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FROM SPAIN 1989-2009**

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Abstract

The response of human capital accumulation to changes in the anticipated returns to schooling determines the type of skills supplied to the labor market, the productivity of future cohorts, and the evolution of inequality. Unlike the US, the UK or Germany, Spain has experienced since 1995 a drop in the returns to medium and tertiary education and, with a lag, a drop in schooling attainment of recent cohorts, providing the opportunity to estimate the response of different forms of human capital acquisition to relative increases in low-skill wages. We measure the expected returns to schooling using skill-specific wages bargained in collective agreements at the province-industry level. We argue that those wages are easily observable by youths and relatively insensitive to shifts in the supply of workers. Our preferred estimates suggest that a 10% increase in the ratio of wages of unskilled workers to the wages of mid-skill workers increases the fraction of males completing at most compulsory schooling by between 2 and 5 percentage points. The response is driven by males from less educated parents and comes at the expense of students from the academic high school track rather than the vocational training track.

Keywords: Collective bargaining, human capital.

JEL classification: J52, J24.

Resumen

La respuesta del capital humano ante cambios de la estructura salarial tiene implicaciones sobre la evolución de la productividad del trabajo. En España han caído tanto los rendimientos salariales de distintas formas de educación como el nivel educativo de las cohortes nacidas tras 1976. Este documento utiliza datos de la Encuesta de Población Activa entre 1992 y 2009 y del Registro de Convenios Colectivos para estimar la respuesta del capital humano ante cambios en la estructura salarial percibida por los jóvenes a los 17 años de edad. Los rendimientos salariales de la educación se miden utilizando los salarios negociados para cada nivel de cualificación en convenios de ámbito provincial y sectorial, ya que estos son fácilmente observables y, como se documenta, varían poco ante cambios en la oferta de trabajo de los jóvenes. Un aumento relativo de los salarios de los peones del 10% aumenta la proporción de varones con educación obligatoria entre 2 y 5 puntos porcentuales, a costa de la proporción de jóvenes que acaban el bachillerato. La respuesta se debe principalmente a los varones cuyas familias tienen un menor nivel educativo.

Palabras claves: Negociación colectiva, capital humano.

Códigos JEL: J52, J24.

1 Introduction

The response of human capital to changes in anticipated returns to schooling determines the productivity of future cohorts in the labor market and the evolution of inequality. For example, the fact that college enrolment among US young adults has not kept up with the increase of the returns to college has led some authors to forecast an increase in wage inequality during the next decades (see Altonji et al., 2008). Unlike other advanced economies, including the United States, the United Kingdom or Germany, Spain has experienced since the mid-90s a drop both in the returns to medium and tertiary education (see Lacuesta and Izquierdo, 2012 or Pijoan and Sanchez-Marcos, 2010) and, as we document below, a drop in the schooling attainment of recent cohorts measured at the age of 25. Hence, the Spanish case provides an ideal setup to estimate how the decisions of young adults to accumulate human capital in the schooling system respond to increases in low-skill wages relative to high-skill ones.

The basic model of human capital acquisition stresses the role of the expected return to skill acquisition as a key determinant of the decision to enrol in formal education. In the absence of credit constraints, the opportunity cost of attending school relative to expected returns of acquiring formal skills determines the supply of human capital in an economy. On the empirical side, there is evidence that young adults' enrolment probabilities decrease with the wages of unskilled workers – Sanders et al. (2005) Neumark and Wascher (1995) – the unemployment rate – Clark (forthcoming), Dellas and Sakellaris, 2003, Petrongolo or San Segundo, 2002- or proxies for the demand in industries intensive in unskilled labor – Aparicio, 2010. Unfortunately, while enrolment is a very important outcome, it provides little information about the type of skills finally acquired in the formal education system. Firstly, early school leaving decisions may be later compensated by other forms of human capital acquisition, such as GEDs in the US. Secondly, the evolution of productivity depends on the level of schooling finally attained by an individual, not on point-in-time enrolment decisions. Interesting empirical evidence about the impact of increases in the returns to human capital on schooling attainment is documented by Abramitzky and Lavy (2011), who use a change in the compensation policy in Israeli kibbutzim to estimate the response of high school completion to changes in the returns to human capital.

Our study estimates how the drop and subsequent increase of the relative wages of unskilled workers in Spain between 1986 and 2009 has affected the form of human capital acquired by youths. We start by documenting that, similarly to the development in the US and other OECD countries, the schooling attainment of male Spanish citizens has stagnated during the last 15 years –see Autor and Dorn, 2010, or Goos, Manning and Salomons, 2010. Secondly, we provide evidence that wages in low-skilled jobs, relative to those in mid-skilled ones, experienced a sustained increase after 1995 - after a fall between 1987 and 1992. The wages in the jobs, held by mid-skill workers, relative to those held by college workers, stagnated after 1995. Both developments in the wage structure were sustained over time, thus making it likely for young adults to infer that the

movements in the relative wages of unskilled workers had indeed a permanent component and were likely to shape the decision to acquire human capital.

We focus on the educational decisions right after the legal working age- 16 years. Spain has a dual track schooling system and young adults who continue studying can either choose the vocational track - a professionally oriented track involving training in firms- or an academic track - with an academic curriculum and that constitutes the main way to college. Completion of both tracks implies supplying very different skills to the labor market. Hence, we consider the following choices of the youth at age 17: (a) finishing at most compulsory schooling, (b) enrolling and finishing the vocational track and (c) engaging in the academic track. To mitigate the biases associated to the simultaneity between the quantity of unskilled workers entering the labor market and the relative changes in unskilled wages, we measure the wage structure perceived by youths at the age of 17 using skill-specific wages determined in collective agreements at the province-industry level. That strategy is motivated by three observations. Firstly, unskilled and skilled young adults work in different industries. Unskilled young men typically work in construction and retail, while skilled young men work in services to industries, health and education. Secondly, due to a boom that has lasted some 10 years, the construction sector has experienced higher-than-average wage growth. Thirdly, wages set in collective agreements effectively act as minimum wages at the province-industry cell level. Those wages are downwardly rigid for years and legally binding for all employers in the scope of the agreement -regardless of the degree of unionization at the firm level. We document that collectively bargained wages affect the distribution of wages: there is substantial concentration in the wages of the youth around collectively bargained wages for unskilled workers and they correlate with wage growth at the province level. We also show that the variation in wages set in collective agreements does not reflect the outside opportunities of unskilled youth in the province-measured by the age-specific unemployment rate. Hence, we construct several measures of the return to skill anticipated at age 17 by combining public information on skill-specific collective bargained wages across industries and the industrial share of young employment in the province before the last construction boom.¹

We document the following set of results. A 10 percent increase in the relative wages of unskilled workers leads cohorts that turn 17 to be between 2 and 5 percentage points more likely to complete basic education at most. The result depends on whether or not we adjust for unemployment differences across skill levels. In our preferred specification, the increase in the share of male youths with basic schooling comes at the expense of the share of male youth with academic high school track and is most pronounced among males whose parents have lower levels of schooling. We also provide some evidence

¹Our strategy then departs from Abramitzky and Lavy (2011) in two main aspects. First, we focus on economy-wide changes and investigate if youths respond to those changes. Secondly, we exploit the dual track educational system in Spain and analyze the impact of changes in the wage structure on the final form of human capital acquired (vocational vs academic high school tracks).

suggesting that young adults responded to the increase in unskilled wages by leaving the educational system at the early stages of tertiary education. We find weaker schooling response to the relative increase of unskilled wages among females, a finding that could be due to wage increases below construction in the industries where unskilled females work.

Section 2 provides some background on schooling and wages in Spain. Section 3 describes the data and methods. Section 4 shows the results when we use market wages and Section 5 shows the results of our preferred empirical strategy when we use measures of the return to skill based on wages in collective agreements. Section 6 concludes.

2 Trends in Wages and Schooling in Spain

This Section provides the basic facts about educational attainment and the wage structure that each cohort observes at the age of 17.

2.1 The Educational System and trends in schooling attainment.

Spain features a dual track system. Once a young adult finishes compulsory education, he or she has two options. The first is to enter the academic track that, upon completion, gives access to college. The second is vocational training (*Formación Profesional*), a more professionally-oriented track that involves training in firms and trains for specific occupations. For almost all cohorts in our study (born between 1969 and 1983), compulsory schooling ended at age 14. After that age youth could opt for leaving the system altogether, or for entering either the academic or the vocational training tracks.

The *Academic* track consisted of three grades, with common curricula during the first two years and partial choice of subjects during the last one. An additional grade gave plus passing a national-level exam gave access to college.

The *Vocational training* track consisted of three levels (or “modules”). The first two were assimilated to secondary schooling, and each of them took two years to complete. The third one also took two years and is assimilated to tertiary education by the definition of Eurostat and the OECD.

A new Educational Act passed in 1990 but introduced in 1993 (LOGSE law 14/1990) extended compulsory education until age 16. It maintained the first two grades of the academic and the vocational tracks in the former system as secondary education, but as “compulsory” secondary education. Access to tertiary education or the composition of the last two grades of the vocational training remained unchanged. What cohorts would be affected by that change? The law specified that those who were attending 3rd and 4th degree of primary education in 1993 were to initiate 3rd and fourth degree of the “new” primary education. In principle, and according to such legislation, the first birth cohort completely affected by the new legislation would then be the one born in 1984 the second-to-last cohort in our study. Many schools, however changed before

and even in the case of a late change, some individuals born before could have been affected by the reform if they repeated some grade. Hence, as we lack information about the share of students whose school anticipated the law change, we create a taxonomy of grades that is consistent over time, and discuss if legislative changes are likely to affect our measures of schooling attainment.

Namely, for the purpose of documentation of trends we distinguish between

- *Primary Schooling or Less*: We include here young adults who completed at most primary schooling under any of the systems. We include in this category individuals who fail to complete “compulsory” schooling, a group that constitutes a non-trivial fraction of the population, reaching 30% for cohorts born after 1985.
- *Upper secondary school*: This group includes all young adults who completed at least high school (in the academic track) in either the old or the new systems. Young adults in this group failed to finish education without a tertiary education degree.
- *Vocational training*: Young adults who complete any form of vocational training under both systems.
- *Tertiary education*: Young adults who complete some form of college

Figure 1a shows the evolution of the educational attainment for male young adults born between 1967 and 1983, measured as of age 25 in the EPA *Spanish Labor Force Survey*. Figure 1 documents a rapid increase in the educational attainment across cohorts born in the early seventies. The fraction of male young adults born in 1967 who completed primary school only was over 50%. That fraction dropped to 38% among the cohort of males born in 1977. Correspondingly, the 1977 cohort had a fraction of youth with a vocational training degree or upper secondary school 4 and 5 percentage points higher than the 1967 cohort, with college attainment also increasing by some 9 percentage points.

