Economic Development and Intergenerational Earnings Mobility: Evidence from Taiwan

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August 2016

Abstract

How economic development affects intergenerational earnings elasticity is not well-documented. In this paper, we estimate intergenerational earnings elasticities between fathers and sons in two periods. In the current period, 2005–2010, Taiwan is already a developed economy with slower economic growth. We apply the two-sample approach developed by Björklund and Jäntti (1997) and find that intergenerational earnings elasticity is around 0.4–0.5 in this period. In the earlier period, 1990–1994, Taiwan was still a developing economy with fast economic growth. We mimic the Björklund-Jäntti two-sample approach and use average earnings by occupation as a proxy for fathers' earnings. To quantify potential bias, we apply the same method to the 2005–2010 data. Our proxy method yields similar estimates in both the early 1990s and late 2000s. These results suggest stable intergenerational transmission of economic status in Taiwan, despite its rapid economic development.

"It's harder to climb a ladder when the rungs are farther apart."

Timothy Noah, *The New Republic*, January 13, 2012

1. Introduction

The persistence of inequality is ubiquitous throughout human history. Nevertheless, economists tend to believe that economic development will eventually reduce inequality. For example, the famous Kuznets curve suggests that cross-sectional inequality will first increase, then decrease, as an economy grows.[1] Another important dimension of inequality is the intergenerational transmission of economic status. Economic theory suggests that there are many causal mechanisms that determine intergenerational income associations. However, as evidence on causal mechanisms and their relative importance is very sparse, different theoretical models often offer different predictions. For instance, some researchers have suggested that economic development reduces cross-sectional inequality and increases intergenerational mobility through efficient allocation of human capital (Maoz and Moav 1999; Owen and Weil 1998). Others point out that economic development and lower inequality may not necessarily promote mobility if the intergenerational transmission of abilities plays a major role (Han and Mulligan 2001; Iyigun 1995; Solon 2004).

Empirical research, even if it is correlational in nature, can provide a rich set of stylized facts to highlight potential mechanisms and to sharpen future theoretical research. However, there have been almost no empirical studies about the relationship between economic development and intergenerational income mobility. It is very challenging to estimate intergenerational mobility in developing or newly developed countries because high-quality data with information on two generations are often unavailable. For example, recent literature suggests high intergenerational earnings mobility in the fast-growing Asian Tigers: Korea (Choi and Hong 2011; Ueda 2013), Singapore (Ng 2007; Ng, Shen, and Ho 2009), and Taiwan (Kan, Li, and Wang 2015; Sun and Ueda 2015). However, as most of these studies rely on co-residing father-son pairs, the high estimated mobility could be a result of downward bias from using non-representative samples (Solon 1992). To the best of our knowledge, there is nothing in

[1] This traditional view has recently been challenged by many researchers. For example, in his popular book *Capital in the Twenty-First Century*, Piketty (2014) provides substantial historical evidence of long-term inequality and argues that the Kuznets curve is in fact a post-World World II anomaly.

the literature that documents changes in intergenerational mobility during a period of rapid economic development.

In this paper, we estimate intergenerational earnings elasticities between fathers and sons in Taiwan in 1990–1994 and 2005–2010. Taiwan has experienced rapid economic growth since the 1960s and has developed into a high-income economy in less than four decades. Taiwan was still an upper middle-income economy with high growth rates in 1990–1994; the average real GDP per capita (in 2011 Taiwanese dollars) was TWD 271,001 and the average growth rate was 7.3%. In 2005–2010, the average real GDP per capita had doubled to TWD 540,628 (1 USD ≈ 30 TWD), while the average growth rate had slowed to 4.6%. The two generations of fathers are from the late 1960s and the late 1970s, which were periods of extremely fast growth with real GDP growth rates of more than 10%. Although we do not have a generation from before the start of rapid growth because the earliest available data are from the 1960s, the four generations of fathers and sons studied in this paper cover most of the economic development process in Taiwan.

The primary samples for sons in this paper are working males aged 35–50 from the Taiwan Social Change Survey (TSCS) in the early 1990s (1990, 1991, 1992, and 1994 TSCS) and the late 2000s (2005, 2007, 2009, and 2010 TSCS). The TSCS is a representative repeat cross-sectional survey that was designed to track the profound economic, political, and social changes taking place in Taiwan, starting in 1990. Importantly, the TSCS provides information on the level of education, occupation, and industry of the fathers of survey respondents when the respondents were 15 years old. Our main empirical strategy is the Björklund and Jäntti (1997) two-sample method that utilizes a secondary sample to predict fathers' missing earnings. To avoid potential bias in the predicted earnings, as the average age of sons is about 40 years old, the secondary sample should be drawn from roughly 25 years ago when they were 15 to be consistent with the fathers' information in the primary sample. For the current period, 2005–2010, we use working males aged 35–50 from the Manpower Utilization Survey (MUS) in 1978–1982 as a secondary sample of potential fathers. For the earlier period, 1990–1994, because the microdata were not available, we use average earnings by occupation of household heads from the 1968 and 1970 Survey of Family Income and Expenditure (SFIE) government reports as a proxy for fathers' missing earnings. This proxy method is essentially equivalent to using occupations to predict earnings in an unrestricted secondary sample by the Björklund and Jäntti two-sample approach. To quantify the

bias and facilitate comparison between the two periods, we apply the proxy method to the 2005–2010 data using average occupational earnings from the 1981 SFIE government report.

Our results suggest that intergenerational earnings elasticity between fathers and sons in Taiwan is around 0.4–0.5 in the late 2000s. Intergenerational earnings mobility in Taiwan is similar to relatively less mobile countries such as the U.K and the U.S. We also apply the decomposition method from Lefgren, Lindquist, and Sims (2012) and find that intergenerational transmission of human capital can account for the majority of the intergenerational earnings elasticity in Taiwan in this period. Surprisingly, despite significant economic development in Taiwan, intergenerational earnings mobility appears to have been stable over time. The estimates for intergenerational earnings elasticity from the proxy method are around 0.37 in both the early 1990s and the late 2000s. The estimates in both periods are similar even within each age group. True intergenerational earnings elasticity in Taiwan is likely of the same magnitude, around 0.4–0.5, for the entire period.

This paper contributes to the literature in several important ways. We use carefully chosen representative samples to provide more reliable estimates of intergenerational earnings elasticity in Taiwan. Our results suggest that the high mobility reported in the literature for the Asian Tigers is possibly the result of non-representative samples. More importantly, we find that intergenerational earnings elasticity has remained stable, even though Taiwan has gone through fundamental economic and social changes. This finding appears to be consistent with the notion that the intergenerational transmission of ability, which is likely to be relatively stable, is the main channel for the intergenerational transmission of economic status.

This paper proceeds as follows. Section 2 reviews the relevant literature, and Section 3 briefly introduces the background in Taiwan. We discuss the TSCS, MUS and SFIE datasets in Section 4 and the regression models in Section 5. Section 6 presents the estimation results, and in Section 7 we state our conclusions.

2. Literature Review

Considering the significance of persistent income inequality, it is surprising that intergenerational mobility did not attract much attention from economists until the seminal work of Solon (1992) and Zimmerman (1992). They find an elasticity of about 0.4 in the U.S. and suggest that the small estimates in the previous literature are the

result of measurement error and non-representative samples. As data with earnings from two generations are often unavailable, Björklund and Jäntti (1997) construct a two-sample estimator that predicts fathers' earnings from a secondary sample and use the predicted earnings as a generated regressor.

Intergenerational income transmission appears to be stronger 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). Chetty, Hendren, Kline, and Saez (2014) find a strong correlation between intergenerational income association and cross-sectional inequality across areas within the U.S. as well. Naturally, there is growing concern that intergenerational income mobility is declining due to the large rise in overall income inequality in the U.S. in recent years (Mayer and Lopoo 2005). Surprisingly, recent studies show that intergenerational income mobility in the U.S. has remained stable (Chetty, Hendren, Kline, Saez, et al. 2014; Lee and Solon 2009). The available evidence also suggests no broad trends in intergenerational income persistence across many European countries (Bratberg, Anti Nilsen, and Vaage 2005; Lefranc and Trannoy 2005; Nicoletti and Ermisch John 2007; Pekkala and Lucas 2007).

