for 351 *mega-cities* c :

$$\Delta \text{LogNL}_{c,r,96-11} = \alpha + \beta \times \text{CDR}_{c,r,90} + \gamma \times \text{ADR}_{c,r,90} + X_c \zeta + \mu_c$$

$\Delta \text{LogNL}_{c,96-11}$ change in log mean night light intensity 1996-2011

$\text{CDR}_{c,r,90}$, $\text{ADR}_{c,r,90}$ child & age dep. ratios ca. 1990 (1985-1996)

- ▶ We add three **core controls** and **continent or country FE**:
 - ▶ Log city population size ca. 1990
 - ▶ Log city mean night light intensity in 1996
 - ▶ Log city population growth between 1995 and 2010
- ▶ β and γ capture effects on **night light per capita**.

Within vs. Between Regressions

- ▶ Three issues with **within-country regressions**:
 - ▶ Cities within any given country have very similar age structures (*within* component = only about 10% of the CDRs & ADRs)
 - ▶ Given free mobility, wages across cities equalized at the margin. Any increase in wage offered in one location induces in-migration that offsets the initial wage increase. Long-run: City economic growth measured by population growth only.
 - ▶ Free mobility also encourages sorting across cities in ways likely to endogenously influence the age structure of cities.
- ▶ **Between-country regressions**:
 - ▶ Restrict sample to largest city of each country, since no (or very little) mobility between them.

Baseline Results: CDR & ADR

Dep. Var.:	Δ Log Mean Night Light (NL) Intensity 1996-2011							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total Dep. Ratio 90	-1.11*** [0.13]	-0.86*** [0.14]	-0.09 [0.22]	-0.57* [0.29]				
Child Dep. Ratio 90					-1.12*** [0.13]	-0.86*** [0.14]	-0.12 [0.24]	-0.62** [0.28]
Aged Dep. Ratio 90					-1.21*** [0.35]	-1.13*** [0.38]	0.12 [0.57]	-1.03* [0.57]
Log Pop. 95	0.07*** [0.02]	0.05** [0.02]	0.04 [0.03]	0.07** [0.03]	0.07*** [0.02]	0.05** [0.02]	0.04 [0.03]	0.06* [0.03]
Log Mean NL 96	-0.38*** [0.03]	-0.34*** [0.04]	-0.22*** [0.05]	-0.25*** [0.05]	-0.37*** [0.04]	-0.33*** [0.04]	-0.22*** [0.05]	-0.25*** [0.05]
Δ Log Pop. 95-10	0.66*** [0.08]	0.64*** [0.09]	0.37*** [0.11]	0.33** [0.13]	0.66*** [0.09]	0.63*** [0.09]	0.37*** [0.11]	0.28* [0.16]
Observations	351	351	351	97	351	351	351	97
Adjusted R2	0.55	0.58	0.76	0.27	0.55	0.58	0.76	0.27
Fixed Effects	N	Cont.	Cntry	N	N	Cont.	Cntry	N
Largest Only	N	N	N	Y	N	N	N	Y

Going from 10th percentile to 90th percentile in CDR—one extra child—reduces growth rate of night lights by 28-50%. For ADR, the corresponding decrease is 17-20%.

Investigation of Causality:

- ▶ We compare cities with **same initial pop. size, economic development, pop. growth, and within same continent.**
- ▶ There could still be endogeneity.

1. Exploiting granularity of the age structure data.

Worse effect for younger children (0-9) & older seniors (75+).

2. Exploiting demographic cycles.

Children only have negative effect when they are children. Seniors have less negative effects later, probably because die.

3. Past age structure (1960s) as instrumental variable.

Assumption: not correlated with factors affecting growth 96-11.

Robustness Checks:

- ▶ Controlling for “**college share**” ca. 1990.
- ▶ Using **city per capita GDP** as alternative outcome (source: Oxford Economics 2019, not sure it is reliable).
- ▶ **Panel data** using per cap. GDP from Oxford Economics, since gives per cap. GDP and dep. ratios every 4 yrs from 2000-16.
- ▶ **Rural areas and secondary cities:**
 - ▶ Need to control for correlation with dep. ratios there.
 - ▶ Different effect of dependency ratios there? Smaller.
 - ▶ Cities disproportionately suffer from high dep. ratios.

Mechanisms:

- ▶ **Labor supply & productivity (I2D2) & time use (U.S.):**

Large negative effects of children and seniors in urban areas.

