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# HETEROGENEITY IN LONG TERM HEALTH OUTCOMES OF MIGRANTS WITHIN ITALY

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Heterogeneity in Long Term Health Outcomes of Migrants within Italy
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## ABSTRACT

This article examines the long term physical and mental health effects of internal migration focusing on a relatively unique migration experience from Southern and Northeastern regions of Italy to Northwestern regions and to the region around Rome concentrated over a relatively short period from 1950-1970. OLS regression estimates show significant evidence of a migration effect among early-cohort females on physical health. We find no evidence of migration-health effects for the later cohort, nor for males in the early cohort. We use finite mixture models to further explore the possibility of heterogeneous effects and find that there is a significant and substantial improvement in physical and mental health for a fraction of migrant females in the early cohort but not for others. Analysis of the group for which effects are significant suggest that health effects are concentrated among rural females in the early cohort.

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# 1 Introduction

The analysis of migration flows, its determinants and its effects on a wide range of socio-economic phenomena have been examined in the literature beginning with the seminal contribution of Chiswick (1978) and Carliner (1980) who use cross-section of earning functions to investigate earning profiles for native born and immigrants in the United States. Jasso and Rosenzweig (1986) and Borjas (1985, 1987) extended this analysis using panel data techniques that allowed for the disentangling of aging from cohort effects. These, and other similar analyses, have focused either on the determinants of migration decisions or on the effects of migration on labor market outcomes and earnings and have been mostly confined to the United States. More recently, Antolin and Bover (1997) and Giannetti (2001) have explored migration related issues within Europe, investigating why the rate of European Union internal migration has been very low, despite the pronounced regional disparities which persist in many European Union countries.

The relationship between migration decisions and migrant health status (especially in the long-run) still remains a relatively neglected topic in the economics literature. According to Hull (1979) individual health status can affect migration decisions (the health selection hypothesis), and migration can affect the health of those who move (due to disruption of individual life and adaptation to new environments and due to better health care services in the hosting country), those who stay (due to remittances from migrants), and perhaps even the health of the hosting populations (due to diffusion of new pathologies and/or new life styles). From an economic standpoint, understanding the net effect of migration on health status is important for several reasons. In terms of economic growth the "healthy body" drain could negatively affect sending countries and benefit hosting counties. In addition, this drain could have significant long-term public finance consequences for origin and destination countries. In fact, the benefits of increasing productivity and higher economic growth due to migration flows could be counter-balanced by long-term health care and social assistance costs if migration results in deteriorating health status. The relevance of these problems has been magnified in recent years as migration flows have dramatically increased.[1]

[1]According to a report commissioned by the BBC World Service (Fix et al., 2009), in 2005 the

Italy has a relatively unique migration experience, which makes it a valuable case study. Migration took place in two concentrated waves, the first abroad and the second internal from the South and Northeast of Italy to the Northwest and the region near Rome. These migration flows were a direct consequence of especially harsh living conditions in the South and were accompanied by two secular societal changes. First, employment for women virtually collapsed. Second, the agricultural sector shrank dramatically, especially in the Northwest, as industrialization made rapid strides. The historical record shows that men led the migration process and that women and children followed, i.e., men went to the North for "work reasons", while women followed for "family reasons".

In this paper, we study the health effects of internal migration from Southern and Northeastern regions of Italy to Northwestern ones and to the region around Rome, which was concentrated over a relatively short period of time from 1950 to 1970. We are able to test if current health differences between migrants and non-migrants are purely due to selection effects at the origin, or to living conditions effects at the destination. Our study improves on the existing literature in substantial ways. First, because our dataset includes information on the region of birth of each person, we can conduct a comparison between migrants and and non-migrants from the origin regions as well as between migrants and non-migrants in the destination region. Second, we compare the health of migrants to non-migrants more than 30 years after migration for one cohort and over 40 years after migration for another cohort, allowing us to identify long term impacts. Third, because we examine internal migration, heterogeneity among sending or origin regions is considerably reduced.

There are many intuitive reasons for expecting that health-effects of migration are not constant across the population, some of which we explore in this paper. We distinguish between impacts on women and men as we expect the existence of some heterogeneity driven by differences in their life experiences (mainly due to work experiences). We also distinguish the experience of "early" migrants with that of "late" migrants as it is likely that health effects of migration are influenced by whether the migrants were "pioneers" and also by the states of the origin and destination regions over time. We also expect heterogeneous effects on some characteristics that

number of international migrants was close to 195 million, a value two and a half times greater than the 75 million recorded in 1960.

are unobserved in our data. Arguably, an important unobserved characteristic is whether the person lived in a rural or urban area at the "origin". We estimate finite mixture models (Mclachlan and Peel, 2000; Deb and Trivedi, 1997) to explore the possibility of such heterogeneity, to estimate heterogeneous effects of migration and to characterize the sources of such unobserved heterogeneity.

In what follows, section 2 introduces a short review of the literature on the relationship between health status and migration decision. Section 3 provides a historical overview of internal migration in Italy since the second World War. Section 4 introduces our empirical strategy and the econometric model and section 5 presents the data. Section 6 discusses the empirical results and provides some interpretations. We wrap up with conclusions in section 7.

## 2 Health status and migration: a review of the literature

The empirical relationship between migration decision and health status can be examined from two different points of view: one can compare the health status of migrants to that of the hosting population, or to that of the origin country. As noted by Lu (2008), the vast majority of the existing literature on migration and health compares the health status of migrants to that of the population in the destination countries, rather than to that in the origin countries. According to this literature, immigrants are found to be generally healthier than hosting populations. However, this health advantage deteriorates over time (Anson, 2004; Feranil, 2005; Marmot, Adelstein, and Bulusu, 1984a, 1984b; Palloni and Morenoff, 2001) due to harsh life conditions in the new country. This phenomenon has been referred to in the literature as the "epidemiological paradox".

A number of studies examine the short run health effects of migration relative to the origin population. When compared to the origin populations, Kanaiaupuni and Donato (1999) found that infant mortality declined with the increased flow of remittances for five Mexican states that have traditionally sent migrants to the U.S.. Carballo et al. (1998) showed that migration involves a great deal of stress and anxiety. Antman (2010) showed that migration to the U.S. increased the likelihood that an elderly parent "left behind" in Mexico would be in poor physical and mental health. Lu (2012) shows that adults left behind by migrants in the context of Indonesia are more susceptible to stress-related health impairments and to psychological distress than others. Andaln, et al (2012) show that households of internal migrants within Mexico exhibit worse adult and child health in the near term than non-migrant households. Gibson and McKenzie (2007) showed that migrants from Tonga to New Zealand had lower health status than those in a control group who did not migrate. They exploited a New Zealand immigrant lottery as an instrument to identify the causal effect of migration on health. But other research on the same data shows favorable effects of migration (Hildebrandt and McKenzie, 2005). In addition, Frank and Hummer (2002) also find that the incidence of low birthweight is reduced in households with migrants. In sum, it appears that, while migrants have better health and lower mortality than the local-born population due to the selection of the fittest applicants for immigration, migration may also have a negative impact on the health status of migrants due to the multiple physical and psychosocial strains affecting them during the entire process of migration.