Solon (2004) modifies the theoretical model in Becker and Tomes (1979) and shows that intergenerational income elasticity decreases with the progressivity of public investment in human capital, but that it becomes greater with stronger heritability of income-generating traits, more productive human capital investment, and higher returns to human capital.[2] Therefore, cross-country differences in both intergenerational mobility and cross-sectional income inequality could arise from differences in any of these factors. It is also possible that the effects of two or more factors may cancel each other out, so that intergenerational income mobility remains stable over time. Unfortunately, empirical evidence on the causal mechanisms and their relative importance in determining intergenerational income transmission is very limited. (See a comprehensive literature review by Black and Devereux (2011).) Lefgren, Lindquist, and Sims (2012) suggest a decomposition method that compares estimators from different earnings predictors (and the OLS estimator). They find that human capital transmission accounts for the majority of intergenerational income elasticity in Sweden, while fathers' financial resources play only a minor role.

[2] There is macroeconomic literature that models intergenerational income mobility in terms of human capital, inheritable ability, liquidity constraint, and redistributive policy (Durlauf 1996; Han and Mulligan 2001; Hidalgo Cabrillana 2009; Iyigun 1995; Maoz and Moav 1999; Owen and Weil 1998).

The literature on intergenerational mobility is limited in East Asian countries due to data availability problems. Only a handful of studies are available in China (Deng, Gustafsson, and Li 2013; Gong, Leigh, and Meng 2012), Japan (Lefranc, Ojima, and Yoshida 2014; Ueda 2009), Korea (Choi and Hong 2011; Kim 2013; Ueda 2013), Singapore (Ng 2007; Ng, Shen, and Ho 2009), and Taiwan (Kan, Li, and Wang 2015; Sun and Ueda 2015). Intergenerational earnings elasticities between fathers and sons appear to be 0.5 or greater in urban China, 0.4 in Japan, and around 0.25 among the Asian Tigers. However, in order to have information on both generations, many studies rely on non-representative samples such as co-residing father-son pairs (Choi and Hong 2011; Deng, Gustafsson, and Li 2013; Kan, Li, and Wang 2015; Ng 2007; Ng, Shen, and Ho 2009; Ueda 2013). Not only is sample selection a problem, there could also be substantial life-cycle bias, because the fathers tend to be too old and the sons too young among these pairs (Haider and Solon 2006). For example, the co-residing rate is only about 40% in Taiwan, and these families tend to be relatively poorer (Chu and Yu 2009). Because Kan, Li, and Wang (2015) use a co-residing sample, the average age of sons in their study is only 30. Since Taiwanese men need to complete two to three years of compulsory military service before entering the labor market, these sons are still in the early stages of their careers, and their short-run earnings are not a good proxy for permanent earnings.

The Asian literature relies strongly on the Björklund and Jäntti two-sample approach. However, one potential problem that is rarely discussed in the literature is prediction bias: the distribution of predicted earnings will not necessarily represent the distribution of true earnings. Many studies use current occupations to predict permanent earnings (Gong, Leigh, and Meng 2012; Lefranc, Ojima, and Yoshida 2014; Ng 2007; Ng, Shen, and Ho 2009; Ueda 2009), ignoring the possibility that a person's occupation may change over their life cycle. Moreover, in many studies, the secondary samples are only a few years apart from the primary samples and they may not reflect the labor market for the real fathers (Kan, Li, and Wang 2015; Sun and Ueda 2015; Ueda 2009, 2013). For example, the primary sample in Sun and Ueda (2015) is from 2004–2008, but the secondary sample is from 1998, only six to ten years earlier. In Kan, Li, and Wang (2015), the secondary sample is from 1978–1988 and even overlaps with the primary sample, which is from 1988–2006. Since the relationships between earnings and their predictors in a fast-growing economy can change rapidly, the secondary

sample needs to be drawn from the particular time when the real fathers were at their prime working age (Kim 2013).

3. Background in Taiwan

Taiwan has been rapidly growing since the 1960s along with the other Asian Tigers. Figure 1 shows real GDP per capita (in 2011 Taiwanese dollars) from 1965–2010. It doubled about every ten years until 1995. It was only TWD 39,429 (USD 986) in 1965. It increased to TWD 79,658 (USD 2,096) in 1975, TWD 160,128 (USD 4,017) in 1985, and TWD 323,363 (USD 12,207) in 1995.[3] In 2010, real GDP per capita reached TWD 595,811 (USD 18,825). (Purchasing power parity GDP per capita was USD 38,593 in 2010.) Figure 2 shows real GDP growth rates in Taiwan from 1965–2010. Taiwan enjoyed extremely fast economic growth prior to 1985. Average growth rates were 10.6% in 1965–1974 and 9.3% in 1975–1984. The average real GDP growth rate was 7.3% in 1990–1994 when Taiwan was still an upper middle-income economy. However, as Taiwan became a high-income economy, average GDP growth rates slowed to 5.1% in 1995–2004 and 4.6% in 2005–2010. The Gini coefficients are presented in Figure 3. Interestingly, the Kuznets curve is not applicable to Taiwan. Inequality appears to decrease at first, but it has been increasing since 1980. The Gini coefficient rises from 0.31 in 1990 to 0.34 in 2010.

Taiwan has undergone significant political and social changes starting in the late 1980s. It had been under martial law for more than 38 years, but martial law was ended in 1987. The parliament (Legislative Yuan), which was elected in 1947 and was supposed to represent mainland China constituencies, resigned in 1991, and a new parliament was elected in 1992. The first direct presidential election took place in 1996. However, it was not until 2000 that the major opposition party (the Democratic Progressive Party, DPP) won the presidential election for the first time. This ended more than 50 years of hegemony by the former ruling party (the Kuomintang, KMT). Taiwan has become a stable democracy. The 2016 presidential election brought party alternation for the third time and the first female president.

The considerations just discussed suggest that sons in the early 1990s were living and working in a society very different from sons in the late 2000s. Taiwan was

[3] Year 2011 is the base year, in which the GDP deflator equals 100. The USD values are based on the official exchange rates for each year. Figures 1 and 2 are based on data from the Directorate General of Budget, Accounting and Statistics, Executive Yuan, Taiwan.

still a developing economy with high growth rates in the early 1990s. However, Taiwan had become a developed economy with slower growth rates and democracy by the late 2000s. Cross-sectional inequality also increases during this period. In the next section, the data will also show the generational differences in labor force composition across the four generations of fathers and sons.

4. Data

In this paper, we use the Taiwan Social Change Survey (TSCS) as our primary sample for sons in both periods studied, 2005–2010 and 1990–1994. Since the TSCS does not have information on earnings for the participants' fathers, but only earnings predictors for them, we utilize two other datasets to obtain fathers' earnings. We use the Manpower Utilization Survey (MUS) in 1978–1982 for the current period, 2005–2010, and the Survey of Family Income and Expenditure (SFIE) in 1968 and 1970 for the earlier period, 1990–1994. We discuss these datasets in detail below.

4.1. The Current Period, 2005–2010

As few datasets have information for the earnings of two generations, many studies apply the Björklund and Jäntti two-sample method that predicts fathers' earnings from a secondary sample. Although common earning predictors such as education, industry, and occupation are available in most datasets, the data requirements for this approach are still very demanding. Haider and Solon (2006) suggest using earnings from the prime working age, 30–50 years old, for both generations to minimize so-called life-cycle bias. Therefore, while many surveys, for example, ask respondents about their fathers' *current* occupations, we need to know what the fathers' occupations were when they were 30–50 years old, to minimize life-cycle bias in the predicted earnings. More importantly, not only may people change occupations, the returns from different occupations may change as well. The relationship between earnings and their predictors may not remain the same over time. Therefore, to reduce prediction bias (and thus life-cycle bias), we need the information on earnings predictors and the fathers' sample to be drawn from the time when fathers were at prime working age.

In this paper, we use the Taiwan Social Change Survey (TSCS) as our primary sample for sons. The TSCS is a repeated cross-sectional survey, a representative sample of Taiwanese adult individuals aged 18 and above. The survey was first conducted in

1984–1985 as a pilot study. It has been since conducted every year from 1990 to the present. While the TSCS was designed to track social changes and it thus focuses on cultural, social, and political considerations, it does contain information on respondents' earnings and relevant earnings predictors for respondents and their fathers. The earnings measure in the TSCS is pre-tax monthly earnings (labor income).[4] Moreover, the TSCS asks survey participants what their father's educational level, industry, and occupation was *when they were 15 years old*. For the current period, we use the TSCS from 2005, 2007, 2009 and 2010, years in which all of the required information was requested in the surveys.[5] Taiwanese men need to serve in the military for two to three years; the average retirement age is also relatively young, around 55–60. [6] As Taiwanese men enter the labor market relatively late and leave it relatively early, we restrict the sample to working males aged 35–50 (born in 1955–1975) with positive earnings. We also restrict the sample to respondents whose fathers were alive when they were 15. This leads to a sample size of 1,299 in the primary sample of sons.