Smaller negative effects of children and seniors in rural areas.

May affect the growth trajectory of the cities.

- ▶ **Other data sets:**

Possibly larger effects for business & financial services.

Possibly larger effects for larger cities.

Effects not different across different areas within cities.

Dep. Var.:	Dummy if Works		Log Work Hours		Log Hourly Wage		Log Monthly Wage	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Panel A:</i>	Direct Effects (Including All Urban Individuals in the Samples)							
0-14 y.o.	-0.32*** [0.00]	-0.37*** [0.00]	-0.16*** [0.05]	-0.18*** [0.04]	-0.58*** [0.09]	-0.53*** [0.04]	-0.82*** [0.07]	-0.80*** [0.05]
65+ y.o.	-0.37*** [0.00]	-0.42*** [0.00]	-0.26*** [0.01]	-0.28*** [0.00]	-0.09*** [0.01]	-0.09*** [0.01]	-0.36*** [0.01]	-0.38*** [0.00]
Obs. (000s)	38,076	15,549	15,625	6,846	12,875	6,335	13,139	6,392
Adj. R2	0.30	0.34	0.14	0.16	0.91	0.85	0.91	0.83
Num. Country	122	52	122	52	122	52	122	52
Num. Sample	835	222	835	222	835	222	835	222
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Core Controls	Y	Y	Y	Y	Y	Y	Y	Y
Cntry-Dist. FE	N	Y	N	Y	N	Y	N	Y

- ▶ I2D2 database (World Bank): 835 household surveys in 122 countries.
- ▶ **Direct effects** of children/seniors on own labor supply and earnings?
- ▶ Urban obs., country-year sample FE, standard Mincerian controls.
- ▶ Children/seniors work less and earn much lower wages when do.

Dep. Var.:	Dummy if Works		Log Work Hours		Log Hourly Wage		Log Monthly Wage	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Panel B:</i>	Indirect Intra-Household Effects (Restricting to Urban Work.-Age Adults (15-64 y.o.))							
HH CDR	-0.02** [0.01]	-0.04*** [0.00]	-0.04*** [0.01]	-0.04*** [0.00]	-0.05*** [0.02]	0.01** [0.01]	-0.09*** [0.01]	-0.02*** [0.00]
HH ADR	-0.05*** [0.01]	-0.03*** [0.00]	-0.01 [0.01]	-0.01 [0.01]	-0.06*** [0.02]	-0.05*** [0.01]	-0.07*** [0.01]	-0.06*** [0.01]
Obs. (000s)	27,530	10,790	12,435	6,093	12,435	6,093	12,691	6,148
Adj. R2	0.17	0.25	0.2	0.08	0.96	0.86	0.95	0.85
Num. Country	121	52	121	52	121	52	121	52
Num. Sample	829	222	829	222	829	222	829	222
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Core Controls	Y	Y	Y	Y	Y	Y	Y	Y
Cntry-Dist. FE	N	Y	N	Y	N	Y	N	Y

- ▶ **Indirect intra-household effects of household CDR & ADR?**
- ▶ Same sample and specification but restrict to 18-67 y.o.
- ▶ Higher household CDR/ADR → reduced labor supply and wages.

Dep. Var.:	Dummy if Works		Log Work Hours		Log Hourly Wage		Log Monthly Wage	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
HH CDR	-0.05*** [0.00]	-0.01*** [0.00]	-0.03*** [0.00]	-0.05** [0.02]	0.00 [0.00]	0.02 [0.03]	-0.03*** [0.00]	-0.02* [0.01]
HH ADR	-0.06*** [0.00]	0.01 [0.02]	-0.02*** [0.00]	-0.00 [0.02]	-0.08*** [0.01]	-0.02 [0.03]	-0.10*** [0.01]	-0.02 [0.03]
Local CDR	-0.07*** [0.02]	-0.08*** [0.02]	-0.14*** [0.02]	-0.16* [0.09]	-0.44*** [0.08]	0.01 [0.17]	-0.58*** [0.08]	-0.145 [0.11]
Local ADR	-0.02 [0.03]	-0.30*** [0.05]	-0.11** [0.04]	-0.21 [0.32]	-0.57*** [0.11]	0.01 [0.76]	-0.69*** [0.12]	-0.20 [0.45]
“Local” Level	Dist.	PSU	Dist.	PSU	Dist.	PSU	Dist.	PSU
Obs. (000s)	7,109	1,639	4,287	613	4,287	613	4,329	639
Adj. R2	0.25	0.2	0.13	0.16	0.84	0.82	0.83	0.87
Num. Country	31	38	31	38	31	38	31	38
Num. Sample	83	124	83	124	83	124	83	124
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Core Controls	Y	Y	Y	Y	Y	Y	Y	Y

- ▶ **Effects of city CDR & ADR** on working-age members.
- ▶ Higher city CDR/ADR → labor supply and wages.