## 3 Italian migration flows: a brief overview

Italy experienced large migration flows since its unification in 1860, mostly in two waves. The first wave took place before World War II, when the vast majority of migrants went to other European countries and to North and South America. Between 1880 and 1920, approximately 14 million Italians left for the New World (Favero and Tassello, 1978; Sori, 1979). The second large migration occurred after World War II, from 1946 until 1970. Italian migration in this era included a new phenomenon: a mass internal migration from the South and Northeast of Italy to the Northwest.

According to a Report prepared in 1951 by the Parliamentary Commission on Poverty, these migration flows were a direct consequence of harsh living conditions faced by a large share of the Italian population. Overall, 870,000 households stated that they had not consumed meat, sugar or wine in a whole year. More than 3 million households did not consume adequate food calories and over 600,000 households did not wear serviceable shoes. Many of the households interviewed were still sharing their living with animals in caves and cellars. These harsh living conditions were heterogeneous across regions. For example, the share of households with more than

4 persons living in a single room was 2.9% in the North and 15.5% in the South. Similarly, the share of households with scarce or no consumption of meat, sugar and wine was 6.9% in the North and an incredible 57% in the South.

The Italian situation reflects many features of general trends in migration also witnessed in other European countries. However, what made Italy different from the rest of Europe was that the internal migration process occurred after WWII was concentrated in a relatively short time span (1955-1975), as clearly shown in Figures 1 and 2. In fact, as reported by Bonifazi and Heinz (2000, p.112), "in the early 1950s, Italy was still mainly agricultural and rural: 43% of the workforce was employed in the primary sector and 27% of the population lived in municipalities with fewer than 5,000 inhabitants. The economic growth of subsequent years radically changed the situation, enabling the growth of a definitive modern industrial sector able to compete in European markets. Inevitably, this process coincided with enormous population flows. The major industrial areas in northwestern Italy concentrated in the 'industrial triangle' of Milan, Turin and Genoa, which together with Rome were powerful points of attraction that could absorb immigrants from adjacent provinces and regions, and also from the regions of northeastern Italy and the South. After this intense initial phase ended in the early 1970s, the flows tended to follow patterns less linked to regional economic imbalances."

It is important to note that, despite the sustained period of economic expansion, the total number of employed workers in Italy decreased by 1,524,000 between 1959 and 1971 of which a disproportionate share of 1,212,000 were women (ISTAT, 1976, Table 107.) Employment declined by 500,000 over the period 1959-1963, almost entirely among women. Some authors have questioned these data (Padoa-Schioppa, 1977; Cacioppo, 1982), claiming that official statistical sources were not able to capture the vast complexity of the occupational opportunities (mainly informal market) that women were able to exploit, but it would be difficult not to acknowledge gender differences. The primary sector was the most affected sector in terms of job losses. All regions were equally affected, although the timing was different, with Northern regions experiencing this phenomenon before Central and Southern regions. The contraction of the labor force in the agricultural sector was so intense that in some regions there was a complete abandonment of rural areas. In the Southern regions the abandonment was slower and connected to migration flows (both internal and international).

Changing labor market and living conditions over the decades of migration and differences in those conditions between the Southern and Northwestern regions lead us to separately analyze the sample from which migration "pioneers" would have been drawn from the sample from which later migrants were drawn.

# 4 Empirical strategy and econometric model

Over time, the stock of health of each individual can deteriorate (improve) as long as the individual investment in health is lower (greater) than his/her health deterioration. If we assume that the origin region is the South of Italy while the destination region is the North of Italy, then we can define the following variables:

- $H^{s,n}$ is the health status at time $t$ of an individual who migrated at time $t-k$ from the south to the north;
- $H^{s,s}$ is the health status at time $t$ of an individual who did not migrate at time $t-k$ from the south.

If we observe that $H^{s,s} \leq H^{s,n}$, and assuming that $k$ is large, this may be the result of one or both of the following situations:

- migrants were positively selected in terms of health status and living and working conditions in the destination regions did not play an important role;
- migrants were not positively selected in terms of health status, but they found better living and working conditions in the destination region;

Similarly, if we observe that $H^{s,s} \geq H^{s,n}$, this may be the result of one or both of the following situations:

- migrants were positively selected in terms of health status, but living and working conditions in the destination region did play an important role;

- migrants where not positively selected in terms of health status and living and working conditions in the destination region had a negative impact on health status.

Clearly, following this approach we could also compare situations like $H^{s,n} \leq H^{n,n}$ or $H^{s,n} \geq H^{n,n}$. However, these are comparisons of migrants to individuals in the destination rather than in the origin region, thus are considerably less interesting (Lu, 2008).

A corollary of this conceptual framework is that the long-term health effects of migration may be substantially heterogeneous. In fact, we should expect the effect to be different for men and women, as well as for individuals in the early versus late cohorts. We expect living and, especially, working conditions to be quite different for men than for women. Migrants in early cohorts would be pioneers and face substantially unknown conditions while migrants in later cohorts would be more likely to arrive to locations where others had already migrated. Finally, as standard migration theories (Harris and Todaro, 1970; Basu, 1997) and empirical evidence (Lanzona, 1998; Agesa, 2001) suggest, migration from rural areas will likely be quite different than migration from urban areas. Thus health outcome effects of migration may differ by rural-urban status in the origin location. For all these reasons, our econometric strategy is to take into account all the heterogeneity that we believe will shape the results of our analysis.

We identify these effects using the following econometric specification:

$$H_i = \beta_0 + \beta_1 M_i^{sn} + \beta_2 AgeatM_i^{sn} + \beta_3 M_i^{o} + \beta_4 AgeatM_i^{o} + \beta_5 BornN_i + \mathbf{X}_i \alpha + \epsilon_i \quad (1)$$

where $i$ refers to the individual and $H_i$ is the health component summary measure. The variable $Age_i$ denotes age in years, $M^{SN}$ is an indicator variable that equals 1 for individuals who moved from the South or Northeast to the Northwest or Rome while $M^{O}$ is an indicator for individuals who migrated across other regions, i.e., within South, within North and North to South. $AgeatM^{SN}$ and $AgeatM^{O}$ measure exposure to the origin region among migrants. Specifically, $AgeatM^{SN}$ is the age at which the individual migrated from the "South" to the "North". $AgeatM^{O}$ is the age at which the individual migrated across "other" regions. Both $AgeatM^{SN}$

and $AgeatM^O$ are equal to zero for non-migrants, i.e, among individuals who were *not* exposed to migration. $\mathbf{X}_i$ is a vector of control variables consisting of age and education (measured at individual level) and income in 1931 and migration rate out of the region in 1945 (measured at regional level).