Nevertheless, that upward trend in attainment was reversed among cohorts born in the late seventies and early eighties. Male young adults born after 1977 have not attained higher degrees of college or upper secondary schooling than the 1977 cohort. While such pattern might partly reflect that individuals are attending longer university degrees over time, the stagnation in educational attainment is especially evident in lower levels of schooling: the fraction of young males who have attained basic education or less after the 1980 cohort has stagnated and even increased for the last three cohorts in the graph. Figure 1b shows the evolution for females. While less stark, Figure 1b also documents stagnation of the levels of female youths completing at most compulsory schooling.

2.2 Trends in Wage Structure at age 17

Figure 2 displays a series of the returns to skill that cohorts could observe at the age of 17. The construction of these series is detailed in Section 4.2,

but we provide here an overview. We computed for each of the 50 provinces in Spain the median of the wage of unskilled workers -those classified by the Social Security system “laborers”- between the ages 16 and 45. We performed a similar computation for workers with some skill level that is inferior to college (ages 25-45) and the wages of workers in positions that require college (ages 25-45). Figure 2 plots the national averages of the ratio of the wage of unskilled workers to mid-skill ones ($\frac{W_{unskilled}}{W_{mid_skill}}$) and the ratio of mid-skill workers to college ($\frac{W_{mid_skill}}{W_{college}}$). The horizontal axis has the birth year of the cohort and the vertical axis contains the ratio of unskilled-to mid-skill wages prevailing the year when the cohort turned 17.

According to our measure, the cohorts born between 1969 and 1977 would have observed a drop in relative wages of unskilled and mid-skill workers. When the cohort born in 1969 turned 17 –year 1986- the ratio between the median wage of unskilled workers and the median of mid-skill workers was 76%. Ten years later, at the time of taking the decision of whether or not to finish upper secondary school, the 1977 cohort observed an equivalent ratio of 69%. Since then, each cohort of males has been observing a secular increase in the relative wage of unskilled workers. The remainder of this study uses several methods to assess whether or not the evolution of wages observed at age 17 may have caused the trends in schooling attainment depicted in Figure 1.

3 Methods

We assume that a risk neutral youth lives for three periods. Period 1 represents ages 16-19. In that period young adults can either work as an unskilled worker or, alternatively, continue accumulating human capital in either the academic or the vocational track of high school. Period 2 represents ages 20-24, the time when a youth that has successfully completed vocational training can start his or her working life. Meanwhile, a youth who completed the academic track would be attending college. The third period represents age 24+, when returns to college start being reaped.

Leaving the schooling system at 16 allows earning the stream of earnings $w_u(1 + \frac{1}{R} + \frac{1}{R^2})$, where R is the market interest rate. Going to the vocational track involves giving up earnings between 16 and 19 and start earning the stream $w_v(\frac{1}{R} + \frac{1}{R^2})$. Successful high school completion permits access to college in the second period and, if the young adult succeeds in college, a wage in the third period of $w_c \frac{1}{R^2}$.² The outcome of the high school route is uncertain. With probability p the young adult graduates from college. Otherwise, he or she obtains a fraction κ of the earnings in vocational training. We set $\kappa = 1$.

The utility function of each of the choices is $U_u = w_u[1 + \frac{\beta}{R} + \frac{\beta^2}{R^2}]$, where β measures either patience or the relative preference for current consumption -because of family need or other factors. The utility of vocational training is

²We use $\frac{w_u}{w_v}$ in the model to term what we called $\frac{W_{unskilled}}{W_{mid_skill}}$ in the data, and $\frac{w_u}{w_{col}}$ to denote the ratio $\frac{W_{mid_skill}}{W_{college}}$

the stream of earnings plus the utility from performing professional tasks -an idiosyncratic component that may vary across individuals.

$$U_{voc} = w_v \left[\frac{\beta}{R} + \frac{\beta^2}{R^2} \right] + \frac{\beta}{R} S$$

Finally, the utility of the academic track is $U_{col} = \beta^2 p \left(\frac{w_{col}}{R^2} \right) + (1-p) \beta w_v \left(\frac{1}{R} + \frac{1}{R^2} \right)$ -

We further assume that there are returns to any type of human capital investment. That is, the discounted lifetime earnings of a college graduate exceed the lifetime earnings associated to vocational training and those, in turn, exceed lifetime earnings of unskilled workers:

$$\frac{w_{col}}{R^2} > w_v \left(\frac{1}{R} + \frac{1}{R^2} \right) > w_u \left[1 + \frac{1}{R} + \frac{1}{R^2} \right]$$

The choice of whether or not continue studying at age 16 depends on the alternative earnings stream. The tradeoff between the academic high school and the vocational training depends on the difference between the wage return of college -net of the cost of foregoing the vocational training wage in the second period- and the preference for professional jobs, or

$$\frac{S}{w_v} = p \left[\frac{\beta \Delta_v w_{col} - R}{R} \right] \quad (\text{VT - A})$$

where $\Delta_v w_{col} = \frac{w_{col}}{w_v} - 1$. The indifference between vocational training and leaving the schooling system altogether also reflects a trade-off between the advantage of getting wages in the first period and starting vocational training, that yields the discounted professional taste for the job on top to a future wage return.

$$\frac{\beta}{R} \left[\frac{S}{w_v} + \Delta_u w_v \left(1 + \frac{\beta}{R} \right) \right] = \frac{w_u}{w_v} \quad (\text{VT - DO})$$

Here, $\Delta_u w_v = \frac{w_v}{w_u} - 1$. Finally, students considering whether to take the academic high school or leaving the educational system have to balance the opportunity cost of studying and the wage return of the academic track, that includes the possibility of accessing college wages or, at a minimum, discounted earnings of the professional track:

$$\left[\frac{\beta}{R} + \frac{\beta}{R} \right] \Delta_u w_v + p \left[\frac{\beta \Delta_u w_{col} - 1 - R}{R} \right] = 1 \quad (\text{A-DO})$$

Figure A.1. illustrates these choices in the $\left\{ \beta, \frac{S}{w_v} \right\}$ space when R equals 1 and p is fixed-see Appendix 2 for details. Students with a high level of β and relatively low $\frac{S}{w_v}$ choose the academic track. For values of β below $\frac{1}{\Delta_v w_{col}}$, all youths drop out. Finally, vocational training is the best choice for intermediate values of β and youths with a preference for professional jobs.

How do choices vary with changes in $\Delta_v w_{col}$ and $\Delta_u w_v$ equivalent to those observed in Spain since 1995?

- An increase in $\frac{w_u}{w_v}$ leads some vocational training students to drop out. In Figure A.2., the increase in unskilled wages expands the set of β and $\frac{S}{w_v}$ that find it optimal to leave vocational training. In addition, students of the academic track with low levels of patience (β) and a low taste for professional jobs (low level of $\frac{S}{w_v}$) also choose to drop out.
- Holding $\frac{w_u}{w_v}$ constant, a drop in $\Delta_v w_{col}$ alters the choice between vocational and academic training only. Under the assumptions of Figure A.3., the fraction of individuals that drop out is unaffected

3.1 Identification

The data we use is the *Spanish Labor Force Survey* (EPA, by its Spanish initials), similar to the Current Population Survey in the U.S.. We observe only the final educational attainment at the age of 25. As for $\frac{w_v}{w_u}$ and $\frac{w_{col}}{w_v}$, we assume that young adults form their expectations based on the observed wages of different skill groups in the relevant local labor market. Below, we argue that the relevant local labor market in our application is the province: that is level that most wages are bargained in collective agreements. Hence, we estimate reduced-form versions of the choice

$$S_{i,p,t} = \alpha_0 + \alpha_1 \frac{w_u}{w_v} + \alpha_2 \frac{w_v}{w_{col}} + \mu_p + \theta_t + \varepsilon_{i,p,t}$$

$S_{i,p,t}$ is the educational attainment reported by the individual at the age of 25. μ_p are local labor market fixed effects, θ_t are time fixed effects and $\frac{w_u}{w_v}$ and $\frac{w_v}{w_{col}}$ denote the wage structure that youths would observe at the age of 17 -when educational decisions are taken.³

The relevant measure of $\frac{w_v}{w_u}$ and $\frac{w_{col}}{w_v}$ is not obvious. One option is directly elicit wage expectations by young adults (Beffy et al, 2009, Manski, 2004). An alternative option is to use contemporaneous average wages by skill level in the relevant local labor market: Manski 1993, López-Mayán, 2010. Buchinsky and Leslie (2010) suggest a more sophisticated approach in which youth adults base their schooling decisions on the structure of current and past wages and update their beliefs about the future using a VAR of the different centiles of the distribution. Those strategies assume that youths take the wage of contemporaneous adults as indications of the wage the young adult will have when older if that level of skill is chosen. A problem with the strategy of focussing on current wages is that contemporaneous wages are likely to be determined by the relative scarcity of unskilled labor. Studies of the wage structure by Card and Lemieux (2001) or Carneiro and Lee (2011) illustrate that the relative supply of workers with different skill levels determines versions of the ratios $\frac{w_u}{w_v}$ and $\frac{w_v}{w_{col}}$. Secondly, it is not obvious what wages young adults actually observe

³In principle, it is not obvious that the ratios of wages in different skill levels are the best choice to measure the incentive to study -rather than, for example, the level of the wage. Nevertheless, as we use variation across provinces over time, by taking ratios of wages we mitigate problems related to inter-provincial differences in the cost of living (see Moretti, 2010).

when taking their decisions about human capital investment. An ideal measure of incentives should be (a) observable by the youth and (b) unresponsive to relative changes in the relative supply of unskilled workers. Our proposal is to exploit the prevalence of binding collective agreements at the province level in the Spanish economy. We see two main advantages in these measure. The first is that collective agreements set skill-specific wages that are legally binding during a pre-specified period of time - the typical period ranges between 1 and 3 years in your sample. By definition, during the life of the agreement those wages are downwardly rigid, thus will not respond to changes in the relative supply of workers. Secondly, we document below that the wages of the unskilled youths present substantial bunching of wages around the collectively contracted wages. Hence, agreed wages are effective and likely to be observed by a youth considering leaving the educational system .

Of course, in the moment they are initially signed wages in collective bargaining are not randomly assigned and respond to the expectations of the local labor market of unions and employers. We use several strategies to control for such effects. Firstly, we include controls for the contemporaneous unemployment rate of the youth by skill level. Secondly, we also experiment including additional controls for province-level trends. To the extent that the influx of new entrants is partly determined by the evolution of demography (larger cohorts at the province level), provincial time trends would net out such effects.

$$S_{i,p,t} = \beta_0 + \beta_1 \frac{w_u}{w_v} + \beta_2 \frac{w_v}{w_{col}} + \mu_p + \mu_p * t + \theta_t + \varepsilon_{i,p,t}$$

As mentioned above, we define three levels of schooling attainment by a young adult i in a province p at time t : basic schooling (or less), vocational training, or a joint outcome that lumps together secondary academic track and college. The vocational and the academic track provide a very different set of skills to youth that complete them. As we found it very hard to rank those skills, we estimate the model as a multinomial logit. In addition, in most specifications we also show the results with a binary dependent variable that takes value 1 if the youth completed any degree beyond the compulsory one. Familial characteristics exhibited a steady improvement over the sample period. To control for those, some specifications we select a sample of coresident young adults (86% of our sample live with their parents at the age of 25). Namely, we control for dummies with the educational attainment of the mother and indicators of whether the mother and the father are present.

