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Long-term Trends in Intergenerational Income Mobility in Japan: From High Increasing to Lost Decade*

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Abstract

This paper focuses on how components of intergenerational income mobility (IGM) in Japan vary with cohorts. Intergenerational income elasticity (IGE) between fathers and sons is estimated using Two Sample Two Stage Least Square (TS2SLS) approach and is decomposed into several intergenerational transmission pathways. Contribution of each pathway to IGE is jointly determined by the strength of transmission and income premiums. How IGE due to these transmission pathways vary with cohorts is analyzed by estimating long-term trends in intergenerational transmissions and income structure. This paper finds IGE in Japan for sons born from 1935 to 1976 lies around 0.35 to 0.40. What's

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more, although upward educational mobility decreases for sons born after early to mid 1950s, it contributes to an increasing in IGM after considering long-term trends in income premiums of education. However, it is not the case for upward occupational mobility.

Key words: cohort, decomposition, intergenerational elasticity, intergenerational mobility, Japan, Two Sample Two Stage Least Square

JEL Classification: D31, J62

1. Introduction and Related Literatures

Intergenerational income elasticity (IGE), which is estimated by regressing logarithm of sons' income on logarithm of fathers' income, is one of the most standard measurements of intergenerational income mobility (IGM). It captures the extent to which economic advantages are transmitted across generations.[1] IGE has been widely estimated in different countries by different approaches (See Gong et al. (2012) and Blanden (2013) for review). However, how IGE varies with cohorts within a certain country is still a somewhat unexplored area. The objective of this study is to provide a new perspective to analyze this issue in Japan.

Japan provides an interesting case to analyze long-term trends in IGE as its economy experienced enormous changes during the second half of 20^{th} century. Initiated by jinmu boom from 1954 to 1957, Japanese economy experienced nearly 20 years of high growth during which its real GDP growth rate exceeded 9%. Such prosperity was ended by first oil crisis, after which Japan experienced roughly two decades of stable growth with real GDP growth rate of 4.2%. After the collapse of bubble boom from 1986 to 1991 with real GDP growth rate over 5%, Japan entered its so-called lost decade(s) in 1991 with stagnant economy.

[1] For instance, an IGE of 0.3 indicates if father's income is 100% above the average in his generation, then son's income is 30% above the average in his generation. In other words, 30% of income inequality in fathers' generation is transmitted to sons' generation. The higher the IGE, the lower the IGM.

Previous studies mainly relied on some straight-forward methods to analyze how IGE vibrates across cohorts. One approach is controlling interaction terms of fathers' income with sons' birth cohorts in regression estimating IGE, while another one is separately estimating IGE for sons from each cohort (Nicoletti and Ermisch, 2007; Pekkala and Lucas, 2007; Lee and Solon, 2009; Ueda, 2009; Lefranc et al., 2014; Lefranc, 2018; Chu and Lin, 2019). These approaches can easily provide pattern of long-run trends in IGE, although such pattern might be distorted by collinearity between cohort effect and age effect (See Lee and Solon (2009) for a discussion).[2] For instance, Ueda (2009) and Lefranc et al. (2014) found IGE in Japan remains almost unchanged from 1959 to 1979 cohorts and 1935 to 1975 cohorts, respectively. However, such approaches cannot give a more in-depth understanding of how IGE altering over cohorts.

The main contribution of this paper is to provide a new perspective to analyze how IGE evolves over cohorts by focusing on how components of IGE, instead of entire IGE, vary throughout cohorts. Firstly, this study decomposes IGE into several intergenerational transmissions of factors

[2] It is difficult to distinguish between cohort effect and age effect since cohort equals observation year minus age. What's more, the estimate of IGE is very sensitive to age selection. Income in early (resp., late) stage of career underestimates (resp., overestimates) life-time income. Such non-classical measurement error induces so-called life-cycle bias (Grawe, 2006; Haider and Solon, 2006). For instance, IGE will be underestimated if sons' (resp., fathers') income is observed at early (resp., late) ages. Such problem is more serious in Japan, since in currently available datasets, seniority-wage system and life-time employment system, which ensure income to increase stably with age, are common practices for most of males respondents in prime working ages. Lee and Solon (2009) isolated age effect by elaborately controlling sons' ages and estimating IGE at age 40, and its specification was followed by, for instance, Lefranc (2018).

(e.g., intergenerational transmission of education). These factors might induce intragenerational income inequality and might be transmitted across generations. Contribution of each transmission pathway to IGE is jointly determined by strength of intergenerational transmission of that factor as well as returns to that factor in both sons' generation and fathers' generation. Similar decomposition frameworks were also proposed in Österbacka (2001), Lefranc and Trannoy (2005) and Blanden (2013).[3] Next, this study analyzes how IGE due to these transmission pathways vary with cohorts by estimating long-term trends in returns to these factors and intergenerational transmissions of these factors. Similar procedures were also presented in Pekkala and Lucas (2007) and Lefranc (2018). They extracted the effect of parental investment in children's education from IGE and analyzed trend in that effect. However, these papers only considered one pathway, i.e., education. Moreover, intergenerational transmission of education was not taken into consideration directly in those papers (See Section 2 for a detailed discussion).

Decomposition framework in this study is based on IGE estimator obtained by Two Sample Two Stage Least Square (TS2SLS). In many IGM studies in which fathers' income cannot be observed in primary sample, an auxiliary sample in which both income and characteristics (education, occupation, etc.) of individuals whom are assumed to be representative of fathers are observable is used to impute fathers' missing income.[4] TS2SLS has been widely applied in IGM studies since

[3] As mentioned in Lefranc and Trannoy (2005), this framework is a special case of Bowles and Gintis (2002)'s model.

[4] TS2SLS is asymptotically the same as 2SLS. Its statistical properties were reviewed in, e.g., Inoue and Solon (2010).

Björklund and Jäntti (1997)'s first attempt (See Jerrim et al. (2016) for a review), including Japanese ones (Ueda, 2009; 2015; Lefranc et al., 2010; 2014) due to lack of datasets in which information on fathers' income is suitable for analyses.[5] In this study, both primary sample and supplementary sample are extracted from Survey of Social Stratification and Social Mobility (SSM), one of the most traditional and large-scale Japanese social surveys covering six decades since 1955 with rich information on respondents' income, personal background and family background.

Previous Japanese IGM studies found IGE between fathers and sons in Japan lies around 0.30 to 0.35 (around 0.30 in Lefranc et al. (2010) and Ueda (2015), around 0.35 in Lefranc et al. (2014)),[6] which is at intermediate level in developed world. It implies Japan is a relatively equal society as suggested by The Great Gatsby Curve which summarizes the positive relationship between IGE and intragenerational inequality (Blanden, 2013; Corak, 2013). On the other hand, however, once equal Japan characterized by its solid middle class has been experiencing an increasing in income, or wage inequality since 1980s, especially for males (Lise et al., 2014; Yamada and Kawaguchi, 2015).

[5] Ueda (2009) used Japanese Panel Survey of Consumers (JPSC) in which parents' income is observable. However, parental income in JPSC is too poorly measured to be used when estimating IGE (See Lefranc et al. (2014) for a more detailed discussion), which leads Ueda (2009) to rely on 2SLS and TS2SLS to impute parental income in most of its specifications. Kubota (2017) used Parent and Children Survey (PCS) in which both children's wealth and parents' wealth can be observed. However, in most of its specifications, sample size is smaller than 300. In addition, wealth is not a commonly used measurement of economics status in IGM studies. Kubota (2017) also reported 2SLS results.

[6] Besides these studies, Ueda (2009) found IGE between parents and married sons is above 0.40 from 2SLS and TS2SLS. Kubota (2017) found IGE between parents and children is around 0.35 from 2SLS.

In recent years, some scholars have argued that Japan has become a society of disparity to some extent (Moriguchi, 2017). Since IGE captures the transmission of income inequality over generations, therefore decomposing IGE and analyzing how components of IGE evolve with cohorts can deepen our understanding on long-term patterns of income inequality.