Since we do not have data on fathers' earnings when the sons were 15 years old, we need another sample to predict fathers' missing earnings. As the average age of sons in the primary sample is 43 years old, the secondary sample of potential fathers should be drawn from around 28 years earlier. We use the Manpower Utilization Survey (MUS) for 1978–1982, which is repeated cross-sectional data available every year since 1978. The MUS is a large representative sample of the Taiwanese labor force (aged 15 and above) with more than 15,000 households (about 50,000 individuals) interviewed every year. We restrict our secondary sample of potential fathers to working males aged 35–50 who have positive earnings and information available on their educational levels,

[4] The earnings variable in 2005–2010 TSCS is recorded in 19 brackets in TWD 10,000 (about USD 300): TWD 1–10,000, TWD 10,001–20,000 ... TWD 190,001–200,000, and two top brackets: TWD 200,001–300,000 and TWD 300,001 and above. For the top bracket, we take TWD 300,000 as respondents' earnings. For the lower brackets, we take mid-points to be respondents' earnings: 5000, 15,000 … 195,000, 250,000. We also estimate intergenerational earnings elasticity using interval regressions as a robustness check.

[5] Since the second round of the TSCS, each round lasts for five years, with ten different questionnaires in use. Two random samples of adults are selected each year to complete two questionnaires. We use two surveys in 2005 and one survey in 2007, 2009, and 2010. The 2010 data are from the sixth round of the TSCS. All other data are from the fifth round of the TSCS.

[6] The average self-reported retirement age was 54.9 in 2005 and 56.6, in 2010 based on the Survey on Turnover and Movement of Employees. As some people continue to work after they retire from their primary jobs, the average retirement age based on labor force participation was around 61 from 2005–2010.

industries, and occupations.[7] The sample size in the secondary sample of potential fathers is 29,254. [8]

The earnings predictors need to be coded in exactly the same way in both the primary and secondary samples in order to apply the Björklund and Jäntti two-sample estimator. For education, there are seven categories in the MUS but twenty categories in the TSCS. We aggregate the finer categories in the TSCS to the seven categories in the MUS: no formal education, elementary school, middle school, general high school, vocational high school, junior/vocational college, university and above.[9] Both the MUS and TSCS record industries using Taiwan's standard 2-digit industrial classification system.[10] We aggregate industries in both datasets to the following nine categories, based on the first digit of the classification: agriculture, fishing, and forestry; mining; manufacturing; utilities; construction; wholesale and retail trade; transport, storage, and communication; finance, insurance, real estate, and business services; education, public administration, and personal services. The occupations in the TSCS are reported in its own 3-digit classification. While the TSCS classification is not exactly the same as the 3-digit standard occupational classification in the MUS, we are able to aggregate the occupations in the TSCS to the seven 1-digit categories in the MUS: professionals and technicians; administrative executives and managerial workers; clerical workers; sales workers; service workers; agricultural, fishery, and forestry workers; production workers, transport workers, and laborers.[11]

Table 1 presents the ages, earnings, and distributions of educational levels, industries, and occupations of fathers and sons. We apply the corresponding sampling weights in each dataset to create the descriptive statistics. Columns (1) and (2) show the distributions of earnings predictors of sons and their fathers from the 2005–2010 TSCS. Although sons' earnings predictors are not needed for estimation, they vividly illustrate the generational changes in the Taiwanese labor force. For example, the sons

[7] The MUS asks people about their secondary jobs, but it only reports earnings from the primary job. However, 98% of working males aged 35–50 report having only one job.
[8] The MUS does not ask male participants whether they have children or not. Although it is possible to identify whether a male household heads have children through reports from their wives, the information is very incomplete. Only half of wives report this information.
[9] We combine illiterate and no formal education into one category. We treat both 2-year and 4-year military and police academies as junior/vocational colleges. Cadet school is coded as vocational high school.
[10] The 1-digit categories are identical in both datasets, but the TSCS is based on a newer 2-digit standard industrial classification and has slightly finer industries categories than the MUS.
[11] All the agriculture, fishing, and forestry workers are in the agriculture, fishing, and forestry industry. However, that industry also includes managerial workers such as farm owners.

are much more educated and less likely to work in the agricultural sector. Column (3) reports earnings, age, and the distributions of earnings predictors for working males aged 35–50 from the 1978–1981 MUS. Columns (2) and (3) show that the two samples are indeed comparable and match each other well in terms of the relative distributions of earnings predictors. Only minor differences exist. For example, compared to the working males in the MUS, there is a higher proportion of real fathers in the TSCS who have no formal education, who work in the agriculture, fishing, and forestry industry, or who are agriculture, fishing or forestry workers. Some of the difference may be due to reporting error, since the TSCS asks survey participants to recall information about their fathers from decades earlier. It is also possible that real fathers are from slightly older cohorts than the working males in the MUS.[12]

4.2. The Earlier Period, 1990–1994

For the earlier period, we use the TSCS from 1990, 1991, 1992, and 1994 to create our primary sample of sons.[13] The TSCS in those years asked respondents what their father's educational level, industry, and occupation was when they were 15 years old (1992 and 1994) or 18 years old (1990 and 1991), if their fathers were alive at that time. The coding of these earning predictors is essentially the same as the 2005–2010 TSCS, and we are able to aggregate to seven education categories, nine industry categories, and seven occupational categories. We restrict our primary sample to working males aged 35–50 (born in 1940–1959) with positive earnings.[14] This leads to a sample size of 2,143 in our primary sample of sons.

In Table 2, column (1) presents age, earnings, and earnings predictors for the sons from the 1990–1994 TSCS data. The composition of the Taiwanese workforce in the early 1990s was very different from what it was in the late 2000s, as shown in Table 1. For example, in column (1), while most people have some formal education, one-third of them have only an elementary school degree. (Taiwan increased its compulsory

[12] Only the 2007 TSCS asks respondents for their father's age. The average father-son age difference in the TSCS data is 31 years, with a standard deviation of 7 years. This implies the average age of real fathers would have been 46 when the sons were 15. The estimate of intergenerational earnings elasticity is nearly identical if we restrict the MUS sample to fathers 40–55 years old (not reported).

[13] We use one survey in 1990 and two surveys in 1991, 1992, and 1994. All data are from the second round of the TSCS.

[14] The top income bracket is TWD 200,000 in the 1990–1994 TSCS. Earnings in the 1990 TSCS are recorded in their original values. Earnings are recorded in TWD 20,000 brackets in the 1991 TSCS, while earnings in the 1992 and 1994 TSCS are recorded in TWD 10,000 brackets, as in the 2005–2010 TSCS. The estimates in the next section are quantitatively similar if we exclude data from 1991.

education requirement from six years to nine years in 1968.) Also, a substantial share of the labor force was still employed in the agricultural sector in the early 1990s. Column (2) shows the distributions of earnings predictors for the fathers reported in the 1990–1994 TSCS. It is clear that the fathers in Table 2 are older than the fathers in Table 1. The fathers in column (2) have very low educational attainments; less than 20% of them have a middle-school degree or higher. The agricultural sector accounts for a large share of Taiwan economy; half of the fathers in column (2) are agricultural, fishery, or forestry workers. It is easily seen from Tables 1 and 2 that since then Taiwan has significantly improved its workforce and been transformed from an agricultural to an industrial economy.

As the average age of sons in the 1990–1994 TSCS data was 41 years old, and they were asked for information about their fathers from when they were 15 or 18 years old, the secondary sample should be drawn from about 25 years earlier, i.e., the late 1960s. Unlike most newly developed countries, Taiwan has many extensive datasets from earlier years because of institutions that were first developed by the Japanese colonial government and later continued by the Taiwanese government. One limitation is that the original microdata of many early datasets are unavailable, so we can only rely on summary statistics from government publications. To investigate the validity of the father characteristics reported in the TSCS, we compare them with the summary statistics from the *1968 Statistical Abstract of Interior of the Republic of China*, which is available for every year since 1946 and which provides population counts by gender in each education, industry, and occupation category. Column (3) in Table 2 shows the distributions of education levels, industries, and occupations among employed males aged 15 and above in 1968.[15] The finance, insurance, real estate, and business services industry was not reported separately in 1968; rather, it was combined with the public administration, education, and personal services industry. Even though we cannot restrict the age range in column (3), the distributions of earnings predictors in column (3) are very similar to those in column (2).