The coefficients of interest are those of the two measures of the returns to skill β_1 and β_2 . The identification is obtained from changes across provinces and time in the ratios of unskilled to skilled wages when a cohort reaches the age of 17.

4 The data.

4.1 Main dataset

We use the 1992-2009 waves of the Spanish Labor Force Survey “*Encuesta de Población Activa*”, the Spanish equivalent to the Current Population Survey in the U.S. The survey we use is a repeated cross-section representative of the Spanish population, interviewing some 20,000 households every quarter. It provides detailed information on the educational attainment and the labor market and demographic outcomes of individuals above 16 years old. In the case of young adults residing with their parents, the survey allows reconstructing parental characteristics. While the public-release version of the survey typically codes the age of individuals in five-year bands, the Spanish Statistical Institute provided us with the age in years. The Spanish Labor Force Survey does not contain wages in the sample period we examine. As for province, we use that of current residence.⁴

4.2 Information on wages

We rely on out-of-sample information to construct two measures of the wages that a young adult would use to form expectations about earnings in different education paths.

Measuring the expected return to skill at age 17 using actual wages

We use administrative records of earnings as drawn from Social Security records *Muestra Continua de Vidas Laborales: Wave 2007*. This dataset contains a random sample of 4% of individuals who were affiliated to the Social Security system in 2007 (either as employees or as unemployed). The sample contains the monthly earnings of all labor relationships since the moment when the person joined the Social Security system. While the register contains high quality information on wages, it lacks reliable information about the education level of young workers.⁵ Despite the lack of information about educational level, we construct proxies of wages by skill level using the fact that workers are grouped into 11 categories for Social Security purposes. The grouping consists on a partition that is a mix of occupation and skill (see Table A.2.) The top two groups explicitly correspond to individuals with some form of college degree.

⁴In some specifications, we use information about the enrolment status of the individual. The information about schooling attainment and enrolment is obtained from each individual 16 or above and asks about whether children over 16 were in school during the last four weeks. We dropped the third quarter, that spans the summer. Prior to 2005 there was only one question on attendance, but after that date there was a separation between regular and non-regular courses. The mere fact of separating the pre-2005 question into two seems to have led additional respondents to report they were attending school. Since before 2000, the distinction between regular and non-regular courses was not available, so we are forced to consider non-regular students post 2005 as enrolled in the educational system. However, the break in the series due to the change in the questionnaire is not evident below the age of 20.

⁵There is a measure of schooling in the Registry that was obtained by linking the Social Security Registers with information with Census data. The quality of the information on education is not very reliable for young individuals.

The rest of groups are numbered according to a decreasing level of qualification, with the bottom two groups representing “laborers” - positions for which no degree is required. Admittedly, there are cases of individuals with a college degree whose employer pays wages according to contribution groups other than the first two. Nevertheless a study of the evolution of the wage structure in Spain in Felgueroso et al (2010) documents that returns to skill using contribution groups or education level give a very similar picture. Hence, in what follows we rely on the classification for Social Security purposes. It is worth noting that such classification is not merely administrative: collective agreements specify wages for each of those groups separately, and those increase monotonically with the skill level.

There are two additional concerns with our measure of earnings. The first is that monthly earnings are capped at the maximum wage that the Social Security uses to compute contributions to old age and health pensions. The second in the presence of selective attrition from the labor force, the sampling method does not guarantee that the wage that a worker in 2006 perceived ten years before is representative of the past distribution of earnings. To overcome the problem of censoring in earnings, our analysis focuses on median wages. Censoring affects very little the median of young worker’s wages, that are very concentrated and typically far away from the cap. The issue becomes more problematic for our measures of other age groups, so we limit ourselves to groups up to 45 years of age. Second, regarding the representativeness of the sample, we use only males’ earnings.

We construct a measure of the expected wage profile over a lifetime if the worker obtains tertiary education (first two contribution groups) intermediate education (groups 3-9) or no education at all (group 10 or laborers) assuming a zero interest rate. The exact measure of wages for the unskilled is the following

$$W_{s,p,t} = \sum_{g=1}^{g=3} .33 * Med[W(s)_{g,p,t}] \quad (1)$$

Where g is an index for age group (we use three groups: 16-25, 26-35, and 36-45), p is an index of the 50 provinces, t refers at the year of measurement and s is the skill level. $W(s = 10)$ is the wage of workers classified as laborers, that we use to define unskilled workers. We construct similar measures for mid-skill workers (same age groups, but using $W(s = 3..9)$ skill groups 3-9) and for high-skill workers $W(s = 1..2)$ -see Table A.2.

Measures based on Bargained Wages in Collective Agreements

An alternative measure of wages is obtained from the Registry of Collective Agreements between 1990-2009. Collective contracts in Spain are automatically extended to all employers and employees under the scope of the agreement and the clauses included are legally binding. As a matter of fact, they have the same publicity as an Act from the Parliament and it is compulsory for the unions and employers signing them to register their terms and conditions at the Ministry of Labor. The information in the register contains, among other variables, its industrial and geographical coverage, the wage growth agreed in the contract

as well as the month and year when the contract was signed and the period during which it is binding. We selected those agreements whose coverage was at the province-industry level. Between 1993 and 2001 the registry contains information about the wage levels for each of the skill groups in Table A.2, and that is the information we use to construct our preferred measure of earnings. The concept we use is the “base wage”, that excludes any premia linked to tenure on the job, age or performance. The concept is closely linked to entry wages. We were unable to construct the wage measure for all provinces as not all collective agreements register the levels of agreed wages. Hence, out of the 50 provinces, we only use 35.

We construct proxies of the wages of workers with college education using the “base wages” of the first and second contribution groups. We proxy the wages of unskilled workers using the base wage of laborers (group 10 in Table A.2.). For the group with intermediate education, we use the wage of group 3 (administrative workers).⁶ The measure of skill-specific wages we use is

$$\bar{W}_{s,p,t} = \sum_{j=1}^{j=6} \pi_{s,j,p,1995} \bar{w}_{s,j,p,t} \quad (2)$$

Where j indexes industries, p indexes the province and t indexes time. $\bar{w}_{s,j,p,t}$ is the wage bargained in industry j for province p and period t for skill group s . We use information on 6 industries. The first five are construction, retail, metal, hostels and restaurants and services to the industry. We aggregate the wages of the rest of the industries into a 6th group. $\pi_{s,j,p,1995}$ is the employment share of the industry in a province - education group as of 1995.⁷ The temporal variation of industry share of employment is likely to be determined by the relative supply and demand of unskilled workers, and may thus reflect factors other than the opportunity cost of studying. Hence, we fix the province-specific weight at the beginning of our sample, in 1995. The computation of province-skill specific weight of the industry for young adults are computed using the Labor Force Survey. As in the previous case, we construct measures of unskilled wages, mid-skill wages (group 3 in Table A.2.) and top skill wages (groups 1 and 2 in Table A.2.).⁸

The choice of industries is based on the pattern of specialization of skilled and unskilled young adults. Workers below 40 years of age and with basic edu-

⁶Most values between groups 4-9 are missing in the collective agreements database and that is the reason why group 3 is the only one used. In any case, group 3 is the most important quantitatively in terms of workers.

⁷The skill groups used to compute the incidence of the industry in the province are defined in terms of schooling. We define three groups: compulsory or less, vocational training and upper secondary schooling and college.

⁸Wage changes can be decomposed into two components (see Gould et al., 2002) The first one measures wage growth *within* the industry holding the initial share of employment in the industry constant. The second component reflects compositional effects due to the increasing weight of certain industries. Our measure of the returns to skill uses only the first component, as part of the increase in the employment in the construction sector may be associated to the fact that the youth that abandoned the schooling system work in industries that are intensive in unskilled workers.

cation -or less- work mainly in construction (20% in 1995), retail (7% in 1995) and agriculture (10%). On the other hand, males with at least upper secondary schooling work in services to industry and the education and health sector (23% in 1995). While workers with upper secondary schooling or higher also work in construction, they do so to a lesser extent than unskilled young adults (10% in 1995, and the fraction did change much after that year). Between 1997 and 2009, the concentration of unskilled youth working in construction increased substantially: see Figure A.4. The second reason to focus on industries to construct wage levels is that wages increased differently across industries. Between 1993 and 2001 unions and firm representatives in the construction sector bargained yearly wage increases between 50 and 75 basis points larger than in the rest of the industries. Figure 5 compares the evolution of the year-on-year growth of wages in collective bargaining agreements in construction and the rest of industries. Bargained wages in construction have been consistently higher than the rest of industries since 1998. Hence, the returns to any form of skill are most likely to fall in provinces where young adults were, as of 1995, specially likely to work in construction.

4.3 Do collective agreement wages reflect the economic opportunities of young adults?

We present three pieces of evidence suggesting that the relative variation in wages bargained in collective agreements does reflect the opportunity cost of studying. Firstly, we document that the wages settled for unskilled workers actually bind, as there is substantial concentration of actual wages of young workers around the levels bargained in collective agreements (at least for construction). Secondly, the variation over time of bargained wages responds to the labor market tightness of workers after 40 years of age, not that of young adults. Finally, we show that changes in bargained and actual wages are linked.

Accumulation of wages at the level settled by collective agreements: Figure 3 shows the histogram of wages of unskilled young workers in a large Spanish province: Barcelona. Those are monthly wages from Social Security records, and correspond to all male adults with at least one year of experience, between 18 and 35 years of age and who has the lowest level of skill according to Social Security definitions. The histogram also displays two lines: the wage in the collective agreement for retail and for construction. Figure 4 displays substantial accumulation of monthly earnings around the bargained wage in construction. Note that the degree of bunching is apparent without conditioning on the industry where the young adult works. Hence, the degree of bunching in Figure 3 also reflects that construction is a prevalent option among unskilled workers. Figure 4 shows the same histogram for 2000 –same province, age and contribution group. The accumulation at the collectively bargained wage in construction for that year is equally prominent. Hence, both from a legal and an economic point of view, the wage level settled in the construction collective agreement acts as an industry-province specific minimum wage.

Some determinants of wage growth in collective agreements

The identification strategy in our study relies in the time-series variation in industry-specific minimum wages within provinces. A key assumption is that province-specific changes in bargained wages do not respond to province-specific shifts in the supply of unskilled young adults. Models of wage bargaining typically assume that final wages depend on the outside opportunities of firms and workers, and stress the role of unemployment as an (inverse) measure of outside opportunities. Hence, to understand whose outside opportunities are taking into account in wage bargaining, we regressed wage growth on (one-year lagged) unemployment rates of unskilled workers in four age groups: 16-25, 26-35, 36-45 and 46-55. The regression also includes province-level and year dummies. The former control for provincial long-run specialization, and the latter for macro factors that affect wage growth (such as the inflation rate). We lag the unemployment rate to mitigate simultaneity biases.

