Language Unification, Labor and Ideology*

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Abstract

By exploring an instance of nationwide language education reform—the Chinese Pinyin Act of 1958-1960—we estimate the effects of language unification using a difference-in-difference approach by interacting a birth cohort exposure dummy with the linguistic distances between local languages and Putonghua—modern standardized Mandarin. This paper presents five main findings: (1) learning Putonghua results in modest short-term negative effects, but long-term positive effects on educational attainment; (2) learning Putonghua increases rural households' non-agricultural employment; (3) sharing a common language empowers workers to migrate across provinces and language regions; and (4) using a unified language fosters patriotism, a stronger national identity, a more positive subjective evaluation of China, and even more distrust in people of another nationality. One plausible channel is that the common language builds national identity by expanding exposure to audio-based media (e.g., radio, cell phone, and the internet); and (5) the post-reform population shows more skepticism about democracy, a better subjective evaluation of governance, and greater support for government intervention over economic liberalism. These changes in ideology and social preferences are consistent with the political doctrine of the Communist Party of China.

Keywords: Language, Education, Labor market, Ideology, Social Preference
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1. Introduction

This paper studies the causal impact of learning in a unified national language rather than a local language, on educational and labor market outcomes, ideology, and social preferences by exploring the Chinese Pinyin Act Reform of 1958-1960. Although written Chinese is identical across China, local spoken languages (dialects) can differ so greatly throughout the country that people from diverse regions cannot understand each other. The language education reform unified spoken languages by shifting language pedagogy from "learning by character" to "learning by pronunciation" using Pinyin.

To identify the language effects, we explore variation in computational linguistic distance from each local dialect to Putonghua (Zheng 1994). People whose native dialects are linguistically distant (close) are exposed to a larger (smaller) language unification shock. For example, Beijing Mandarin speakers are not affected by the Pinyin Act since Pinyin is precisely how their parents and neighbors speak. However, Cantonese speakers must learn a new language while in school because Putonghua differs so greatly from Cantonese. We generate a birth cohort exposure dummy[1] based on the effective years of exposure to the Pinyin regime and use a difference-in-difference approach to estimate language effects by interacting the birth cohort exposure dummy with the linguistic distances.

This paper documents results in three categories: First: Educational Attainment. One particular concern is that compulsory new language learning discourages students from education. In the Chinese context, we find evidence that new language learning very modestly deters students from schooling in the first five birth cohorts but encourages primary school enrollment in the long-run. However, the dynamic is weak in both economic scale and statistical power.

[1] The Compulsory Schooling Law explicitly specifies that children should enroll in primary school between the ages of six and seven. In rural areas, children may start school at the age of eight or later. We assume students start primary school at the age of seven. For example, the Pinyin Act effect in 1960 for Jilin Province; we assume the birth cohort of 1953 is treated while the birth cohort of 1952 is not treated.

Second: Labor Market and Migration. According to the Population Census Survey in 2000, rural residents were more likely to gain non-agricultural employment, with a 10% increase in the linguistic distance corresponding to a 0.62% higher non-agricultural employment in the 20 post-reform birth cohorts. Using the same identification approach, we find that language unification increases migration across provinces and language areas, but reduces migration within provinces. These findings imply that a unified language enables workers to collaborate in the workplace more easily and lowers the cost of migration (Dustmann 2011).

Third: Nation-Building, Ideology, and Social Preferences. Language unification also unifies peoples' mindsets; speaking a common language nurtures their patriotism, strengthens national identity, and weakens local identity. People also express more distrust in people of another nationality. To investigate the mechanism, we find that the media may play an important role: people are inclined to follow political news more avidly and use more audio-based devices (e.g., radios and cell phones) but not text-based media (e.g., newspapers). Consistent with Chinese government's doctrine, people believe that the Chinese government is more socialist democratic and its governance is better. Also, people express more skepticism towards the importance of democracy in western countries and develop stronger socialist preferences. We hypothesize that the common language increases information availability for non-Putonghua speakers, thus increasing their exposure to ideological doctrine broadcast by the government-controlled media. Language unification plays an important role in unifying ideologies across China and building a more integrated nation.

This paper investigates language unification with broad implications in many countries both historically and contemporarily. Language matters in some recent disputes: President Donald Trump took down the Spanish White House webpages and catalyzed debate about whether the United States should implement an English-only policy, even though 17.6% of the national population is Hispanic and Latino. In Spain, Catalan speakers, who feel more Catalan than Spanish (Clots-Figueras and

Paolo Masella 2013), fought for an independent republic through the Catalan Independence Referendum of 2017. Historically, language unification typically happened simultaneously with state formation. In France, Weber (1976) emphasized that linguistic conversion to French was a crucial causal factor in developing the unity of minds, and French-speaking education was important to achieve national integration. Similarly, the Italian spoken today was known to less than 3% of the population when Italian unification began in 1861. Long after state formation, standard Italian, which had co-existed with diverse dialects, gradually spread over Italy and was ultimately approved as the official language by the Italian Parliament in 2007. Some recent trends also contribute to the growing importance of understanding language effects: globalization requires English fluency, as it is the dominant language in international trade. Many other countries[2] are experiencing or have experienced language unification to some extent.

This paper contributes to several strands of the literature. The primary focus in the literature is to measure labor market returns to language proficiency. Several papers (Kit-Ken 1994, Sridhar 1996, Yip et al. 2003, Grin 2006, Seid 2016) further compare the educational outcomes of learning in a foreign language versus a mother tongue. This paper shows the short-run negative, but subsequent long-run positive, dynamics of a new language on educational attainment; it further documents that learning Putonghua helps rural peasants shift to non-agricultural employment sectors. Additional, this paper relates to a more recent strand of literature that documents how language shapes migration (Isphording and Otten 2003, Falck et al. 2012, Adsera and Pytlikova 2015), cultural transmission (Lazear 1999, Fouka 2016), and economic preferences (Bleakley and Chin 2010, Chen 2013, Falk et al. 2016). This paper moves the frontier of identification strategy in literature by using an exogenous language policy shock to provide the causal evidence.

[2] US (Lazear 1999, Saiz and Zoido 2005, Dustmann and Soest 2001), UK (Dustmann and Fabbri 2003), Canada (Carliner 1981, Chiswick and Miller 2001), Singapore (Kit-Ken 1994), Luxembourg (Fehlen 2002) and other EU Countries (Eurobarometer 2006) China (Zhou and Sun 2006), India (Sridhar 1996, Clingingsmith 2014), Chad (Thierry et al. 2016), Ethiopia (Seid 2016) and other African countries (Phillipson 1996, Banda 2000, Phillipson 2009)

Furthermore, this paper is connected to growing political economy literature on nation-building and ideology unification (Bandiera et al. 2017, Alesina et al. 2017, and Alesina et al. 2018). Alesina et al. (2018) argue that dictators are more likely than democratic governors to enforce uniformity of language and education curricula, especially when they feel threatened by a democratic movement or drive in their population. This paper provides consistent evidence that China successfully used language unification as a tool to achieve national unity, instill the values of communism, and reduce concerns about democracy. Nations stay together when citizens share homogeneity: the same language, a shared religion, similar social values, and preferences. Nation-building over a multi-lingual and multi-cultural area is exceptionally challenging, and potential collapse of the country is a persistent threat. The Soviet Union serves as an example of a state that unified language and culture through education but ended in dissolution[3]. In the Chinese context, the threat of disintegration boosts the desire for a regime to reduce differences across regions. That desire was unusually strong in the 1950s when the People's Republic of China was established and faced multiple external threats from capitalist countries and Taiwan (Republic of China). The implementation of a powerful language unification policy—the Chinese Pinyin Act—illustrates the theory of threat and nation-building in Aghion et al. (2014) and Alesina et al. (2017).

The remainder of the paper is organized as follows. In Section 2, we discuss the background of language diversity in China and the Pinyin Act of 1958-1960. Section 3 describes the data and empirical identification strategy. Section 4 verifies Putonghua proficiency improvement in post-reform cohorts and documents its impacts on educational attainment. Section 5 studies the labor side of language effects on non-agricultural employment and migration decisions in both full sample and gender-specific subsamples. Section 6 documents how language unification builds national identity, patriotism, and positive national image. Then we investigate impacts

[3] In 1975, Leonid Brezhnev, the leader of Soviet Union from 1964 to 1982 as the General Secretary, said "... a new historical concept—the Soviet people—it is an objective growth in Russian language's role as the language of international communications when one builds Communism, in the education of the new man!"

on ideology and social preferences, suggesting that language unification amplifies the power of political doctrine by increasing people's exposure to the media. Section 7 concludes.

2. Background

Language Diversity and Linguistic Distance

China is a nation with huge language diversity. Chinese languages (or dialects) are pronounced so differently that they can prohibit mutual understanding. For example, Cantonese (Yue Group), commonly used in Guangdong Province, is almost incomprehensible to people who are native speakers of Beijing Mandarin, and vice versa. All languages in our sample apply the same standard Chinese characters, thus there is no linguistic barrier in written language. Grammar and vocabulary may vary slightly across languages but do not inhibit mutual understanding. In our analysis, we only include languages spoken by the Han ethnicity, the majority ethnic group in China, and exclude minority areas because the government designed alternative language policies for minorities.

To better understand the linguistic distance among Chinese languages, we use the lexical distance matrix from the ASJP database to compare the lexical distance among Chinese languages and European languages. The ASJP database computes lexical distance by comparing the pronunciation similarity of a small word list (around 100 basic words). For example, "I" is pronounced as "Wo" in Beijing Mandarin, "Noh" in Cantonese, "Ei" in English, "io" in Italian, and "yo" in Spanish. We choose Beijing Mandarin, Southwestern Mandarin, and Cantonese in the Chinese language groups. The ASJP lexical distance is 71.65 between Beijing Mandarin and Northwestern Mandarin, and 81.94 between Beijing Mandarin and Cantonese. We set two comparison groups. First, we pick Germanic languages—Danish, Swedish, and Norwegian—spoken in Northern Europe and compare them with German, a more

linguistically distant language but one sharing a common origin. The lexical distance is 57.0 between Danish and Norwegian, 52.9 between Danish and Swedish, 58.0 between Swedish and Norwegian, 68.1 between German and Danish, 69.8 between German and Swedish, and 75.7 between German and Norwegian. Among these six language pairs, the communication barrier in each pair is lower than in the Mandarin-Cantonese pair (81.9), and the barrier in five of the six pairs is even lower than the lexical distance within Mandarin groups (71.7). Another comparison group comprises more widely spoken European languages—Spanish, French, and Italian. The Italian-Spanish distance is 56.7, which is below the Beijing-Southwestern Mandarin distance. The Italian-French distance is 78.2, which is below the Beijing Mandarin–Cantonese distance but above the Beijing-Southwestern Mandarin distance. The Spanish-French distance is 84, which is the only one higher than the Beijing Mandarin–Cantonese distance. We quantitatively illustrate how much Chinese languages differ using the ASJP lexical distance.