Unfortunately, the *1968 Statistical Abstract of Interior of the Republic of China* does not report earnings. One dataset with information on earnings and their predictors

[15] The levels of education are from the *Taiwan Demographic Fact Book, Republic of China* because the *Statistical Abstract of Interior of the Republic of China* does not separate a university degree from a junior college degree. The data in both reports are from the same source. The distribution of education in column (3) is based on all males aged 15 and above who are not students, regardless of their employment status.

in this period is the Survey of Family Income and Expenditure (SFIE). The SFIE is a representative household survey that was first conducted biennially from 1964–1970 with a sample size of about 3,000 households. It then became an annual survey with growing sample sizes. Although the microdata of the SFIE before 1976 are not available, the *1968 Report on the Survey of Family Income and Expenditure* provides information on average household earnings by occupation of household heads.[16] For robustness, we also use average earnings from the 1970 SFIE report.[17] In Table 3, the upper and middle panels present the distributions, average household monthly earnings, and the average numbers of people employed per household in 1968 and 1970 by occupation of household heads. The distributions of household heads' occupations in 1968 and 1970 are very close to the real fathers' occupations in Table 2. So the SFIE data are indeed drawn from a population comparable to the real fathers in the TSCS. The lower panel shows the same information in 1981 from the 1981 SFIE report. The distribution of occupations in 1981 is also similar to fathers' occupations in Table 1.

5. Regression Model

Our main empirical strategy is to estimate intergenerational earnings elasticity by the Björklund and Jäntti two-sample method, which is the standard methodology when fathers' and sons' earnings are not available in one dataset. As the theoretical properties of this approach have been thoroughly discussed in many papers, such as Björklund and Jäntti (1997) and Inoue and Solon (2010), we focus on the empirical models in this section.

If the data provide lifetime earnings for both generations, we can easily estimate the intergenerational earnings elasticity by OLS:

1) $$Y_i^s = \beta Y_i^f + e_i,$$

[16] The earnings measure is the sum of the following three sources of labor incomes: wages, net agricultural income, and mixed income that consists of net operation surplus and net professional income. We divide annual earnings by 12 to get monthly earnings.

[17] The 1970 data are from the *1974 Report on the Survey of Personal Income Distribution in Taiwan Area*, which includes information back through 1970. The *Report on the Survey of Family Income and Expenditure* series does not include the SFIE data from Taipei city (the capital) after 1968 due to the separation of responsible statistics departments. The 1981 data are from the *1981 Report on the Survey of Personal Income Distribution in Taiwan Area*.

where Y_i^s and Y_i^f are the permanent earnings of sons and their fathers in logarithm, and e_i is an error term that is orthogonal to Y_i^f. The intergenerational earnings elasticity, β, is the linear projection of Y_i^s on Y_i^f and it is therefore not a causal relationship but a correlation. One can show that β is the correlation coefficient between Y_i^s and Y_i^f when their variances are equal to one other. In practice, researchers often rely on short-run measures like current earnings as a proxy for permanent earnings, but this introduces a measurement error into the variables and causes the estimate of β to be biased. In general, not just a noisy independent variable, but a noisy dependent variable, could cause bias in the estimate. Haider and Solon (2006) point out that the traditional classical measurement error assumption is not valid in this context because of changing earnings profiles over the life cycle.[18] In this paper, we restrict our main samples to males aged 35–50 to minimize the life-cycle bias.

To estimate intergenerational earnings elasticity in 2005–2010, we first estimate the following model by OLS using the MUS sample, in order to predict fathers' missing earnings:

2) $$y_i = X_i Y + age_i + age_i^2 + MUS\ year\ dummies + \varepsilon_i,$$

where 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 also control for age and its square and dummy variables for each year in the MUS.

Next, we use $\hat{Y}$ to predict the permanent component of fathers' log earnings, and then regress sons' log earnings on fathers' predicted log earnings in the TSCS sample:

3) $$y_i^s = \beta \hat{y}_i^f + age_i^s + age_i^{s\,2} + TSCS\ year\ dummies + u_i,$$

where y_i^s is sons' log monthly earnings and $\hat{y}_i^f = X_i^f \hat{Y}$ is fathers' predicted log monthly earnings based on a vector of earnings predictors X_i^f reported in the TSCS. We

[18] The life-cycle bias arises because the slope coefficient in the linear projection of current (observed) earnings on permanent earnings differs from unity at the early or late stage of the life cycle. ($y^{permanent} = \lambda y^{short\text{-}run} + \varepsilon$, where $\lambda \neq 1$.) In fact, life-cycle bias could result in amplification bias rather than attenuation bias.

control for sons' age, age squared, and dummy variables for each year 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).[19] Since introducing sampling weights complicates the bootstrap, as is common in the literature, we do not use sampling weights in all of the regressions. All of the point estimates in this paper are quantitatively similar with sampling weights.

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

$$4) \qquad y_i^s = \beta \bar{y}_i^o + age_i^s + age_i^{s2} + TSCS\ year\ dummies + u_i,$$

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 (column (2) in Table 3) by the average number of people employed (column (3) in Table 3) and then taking the logarithm. Because our focus is to investigate the change in intergenerational earnings mobility, we also estimate Equation (4) using the 2005–2010 TSCS data, where average occupational earnings are calculated from the 1981 SFIE report. We use bootstrap to estimate the standard errors with 1,000 replications.[20]

Notice that predicted earnings without an age adjustment are simply the average earnings by occupation, when occupations are the only earnings predictors in Equation (2).[21] If we have average earnings of household heads, Equation (4) is essentially the same as applying the Björklund and Jäntti two-sample method in a secondary sample of household heads without restricting their age and gender. As most real fathers are household heads, this proxy method should introduce little bias into the estimates, even with an unrestricted secondary sample. However, only household earnings are available in the SFIE reports, and the average earnings that we construct, $\bar{y}_i^o$, suffer a division

[19] Inoue and Solon (2010) also provide a consistent estimator for the standard error.
[20] The estimated standard errors could be underestimated because we do not have a secondary sample and therefore ignore randomness in the average earnings. However, in Table 7, for the 2005–2010 data, the estimated (bootstrap) standard errors using averages (columns (5) and (6)) are similar to those using microdata (columns (7) and (8)). Therefore, the magnitude of the bias should be small.
[21] The Björklund and Jäntti two-sample estimator often predicts earnings in logarithm. Using average occupational earnings is equivalent to using occupations to predict earnings in levels and then taking the logarithm of the predicted earnings.

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. If the magnitudes of division bias, the ratios of $\bar{y}_i^o$ to true household head earnings, differ across occupations, the estimate of β in Equation (4) would be biased.[22] More importantly, while the estimates may be biased, we can still compare the estimated elasticities from the two periods, so long as the magnitudes of bias remain stable, that is, if these ratios do not change over time in each occupational category.[23]

6. Estimation Results

6.1. The Current Period, 2005–2010

In Table 4, we present the estimates for earnings predictors from Equation (2) in the MUS sample. The omitted education category is no formal education, and the omitted industry and occupational categories are the agriculture, fishing, forestry industry and workers. All of the estimates for industries and occupations are positive and significant, suggesting that workers from the agricultural sector earn significantly less than workers from other industries and occupations. Other estimates are also consistent with our expectations. For example, workers with better education earn more, managerial workers have the highest earnings, and so forth. The more important statistic in Table 4 is the R-squared that measures the predictive power of the regressors. The adjusted R-squared equals 0.46. Because our goal is to predict permanent earnings, we also calculate the partial R-squared from the above regression by partialling out age, age squared, and dummies for each year. The partial R-squared remains a good size and equals 0.35, indicating that level of education, industry, and occupation are strong predictors of permanent earnings.

We report the Björklund and Jäntti two-sample estimates of intergenerational earnings elasticity from Equation (3) in Table 5. In column (1), we use all earnings predictors shown in Table 4 and regress sons' log monthly earnings on their fathers' predicted log monthly earnings. The estimate of intergenerational earnings elasticity

[22] We calculate these ratios using the 1981 SFIE microdata and find that they are fairly similar across occupations. These ratios range from 0.7–0.8, except for the category of agricultural workers, in which the ratio is 0.6. If these ratios are similar in the 1968 and 1970 SFIE data, the bias in our estimates due to such division bias in $\bar{y}_i^o$ is probably not overly large.

