Economic Development and Intergenerational Earnings Mobility: Evidence from Taiwan

Yu-Wei Luke Chu (Victoria University of Wellington)

Ming-Jen Lin (National Taiwan University)

Introduction

- The persistence of inequality/social class is ubiquitous

- Economists tend to believe that economic development will eventually reduce inequality.
  - Ex. the Kuznets curve suggests that the cross-sectional inequality will first increase then decrease as an economy grows.

- Another dimension of inequality is the intergenerational transmission of economic status; the most common measure is the intergenerational earnings elasticity (IGE)

Introduction

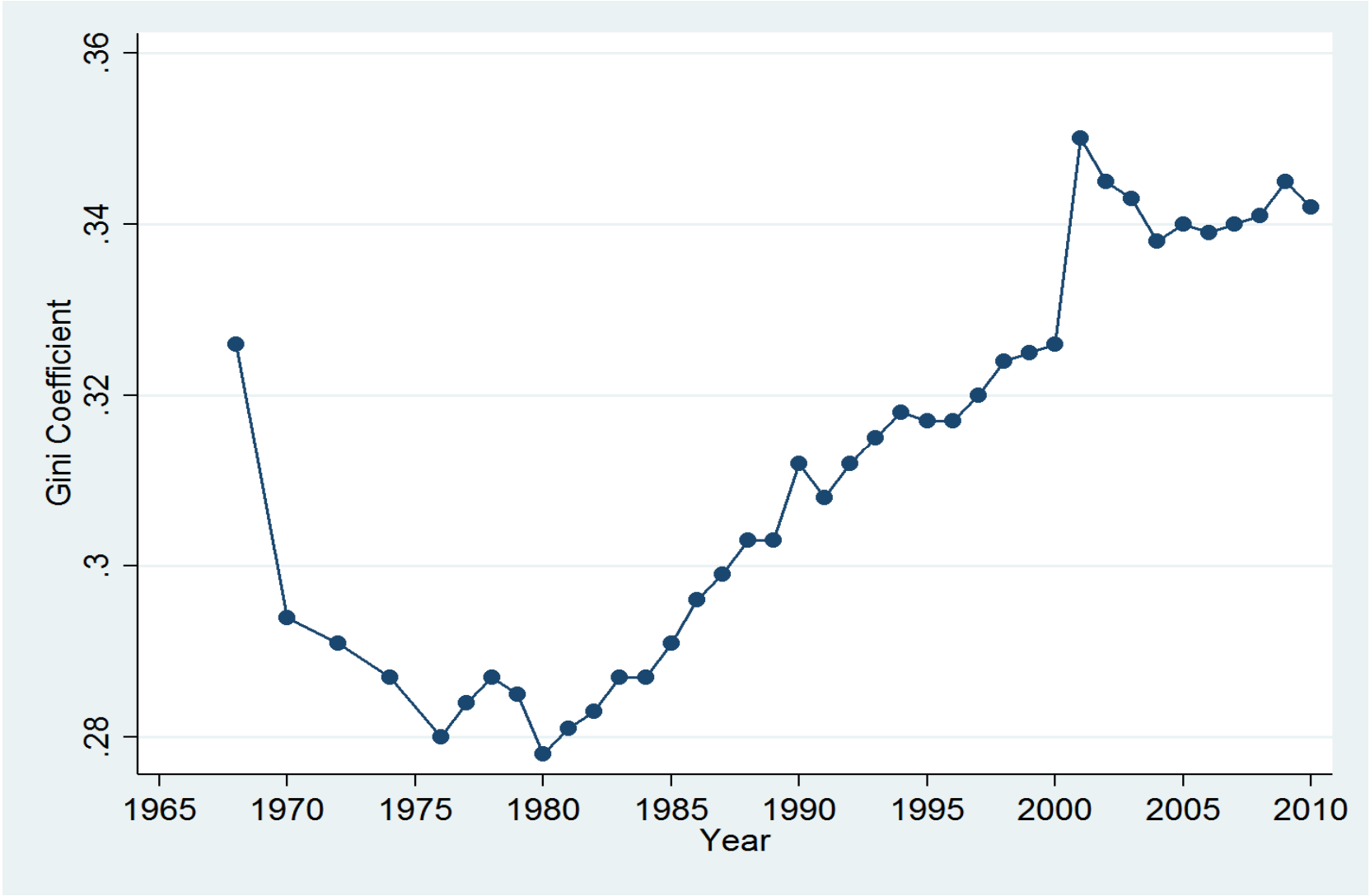
- There is little empirical evidence on the relationship between economic development and intergenerational earnings mobility

- Theoretical models often offer different predictions because causal mechanisms of IGE and their relative importance are still largely unclear.
  - For instance, economic development may increase intergenerational mobility by reducing cross-sectional inequality.
  - However, it may not be the case if the intergenerational transmission of abilities plays a major role in mobility.