However, the ASJP does not include a complete list of Chinese languages, and the word list is quite limited. Thus, we use the linguistic distance matrix of local languages spoken in 17 Chinese cities in Zheng (1994) calculated from digitalized syllables in the book *Syllabary of Dialect Pronunciations of Chinese Characters*, published by the Peking University Department of Chinese Language and Literature. This book comprehensively covers more than 3000 words and is one of the most authoritative materials for phonetics research on Chinese languages and dialects. Thus, the metrics in Zheng (1994) measure linguistic distance better than the ASJP in the Chinese context.

The Chinese Pinyin Act

Putonghua, the unified language, is predominately Beijing Mandarin after linguistic standardization. The First National People's Congress approved the Chinese

Pinyin Act on February 11, 1958. Pinyin[4] is the official Romanization system for the standardized Mandarin in China. Under the Pinyin education regime, students learn pronunciation with Pinyin first and then associate Chinese characters with pronunciation. The Pinyin Act commanded that *Chinese Pinyin* was the mandatory curriculum for all schools with standardized Pinyin textbooks. Each province-level administrative region also organized teacher training so that teachers could efficiently deliver Pinyin education to students. The Pinyin Act was effective in all provinces from 1958 to 1960. Table 2 displays the data on effective year-month by province.[5]

[Table 2 Here]

The Chinese Pinyin Act offers a unique natural experiment to study language effects for two main reasons. First, the Pinyin Act effectively increases Putonghua adoption exogenously. From 1958 to 1960, all enrolled students were forced to learn Chinese with Pinyin using the same Pinyin textbooks. Teachers were required to teach in Putonghua and students were strongly encouraged to speak Putonghua on campus. Although no formal law forbade speaking in local dialects, many schools banned their use on campus and punished students who were caught speaking in their local dialects Therefore, many students were not allowed to use their local languages on campus de facto.

Second, the Pinyin Act does not incur a selection problem. The language pedagogy reform applied to every student in the education system; no one had the option to learn in the local language instead. Some anecdotal evidence shows that Cantonese speakers held anti-Putonghua sentiments because cultures in Cantonese-speaking areas are more separated from Mandarin-speaking areas. Still, every Cantonese-speaking student began learning Pinyin in May 1960, so either the

[4] Zhou Youguang, who passed away on January 14, 2017 at the age 112, led the language unification committee in 1955 and proposed the Pinyin Act. He devoted his entire life to promoting Pinyin and standardized language. Google honored him as "the father of Pinyin" on January 12, 2018.
[5] The effective year data is hand collected from the education section of provincial China Gazetteers (Chinese Historical Archive Collections).

anti-Putonghua sentiment was not strong enough to deter learning Pinyin, or government repression was powerful enough to enforce learning Pinyin.

Since 1958, the socialist sentiment of the Great Leap Forward campaign has entered education by its emphasis on ideological indoctrination, reducing the number of courses taught, and increasing the numbers of hours spent in factories or fields. The Pinyin Act's implementation was orthogonal to other course material reforms. The Chinese Language Reform Committee handled Pinyin promotion while the Ministry of Education managed course material reforms. We found no evidence that the Pinyin reform mixed with other educational changes or any nationwide reform correlated with the linguistic distances we explore in this paper.

3. Data and Research Design

Data

This paper explores three main categories of variables. First: Language variables. Figure 1 shows the Chinese Language Atlas (Lavely 2000) in Panel A and language distribution with county boundaries from Census 1982, 1990, and 2000[6] in Panel B, C, and D. We use the 18-major languages classification system, dividing all languages into nine major Mandarin groups[7] and nine non-Mandarin groups.[8] Zheng (1994) computes a language mutual intelligibility matrix among languages/dialects in 17 cities based on syllable data collected in 1962. The 17 cities cover the five Mandarin super-group branches (Zhongyuan, Southwestern, Beijing, Jilu, Jianghuai) and seven non-Mandarin branches (Wu Group, Gan Group, Xiang Group, Min Group, Hakka Group, Jin Group Yue Group). We define the dialect-Putonghua linguistic distance as the average intelligibility from the dialect to Beijing Mandarin. To measure

[6] The China Gazetteer Project provided the county administrative crosswalk file https://www.chinagazetteer.com

[7] Nine Mandarin groups: Northeastern Mandarin, Beijing Mandarin, Beifang (Jilu) Mandarin, Jiaoliao Mandarin, Zhongyuan Mandarin, Lanyin Mandarin, Southwestern Mandarin, Jianghuai Mandarin, Unclassified Mandarin.

[8] Nine Non-Mandarin groups: Jin Group, Wu group, Gan Group, Xiang Group, Min Group, Yue Group, Hakka Group, Hui Group, Residual Group.

Putonghua proficiency, we use survey questions on Putonghua from the China Labor Dynamics Survey (CLDS), China General Social Survey (CGSS), and Asian Barometer Survey (ABS).

Second: Labor and education variables. The Census of Population Survey (CPS) 2000 provides data on educational attainment, occupation, birth-county, and migration. We assign a local language to each observation in the Census based on birth-county. County is the lowest official administrative level in China, below province and prefecture. China comprised 2870 county-level administrative regions in 2000, and each county's average population was approximately 466,000. Using samples of 15 pre-reform and 20 post-reform birth cohorts, Table 1 reports the summary statistics by language group. 78 percent of the counties (2248 out 2870) and 87 percent of the population belong to the 12 language groups in our sample. Data from Census 1982 and 1990 provide additional evidence and robustness checks, although they suffer from some data limitations[9]. Our data is the 0.1% representative sample of Census 2000, and the 1% representative sample of Census 1982 and 1990.

[Table 1 Here]

Third: Ideology and social preferences variables. The World Value Survey (WVS) and the Asian Barometer Survey (ABS) provide rich survey questions on patriotism, identity, subjective evaluation of government, social preferences, etc. We pool a set of related questions from five waves of the WVS and three waves of the ABS. Each wave consists of a different number of respondents, ranging from 1000 to 2300 in the WVS and from 3183 to 5098 in the ABS. The WVS sample covers 32 provincial regions in the first wave and 31 in all of the next four waves. The ABS covers 29 provincial regions in the first wave, 27 in the second, and 25 in the third wave. the WVS and ABS also ask some similar questions. Thus, we use two surveys

[9] The 1982 and 1990 Censuses do not offer birth-county; thus, it is impossible to determine native languages precisely. Instead, we matched native languages with the county where the survey was administered. Neither Census 1982 nor 1990 included migration variables. The online appendix reports some results from Census 1982 and 1990 data.

to cross-validate our findings for robustness. The online Appendix A discusses survey question selection in detail.

Discussion of Variation

This paper mainly exploits the linguistic distance variation from the local language to Putonghua, interacted with the cohort exposure dummy to the different language instruction regimes as the identification strategy. The working assumption is that people with higher (lower) communication difficulty experience larger (smaller) shock in the Pinyin education regime. Linguistic distance variation has two merits: the native language is exogenous, and linguistic distance affects Putonghua ability acquisition differently before and after the Pinyin reform. For the Cantonese speaking group, the Pinyin Act tends to be a huge shock since Putonghua is a new language for students to learn, while Northeastern Mandarin speakers can learn Putonghua reasonably easily since their language is more similar to Beijing Mandarin.

We exclude Beijing Mandarin native speakers in the baseline estimation.[10] Our model identifies how new language affects different language groups disproportionately exploring the variation in linguistic distance from local language to Putonghua. Southwestern Mandarin is the most similar language with only 27.1% difference, and the Wu language is the least similar language with 56.5% difference. Thus, the estimated average treatment effect (ATE) of the Pinyin Act survives on the support of [27.1%, 56.5%] linguistic distance.

Empirical Specifications

Using CPS data, we estimate a difference-in-difference specification:

$$y_{i,j,t} = \beta_1 Post_{i,j,t} + \beta_2 Post_{i,j,t} * Distance_j + \zeta_{prov,t} + \alpha_j + \varepsilon_{i,j,t} \quad (1)$$

[10] Alternatively, we include Beijing Mandarin native speakers who are not affected by the Pinyin Act. Our results still hold, but the coefficients modestly decrease after covering Beijing Mandarin native speakers.

$y_{i,j,t}$ is the outcome variable of interest for individual i born in county j in birth cohort *t*. $Post_{i,j,t}$ is the Pinyin regime exposure dummy for individual i. $Post_{i,j,t} = 1$ if the individual learned Putonghua with Pinyin, otherwise $Post_{i,j,t} = 0$. We assume that children enrolled in primary school at the age of seven.[11] For example, Henan Province implemented the Pinyin Act in 1958; therefore $Post_{i,j,t} = 0$ for people born before 1951 and in 1951, and $Post_{i,j,t} = 1$ for people born in 1952 onward.[12] $Distance_j$ is the linguistic distance from the local language to Putonghua (Beijing Mandarin) for people who were born in country j.[13] $Distance_j = 0$ means a perfect understanding of Putonghua.[14] $Post_{i,j,t} * Distance_j$ is the interaction term between the exposure dummy and linguistic distance. We omit $Distance_j$ in regression (1) because the county fixed effects absorbs it. α_j is the county fixed effect; $\zeta_{prov,t}$ is the province-cohort fixed effect. The province-cohort dummies are critical to addressing the concern that linguistic distance may be correlated with other province-level birth cohort-specific shocks.[15]

β_2 is the key coefficient of our research interest. When β_2 is larger, the linguistically distant population tends to experience a larger increase in y after the Pinyin Act. β_1 captures the average pre-post reform change in y. Two main concerns for the identification are that β_2 picks up the trend in the data, or some outliers drive the coefficients. To address these two concerns, we generalize the reduced-form model to the specification (2) allowing for birth-cohort-specific $\beta_{1,t}$

[11] The Chinese Compulsory Schooling Law, effective in 1986, set age six as the compulsory primary school enrollment age.

