



IZA DP No. 4371

## A Cohort Analysis of Labor Participation in Mexico, 1987-2009

Robert Duval-Hernández  
Pedro Orraca Romano

August 2009

# **A Cohort Analysis of Labor Participation in Mexico, 1987-2009**

**Robert Duval-Hernández**

*Centro de Investigación y Docencia Económicas, A.C.  
and IZA*

**Pedro Orraca Romano**

*Secretaría de Finanzas, GDF*

Discussion Paper No. 4371  
August 2009

IZA

P.O. Box 7240  
53072 Bonn  
Germany

Phone: +49-228-3894-0  
Fax: +49-228-3894-180  
E-mail: [iza@iza.org](mailto:iza@iza.org)

Any opinions expressed here are those of the author(s) and not those of IZA. Research published in this series may include views on policy, but the institute itself takes no institutional policy positions.

The Institute for the Study of Labor (IZA) in Bonn is a local and virtual international research center and a place of communication between science, politics and business. IZA is an independent nonprofit organization supported by Deutsche Post Foundation. The center is associated with the University of Bonn and offers a stimulating research environment through its international network, workshops and conferences, data service, project support, research visits and doctoral program. IZA engages in (i) original and internationally competitive research in all fields of labor economics, (ii) development of policy concepts, and (iii) dissemination of research results and concepts to the interested public.

IZA Discussion Papers often represent preliminary work and are circulated to encourage discussion. Citation of such a paper should account for its provisional character. A revised version may be available directly from the author.

## ABSTRACT

### **A Cohort Analysis of Labor Participation in Mexico, 1987-2009\***

This paper conducts a cohort analysis of labor participation in urban Mexico in recent decades. The rates analyzed are the labor force participation, the unemployment rate, and the employment shares of the formal and informal salaried sectors, as well as of self-employment. These rates are decomposed into age, cohort, and time effects. The life cycle patterns of labor force participation and formal employment follow a standard inverted U-shape. Younger workers are more likely to participate in the informal salaried sector, while self-employment increases monotonically with age. However, significant informal salaried employment is also observed among older unskilled workers and women of different ages. Strong countercyclical variations are observed for the informal salaried sector, while the opposite occurs for the formal sector. Self-employment fluctuations are for the most part acyclical. These facts support a mixed view of the labor markets whereby some informal sector workers are rationed out of the formal sector, while others go into this sector voluntarily. The analysis also indicates that the female labor force is countercyclical, suggesting the existence of an "added worker" effect. Long-run generational effects show a steadily rising participation in the informal sector with a corresponding decline in formality among newer generations of salaried workers. Some preliminary explanations for this fact are discussed.

JEL Classification: J21, O17, O54

Keywords: labor force composition, informal sector, Latin America

Corresponding author:

Robert Duval-Hernández  
División de Economía  
Centro de Investigación y Docencia Económicas, A.C.  
Carretera México-Toluca 3655  
Col. Lomas de Santa Fe  
01210 México, D.F.  
Mexico  
E-mail: [robert.duval@cide.edu](mailto:robert.duval@cide.edu)

---

\* The authors would like to thank seminar participants at Mexico's Central Bank for valuable suggestions and comments. The remaining errors are our sole responsibility. The views in this paper should not be interpreted as reflecting the views of the institutions where we work.

# 1 Introduction

This paper analyzes participation in the labor force, unemployment, and employment in the formal and informal salaried sectors of the economy, as well as in self-employment in urban Mexico over the past two decades.

While the literature has analyzed these topics for Mexico and other developing countries, most studies have relied on cross-sectional databases or short-lived panels at best. Instead, this paper uses a series of comparable cross-sectional surveys to conduct a cohort analysis of labor participation over a long period of time.

The advantage of a cohort analysis is that it disentangles the life cycle, the generational, and the business cycle fluctuations of participation. The decomposition of the aforementioned rates in these three components gives a series of interesting stylized facts that can be related to different labor market theories for developing countries.

For instance, the study of life cycle patterns allows one to test theories positing that the informal salaried sector serves as an entry stage where young workers acquire labor market experience, then migrate to the formal sector, and finally retire into self-employment by opening a small business.

The estimated generational effects allow the identification of the long-run trends in labor participation. Such trends cannot be properly studied by only looking at the evolution of the aggregate rates over time because of the confounding effects of age and business cycle variations. The analysis of these long-run dynamics provides new evidence about structural changes in the economy and opens a new series of questions not yet addressed in the literature.

Finally, isolating the business cycle fluctuations in the labor supply provides useful information on which sectors of the economy have a procyclical employment pattern and which have a countercyclical one. This

evidence becomes relevant for the controversy over the role of the informal sector as a second-best option versus models that explain the existence of this sector as the product of the natural alignment of forces of comparative advantage.

The comparison between the cyclical participation in the workforce of men and women with different education levels also helps the testing of the extent to which there is an “added worker” effect for certain population groups in times of economic crisis.

Section 2 presents a brief review of the literature that is relevant for Mexico. Section 3 discusses the methodology followed and the data used in the paper. Section 4 presents the results of the analysis, and section 5 concludes.

## **2 Related Literature**

The literature has extensively considered the labor supply in developing countries, not only focusing on the decision of entering the labor force but also analyzing the determinants of working in the formal versus the informal sector of the economy.

For the case of Mexico, analyses of labor force participation have mostly focused on specific population groups like women, children or the elderly (see for instance García and de Oliveira, 1994; Wong and Levine, 1992; van Gameren, 2008). Studies documenting trends in the overall labor force have shown increased labor participation driven by a rapidly rising female workforce. In contrast, the male labor force participation has remained relatively stable over the years. In addition, it has been shown that the participation over the life cycle follows the traditional inverted-U shape, although for men this curve reaches its peak at earlier ages than for women (see for instance Inter-American Development Bank, 2003).

Another area of recent research has been the response of labor force participation to macroeconomic shocks. In particular, some authors have argued that households increase their labor supply when facing a

negative aggregate shock (Hernández Licona, 1997; Inter-American Development Bank, 2003). This usually comes in the form of an increased labor supply of women and young adults not previously working. This phenomenon is known in the Labor Economics literature as the *added worker* effect (Lundberg, 1985). However, other studies have failed to find strong evidence supporting such response in the Mexican case (McKenzie, 2003). This remains an unsolved issue in the literature.

The study of participation in the formal versus the informal sector has been extensively studied too for the case of Mexico. In particular, the attention has been directed at assessing whether the existence of a large informal sector is evidence of labor market segmentation or whether workers voluntarily choose the informal sector over the formal one.

In a long series of papers, William Maloney and coauthors have questioned the segmented view of the labor markets for Mexico and Latin America (Maloney, 2004; Bosch and Maloney, 2007; Perry, Maloney, Arias et al., 2007, are some examples). In Bosch and Maloney (2007) the authors present an analysis on the transitions between the formal and informal sectors of the economy over different phases of the business cycle. One of their main findings is that participation in the informal sector is countercyclical, mostly because the job finding rates in the formal sector are procyclical and less because the formal sector is expelling workers during recessions.

Another study providing evidence on sector transitions in Mexico is Gong, van Soest, and Villagómez (2004). The paper uses a dynamic multinomial logit model to analyze the transition patterns between the informal and formal sectors, and non-participation in periods before and after the 1994 Peso crisis. The authors find that entry and exit rates for the formal sector are lower than those of the informal sector are. In addition, the probability of formal sector employment increases with education, while that of working in the informal sector decreases with family income. The authors interpret these findings as providing support for the view that the informal sector is a temporary state for workers rationed out of the formal sector.

More recently, Calderón-Madrid (2008) analyzes unemployment duration in Mexico and its relation with transitions into the formal and informal sectors. The author concludes that some workers displaced from the formal sector into unemployment eventually start reducing their formal sector reservation wage. In addition, they start looking for jobs in the informal sector.

Finally, a number of studies related to this paper analyze the participation in the informal sector over the life cycle. The main findings in this regard are that young individuals have higher participation rates in the informal salaried sector (i.e., informal workers who do not own their business), while older workers are more likely to be self-employed. These findings have led researchers to propose a “staging” hypothesis, whereby many workers would voluntarily start their work life as informal employees in order to acquire labor market experience, then become formal sector workers, and finally, after having accumulated capital and experience, transition into self-employment (see, for instance, Maloney and Aroca, 1999; Maloney, 2004; Perry, Maloney, Arias et al., 2007).

### 3 Methodology and Data

This section discusses the cohort analysis methodology followed then presents the data used.

#### 3.1 Methodology

Cohort analysis is based on the idea of following a *group* of individuals (i.e., a “cohort”) over different points in time, hence tracking their behavior dynamically. The main difference between this methodology and a regular panel data study is that the latter follows each single individual or household over different periods (unless the unit of observation unexpectedly drops out of the sample), while the former only tracks entire population groups, and not particular individuals/households.

If we have comparable cross-sectional surveys collected at different points in time it is possible to construct a “pseudo-panel” following dynamically specific groups of the population. For instance, the *average* behavior

of males born in 1977 can be tracked over time by means of cross-sectional surveys, even if the individuals in this cohort who appeared in the initial survey are not subsequently re-interviewed. In other words, cohort analysis assumes that on average the behavior of a group of individuals is well approximated at other points in time by the behavior of other individuals belonging to the same cohort, even if they are not necessarily the ones initially surveyed.