Estimation results show that IGE in Japan for sons born from 1935 to 1976 is around 0.35 to 0.40. Intergenerational transmission of tertiary education is one of the most important and stable pathways through which income inequality is transmitted from fathers to sons throughout 1935 to 1976 cohorts. Upward educational mobility contributes to an increasing in IGM since early-mid 1950s cohorts generally after considering long-run variations in returns to education, although upward mobility of education itself decreases.

The rest of this paper is organized as follows. Section 2 shows conceptual framework of decomposing IGE. Section 3 presents empirical specifications. Section 4 introduces SSM survey, variables and sample selection. Section 5 discusses estimation results. Section 6 concludes.

2. Conceptual Framework

The logarithm of sons' income and that of fathers' income is supposed to be expressed as

$$I_s = \alpha_s + \sum_{j=1}^{m} X_{sj}\gamma_{sj} + \varepsilon_s \quad (1)$$

and

$$I_f = \alpha_f + \sum_{k=1}^{m} X_{fk}\gamma_{fk} + \varepsilon_f \quad (2)$$

respectively. X_1 to X_m refer to m factors affecting income, and γ's are returns to X's. ε is error term, and it is often referred as luck in related studies (Lefgren et al., 2012). TS2SLS IGE estimator $\hat{\beta}$ is obtained by regressing sons' income I_s on fathers' imputed income $\hat{I}_f$ by OLS:

$$\hat{\beta} = \frac{Cov(\hat{I}_f, I_s)}{Var(\hat{I}_f)} \quad (3)$$

In which $\hat{I}_f = \hat{\alpha}_f + \sum_{k=1}^{m} X_{fk}\hat{\gamma}_{fk}$ refers to fathers' imputed income based on X's. Since sons' income I_s equals $\hat{\alpha}_s + \sum_{j=1}^{m} X_{sj}\hat{\gamma}_{sj} + \hat{\epsilon}_s$ in which $\hat{\epsilon}_s$ equals $I_s - \hat{\alpha}_s - \sum_{j=1}^{m} X_{sj}\hat{\gamma}_{sj}$, therefore $\hat{\beta}$ can be expressed as

$$\hat{\beta} = \sum_{j=1}^{m}\sum_{k=1}^{m}\frac{Cov(\hat{\alpha}_f + X_{fk}\hat{\gamma}_{fk}, \hat{\alpha}_s + X_{sj}\hat{\gamma}_{sj} + \hat{\epsilon}_s)}{Var(\hat{I}_f)} = \sum_{j=1}^{m}\sum_{k=1}^{m}\frac{\hat{\gamma}_{fk}\hat{\gamma}_{sj}(Cov(X_{fk}, X_{sj})/Var(X_{fk}))Var(X_{fk})}{Var(\hat{I}_f)} + \sum_{k=1}^{m}\frac{\hat{\gamma}_{fk}Cov(X_{fk}, \hat{\epsilon}_s)}{Var(\hat{I}_f)} \quad (4)$$

Right-hand side of Equation (4) divides $\hat{\beta}$ into two parts. First part is explained by intergenerational transmissions of X's from fathers to sons. Second part is uninterpretable part.[7]

[7] Same decomposition can also be performed in 2SLS since it follows the essentially same procedure as TS2SLS with

In most of empirical IGM studies using TS2SLS, income is imputed based on at least two X's. Commonly used X's include education, occupation, and so on (See Jerrim et al. (2016) for a review).[8] If m X's are incorporated in this framework, then first part consists of m^2 intergenerational transmission pathways, within which m pathways are intra-factor transmission (e.g., intergenerational transmission of education from fathers to sons), while other m^2-m pathways are inter-factor transmission (e.g., intergenerational transmission from fathers' education to sons' occupation). This framework indicates that the contribution of intergenerational transmission from fathers' X_k to sons' X_j to overall IGE is determined by four elements simultaneously: (1) return to X_k in fathers' generation (γ_{fk}); (2) return to X_j in sons' generation (γ_{sj}); (3) variance of X_k in fathers' generation ($Var(X_{fk})$) and (4) strength of intergenerational transmission from X_k to X_j ($Cov(X_{fk}, X_{sj})/Var(X_{fk}) \stackrel{\text{def}}{=} \rho_s$), in which $k=j$ refers to intra-factor transmissions, while $k \neq j$ refers to inter-factor transmissions. γ_{fk}, γ_{sj} and $Var(X_{fk})$ capture the labor market structure in fathers' generation and sons' generation. Based on this framework, this study analyzes how γ_{sj} and ρ_s vary with sons' birth cohorts, and how these variations contribute to an overall variation in IGE.

This framework has following advantages. Firstly, it directly relates IGE with intergenerational

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the exception that TS2SLS combines two separate samples due to unavailability of fathers' income in primary sample.

8 If fathers' income is imputed based only on education, then TS2SLS IGE estimator might be upwardly biased too much due to small R^2 of first step equation as well as strong direct effect of fathers' education on sons' income. See Nicoletti and Ermisch (2007), Jerrim et al. (2016) and Section 3 for discussion.

capital transmissions compared with Blanden et al. (2014)'s model in which capital is only served as a mediator (e.g., parental investment in children's education) between income of fathers and income of sons as well as methods similar to or following Blanden et al. (2014) (Pekkala and Lucas, 2007; Gong et al., 2012; Kubota, 2017; Lefranc, 2018; etc.). Secondly, it considers both intra-factor transmissions and inter-factor transmissions. Rare studies consider inter-factor transmissions. Besides Österbacka (2001) and Lefranc and Trannoy (2005) using similar frameworks, Bevis and Barrett (2015) provided a framework incorporating both intra-factor transmissions and inter-factor transmissions among education, health and land. Thirdly, it better captures the effect of fluctuations in income structure between fathers' generation and sons' generation on IGE since returns to X's in both fathers' generation and sons' generation are considered compared with Blanden et al. (2014)'s and related methods in which only returns to capitals in sons' generation are considered and Lefgren et al. (2012)'s and Miller and Mclntyre (2020)'s methods which only considere the explanatory ability of capitals in fathers' income inequation.

3. Empirical Specifications

The basic specification for estimating IGE by TS2SLS in this paper takes the form of

$$I_s = \beta_0 + \beta_1 \hat{I}_f + \varepsilon_s \quad (5)$$

In which I_s refers to the logarithm of sons' annual income, $\hat{I}_f$ refers to the imputed value of the logarithm of fathers' income at age of 40 (See below). β_1 refers to IGE in the context of TS2SLS.

Three empirical issues should be emphasized when estimating β_1. The first one is classical measurement error on fathers' income when using short-term income or annual income to measure father's income, which attenuates $\hat{\beta}_1$ (Solon, 1992; Zimmerman, 1992). TS2SLS is immune to attenuation bias since it follows essentially the same procedure as 2SLS with the exception that TS2SLS combines two separate samples.

The second one is life-cycle bias (Grawe, 2006; Haider and Solon, 2006), which arises when using current income as a proxy for permanent income (See footnote 3). TS2SLS cannot overcome this error since it correlates with permanent income, which implies that it is non-classical type of measurement error. Based on Haider and Solon (2006)'s conclusion that life-cycle bias is relatively small around the age of 40 (i.e., income at early 40s is a better approximation for life-time or permanent income), this paper deals with this issue by two ways. Firstly, ages of sons and individuals whom are assumed to be representative of fathers in auxiliary sample are restricted to [30, 59], i.e., around the prime working age (early 40s). Secondly, fathers' income is imputed at age of 40 following Lefranc et al. (2014)'s and Lefranc (2018)'s specifications (See Equation (6)).