The coefficient $\beta_1$ incorporates both selection effects and treatment effects of migration. The coefficient $\beta_2$ denotes the effect of a year of exposure to the origin (South and Northeast) for migrants. Thus, if any *positive* health effect of migration is entirely due to selection, we expect only origin effects ($\beta_1 > 0$) and no migration treatment effects ($\beta_2 = 0$). In other words, if differences between migrants and non-migrants are purely due to selection, exposure to the origin conditions among migrants should not affect outcomes. Alternatively, suppose that migration *improves* health because of exposure to better living and environmental conditions in the North. Then, $\beta_2 < 0$ regardless of the existence of selection effects at the origin. In this case, however, $\beta_1$ incorporates both selection and living/working condition effects.

Finally, for the issue of heterogeneity due to rural vs. urban migration, although we know current rural/urban status, we do not observe migrant rural/urban status in the origin community. If rural-urban origin status is an important determinant of outcomes, a simple regression of outcomes on migration status would produce a sort of "average" estimate, which might be not particularly insightful for either rural or urban migrants. Thus, we explore the possible effects of such unobserved heterogeneity by estimating a finite mixture model for the distribution of the errors in the equation above.[2]

Following Deb and Trivedi (1997), the density function for a $C$-component finite mixture is

$$f(y|\mathbf{x};\theta_1,\theta_2,...,\theta_C;\pi_1,\pi_2,...,\pi_C) = \sum_{j=1}^{C} \pi_j f_j(y|\mathbf{x};\theta_j) \tag{2}$$

[2]Finite Mixture Models have received increasing attention in the statistics literature mainly because of the number of areas in which such distributions are encountered (see McLachlan andPeel, 2000; Lindsay, 1995, for numerous applications). Econometric applications of finite mixture models include the seminal work of Heckman and Singer (1984) to labor economics, Wedel et al.(1993) to marketing data, El-Gamal and Grether(1995) to data from experiments indecision making under uncertainty, Deb and Trivedi(1997) to the economics of health care. More recent applications include Ayyagari, et al. (2013) and Deb, et al. (2011) in studies of BMI and alcohol consumption, Bruhin, et al. (2010) to experimental data and Caudill et al (2009) and Günther and Launov (2012) to issues in economic development.

where $0 < \pi_j < 1$, and $\sum_{j=1}^{C} \pi_j = 1$ and $f_j$ denotes an appropriate density given the characteristics of the error terms. As we will describe below, normally (Gaussian) distributed components appear to be appropriate in the context of the outcome of interest. We estimate the parameters of this model using maximum likelihood.

As a further step, in post estimation, we calculate the posterior probability that observation $y_i$ belongs to component $c$ (the prior probability is assumed to be a constant):

$$\Pr[y_i \in \text{population } c|\mathbf{x}_i, y_{i;}\theta] = \frac{\pi_c f_c(y_i|\mathbf{x}_i, \theta_c)}{\sum_{j=1}^{C} \pi_j f_j(y_i|\mathbf{x}_i, \theta_j)}, \qquad c = 1, 2, ..C \tag{3}$$

which we use to explore the determinants of class membership, and especially to see if these determinants are consistent with our a priori notion that rural/urban status at the origin is a likely source of essential unobserved heterogeneity.

# 5 Data and descriptive statistics

The data used for the empirical analysis are from the Multiscopo Survey (MS), conducted by the Italian National Institute of Statistics in 2004-2005 (ISTAT, 2005). This survey is conducted every 5 years with the aim of evaluating prevalence of chronic health conditions and the use of the health care services in the Italian population. MS includes information on health conditions, disabilities, life styles, prevention, use of health care services and several socio-demographic variables. The dataset includes 50,474 households, for a total of 128,040 individuals, sampled in 1,465 areas known as "comune". In addition to the information available in the public-use MS datasets, ISTAT provided us with information on the region of birth of each individual and the number of years the person has lived in the region observed at the time of the survey, giving us the opportunity to identify the migration flows and the duration of migration.[3]

The outcomes in our analysis are two recognized measures of health status, the Physical Component Summary (PCS) and the Mental Component Summary (MCS),

[3] Note that if an individual migrated from one region to another more than once, we would observe duration of migration away from the birth region with error, as we would only observe the duration of the final migration. However, multiple spells of migration are rare in the Italian context.

which are based on the SF-12 (Ware, Kosinski, and Keller, 1996). The SF-12 contains 12 questions in which people are asked about the following topics:

1. Limitations in performing moderate physical activities, such as moving a table.
2. Limitations in climbing several flights of stairs.
3. Extent to which pain interfered with normal work.
4. Whether they accomplished less than they would like at work or other regular activity as a result of their physical health.
5. Whether they were limited in kind of work or other activities as a result of their physical health.
6. How often they felt calm and peaceful.
7. How often they felt downhearted and blue.
8. Whether they accomplished less than they would like at work or other regular activity as a result of emotional problems.
9. Whether they didn't do work or other activities as carefully as usual as a result of emotional problems.
10. How often they felt that they had a lot of energy.
11. How often physical health or emotional problems interfered with social activities.
12. Overall rating of health (from excellent to poor).

Responses to these questions are combined to form two summary scores. The PCS weights responses to the first five items more heavily, while the MCS weights responses to items 6-9 more heavily. Each score is typically scaled to have a mean of 50 and a standard deviation of 10 in the reference population. We multiply each score by 100 so that the scores are centered at 5,000 in the reference population.

Regressors include dummies for migration distinguishing between the migration variable of interest (from south and northeast to northwest and Rome) from other migration, the age at which the individual migrated to capture exposure to the destination, coded as zero for non-migrants, a dummy for location of birth, and control variables including age, education and gender.

We conduct separate analyses for men and women. As described in Section 3, there are historical reasons to expect different effects for women than for men. In addition, while selection effects among men may be large, given the expectation that only the "fittest" men would consider making the migrant's journey, one would expect less selection on health fitness for the women who "followed" them.