Table A.3 presents the results for 4 different agreements: construction, retail, metal and a composite of the rest of the agreements. All regressions are weighted by the number of workers covered by the agreement. The result in column 1 row 1 is -239. That is, a 10% increase of the provincial unemployment rate of workers between 16 and 25 years of age reduces wage growth in construction by .239 percentage points (standard error: .18). The estimate in row 4 column 1, measuring wage responses to unemployment among the 46-55 year old is -755. That is, increases in unemployment rate among individuals between 46 and 55 years have three times the impact on wage growth than that of 16-25 years of age. The estimates vary a bit across industries but generally suggest a much larger wage growth response to the unemployment rate of workers over 35 than to the unemployment rate of unskilled young workers. We infer from the pattern of estimates that bargained wage growth do not react to the economic condition of unskilled young workers.

Bargained and actual wages The third piece of evidence shows the link between wages in collective agreements and the measures of wages used in the previous section –the median of actual wages perceived by unskilled workers relative to the median of actual wages perceived by mid- and high-skilled workers.

Table 3, row 1 shows weighted-least squares estimates of the impact of the ratio of the wages of laborers on mid-skill groups on the wage bargained for laborers in the province for the five industries considered: construction, metal, services, retail and rest. Each province-year unit provides one observation, and the coefficients are estimated using Weighted Least Squares, where the weights are the number of workers in the province in the Social Security database (as that was the database used to compute median wages). One thousand euros extra in the collective agreement wage in construction increases the ratio of unskilled to mid-skill wages by 1.9 percent (standard error: .6). We also obtain a significant coefficient for the retail industry (albeit much smaller in magnitude) and for the rest of industries. Overall, the ratio of skill specific wages defined as in (2) is a significant determinant of the ratio of low-to mid- skill wages. We obtain a worse fit for skilled wages. Such result is well known in the literature: collectively bargained wages matter more in the lower and in the higher part of the distribution of wages.

5 Results using median wages in province-skill-age cells

Table 4 presents estimates of the impact on final schooling attainment (measured at age 25) of two measures of the skill premium when a young adult was 17. The measures utilized are the return to some form of high school education –either vocational training or high school– measured as the provincial ratio of wages in unskilled jobs over wages in mid-skill ones: $\frac{W_{unskilled}}{W_{mid_skill}}$. The second measure is the (inverse of the) returns to college –measured as the provincial ratio of wages in jobs that require a college degree and wages in jobs that require some training: $\frac{W_{mid_skill}}{W_{college}}$. The estimates shown are the marginal effects of the variable in each row on the probability of observing the educational outcome in each column.⁹ All specifications include province and year fixed effects. Standard errors are all clustered at the province level.

We start by showing marginal effects measuring the impact of each wage ratio on the overall probability of completing some form of post-compulsory schooling. The response of post-compulsory education to a 10% increase in $\frac{W_{unskilled}}{W_{mid_skill}}$ is shown in Table 4, Panel A, row 1, and is -.018 (standard error: .08). A cohort that observes at age 17 a ratio of the wages of laborers relative to mid-skill jobs 10% higher than the province average is 1.8 percentage points less likely to complete basic school. Columns 2-4 in Table 4 explore how such change changes the educational composition of the cohort. The coefficient of vocational training is -.016 (standard error: .009), while that of the academic high school track is .006 (standard error: .014). The pattern of results suggests that relative increases in the wages of unskilled workers increase the pool of workers without any level of skill at the expense of students with vocational training.

The second row of Table 4 documents how increases in the upper part of the wage structure affect the composition of educational attainment. Firstly, a 10% increase in the ratio $\frac{W_{mid_skill}}{W_{college}}$ observed at age 17 does not affect much the fraction of male youths achieving post-secondary education. The marginal estimate in Table 4, Panel A, column 1, row 2 is -.002, not significantly different from zero. Still, within the group of individuals that achieve more than basic education, a 10% increase in $\frac{W_{mid_skill}}{W_{college}}$ over the provincial average increases the share of male youths completing vocational training by .7 percentage points at the expense of the academic high school track, that falls by 1.1 percentage points. The estimates are not very precise, though.

Unemployment in the province at age 17 plays a small role in the educational decisions of young males. A cohort that observed a one percent increase in the ratio of the unemployment rate of unskilled workers relative to that of skilled workers at the age of 17 seems to be .2 pp percent more likely to finish basic

⁹The estimates are evaluated for a young adult living in Madrid at 25 years of age and born in 1974.

schooling, contrary to the idea that unemployment leads young adults to stay at school. However, as it will be clearer later, once we control for time and province dummies the effect is not significantly different than zero. Therefore, conditional on the wage the young adult obtains if working, the rate of arrival of new offers does not seem to be an important determinant of schooling attainment. Clark (forthcoming) using UK data and Petrongolo and San Segundo (2002), with Spanish data, document that regional unemployment diminishes the chances of school enrolment between 16 and 18. Nevertheless, those studies do not control for relative wages. We also note that those studies focus on enrolment at age 16 or 17, a different outcome than schooling attainment at age 25 if young adults re-enter the educational system at some point. We study the enrolment responses to wages below.

Table 4, Panel B shows the coefficients when we select to the sample of workers who live with their parents at their age of 25 –85% of the sample. The advantage of that sample is that we can control for the educational level of the parents of the youth. The coefficients become more precise: a 10 percentage points increase in ratio of wages in low-skill positions relative to mid-skill positions observed at age 17 leads to an increase of 1.8 percentage points in the fraction of young adults who only complete basic schooling (standard error: 1.1) and a drop of 2.3 percentage points in the fraction of young adults completing vocational training. The pool of students with academic high school at 25 is not affected much, a finding consistent with cross-sectional evidence using a structural model by Lopez-Mayan (2010).

Table 4 Panel C shows the results of the specification (2) when one adds province-level trends. Such trends absorb any province-specific development in educational attainment - like if the reform of the educational system was province-specific - or wages -like trends in population growth that affect relative wages. Such specification is very demanding, as coefficients are now identified out of variation in changes in the skill-wage profile that depart from a province level trend. The estimates of the response of educational attainment to increases in the relative wages of unskilled workers are very similar to those in Table 4 Panel B, suggesting that omitted biases related both to wages and schooling attainment at the province level are not driving our results.

Finally, we test the suitability of the cohort-level specification by regressing the schooling attainment of a cohort on the wages that such cohort observed at the age 22 –once schooling decisions are basically taken. The coefficients are either statistically insignificant and lower in magnitude than those in Table 4.B. The results suggests that median wages in the province-skill-age cell at age 17 are not driven by spurious trends at the province level and that the timing of changes in relative wages matters for educational attainment.

6 The response of schooling attainment to wage structure: using wages in collective agreements

Next, we examine the schooling responses to changes in relative wages of unskilled and mid-skilled workers when the latter are measured using wages established in collective agreements. As we mention above, this measure is arguably better than using median wages in province-skill-age cells, as it is less affected by relative changes in the supply of unskilled workers.

6.1 The Response of Males.

Table 5A shows the response of schooling attainment at age 25 to a 10% increase in the ratio of bargained wages in low-skill jobs relative to mid-skill (row 1) and the ratio of mid- to high-skill jobs (row 2), both observed at age 17. As in Table 4, the first magnitude measures are the (inverse of the) returns to acquire at least some schooling. The second is the (inverse of the) returns to college: the ratio between mid-skill wages and the bargained wages of jobs that require college. As before, all responses are evaluated for a young adult born in 1974, living in Madrid and, in Panels B-D, living with parents and whose mother has high school.

Column 1 of Table 5A Panel A shows the response of the probability of completing any form of secondary schooling on both measures of the wage structure, estimated using a Probit. Cohorts that observed a ratio of unskilled to mid skill wages 10 percentage points above the provincial mean were 6.5 percentage points less likely to having completed schooling beyond the compulsory at the age of 25. The standard error is 1.8 percentage points. Instead, the ratio of mid-skill to top skilled wages at the age 17 does not help predicting secondary schooling completion. The estimates are substantially larger than comparable ones presented in Table 4. Even though the sample is different -as for some provinces, we had no information about collective agreements, the large magnitude of the estimates suggests attenuation bias due to the simultaneity of demand for and supply of unskilled work. In Columns 2-4 we show how the different forms of schooling attainment are affected by changes in the wage structure, now using a multinomial logit. The coefficient of the first row of Table 5, Panel A, column 2 is .055 (standard error: .015). That is, a cohort exposed at age of 17 to a ratio of unskilled-to mid skill wages 10% higher than the provincial average is 5.5 percentage points more likely to attain only basic schooling and 6.5 percentage points less likely to finish high school than a cohort who faced at age 17 the average ratios in the province. Aside from the larger magnitude, the key difference with respect to the results in Table 4 is that we now find mainly a response among students of the academic high track. López-Mayán (2010) successfully estimates a structural model of grade progression for the 1985 cohort, finding that students of vocational training are most sensitive to relative changes in the return to vocational training, measured in a way that is similar to our first measure. While our estimates in Table 4 resemble those of López-Mayán, once

we use a measure of relative wages that is less sensitive to relative changes in the supply of unskilled workers, the high wage sensitivity of vocational training students disappears. In principle, the simple model in Model 2 is ambiguous about what group should respond most.

The impact on schooling attainment of our measure of the returns to college is shown in the second row of Table 5A. A cohort who was exposed at 17 to a ratio of mid-skill wages to college wages 10% higher than the provincial average is 3.8 percentage points less likely to complete high school (standard error: 1.5 pp) and 3.6 percentage points more likely to finish vocational training. The result suggests again that young adults engage in upper secondary schooling as a route to complete college. Holding constant the ratio of unskilled wages to mid-skill ones, a drop in college returns does not affect the chances of completing primary schooling. That pattern of results also departs from what we found in Table 4, where the fraction of youth with basic schooling increased when the return to college dropped while that with vocational training was affected little.

Panels B and C in Table 5 examine the robustness of the results in Panel A when we limit the sample to coresidents (and are thus able to control for parental background characteristics) or add province-specific trends. The main result that an increase in the relative wage of unskilled workers leads to affected cohorts to complete at most the compulsory schooling level at the expense of potential students of the high school academic track is robust to those changes in the specification. The most noticeable change is that, when we add provincial trends, we no longer find statistically significant impact of the returns to college on the share of young adults completing either upper secondary or vocational training. A possible reason for that is that, unlike the return to acquiring some education, returns to college fell uniformly during the sample period –see Figure 2. It may be hard to empirically distinguish between a provincial trend and a decreasing return to college.