[23] We find that the average share of household wages earned by household heads is about 80% in both 1966 and 1981. Unfortunately, this information is only available for wage income, and we are not able to compare it within occupations because the occupation categories in the 1966 report are not comparable to those in later reports.

equals 0.45 in this period.[24] Our estimate is substantially greater than the previous estimates of around 0.25 from Kan, Li, and Wang (2015) and Sun and Ueda (2015). As Solon (1992) has pointed out, non-representative samples can cause severe downward bias in the estimates. The larger estimate is what we would expect from correcting such bias in the previous studies. In fact, if we restrict our primary sample to working males aged 26–45 years old who are co-residing with their fathers, as in Kan, Li, and Wang (2015), we find a similar intergenerational earnings elasticity of 0.22 (not reported in the paper). Our result shows that intergenerational earnings mobility in Taiwan is not as high as previous studies suggest.

In columns (2) – (4), instead of using all earnings predictors, we use only two out of three sets of predictors to predict fathers' earnings. The estimates remain quantitatively similar to column (1), ranging from 0.40–0.48. In the last three columns, columns (5) – (7), only one set of earnings predictors is used in the first stage regression. Using only industry or occupation yields similar estimates of about 0.4. However, using only level of education gives a much larger estimate of 0.79. As education is strongly correlated with income generating traits and abilities, and the intergenerational transmission of these traits is likely stronger than the intergenerational income correlation, using education as an earnings predictor may introduce upward bias into the estimates (Solon 1992). Given the intense competition in the Taiwanese education system, such a mechanism is probably even stronger in Taiwan, and it is not surprising to get a large (but biased) estimate for intergenerational earnings elasticity by using education attainment as a predictor. To check the robustness of our results, as sons' earnings are originally recorded in intervals (Note 4), we estimate intergenerational earnings elasticity by interval regressions. These results are in Appendix Table A1 and remain quantitatively similar to those in Table 5. Since the 1985 TSCS has comparable information on industries and occupations (but not education), as another robustness check, we also use the 1985 TSCS as the secondary sample, and the estimate of intergenerational earnings elasticity is 0.43 (not reported in the paper).

The finding that the intergenerational earnings elasticity in Taiwan is similar to relatively less mobile countries like the U.K. and the U.S. is especially notable. Intuitively, we would expect fathers' earnings to be correlated only weakly with sons'

[24] The estimate for intergenerational earnings elasticity equals 0.47 if we predict earnings in levels and then take the log of the predicted earnings. Notice that the estimates for age and year dummies in Equation (2) are needed for predicting fathers' earnings in levels.

earnings, because the fathers' generation experienced fast economic growth, and cross-sectional inequality in Taiwan was at its lowest level around 1980. A potential explanation is that parental financial resources may not play a major role in intergenerational earnings transmission in Taiwan. Indeed, such explanation is consistent with the result in column (7) that the estimate is largest when education attainment is used as the only predictor. Lefgren, Lindquist, and Sims (2012) decompose intergenerational earnings elasticity into the effects of the father's financial resources on the son's earnings (π_1) and the effects of intergenerational transmission of human capital (π_2). Here, they refer human capita transmission as mechanistic persistence across generations that is independent of the level of financial investment such as genetic transmission of attributes and at-home nonfinancial investments. They suggest that π_2 equals to $\frac{\hat{\beta}^{\text{edu}} - \beta}{1 - R^2}$, where $\hat{\beta}^{\text{edu}}$ is the estimate from using level of education as the only predictor, β is intergenerational earnings elasticity, and R^2 is the R-squared from a Mincer regression that regresses paternal permanent income on human capital variables.[25] Regressing fathers' permanent earnings (partialling out age, age-squared, and year dummies) on levels of education yields an R-squared of 0.13 in the MUS sample. If we take the two-sample estimate of 0.45 in column (1) to be β, then the above formula implies a π_2 of 0.39. Therefore, the majority of intergenerational earnings elasticity in Taiwan appears to be driven by the effect of human capital transmission. Since education is used as an earnings predictor, our two-sample estimate could be biased slightly upward. As the true β may be smaller, and the true fraction of paternal earnings explained by human capital may be larger than the estimated Mincer R-squared, we probably underestimate the importance of π_2.

Table 6 presents the estimates of intergenerational earnings elasticity by age group (the upper panel) and by cohort (the lower panel). All of the earnings predictors are used to predict fathers' earnings. In the upper panel, in column (1) we increase the age range of sons in the TSCS data to 30–55 years old. (The age range in the MUS sample remains 35–50.) The estimate for intergenerational earnings elasticity is 0.46, nearly identical to the results in Table 5. Columns (2) – (5) show the estimates in four

[25] Lefgren, Lindquist, and Sims (2012) show that the OLS estimate is a consistent estimate of intergenerational earnings elasticity (β), which equals $\pi_1 + R^2 \cdot \pi_2$, while an estimate that uses education as the predictor is a consistent estimate of $\pi_1 + \pi_2$. Therefore, $\pi_2 = \frac{\hat{\beta}^{\text{edu}} - \beta}{1 - R^2}$. More generally, Lefgren, Lindquist, and Sims (2012) suggest that $\frac{\hat{\beta}^{\text{edu}} - \beta}{1 - R^2}$ is a lower bound of π_2.

overlapping age groups: 30–40, 35–45, 40–50, and 45–55. There appears to be life-cycle bias in the youngest age group. In column (2), the estimate for 30–40 year olds is only 0.32, substantially smaller than the estimates for the older age groups. In columns (3) and (4), the two age groups belong to the main sample (ages 35–50), and the results are quantitatively similar to the results in Table 5. The estimate in column (5) is a bit large. Because the real fathers in column (5) would be older, the earnings relationships estimated from the 1978–1982 MUS sample may be less reflective of the earnings structure for some of these fathers. The potential threats of prediction bias and life-cycle bias are the reasons why we restrict our main sample in Table 5 to a narrow age range.

Most studies in the literature, such as Lefranc, Ojima, and Yoshida (2014) and Kan, Li, and Wang (2015), rely on cohort-specific estimates to identify the trend in intergenerational mobility. However, this approach is problematic because of the collinearity between age and cohorts (Lee and Solon 2009). In Table 6, the lower panel vividly illustrates this problem. The estimates from the five overlapping cohorts show exactly the same pattern as the age-specific estimates in the upper panel. The estimates are smaller among the younger cohorts and larger among the older cohorts. The differences in the estimates across cohorts likely reflect life-cycle bias rather than changes in intergenerational earnings mobility. Therefore, we need additional data from earlier periods in order to estimate intergenerational mobility for older cohorts. One might be concerned that our main sample (columns (3) and (4) in the upper panel) also contains a small fraction of cohorts that could be too young or too old. For example, for people born in 1955 (1975), fathers' earnings are predicted using the 1978–1982 MUS sample, but the information on father's earnings predictors was actually drawn from 1970 (1990), when these people were 15 years old. To address this concern, note that the cohort in column (3) in the lower panel is strictly consistent with the sample period of the MUS sample, and that the estimate is nearly identical to the main results in Table 5.

6.2. The Earlier Period, 1990–1994, and Change in Intergenerational Mobility

In Table 7, we investigate the change in intergenerational earnings mobility. In columns (1) – (4), the primary sample for sons is the 1990–1994 TSCS. In columns (5) – (8), the primary sample for sons is the 2005–2010 TSCS. The majority of the two samples are indeed from different cohorts; the sons in the 2005–2010 TSCS were born

in 1955–1975, while the sons in the 1990–1994 TSCS were born in 1940–1959. In columns (1) and (2), the average earnings are based on seven occupation categories, and the estimate for intergenerational earnings elasticity is 0.38. In the SFIE government reports, average earnings for 1968 are originally reported in nine categories, and average earnings for 1970 in eight categories.[26] Columns (3) and (4) show the results based on these slightly finer averages. The estimates are nearly identical and equal to 0.38. In columns (5) and (6), we proxy fathers' permanent earnings by average earnings in seven or nine occupation categories from the 1981 SFIE report. The estimates for the intergenerational earnings elasticity are 0.36–0.37. The results suggest that intergenerational earnings mobility remained stable in Taiwan from the early 1990s to the late 2000s.