[12] To classify the pre- and post-reform groups, we use the 0-1 dummy rather than years of Putonghua education exposure for the following two reasons: First, the Pinyin curriculum mainly targeted Grade one and Grade two students (not the entire student population) so they could use Pinyin as a new tool to learn Chinese. Second, education did not shift from local dialects to Putonghua overnight. Most non-Pinyin teachers still taught in the local language, thus students above Grade 3 may have had insufficient access to Pinyin.

[13] Census 2000 provides birth province, rather than birth-county, for migrants who moved before 1995. For these migrants, we use the provincial population-weighted average linguistic distance as the proxy for the linguistic distance.

[14] In this context, the Beijing Mandarin-speaking group is defined as the group with zero linguistic distance and is excluded in the sample.

[15] Each province has the power to decide its policies and development plans under the Chinese government. Province-cohort fixed effects attempt to control other provincial time-varying treatments that correlate with the linguistic distance. Specifically, $\zeta_{prov,t}$ can absorb the "catch-up" effect. If linguistic distance correlates with the pre-reform economic development level, the under-developed areas may grow faster and benefit junior birth cohorts more than senior birth cohorts. $\zeta_{prov,t}$ allows each low-income province to have a cohort-specific fixed effect.

and $\beta_{2,t}$ and estimate the coefficients with 15 pre-reform and 20 post-reform birth cohorts.

$$y_{i,j,t} = \sum_t \beta_{1,t} Post_{i,j,t} + \sum_t \beta_{2,t} Post_{i,j,t} * Distance_j + \zeta_{prov,t} + \alpha_j + \varepsilon_{i,j,t} \quad (2)$$

We plot $\beta_{2,t}$s as a function of the birth year and examine how the function behaves in the pre-reform and post-reform birth cohorts. If there is a pre-trend, we should find the coefficients $\beta_{2,t}$s are trending in the 15 pre-reform cohorts. If outliers drive the difference-in-difference estimation, some $\beta_{2,t}$s should deviate enormously from the mean, being either too high or too low in the 20 post-reform cohorts. The $\beta_{2,t}$s also reveals the dynamic effect of language unification over time. Bear in mind that our Census 2000 data is only a 0.1% sample. When we split the sample into birth cohorts, the point estimates of $\beta_{2,t}$ can be noisy with a wide confidence interval.

An additional plausible concern is that another county-specific variable X_j is correlated with linguistic distance and has a similar time-varying effect. We can interact X_j with the exposure dummy and plug it into the specification as (3).

$$y_{i,j,t} = \beta_1 Post_{i,j,t} + \beta_2 Post_{i,j,t} * Distance_j + \beta_3 Post_{i,j,t} * X_j + \zeta_{prov,t} + \alpha_j + \varepsilon_{i,j,t} \quad (3)$$

The WVS and ABS only contain two-digit province codes, not six-digit county codes. To compensate for the geographic imprecision, we modify the specification in the following steps: First, we substitute county fixed effect with province fixed effects and substitute province-cohort fixed effects $\zeta_{prov,t}$ with birth cohort fixed effects ζ_t.[16] Second, we use the population-weighted average linguistic distance of the province as the main variation $Distance_{prov}$. Then, we analyze the WVS and ABS data with the specification (4):

$$y_{i,j,t} = \beta_1 Post_{i,prov,t} + \beta_2 Post_{i,prov,t} * Distance_{prov} + \alpha_{prov} + \zeta_t + \varepsilon_{i,prov,t} \quad (4)$$

The small sample size does not allow us to study the dynamic effect of language unification on ideology. To explore the heterogeneous effect of language unification,

[16] It is not feasible to control province-cohort fixed effects since they will absorb all variation in linguistic distance.

we split the sample into groups of those with formal education at primary school level or above, and those without formal education. We hypothesize that the group with formal education may be more affected than the group without formal education.

4. Language and Education

This section first confirms that the Chinese Pinyin Act improves Putonghua proficiency for non-native speakers; it then investigates the impact of learning Putonghua on educational attainment. We find that the Pinyin Act effectively achieves the goal of language unification by significantly improving Putonghua proficiency. No significant evidence indicates that education in a new language deters children from entering into formal education.[17] If the effect exists, the new language modestly reduces educational attainment in the first post-reform five cohorts but increases educational attainment in more junior birth cohorts.

Language Proficiency

The most important assumption throughout this paper is that the language groups with greater linguistic distances experience larger treatment by language unification program. Before proceeding to the main analysis, it is critical to validate that language unification improves Putonghua proficiency more significantly in the linguistically distant population.

We examine three surveys with questions on language proficiency measured in three different evaluation methods. For this research, the most preferred method is language proficiency evaluation by survey interviewers (e.g., as in the China Labor Dynamic Survey); the second most preferred method is self-reported Putonghua ability (e.g., as in the China General Social Survey) because self-reporting may

[17] In the rural areas of developing countries, it is possible that any increase in the cost of education may reduce students' willingness to receive formal education. In particular, China did not enact the Compulsory Schooling Law until 1985. Education in a new language may impose an extra burden on students.

include subjective bias or measurement errors; and the least preferred method is intra-household communication language (e.g., as in the World Value Survey) since it measures Putonghua proficiency indirectly. Table 3 reports statistically significant and sizeable Putonghua proficiency improvement after language unification by all three Putonghua proficiency metrics.

In all three surveys with language questions, only CLDS provides 6-digit county identifiers; the other two surveys only offer 2-digit province identifiers. Thus, columns 1-4 control for county fixed effects and columns 5-7 control for province fixed effects. In Table 3, β_1 is negative, and β_2 is positive in all surveys. CLDS and CGSS are relatively more comparable because they both have the same scale in language proficiency (from 1 to 5)[18] and fluency. The estimates for β_2 are quite comparable in these two surveys as well: for language proficiency, β_2 is 0.757 for the CLDS sample and 0.656 for the CGSS sample. Using the fluency dummy as the dependent variable, β_2 is 0.245 for the CLDS sample and 0.252 for the CGSS sample. After excluding Beijing Mandarin speakers, β_2 rises to 0.906 for language proficiency, and 0.274 for the fluency dummy in the CLDS. Column 7 shows that Putonghua is also more commonly used for intra-household communication. Thus, we validate our fundamental assumption that the Pinyin Act improves Putonghua proficiency much more for people whose local languages are distant from Putonghua.

Educational Attainment

One first-order concern in language policies is that new languages may impose a higher barrier to education, thus reducing human capital accumulation.[19] This section shows that the effect of a new language on educational attainment is quite small in magnitude and weak in statistical power. We pool 15 pre-reform birth cohorts as the

[18] 1, Neither speak or understand; 2, Understand but cannot speak; 3, Cannot speak fluently; 4, Fluent but with an accent; 5, Very fluent. The fluency dummy is 1 if language proficiency is either level 4 or 5. Otherwise, the fluency dummy is 0.

[19] Important literature in education (Sridhar 1996, Yip et al. 2003, Seid 2016) shows that learning knowledge in a non-native language leads to lower test scores and less comprehension of the course material, which implies that teaching in a new language may have adverse impacts on education.

control group and experiment pooling 5, 10, 15, and 20 post-reform birth cohorts as the treated group to understand the dynamic effect. If the impact does exist, the new language modestly reduces educational attainment in the first five birth cohorts after policy implementation but bounces back to a positive effect when we extend the post-reform horizon to 20 birth cohorts.

We consider three educational outcomes: years of education, primary school enrollment, and conditional secondary school enrollment. Table 4 Panel A reports the estimation of the specification (1) with Census 2000 data; Panels B and C report the results for male and female subsamples. Appendix Table 1 reports estimation with Census 1982 and 1990 data. For years of education, the coefficient β_2 is modestly negative in the first five post-reform birth cohorts and gradually shifts toward the positive range when we include additional post-reform cohorts. The result holds for both male and female subsamples. For primary school enrollment, the coefficients are close to zero; thus no evidence shows that Putonghua hinders children from entering primary schools. On the contrary, we do find the first five post-reform birth cohorts are less likely to continue their schooling in secondary schools. The coefficients β_2 for secondary school enrollment are all negative for: -0.022 (t=-0.7) in Census 2000, -0.029 (t=-0.9) in Census 1982 and -0.042 (t=-1.8) in Census 1990. In Appendix Table 2, no evidence shows that language unification induces higher dropout rates, even in the first five post-reform cohorts.

Figure 2 shows the dynamic effect in Census 2000 by plotting the cohort-specific $\beta_{2,t}$ estimated from the specification (2). The $\beta_{2,t}$ conforms to a flat trend in the pre-reform cohorts and tilts up on a positive slope in the post-reform cohorts. No pre-trend appears in the coefficient plot. Appendix Figure 1 shows the same dynamic with the data from Census 1982 and 1990.

Keep in mind that the economic importance is limited. To illustrate this point, we calculate the bounds for language impact on education for any post-reform birth cohort. The maximal linguistic distance within the sample is 0.294 between speakers

of Southwestern Mandarin and the Wu Language Group. The cohort-specific $\beta_{2,t}$ lies in interval $[-0.2, 0.4]$ for years of education, $[-0.01, 0.05]$ for primary school enrollment and $[-0.1, 0.05]$ for secondary school enrollment. Multiplying by 0.294, the real effect for any birth cohort should be from -0.06 to 0.12 years of education, from -0.3% to 1.5% primary school enrollment and from -3% to 1.5% secondary school enrollment. Given these interval bounds, we conclude that Putonghua learning has limited importance in education in terms of magnitude.

5. Language and the Labor Market

Non-agricultural Sector Employment

In this section, we test whether learning Putonghua with Pinyin can help rural residents gain more non-agricultural employment. "Rural residents" are defined as people who hold a rural Hukou registration.[20] In the sample, 76.6 percent of the population holds the rural-type Hukou registration even though 21.3 percent of rural workers served in non-agricultural jobs by the year 2000. Table 5 Columns 1, 3, and 5 report the baseline specification (1) with full, male, and female samples respectively. Post-reform rural residents can expect, on average, 0.62% higher non-agricultural participation if the linguistic distance to Putonghua increases by 10%. We also find that men benefit more from learning Putonghua than women, with larger magnitude and statistical significance. In the 20 post-reform cohorts, the language effect in the male subsample is almost twice as large as the effect in the female subsample. Columns 2, 4, and 6 in Table 5 report the results of the specification (3) with geographical distance[21] interaction control. The coefficients are very similar to the corresponding ones in Columns 1, 3, and 5. Geographical distance cannot explain the identified language effects.