We also expect results to vary by wave of migration. For this reason we define as "early cohort" individuals born between 1925 and 1945 (60 to 80 years old in 2005) and as "early" migrants those among them who moved before 1965. Similarly, we define as "late" cohort individuals born between 1945 and 1965 (40 to 60 years old in 2005) and as "late" migrants those among them who moved before 1975. As standard in all migration waves, we expect the early cohort to experience different conditions at both origin and destination and, possibly, exhibit different selection effects into migration as compared to the late cohort. Thus we also estimate separate models for early and late cohorts.

Our final samples, after a small amount of listwise deletion for missing values, consist of 11,050 and 12,895 individuals for early cohort males and females and 15,730 and 16,326 individuals for their late cohort counterparts. Table 1 shows summary statistics for the outcomes and regressors for each of these samples. Health status is apparently better in the late cohort, but they are also 20 years younger on average. Migration rates were about 7.5% in the early cohort and about 1 percentage point lower in the late cohort.

# 6 Empirical results

Tables 2 and 3 present OLS estimates of migration on PCS and MCS respectively. In both cases, there is little evidence of migrant or exposure effects, except for physical health of women in the early cohort. In this case, the results show that South (and Northeast) to Northwest migrant women are significantly healthier than non-migrant women and that the health of migrant women is better the earlier they migrated to the North, i.e., the shorter their exposure to the South. Some of the "other" migration coefficients are also significant, but it is difficult to interpret these effects because other migration includes within-region migration, and because these are relatively few in number. The effects of other demographic characteristics are statistically significant and intuitive. Those who were born in the North have significantly better physical and mental health. Older and less educated individuals report worse physical and mental health.

There are a number of important sources of unobserved heterogeneity that may mask significant effects for some groups of migrants. As we have mentioned above, the health outcomes for rural to urban migrants may be quite different than those for urban to urban or rural to rural migrants. Indeed, evidence of the existence of such heterogeneity may be seen in figures 3 - 6. These figures are kernel density estimates of the distribution of OLS residuals from our model in equation 1. Especially for the early cohort samples shown in figure 3 for physical health and figure 5 for mental health, the distributions of the residuals indicate the existence of bimodal distributions of errors. In addition, as these are "textbook" examples of mixtures of Gaussian distributions, we conduct our subsequent analyses using finite mixtures of Gaussian distributions.

Parameter estimates of the finite mixture model for PCS are reported in table 4 for the early cohort and in table 5 for the late cohort. Similarly, parameter estimates for MCS are reported in tables 6 and 7 for the early and late cohorts respectively. These results support the graphical impression that migrant health outcomes are generated by two different distributions. Individuals in component 1 have lower physical and mental health status than individuals in component 2. For example, in the early cohort the predicted mean PCS for males and females in component 1 are 4,107 and 3,884 respectively, while the mean PCS in component 2 are 5,436 and 5,361 respectively.[4] Now, very consistent evidence emerges for the early cohort samples. Although there are no migration effects for males, there is a statistically significant and substantial improvement in physical and mental health for females who started out in lower health. In other words, migrant women in component 1 exhibit better health via the migrant status dummy for PCS and via the exposure variable (age of South to North migration) for both PCS and MCS. The estimates on the exposure coefficient are also remarkably similar, a decrease of 16.2 in PCS and of 15.3 in MCS for every year spent in the South.

Focusing on the results for the early cohort in tables 4 and 6, we find once again a consistent negative effect of age and low education on health for individuals in both components. Being born in the North has a significant effect on PCS for men and women in component 1 but a significant effect on MCS for men and women in component 2.

The estimated class probabilities are informative vis-a-vis our speculative hypoth-

[4]These values are not reported in the tables.

esis that the distributions are drawn from rural and urban populations, with the evidence consistent with the view that component 1 represents the rural population. First, note that in table 4, for the early cohort, the probabilities of being in component 1 are 0.59 and 0.68 for the male and female samples respectively, while for the later cohort, reported in Table 5, the class 1 probabilities drop to 0.46 and 0.54 respectively. These magnitudes of the probabilities and the decline over cohorts are consistent with estimates of the rural population rates and changes over the relevant decades (United Nations, 2011) as shown in figure 7. Second, we characterize class membership, for the sample of *non-migrants* in the early cohort, by estimating OLS regressions of the posterior probability (multiplied by 100) of belonging to class 1 on an indicator for born in the North, age, education status and current height. The results presented in table 8 support the rural-urban categorization. Shorter non-migrants are more likely to be in class 1. This is consistent with a long tradition of nutritional studies and population studies that sees in rural population a less healthy and shorter population due to non-optimal diet. Furthermore, low educated individuals are more prone to belong to rural areas. This is consistent with the fact that illiteracy rates are higher in rural areas (Barberis, 2009). Finally, individuals born in the North are less likely to be in class 1. While all of these evidence point towards heterogeneous effects of migration by rural-urban status, these analyses are exploratory so other explanations for the latent classes cannot be ruled out.

Overall, the results obtained show that less healthy (rural) women benefited from migration; migration does not appear to have benefited men. This is an interesting result and prompts the question of why only women - more specifically less healthy women - benefited and not men? The findings are consistent with the historical record which shows that men led the migration process and that women and children followed, i.e., healthy men went to the North for "work reasons", while women just followed as wives for "family reasons". Men may have been positively selected on health status but would have faced harsh, industrial work environments at the destination. For women, one expects less positive selection, so that the fact that migrant women's health is better suggests that, although there might still be some amount of positive selection, the majority of the improvement could be attributed to better living conditions and better access to health care.[5]

## 7 Conclusion

The historical record of Italy allows us to study a relatively unique migration experience from Southern and Northeastern regions of Italy to Northwestern regions and to the region around Rome concentrated over a relatively short period from 1950-1970. We find little evidence of health effects of migration in our analysis using OLS regression. When we allow for heterogeneous effects, over and above heterogeneity by gender and cohort, we find very consistent evidence for the early cohort samples. Although there is no migration health effect for males, there is a statistically significant and substantial improvement in physical and mental health for females who started out in lower health and who very likely migrated from rural areas. In addition, for these women the effect can be attributed to better living conditions at the destination and not simply due to selection. We find no evidence of migration-health effects for the later cohort.

As described above, in the years following WWII Italy went through a period of profound economic and social change that transformed the country from a agricultural to an industrial economy. These changes particularly affected women and their labor choices. Phenomena such as economic development, the exodus from the rural areas and internal migration all played a role in shaping a new form of relationship between women and the labor market. During the period of the early waves of migration, the South and Northeast of Italy were substantially rural and much poorer, and had inferior infrastructure compared to the Northwest of Italy and around Rome. Thus, migrants moved away from substantial deprivation to urban areas with better living conditions. Unfortunately, men who made that journey would then have been confronted by poor industrial working conditions. Women, by and large, would have not been engaged in the formal labor market and would have been spared the ill effects

[5]The dataset has no childhood measures of health so it is not possible to test the selection hypothesis rigorously. Nevertheless, assuming that today's height is a good proxy for height in teenage years when individuals migrated, we estimated probit models of migration from South to North for males and females in the early cohort who were born in the South on age, education status and height. These results, available upon request, show that the effect of height is not statistically significant for males or females, arguably ruling out substantial selection effects.

of those working conditions. By the time of the later waves of migration, however, the South had become considerably more industrialized and urban, and women were much more likely to be engaged in the formal labor market.