As discussed previously, using average earnings by occupation as a proxy for fathers' permanent earnings is similar to using earnings imputed by occupation. Indeed, the estimates in columns (5) and (6) are not too different from the two-sample estimate in column (6) of Table 5. Because the microdata from the 1981 SFIE are available, we can compare results in columns (5) and (6) to those from the SFIE microdata to further quantify the potential bias in this proxy approach. In columns (7) and (8), we estimate intergenerational earnings elasticity by the Björklund and Jäntti two-sample approach, where fathers' permanent earnings are predicted by seven occupation categories from the 1981 SFIE microdata. Since the main source of bias in the previous columns is probably due to division bias – that is, dividing average household earnings by the average number of people employed – in column (7), we use economic household heads as the secondary sample to correct such bias. However, we still do not restrict age and gender of these household heads. The two-sample estimate for intergenerational earnings elasticity equals 0.41, which is similar in magnitude to the estimates in columns (5) and (6), which use average earnings as a proxy. Therefore, division bias does not seem to be overly large in our data. In column (8), we further restrict household heads to males aged 35–50. Since most real fathers are household heads, the bias in column (7) should be small even without age and gender restriction. Indeed, the

[26] In the 1968 SFIE report, transport workers and mining workers are separate from production workers and laborers. In the 1970 SFIE report, transport workers are reported as an individual category. In the 1981 SFIE report, transport workers, production workers, and laborers are reported as three individual categories.

estimate in column (8) is 0.44, very close to that in column (7).[27] While not reported in the paper, if fathers' earnings are predicted in levels and then taken logarithms, the estimates in columns (7) and (8) are 0.46 and 0.49. As a robustness check, Appendix Table A2 shows the estimates from interval regressions.

Table 8 shows the estimates for different age groups in both 1990–1994 and 2005–2010. As in Table 6, we increase the age range to 30–55 years old. In the upper panel, we estimate intergenerational earnings elasticity based on the 1990–1994 TSCS and 1968 average earnings by occupation. In the lower panel, we estimate intergenerational earnings elasticity based on the 2005–2010 TSCS and 1981 average earnings by occupation. (We use seven occupation categories in both panels.) For both time periods, the estimates in column (1) remain similar to those in Table 7, so the results are not sensitive to using a wider age range. Columns (2) – (5) exhibit a pattern similar to Table 6 and indicate potential life-cycle bias in the youngest age group (column (2)). Notice that column (5) in the upper panel and column (2) in the lower panel cover the same cohort, but the estimates for intergenerational earnings elasticity are much smaller for when the workers are younger. Nevertheless, within each age group, there is little difference between the estimates from the two time periods, indicating stable intergenerational earnings mobility in Taiwan from the early 1990s to the late 2000s.

To check the robustness of the results, in Table 9, instead of earnings, we use average wages as a proxy for fathers' earnings. Although we expect the estimates to be further downward biased because wages only account for a fraction of earnings, one advantage is that average wages can be calculated from information about both employers and employees. We calculate the average wages (received) by occupation in 1968, 1970, and 1981 from the SFIE reports, and the average wages (paid) by industry in 1966 and 1981 from the Industrial and Commercial Census (ICC) government reports. The ICC is a census conducted every five years of all business establishments in Taiwan. Because the ICC does not cover the agriculture, fishing, and forestry industry, the average wage for that industry is taken from the 1966 and 1981 SFIE. Similarly, these average wages are equivalent to wages predicted by occupation or

[27] The estimates based on all earnings predictors (education, industry, and occupation) are 0.48 from the 1981 SFIE and 0.44 from the 1981 MUS.

industry from a secondary sample without age or gender restriction. Therefore, our goal is not to obtain precise estimates but to compare estimates between the two periods.

In Table 9, the estimates continue to suggest stable intergenerational mobility. In columns (1) – (3), the estimates are around 0.20 for 1990–1994; in columns (4) – (5), the estimates are around 0.25 for 2005–2010. As expected, the estimates are much smaller than those based on earnings in the previous tables, due to measurement error. In both periods, the estimates based on the SFIE data are almost identical to the estimates based on the ICC data. So the results are consistent across datasets even though all of our estimates are downward biased. The estimates in columns (4) – (5) seem to be slightly larger, probably because wages comprise a larger fraction of earnings in 1981 than in the late 1960s.

7. Conclusion

In this paper, we estimate intergenerational earnings elasticity in Taiwan in 1990–1994 and 2005–2010. We use representative samples and correct problems common in the literature on Asian countries such as life-cycle bias and prediction bias. Our secondary samples for potential fathers are carefully chosen so that they are indeed representative of real fathers. We find that intergenerational earnings elasticity 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, and that true intergenerational earnings mobility in the Asian Tigers is much lower than the previous literature suggests. Surprisingly, our results show that the intergenerational earnings mobility in Taiwan has remained stable, despite dramatic economic and social changes during this period. One possible explanation is that the main channel for intergenerational income transmission is the intergenerational transmission of abilities, which is likely to be relatively stable. Indeed, we apply the decomposition method from Lefgren, Lindquist, and Sims (2012) to the 2005–2010 data and find that the majority of intergenerational earnings elasticity in Taiwan can be attributed to the effect of human capital transmission rather than the effect of parental financial resources.

Some limitations exist in the paper. First, the data for the fathers' generation are limited in the earlier period. We can only rely on a single predictor, such as occupation, and we cannot apply the decomposition method, as we can for the more recent period. It could be the case that intergenerational earnings elasticities have remained about the

same, but the relative importance of causal channels has changed. In particular, education attainments and returns to education have increased considerably in Taiwan during this period. It is possible that human capital transmission effects have become more important in the more recent period as compared with the earlier period.

Second, this paper focuses on intergenerational earnings elasticity that is measured at the mean. Research shows that intergenerational mobility could be nonlinear, and lower or higher at the tails of income distribution (Björklund and Jäntti 2009).[28] Although the intergenerational elasticity at the mean may be stable over time, it could have changed at the tails of income distribution. For example, better protection of property rights may increase intergenerational earnings transmission among high-income people.

In sum, this paper provides descriptive evidence of the relationship between economic development and intergenerational earnings mobility. Future studies may be able to address this topic with better data. Given the current state of the literature, more empirical research is needed to understand better the causal mechanisms behind the persistence of income inequality.

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[28] For example, Björklund, Roine, and Waldenström (2012) find an intergenerational income elasticity of about 0.9 among the top 0.1% income group in Sweden.

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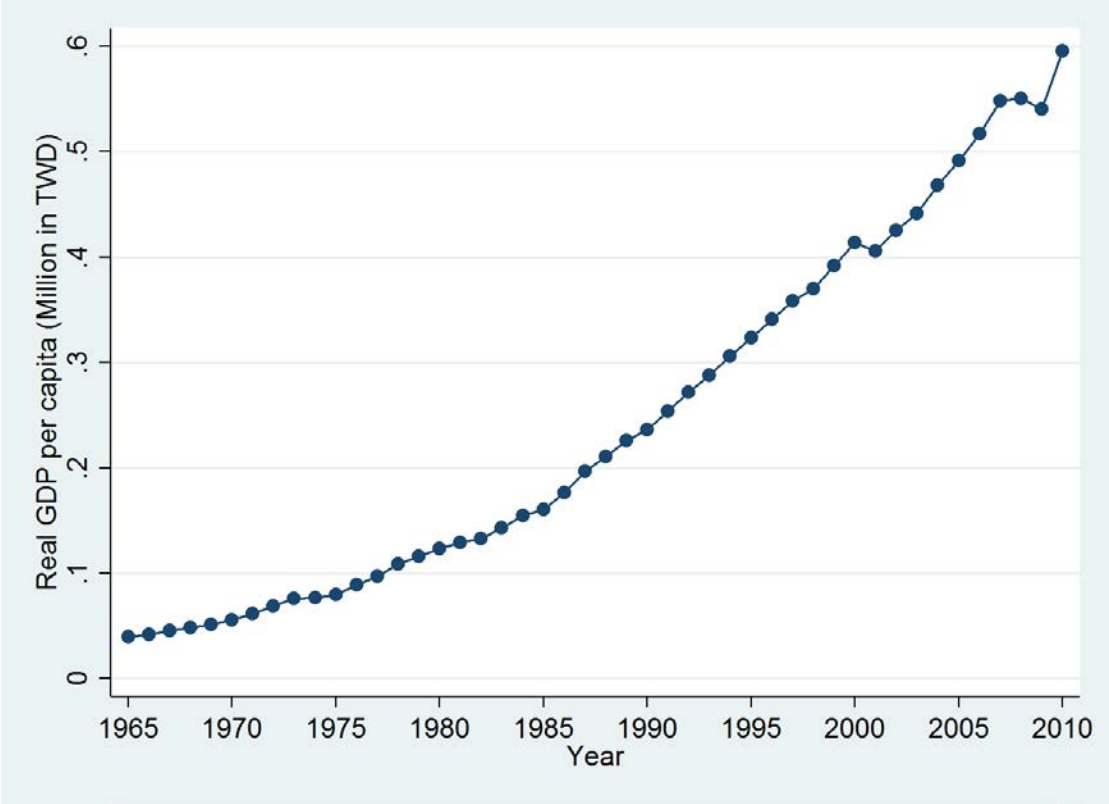

Figure 1: Real GDP per capita in Taiwan, 1965–2010 (2011 Taiwanese dollars).