[20] The Hukou system was first introduced in China in 1955, following the Soviet Union system. People are assigned either rural or urban Hukou based on their birthplace. The Hukou system is very rigid, and people have almost no opportunity to change their Hukou registration type even if they work in an urban area.
[21] We calculate the geographical distance as the "centroid to centroid" distance from county j to Beijing.

Figure 3 Panels A, B, and C show the dynamic effects with Census 1982, 1990, and 2000 data respectively. Across the board, coefficients $\beta_{2,t}$ are slightly downward sloping for the pre-reform cohorts, confirming that little pre-trend exists. Coefficients are higher in the post-reform cohorts and the magnitude of the language effect increases when the birth cohort gets younger.

Appendix Figure 2 Panel A shows the estimation using the male subsample, and Panel B shows the estimation using the female subsample of Census 2000. Comparing Panels A and B, the male sample has higher average non-agricultural employment in the post-reform cohorts. We also estimate the slope for the post-reform $\beta_{2,t}$: 0.0041 (t=4.05) in the full sample, 0.0046 (t=2.97) in the male subsample and 0.0037 (t=2.93) in the female subsample. We conclude that the amplification speed of the language effect is also faster for men than women.

Sectorial Decomposition

This section deconstructs non-agricultural employment into five broad occupation categories: government officials, technology specialists, administrative staff, service workers, and factory workers. We estimate the baseline specification (1) with the linear OLS and the Logit model[22] and report results in Table 6 Panels A and B. Appendix Table 3 repeats the analysis with Census 1982 and Census 1990 data.

Table 6 Panel A shows the OLS results. Regarding magnitude, the "factory workers" category gains the largest coefficient, 0.075 at 1% significance, apparently serving as the most crucial category. Language mainly helps rural workers to fill positions in factories or other industrial production workplaces. For the remaining categories, β_2 is lower but with considerable statistical significance: β_2 for technology specialists is 0.015 at 10% significance; β_2 for government officials is

[22] In the Logit specification, we drop the county dummies for two reasons: 1. Observations will be dropped if no variation within the county exists; 2. Too many dummies lead to unstable coefficients. We still keep province fixed effects and birth cohort fixed effects. Standard errors are clustered at the county level.

0.019 at 1% significance; β_2 for administrative staff is 0.014 at 5% significance; β_2 for technology specialists is 0.015 at 10% significance; and β_2 for service workers is 0.024 at 10% significance. As we find in the number of observations in Panel A, factory workers account for the majority of non-agricultural jobs for rural residents.

In Table 6 Panel B，all β_2 are positive and significant at the 1% level, which confirms that cohorts under the Pinyin regime do have advantages in competing for all types of non-agricultural jobs. Comparing with Appendix Table 4 Panels B and D, we find that β_2 for technology specialists monotonically increases from 1.9 in Census 1982, to 4.2 in Census 1990, to 7.4 in Census 2000. As technology improves over time, the importance of Putonghua expands significantly in technology specialist jobs. This indicates that a common language matters for technologically advanced economies since sophisticated production may require more communication.

Migration

Breaking the language barrier alleviates labor market friction so workers can migrate and find better jobs. In developing countries, the effect can be particularly significant due to substantial urban-rural income gaps and the rapid urbanization. In the Chinese context, language unification can potentially contribute to a massive flood of rural labor toward urban areas (i.e., proficiency in Putonghua is necessary to work in Beijing).[23]

Table 7 Column 1 presents the evidence that language unification encourages more long-distance migration across provinces and language areas, and reduces the probability of intra-province migration in the full sample.[24] If we limit our sample to rural residents in Column 4, the coefficients for long-distance migration decrease and there is no evidence that intra-province migration decreases after language unification.

[23] In the China Labor Dynamics Survey (2012), over 95% workers living in Beijing could speak Putonghua at a "native or bilingual" or a "fluent with an accent" level.
[24] Appendix Table 5 shows the full dynamics of migration.

Splitting the data into male and female subsamples, Columns (2), (3), (5) and (6) show the same pattern as Columns (1) and (4). One notable finding is that the migration effect for female workers is roughly twice as large as the effect for men. One possible explanation is that female migrant workers tend to participate in the service industry (e.g., as cashiers in shops and servers in restaurants), which requires that they communicate with customers, while male migrant workers tend to work in more labor-intensive industries (e.g., as construction workers and truck drivers) where language is less important. If this is the case, Putonghua proficiency empowers women who want to migrate to improve their lives.

Discussion on Dynamics

The dynamic treatment effect tends to slowly diffuse and be more significant in the junior birth cohorts. Two main reasons may contribute to this pattern. First, it requires time to improve the quality of teaching in a new language. For example, although *Chinese Pinyin* entered school curricula, teachers needed time to adapt to teaching in Putonghua. Second, junior birth cohorts' job searches occurred in an environment with higher Putonghua usage rates than for senior cohorts. The Putonghua speaking rate has continued to increase since the language unification; thus the importance of Putonghua has grown over time.[25] For example, Shanghai, the most linguistically distant of the Wu language area, already registered a 70.47% Putonghua usage rate in 2000. The younger generation had sufficient skills in Putonghua to look for jobs in 2000, which was not true in the 1980s when the Wu language was still dominant in Shanghai. These two reasons jointly explain why the treatment effects of language unification drift upward over time.

[25] The PRC was founded in 1949 when over 80% of the population in China was illiterate. As a result, most people of that time never learned Putonghua at all. According to the Putonghua Usage Survey conducted in 2000, 53.06% of the Chinese population could communicate in Putonghua.

6. Language, Ideology, and Social Preferences

This section presents how language unification influences people's information environment and further changes ideology and social preferences. We show that language increases news consumption, mostly through radio and telephone. Then, we examine changes in ideology from the following four dimensions: Patriotism and Identity, Views about Democracy, Evaluation of Government, and Liberalism versus Government Intervention.

Before diving into the empirical results, we present the ideology that the Chinese government espouses. The government emphasizes that China adopts socialist democracy (Cantoni et al. 2017), promotes socialism (Alesina and Giuliano 2013), denies the importance of western political democracy, and encourages pro-government/party voices in the media (Alesina and Zhuravskaya 2011). In turn, the Chinese media delivers these ideological doctrines to the public.[26] Our findings suggestively imply that language unification amplifies the government's ability to indoctrinate the population with certain social preferences and thus achieve ideological unification.

We further split the survey respondents into two groups: 1. Primary school or above sub-sample, educated in formal schools with systematic Putonghua learning using Pinyin. 2. Short-term literacy class or illiterate, with limited Putonghua learning experience. This demarcation sheds light on ideological segregation by the availability of education.

Political News Consumption

Most radio and television programs, if not all, are recorded in Putonghua. Therefore, Putonghua literacy is essential for people to understand news and absorb information

[26] In China, the main media are highly regulated, monitored, and owned by the Communist Party of China (Djankov, McLiesh, Nenova and Shleifer 2003)

from the media; at the same time, it exposes them to the Chinese political doctrine. Rich evidence shows that the media can greatly influence ideology formation and social preferences (Mullainathan and Shleifer 2005, Glaeser, Ponzetto and Shleifer 2007, Gentzkow and Shapiro 2011, Gentzkow, Shapiro and Sinkinson, 2014). Language unification removes a huge barrier for ideological unification since a common language enables political doctrines to reach everyone regardless of their local languages.

To analyze language effects in regard to news consumption, we attempt to address two questions. First, does Putonghua cause more political news consumption? Second, if so, which informational channels are more affected by language unification?

In Table 8 Panel A, both the Asian Barometer Survey (ABS) and the World Value Survey (WVS) show that language unification significantly increases political news consumption. In the ABS, the frequency that people access political news is classified into five categories: 1. Practically never; 2. Not even once a week; 3. Once or twice a week; 4. Several times a week; and, 5. Every day. The WVS uses the same scale to measure political news consumption. To avoid the potential bias of using a categorical variable as the dependent variable, we also create a dummy variable for political news consumption frequency, defining people who fall into categories 4 and 5 as frequent news readers, while those in categories 1, 2, and 3 are not. By all measures, people under the Pinyin regime tend to follow political news more frequently.

To understand the mechanism, we examine five main informational channels: 1. Radio: a purely audio channel; 2. Cell Phone: a audio and text channel; 3. Internet: almost exclusively a text channel; 4. Television: a audio and text channel; 5. Newspaper: a purely text channel. The Pinyin Act unifies language by pronunciation and has little to do with written Chinese. Conceptually, audio-based information channels should to be affected while text-based channels should be less affected or

not affected at all. Table 8 panel B shows that language unification increases the usage of radio and cell phone significantly, encourages internet usage modestly, but presents no significant impact on television and newspaper usage. The empirical findings indicate that language unification helps people receive audio information (radio) and communicate audio information better (cell phone). This finding is consistent with our hypothesis that Putonghua increases information access, particularly through audio-based media.

Patriotism and Identity

Nation integration and identity formation are important to both social scientists and policy makers.[27] A common language is usually believed to be an important building block for nation-building (Alesina et al. 2018). This section provides evidence for that view by showing more patriotism and stronger national identity after the Pinyin Act.

Table 9 Columns (1) and (4) in Q1 imply that learning Putonghua with Pinyin breeds patriotism by showing respondents are more likely to agree that "they are proud to be Chinese." Q2-Q4 show that respondents agree that they "belong to the country" more; that they "belong to the local community" less; and are more likely to choose their first identity as belonging to a "Province" or the "Nation as a whole," rather than a "locality or town." Q5 shows people agree that China benefits Asia more than it harms Asia. All these findings indicate that language unification improves the country's unity and builds a stronger national identity.