Introduction

- We estimate the IGE and its change in Taiwan during a period of fast economic growth.
  - Taiwan started fast economic growth since 1960s and has relatively high-quality datasets
  - The current period: the sons' sample is from 2005-2010, and the fathers' sample is from 1978–1982
  - The earlier period: the sons' sample is from 1990-1994, and the fathers' sample is from 1968/1970
  - In 1990–1994, Taiwan was still an upper-middle income country and the real GDP per capita was around TWD 271,001 (~USD 9,000)
  - In 2005–2010, Taiwan had become a high income country, and the average real GDP per capita had doubled to TWD 540,628

Gini Coefficients in Taiwan, 1968–2010



Education
2005-2010 TSCS

Education Level (%)	TSCS Sons	TSCS Fathers	MUS Fathers
No Formal Education	0.0	18.6	10.3
Elementary School	4.1	54.2	57.2
Middle School	21.4	11.2	11.0
Vocational High School	36.0	4.5	7.3
Academic High School	6.0	4.8	5.4
Vocational College	17.7	3.5	3.6
University and above	14.8	3.2	5.4
Obs.	1,299	1,299	29,254

Education
1990-1994 TSCS

Education Level (%)	TSCS Sons	TSCS Fathers	1968 TW Statistical Abstract
No Formal Education	2.9	36.0	20.8
Elementary School	31.8	45.2	51.9
Middle School	19.6	7.6	12.2
Vocational High School	8.3	1.2	4.7
Academic High School	15.7	5.1	5.4
Vocational College	11.7	2.7	2.1
University and above	10.1	2.3	2.8
Obs.	2,143	2,143	n/a

Industry
2005-2010 TSCS

Industry (%)	TSCS Sons	TSCS Fathers	MUS Fathers
Agriculture, Fishing, and Forestry	4.8	34.8	25.8
Mining	0.5	1.7	1.8
Manufacturing	29.4	16.1	21.6
Utilities	0.7	0.9	0.9
Construction	13.7	9.4	11.1
Wholesale and Retail Trade	17.0	15.5	15.6
Transport, Storage, and Communication	6.8	6.6	8.5
Finance, Insurance, and Business Services	8.5	1.4	2.0
Education, Public Administration, and Personal Services	18.6	13.6	12.8

Industry
1990-1994 TSCS

Industry (%)	TSCS Sons	TSCS Fathers	1968 TW Statistical Abstract
Agriculture, Fishing, and Forestry	14.3	51.4	45.2
Mining	1.0	1.8	1.8
Manufacturing	28.1	10.8	11.7
Utilities	1.7	0.6	0.8
Construction	12.2	5.6	3.2
Wholesale and Retail Trade	14.6	11.3	9.6
Transport, Storage, and Communication	8.7	5.1	4.4
Finance, Insurance, and Business Services	3.7	1.0	n/a
Education, Public Administration, and Personal Services	15.8	12.5	23.3

Introduction

- We find that the IGE in Taiwan is around 0.4-0.5
  - It is similar to relatively less mobile countries like the U.S. and the U.K.

- Surprisingly, our results suggest that the IGE remains stable even though Taiwan experienced dramatic economic growth and social changes.

- We apply the decomposition method from Lefgren et al. (2012) and find that the intergenerational transmission of ability plays an important role in the IGE in Taiwan.

IGE

- If **permanent earnings** are available from a **representative sample**, we can easily estimate the intergenerational earnings elasticity (IGE) by OLS: $Y_i^s = \beta Y_i^f + e_i$
  - Y_i^s and Y_i^f are the permanent earnings of sons and their fathers in logarithm.
  - The intergenerational earnings elasticity, β, is the linear projection of Y_i^s on Y_i^f and simply a correlation not causality.
  - Short-run measures like annual earnings introduce measurement error and cause bias in the estimate of β.
  - In practice, researchers use long-run earnings (5-year average) to proxy fathers' permanent earnings (Solon 1992)

B-J Two Sample Estimation

- Panel data cover earnings from two or more generations are often unavailable

- Most research relies on Björklund-Jäntti's (1997) two sample method that predicts fathers' permanent earnings from a secondary sample

- To minimize life cycle bias, both the **secondary sample** and **earnings predictors** (e.g., occupation) need to be drawn from the time when fathers were at their prime working age
  - Short-run measures are good proxy only when earnings profile becomes stable
  - Haider and Solon (2006) suggest using people older than 30

Literature

- Most research on IGE is from developed countries where high quality data are available
  - The U.S. and U.K. is 0.4-0.5; the Nordic counties are ≈ 0.2
  - AU ≈ 0.2 (Leigh 2007) or 0.35 (Mendolia & Siminski 2016)
  - IGE appears to be small and around 0.25 in Korea (Choi and Hong 2011; Kim 2013; Ueda 2013), Singapore (Ng 2007; Ng et al. 2009), and Taiwan (Kan et al. 2015; Sun and Ueda 2015). However, these studies often lack of appropriate data such as representative samples.