6.1.1 Unemployment -adjusted wages

The returns to education are not only observed in higher wages, but also in a lower probability of losing the job –see De la Fuente and Jimeno (2009). There is a strong relationship between the educational level and the probability of being unemployed. Hence, we adjust the measure of wages (3) as follows

$$\widehat{W}_{s,p,t} = \sum_{j=1}^{j=6} \pi_{s,j,p,1995} \bar{w}_{s,j,p,t} [1 - P(U_{S,j,p,t})]$$

That is, we weight the average wage of unskilled workers in collective agreements by the province-specific probability of being unemployed among workers with basic education level and ages between 26 and 35 when the cohort was 17. The measure assumes that income is zero when a young adult that does not work –ie, we ignore unemployment benefits. We adjust the returns of mid-skill (high-skill) workers by multiplying by 1 minus the probability of being unemployed by workers with vocational training or only with upper secondary

school (college). The probability of being unemployed is computed only among active workers, and ignores nonparticipation. The results of the new measure are shown in Table 5B. In that specification, we also control for the ratio of unemployment rate between the unskilled and the mid-skilled workers as well as for the ratio of unemployment between the mid-skilled and the high skilled. The results are similar to those in Table 5A and we do not comment them in detail.

6.1.2 Responses by parental background

Next, we examine what groups are most responsive to changes in the wage structure observed at 17. The discussion in Section 2 leads us to expect that less patient youths -or those with a higher marginal propensity for present consumption- are specially sensitive to increases in $\frac{\overline{W}_{unskilled}}{\overline{W}_{mid_skill}}$. We do not have information about both parental income and education, to decisively disentangle between parental education and parental income effects. Still, we control for parental education. We re-estimate the multinomial logit for each subsample of coresident youths separately.

When we compare the response of educational attainment in rows 1 and 3 of Table 5B we find much larger point estimates of $\frac{\overline{W}_{unskilled}}{\overline{W}_{mid_skill}}$ in the subsample of males with low-education mothers than in the subsample of mothers with high education or higher. As in Table 5A, once we condition on province-specific trends, we fail to detect a statistically or economically relevant response of educational attainment of changes in $\frac{W_{mid_skill}}{W_{college}}$ in any of the partitions considered.

6.2 The Response of the schooling attainment of females

The educational attainment of females also stagnated among Spanish nationals, but to a lesser extent than for males. The share of female Spanish citizens that by the age of 25 had achieved compulsory schooling or less dropped from 50% (1967 cohort) to 26% (1979 cohort) to subsequently increase to 30% among the 1984 cohort. Aparicio (2010) documents that unskilled Spanish females do not work in the construction sector. Yet, wage growth in the sectors where unskilled females typically work (retail and restaurants+hotels) was also higher than that in skill-intensive industries. Hence, it can be argued that females' incentive to acquire higher education also fell during the sample period.

Table 6 redoes the whole exercise for females but modifying the measure of wages (2) to take into account that $\pi_{s,j,p,1995}$ are female specific. Panel A of Table 6 suggests that the increase in unskilled wages, relative to mid-skill ones has little explanatory power for schooling attainment at the age of 25 whatever the sample considered.

Unlike in the case for males, there is some evidence of a response of schooling attainment to increases in the relative wage of wages in high-skilled jobs. When we control for parental background, a 10% increase in the ratio of the wages in

high-skill jobs relative to mid-skill ones decreases the share of females completing vocational training by 0.99 percentage points (Panel B, row 4, column 2) increasing the fraction completing upper secondary or more by .96 pp (Panel B, row 4, column 3). Interestingly, the negative response of vocational training to increases in high-skilled wages is robust to the inclusion of province level trends. Still, some of the estimates are imprecise.

6.3 Quantification of the impact for males.

Table 7 provides an alternative quantification of the impact of the responses in the fourth panel of Table 5, conducting the following counterfactual: What would have been the evolution of schooling attainment of the 1984 cohort had it faced at age 17 the wage structure of the 1978 cohort? We perform the computation using the properties of multinomial logit specification. In particular, we first predict for each individual his educational attainment at age 25 based on the wage structure observed at 17. The special assumptions of the multinomial logit guarantee that the predicted share for each cohort coincide with actual values. We then predict the educational attainment when, holding constant the rest of the covariates, we change the wages structure with that of the same province, but observed by the 1984 cohort.

The results in the first panel of Table 7 suggest that the observed changes in the wage structure have contributed substantially to the changes in educational attainment. For example, within the cohort of males born in 1984, 36% completed at most basic schooling. The fraction was 33.2% among the 1976 cohort. According to our estimates, had the 1984 cohort observed the returns of the 1978 one, the corresponding share of youths with basic schooling would have been 34.2%. That is, changes in the wage structure would explain 1.8% of the 2.4% observed increase. The model does worse when fitting the evolution of the share of youths with vocational training and the academic high school track.

In the second Panel of Table 7, we present additional estimates that control for covariates -the education of the mother and household structure at 25- to take into account that the educational attainment of parents has been increasing during the sample period. The results are similar to those in Panel A and we do not comment them in detail.

6.4 The response of school enrolment to changes in wage structure.

We provide evidence on the dynamics of the response of human capital investment to changes in the structure of wages at ages 16-18. The aim of the exercise is to check whether a higher ratio of the wage of unskilled workers relative to wages in mid-skill jobs leads the youth to leave the school (in the spirit of the exercises by Sanders et al, 2005). As in Tables 5 and 6, we use measures that rely on wages signed in collective agreements.

The OLS coefficient in row 1, column 1 in Table 8 indicates that a cohort that observes a 10% increase in the ratio of the wages of laborers and the wages of mid-skill workers is .7 percentage points more likely to abandon the schooling system between the ages of 16 and 18 than a cohort that observes the province-specific mean ratio of unskilled to mid-skill workers. The standard error, corrected for arbitrary correlation across observations in the same province is .39. The response of enrolment to a 10% increase in the wage of unskilled workers is slightly lower when we examine at the sample of coresidents: .6 percentage points. Probit estimates are qualitatively similar but smaller and less precise –and not statistically significantly different from zero at the 5 percent confidence level.

Overall, the estimates of enrolment are broadly in line with the evidence from the educational attainment specifications, and suggest that one of the channels by which young adults end up achieving a lower level of attainment is through leaving school at early ages.

7 Implications and conclusion.

Between 1986 and 2009 Spain experienced a drop and a subsequent increase in the wage of unskilled young workers relative to mid-skill ones. That ratio diminished during the 1992 crisis - that expelled some 8% of the workforce from the labor market- but increased steadily during the subsequent expansion, that involved a large increase of the unskilled-intensive construction sector. At the same time, the schooling attainment of Spanish cohorts experienced improvement until that born in 1976 and deteriorated afterwards. We combine administrative records on earnings, information on industry-province collective agreements and information on educational attainment in an employment survey to estimate the response of schooling attainment to changes in the return to skill that adults may observe at the age of 17. Unlike previous work, we examine the response of final schooling attainment to changes in the return to skill. Hence, our estimates can inform about how perceived returns may affect the final set of skills acquired in the formal education system (academic skills in upper vocational branch and professional skills acquired in the vocational branch). We use the wage structure in collective agreements to obtain variation in wages that unskilled workers effectively get and that are not affected by the contemporaneous changes in the supply of labor.

Our preferred estimates suggest that changes in the wage structure have effects on the composition of skills that males acquire in the formal education system. In particular, the increase in the unskilled to mid-skill wages ratio observed between the years 1993 and 2001 led to a 1.8 percentage points increase in the fraction of youth who completed primary education (or less), mainly at the expense of the proportion of youth completing upper high school. The finding is robust to adjustments for differential incidence of unemployment across education groups and suggests that the investment in academic skills is more elastic to unskilled wages than investments in skills directly related to profes-

sional activities. We find weak schooling responses to perceived wage increases in high-skill jobs. As for females, we find a weak response of the probability of investing in academic skills in response to relative increase in high skill wages, but no response whatsoever to increases in wages in low-skilled jobs.

These estimates have implications on the future productivity of those cohorts – wages of workers in their twenties with basic schooling were 6 and 9 percent lower than those with vocational training and 3 percent lower than those with upper secondary schooling only according to the 2006 Spanish Survey on the Structure of Wages. A quantification of the amount of the associated losses is left for future research.

8 Appendix 1: Correspondence between schooling levels, both systems

This appendix describes our assumptions to make a correspondence between systems. To provide some intuition, Table A.1 shows the educational system before and after 1990.

Basic schooling: Equivalent to 8th grade of primary schooling (or less) under the old system and second cycle (or less) under the new one.

Upper secondary schooling: Equivalent to finishing pre-University (and high school) under the old system, and the second cycle of upper secondary schooling under the new one.

Vocational training: Completing any of the grades under both systems. Ideally, we would like to distinguish between grades within each systems and, even better, across systems. Unfortunately, the coding in the Spanish Employment Survey does not allow a clear correspondence between the old and the new system. We lumped together all vocational training together, and note that students finishing the degree under the new system may be better qualified than those under the old system if the first grade of Vocational Training was prevalent under the old system.

College: Any college under any of both systems.

9 Appendix 2: Explanation of Figures A.1. and A.2.

A young adult will choose vocational training over academic training if the relative gains of waiting one more year to reap the returns (weighted by the chances of success at college) exceed the cost of weighting (measured at the market price R) by an amount sufficient to exceed the idiosyncratic taste for occupational jobs.

$$\frac{S}{w_v} = p\left[\frac{\beta\Delta_v w_{col} - R}{R}\right] \quad (\text{VT -A})$$

where $\Delta_v w_{col} = \frac{w_{col} - w_v}{w_v}$. The individual will choose the vocational track over no schooling if the preference for professional tasks plus the extra return on vocational activities during the 2 final periods exceeds the benefit of already consuming in the first period.

$$\frac{\beta}{R} \left[\frac{S}{w_v} + \Delta_u w_v \left(1 + \frac{\beta}{R} \right) \right] = \frac{w_u}{w_v} \quad (\text{VT - DO})$$

where $\Delta_u w_v = \frac{w_v - w_u}{w_u}$. Finally, the indifference condition between the academic training and unskilled work is determined by:

$$\left[\frac{\beta}{R} + \frac{\beta}{R} \right] \Delta_u w_v + p \left[\frac{\beta \Delta_u w_{col} - 1 - R}{R} \right] = 1 \quad (\text{A-DO})$$

where $\Delta_u w_{col} = \frac{w_{col} - w_u}{w_u}$.

Obviously, a set of individuals will always choose no training if the discount factor is sufficiently low (β close enough to zero). Imagine that there is a set of prices in the market R , $\frac{w_v}{w_u}$ and $\frac{w_{col}}{w_v}$. Individuals will select in any of the three choices according to their values of β , p and S .

Figure A.1. displays the equilibrium choices in the β , S space assuming $R = 1$. For a level of $\beta = 1$, no one will be a high school dropout under our assumptions of existence of market returns to any form of schooling. For that level of patience, only individuals with relatively a level of $\frac{S}{w_v}$ such that, $\frac{S}{w_v} > p[\Delta_v w_{col} - 1]$ will choose the vocational training. Now, $S = 0$ at a minimum. Hence, the minimum level of β for which there are indifferent youths between the academic and the vocational track is.

$$\bar{\beta} = \frac{1}{\Delta_v w_{col}}$$

Hence, in the $\left\{ \frac{S}{w_v}, \beta \right\}$ space, a straight line with slope $p \Delta_v w_{col}$ from $\left[0, \frac{1}{\Delta_v w_{col}} \right]$ to $[1, \Delta_v w_{col} - 1]$ defines the indifference levels between vocational training and the academic track. Points above that curve (see Figure A.1.) contain the set of values $\left\{ \frac{S}{w_v}, \beta \right\}$ for which vocational training is the best option.