To understand the heterogeneity in ideological shifts, we deconstruct the effect on the population with and without formal education. Coefficients in Columns (2) and (5) have the same sign and comparable magnitude with coefficients in Columns (1) and (4), while coefficients in Columns (3) and (6) tend to have the opposite sign without statistical power. We conclude that people with formal education are the driving force

[27] Segregation positively correlates with less social mobility and larger income inequality (Chetty et al. 2014), more social disorder, civil conflicts (Corvalan and Vargas, 2015) and riots (Field et al., 2008).

behind stronger patriotism and national identity. Formal language education plays an important role in nation-building, which supports the view in Alesina et al. (2018) and the historical narrative by Weber (1976) on French state formation.

We also investigate social trust in Appendix Table 6 (Enke 2017). We find that language unification reduces trust in people from other nations, but has no impact on trust in Chinese people including family, neighbors, people known personally, those met for the first time, and people of another religion. Thus, language unification even establishes nationalism and some anti-foreign sentiment.

Democracy

This section presents the evidence that Putonghua helps the Chinese government successfully persuade people of the Chinese "mainstream" democracy views. Table 10 presents three main findings. Panel A shows that people give the current Chinese government a significantly higher democracy score. Panel B shows that demand for democracy is not affected. In Panel C, people are more skeptical of the effectiveness of democracy. Survey respondents are more likely to agree on the following three beliefs: First, building a democratic institution is of lower priority than economic development. Second, democracy cannot solve China's social problems. Third, democracy may not be the best political institution available in the world. This ideology, emphasizing economic development rather than the importance of political democracy, is the central justification for the legitimacy of the Communist Party of China's governance.

Evaluation of Government

Table 11 Panel A adds three additional empirical facts to support that language unification improves the evaluation of government performance. First, people express more confidence in the leadership of the Communist Party of China. Second, people

are more likely to believe that China is the most influential country in Asia. Third, people are less willing to participate in petitions. The Chinese government dislikes petitions since they can impair social stability and potentially evolve into social conflicts. Maintaining social stability has been regarded as an important political target since 1987.[28] Putonghua successfully helps the government achieve this policy goal and reduce the risk of anti-government sentiments.

Liberalism versus Government Intervention

The choice between liberalism (free market) and government intervention remains at the center of economic debates. Table 11 Panel B documents that language unification induces people to develop stronger trust in government and be more skeptical of the free market. People are more likely to support the following two statements. First, the government should maintain ownership of state-owned enterprises or even enlarge public ownership in society. Q1 and Q2 are the same questions in the VWS and ABS. The results point in the same direction, and the coefficients are fairly comparable: 1.27 (t=2.24) in the VWS question and 1.23 (t=2) in the ABS question. Second, the government, rather than individuals, should be responsible for social welfare. Respondents without formal education present larger increases in support for government intervention, while people with primary school education or above only show a modest increase.

The social preference shifts toward government intervention are consistent with the doctrine of socialism. The Communist Party of China describes its economic institution as a "socialist market economy," which emphasizes that the free market must function under government regulation and that state-owned enterprises should play a leading role in the economy to guarantee social welfare. To make the economic

[28] Xiaopeng Deng, the paramount leader from 1987-1990 and responsible for Economic Open-up for China, first articulated "Nothing can be achieved without social stability" in June 1987. In 1989, Deng met with US president George Bush and said: "Social stability is the top priority in all Chinese issues." In 1990, Deng listed "Stability," "Reform," and "Development" as three long-term goals for the Communist Party of China.

institution sustainable, the government has been broadcasting the merits of public ownership and concerns about private ownership (e.g., capitalists would charge high prices and extract unethical profits). Our evidence indicates that Putonghua enables the government to persuade people and successfully shifts nationwide social preference toward socialism.

7. Conclusion

This paper extensively analyzes the outcomes of the Pinyin Act in 1958-1960 and identifies the effects of language unification by exploiting the variation in the linguistic distances from local languages to Putonghua. We find that Putonghua modestly reduced educational attainment in the short run but improved educational attainment in the long run. In the labor market, post-reform non-Beijing Mandarin native rural workers gained a 0.62% higher rate of non-agricultural employment if the linguistic distance to Putonghua increased by 10%. Language unification also induces more migration across provinces and language groups.

This paper further documents the effects of language on ideology and social preferences. The common language increases exposure to political news consumption through media including the Internet, radio, and cell phone. We suggest that language unification helps the government successfully indoctrinate people with the specific ideology and social preferences. Putonghua fosters patriotism, shifts people's identity from locality to nationality, and incurs distrust in people of another nationality. People exposed to the Pinyin regime also express more pro-government views, skepticism of democracy, and more confidence in the public ownership.

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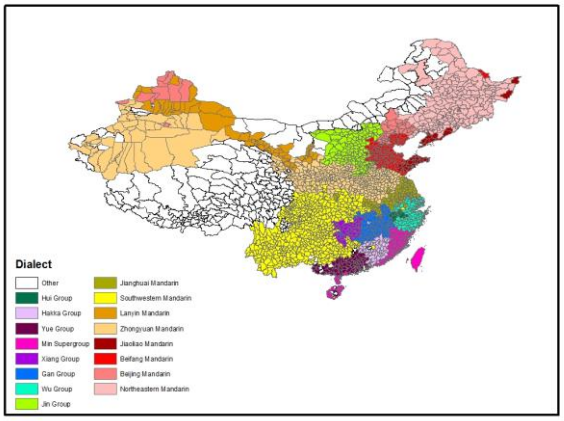
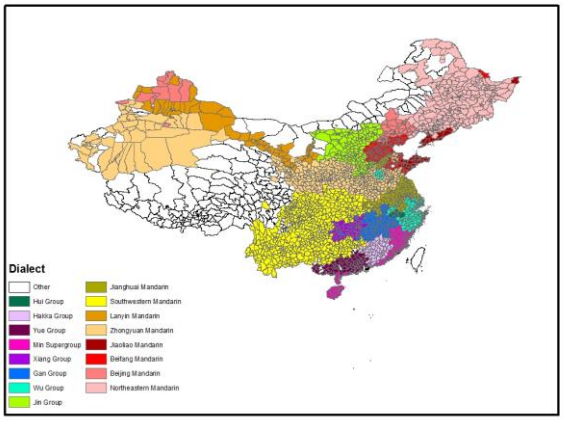
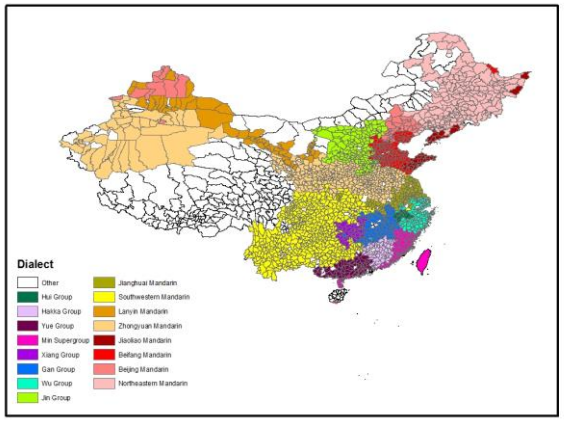
Panel A: Language Atlas 1990



Panel B: Census 2000 Boundary



Panel C: Census 1990 Boundary



Panel D: Census 1982 Boundary

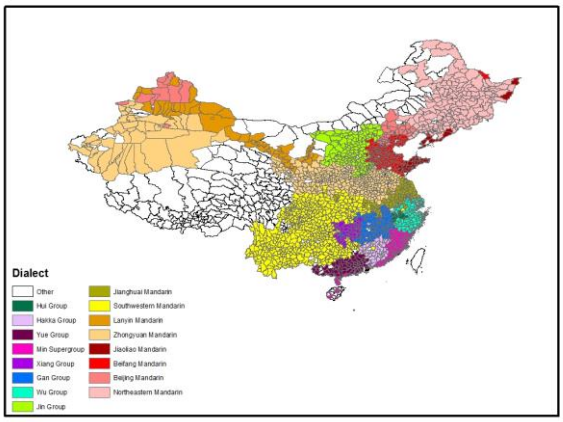


Fig 1: Panel A is the original Chinese Language (Dialect) Atlas published by the China Academy of Social Science in 1990. Panels B, C, and D present language distribution with county boundaries in the Census of Population Surveys of 1982, 1990, and 2000 based on the linking files manually created by the China Gazetteer Project.

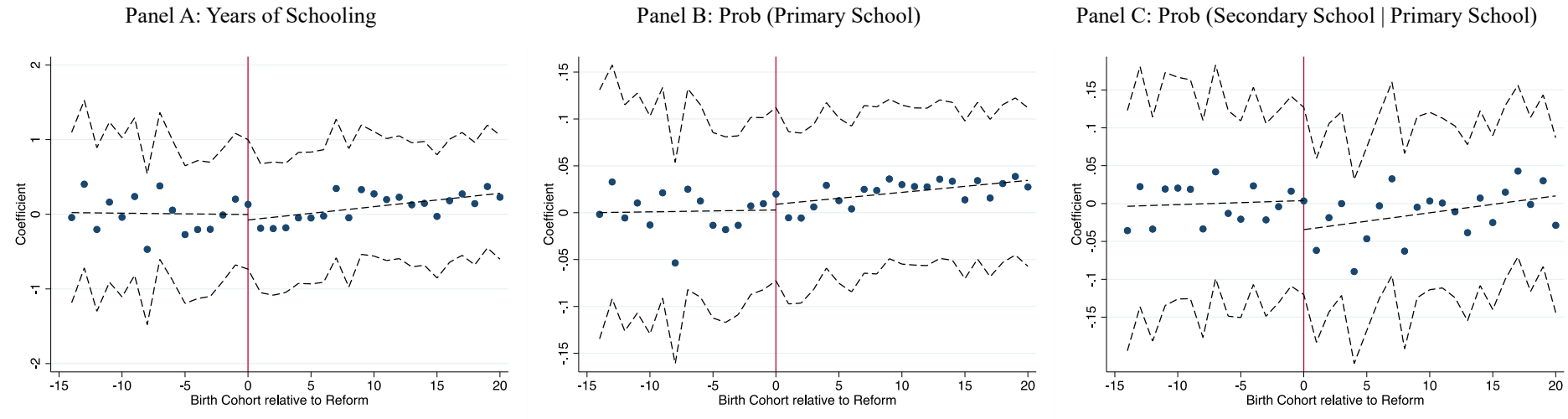


Fig 2: This figure plots the birth cohort-specific coefficients $\beta_{2,t}$ with educational outcomes. The sample includes 15 pre-reform birth cohorts and 20 post-reform birth cohorts. Birth cohort -15 is set as the base. $y_{i,j,t}$ in Panel A is years of schooling, $y_{i,j,t}$ in Panel B is the probability of entering primary school, and $y_{i,j,t}$ in Panel C is the conditional probability for entering secondary school. The dashed straight lines are fitted lines in pre- and post-reform birth cohorts. 90% confidence intervals are plotted. Standard errors used for confidence intervals are clustered at the county level.