The third one is imputation bias due to Two Sample approach. Firstly, since fathers' characteristics are reported ex post by sons, therefore sons may misreport their fathers' characteristics (Björklund and Jäntti, 1997). This paper assumes such bias is small if not nil since recall of fathers' education, occupation and other characteristics is much more reliable than recall of fathers' income when sons were teenagers. Secondly, individuals in auxiliary sample may not be representative of fathers. This paper solves this problem through following strategy. In this paper, fathers' average age is about 76 in 1995 and 2005. It implies it was roughly 30 years ago when fathers were at prime working ages. Therefore, supplementary sample is extracted from 1965's and 1975's surveys. Since SSM spans over six decades, therefore such selection is possible. Similar strategy was also used in Chu and Lin (2019). Thirdly, fathers' characteristics would directly affect sons' income, therefore IGE might be biased upwardly (See footnote 9). Although this problem is unavoidable when using TS2SLS, this paper tries to reduce such bias by using four categories of variables, i.e., type of employment, firm size, occupation and education (See Section 4.1) to impute fathers' income based on Jerrim et al. (2016)'s suggestion that use a detailed first step specification. In the end, the first step equation takes the form of

$$I_i = \alpha_i + \sum_{k=1}^{m} X_{ik}\gamma_{ik} + \sum_{k=1}^{m} X_{ik}(age_i - 40)\delta_{1ik} + \sum_{k=1}^{m} X_{ik}(age_i - 40)^2\delta_{2ik} + \varepsilon_i \qquad (6)$$

In which subscript i refers to individuals in supplementary sample. They are referred as pseudo fathers henceforth to simplify expression. I_i refers to the logarithm of annual income of pseudo fathers. X_i's refer to factors affecting I_i. Specifically, γ_i's refer to returns to X_i's at age of 40. Fathers' imputed income at age 40 is

$$\hat{I}_f = \hat{\alpha}_i + \sum_{k=1}^{m} X_{fk}\hat{\gamma}_{ik} \quad (7)$$

Then Equation (5) can be estimated. In order to perform decomposition, the logarithm of sons' annual income I_s is regressed on their characteristics X_s's following the same specification as Equation (6):

$$I_s = \alpha_s + \sum_{j=1}^{m} X_{sj}\gamma_{sj} + \sum_{j=1}^{m} X_{sj}(age_s - 40)\delta_{1sj} + \sum_{j=1}^{m} X_{sj}(age_s - 40)^2\delta_{2sj} + \varepsilon_s \quad (8)$$

In which γ_s's refer to returns to X_s's at age of 40. Since I_s can be rewritten as $I_s = \hat{\alpha}_s + \sum_{j=1}^{m} X_{sj}\hat{\gamma}_{sj} + \hat{\epsilon}_s$ after Equation (8) is estimated as shown in Section 2, therefore β_1 can be decomposed based on the framework in Section 2.

In order to analyze how components of IGE vary with cohorts, this study allows returns to X's in sons' generation (γ_s's) and intergenerational transmissions of X's from fathers to sons (ρ_s's) to vary with sons' birth cohorts. Sons in this study were born from 1935 to 1976. In order to relax assumptions on cohort trends (e.g., quadratic cohort trend or piecewise linear cohort trend), this paper divides all the sons into 8 broad cohorts in which each group consists of 5 to 6 years: 1935 to 1940 cohorts, 1941 to 1945 cohorts, …, 1966 to 1970 cohorts and 1971 to 1976 cohorts. γ_s's and ρ_s's are allowed to vary with these eight broad cohorts.

4. Data

4.1 Survey of Social Stratification and Social Mobility (SSM)

This paper uses data from Survey of Social Stratification and Social Mobility (SSM), a decennial repeated cross-sectional survey. SSM was firstly conducted in 1955, and it has six waves available at present (SSM 1955, 1965, …, 2005). The latest wave was conducted in 2015, however, it has not been released yet. SSM is representative of Japanese people aged 20 to 70, and from the fourth wave (1985), females were taken into consideration. SSM focuses on social classes, inequality and social mobility, education, and attitudes towards life and society, etc. The most appealing feature of SSM is that it currently covers five decades, which makes choosing the suitable periods during which fathers were at prime working ages within one survey when applying TS2SLS possible.

SSM has three measurements of income: personal income, spouse's income and household's income, where income refers to pre-tax gross annual income in the past year. Personal income is used in this study. Incomes in SSM are coded in interval form except SSM 1965, and mid-value of each interval is used. Meanwhile, extremely high incomes are also coded continuously in some waves. Income equations (Equation (6) and (8)) are regressed on type of employment, firm size, occupation and education. Type of employment is divided into two groups: (1) irregular employment and self-employment (TE0) and (2) regular employment (TE1).[9] Firm size is divided into three categories: (1) working in small- or medium-sized firms (FS0); (2) working in big firms (FS1) and (3) working in public sector (FS2).[10] Occupation is divided into six groups: (1) agricultural workers (O0); (2) professional workers (O1); (3) administrative and managerial workers (O2); (4) clerical workers (O3); (5) sales workers (O4) and (6) manual workers (O5).[11] Education is divided into three levels based on Kondo (2000)'s classification: (1) lower secondary education or less (E0); (2) upper secondary education (E1) and (3) tertiary education (E2).[12]

SSM 1995 and 2005 are used in this paper. Since SSM does not ask for fathers' income, but only their education, occupation, job characteristics, etc. reported ex post by respondents, based on

[9] SSM provides detailed classifications of employment type. In this study, company president or executive and regular full-time employee are classified as regular employment. Temporary or part-time employee, employee dispatched by a temporary employment agency and contract employee or employee on a short-term contract are classified as irregular employment. Self-employed or freelance worker and family worker are classified as self-employment. In first three waves of SSM, irregular employment is not included in options of questions for type of employment, which reflects that irregular employment became an important component in employment structure since 1980s.

[10] Big firm is defined as a firm with more than 999 employees.

[11] Skilled manual workers, semi-skilled manual workers and unskilled manual workers are merged into one category (O5) in order to simplify specification.

[12] SSM distinguishes between old school system and new school system since Japanese education system changed after World War II. In this study, lower secondary school, elementary school (old system) and upper elementary school (old system) are classified as lower secondary education or less. Upper secondary school, middle school or girls' high school (old system), vocational school (old system) and normal school (old system) are classified as upper secondary education. Junior college / technical college, university, graduate school, high school (old system), technical school (old system), higher normal school (old system) and university in old system are classified as tertiary education.

which fathers' income can be imputed, therefore SSM 1965 and 1975 are used as supplementary datasets to impute fathers' income by TS2SLS.

4.2 Primary Sample and Supplementary Sample

Primary sample is extracted from SSM 1995 and 2005. There are 2,490 and 2,660 male respondents in SSM 1995 and SSM 2005, respectively. Those whose age are older than 59 or younger than 30 are dropped. Those who do not report their income, characteristics, and those who have no jobs (unemployment, students, etc.) are dropped. [13] Those who do not report their fathers' characteristics and birth year are also dropped. In the end, there are 1,828 male respondents, and therefore 1,828 father-son pairs in primary sample. The top panel of Table 1 shows the descriptive statistics for primary sample.

Supplementary sample is extracted from SSM 1965 and 1975. There are 2,158 and 2,724 male respondents (i.e., pseudo fathers) whom are assumed to be randomly drawn from the same underlying population as fathers of SSM 1995 and 2005's respondents in SSM 1965 and SSM 1975, respectively. Pseudo fathers in SSM 1965 and 1975 whose age are older than 59 or younger than 30 are dropped. Moreover, those who do not report their income, characteristics, and those who have no jobs are dropped. In the end, there are 2,893 pseudo fathers. The bottom panel of Table

[13] Those who have no income are therefore automatically dropped.

1 shows the descriptive statistics for supplementary sample.

[Insert Table 1 here]

5. Results

Estimation result of Equation (5) is shown in column (1) Table 2. As it shows, IGE between fathers and sons in Japan for sons born from 1935 to 1976 lies around 0.367.