Our empirical results are consistent with the historical record suggesting that long term health improvements may be observed in migrant populations relative to their peers in the origin location but only if the improved living conditions at the destination are not countered by worse working conditions. In the developing country context, to the extent that migrant households from poor, rural areas migrate to richer, urban areas, we may expect to see long term health improvements for women and children, but not for men who may often take up undesirable jobs in undesirable work environments.

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Table 1: Summary statistics

| | Early cohort | | Late cohort | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| PCS Score | 4,649.026 | 4,357.237 | 5,228.084 | 5,093.391 |
| MCS Score | 4,931.448 | 4,630.138 | 5,088.717 | 4,865.054 |
| South to North migrant | 0.074 | 0.077 | 0.056 | 0.061 |
| Age of S to N migration | 1.498 | 1.596 | 0.731 | 0.797 |
| Other migrant | 0.038 | 0.043 | 0.035 | 0.039 |
| Age of other migration | 0.639 | 0.799 | 0.389 | 0.501 |
| Born in North | 0.282 | 0.292 | 0.302 | 0.298 |
| Age in years | 68.628 | 69.336 | 49.239 | 49.404 |
| Low education | 0.571 | 0.690 | 0.167 | 0.247 |
| Income in region in 1931 | 3,733.272 | 3,744.571 | 3,699.529 | 3,702.438 |
| Migration rate in region | 8.701 | 8.626 | 8.699 | 8.613 |
| $N$ | 10,704 | 12,480 | 15,198 | 15,793 |

Table 2: OLS Estimates of migration effects on PCS

| | Early cohort | | Late cohort | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| South to North migrant | 64.81 | 287.38* | 4.21 | -89.88 |
| | (126.23) | (119.14) | (66.64) | (74.17) |
| Age of S to N migration | -3.00 | -14.17** | 0.92 | 2.06 |
| | (5.59) | (5.35) | (4.08) | (5.20) |
| Other migrant | -13.41 | 7.29 | 79.40 | 120.25 |
| | (95.08) | (128.06) | (52.77) | (62.82) |
| Age of other migration | 1.96 | -0.58 | -2.10 | -9.42* |
| | (4.87) | (5.91) | (4.34) | (4.35) |
| Born in North | 73.49* | 120.28** | 12.34 | 36.40 |
| | (36.87) | (36.90) | (22.63) | (25.46) |
| Age in years | -39.75** | -48.72** | -13.48** | -21.61** |
| | (1.97) | (1.92) | (1.16) | (1.32) |
| Low education | -239.69** | -190.40** | -193.55** | -203.64** |
| | (22.10) | (23.43) | (20.66) | (19.81) |
| Income in region in 1931 | 0.07** | 0.10** | 0.02* | 0.03** |
| | (0.02) | (0.02) | (0.01) | (0.01) |
| Migration rate in region | 4.00** | 8.07** | 0.20 | 2.71** |
| | (1.15) | (1.15) | (0.72) | (0.76) |
| *N* | 10,704 | 12,480 | 15,198 | 15,793 |

* $p < 0.05$; ** $p < 0.01$

Table 3: OLS Estimates of migration effects on MCS

| | Early cohort | | Late cohort | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| South to North migrant | 15.93 | 41.71 | -51.22 | 41.78 |
| | (135.06) | (118.47) | (98.00) | (93.26) |
| Age of S to N migration | -5.27 | -6.54 | 1.35 | 1.40 |
| | (6.04) | (5.58) | (5.77) | (5.87) |
| Other migrant | 78.46 | 141.05 | -165.20* | -34.21 |
| | (91.54) | (114.90) | (71.63) | (80.45) |
| Age of other migration | -1.96 | -9.65 | 12.34** | 0.50 |
| | (5.11) | (5.37) | (4.65) | (5.30) |
| Born in North | 52.75 | 81.74* | 12.01 | 38.36 |
| | (36.01) | (39.03) | (28.57) | (32.43) |
| Age in years | -13.41** | -16.86** | -3.73** | -7.45** |
| | (2.00) | (2.01) | (1.38) | (1.65) |
| Low education | -103.46** | -165.21** | -137.91** | -92.98** |
| | (22.27) | (24.48) | (23.25) | (22.94) |
| Income in region in 1931 | 0.05** | 0.03 | 0.03* | 0.01 |
| | (0.02) | (0.02) | (0.01) | (0.01) |
| Migration rate in region | 3.33** | 7.33** | -0.50 | 1.19 |
| | (1.20) | (1.20) | (0.87) | (0.95) |
| $N$ | 10,704 | 12,480 | 15,198 | 15,793 |

* $p < 0.05$; ** $p < 0.01$

Table 4: Early cohort FMM estimates of migration effects on PCS

| | Male | | Female | |
|---|---|---|---|---|
| | Comp. 1 | Comp. 2 | Comp. 1 | Comp. 2 |
| South to North migrant | -44.62 | 61.71 | 393.26** | 45.47 |
| | (187.07) | (42.70) | (150.15) | (97.27) |
| Age of S to N migration | 1.87 | -1.70 | -16.18** | -3.21 |
| | (7.72) | (2.05) | (6.21) | (4.79) |
| Other migrant | -43.54 | 58.11 | -116.26 | 109.01* |
| | (142.35) | (38.63) | (175.68) | (48.59) |
| Age of other migration | 4.70 | -3.19 | 0.90 | -0.91 |
| | (6.86) | (2.26) | (7.76) | (2.52) |
| Born in North | 110.31* | 14.74 | 205.42** | -17.74 |
| | (55.59) | (15.81) | (50.54) | (24.48) |
| Age in years | -38.69** | -8.18** | -47.76** | -12.38** |
| | (2.66) | (1.22) | (2.43) | (1.72) |
| Low education | -276.66** | -40.99** | -181.45** | -35.45* |
| | (32.31) | (10.98) | (31.96) | (14.63) |
| Income in region in 1931 | 0.05* | -0.00 | 0.07** | 0.03** |
| | (0.02) | (0.01) | (0.02) | (0.01) |
| Migration rate in region | 4.02* | 0.02 | 7.48** | 0.83 |
| | (1.66) | (0.50) | (1.52) | (0.68) |
| Constant | 6,675.13** | 6,024.11** | 6,948.91** | 6,131.47** |
| | (202.18) | (72.78) | (188.85) | (107.72) |
| $\sigma$ | 943.84 | 209.52 | 936.93 | 280.51 |
| | (8.43) | (15.46) | (8.40) | (15.01) |
| $\pi$ | 0.59 | 0.41 | 0.68 | 0.32 |
| | (0.02) | (0.02) | (0.01) | (0.01) |