$$y_{i,j,t} = \sum_t \beta_{1,t} Post_{i,j,t} + \sum_t \beta_{2,t} Post_{i,j,t} * Distance_j + \alpha_j + \zeta_{prov,t} + \varepsilon_{i,j,t}$$

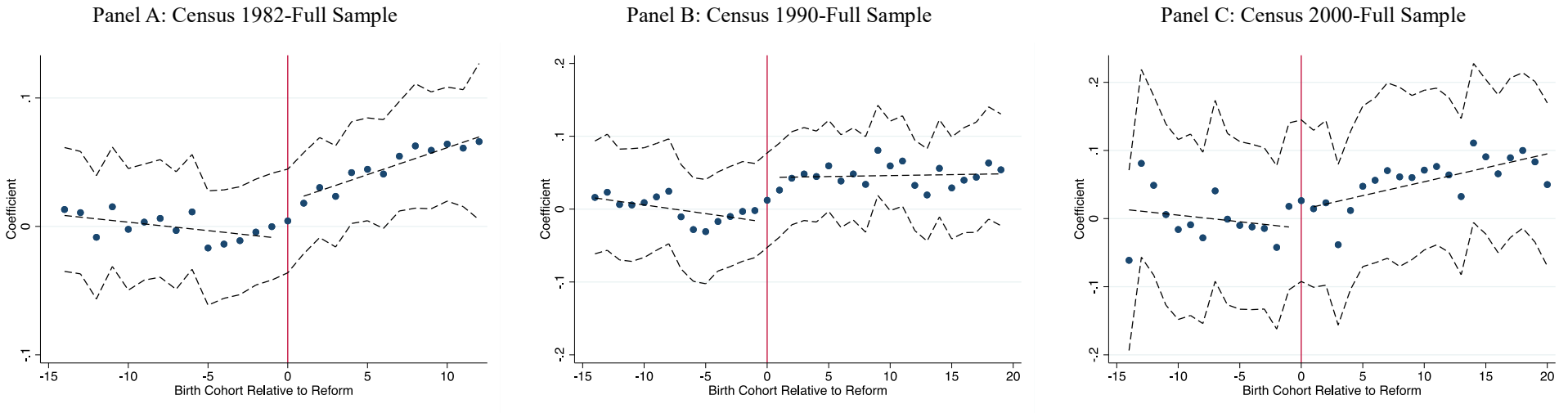


Fig 3: This figure plots the birth cohort-specific coefficients $\beta_{2,t}$ with non-agricultural employment as the dependent variable ($y_{i,j,t}$) for 15 pre-reform and 20 post-reform (12 for Census 1982) birth cohorts. Birth cohort -15 is set as the base. Panel A, Panel B, and Panel C report full sample estimates for Census 1982, 1990, and 2000. The dashed straight lines are fitted lines in pre- and post-reform birth cohorts. 90% confidence intervals are plotted. Standard errors used for confidence intervals are clustered at the county level.

$$y_{i,j,t} = \sum_t \beta_{1,t} Post_{i,j,t} + \sum_t \beta_{2,t} Post_{i,j,t} * Distance_j + \zeta_{prov,t} + \alpha_j + \varepsilon_{i,j,t}$$

Table 1: Summary Statistics by Language Group

Language Group Name	Language Distance to Putonghua	# Native Counties	% Native Speakers	Years of Education			Primary School Enrollment			Secondary School Enrollment		
				Full	Male	Female	Full	Male	Female	Full	Male	Female
Beijing Mandarin	0	51	2.4%	9.273	9.644	8.881	95.5%	98.0%	92.9%	75.4%	79.2%	71.1%
Southwestern Mandarin	0.271	441	23.0%	7.298	7.940	6.611	89.7%	94.8%	84.3%	51.1%	56.0%	45.3%
Beifang (Jilu) Mandarin	0.287	173	8.9%	8.307	8.868	7.719	95.0%	97.9%	92.0%	65.8%	72.7%	58.1%
Zhongyuan Mandarin	0.344	322	17.5%	7.412	8.240	6.531	88.0%	93.7%	81.9%	62.0%	70.4%	51.8%
Jin Group	0.392	194	6.1%	8.317	8.857	7.734	93.4%	96.3%	90.3%	68.1%	74.2%	61.2%
Gan Group	0.413	114	5.0%	7.700	8.527	6.841	92.2%	97.2%	87.0%	54.8%	63.2%	45.0%
Hakka Group	0.447	58	2.2%	7.876	8.890	6.867	93.2%	98.6%	87.8%	58.6%	69.8%	46.0%
Xiang Group	0.4555	71	4.3%	8.195	8.647	7.715	95.9%	98.1%	93.6%	60.9%	66.0%	55.3%
Jianghuai Mandarin	0.475	161	11.2%	7.513	8.435	6.549	88.9%	95.1%	82.5%	59.7%	68.1%	49.5%
Min Group	0.488	103	5.2%	7.583	8.439	6.687	92.6%	97.5%	87.4%	52.4%	62.7%	40.4%
Yue Group	0.536	68	3.9%	8.701	9.312	8.057	96.7%	99.1%	94.1%	66.5%	73.7%	58.5%
Wu Group	0.5645	153	10.3%	7.978	8.636	7.290	91.7%	96.4%	86.7%	62.0%	66.9%	56.3%
Average	0.389	159	8.3%	8.013	8.703	7.290	92.7%	96.9%	88.4%	61.4%	68.6%	53.2%

[Table 1 Continued]

Language Group Name	Non-agricultural Employment of Rural Residents			Migration			Migration of Rural Residents		
	Full	Male	Female	Full	Male	Female	Full	Male	Female
Beijing Mandarin	28.0%	35.0%	18.9%	15.2%	13.4%	17.2%	6.6%	4.6%	8.7%
Southwestern Mandarin	13.4%	16.9%	9.5%	13.6%	12.0%	15.3%	10.2%	8.2%	12.3%
Beifang (Jilu) Mandarin	18.2%	24.9%	10.3%	10.7%	8.3%	13.2%	5.6%	2.5%	8.8%
Zhongyuan Mandarin	9.1%	12.8%	5.1%	8.1%	6.4%	9.9%	5.1%	3.1%	7.2%
Jin Group	18.4%	25.4%	8.9%	15.3%	13.2%	17.6%	9.6%	7.0%	12.4%
Gan Group	19.0%	24.1%	12.9%	13.8%	12.9%	14.8%	9.9%	8.8%	11.1%
Hakka Group	19.8%	27.4%	12.0%	12.1%	11.5%	12.7%	8.7%	8.0%	9.4%
Xiang Group	16.9%	20.2%	12.9%	15.0%	12.9%	17.2%	10.8%	8.3%	13.3%
Jianghuai Mandarin	19.9%	26.8%	12.3%	11.4%	10.0%	12.8%	8.6%	6.9%	10.3%
Min Group	32.0%	34.5%	28.5%	9.9%	8.6%	11.2%	7.0%	5.4%	8.6%
Yue Group	36.3%	42.5%	28.8%	25.6%	25.4%	25.9%	20.2%	20.0%	20.3%
Wu Group	47.3%	49.6%	44.4%	13.7%	12.3%	15.3%	9.0%	7.2%	10.9%
Average	**23.2%**	**28.3%**	**17.0%**	**13.7%**	**12.2%**	**15.3%**	**9%**	**8%**	**11%**

Notes: Summary statistics by language group. The data is a 0.1% micro representative sample of the Census of Population Survey 2000. The table includes linguistic distance from local language to Putonghua, number of native speaking counties, percentage of native speakers, years of education, non-agricultural employment, and migration. 78 percent (2248 out 2870) counties and 86.6 percent of the population belong to these 12 language groups.

Table 2: Language Pedagogy Reform by Province

Province	Start Year	Start Month	Province	Start Year	Start Month
Hebei	1958	6	Inner Mongolia	1960	NA
Shanxi	1958	8	Liaoning	1960	5
Heilongjiang	1958	NA	Jilin	1960	2
Jiangsu	1958	NA	Shanghai	1960	8
Shandong	1958	7	Zhejiang	1960	4
Henan	1958	NA	Fujian	1960	1
Ningxia	1958	NA	Jiangxi	1960	10
Tianjin	1959	NA	Hubei	1960	4
Anhui	1959	NA	Hunan	1960	3
Chongqing	1959	11	Guangdong	1960	5
Sichuan	1959	9	Yunnan	1960	12
Beijing	1960	10	Gansu	1960	6

Notes: The Chinese Pinyin Act implementation year-month by province. The Pinyin reform data covers 24 provinces out of 34 province-level administrative regions in China. “NA” refers to the case that the provincial gazetteer does not explicitly specify the start month.