[Insert Table 2 here]

In column (2) of Table 2, IGE is re-estimated following common specifications (e.g., Lefranc, 2018 and Chu and Lin, 2019). A quadratic function of sons' age and interaction terms of this function with fathers' imputed income are also controlled, in which sons' age is centered at 40. The resulting outcome, i.e., the estimate of IGE at sons' age of 40 is 0.403. This paper finds IGE between fathers and sons in Japan lies around 0.35 to 0.40, which is comparable to, although a little bit higher than previous Japanese studies using TS2SLS as reviewed in Section 1. It is reasonable to believe estimation results in this paper are relatively reliable due to following reasons. Firstly, life-cycle bias is carefully controlled by imputing fathers' income at age 40 and restricting sons' age to [30, 59]. Secondly, imputation bias due to TS2SLS is expected to be reduced by choosing pseudo fathers who are representative of fathers' population and using a first step specification with rich variables for imputing income. To sum up, this study finds IGE in Japan lies at intermediate level compared with other developed countries together with most of previous Japanese IGM studies.

5.1 The Estimate of Income Equations

5.1.1 Main Results

Estimation results of Equation (6) and Equation (8) are shown in columns (1-1) to (1-3) and columns (2-1) to (2-3) of Table 3, respectively. Column (1-1) and (2-1) shows returns to type of employment, firm size, occupation and education of pseudo fathers and sons at age 40, respectively. Fathers' missing income is imputed based on results in column (1-1).

[Insert Table 3 here]

Results in columns (1-1) to (1-3) and in columns (2-1) to (2-3) are estimated in supplementary sample and primary sample, respectively. Three results are notable. Firstly, in 1965 and 1975, return to regular employment is negative (-0.187 log points (lp)) compared with return to other types of employment. In 1995 and 2005, however, return to being regular staffs become positive (0.116 lp). This can be explained by rapid increasing in irregular employment and that in wage gap between regular and irregular staffs. Based on Employment Status Survey (ESS), the ratio of irregular employment had increased to 31.9% in 2002. Moreover, average annual wage of regular staffs was

348,100 Yen in 2005, while that of irregular staffs was 221,300 Yen as Basic Survey on Wage Structure (BSWS) shows. Secondly, in 1965 and 1975, return to being agricultural workers at age 40 is significantly less than all other occupations. In 1995 and 2005, however, being sales or manual workers earns significantly less than being agricultural workers at age 40. One possible reason is that irregular employment is more prevalent in sales and manual occupations than in professional, managerial and clerical occupations. In this paper, roughly 15.75% of sons working as sales or manual workers are irregularly staffs, while that ratio is only 3.79% for sons working as processional, managerial or clerical workers.[14] Thirdly, there is a decrease of 0.111 lp in return to upper secondary education from 1965 and 1975 to 1995 and 2005, and return to upper secondary schools becomes insignificant. It might be explained by increasing in senior high school enrollment in Japan during the second half of 20th century. Based on School Basic Survey (SBS), enrollment rate of middle school graduates to high school in Japan increased dramatically from 51.5% in 1955 to over 96% in 1995, which implies compared with 1965 and 1975, upper secondary education degree may no longer be such valuable in 1995 and 2005 due to its prevalence.

[14] Another possible reason for these results is seniority-wage system in Japanese firms. Since agricultural workers are less likely to be employed with such system, which indicates age-income profiles of agricultural workers should be much flatter than those of other occupations, therefore returns to other occupations at age 40 might be smaller than return to agricultural occupation. After dropping all age controls, return to professional occupation (0.21 lp) and return to managerial occupation (0.45 lp) are significantly higher than that to agricultural occupation. Although return to sales occupation (-0.05 lp) and manual occupation (-0.14 lp) are lower than that to agricultural occupation, these estimates are insignificant. Similar patterns can also be found in 1965 and 1975.

5.1.2 Long-term Variations in Japanese Income Structure

As discussed in Section 2 and Section 3, this paper allows returns to type of employment, firm size, occupation and education to vary with sons' birth cohorts. Figure 1 summarizes estimation results.

[Insert Figure 1 here]

Three results are worth noting. Firstly, from 1935 cohort to 1976 cohort, regular employees as well as those being employed in big firms and public sector move to the center of Japanese labor market. This can be seen from Panel A of Figure 1. From 1935 cohort to 1950 cohort, income premium of staffs other than regular staffs (mainly self-employed staffs in these early cohorts) keeps decreasing from 0.19 lp to 0.05 lp. Similar patterns were also documented in Genda and Kambayashi (2002) and Lefranc et al. (2014). From 1951 cohort, return to regular employment becomes positive (0.04 lp) and keeps increasing to 0.25 lp, which can be explained by the same reason as mentioned in Section 5.1.1. Meanwhile, returns to working in big firms and public sector also increase from 1935 cohort to 1976 cohort, although those increases are not as monotonous as regular employment. Secondly, returns to all the occupations at age 40 decease compared with agricultural occupation from 1935 cohort to 1976 cohort and such trends are almost monotonous. For occupations other than agricultural ones, income gap between top and bottom group generally decreases from 1935 cohort to 1960 cohort (from 0.56 lp to 0.36 lp). However, it raises again afterward to 0.50 lp.[15] Thirdly, although returns to upper secondary and tertiary schools decline with fluctuation from 1935 cohort to 1960 cohort, they increase again from 1961 cohort, especially for tertiary education. Similar patterns were also found in Tachibanaki (2009) and Lefranc et al. (2014). To sum up, this paper finds for sons born after mid 1950s, income inequality increases. This finding is consistent with Lise et al. (2014) and Yamada and Kawaguchi (2015) in which a stable increasing in income or wage inequality was found from mid 1990s to 2000s, during which individuals born after mid 1950s were at their prime working age.

5.2 The Estimate of Intergenerational Transmissions

5.2.1 Main Results

Next, strengths of intergenerational transmissions (i.e., ρ_S's) are estimated. This paper considers 10 factors which might induce income inequality and might be transmitted from fathers to sons. Therefore, there are 100 transmission pathways within which 10 pathways are intra-factor transmissions, while remaining 90 are inter-factor transmissions. Table 4 shows estimation results.

[Insert Table 4 here]

Each cell of Table 4 refers to a simple Linear Probability Regression (LPR) regressing a sons'

15 In this section, top occupational group and bottom occupational group are defined based on returns at age 40.

characteristic X_{sj} on a fathers' characteristic X_{fk}. All the diagonal elements refer to intra-factor transmissions ($j = k$), while others refer to inter-factor transmissions ($j \neq k$). As shown in Table 4, all the intra-factor transmissions are significantly positive except intergenerational transmission of upper secondary education. This can be explained by the rapid expansion of upper secondary education as mentioned in Section 5.1.1, which equalized opportunities for senior high schools regardless of sons' family backgrounds.

What mechanisms underlie these transmissions is still an open question. Lefgren et al. (2012) and Miller and Mcintyre (2020) proposed similar models which identified two structural parameters captured by IGE. Based on these models, intergenerational transmissions occur through both finical investment (e.g., parental investment in human capital) and direct transmission (e.g., inheritance of preference through daily interaction and specific family culture). It is still ambiguous that which of above two mechanisms prevails, but one should believe both of them play a role. For instance, this paper finds if sons are raised by fathers with tertiary degree, then the probability that they become professional workers is 20.9% higher than sons whose fathers do not have tertiary degree. On the other hand, the corresponding probability that these sons become managerial workers is only 3.8% higher than other sons. College income premium is considerably high in fathers' generation (0.292 lp, see Table 3), which implies these fathers would have more finical resources to invest in their sons for generously salaried jobs. However, the probability that these sons become managerial workers whose income are higher than professional ones is pretty low.

This result implies there must be something else besides monetary matters.

5.2.2 Long-term Variations in Intergenerational Transmissions

Following the discussion in Section 2 and Section 3, this paper analyzes how ρ_S's vary with sons' birth cohorts. This paper has 100 ρ_S's and it is inefficient to consider all of them. Besides 10 intra-factor transmissions, only upward educational mobility and upward occupational mobility are focused on. Upward occupational mobilities are defined based on Occupational Prestige Score (OPS) provided by SSM.[16] This paper identifies four upward mobilities and they are allowed to vary with sons' birth cohorts. Estimation results are summarized in Figure 2.