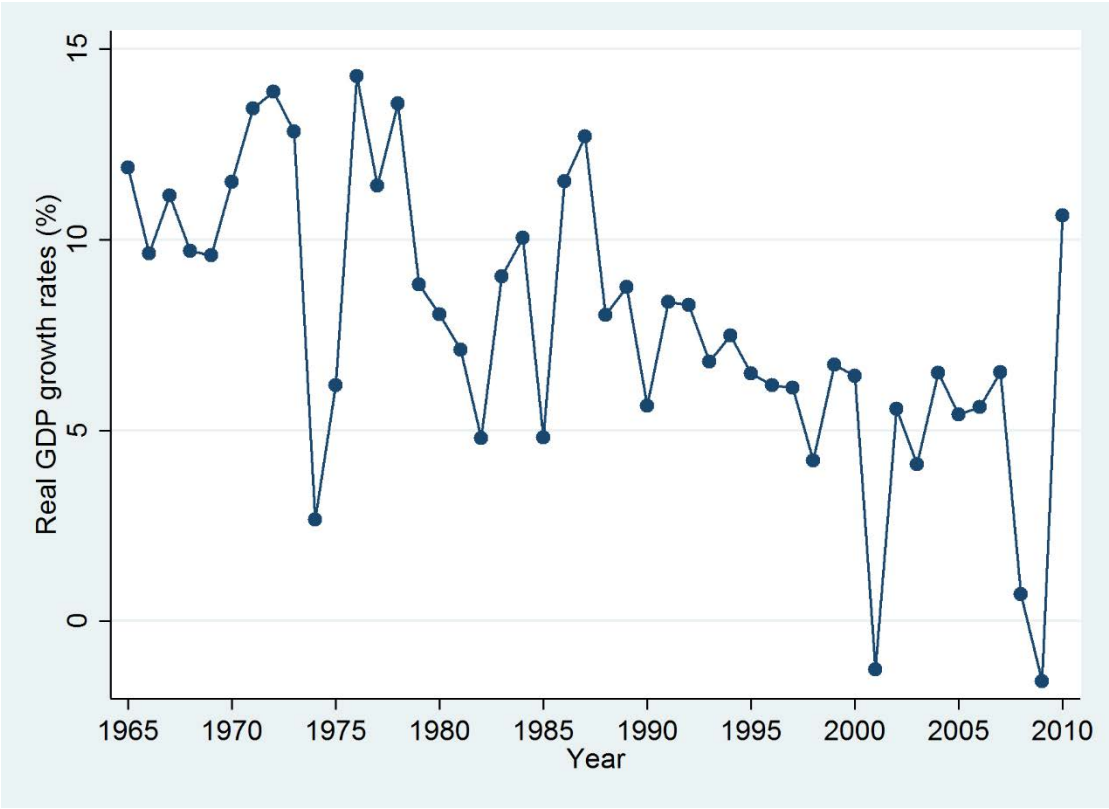

Figure 2: Real GDP Growth Rates in Taiwan, 1965–2010.

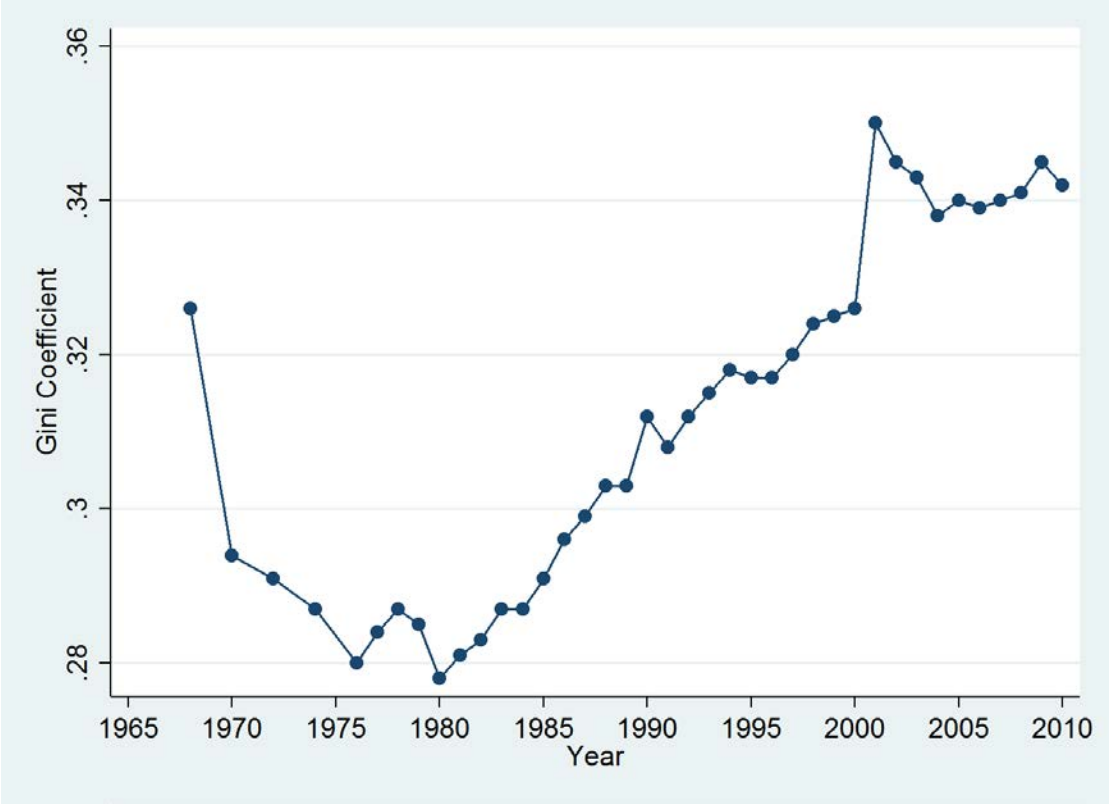

Figure 3: Gini Coefficients in Taiwan, 1968–2010.

Note: Gini coefficients are unavailable for the years 1965–1967, 1969, 1971, 1973, and 1975. These Gini coefficients are from the 2012 Report on the Survey of Family Income and Expenditure.

Table 1: Descriptive Statistics for the 2005–2010 TSCS and the 1978–1982 MUS

	(1)	(2)	(3)
	2005–10 TSCS Sons	2005–10 TSCS Fathers	1978–82 MUS Fathers
Earnings (TWD/month)	50833.7 (38668.8)		10504.6 (7227.0)
Age	42.7 (4.5)		42.3 (4.6)
Education (%)			
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
Occupation (%)			
Professionals and Technicians	15.8	7.0	5.8
Administrative Executives and Managerial Workers	9.3	5.6	2.0
Clerical Workers	5.8	4.7	11.2
Sales Workers	13.0	13.0	13.4
Service Workers	10.0	7.2	6.5
Agricultural, Fishery, and Forestry Workers	4.4	33.3	25.3
Production Workers, Transport Workers, and Laborers	41.7	29.2	36.0
Industry (%)			
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
Obs.	1,299	1,299	29,254

Note: Sampling weights are applied to all columns. Earnings are reported in nominal Taiwanese Dollars (TWD).