The use of pseudo-panels presents a clear advantage over the analysis of a single cross-sectional survey at a given point in time. First, pseudo-panels help one to study the dynamic behavior of a population group, something impossible to do with a single cross-section. Secondly, when life cycle profiles are generated with cross-sectional data, the results confound age effects (i.e., life cycle effects) with generational effects (i.e., cohort effects) because it is impossible to disentangle those two with only one observation in time.

In comparison with real panel data, the analysis of cohorts has the disadvantage of not tracking over time the same units of observation but only following groups of them. In practical terms, however, pseudo-panels can have an advantage over short-lived panels by extending the time span of a study. Another advantage occurs if the available panel data has high levels of attrition between waves, something that could bias estimations performed on the observations remaining in the panel over time. Since in developing countries (Mexico not being the exception) panel data are usually short-lived and have high attrition rates, the use of pseudo-panels is justified to analyze long-run dynamics.<sup>1</sup>

The approach followed in this paper is to construct pseudo-panels tracking the labor participation for population groups classified in cohorts according to their year of birth, gender, and education level.

The analysis consists of decomposing the various participation rates in age, cohort and time effects. The age effects capture the standard life cycle patterns in the data. The cohort effects illustrate the evolution of the rates across generations, while the time effects capture the variations in the rates as a response to business cycle fluctuations.



The decomposition method followed is the one proposed by Deaton (1997).<sup>2</sup> If we denote by  $p_{ct}^s$  the participation rate of the cohort  $c$  at time  $t$  in sector  $s$ , the method decomposes the rate in the aforementioned effects as

$$\ln\left(\frac{p_{ct}^s}{1-p_{ct}^s}\right) = \theta + \alpha_a + \kappa_c + \tau_t + \epsilon_{ct} \quad (1)$$

where  $\alpha_a$  represents the age effect at age  $a$ ,  $\kappa_c$  represents the cohort effect for generation  $c$ ,  $\tau_t$  is the aggregate time effect at period  $t$ , and  $\epsilon_{ct}$  is an error term.

The participation rates are introduced in log-odds because we make predictions of the age, cohort and time profiles of these rates and this specification ensures that the linear predictions fall within the (0,1) range.<sup>3</sup> The model is estimated by least-squares weighted by the cohort population size.<sup>4</sup>

In order to allow for the greatest flexibility in the estimation of the effects, we use a full set of dummy variables for each age, cohort and period. Since there is perfect collinearity between the three effects, an additional restriction is needed to identify the model.<sup>5</sup> The normalization imposed here is that the time effects are orthogonal to a time trend, which implies that all the growth in the dependent variables is attributed to age and cohort effects.

## 3.2 Data

The data used comes from the National Survey of Urban Employment (“Encuesta Nacional de Empleo Urbano” or ENEU) from 1987 to 2002, and its offshoots, the National Survey of Employment (“Encuesta Nacional de Empleo” or ENE) from 2002-2004, and the National Survey of Employment and Occupation (“Encuesta Nacional de Ocupación y Empleo” or ENOE) from 2005 onwards.

These labor surveys are conducted on Mexican households in urban areas, although more recently the coverage has expanded to include rural areas. They collect information on socioeconomic characteristics such as age, gender, education, marital status, labor force participation, labor market earnings, sector of

employment, occupation, hours worked in the market, among others. The surveys are representative at the city and state levels and are used by the government to generate unemployment statistics.<sup>6</sup>

Although the database is a rotating panel with quarterly data tracking households for one year, each quarterly survey is treated as a separate cross-section because of the short time span of the panel and its high attrition rates (see for evidence Duval Hernández, 2006).

Since the samples from 1987 to 2002 are urban, and since informality is usually conceptualized as an urban phenomenon, the analysis is limited to urban areas.<sup>7</sup>

A cohort is defined by year of birth, gender, and education level, namely: elementary (0-6 yrs of education), middle (7-12 yrs. of education) or higher (13+ yrs. of education). The analysis is for the most part based on individuals aged between 20 and 70 years in order to fully span the life cycle of labor participation. The lower age range of 20 is selected because after this point very few individuals change between the previous education categories, guaranteeing that the cohort analysis tracks the same population groups over time. In all cases the participation rates estimated per cohort/period are based on cells averaging the behavior of more than 100 individuals.

The years available in the data go from 1987 to early 2009. This means that each cohort is tracked for at most 89 periods.<sup>8</sup> These years include several periods of growth, the major recession following the 1994 Peso crisis, and the beginning of the recent 2008 global financial crisis. This period also captures the years of trade liberalization in Mexico.

The participation rates to be analyzed are: 1) Labor force participation rate; 2) Unemployment rate; 3) Employment share of the formal salaried sector; 4) Employment share of the informal salaried sector; and 5) Share of self-employment.

In this paper, we consider an individual to be in the informal sector if s/he lacks coverage at a social security institution or if the job does not provide her/him with medical coverage. This clearly is not the

only possible definition of informality (see, for instance, Charmes, 1990; Fields, 2008), but it is one closely related to the well-being of workers.

Self-employment is treated as a separate category. It is not appropriate to apply the aforementioned coverage criterion to this sector because the Mexican labor code does not require self-employed individuals to enroll themselves in social security institutions.<sup>9</sup>

An alternative classification criterion would further divide the self-employed depending on whether they are operating a registered business. Unfortunately, this approach cannot be implemented because the questionnaire on business registration changed in 2005, making the employment rates in registered businesses not comparable over time.

## 4 Results

In this section, we present the results of the estimation of the age, cohort and time effects derived from equation (1). First, however, we discuss the overall evolution of the aggregate participation rates over the studied period.

Figure 1 contains the labor force participation and unemployment rates for men and women of different education groups. This graph shows that for most groups, participation in the labor force has been rising over time, with the exception of males with a higher level of education, who have a stable participation, and of unskilled males, who exhibit a decreasing workforce participation trend.

The labor force participation of women is about half of that of men. However, their participation has been rapidly rising, especially among women with the highest level of education. Unlike the case of men, where the participation rates are converging among education groups, in the case of women there is a parallel increase in labor participation with the level of education at all points in time.

The unemployment rates portray the aggregate cyclical fluctuations in the economy. From 1987 to 1991

the Mexican economy was in an expansive phase recovering from its crises in the first part of the 1980s. It then started a relative slowdown until late 1994, when the Peso crisis hit the economy. From that point until 1997, the economy suffered high unemployment rates due to the crisis. Unemployment fell from 1997 to 2001. At that point, the economy started decelerating again as a consequence of the recession in the US economy. From 2004 to 2008, unemployment stabilized at rates of 4% to 5%, only to start rising afterwards as a result of the recent global financial crisis.

The fact that unemployment rates in Mexico are relatively low in comparison with those in developed countries and that the lowest unemployment rates occur among unskilled individuals indicates that a long job search process while unemployed is a “luxury” that most workers cannot afford. Instead, workers will lower their reservation wages and take jobs that are less than ideal because they cannot remain without an income source for long periods of time (see, for instance, Hernández Licona, 1997).

In Figure 2, we observe that the employment share of the formal salaried sector has been decreasing over time, especially for workers with middle and low education levels. Formal sector participation clearly increases with education, with the formal sector representing a share of above 60% of the employed skilled population, while this sector only represents a share of about 30% for employed unskilled individuals. Women with middle and high education levels have higher participation rates in this sector than do men, but the opposite occurs for unskilled workers.

The opposite picture in sector participation occurs for the informal salaried sector. In this case, participation decreases with education, especially in the case of women, and the sector shares have increased over the years for every group, but the high-skilled workers. In the case of unskilled women, employment in this sector now comprises half of the total employed population.

Finally, for the case of self-employment, we observe the highest participation shares among unskilled workers, (for these workers self-employment amounts to about 30% of the employed population). In addition,

the employment shares in this sector have increased over the years for females with intermediate education levels.

In addition to observing the evolution of the overall participation rates, we also present in Figures 3 and 4 the raw life cycle profiles for different cohorts observed in the data.<sup>10</sup>

These raw profiles illustrate that the participation in the labor force and in the formal salaried sector have an inverted-U shape over the life cycle, while unemployment and participation in the informal salaried sector decrease between ages 15 and 30 and stabilize at a lower level or sometimes slightly increase afterwards. Finally, participation in self-employment steadily increases with age.

The fact that several of these graphs present displacements between segments indicates the presence of cohort (or generational) effects for a given age. Such displacements are particularly marked for the labor force participation of women. These strong inter-cohort differences are expected, given the changing insertion of women in the labor market in recent decades.

The next section presents the results of the decomposition method (1) disentangling age, cohort, and time effects for males and females with different education levels. As mentioned before, in order to avoid misclassification errors due to young individuals changing education cohorts, the following analysis is limited to workers aged between 20 and 70 years.

## 4.1 Age Effects

The first row in Figure 5 illustrates the life cycle profiles of labor force participation free of cohort and business cycle effects. For men these profiles have a standard inverted-U shape, with highly skilled workers entering the labor force at a later age, which is expected because of the extra time required to acquire human capital. For all male groups, participation is high and stable until around age 55 when workers start retiring.<sup>11</sup>

While for women the profiles also have an inverted-U shape, there are important differences worth noting.

First, unlike the case of men, where labor force participation is somewhat homogeneous among education groups, female participation in the labor force strongly increases with education at virtually all ages. This is consistent with a market where men are the main “breadwinners” in the household, while it is mainly the more educated women who are abandoning their traditional role as housewives to start working in the market.