- Intergenerational earnings mobility appears to be smaller in less developed countries and in countries with more cross-sectional income inequality (Blanden 2013; Bratsberg et al. 2007; Corak 2013; Solon 1999, 2002, 2015).

Literature

- Research on trends in IGE is relatively recent and small even in developed countries

- The evidence sometimes appears conflicting perhaps due to the substantial data requirement these studies face (Aaronson and Mazumder 2008; Bratberg et al. 2005; Chetty et al. 2014; Hertz 2007; Lee and Solon 2009; Lefranc and Trannoy 2005; Leigh 2007; Mayer and Lopoo 2005; Mendolia & Siminski 2016; Nicoletti and Ermisch 2007; Pekkala and Lucas 2007)

Literature

- In general, the literature does not find much evidence that IGE changes over time within a country.
  - Ex. The IGE in the U.S. has remained stable even though inequality has increased in recent years (Chetty et al. 2014; Lee and Solon 2009).
  - Maybe ability is more important than financial resources? (Lefgren et al. 2012; Cardak, Johnston, and Martin 2013)
  - These developed countries are too stable?

- The long-term trends in intergenerational mobility in occupation and social status seem to be stable in developed countries (Clark and Cummins 2015; Long and Ferrie 2013; Modalsli 2016; Olivetti and Paserman 2015; Xie and Killewald 2013).

2005-2010 TSCS

- The Taiwan Social Change Survey is a representative, repeated cross-sectional data available from 1990.

- We use working males aged 35-50 from the TSCS in 2005, 2007, 2009 and 2010 for the current period.
  - We choose a relatively narrow age range to minimize life cycle bias because Taiwanese men enter the labor market later due to military service and retire earlier (≈ 55) than other countries

- In these years, the TSCS asks survey participants their earnings and what their father's educational level, industry, and occupation was *when they were 15 years old*

1978-1982 MUS

- The average age for sons is 43 years old => the secondary sample for fathers should be from roughly 28 years ago when they were 15

- The secondary sample consists of working male aged 35-50 from the Manpower Utilization Survey (MUS) for 1978–1982, which is repeated cross-sectional data available every year since 1978.

- The distributions of earnings predictors in the MUS are consistent with those reported in the TSCS

Regression Model

- To estimate the IGE in 2005–2010, we first predict fathers' earnings based on the following model using the MUS sample:

$$y_i = \alpha + \mathbf{X}_i\boldsymbol{\Upsilon} + age_i + age_i^2 + year\ dummies + \varepsilon_i$$

  - y_i is monthly earnings in logarithm and X_i is a vector of earnings predictors including dummy variables for the seven education levels, nine industry categories, and seven occupational categories.

- We use $\widehat{\boldsymbol{\Upsilon}}$ to predict the <u>permanent component</u> of fathers' log earnings
  - The partial R-squared of $\widehat{\boldsymbol{\Upsilon}}$ is around 0.36

Regression Model

- Next, regress sons' log earnings on fathers' predicted log earnings in the TSCS sample:

$$y_i^s = \alpha + \beta \hat{y}_i^f + age_i^s + age_i^{s2} + year\ dummies + u_i$$

  - where y_i^s is sons' log monthly earnings and $\hat{y}_i^f = \mathbf{X}_i^f \hat{\Upsilon}$ is fathers' predicted log monthly earnings based on a vector of earnings predictors $\mathbf{X}_i^f$ reported in the TSCS.
  - In order to account for randomness in the two different samples, we resample both the primary and secondary samples with 1,000 replications to obtain the bootstrapped standard errors as suggested by Björklund and Jäntti (1997) and Inoue and Solon (2010).

IGE in 2005-2010

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All	Ind. & Occ.	Edu. & Ind.	Edu. & Occ.	Ind.	Occ.	Edu.
IGE	0.449***	0.403***	0.480***	0.448***	0.403***	0.401***	0.785***
	(0.053)	(0.053)	(0.060)	(0.055)	(0.062)	(0.054)	(0.102)

1990-1994 TSCS & SFIE

- We use working males aged 35-50 from the TSCS in 1990, 1991, 1992, and 1994

- As the average age of sons in the 1990–1994 TSCS data was 41 years old, the secondary sample should be drawn from about 25 years earlier, i.e., the late 1960s.