Regarding points for $\beta < \frac{1}{\Delta_v w_{col}}$, the only relevant condition is whether enrol in vocational training or to leave the schooling system altogether. The indifference curve between both options is given by condition VT-DO, that yields the following curve

$$\frac{S}{w_v} = \frac{1}{\beta} \frac{w_u}{w_v} - \Delta_u w_v (1 + \beta)$$

That is a decreasing function, that tends to infinity at $\beta = 0$ -no level of idiosyncratic utility can induce a person who only cares about today to incur in any investment. The curve must cross the axis of β at a value below $\beta < 1$ (as when $\beta = 1$ being a school dropout can never be optimal given our assumptions). We draw Figure A.1. under the assumption that the level of β that makes $\frac{S}{w_v}$ equal zero exceeds $\frac{1}{\Delta_v w_{col}}$.

Hence, Figure A.1. allows us to examine what happens when $\frac{w_u}{w_v}$ increases. In that case, the indifference curve between vocational training and being a drop out moves to the right, inducing to be a drop-out both impatient vocational training and academic track students with a low level of $\frac{S}{w_v}$.

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Table 1: Evolution of schooling attainment of male natives at age 25

Year of birth	Primary	Vocational training	Upper secondary	College
1971	47.6	20.82	15.17	16.41
1972	45.52	20.54	15.25	18.7
1973	45.46	20.7	15.63	18.22
1974	42.53	21.9	15.09	20.48
1975	38.63	21.74	18,00	21.63
1976	38.28	23.31	16.51	21.89
1977	36.25	23.42	19.3	21.03
1978	37.23	20.85	17.91	24.01
1979	38.66	21.29	17.53	22.52
1980	37.83	24,00	18.02	20.16
1981	37.78	25.4	16.91	19.91
1982	38.35	24.74	17.78	19.12
1983	37.63	25.57	15.45	21.34
1984	40.02	25.00	15.13	19.85

Source: EPA, 1992-2009 waves (excluding third quarter). Sample of males age 25 each year. Primary school includes individuals who dropped before finishing compulsory education. For definitions of upper secondary and vocational training, see Table A.1.

Table 2: The evolution of the ratio of skilled-to unskilled wages observed at age 17

Calendar year	Cohort turning 17	Wun(16-45)/Wmed(25-45)	Wmed(16-45)/Wsk(25-45)
1986	1969	0.766	0.645
1987	1970	0.763	0.642
1988	1971	0.758	0.632
1989	1972	0.746	0.605
1990	1973	0.749	0.591
1991	1974	0.746	0.590
1992	1975	0.752	0.579
1993	1976	0.725	0.590
1994	1977	0.710	0.577
1995	1978	0.697	0.569
1996	1979	0.693	0.562
1997	1980	0.702	0.567
1998	1981	0.712	0.563
1999	1982	0.726	0.560
2000	1983	0.739	0.562
2001	1984	0.743	0.563
2002	1985	0.742	0.564
2003	1986	0.740	0.567
2004	1987	0.738	0.561
2005	1988	0.741	0.563
2006	1989	0.756	0.569
2007	1990	0.769	0.565

Source: Longitudinal Social Security Records

Wun(16-45)/Wmed(25-45): Ratio of the wages of unskilled workers (average 16-45) to mid-skill levels

Wmed(16-45)/Wsk(25-45): Ratio of wages of mid skill workers to high skill workers

Table 3: The response of schooling attainment at age 25 to return to skill at age 17 -males

Estimation method:	Probit	Multinomial logit		
	> Primary	Primary school	Voc. training	HS+
<i>Panel A: Full sample (covariates: province and year dummies)</i>				
1. Wage unsk./medskill	-0.018 (.08)**	.012 (.011)	-0.0166 (.0087)*	.0057 (.014)
2. Wage med /High skill	-0.002 (.07)	.0036 (.0058)	.007 (.007)	-.011 (.008)
3. Unskilled/Unskilled	-0.003 (.0017)*	.002 (.0016)	-.0007 (.001)	-.0015 (.0022)
Number of observations			46135	
<i>Panel B: Coresidents (covariates: former plus family size and parental background)</i>				
4. Wage unsk./medskill at 17	-0.021 (.09)**	.018 (.011)*	-.023 (.010)**	.006 (.014)
5. Wage med/high skill age 17	-.072 (.07)	.009 (.006)	.008 (.008)	-.017 (.08)**
6. Unskilled/Unskilled	-0.002 (.002)	.0016 (.0019)	.0002 (.0014)	-.0018 (.0023)
Number of observations:			38982	
<i>Panel C: Coresidents (covariates: former plus province-level trends)</i>				
7. Wage unsk./Wage medskill at age 17		.017 (.013)	-.029 (.012)**	.013 (.017)
8. Wage med sk./Wage high skill at age 17		.013 (.008)	.003 (.008)	-.017 (.09)*
9. Unemployment rate (unskilled/skilled)		.0015 (.002)	0 (.0013)	-.0015 (.0025)

Source: own computations using the Spanish Employment Survey (EPA, 1995-2009) merged with wages in the Registry of Social Security records (years 1987-2001). The coefficients shown are marginal effects of an increase in 10 percentage points in the ratio of bargained wages detailed in each row on the probability of achieving the educational outcome shown in the relevant column. Coefficients are evaluated for a young adult interviewed in Madrid, born in 1974 and, in Panels B and C living with both parents where the mother has high school. All specifications include province and year dummies. Standard errors clustered at the province level

Table 4: Actual wages and wages in collective agreements

Dependent variable:	Ratio of unskilled to mid-skill wages			Ratio of mid- to high skill wages	
	(1)	(2)	(3)	(4)	(5)
1. Wage laborers /Wage mid-skill (service+construction+retail+metal+rest)	--	.137 (.061)	.132 (.07)	--	-.109 (.031)
2. Wage mid-skill /Wage top skill	--	--	-.0467 (.064)	.073 (.044)	.029 (.049)
3. Laborers in construction	.0187 (.0057)				
4. Laborers in services to industries	-.0016 (.0030)				
5. Laborers in retail	.0030 (.0003)				
6. Laborers in metal	-.0041 (.0055)				
7. Laborers, rest of industries	.0122 (.0069)				
Constant	.559 (.089)	.519 (.048)	.559 (.058)	.535 (.027)	.639 (.054)
Number of observations:	365	365	274	275	275

Each unit observation is a province-year unit. The dependent variable is the ratio of unskilled wages (laborers, according to the Social Security classification) and mid-skill levels (groups 3-8, in that same category). Covariates are bargained wages for for the skill and industry level shown in each covariate. All specifications include year and province dummies. Standard errors clustered at the province level.

Table 5A: Schooling attainment at age 25 and return to skill at age 17 -MALES, measures with collective agreements

	Probit	Multinomial Logit		
	>Primary	Primary school	Voc. training	HS+
<i>Panel A: Full sample (covariates: province and year dummies)</i>				
1. Wage laborers / Wage mid-skill (17)	-.065 (.018)**	.055 (.015)**	.010 (.020)	-.065 (.025)**
2. Wage mid-skill / Wage top skill (17)	.006 (.015)	.001 (.010)	.036 (.015)**	-.0375 (.015)**
Cases:			25419	
<i>Panel B: Coresidents (covariates: former plus education of mother)</i>				
3. Wage laborers / mid-skill (17)	-.058 (.024)**	.017 (.007)**	.0166 (.029)	-.034 (.017)**
4. Wage mid-skill / top skill at age 17	.005 (.02)	.003 (.005)	.0268 (.009)**	-.030 (.010)**
Number of observations:			21014	
<i>Panel C: Coresidents (covariates: former plus provincial trends)</i>				
5. Wage laborers /Wage mid-skill at age 17	-.064 (.023)**	.040 (.018)**	.020 (.022)	-.060 (.030)**
6. Wage mid-skill /Wage top skill at age 17	.00 (.026)	.0035 (.015)	.015 (.023)	-.017 (.027)
Number of observations:			21014	
<i>Panel D: Adjusting for unemployment (provincial trends, coresidents)</i>				
7. Wage laborers (1-Uunsk) / Wage mid-skill (1-Umidsk)	-.030 (.020)	.024 (.010)**	.018 (.010)*	-.043 (.017)**
8. Wage mid skill (1-Umidsk) / Wage top-skill (1-Utopsk)	.00 (.018)	.004 (.007)	.006 (.0067)	-.010 (.0099)
Number of observations:			16955	

Source: own computations using the Spanish Employment Survey (EPA, 2001-2009) merged with wages in the Registry of collective agreements (1993-2001)
 Estimation method: Multinomial Logit. The coefficients shown are marginal effects of an increase in 10 percentage points in the ratio of bargained wages in each row on the probability of achieving the educational outcome shown in the relevant column. All specifications include province and year dummies, and the ratio of the unemployment rate of unskilled to skilled workers in the province.

The responses are evaluated for a young adult interviewed in Madrid, born in 1974 and, in Panels B and C living with both parents and whose mother has high

Table 5B: Schooling attainment at age 25 and return to skill at age 17 -MALES, including statutory wage growth

	Probit	Multinomial Logit		
	>Primary	Primary school	Voc. training	HS+
<i>Panel A: Full sample (covariates: province trends and year dummies)</i>				
1. Wage laborers / Wage mid-skill (17)	-.062 (.029)**	.048 (.031)	.040 (.032)	-.089 (.046)**
2. Wage mid-skill / Wage top skill (17)	-.02 (.02)	.01 (.016)	.00 (.018)	-.015 (.018)
Number of observations:		18330		
<i>Panel B: Coresidents, mother with basic schooling (covariates: provincial trends)</i>				
3. Wage laborers /Wage mid-skill at age 17		.066 (.030)**	.020 (.044)	-.087 (.058)
4. Wage mid-skill /Wage top skill at age 17		.028 (.030)	-.016 (.044)	-.012 (.048)
<i>Panel C: Coresident, mother with high school (provincial trends)</i>				
7. Wage laborers / Wage mid-skill		.018 (.007)**	.033 (.025)	-.051 (.029)*
8. Wage mid skill / Wage top-skill		.011 (.006)	-.008 (.0235)	-.002 (.025)
Number of observations:		17647		

Source: own computations using the Spanish Employment Survey (EPA, 2001-2009) merged with wages in the Registry of collective agreements (1993-2001). Estimation method: Multinomial Logit. The coefficients shown are marginal effects of an increase in 10 percentage points in the ratio of bargained wages in each row on the probability of achieving the educational outcome shown in the relevant column. All specifications include province and year dummies, and the ratio of the unemployment rate of unskilled to skilled workers in the province.