* $p < 0.05$; ** $p < 0.01$

Table 5: Late cohort FMM estimates of migration effects on PCS

| | Male | | Female | |
|---|---|---|---|---|
| | Comp. 1 | Comp. 2 | Comp. 1 | Comp. 2 |
| South to North migrant | -149.51 | 34.41 | -118.27 | 13.97 |
| | (156.11) | (32.17) | (112.21) | (24.82) |
| Age of S to N migration | 38.48** | -3.98 | 1.32 | -2.06 |
| | (13.09) | (3.74) | (8.06) | (2.02) |
| Other migrant | 431.51** | -15,351.52 | 149.62 | 6.75 |
| | (71.63) | (0.00) | (109.27) | (17.64) |
| Age of other migration | 14.90 | -6,678.94 | -10.22 | 0.01 |
| | (10.33) | (0.00) | (6.67) | (1.21) |
| Born in North | 15.20 | 5.07 | 43.81 | 13.33 |
| | (42.61) | (7.03) | (42.87) | (7.59) |
| Age in years | -15.26** | -3.09** | -26.78** | -2.88** |
| | (2.22) | (0.34) | (2.24) | (0.43) |
| Low education | -275.65** | -4.46 | -246.58** | -17.02** |
| | (34.76) | (6.27) | (30.37) | (6.54) |
| Income in region in 1931 | 0.04 | -0.00 | 0.07** | -0.01 |
| | (0.02) | (0.00) | (0.02) | (0.00) |
| Migration rate in region | 0.50 | -0.06 | 3.72** | 0.08 |
| | (1.33) | (0.19) | (1.25) | (0.23) |
| Constant | 5,462.03** | 5,755.36** | 5,800.73** | 5,739.30** |
| | (127.68) | (18.54) | (121.94) | (22.17) |
| $\sigma$ | 853.67 | 113.19 | 896.54 | 124.99 |
| | (9.64) | (3.43) | (8.67) | (10.07) |
| $\pi$ | 0.46 | 0.54 | 0.54 | 0.46 |
| | (0.01) | (0.01) | (0.02) | (0.02) |

* $p < 0.05$; ** $p < 0.01$

Table 6: Early cohort FMM estimates of migration effects on MCS

| | Male | | Female | |
|---|---|---|---|---|
| | Comp. 1 | Comp. 2 | Comp. 1 | Comp. 2 |
| South to North migrant | -433.78 | 143.54 | 213.34 | -84.50 |
| | (293.22) | (93.81) | (159.39) | (109.93) |
| Age of S to N migration | 7.11 | -6.66 | -15.33* | 4.63 |
| | (11.50) | (4.34) | (6.56) | (4.86) |
| Other migrant | 295.95 | -10.38 | 71.80 | 190.46* |
| | (234.63) | (65.00) | (211.89) | (77.79) |
| Age of other migration | -13.99 | 2.43 | -6.88 | -11.39** |
| | (11.29) | (3.32) | (9.75) | (3.85) |
| Born in North | 25.73 | 65.25* | 96.28 | 47.98 |
| | (88.57) | (25.87) | (68.44) | (28.59) |
| Age in years | -21.45** | -3.31* | -17.87** | -6.01** |
| | (4.38) | (1.49) | (3.33) | (1.52) |
| Low education | -250.52** | -20.86 | -248.86** | -35.15 |
| | (51.75) | (15.95) | (43.00) | (18.21) |
| Income in region in 1931 | 0.09* | 0.02 | 0.01 | 0.01 |
| | (0.04) | (0.01) | (0.03) | (0.01) |
| Migration rate in region | 1.50 | 3.76** | 8.47** | 3.26** |
| | (2.78) | (0.78) | (2.39) | (0.87) |
| Constant | 5,242.25** | 5,539.11** | 5,086.45** | 5,710.00** |
| | (330.70) | (104.90) | (259.37) | (109.34) |
| $\sigma$ | 984.55 | 477.09 | 971.25 | 483.70 |
| | (12.52) | (7.91) | (11.72) | (8.86) |
| $\pi$ | 0.33 | 0.67 | 0.47 | 0.53 |
| | (0.01) | (0.01) | (0.01) | (0.01) |

* $p < 0.05$; ** $p < 0.01$

Table 7: Late cohort FMM estimates of migration effects on MCS

| | Male | | Female | |
|---|---|---|---|---|
| | Comp. 1 | Comp. 2 | Comp. 1 | Comp. 2 |
| South to North migrant | -291.55 | 138.49 | 195.85 | 15.77 |
| | (262.61) | (77.23) | (248.23) | (66.57) |
| Age of S to N migration | 43.84 | -13.62 | -4.78 | 1.97 |
| | (34.29) | (8.64) | (15.29) | (3.94) |
| Other migrant | -342.82 | -73.39 | -176.65 | -48.17 |
| | (248.56) | (55.25) | (210.12) | (46.89) |
| Age of other migration | 33.95 | 12.18 | 2.81 | 0.96 |
| | (42.97) | (6.88) | (13.74) | (3.27) |
| Born in North | 187.10* | -7.98 | 43.38 | 27.67 |
| | (88.23) | (20.80) | (71.74) | (21.46) |
| Age in years | -5.22 | -1.61 | -13.17** | -1.93 |
| | (4.04) | (1.01) | (3.87) | (1.12) |
| Low education | -320.42** | -23.10 | -140.23** | 11.18 |
| | (58.79) | (16.73) | (46.25) | (16.31) |
| Income in region in 1931 | -0.02 | 0.01 | -0.00 | 0.01 |
| | (0.04) | (0.01) | (0.03) | (0.01) |
| Migration rate in region | -1.87 | 0.13 | 1.67 | 1.01 |
| | (2.70) | (0.59) | (2.06) | (0.64) |
| Constant | 4,424.03** | 5,454.58** | 4,554.91** | 5,406.40** |
| | (234.92) | (58.07) | (214.68) | (61.32) |
| $\sigma$ | 970.24 | 436.13 | 980.62 | 455.10 |
| | (11.61) | (6.19) | (10.00) | (6.51) |
| $\pi$ | 0.25 | 0.75 | 0.34 | 0.66 |
| | (0.01) | (0.01) | (0.01) | (0.01) |