Women start retiring as early as age 50, although the moment of retirement is delayed for females with low educational attainment.

More interestingly, female labor force participation decreases between ages 20 and 25 for all education groups, and then grows again for the next 25 years. This slowdown in labor participation at an early age is most likely associated with child-rearing obligations undertaken for the most part by women.

In the second row of Figure 5 we present the unemployment age profiles. These profiles together with the ones in Figure 3 confirm that unemployment is a phenomenon mostly affecting young workers who have recently entered the job market and have a high job turnover rate. However, for workers with high levels of education the unemployment rates grow again after age 50.

Life cycle profiles by employment sector are presented in Figure 6. In the first row of this figure, we observe that participation in formal salaried jobs peak around age 20 for workers with low or middle education levels, and between ages 25 to 30 for workers with 13+ years of education. After this peak, the employment shares steadily decline for all groups, although this fall is less marked for educated females.

The estimated age profiles for the informal salaried sector display a U-shaped form for males. In other words, there is higher participation among young workers. The participation level stabilizes over time, then starts rising after age 60, especially among workers with 12 years of education or less. It is important to note that this later rise occurs at a point where men begin retiring from the labor force. This, along with the

fact that the steepest increases occur for less educated workers, suggests that many individuals who cannot afford retiring continue to work in the informal salaried sector.

For women the situation is more complex. While we saw in Figure 4 that the highest (albeit declining) female participation shares in this sector occurred for teenagers, after age 20 there is a rising trend of participation among women without a college education. This means that the informal salaried sector plays an important role in employing this group of women as they age. Women with higher education are more likely to work in this sector only while they are young, but as they age, their participation stabilizes at a low level without rising again.

Finally, the estimated life cycle profiles for the self-employed show participation monotonically increasing with age for all population groups. This finding is consistent with previous studies and probably occurs because in order to become a successful entrepreneur it is necessary to have some labor market experience as well as some accumulated capital.

The profiles depicted in Figure 6 indicate that while the “staging” hypothesis discussed in section 2 might be true for some workers, it certainly does not apply widely. In particular, the data corroborates the high participation shares of young workers at informal salaried jobs. However, as we have seen, among less-educated workers there is still an important fraction participating in this sector at advanced ages. This is particularly important for women who have rising informal sector participation shares as early as age 20.

It seems hard to argue that the significant participation in the informal salaried sector among elderly workers and women reflects a voluntary decision, especially since jobs in this sector pay the lowest wages, do not provide the independence of self-employment, and have minimal or non-existent associated fringe benefits.

## 4.2 Cohort Effects

In Figure 7, the evolution of participation in the workforce and unemployment over cohorts is presented.

The first graph in this figure indicates that the labor force participation of men has remained stable over generations at high levels of participation, with the exception of a small decline in participation rates among new generations of unskilled males.<sup>12</sup>

Female labor force participation has rapidly increased over generations, especially among the low-skilled. These patterns are consistent with those observed elsewhere in the world (see, for instance, Beaudry and Lemieux, 1999).

Unemployment rates present a slowly increasing trend, indicating that this phenomenon is becoming more prevalent among newer generations.

The graphs with the sector shares over generations are presented in Figure 8. These graphs show that employment in the formal sector has decreased steadily over generations and that this decline has been steeper for less-educated workers. The exact opposite pattern is observed with the informal salaried sector, i.e., employment in informal salaried jobs has been steadily increasing across generations, and the largest increases have occurred among less-educated individuals.

Finally, the participation in self-employment over generations is stable for men. For females, however, there is increasing employment share in entrepreneurial activities across new generations of workers with medium or high levels of education, but there is a decreasing employment share for unskilled women.

As previously mentioned, the relevance of these profiles is that they isolate the true generational effects from the confounding impacts of life and business-cycle variations. The steady decline in formality across generations, with its concurrent increase in salaried informality, as well as the fall in self-employment among new generations of unskilled women are important findings that have not been properly explained in the



literature.

### 4.3 Cyclical Components

To end the presentation of results, we discuss the cyclical fluctuations in the participation rates. In order to emphasize the cyclical variations rather than the absolute divergence in overall levels, all of the components are presented as deviations from their means.

A look at the plots in Figures 9 and 10 shows that in general, the cyclical components are very similar between men and women. The only exception to this occurs with the cyclical variations of the labor force participation.

Taking the unemployment rate as an indicator of the business cycle fluctuations, we see, by comparing the top panel in Figure 9 with the bottom one, that the labor force participation of men moves somewhat procyclically, while that of women seems to move countercyclically.

The cyclical variations in the formal and informal salaried sectors go in opposite directions, and the latter move in sync with the fluctuations in unemployment. In other words, for salaried workers employment in the formal sector is procyclical, while employment in the informal sector is countercyclical.

The fluctuations in self-employment look somewhat countercyclical for the case of men, but for women there is not a clearly discernable pattern.

To better understand how these fluctuations are related to macroeconomic shocks in the economy, Table 1 presents the elasticities of the cyclical participation rates with respect to the GDP cycle. In particular, the estimation is based on an OLS regression where the dependent variable is the log of the cyclical component of labor participation for each of the five employment categories by cohort. The independent variables are the log of quarterly real GDP, the predicted log GDP trend based on a linear prediction, and a set of quarterly dummies to control for seasonal effects.<sup>13</sup> Given the trend and seasonality controls included, the parameter

of the variable  $\log$  GDP is the elasticity of the participation rates with respect to cyclical GDP. The first two columns of the table use contemporaneous GDP as regressor, while the last two use lagged ( $\log$ ) GDP, to allow for possible lags in the cyclical response of employment to aggregate fluctuations and to eliminate the possibility of endogeneity between labor supply and GDP.

In this table, we can see that the labor force participation of men with 12 years of education or fewer is slightly procyclical. In particular, a one-percent decrease in the GDP cycle reduces the male labor force participation in about 0.03% for the aforementioned education group. For females, the opposite occurs: a similar decrease in GDP brings about a 0.2% increase in labor force participation. This effect is particularly marked for women without a college education.

These findings support the idea that in Mexico there is an “added worker” effect, whereby women increase their participation in the labor market in bad times to compensate for falling incomes in the household.

As expected, unemployment is also strongly countercyclical. On average, a one-percent increase in GDP reduces unemployment in about 6%.

In addition, the participation in the formal salaried sector is strongly procyclical, especially for unskilled individuals and particularly for unskilled females. On the other hand, the informal salaried rates are strongly countercyclical, especially among skilled workers.

As previewed in the figures the self-employment share is acyclical with respect to GDP, although for males there is some countercyclical relationship with the lagged GDP.

The fact that the informal salaried sector expands while the formal sector contracts in times of recession, supports the idea that informal salaried jobs, and to a lesser extent self-employment, serve as a second-best option for some workers when the economy slows down or enters a recession.<sup>14</sup>

## 5 Conclusions

In this paper, we analyzed labor force participation, unemployment, and participation in formal and informal salaried jobs as well as in self-employment for urban Mexico between 1987 and early 2009. A cohort analysis was conducted, and each participation rate was decomposed into age, cohort, and time (or cyclical) effects.

Rather than reiterating our findings, in this section we discuss what we consider to be important implications stemming from the results obtained.

First, the overall labor supply of men is quite stable at high levels of participation, while that of women is increasing significantly across generations for all education groups. However, the labor force participation of unskilled males has been slowly falling for newer generations. Whether this is related to factors like international migration, an income effect, or even increasing participation in illegal activities is something that requires further investigation.

Our results suggest that while the labor force participation of women has been increasing over generations, women of all educational levels slow down their labor supply as a product of childbearing. This implies that when dynamically modeling the labor supply of women, it is important to endogenously account for the timing of fertility decisions.

Regarding the cyclical variations of the female labor force participation, we find that this participation is countercyclical, especially among women with 12 years of education or less. For less-educated males, labor force participation is procyclical. This provides some support to the hypothesis that there is an “added worker” effect taking place during economic downturns.

The age profiles for the informal salaried sector show that younger workers are much more likely to participate in it. However, after age 30 (or sometimes earlier) participation in this sector starts rising again, especially among unskilled workers and women. Given that the informal salaried sector pays the

lowest wages, provides no benefits, and lacks the independence of self-employment, it is hard to believe that middle-aged and old unskilled workers are voluntarily dropping out of the formal sector to work as employees at an informal business.

The “staging” hypothesis, whereby workers voluntarily move from the informal salaried sector to the formal sector and then into self-employment as they age, receives support mainly for skilled workers.

In addition, the strongly countercyclical fluctuations in informal salaried employment, along with the corresponding procyclical movements in formal employment shares, suggest that informality serves as a second-best option for salaried workers when the economy slows down, as some dualist models posit.

However, the behavior of self-employment is only slightly countercyclical for men and acyclical for women, suggesting that it is more likely to find workers voluntarily opting out of formal sector jobs in this category.

The implication of these findings for the segmented vs. competitive views of the informal sector is that a good place to start looking for workers “rationed out” of the formal sector is among middle-aged and older workers, as well as women with relatively low levels of education, employed in the informal salaried sector.

While our paper does not directly address the ongoing debate on the segmentation of labor markets, it provides evidence supporting a heterogeneous view of the informal sector where some workers are voluntarily participating in it, while others are not.