Dep. Var.:	Number of Minutes Spent Per Day on ... During the Week (Monday-Friday)							
	Personal Care of Relatives		Work, Education or Job Training		Sleep		Leisure & Other Activ.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Panel A:</i>	Indirect Intra-Household Effects (Restricting to Urban Work.-Age Adults (15-64 y.o.))							
HH CDR	67.8*** [1.9]	67.8*** [1.9]	-35.4*** [2.4]	-35.9*** [2.4]	-5.5*** [1.4]	-5.3*** [1.4]	-26.9*** [2.1]	-26.7*** [2.0]
HH ADR	-10.9** [4.5]	-10.1** [4.3]	-18.5** [7.9]	-17.0** [7.7]	7.3 [4.6]	6.8 [4.6]	22.1*** [6.8]	20.3*** [6.4]
Core Ctrls	Y	Y	Y	Y	Y	Y	Y	Y
MSA-County FE	N	Y	N	Y	N	Y	N	Y
Obs.	57,956	57,956	57,956	57,956	57,956	57,956	57,956	57,956
Adj. R2	0.26	0.26	0.20	0.21	0.10	0.11	0.12	0.13

- ▶ Effects of HH CDR & ADR on time use for working HH members?
- ▶ Source: US Time Use Survey. Day/hour FE, Mincerian controls.
- ▶ CDR increases “care”, reduces “work”, “sleep” and “leisure”
- ▶ ADR increases “leisure”, reduces “care” but also “work”

Dep. Var.:	Number of Minutes Spent Per Day on ... During the Week (Monday-Friday)							
	Personal Care of Relatives		Work, Education or Job Training		Sleep		Leisure & Other Activ.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Panel B:</i>	Indirect City-Wide Effects (Restricting to Urban Work.-Age Adults (15-64 y.o.))							
HH CDR	67.7*** [2.1]	67.7*** [2.1]	-36.0*** [2.5]	-36.1*** [2.5]	-5.2*** [1.2]	-5.2*** [1.2]	-26.5*** [2.3]	-26.4*** [2.3]
HH ADR	-10.6** [4.5]	-10.7** [4.5]	-18.0** [7.4]	-18.1** [7.4]	7.2 [4.9]	7.2 [4.8]	21.5*** [6.7]	21.5*** [6.7]
Local CDR	41.8* [24.0]	38.8* [20.6]	-0.9 [39.3]	33.2 [38.2]	-29.3 [19.1]	-42.8* [21.8]	-11.6 [31.6]	-29.3 [26.9]
Local ADR	14.3 [20.3]	39.3* [22.5]	-31.6 [36.1]	-45.6 [41.4]	-8.6 [19.7]	-17.6 [21.7]	25.9 [30.3]	24.0 [36.0]
Core Ctrls	Y	Y	Y	Y	Y	Y	Y	Y
"Local" Level	MSA	county	MSA	county	MSA	county	MSA	county
Obs.	57,956	57,956	57,956	57,956	57,956	57,956	57,956	57,956
Adj. R2	0.26	0.26	0.20	0.20	0.10	0.10	0.13	0.13

- ▶ Effects of city CDR & ADR on time use.
- ▶ Source: US Time Use Survey. Day/hour FE, Mincerian controls.
- ▶ City CDR & ADR increase care, city CDR reduces sleep.

Concluding Discussion

- ▶ We have built a novel new database on the age structure of cities for as many cities and years as possible.
- ▶ We document the rise of *cities of children or seniors*, i.e. cities with high population shares of children or seniors.
- ▶ Negative effects of children, especially younger children. These effects tend to disappear as children get older.
- ▶ Negative effects of seniors, especially older seniors.
- ▶ Effects not necessarily causal & lack of data on mechanisms.
- ▶ No policy recommendations.