[Insert Figure 2 here]

Panel A to Panel C show how intra-factor transmissions vary with cohorts. As they show, intergenerational transmission of tertiary education is the most important and stable pathway. In most of cohorts, the probability that sons with fathers holding tertiary degrees also have tertiary degrees is 40% higher than sons whose father do not have tertiary degrees. In 1951 to 1955 cohorts and 1961 to 1965 cohorts, this probability exceeds 50% and even reaches 60%, respectively. This might reflect the fierce competition for admissions to universities, which forces parents to invest

[16] SSM gives each occupation an OPS. The average OPS of professional occupations, managerial occupations and manual occupations is 61.6, 68.3 and 37.9, respectively.

in children's education, like tutoring schools. Another important finding is that from 1935 cohort to 1976 cohort, the probability that sons are at managerial positions if their fathers are also managerial workers (transmission of managerial occupation) decreases from over 50% to almost zero. This reflects the development of seniority-wage system and life-time employment system, which ensures that promotion depends on tenure in (informally, the loyalty to) a certain firm. Such system significantly dilutes the effect of family background when pursuing for a managerial title.

Panel D to F show how upward educational and occupational mobilities evolve with cohorts. The general pattern is that, from 1935 to mid 1950s cohorts, these upward mobilities generally increase, which corresponds to high-increasing period before early-mid 1970s since most of individuals born from 1935 to mid 1950s enter the labor market during this period. After mid 1950s cohorts, these upward mobilities decline with fluctuations generally, especially for 1971 to 1976 cohorts consists of those who were more likely to enter the labor market after the collapse of bubble economy. One intuitive reason of such pattern might be that during prosperous times, it is easier for children to climb the social ladder from their families of origin. This hypothesis can be reinforced by 1966 to 1970 cohorts consist of those who were more likely to enter the labor market from late 1980s to early 1990s, i.e., in bubble boom during which Japanese economy reaches its peak of the 20th century. It can be seen from Panel D to F that upward mobilities slightly increase for these cohorts.

5.3 Decomposition of IGE

5.3.1 Main Results

Lastly, IGE is decomposed based on the framework shown in Section 2. Table 5 shows decomposition results. Each cell of Table 5 presents IGE attributed to one transmission pathway.[17] The diagonal cells refer to IGE due to intra-factor transmissions, while other cells refer to IGE due to inter-factor transmissions.

[Insert Table 5 here]

As Table 5 shows, intergenerational persistence of income inequality is likely to occur at both ends of distributions of education and occupation. For instance, intergenerational transmissions among tertiary education, managerial occupation and manual occupation. Take intergenerational transmission from fathers' managerial occupation to sons' tertiary education as an example. IGE due to this pathway is roughly 0.069. The high contribution of this pathway to IGE can be explained by high income premiums of managerial positions in fathers' generation and tertiary education in sons' generation as well as strong intergenerational transmission of this pathway. Moreover, if the sign of income premium changes from fathers' generation to sons' generation

[17] For instance, the number in the first row and first column refers to IGE due to intergenerational transmission of being regularly employed.

(e.g., income premium of regular employment) or intergenerational transmission is negative (e.g., transmission of upper secondary education to tertiary education from fathers to sons), then IGE due to related pathways might be negative, i.e., such pathways would increase IGM.

To sum up, this papers finds IGE due to intergenerational transmissions of occupation (0.100) is higher than IGE due to that of education (0.042). This is consistent with Österbacka (2001)'s Finnish study and Lefranc and Trannoy (2005)'s French study. The difference between contribution of occupation and education in this study (0.058) is much lower than that in Lefranc and Trannoy (2005) (over 0.11). One important reason might be different specifications. In Lefranc and Trannoy (2005), occupation was measured by social classes whose income premiums are much more stable than occupation in the long-run. For instance, this papers finds income premiums of 4 out of 5 occupational groups at age 40 compared with reference group (agricultural occupation) change from positive to negative from 1965 and 1975 to 1995 and 2005. Another reason might be competitive education system in Japan, which makes parental investment in children's education more important and therefore plays a more important role in IGE.

5.3.2 Long-term Trends in Components of IGE

Next, long-term variations in income structure and intergenerational transmissions are combined together to analyze how these variations contribute to variations in components of IGE. Results are summarized in Figure 3.

[Insert Figure 3]

Panel A to C present how IGE due to intra-factor transmissions vary with cohorts. Following patterns are notable. Firstly, throughout all the cohorts, IGE due to intergenerational transmission of tertiary education almost remains above 0.04. In 1935 to 1940 cohorts and 1966 to 1970 cohorts, IGE due to this pathway even approaches 0.08 and 0.10, respectively. The stable high contribution of this pathway to IGE is due to strong intergenerational persistence of tertiary education and high return to it. It is worth noting that although both variations in intergenerational transmission and income premium contribute to this final trend, this trend is much more similar to long-term trend in return to tertiary education, instead of that in intergenerational transmission. Secondly, IGE due to intergenerational transmission of regular employment decreases from 0.016 in 1935 to 1940 cohorts to -0.030 in 1971 to 1976 cohorts. In other words, from 1935 cohort to 1976 cohort, intergenerational transmission of being regularly employed increases IGM. The reason is that from 1935 cohort to 1976 cohort, return to regular employment keeps increasing and changes from negative to positive. Moreover, intergenerational transmission of regular employment keeps positive throughout all the cohorts. Lastly, IGE due to transmission of occupations keep decreasing with cohorts, which is very similar to long-term trends in returns to occupations as shown in Panel B of Figure 1.

Panel D to F show how IGE due to upward educational and occupational mobilities vary with cohorts. As panel D shows, From 1935 cohort to 1950 cohort, IGE due to upward educational mobility increases from -0.006 to 0.021 with fluctuations. Since 1951 cohort, this trend is reversed and IGE due to this pathway decreases to almost zero with the exception that IGE due to this pathway reaches 0.034 in 1966 to 1970 cohorts. It implies upward educational mobility contributes to an increasing in IGM generally since 1951 cohort. Similar pattern can be observed from Panel F. From 1935 cohort to 1955 cohort, IGE due to upward mobility from fathers' occupation to sons' education increases monotonously from -0.108 to -0.015. Since 1956 cohort, however, IGE due to this pathway decreases monotonously to -0.055. Different patterns are shown in Panel E. As it shows, IGE due to intergenerational transmission from fathers' manual occupation to sons' managerial occupation decreases from 0.050 to -0.016 from 1935 cohort to 1965 cohort. However, it increases again to 0.050 from 1966 cohort to 1976 cohort. As for IGE due to transmission from fathers' manual occupation to sons' professional occupation, it keeps fairly stable around zero throughout 1941 to 1970 cohorts. However, it also increases to 0.047 for 1971 to 1976 cohorts. To sum up, these upward occupational mobilities do not contribute to an increasing in IGM.

6. Conclusions

This paper has estimated IGE in Japan using TS2SLS and finds IGE in Japan lies around 0.35 to 0.40 for sons born from 1935 to 1976. How components of IGE vary with sons' birth cohorts is analyzed by estimating long-term trends in income structure and intergenerational mobilities of education, occupation, etc. This paper finds income inequality in Japan increases for sons born after early-mid 1950s and upward educational mobility and upward occupational mobility decrease for these recent cohorts of sons. Although upward mobility of education itself decreases for sons born after early-mid 1950s, it contributes to an increasing in IGM for these sons after considering long-term trends in income premiums of education. However, it is not the case for upward occupational mobility. Moreover, income premium of regular employment keeps increasing with the establishment of life-time employment system and seniority-wage system in Japan after World War II, which provides a channel for sons born from 1935 to 1976 to improve their economic status compared with their fathers (See discussion in Section 5.3.2).