Finally, the methodology adopted in this paper illustrates the advantages of performing a cohort analysis to disentangle long-run trends in labor participation.

In this regard, our analysis shows a steadily rising share of employment in the informal salaried sector among newer generations, to the detriment of participation in the formal sector. These changes are more marked for unskilled workers.

Should this tendency continue in the future, Mexican labor markets will see an expansion of informal salaried jobs in the years to come. This is particularly worrisome since the labor productivity in this sector

is low, as are wages (Duval-Hernández, 2006).

Further research is needed to understand what is behind these trends. One possibility is simply that the creation of jobs in the formal sector is falling behind the rising labor participation of new entrants in the market. Another possible explanation is that there are institutional factors making participation in the formal sector less attractive for newer generations. A recent theory by Levy (2008) proposes that informality has risen over the last few years as a consequence of a social protection policy that disincentives participation in the formal sector. However, this theory applies to the actual rates over time and does not explain why we would find different impacts across generations.<sup>15</sup>

The rise in informality seems paradoxical in light of the rising educational attainment of newer generations (see, for instance, figure A-1 in the Appendix). One possible reconciliation of these two facts would be if, as a product of a more skill-oriented economy, the number of formal sector jobs available to unskilled workers is shrinking faster than the reduction in the number of unskilled workers across generations, *and* the rising number of formal sector jobs for skilled workers is not enough to compensate for the increasing number of workers with medium and high levels of education.

In any case, to fully understand these long-run trends, a detailed labor market model is required. This is an unexplored area that requires more research in the future.

## References

- Antman, Francisca, and David J. McKenzie. 2007a. "Earnings Mobility and Measurement Error: A Pseudo-Panel Approach." *Economic Development and Cultural Change* 56, 1:125–161.
- . 2007b. "Poverty Traps and Nonlinear Income Dynamics with Measurement Error and Individual Heterogeneity." *Journal of Development Studies* 43, 6:1057–1083.
- Beaudry, Paul, and Thomas Lemieux. 1999. "Evolution of the Female Labor Force Participation Rate in Canada, 1976-1994: A Cohort Analysis." *Canadian Business Economics* 7, 2:57–70.
- Bosch, Mariano, and William F. Maloney. 2007. "Gross Worker Flows in the Presence of Informal Labor Markets: Evidence from Mexico, 1987-2002." IZA Discussion Paper Series no. 2864.
- Calderón-Madrid, Angel. 2008. "Unemployment dynamics in Mexico: Can micro-data shed light on the controversy of labor market segmentation in developing countries?" Unpublished manuscript.
- Charmes, Jacques. 1990. "A Critical Review of Concepts, Definitions, and Studies in the Informal Sector." In *The Informal Sector Revisited*, eds. D. Turnham, B. Salomé, and A. Schwarz. Paris: OECD.
- Deaton, Angus. 1997. *The Analysis of Household Surveys. A Microeconometric Approach to Development Policy*. Baltimore: The John Hopkins University Press.
- Deaton, Angus, and Christina H. Paxson. 1994. "Saving, growth and aging in Taiwan." In *Studies in the Economics of Aging*, ed. David A. Wise. Chicago University Press for the National Bureau of Economic Research.
- Duval Hernández, Robert. 2006. *Dynamics of labor market earnings and sector of employment in urban Mexico, 1987-2002*. Ph.D. thesis, Cornell University.
- Duval-Hernández, Robert. 2006. "La Evolución Salarial en México." Manuscript, Inter-American Development Bank.
- Fields, Gary S. 2008. "'Informality': It's Time to Stop Being Alice-in-Wonderland-ish." Unpublished manuscript.
- García, Brígida, and Orlandina de Oliveira. 1994. *Trabajo Femenino y Vida Familiar en México*. México: El Colegio de México.
- Gong, Xiaodong, Arthur van Soest, and Elizabeth Villagómez. 2004. "Mobility in the Urban Labour Market: a Panel Data Analysis for Mexico." *Economic Development and Cultural Change* 53:136.
- Hall, Robert E. 1971. "The measurement of quality change from vintage price data." In *Price Indexes and Quality Change*, ed. Zvi Griliches. Cambridge, Mass.: Harvard University Press.
- Hernández Licona, Gonzalo. 1997. "Oferta laboral familiar y desempleo en México. Los efectos de la pobreza." *El Trimestre Económico* LXIV, 4:531–568.
- Inter-American Development Bank. 2003. *Good Jobs Wanted: Labor Markets in Latin America*. Washington, D.C.: Inter-American Development Bank.

- Levy, Santiago. 2008. *Good Intentions, Bad Outcomes. Social Policy, Informality, and Economic Growth in Mexico*. Washington, D.C.: Brookings Institution Press.
- Lundberg, Shelly. 1985. "The Added Worker Effect." *Journal of Labor Economics* 3, 1:11–37.
- Maloney, William F. 2004. "Informality Revisited." *World Development* 32, 7:1159–1178.
- Maloney, William F., and P. Aroca. 1999. "Logit Analysis in a Rotating Panel Context and an Application to Self-Employment Decisions." The World Bank Policy Research Working Paper no. 2069.
- McKenzie, David J. 2003. "How do Households Cope with Aggregate Shocks? Evidence from the Mexican Peso Crisis." *World Development* 31:1179–1199.
- Perry, Guillermo E., William F. Maloney, Omar S. Arias, Pablo Fajnzylber, Andrew D. Mason, and Jaime Saavedra-Chanduvi. 2007. *Informality: Exit and Exclusion*. Washington, D.C.: The World Bank.
- van Gameren, Edwin. 2008. "Labor Force Participation of Mexican Elderly: The Importance of Health." *Estudios Económicos* 23, 1:89–127.
- Wong, Rebeca, and Ruth E. Levine. 1992. "The Effect of Household Structure on Women's Economic Activity and Fertility: Evidence from Recent Mothers in Urban Mexico." *Economic Development and Cultural Change* 41, 1:89–102.