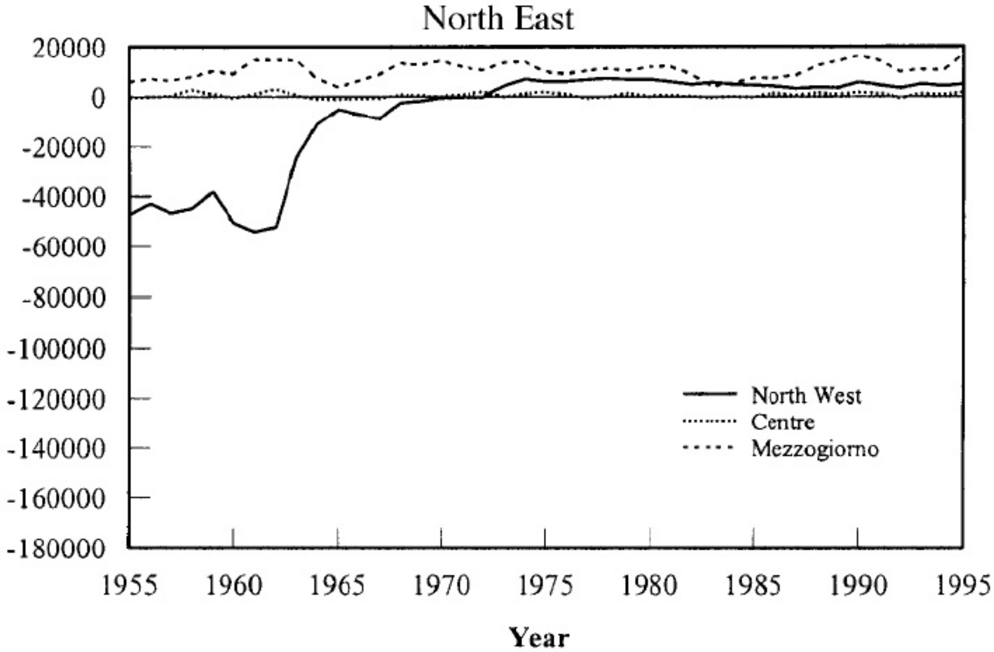
* $p < 0.05$; ** $p < 0.01$

Table 8: OLS estimates of the correlates of the posterior probability

| | PCS | | MCS | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| Born in North | -3.17** | -2.41** | -0.58 | -1.34 |
| | (1.09) | (0.86) | (0.97) | (0.98) |
| Age in years | 0.95** | 0.86** | 0.30** | 0.40** |
| | (0.08) | (0.07) | (0.08) | (0.08) |
| Low education | 4.44** | 3.90** | 0.14 | 1.08 |
| | (0.98) | (0.85) | (0.87) | (0.91) |
| Height in cm | -0.30** | -0.24** | -0.20** | -0.19** |
| | (0.07) | (0.06) | (0.07) | (0.07) |
| *N* | 9,743 | 11,267 | 9,743 | 11,267 |