This paper indicates both the strength of intergenerational transmissions of factors which might induce income inequality (e.g., education) and long-term trends in income premiums of these factors (e.g., return to education) underlie intergenerational persistence of income inequality. Which of these two mechanisms prevails is an open question for further researches. Using Japanese data, this study finds changes in income premiums might be more important. For instance, the patterns of long-run variations in IGE due to intergenerational transmission of tertiary education and that of occupations are highly coincided with long-run trends in returns to tertiary education and occupations (See discussion in Section 5.3.2). All in all, it seems that long-run trends in income inequality might be more important in shaping intergenerational persistence of income inequality.

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Table 1 Descriptive Statistics

	variable	mean	s.d.
primary sample (extracted from SSM 1995 and 2005. n=1,828)	log (sons' income)	15.48	0.56
	sons' birth year	1954.31	9.44
	sons' age	45.16	8.26
	type of employment (sons)		
	regular employment	80.03%	0.40
	firm size (sons)		
	big firms	17.45%	0.38
	public sector	12.20%	0.33
	occupation (sons)		
	professional	14.50%	0.35
	administrative and managerial	11.65%	0.32
	clerical	20.02%	0.40
	sales	12.96%	0.34
	manual	36.71%	0.48
	education (sons)		
	upper secondary education	50.44%	0.50
	tertiary education	38.18%	0.49
	fathers' birth year	1923.10	11.87
	fathers' age	76.42	10.61
	type of employment (fathers)		
	regular employment	52.83%	0.50
	firm size (fathers)		
	big firms	12.20%	0.33
	public sector	12.04%	0.33
	occupation (fathers)		
	professional	7.77%	0.27
	administrative and managerial	11.82%	0.32
	clerical	10.45%	0.31
	sales	11.60%	0.32
	manual	33.42%	0.47
	education (fathers)		
	upper secondary education	27.63%	0.45
	tertiary education	15.48%	0.36
auxiliary sample (extracted from SSM 1965 and 1975. n=2,893)	log (pseudo fathers' income)	13.92	0.95
	pseudo fathers' birth year	1928.38	9.52
	pseudo fathers' age	42.26	8.22
	type of employment (pseudo fathers)		
	regular employment	66.92%	0.47
	firm size (pseudo fathers)		
	big firms	15.62%	0.36
	public sector	10.68%	0.31
	occupation (pseudo fathers)		
	professional	7.50%	0.26
	administrative and managerial	10.75%	0.31
	clerical	15.21%	0.36
	sales	11.30%	0.32
	manual	38.47%	0.49
	education (pseudo fathers)		
	upper secondary education	30.87%	0.46
	tertiary education	15.31%	0.36

Table 2 Estimation results of IGE between fathers and sons in Japan

	Dependent variable: logarithm of sons' annual income (n=1,828)	
	(1)	(2)
fathers' imputed income	0.367*** (0.046)	0.403*** (0.056)
sons' age		○
sons' age^2		○
fathers' imputed income×sons' age		○
fathers' imputed income×sons' age^2		○
year dummy		○

Note: sons' age is centered at 40. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3 Estimation results of income equations

Pseudo fathers' income equation (Equation (6)) Dependent variable: logarithm of pseudo fathers' annual income (n=2,893)						Sons' income equation (Equation (8)) Dependent variable: logarithm of sons' annual income (n=1,828)					
	(1-1)		(1-2)		(1-3)		(2-1)		(2-2)		(2-3)
TE0	Ref					TE0	Ref				
TE1	-0.187*** (0.053)	TE1×age	-0.004 (0.006)	TE1×age²	0.002*** (0.001)	TE1	0.116** (0.054)	TE1×age	-0.002 (0.007)	TE1×age²	0.001 (0.001)
FS0	Ref					FS0	Ref				
FS1	0.244*** (0.032)	FS1×age	0.010*** (0.003)	FS1×age²	-0.001* (0.000)	FS1	0.205*** (0.032)	FS1×age	0.011*** (0.004)	FS1×age²	-0.001** (0.000)
FS2	0.024 (0.040)	FS2×age	0013*** (0.005)	FS2×age²	0.000 (0.001)	FS2	0.023 (0.038)	FS2×age	0.006 (0.005)	FS2×age²	0.000 (0.000)
O0	Ref					O0	Ref				
O1	0.492*** (0.089)	O1×age	0.021 (0.014)	O1×age²	-0.002 (0.001)	O1	-0.058 (0.162)	O1×age	-0.031* (0.019)	O1×age²	0.004*** (0.002)
O2	0.775*** (0.082)	O2×age	0.020* (0.011)	O2×age²	-0.002 (0.001)	O2	0.045 (0.161)	O2×age	-0.054*** (0.020)	O2×age²	0.006*** (0.002)
O3	0.417*** (0.080)	O3×age	0.005 (0.010)	O3×age²	-0.001 (0.001)	O3	-0.126 (0.158)	O3×age	-0.033* (0.018)	O3×age²	0.004** (0.001)
O4	0.290*** (0.073)	O4×age	0.003 (0.009)	O4×age²	0.001 (0.001)	O4	-0.267* (0.162)	O4×age	-0.042** (0.018)	O4×age²	0.004*** (0.001)
O5	0.267*** (0.068)	O5×age	-0.005 (0.008)	O5×age²	0.000 (0.001)	O5	-0.391** (0.154)	O5×age	-0.035** (0.018)	O5×age²	0.004*** (0.001)
E0	Ref					E0	Ref				
E1	0.228*** (0.038)	E1×age	-0.002 (0.004)	E1×age²	0.001 (0.001)	E1	0.117 (0.090)	E1×age	0.008 (0.015)	E1×age²	0.000 (0.001)
E2	0.292*** (0.051)	E2×age	-0.010 (0.007)	E2×age²	0.002** (0.001)	E2	0.230** (0.093)	E2×age	0.014 (0.016)	E2×age²	-0.001 (0.001)

Note: age, age², year dummies and constant terms are controlled. age is centered at 40. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Definitions of variables are introduced in Section 4.1.

Table 4 Intergenerational transmission (ρ_s's)

	$TE1_s$	$FS1_s$	$FS2_s$	$O1_s$	$O2_s$	$O3_s$	$O4_s$	$O5_s$	$E1_s$	$E2_s$
$TE1_f$	0.177***	0.053***	0.035**	0.071***	0.069***	0.051***	-0.003	-0.121***	-0.117***	0.230***
	(0.019)	(0.018)	(0.015)	(0.016)	(0.015)	(0.019)	(0.016)	(0.023)	(0.023)	(0.022)
$FS1_f$	0.125***	0.143***	0.014	0.019	0.092***	0.048	-0.040*	-0.081**	-0.059*	0.147***
	(0.022)	(0.032)	(0.024)	(0.026)	(0.028)	(0.030)	(0.021)	(0.033)	(0.036)	(0.036)
$FS2_f$	0.129***	0.008	0.109***	0.161***	-0.014	0.072**	-0.023	-0.164***	-0.201***	0.269***
	(0.022)	(0.028)	(0.029)	(0.032)	(0.022)	(0.031)	(0.023)	(0.031)	(0.034)	(0.035)
$O1_f$	0.033	0.002	0.059*	0.370***	-0.050**	-0.011	-0.026	-0.253***	-0.341***	0.426***
	(0.033)	(0.033)	(0.033)	(0.043)	(0.023)	(0.034)	(0.027)	(0.031)	(0.035)	(0.037)
$O2_f$	0.100***	0.023	0.024	0.040	0.183***	0.083***	-0.005	-0.259***	-0.241***	0.365***
	(0.024)	(0.029)	(0.025)	(0.028)	(0.031)	(0.032)	(0.024)	(0.027)	(0.033)	(0.033)
$O3_f$	0.100***	0.062**	0.074**	0.049	0.034	0.116***	-0.034	-0.118***	-0.096**	0.170***
	(0.025)	(0.032)	(0.029)	(0.030)	(0.027)	(0.035)	(0.023)	(0.034)	(0.038)	(0.038)
$O4_f$	-0.164***	-0.021	-0.063***	-0.036	-0.025	-0.056**	0.291***	-0.127***	-0.058	0.096***
	(0.034)	(0.027)	(0.019)	(0.024)	(0.022)	(0.027)	(0.034)	(0.032)	(0.036)	(0.036)
$O5_f$	0.052***	0.043**	-0.026*	-0.048***	-0.013	-0.045**	-0.052***	0.211***	0.184***	-0.192***
	(0.019)	(0.019)	(0.016)	(0.027)	(0.016)	(0.019)	(0.016)	(0.024)	(0.024)	(0.023)
$E1_f$	0.024	-0.006	-0.015	0.019	0.017	-0.009	0.064***	-0.089***	0.004	0.083***
	(0.020)	(0.020)	(0.017)	(0.019)	(0.017)	(0.021)	(0.019)	(0.024)	(0.026)	(0.026)
$E2_f$	0.044*	0.053**	0.027	0.209***	0.038*	0.031	0.018	-0.263***	-0.342***	0.464***
	(0.024)	(0.026)	(0.022)	(0.029)	(0.023)	(0.027)	(0.023)	(0.024)	(0.028)	(0.028)

Note: Each cell refers to a simple Linear Probability Regression (LPR) regressing a sons' characteristic X_{sj} on a fathers' characteristic X_{fk}. Constant term is controlled in each of these 100 regressions. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Definitions of variables are introduced in Section 4.1.