Table 2: Descriptive Statistics for the 1990–1994 TSCS

	(1)	(2)	(3)
	1990 - 1994 TSCS Sons	1990 - 1994 TSCS Fathers	1968 TW Statistical Abstract
Earnings (TWD/month)	37319.7 (27481.8)		
Age	41.1 (4.4)		
Education (%)			
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
Occupation (%)			
Professionals and Technicians	10.5	4.0	3.8
Administrative Executives and Managerial Workers	9.6	5.1	2.0
Clerical Workers	9.0	7.5	6.0
Sales Workers	15.9	11.0	9.9
Service Workers	4.8	4.3	9.9
Agricultural, Fishery, and Forestry Workers	13.9	50.8	47.3
Production Workers, Transport Workers, and Laborers	36.2	17.3	21.0
Industry (%)			
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
Obs.	2,143	2,143	n/a

Note: Sampling weights are applied to columns (1) and (2). Earnings are reported in nominal Taiwanese Dollars (TWD). In column (3), the education distribution is based on the total male work force (age 15 and above), while the industry and occupational distributions are based on the employed male work force. The two service industries were not separated until 1971.

Table 3: Descriptive Statistics for the 1968, 1970, and 1981 SFIE

	(1) %	(2) Household Earnings (TWD/month)	(3) # People Employed
Occupation 1968			
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
Occupation 1970			
Professionals and Technicians	4.0	4,211	1.5
Administrative Executives and Managerial Workers	3.9	5,476	1.6
Clerical Workers	7.7	4,092	1.6
Sales Workers	11.4	3,747	1.9
Service Workers	4.4	2,965	1.6
Agricultural, Fishery, and Forestry Workers	46.4	2,580	3.1
Production Workers, Transport Workers, and Laborers	22.2	3,242	1.9
Occupation 1981			
Professionals and Technicians	6.6	30,703	1.7
Administrative Executives and Managerial Workers	4.2	34,513	1.7
Clerical Workers	12.3	25,527	1.7
Sales Workers	13.0	21,980	1.9
Service Workers	5.8	19,336	1.8
Agricultural, Fishery, and Forestry Workers	25.8	15,702	2.7
Production Workers, Transport Workers, and Laborers	32.3	19,166	1.9

Note: Earnings are reported in nominal Taiwanese Dollars (TWD).

Table 4: First Stage Regression from the 1978–1982 MUS

Elementary School	0.094*** (0.009)	Professionals	0.566*** (0.037)	Mining	0.273*** (0.038)
Middle School	0.168*** (0.012)	Managerial Workers	0.911*** (0.040)	Manufacturing	0.195*** (0.034)
Academic High School	0.206*** (0.015)	Clerical Workers	0.531*** (0.035)	Utilities	0.209*** (0.043)
Vocational High School	0.234*** (0.014)	Sales Workers	0.398*** (0.038)	Construction	0.218*** (0.035)
Vocational College	0.264*** (0.019)	Service Workers	0.338*** (0.036)	Wholesale	0.268*** (0.037)
University and above	0.408*** (0.017)	Production Worker	0.292*** (0.035)	Transport	0.307*** (0.035)
				Business Services	0.288*** (0.039)
				Personal Services	0.058* (0.035)
Obs.			29,254		
Adj. R^2			0.46		
Partial Adj. R^2			0.35		

Note: OLS Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Age, age squared, and dummy variables for the years 1979–1982 are controlled in the regression.

Table 5: Estimates of Intergenerational Earnings Elasticity in 2005–2010 from Different Predictors

	(1) All Predictors	(2) Industry & Occupation	(3) Education & Industry	(4) Education & Occupation	(5) Industry	(6) Occupation	(7) Education
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)
Obs.	1,299	1,299	1,299	1,299	1,299	1,299	1,299

Note: Bootstrap standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Estimates of Intergenerational Earnings Elasticity by Age Groups and Cohorts in 2005–2010

	(1)	(2)	(3)	(4)	(5)
Age Groups					
	Ages 30-55 (1950-1980)	Ages 30-40 (1965-1980)	Ages 35-45 (1960-1975)	Ages 40-50 (1955-1970)	Ages 45-55 (1950-1965)
IGE	0.456***	0.319***	0.414***	0.500***	0.565***
	(0.042)	(0.060)	(0.058)	(0.062)	(0.068)
Obs.	2,015	816	856	937	863
Cohorts					
	1970-80 (Ages 30-40)	1965-74 (Ages 31-45)	1960-69 (Ages 36-50)	1955-64 (Ages 41-55)	1950-59 (Ages 46-55)
IGE	0.319***	0.372***	0.459***	0.527***	0.559***
	(0.069)	(0.068)	(0.064)	(0.070)	(0.079)
Obs.	596	728	825	831	594

Note: Bootstrap standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Estimates of Intergenerational Earnings Elasticity in 1990–1994 and 2005–2010

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1990–1994 TSCS				2005–2010 TSCS			
	1968 SFIE 7. Occ.	1970 SFIE 7. Occ.	1968 SFIE 9. Occ.	1970 SFIE 8 8. Occ.	1981 SFIE 7. Occ.	1981 SFIE 9. Occ.	1981 SFIE Microdata	1981 SFIE Microdata (restricted)
IGE	0.378***	0.375***	0.384***	0.381***	0.364***	0.365***	0.411***	0.444***
	(0.027)	(0.027)	(0.028)	(0.027)	(0.048)	(0.047)	(0.055)	(0.061)
Obs.	2,143	2,143	2,143	2,143	1,299	1,299	1,299	1,299

Note: Bootstrap standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Estimates of Intergenerational Earnings Elasticity by Age Group in 1990–1994 and 2005–2010

	(1)	(2)	(3)	(4)	(5)
1990–1994 TSCS &1968 SFIE					
	Ages 30-55 (1950-1980)	Ages 30-40 (1965-1980)	Ages 35-45 (1960-1975)	Ages 40-50 (1955-1970)	Ages 45-55 (1950-1965)
IGE	0.345***	0.245***	0.339***	0.428***	0.555***
	(0.021)	(0.027)	(0.030)	(0.036)	(0.046)
Obs.	3,292	1,876	1,721	1,241	874
2005–2010 TSCS &1981 SFIE					
	Ages 30-55 (1935-1964)	Ages 30-40 (1950-1964)	Ages 35-45 (1945-1959)	Ages 40-50 (1940-1954)	Ages 45-55 (1935-1949)
IGE	0.378***	0.273***	0.368***	0.390***	0.447***
	(0.037)	(0.056)	(0.052)	(0.054)	(0.060)
Obs.	2,015	816	856	937	863

Note: Bootstrap standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Estimates of Intergenerational Earnings Elasticity
in 1990–1994 and 2005–2010 from Predicted Wages

	(1)	(2)	(3)	(4)	(5)
		1990–1994 TSCS		2005–2010 TSCS	
	1968 SFIE 7. Occ.	1970 SFIE 7. Occ.	1966 ICC 9. Ind.	1981 SFIE 7. Occ.	1981 ICC 9. Ind.
IGE	0.198*** (0.016)	0.200*** (0.016)	0.209*** (0.018)	0.252*** (0.035)	0.250*** (0.040)
Obs.	2,143	2,143	2,143	1,299	1,299

Note: Bootstrap standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table A1: Interval Regression Estimates of Intergenerational Earnings Elasticity in 2005–2010 from Different Predictors

	(1) All Predictors	(2) Industry & Occupation	(3) Education & Industry	(4) Education & Occupation	(5) Industry	(6) Occupation	(7) Education
	Interval Regression						
IGE	0.443***	0.399***	0.469***	0.442***	0.391***	0.397***	0.776***
	(0.047)	(0.047)	(0.054)	(0.048)	(0.056)	(0.048)	(0.094)
Obs.	1,299	1,299	1,299	1,299	1,299	1,299	1,299

Note: Bootstrap standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table A2: Interval Regression Estimates of Intergenerational Earnings Elasticity in 1990–1994 and 2005–2010

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1990–1994 TSCS				2005–2010 TSCS			
	1968 SFIE 7. Occ.	1970 SFIE 7. Occ.	1968 SFIE 9. Occ.	1970 SFIE 8. Occ.	1981 SFIE 7. Occ.	1981 SFIE 9. Occ.	1981 SFIE Microdata	1981 SFIE Microdata (restricted)
IGE	0.369***	0.366***	0.375***	0.372***	0.361***	0.362***	0.408***	0.440***
	(0.026)	(0.026)	(0.026)	(0.026)	(0.045)	(0.044)	(0.052)	(0.057)
Obs.	2,143	2,143	2,143	2,143	1,299	1,299	1,299	1,299

Note: Bootstrap standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.