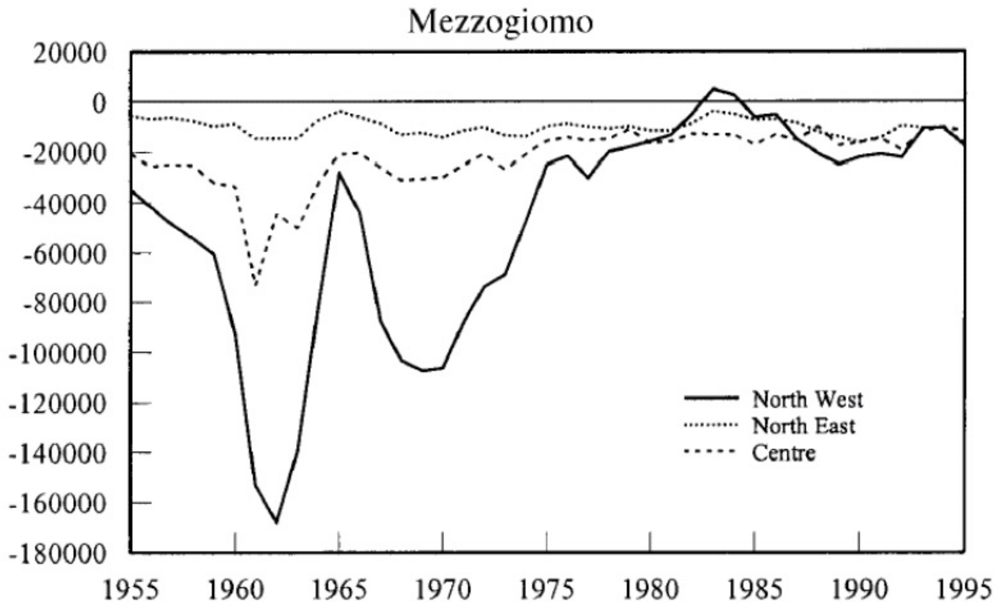
* $p < 0.05$; ** $p < 0.01$

Figure 1: Migration flows from North-East




Source of graph: Bonifazi and Heins, 2000

Figure 2: Migration flows from South




Source of graph: Bonifazi and Heins, 2000

Figure 3: Kernel density of OLS residuals of PCS: Early cohort

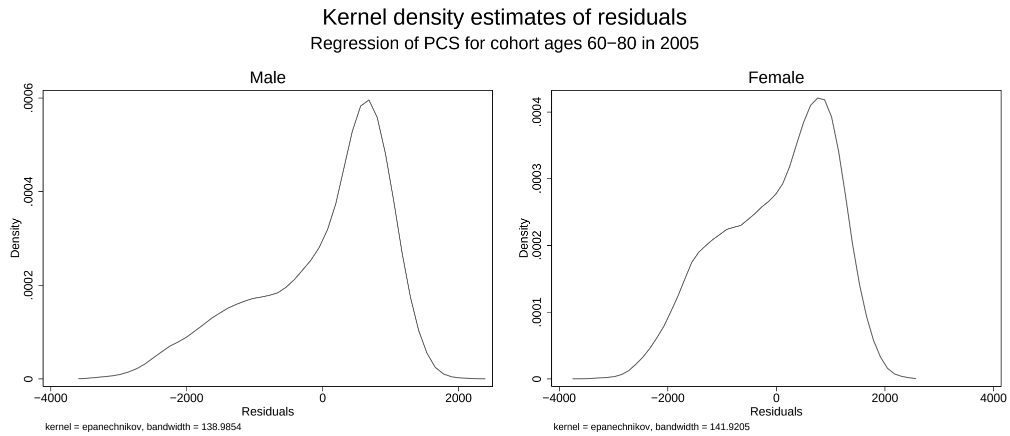



Figure 4: Kernel density of OLS residuals of PCS: Late cohort

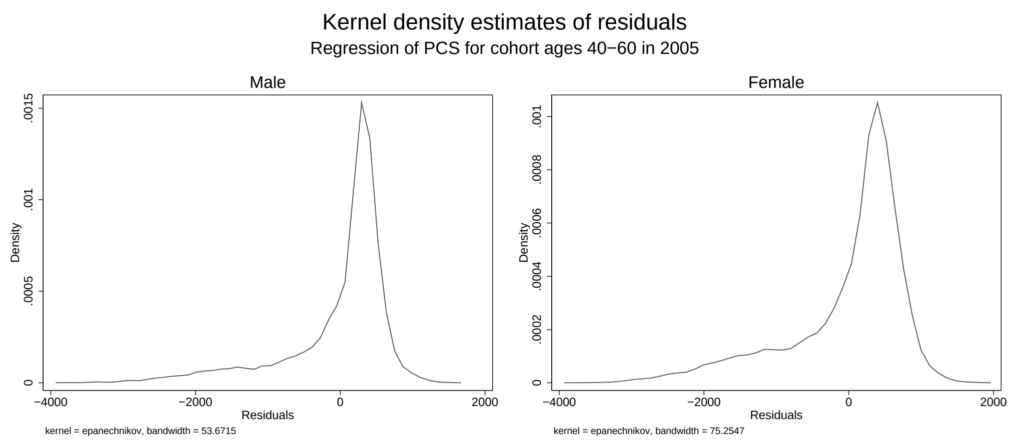


Figure 5: Kernel density of OLS residuals of MCS: Early cohort

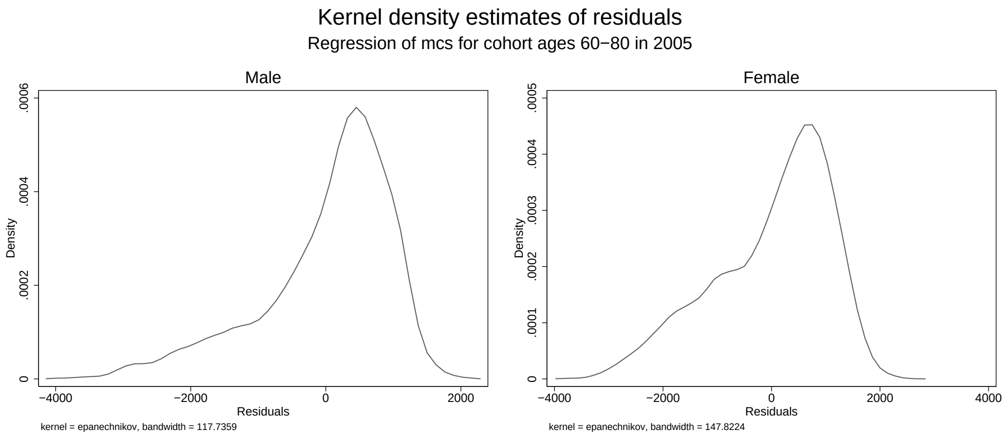



Figure 6: Kernel density of OLS residuals of MCS: Late cohort

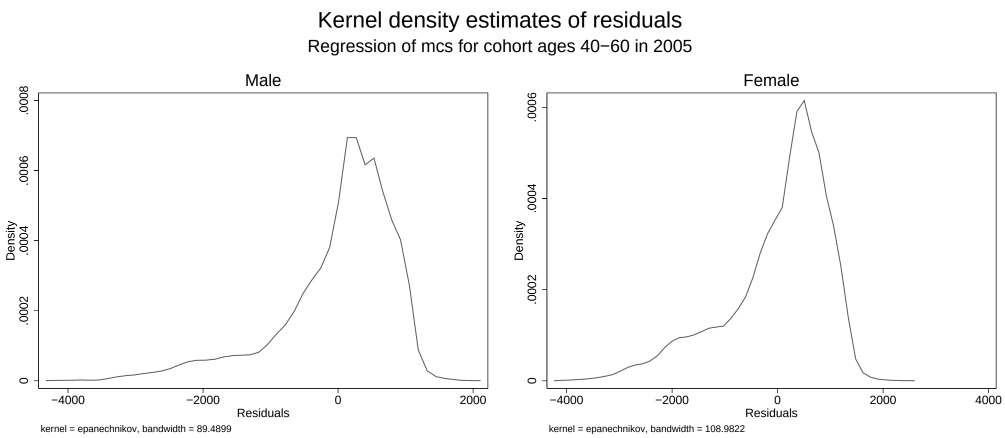
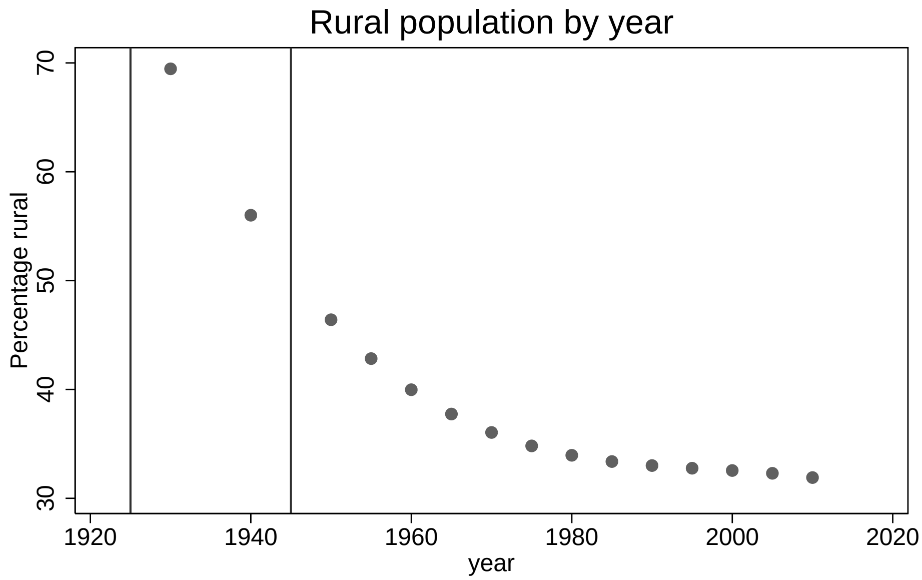


Figure 7: Estimates of rural population percentages by year




Data obtained from World Urbanization Prospects: The 2007 Revision,
Population Division of the Department of Economic and Social Affairs
of the United Nations Secretariat, United Nations, 2011.