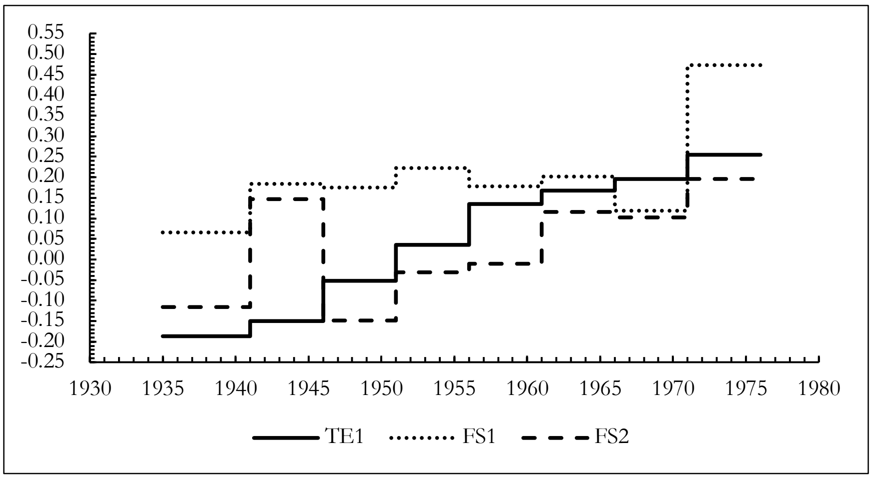
Table 5 Intergenerational income elasticity attributed to each transmission pathway

	$TE1_s$	$FS1_s$	$FS2_s$	$O1_s$	$O2_s$	$O3_s$	$O4_s$	$O5_s$	$E1_s$	$E2_s$
$TE1_f$	-0.01078	-0.00575	-0.00042	0.00217	-0.00163	0.00334	-0.00049	-0.02492	0.00720	-0.02769
$FS1_f$	0.00529	0.01071	0.00012	-0.00040	0.00151	-0.00219	0.00393	0.01153	-0.00250	0.01234
$FS2_f$	0.00041	0.00005	0.00007	-0.00026	-0.00002	-0.00025	0.00017	0.00177	-0.00065	0.00170
$O1_f$	0.00157	0.00014	0.00055	-0.00875	-0.00092	0.00056	0.00284	0.04035	-0.01627	0.03997
$O2_f$	0.00954	0.00379	0.00046	-0.00192	0.00674	-0.00853	0.00115	0.08283	-0.02311	0.06873
$O3_f$	0.00731	0.00805	0.00107	-0.00177	0.00095	-0.00916	0.00566	0.02892	-0.00703	0.02459
$O4_f$	-0.00720	-0.00166	-0.00055	0.00079	-0.00043	0.00266	-0.02947	0.01886	-0.00259	0.00841
$O5_f$	0.00461	0.00674	-0.00046	0.00215	-0.00044	0.00437	0.01072	-0.06341	0.01656	-0.03407
$E1_f$	0.00171	-0.00073	-0.00021	-0.00066	0.00046	0.00065	-0.01047	0.02109	0.00025	0.01157
$E2_f$	0.00239	0.00507	0.00029	-0.00568	0.00080	-0.00181	-0.00225	0.04816	-0.01873	0.04998

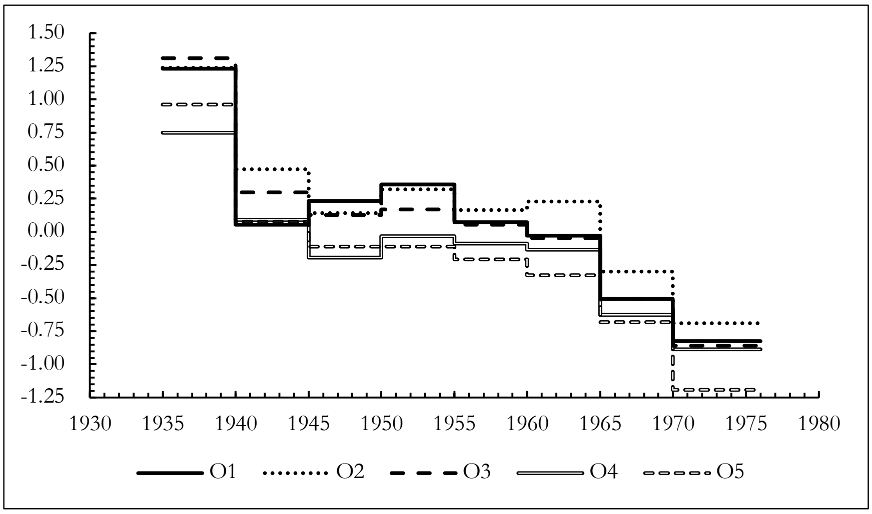
Note: Each cell refers to IGE due to one transmission pathway (e.g., -0.01078 in first row and first column refers to IGE due to intergenerational transmission of regular employment). Definitions of variables are introduced in Section 4.1.

Figure 1 Long-term trends with cohorts in income premiums

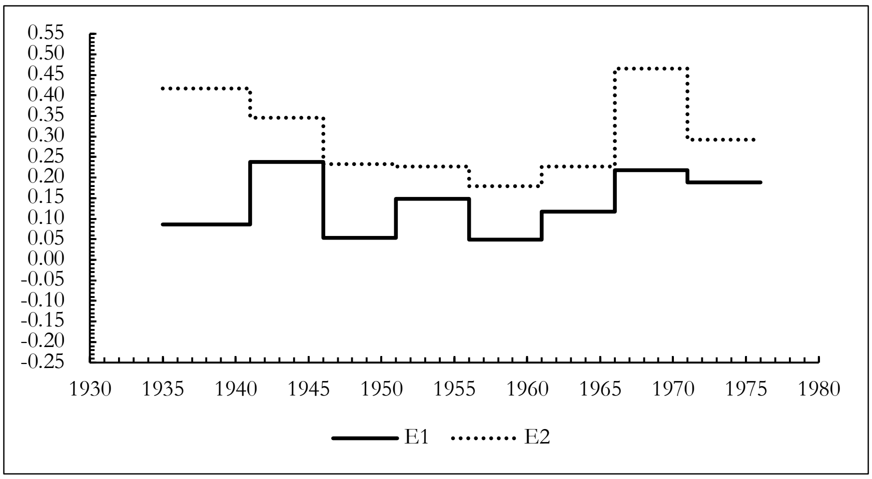
(A)



(B)