# Figures and Tables

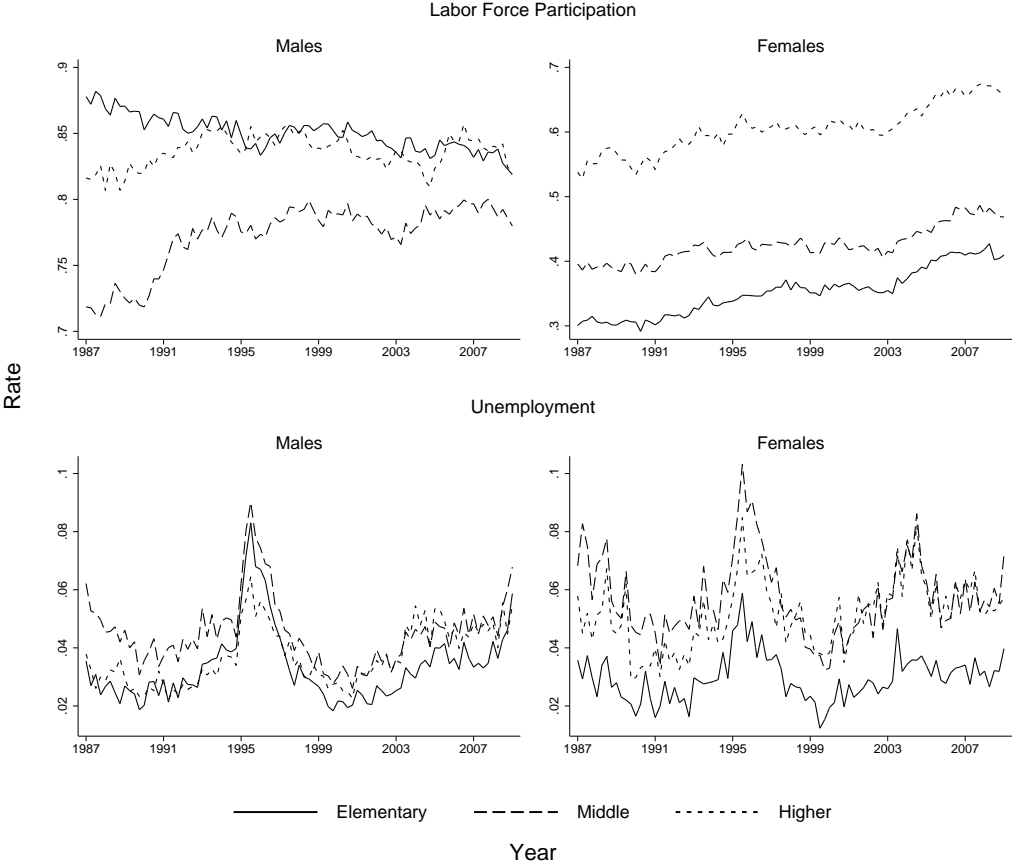


Figure 1: Labor Force Participation and Unemployment Rates



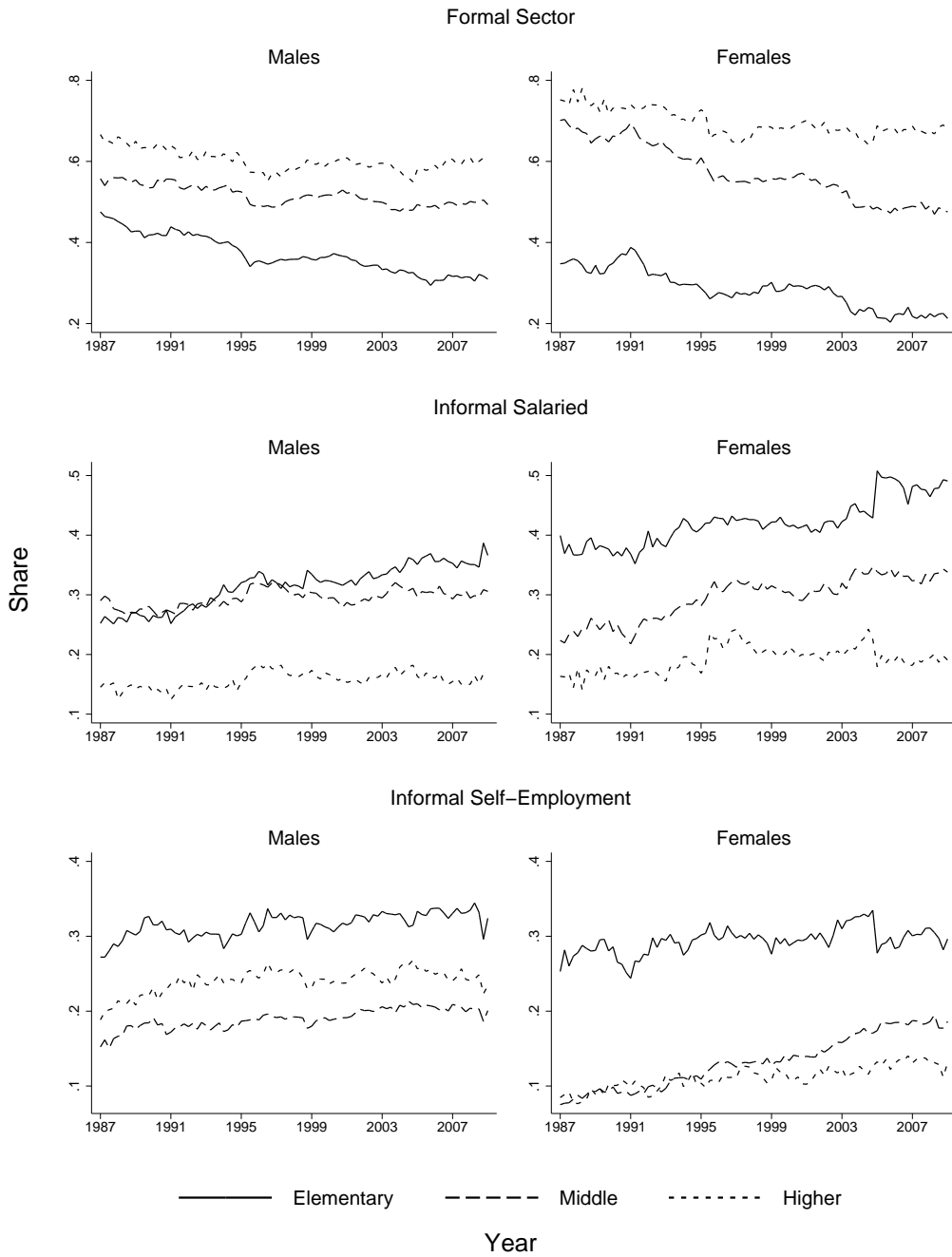


Figure 2: Sector Employment Shares

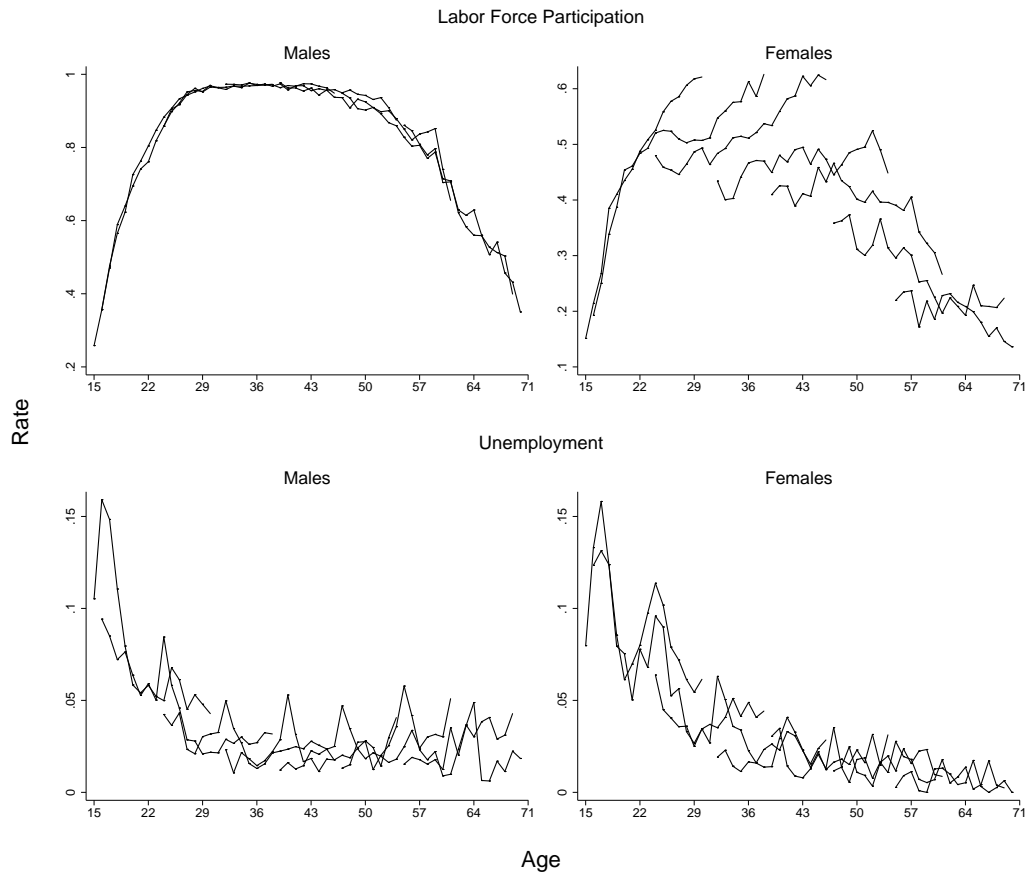


Figure 3: Raw Life Cycle Profiles I

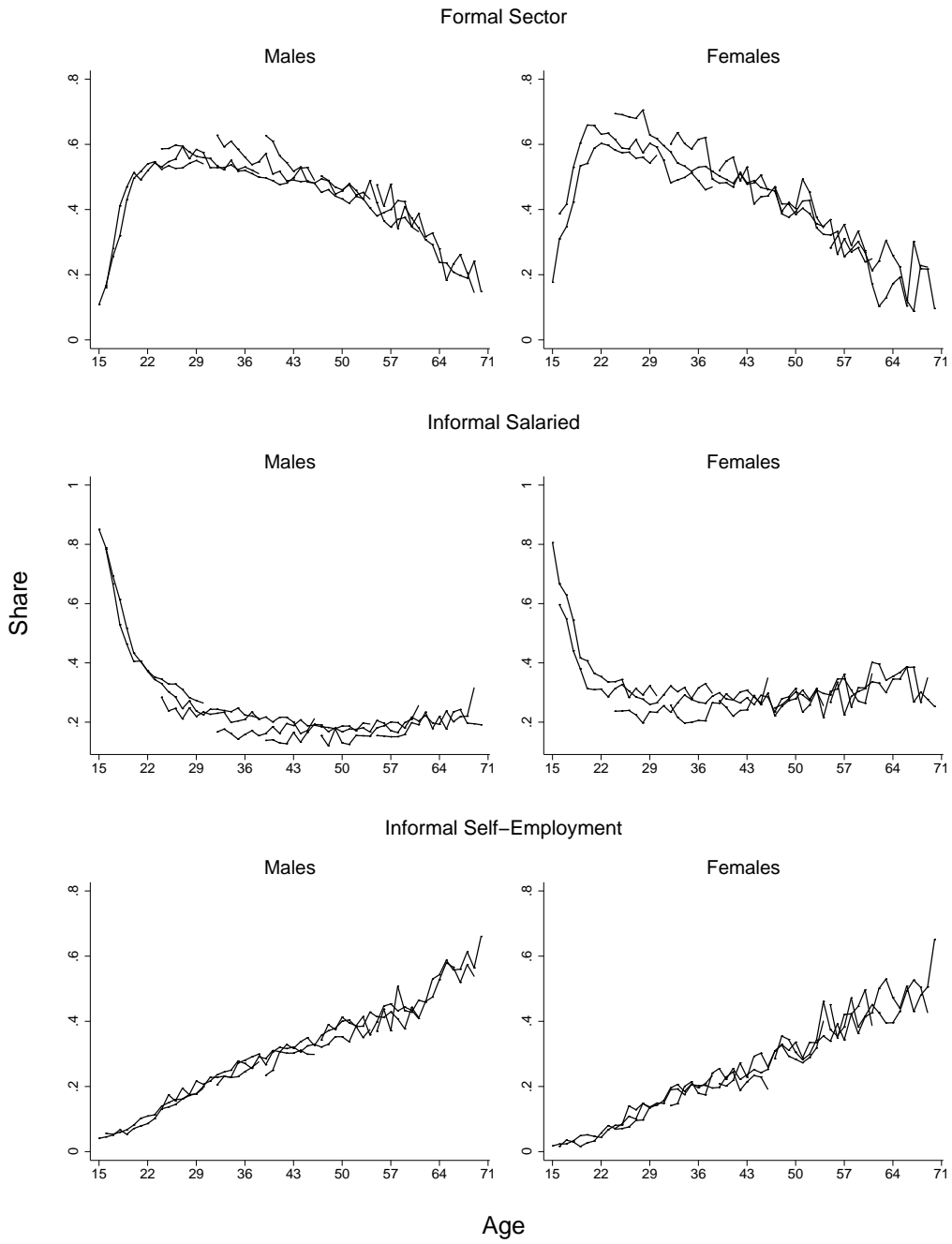


Figure 4: Raw Life Cycle Profiles II

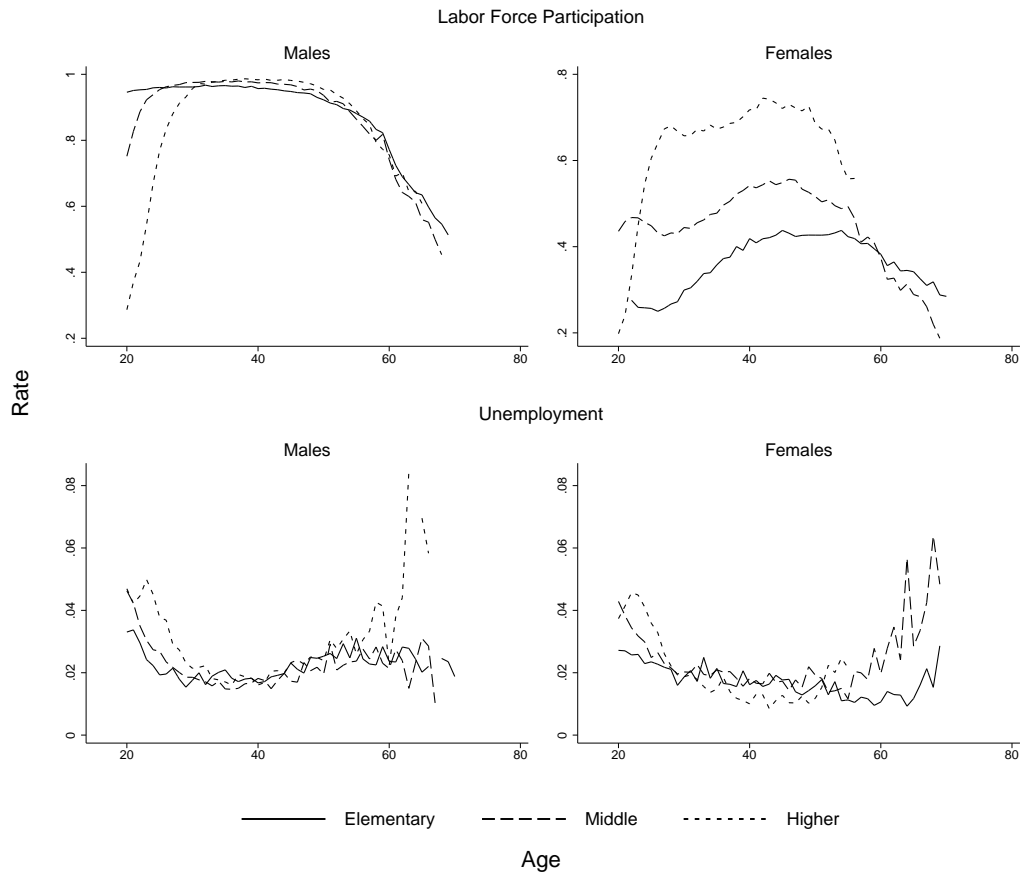


Figure 5: Age Effects I

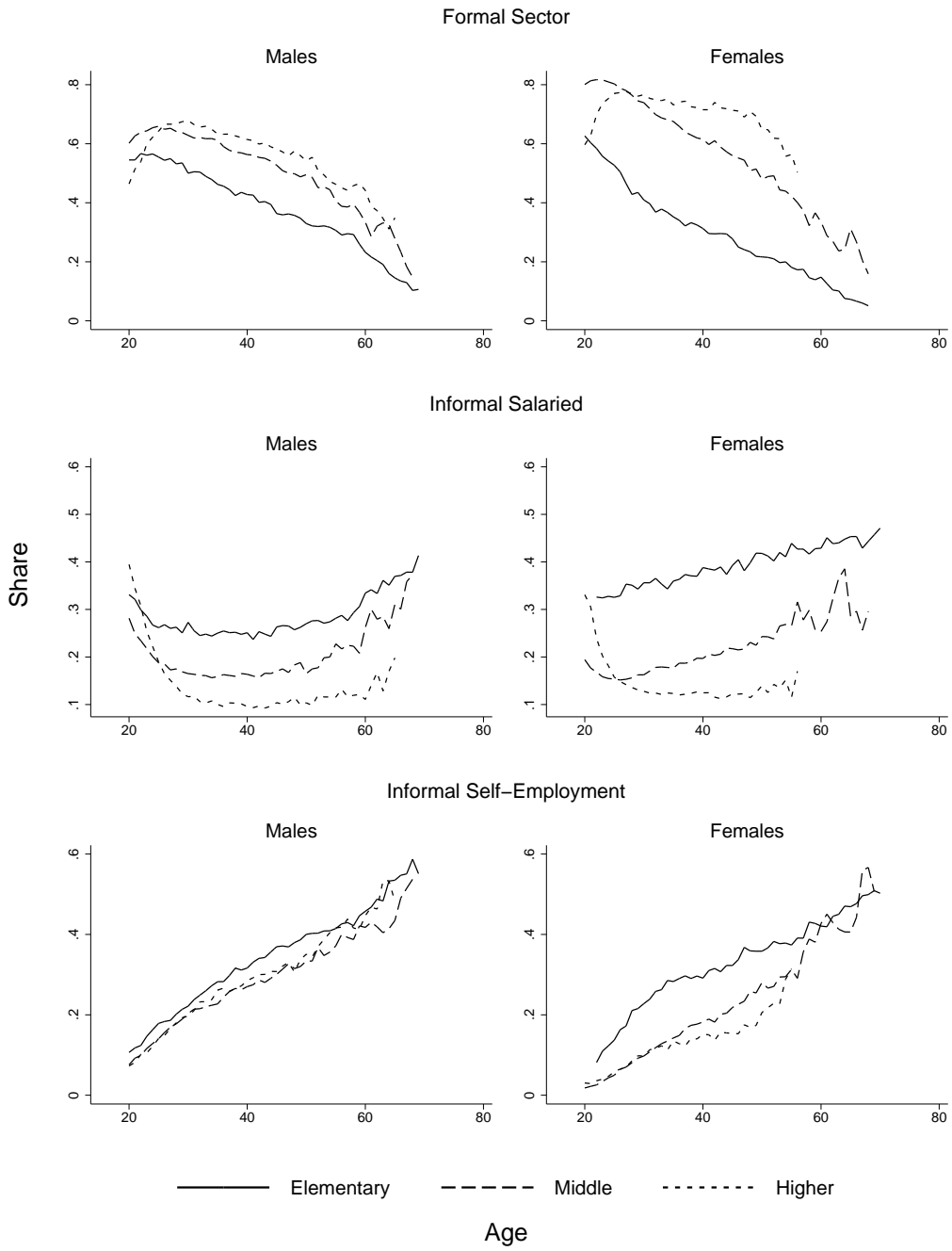


Figure 6: Age Effects II

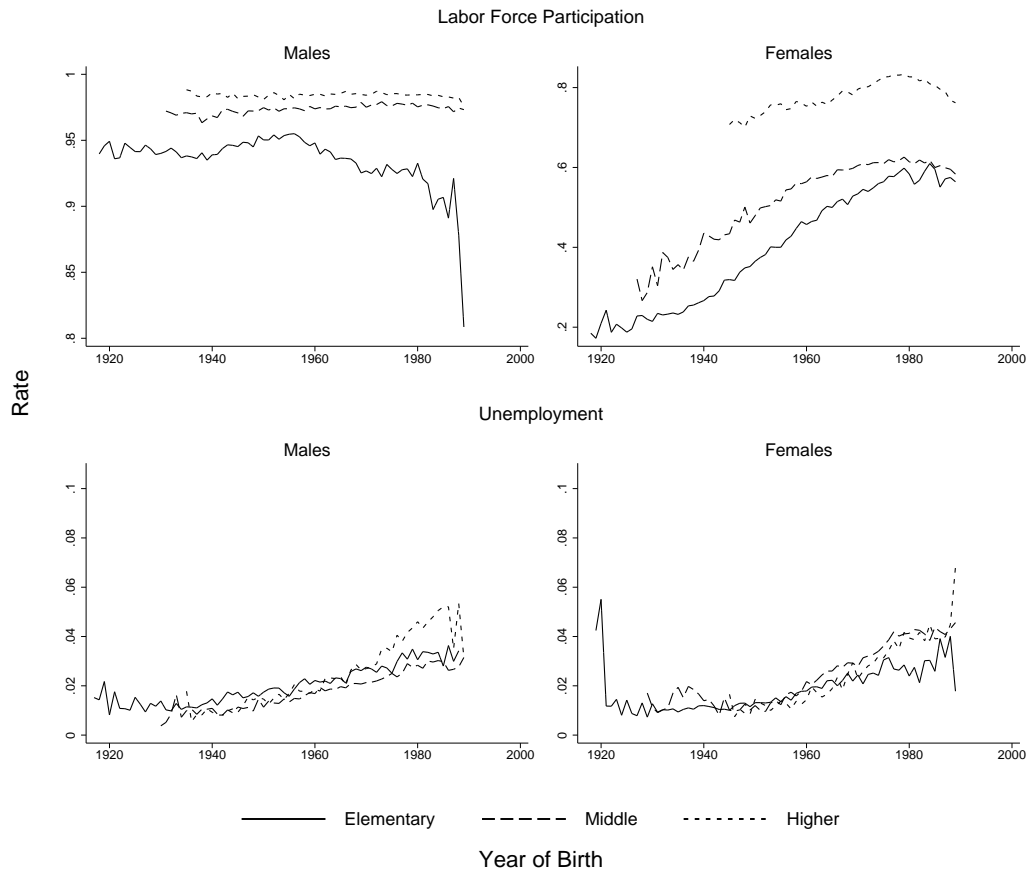


Figure 7: Cohort Effects I

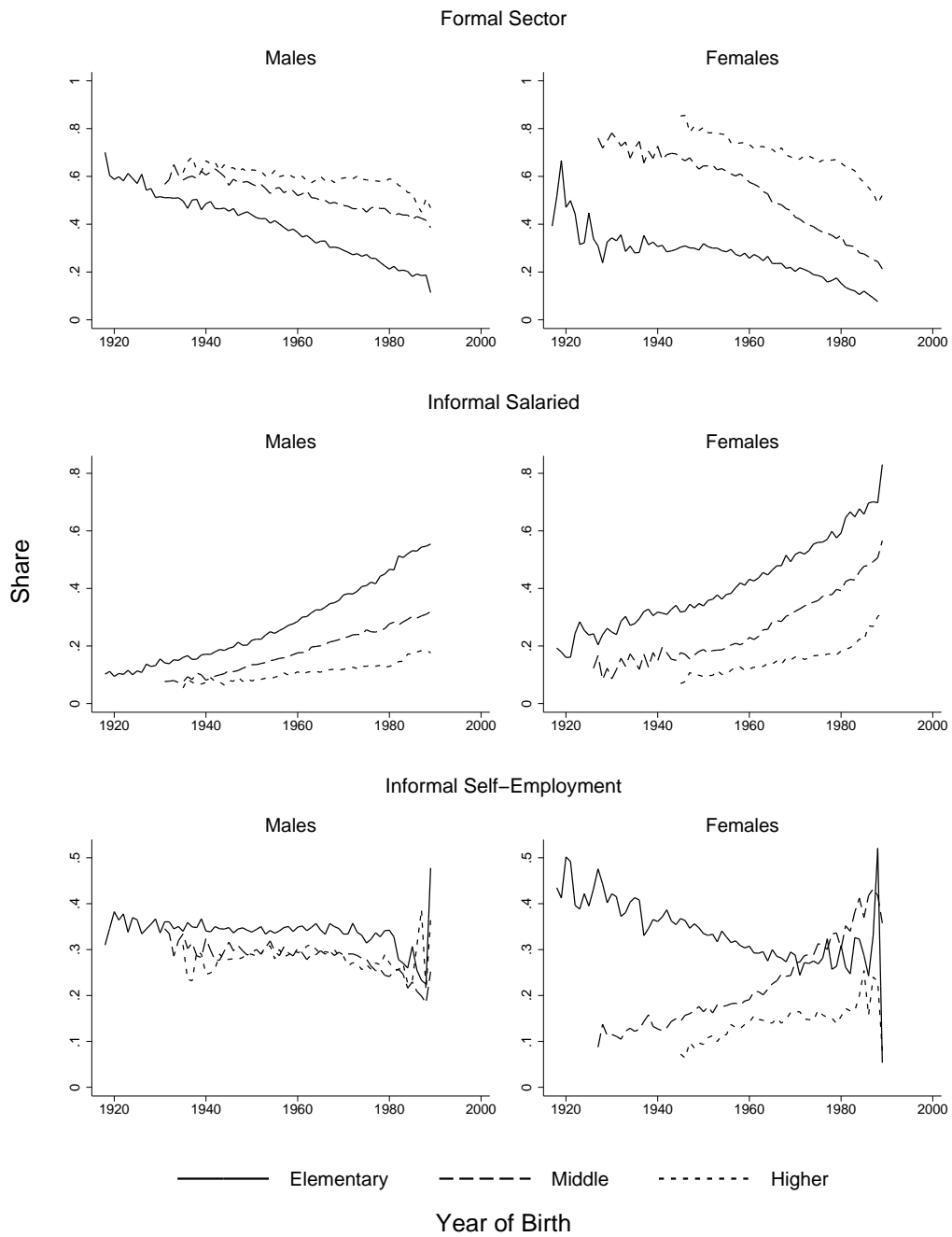


Figure 8: Cohort Effects II

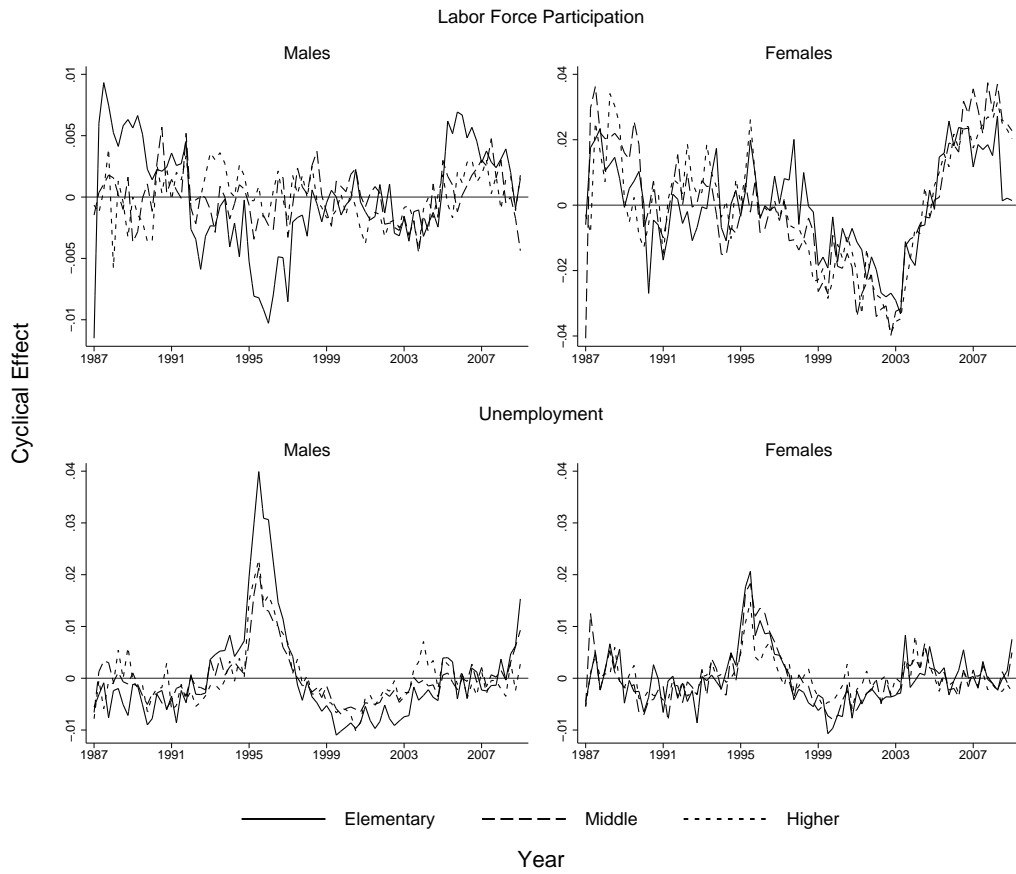


Figure 9: Time Effects I



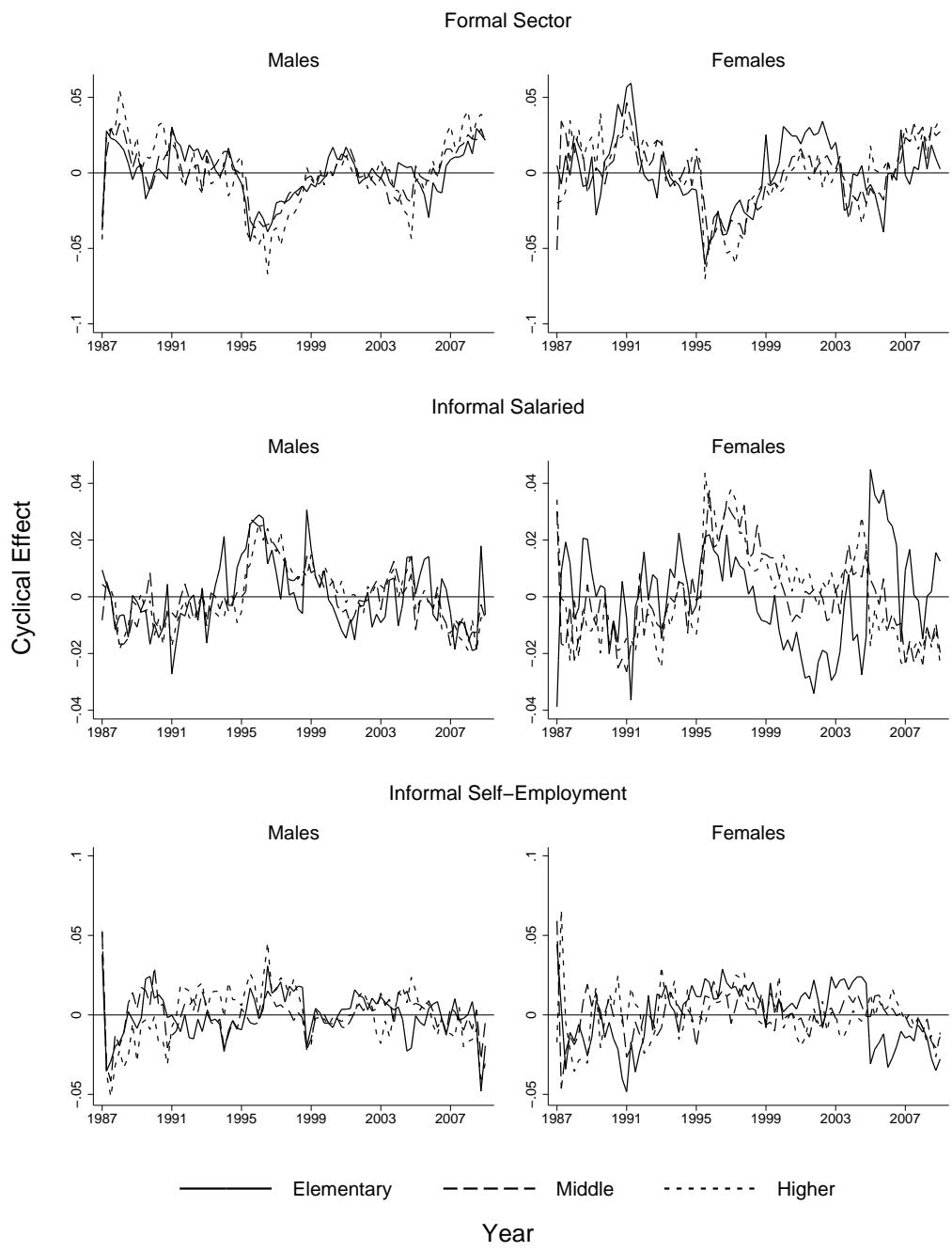


Figure 10: Time Effects II

Table 1: Elasticities of Participation Rates with Cyclical GDP

<i>Regression coefficients against:</i>	<i>Cyclical GDP</i>				<i>Lagged Cyclical GDP</i>			
	<b>Males</b>		<b>Females</b>		<b>Males</b>		<b>Females</b>	
<b>Labor Force Participation</b>								
Elementary	0.035	**	-0.225	*	0.032	*	-0.261	*
	(0.016)		(0.120)		(0.017)		(0.133)	
Middle	0.026	***	-0.236	*	0.018	**	-0.170	
	(0.007)		(0.127)		(0.008)		(0.139)	
Higher	0.006		-0.163	*	0.007		-0.130	
	(0.007)		(0.085)		(0.008)		(0.095)	
<b>Unemployment</b>								
Elementary	-7.428	***	-6.539	***	-6.840	***	-5.859	***
	(1.147)		(0.885)		(1.359)		(1.080)	
Middle	-6.217	***	-5.979	***	-6.005	***	-5.746	***
	(0.784)		(0.781)		(0.911)		(0.927)	
Higher	-5.566	***	-4.064	***	-6.086	***	-3.919	***
	(0.677)		(0.700)		(0.728)		(0.785)	
<b>Formal Sector</b>								