The responses are evaluated for a young adult interviewed in Madrid, born in 1974 and, in Panels B and C living with both parents and whose mother has high

Table 6: The response of schooling attainment of females to the return to skill at age 17 -measured using collective agreements

	Primary school	Vocational training	HS+
<i>Panel A: Full sample (province and year dummies)</i>	(1)	(2)	(3)
1. Wage laborers /Wage mid-skill at age 17 (service+construction+retail+metal+rest)	-.0236 (.0161)	.006 (.013)	.0174 (.0226)
2. Wage mid-skill /Wage top skill at age 17 (service+construction+retail+metal+rest)	.0042 (.018)	.005 (.007)	-.009 (.021)
Number of observations:		23532	
<i>Panel B: Coresidents (covariates: former plus education of mother)</i>			
3. Wage laborers /Wage mid-skill at age 17 (service+construction+retail+metal+rest)	-.003 (.0043)	.0057 (.0092)	-.0023 (.0115)
4. Wage mid-skill /Wage top skill at age 17 (service+construction+retail+metal+rest)	.00036 (.0045)	.0099 (.0048)**	-.0096 (.0081)
<i>Panel C: Coresidents (covariates: former plus province trends)</i>			
3. Wage laborers /Wage mid-skill at age 17 (service+construction+retail+metal+rest)	-.003 (.0043)	.0057 (.0092)	-.0023 (.0115)
4. Wage mid-skill /Wage top skill at age 17 (service+construction+retail+metal+rest)	-.0005 (.0045)	.0073 (.0045)*	-.0068 (.0057)
Number of observations:		17647	

See notes to Table 5B

Table 7: The magnitude of the impacts: attainment of cohorts 1978 on with 1978 (males)

	Schooling attainment of cohort			Schooling of cohort 1984 with returns of		
	1978 (1)	1984 (2)	Difference: (3) = (2) - (1)	1978 (4)	1984 (5)	Difference: (6) = (5) - (4)
<i>Panel A: Full sample</i>						
1. Primary school	33.2	36.0	2.8	34.2	36.0	1.8
2. Vocational training	22.1	23.0	.9	23.4	23.0	-.4
3. Upper secondary (or higher)	44.6	40.9	-3.7	42.4	40.9	-1.5
<i>Panel B: Sample of coresidents</i>						
1. Primary school	29.8	33.2	3.4	31.2	33.2	2.0
2. Vocational training	22.6	23.8	1.2	24.1	23.8	-.3
3. Upper secondary (or higher)	47.5	43.0	-4.5	44.8	43.0	-1.8

Source: combined sample of the Spanish Employment Survey (years 2001-2009) and the Registry of collective agreements.

Each entry in Panel A (B) contains the percentage of males attaining that schooling level by age 25 in the sample used in Table 5A Panel A (B)

Table 8: The response of enrolment (ages 16-18) to changes in the perceived wage structure.

Dependent variable:	1 if enrolled in school, ages 16 - 18; 0 otherwise			
	Full sample	Coresident	Full sample	Coresident
	OLS		Probit	
Estimation method:	(1)	(2)	(3)	(4)
1. Wage laborers /Wage mid-skill (service+construction+retail+metal+rest)	-.0075 (.0039)*	-.0059 (.0036)*	-.0052 (.0036)	-.0021 (.0036)
2. Unemployment in the province	-.019 (.034)	.018 (.029)	-.022 (.038)	.0069 (.0298)
3. Mother completed basic school		-.22 (.01)		-.232 (.011)
4. Mother completed high school		-.07 (.008)		-.086 (.012)
5. Mother completed college		.087 (.008)		.166 (.017)
6. Only father present in household		-.006 (.022)		-.024 (.019)
7. Only mother present in household		-.088 (.019)		-.110 (.018)
8. Constant	.873 (.038)	.964 (.047)		
Province dummies?	yes	yes	yes	yes
Year dummies?	yes	yes	yes	yes
Number of observations	88352	84306	88352	84306

Source: Spanish Employment Survey (EPA): waves 1993-2001 merged with wage information from the Registry of Collective Agreements -sample of provincial agreements.

Sample of young males, ages 16-18. Coefficients in columns 3 and 4 are marginal effects of an increase in the ratio of unskilled wages to med-skill of 10% for a young adult living in Madrid and born in 1976 and, in columns 2 and 4 living with both parents in a household with four members where the mother has a high school degree.

Table A.1: The correspondance between schooling systems, before and after 1999 law

Ages	14/1970 Act, changed in 1990 Pre-1990 system			14/1990 Act (first cohort fully affected: 1983) Post-1999 system		
	Degree	Academic track	Vocational track	Degree	Academic track	Vocational track
23	College	3rd cycle		College	3rd cycle	
22		2nd cycle			2nd cycle	
21		1st cycle	3rd grade		1st cycle	2nd grade
20	Pre-University	1	2nd grade	Upper secondary	2	1st grade
19		3			1	
18	Secondary education	2	1st grade	Compulsory sec. School	2nd cycle	
17		1			1st cycle	
16	Primary education	8		Primary education	3rd cycle	
15		7			2nd cycle	
14		6				
13		5				
12		4				
11		3				
10		2				
9		1			1st cycle	
8						
7						
6						

Table A.2. Correspondence skill groups-schooling group

	Skill groups Social Security definition	Our notation	Schooling
1	College graduates	High-skill	College
2	2-year college degree		
3	Managers	Mid-skill	Vocational training/upper secondary
4	Clerical workers, no college degree		
5	Clerical workers, rest		
6	Supporting clerical staff 1		
7	Supporting clerical staff 2		
8	Craftsmen, 1		
9	Craftsmen, 2	Unskilled	Basic schooling
10	Laborers		
11	Workers below the age of 18		

Table A.3. The determinants of wage growth in collective agreements: lagged unemployment rate

	Dependent variable: yearly wage growth in the agreement (percentage points*100)			
	Construction	Retail	Metal	Rest of industries
	(1)	(2)	(3)	(4)
Covariates: One-year lagged unemployment rate:				
1. Urate 16-25 years old	-239.56 (184.17)	-18 (148.70)	9.981 (181.079)	92.00 (150.16)
2. Urate 26-35 years old	-10.22 (298.77)	112 (238)	-130.88 (305.715)	-9.722 (241.36)
3. Urate 36-45 years old	-600.41 (343.5)*	-684.09 (276.11)**	62.004 (336.82)	-346.67 (276.00)
4. Urate 46-55 years	-755.62 (312.9)**	-107.47 (250.37)	-358.558 (308.055)	-404.47 (254.13)*
Number of observations	323	342	329	350
R-squared	.337	.31	.312	.336

Sample: Merged data set of Spanish Employment Survey and Registry of Collective Agreements

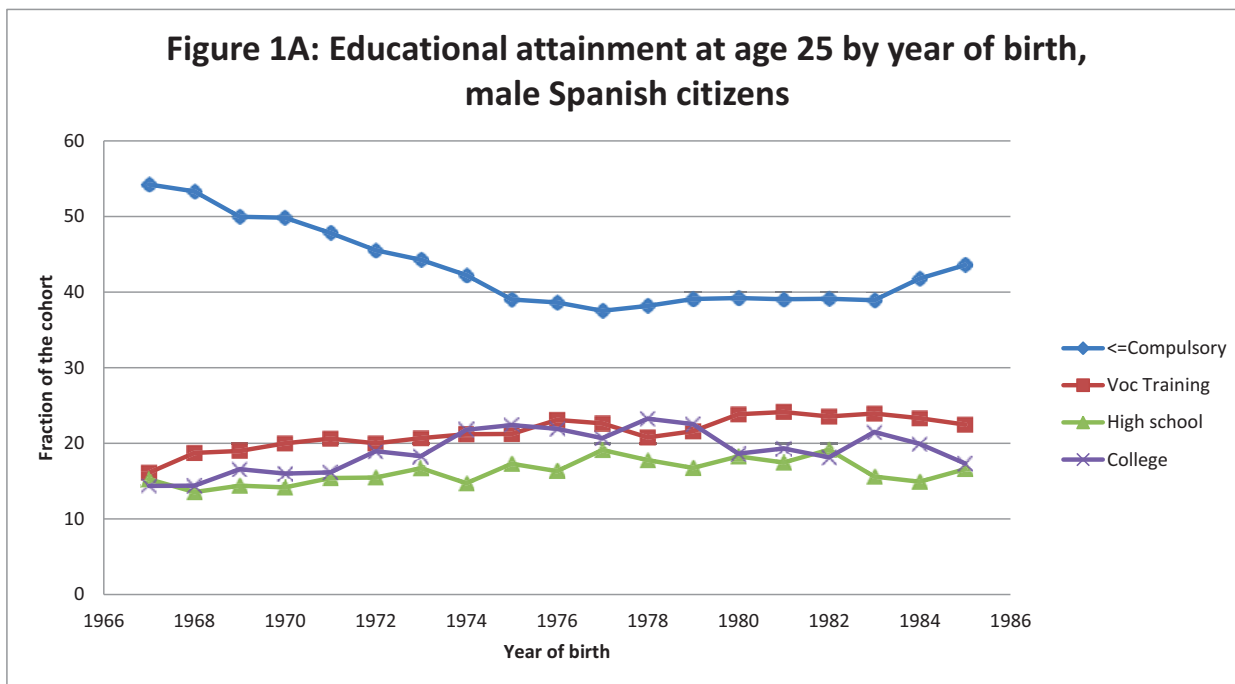
The measure of unemployment rate refers to adults with education at the primary level of less and varies between 0 and 1.

Wage growth is measured in percentage points multiplied by 100, ie, 1000 reflects a 10% wage increase.