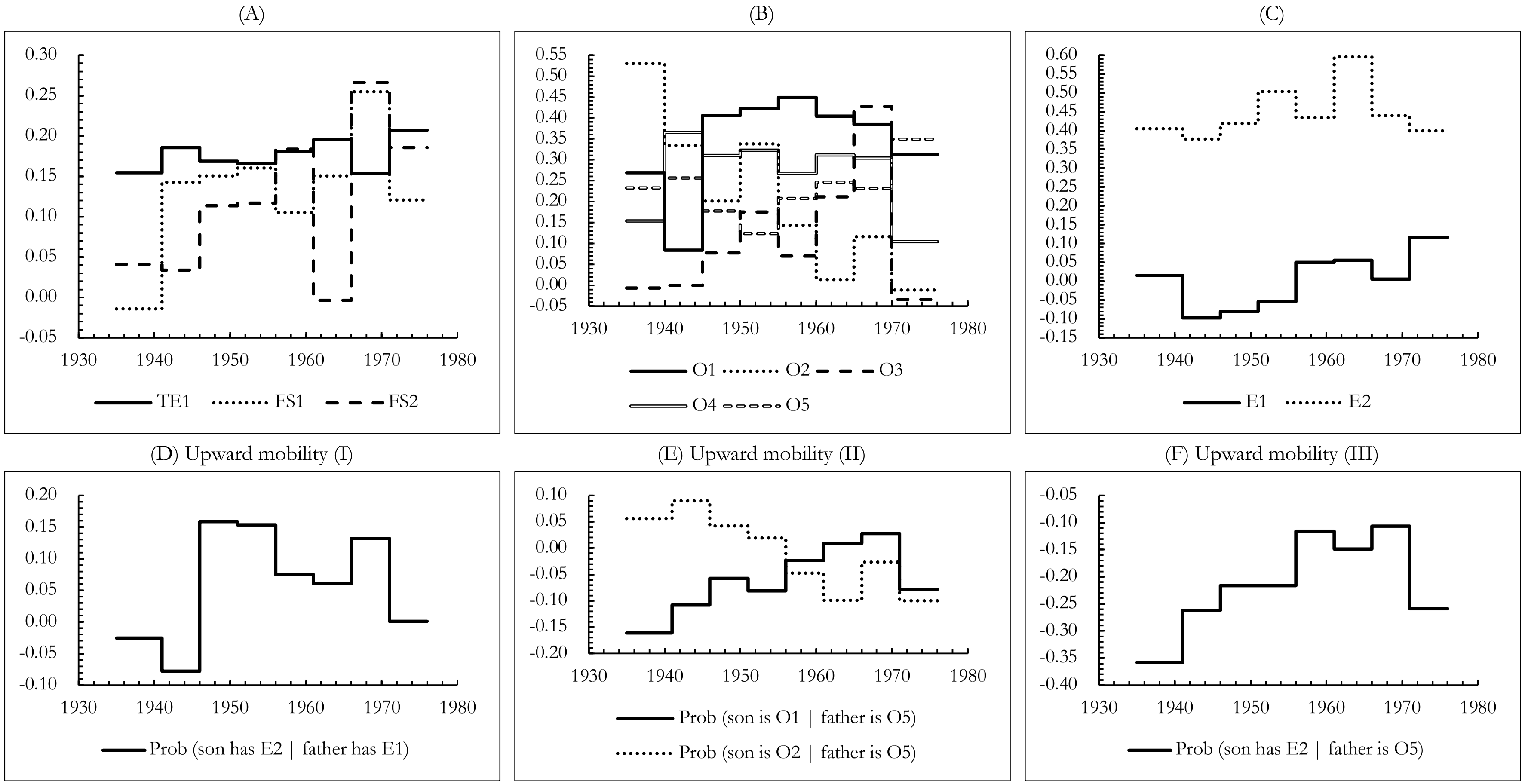


(C)



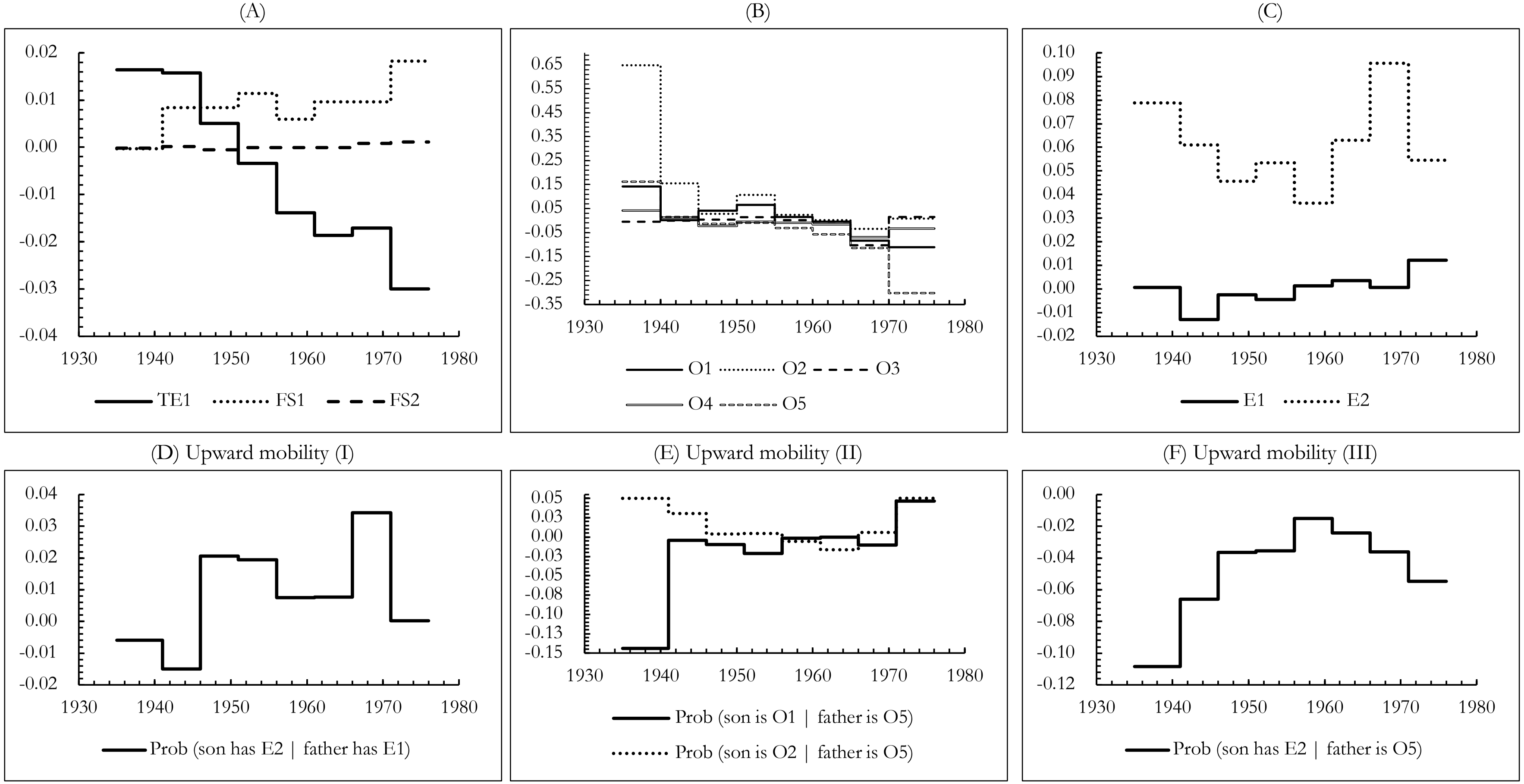
Note: Definitions of variables are shown in Section 4.1. Returns refer to returns at the age of 40.

Figure 2 Long-term trends in intergenerational transmissions



Note: Definitions of variables are shown in Section 4.1. Take Panel (D) as an example. It shows how upward educational mobility (Prob (son has tertiary degree | father only has upper secondary degree)) varies with sons' birth cohorts.

Figure 3 Long-term trends in components of IGE (i.e., IGE due to transmission pathways)



Note: Definitions of variables are shown in Section 4.1. Take Panel (D) as an example. It shows how IGE due to upward educational mobility (Prob (son has tertiary degree | father only has upper secondary degree)) varies with sons' birth cohorts.