Elementary	0.627	***	1.316	***	0.897	***	1.661	***
	(0.130)		(0.245)		(0.121)		(0.257)	
Middle	0.333	***	0.353	***	0.589	***	0.654	***
	(0.100)		(0.115)		(0.095)		(0.106)	
Higher	0.366	**	0.289	***	0.636	***	0.593	***
	(0.142)		(0.111)		(0.143)		(0.108)	
<b>Informal Salaried</b>								
Elementary	-0.592	***	-0.544	***	-0.677	***	-0.611	***
	(0.155)		(0.156)		(0.170)		(0.166)	
Middle	-0.714	***	-0.618	**	-1.077	***	-1.152	***
	(0.207)		(0.252)		(0.214)		(0.251)	
Higher	-0.985	***	-0.957	*	-1.548	***	-2.005	***
	(0.354)		(0.484)		(0.372)		(0.487)	
<b>Self-Employment</b>								
Elementary	-0.155		-0.147		-0.430	***	-0.338	
	(0.146)		(0.219)		(0.149)		(0.232)	
Middle	-0.139		-0.401		-0.370	**	-0.893	***
	(0.157)		(0.251)		(0.154)		(0.232)	
Higher	-0.022		0.221		-0.335		-0.391	
	(0.224)		(0.401)		(0.234)		(0.441)	

Method: Seasonally Adjusted OLS. Standard Errors in parentheses.

\*\*\*, \*\*, \* H0:  $\beta=0$  rejected at 1, 5, 10% of significance

## Appendix

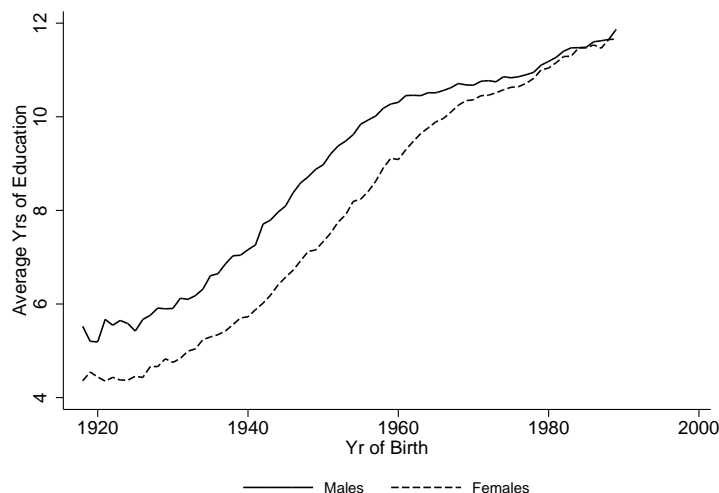


Figure A-1: Years of Education by Cohort

## Notes

<sup>1</sup>Examples of other studies applying a cohort analysis for Mexico are Antman and Mckenzie (2007a) and Antman and Mckenzie (2007b).

<sup>2</sup>His method is in turn based on the decompositions by Hall (1971) and Deaton and Paxson (1994).

<sup>3</sup>The predicted rates are obtained by transforming the predicted dependent variables  $\hat{y}$  as  $\hat{p} = \exp(\hat{y}) / (1 + \exp(\hat{y}))$ .

<sup>4</sup>The equations could be simultaneously estimated with a SUR model, however, since the regressors are the same under each specification the model reduces to an equation-by-equation OLS.