- We use the *1968/1970 Report on the Survey of Family Income and Expenditure* provides information on average household earnings by occupation of household heads.
  - The distributions of occupation is consistent with the TSCS
  - The microdata of the SFIE are available after 1976

Occupation
1968 SFIE

Occupation(%)	%	Household Earnings (TWD/mo)	# People Employed
Professionals and Technicians	4.0	4,366	1.5
Administrative Executives and Managerial Workers	2.2	5,248	1.8
Clerical Workers	6.7	3,438	1.5
Sales Workers	12.9	3,233	1.9
Service Workers	4.6	2,411	1.6
Agricultural, Fishery, and Forestry Workers	47.4	2,326	3.1
Production Workers, Transport Workers, and Laborers	22.2	2,721	1.8

Regression Model

- To estimate IGE in 1990–1994, we replace fathers' missing earnings by average occupational earnings and estimate the following model by OLS:

$$y_i^s = \alpha + \beta \bar{y}_i^o + age_i^s + age_i^{s2} + year\ dummies + u_i$$

  - where y_i^s is sons' log monthly earnings and $\bar{y}_i^o$ is average earnings by occupation in logarithm.
  - $\bar{y}_i^o$ is obtained by dividing average household earnings by the average number of people employed and then taking the logarithm.

- Intuitively, it is similar to applying the B-J method with an unrestricted sample of household heads using occupation as the only predictor

Regression Model

- Since only household earnings are available in the SFIE reports, the average earnings $\bar{y}_i^o$ suffer a division bias.
  - $\bar{y}_i^o$ assumes an equal share of earnings among workers within a household and therefore underestimates the average earnings of household heads.

- To quantify the bias, we also apply the proxy method to the 2005–2010 TSCS data based on the 1981 SFIE report.
  - The 1981 SFIE microdata is available and can help us to quantify the magnitudes of bias

- Although the proxy estimates will be biased, we can still investigate the change in IGE if the bias is stable

IGE in 1990-1994 & 2005-2010

	(1)	(2)	(3)	(4)
			1990–1994 TSCS	
	1968 SFIE 7. Occ.	1970 SFIE 7. Occ.	1968 SFIE 9. Occ.	1970 SFIE 8. Occ.
IGE	0.378*** (0.027)	0.375*** (0.027)	0.384*** (0.028)	0.381*** (0.027)
			2005–2010 TSCS	
	1981 SFIE 7. Occ.	1981 SFIE 9. Occ.	1981 SFIE 7 Occ. Microdata (No Div. bias) Household heads	1981 SFIE 7 Occ. Microdata Males 35-50
IGE	0.364*** (0.048)	0.365*** (0.047)	0.411*** (0.055)	0.444*** (0.061)

Discussion

- Lefgren et al. (2012) propose a decomposition on IGE:

$$\beta = \pi_1 + R^2 \cdot \pi_2,$$

  - π_1 is the effects of the father's financial resources on the son's earnings
  - π_2 is the effects of intergenerational transmission of human capital
  - R^2 is the fraction of paternal incomes explained by human capital
  - Notice that what they mean by "human capital transmission" is more similar to ability transmission; it is mechanistic persistence across generations that is independent of the level of financial investment
  - Ex. Genetic transmission of attributes and at-home nonfinancial investments.

Discussion

- Lefgren et al. (2012) suggest that π_2 equals to $\frac{\hat{\beta}edu\_\beta}{1-R^2}$

- If we take the two-sample estimate of 0.45 to be β, and an R-squared of 0.34 from a Mincer regression in the MUS sample, then the above formula implies a π_2 of 0.52
  - π_2 of 0.52 indicates that 40% of the intergenerational earnings elasticity in Taiwan is due to ability transmission.
  - The π_2 is actually a lower bound, so the true proportion may be more than 50%. (The true β may be smaller, and the true fraction of paternal earnings explained by ability may be larger than the estimated Mincer R-squared.)

Conclusion

- This paper provides descriptive evidence of the relationship between economic development and IGE
  - IGE in Taiwan is around 0.4–0.5, similar to relatively less mobile countries such as the U.K and the U.S.
  - As Taiwan and other Asian Tigers share many similarities, we suspect that the high estimated mobility is a result of estimation bias.
- Surprisingly, the IGE in Taiwan has remained stable, despite dramatic economic and social changes during this period.
- Ability transmission may play an important role in IGE