Table 3: Language Proficiency Improvement

	CLDS				CGSS		VWS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Proficiency Level	Proficiency Level	Fluency	Fluency	Proficiency Level	Fluency	Putonghua Or Not
$Post_{i,j,t} * Distance_j$	0.757***	0.906***	0.245**	0.274*	0.656***	0.252***	0.416**
	(0.270)	(0.346)	(0.114)	(0.147)	(0.219)	(0.072)	(0.166)
$Post_{i,j,t}$	-0.371***	-0.438***	-0.126**	-0.139*	-0.104	-0.094***	-0.101
	(0.135)	(0.165)	(0.059)	(0.072)	(0.097)	(0.029)	(0.102)
County Dummy (α_j)	Y	Y	Y	Y			
Province Dummy (α_j)					Y	Y	Y
Obs.	6,281	6,169	6,294	6,182	6,216	6,216	1,277

Level of Significance * p<0.10 ** p<0.05 *** p<0.01

Notes: Putonghua ability measures are from three data sources: the China Labor Dynamics Survey 2012 (CLDS), the China General Social Survey 2012 (CGSS) and the World Value Survey 2007 and 2012 (VWS). The CLDS provides the county code of the birthplace. Thus the native language can be matched precisely. Columns (1) and (3) use the full sample and columns (2) and (4) exclude Putonghua native speakers. The CLDS reports Putonghua proficiency evaluated by the interviewer (Scale from 1 to 5), the CGSS reports self-reported Putonghua proficiency (scale from 1 to 5), and the WVS reports whether intra-household communication uses Putonghua or not. Putonghua fluency is defined as level 4 (with some accent) or level 5 (native or bilingual level). The dependent variable $Putonghua\ Ability_{i,j,t}$ is the CLDS proficiency level (Scale 1-5) in Columns (1) and (2) and the CLDS fluency dummy (0 or 1) for Columns (3) and (4), the CGSS proficiency level (Scale 1-5) in Column (5), the CGSS fluency dummy (0 or 1) in Column (6), the WVS intra-household Putonghua usage (0 or 1) in Column (7). α_j is the county/province fixed effect, $Post_{i,j,t}$ is the exposure dummy for county/province j in birth cohort t. $Distance_j$ is the linguistic distance from the local langauge in county/province j to Putonghua. Data samples include 15 pre-reform birth cohorts and 20 post-reform birth cohorts. Columns (1) - (4): Robust standard errors are clustered at the county level; Columns (5) - (7): Robust standard errors are clustered at the province level.

$$Putonghua\ Ability_{i,j,t} = \beta_1 Post_{i,j,t} + \beta_2 Post_{i,j,t} * Distance_j + \alpha_j + \zeta_t + \varepsilon_{i,j,t}$$

Table 4: Language Effect on Educational Attainment

Panel A: Full Population Sample				
Number of Post-Reform Cohorts	**5**	**10**	**15**	**20**
	$y_{i,j,t}$: Years of Education			
$Post_{i,j,t} * Distance_j$	-0.124	-0.044	0.068	0.116
	(0.211)	(0.192)	(0.185)	(0.168)
Obs.	159,528	194,937	223,691	270,775
	$y_{i,j,t}$: Primary School Enrollment			
$Post_{i,j,t} * Distance_j$	-0.002	0.007	0.015	0.019
	(0.019)	(0.016)	(0.016)	(0.016)
Obs.	159,528	194,937	223,691	270,775
	$y_{i,j,t}$: Prob (Middle School | Primary School)			
$Post_{i,j,t} * Distance_j$	-0.023	-0.034	-0.025	-0.017
	(0.032)	(0.029)	(0.028)	(0.028)
Obs.	132,822	165,657	193,050	238,637

Level of Significance * p<0.10 ** p<0.05 *** p<0.01

Panel B: Male Subsample				
Number of Post-Reform Cohorts	**5**	**10**	**15**	**20**
	$y_{i,j,t}$: Years of Education			
$Post_{i,j,t} * Distance_j$	-0.171	0.017	0.176	0.218
	(0.254)	(0.216)	(0.214)	(0.190)
Obs.	82,995	101,190	115,855	139,788
	$y_{i,j,t}$: Primary School Enrollment			
$Post_{i,j,t} * Distance_j$	-0.006	0.005	0.013	0.016
	(0.016)	(0.014)	(0.014)	(0.014)
Obs.	82,995	101,190	115,855	139,788
	$y_{i,j,t}$: Prob (Middle School | Primary School)			
$Post_{i,j,t} * Distance_j$	-0.027	-0.028	-0.013	-0.004
	(0.040)	(0.035)	(0.033)	(0.032)
Obs.	76,378	94,076	108,483	132,122

Level of Significance * p<0.10 ** p<0.05 *** p<0.01

Panel C: Female Subsample				
Number of Post-Reform Cohorts	**5**	**10**	**15**	**20**
	$y_{i,j,t}$: Years of Education			
$Post_{i,j,t} * Distance_j$	-0.027	-0.105	0.000	0.060
	(0.284)	(0.245)	(0.229)	(0.211)
Obs.	76,533	93,747	107,836	130,987
	$y_{i,j,t}$: Primary School Enrollment			
$Post_{i,j,t} * Distance_j$	0.007	0.008	0.022	0.024
	(0.033)	(0.027)	(0.026)	(0.026)
Obs.	76,533	93,747	107,836	130,987
	$y_{i,j,t}$: Prob (Middle School | Primary School)			
$Post_{i,j,t} * Distance_j$	-0.010	-0.045	-0.038	-0.028
	(0.044)	(0.039)	(0.038)	(0.037)
Obs.	56,444	71,581	84,567	106,515

Level of Significance * p<0.10 ** p<0.05 *** p<0.01

Notes: This table reports the regression results with education outcomes as the dependent variables ($y_{i,j,t}$). α_j is the county fixed effect, $\zeta_{prov,t}$ is the province-cohort fixed effect. $Post_{i,j,t}$ is the exposure dummy for county *j* in birth cohort *t*. $Distance_j$ is the linguistic distance from the local language in county *j* to Putonghua. Panel A, Panel B, and Panel C report estimates with full sample, male subsample, and female subsample of Census 2000. The data sample includes 15 pre-reform birth cohorts. All regressions include birth-county and province-birth cohort fixed effects. Robust standard errors clustered by birth-county are reported in parenthesis.

$$y_{i,j,t} = \beta_1 Post_{i,j,t} + \beta_2 Post_{i,j,t} * Distance_j + \zeta_{prov,t} + \alpha_j + \varepsilon_{i,j,t}$$

Table 5: Non-agricultural Employment

	Full Population Sample			Male Subsample			Female Subsample		
Number of Post-Reform Cohorts	(1)	(2)	Obs.	(3)	(4)	Obs.	(5)	(6)	Obs.
5	0.012	0.012	126,887	0.018	0.018	69,640	0.002	0.002	57,247
	(0.025)	(0.025)		(0.032)	(0.032)		(0.035)	(0.035)	
10	0.032	0.031	163,828	0.053*	0.051*	89,151	0.005	0.006	74,677
	(0.024)	(0.024)		(0.029)	(0.029)		(0.032)	(0.032)	
15	0.052**	0.052**	223,466	0.066**	0.065**	120,447	0.035	0.039	103,019
	(0.024)	(0.025)		(0.028)	(0.029)		(0.032)	(0.032)	
20	0.062**	0.065**	283,650	0.079***	0.078***	152,432	0.042	0.052	131,218
	(0.026)	(0.027)		(0.029)	(0.030)		(0.034)	(0.035)	
Geo Distance to Beijing	N	Y		N	Y		N	Y	

Level of Significance * p<0.10 ** p<0.05 *** p<0.01

Notes: This table reports the regression results with non-agricultural employment as the dependent variables ($y_{i,j,t}$) using the subsample of rural residents. α_j is the county fixed effect, $\zeta_{prov,t}$ is the province-cohort fixed effect. $Post_{j,t}$ is the post-treatment dummy for county j in birth cohort t. $Distance_j$ is the linguistic distance between local dialect in county j and Putonghua. Geo_j is the geographical distance from county *j* to Beijing. The data sample includes 15 pre-reform birth cohorts. All regressions include birth-county and province-birth cohort fixed effects. Robust standard errors clustered by birth-county are reported in parenthesis. Columns (1), (3), and (5) report the estimates with full sample, male subsample, and female subsample. Columns (2), (4), and (6) report the corresponding results after including the geographical distance control.

$$y_{i,j,t} = \beta_1 Post_{i,j,t} + \beta_2 Post_{i,j,t} * Distance_j + \beta_3 Post_{i,j,t} * Geo_j + \zeta_{prov,t} + \alpha_j + \varepsilon_{i,j,t}$$

Table 6: Sectorial Decomposition of Non-Agricultural Employment

	Non-Agricultural	Gov. Officials	Admin. Staff	Tech. Specialists	Service Workers	Factory Workers
			Panel A: OLS Model			
$Post_{i,j,t} * Distance_j$	0.062**	0.019***	0.014**	0.015*	0.024	0.075***
	(0.026)	(0.007)	(0.006)	(0.008)	(0.019)	(0.029)
Obs.	283,650	230,748	230,141	231,516	245,262	260,092
			Panel B: Logit Model			
$Post_{i,j,t} * Distance_j$	5.527***	6.085***	3.863***	7.372***	5.049***	6.107***
	(0.339)	(0.626)	(0.409)	(0.754)	(0.374)	(0.375)
$Post_{i,j,t}$	-2.308***	-2.165***	-1.556***	-3.246***	-2.378***	-2.458***
	(0.169)	(0.336)	(0.255)	(0.435)	(0.196)	(0.190)
Obs.	283,650	230,748	230,141	231,516	245,262	260,092

Level of Significance * p<0.10 ** p<0.05 *** p<0.01

Notes: The non-agricultural occupations are classified into five categories according to one-digit Chinese occupation classification code GB/T6565-1999: Government officials (classification code: 0), technology specialists (classification code: 1/2), administrative staff (classification code: 3), service workers (classification code: 4), and factory workers (classification code: 6/7/8/9). We estimate the specification (1) by each occupation category. The data sample includes 15 pre-reform birth cohorts and 20 post-reform birth cohorts. Panel A reports the OLS estimators for β_2 with clustered robust standard errors. In Panel B, we estimate the specification using the Logit model without county fixed effects and report the MLE estimators for β_1 and β_2 with clustered standard errors at the county level.