<sup>5</sup>This is the case even after dropping the respective reference dummy variables to avoid the standard “dummy-variable trap”. The collinearity occurs because we can express age as a sum of time and cohort. For instance, if we let the cohort variable  $co$  to be the year of birth, we can write  $age = time + co$ .

<sup>6</sup>The survey also stratifies the population according to wealth.

<sup>7</sup>Since the geographical coverage of the surveys has expanded since 1987, all the estimations were also performed only on the cities originally appearing in the 1987 survey. The results obtained are virtually identical to the ones here presented with the varying urban coverage. Also, similar results are obtained when the sample is limited to households in their first interview of the rotating panel, however for several cohort cells the estimated averages are based on a small number of observations, undermining the reliability of this specification.

<sup>8</sup>Some cohorts are observed for fewer periods because they surpass age 70 or because they entered too recently into the labor market.

<sup>9</sup>In fact, more than 99% of the self-employed report not having such coverage.

<sup>10</sup>To avoid clutter these graphs only present profiles by gender, and not by education level. Since now we can include young workers without risking misclassifying them in a wrong education cohort, the pictures now also include workers between 15 and 20 years of age. In the discussion of the different effects in the next section we will restrict our sample to workers with 20 to 70 years of age.

<sup>11</sup>All the graphed age effects are plotted for the cohort born in 1956. Under the proposed methodology the age profiles of other cohorts are just parallel displacements of the ones drawn. Discontinuities in the plotted lines occur whenever there are less than 100 observations per cell estimated, and hence such cells are discarded in the analysis.

<sup>12</sup>All the graphs in this section correspond to individuals at the age of 42. The cohort effects at other ages are just parallel displacements of the ones plotted. The larger variations presented at the tails of some of these graphs occur because there are few observations for very young or very old cohorts. As before, missing or truncated graphs occur because the cells for rates based on less than 100 observations are dropped from the estimation.

<sup>13</sup>This method is equivalent to regressing log GDP against a linear trend, obtaining the (cyclical) residuals and in a second stage regressing the log labor participation rates against the previous cyclical residual and the seasonal dummies.

<sup>14</sup>Whether these patterns are due to the formal sector expelling workers, or to unemployed not finding jobs in the formal sector during recessions (as Bosch and Maloney, 2007, argue) cannot be disentangled with cohort data because it tell us nothing about individual transitions between sectors.

<sup>15</sup>Other possible explanations for the rise of informality in Latin America are offered in Perry, Maloney, Arias et al. (2007). However, as the authors conclude, this remains an open issue in the literature.