Table 7: Migration

	Urban + Rural Residents			Rural Residents Only		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full	Male	Female	Full	Male	Female
All Type of Migration	0.037*	0.016	0.059**	0.045**	0.019	0.071***
	(0.022)	(0.024)	(0.024)	(0.020)	(0.022)	(0.023)
Migration within Province	-0.032**	-0.041**	-0.024	-0.016	-0.027*	-0.007
	(0.016)	(0.017)	(0.020)	(0.015)	(0.016)	(0.019)
Across Province	0.069***	0.057***	0.083***	0.061***	0.046***	0.078***
	(0.017)	(0.019)	(0.016)	(0.014)	(0.016)	(0.013)
Across Language Area	0.065***	0.050***	0.080***	0.054***	0.035**	0.075***
	(0.015)	(0.017)	(0.015)	(0.012)	(0.014)	(0.012)
Obs.	402,035	206,512	195,523	306,589	155,151	151,438

Level of Significance * p<0.10 ** p<0.05 *** p<0.01

Notes: Four types of migration are used as the dependent variables: migration across counties (10.9% in the sample), migration across the county but within the province (5.5% in the sample), migration across provinces (5.4% in the sample) and migration across language areas (5.9% in the sample). The data sample includes 15 pre-reform birth cohorts and 20 post-reform birth cohorts. All regressions include birth-county, province-birth cohort fixed effects, and the geographical distance control. Robust standard errors clustered by birth-county are reported in parenthesis.

$$Migration_{i,j,t} = \beta_1 Post_{i,j,t} + \beta_2 Post_{i,j,t} * Distance_j + \beta_3 Post_{i,j,t} * Geo_j + \zeta_{prov,t} + \alpha_j + \varepsilon_{i,j,t}$$

Table 8: Political News Consumption and Informational Channels

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Political News Consumption												
	Frequency (WVS)			Frequency (ABS)			Frequency Dummy (WVS)			Frequency Dummy (ABS)		
Dependent Variable	5: Every day 4: Several times a week 3: Once or twice a week 2: Less than once a week 1: Never						1: Several times a week or every day 0: Otherwise					
Education level	All	Above	Below	All	Above	Below	All	Above	Below	All	Above	Below
$Post_{i,prov,t} * Distance_{prov}$	1.451*	1.190	-1.600	0.724*	0.866**	-0.347	0.433*	0.324	-1.539	0.307*	0.296*	0.101
	(0.741)	(0.798)	(11.110)	(0.406)	(0.374)	(0.702)	(0.232)	(0.253)	(3.593)	(0.157)	(0.149)	(0.243)
Obs.	342	288	54	2,473	1,732	741	342	288	54	2,473	1,732	741
Panel B: Informational Channels												
	Radio		Cell Phone		Internet		Television		Newspaper			
Dependent Variable	1: Yes 0: No											
Education level	All		All		All		All		All			
$Post_{i,prov,t} * Distance_{prov}$	0.298***		0.179**		0.052		-0.034		0.099			
	(0.102)		(0.073)		(0.046)		(0.092)		(0.242)			
Obs.	1,288		1,260		1,257		1,529		1,307			

Level of Significance * p<0.10 ** p<0.05 *** p<0.01

Notes: Dependent variables are the political news consumption frequency measures in Panel A, and the usage of five informational channels in Panel B. $Distance_{prov}$ is the average linguistic distance to Putonghua. The data sample includes 10 pre- and 10 post-reform birth cohorts. All regressions include province, birth cohort, and survey wave fixed effects. Columns (1), (4), (7), and (10) report the estimates with the full sample. Columns (2), (3), (5), (6), (8), (9), (11), and (12) provide breakdown estimates with two subsamples: people with primary school education or above, and people without formal education. Robust standard errors clustered by province are reported in parenthesis.

$$y_{i,j,t} = \beta_1 Post_{i,prov,t} + \beta_2 Post_{i,prov,t} * Distance_{prov} + \alpha_{prov} + \zeta_t + \varepsilon_{i,prov,t}$$

Table 9: Patriotism and Identity

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	Q1: How proud are you to be Chinese?					
	4: Very Proud 3: Quite Proud 2: Not very proud 1: Not at all			1: Proud 0: Not proud		
Education Level	All	Above	Below	All	Above	Below
$Post_{i,prov,t} * Distance_{prov}$	0.636**	0.523**	0.317	0.216**	0.225**	-0.188
	(0.194)	(0.189)	(0.840)	(0.086)	(0.082)	(0.536)
Obs	1,531	1,149	382	1,531	1,149	382
Dependent Variable	Q2: Part of my country			Q3: Part of my local community		
	4: Strongly Agree 3: Agree 2: Disagree 1: Strongly Disagree					
Education level	All	Above	Below	All	Above	Below
$Post_{i,prov,t} * Distance_{prov}$	0.252	0.213	-0.375	-0.440*	-0.462*	-0.993
	(0.329)	(0.397)	(1.255)	(0.235)	(0.263)	(1.026)
Obs.	473	407	66	469	399	70
Dependent Variable	Q4: To which geographical groups would you say you belong first of all?					
	1: Province or Beyond 0: Locality					
Education level	All					
$Post_{i,prov,t} * Distance_{prov}$	0.135*					
	(0.076)					
Obs.	1,926					
Dependent Variable	Q5: China helps Asia more than harms Asia					
	4: Strongly Agree 3: Agree 2: Disagree 1: Strongly Disagree					
Education level	All	Above	Below			
$Post_{i,prov,t} * Distance_{prov}$	1.112*	1.161*	-1.780			
	(0.560)	(0.658)	(1.451)			
Obs.	626	530	96			

Level of Significance * p<0.10 ** p<0.05 *** p<0.01

Notes: The dependent variables are responses to five questions about the patriotism and identity in the World Value Survey. Q1: How proud are you to be Chinese? (Survey Year: 2001, 2007, 2012); Q2: I see myself as part of the Chinese nation. (Survey Year: 2012); Q3: I see myself as part of my local community (Survey Year: 2012); Q4: To which of these geographical groups would you say you belong first of all? (Survey Year: 2001); and Q5: Does (answer in Q156) China help Asia more than harm the region? The data sample includes 10 pre- and 10 post-reform birth cohorts. All regressions include province, birth cohort, and survey wave fixed effects. Columns (1) and (4) report the estimates with full sample. Columns (2), (3), (5), and (6) provide breakdown estimates with two subsamples: people with primary school education or above, and people without formal education. Robust standard errors clustered by province are reported in parenthesis.

Table 10: Views on Democracy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Current Democracy Evaluation									
	Democracy rating for current government								
Dependent Variable	1-10: Dictatorship-Democracy								
Education level	All	Above	Below						
$Post_{i,prov,t} * Distance_{prov}$	0.982**	0.748*	1.752*						
	(0.464)	(0.420)	(0.926)						
Obs.	2,754	2,158	596						
Panel B: Democracy Demand									
	Desirable democracy rating			Democracy is suitable for China			Democracy should be preferred		
Dependent Variable	1-10: Dictatorship-Democracy			1-4: Strongly Disagree-Strongly Agree			1-4: Strongly Disagree-Strongly Agree		
Education level	All	Above	Below	All	Above	Below	All	Above	Below
$Post_{i,prov,t} * Distance_{prov}$	-0.129	-0.239	0.235	-0.0148	-0.348	1.292	0.054	0.086	-0.344
	(0.329)	(0.327)	(0.919)	(0.284)	(0.300)	(1.313)	(0.118)	(0.136)	(0.371)
Obs.	2,666	2,102	564	2,761	2,167	594	2,680	2,103	577

[Table 10 Continued]

Panel C: Skepticism of Democracy

	Democracy can solve social problems			Democracy is more important than economic development			Democracy is the best institution		
Dependent Variable	1-4: Strongly Disagree-Strongly Agree			1-4: Strongly Disagree-Strongly Agree			1-4: Strongly Disagree-Strongly Agree		
Education level	All	Above	Below	All	Above	Below	All	Above	Below
$Post_{i,prov,t} * Distance_{prov}$	-0.197**	-0.265***	-0.093	-0.461**	-0.543***	-0.440	-0.250	-0.255	-0.477
	(0.0697)	(0.0638)	(0.240)	(0.174)	(0.189)	(0.430)	(0.173)	(0.182)	(0.691)
Obs.	2,647	2,078	569	2,530	1,939	591	783	634	149

Level of Significance * p<0.10 ** p<0.05 *** p<0.01

Notes: The dependent variable in Panel A is the subjective democracy rating for the current government. The dependent variables are responses to three questions about the demand for democracy in Panel B, and responses to three questions about the skepticism of democracy in Panel C. See Online Appendix A for the list of survey questions. The data sample includes 10 pre- and 10 post-reform birth cohorts. All regressions include province, birth cohort, and survey wave fixed effects. Columns (1), (4), and (7) report the estimates with full sample. Columns (2), (3), (5), (6), (8), and (9) provide breakdown estimates with two subsamples: people with primary school education or above, and people without formal education. Robust standard errors clustered by province are reported in parenthesis.

Table 11: Government Evaluation and Social Preference

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Government Evaluation									
	Q1: Confidence in Political Party			Q2: Most Influential in Asia			Q3: Participation in Petition		
Dependent Variable	1-4: Not Confident -Very Confident			1: Yes 0: No			1: Yes 0: No		
Education level	All	Above	Below	All	Above	Below	All	Above	Below
$Post_{i,prov,t} * Distance_{prov}$	0.405	0.461*	-0.822	0.451	0.475*	-0.116	-0.215	-0.113	-0.814
	(0.239)	(0.232)	(1.007)	(0.264)	(0.231)	(0.886)	(0.143)	(0.139)	(0.638)
Obs.	1,451	1,113	338	698	584	114	1,239	899	340
Panel B: Social Preferences									
	Q1: Public or Private Ownership (VWS)			Q2: Government-Owned Enterprises			Q3: Gov. or Indiv. Responsible for Welfare		
Dependent Variable	1-10: Private -Public			1-4: Strongly Disagree-Strongly Agree			1-10: Individual -Government		
Education level	All	Above	Below	All	Above	Below	All	Above	Below
$Post_{i,prov,t} * Distance_{prov}$	1.270**	0.346	4.296	1.233*	1.026	3.852	0.235*	0.0535	1.167**
	(0.566)	(0.519)	(2.812)	(0.616)	(0.727)	(3.568)	(0.120)	(0.120)	(0.461)
Obs.	1,406	1,104	302	1,181	975	206	1,781	1,401	380

Level of Significance * p<0.10 ** p<0.05 *** p<0.01

Notes: The dependent variables are responses to three questions about government evaluation in Panel A, and responses to three questions about social preferences in Panel B. See Online Appendix A for the list of survey questions. The data sample includes 10 pre- and 10 post-reform birth cohorts. All regressions include province, birth cohort, and survey wave fixed effects. Columns (1), (4), and (7) report the estimates with full sample. Columns (2), (3), (5), (6), (8), and (9) provide breakdown estimates with two sub-samples: people with primary school education or above, and people without formal education. Robust standard errors clustered by province are reported in parenthesis.