The estimation method: weighted least squares, where weights are the number of workers in the province

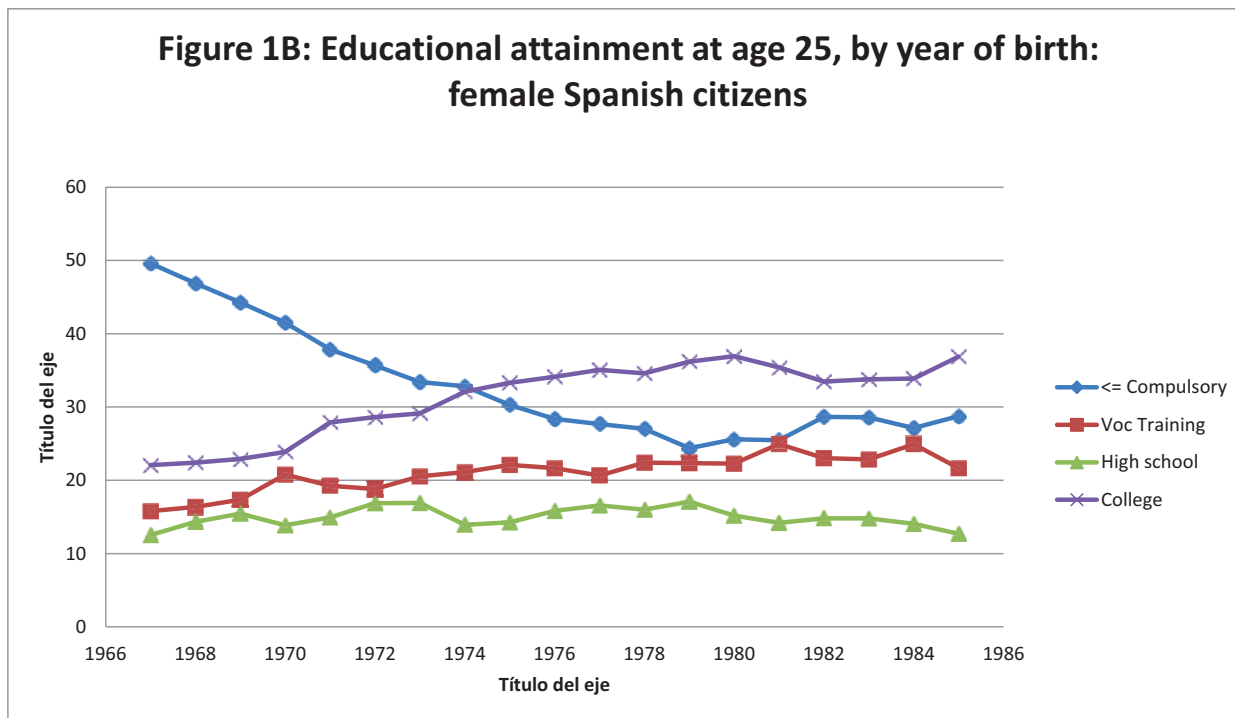
The unit of observation is the year-province. Sample 1995-1999. Additional regressors are province and year dummies.

Figure 1A: Educational attainment at age 25 by year of birth, male Spanish citizens



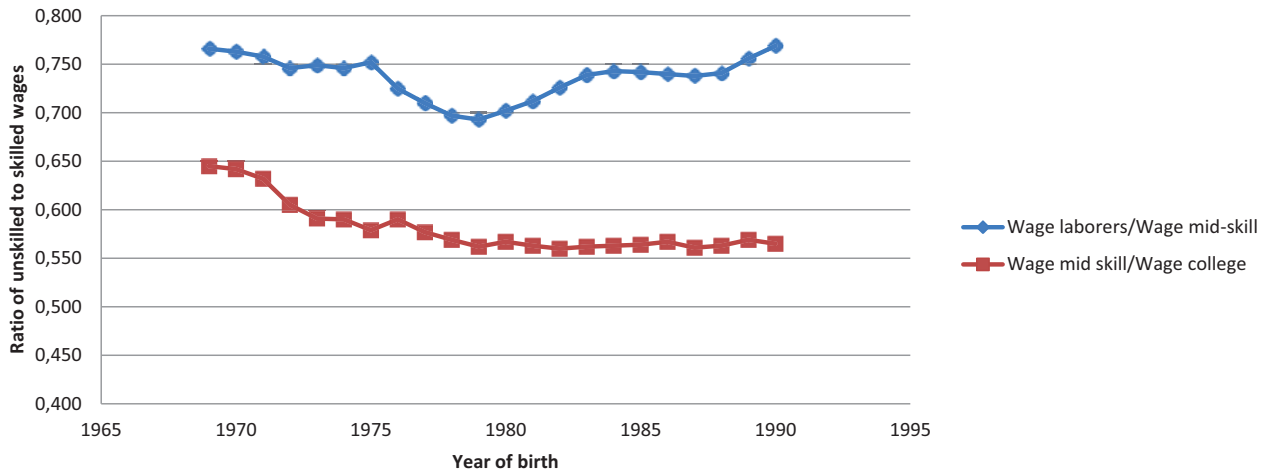
Source: EPA (Spanish Employment Survey), years 1992-2009

Figure 1B: Educational attainment at age 25, by year of birth: female Spanish citizens



Source: EPA (Spanish Employment Survey), years 1992-2009

**Figure 2: Wage structure by skill level at age 17, by year of birth:
Spanish males**



Source: Social Security Registers: 1989-2007

- Wage of laborers are medians among group 10 workers aged 16-45 years in province-year. We take medians in three age cells (16-26, 26-35, 35-45) and average them
- Wage of mid-skill workers are medians among groups 3-9 of workers aged 25-45 age in province-year. We take medians in two age cells and average them
- Wage of college workers are medians among groups 1-2 of workers in 25-45 age in province-year. We take medians in three age cells and average them

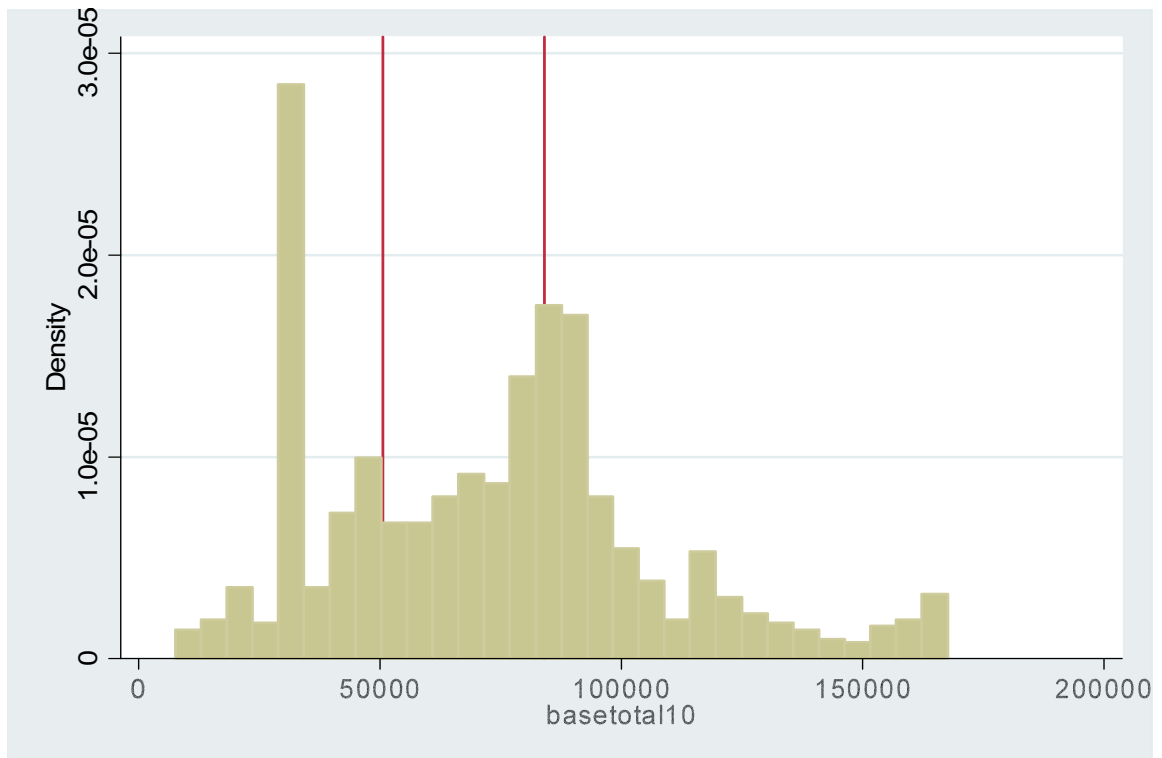


Figure 3: Histogram with the distribution of wages in the Social Security Records (1995)
 Province of Barcelona, all males between 18 and 35 working with the lowest level of qualification (laborers)
 The first line is the collective agreement wage for laborers in retail
 The second line is the collective agreement wage for laborers in construction
 Wages measured in cents of euro.

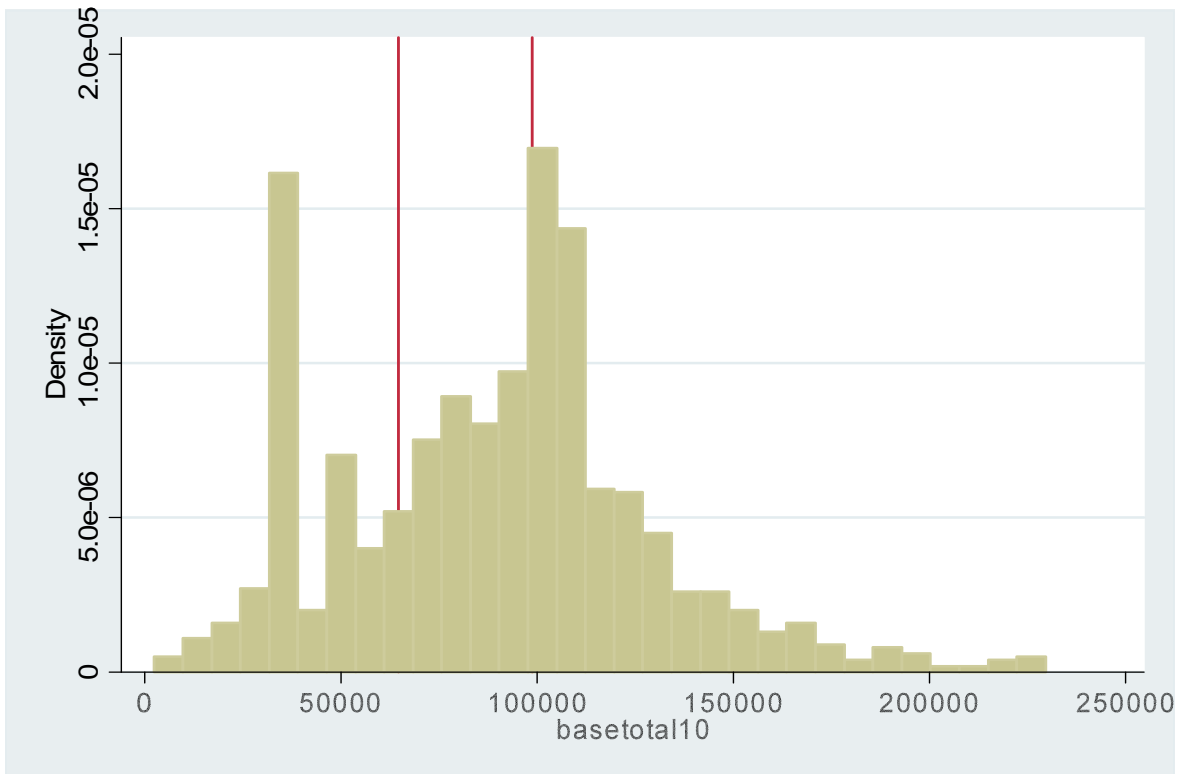


Figure 4: Histogram with the distribution of wages in the Social Security Records (2000)

Province of Barcelona, all males between 18 and 35 working with the lowest level of qualification (laborers)

The first line is the collective agreement wage for laborers in retail

The second line is the collective agreement wage for laborers in construction

Wages measured in cents of euro.

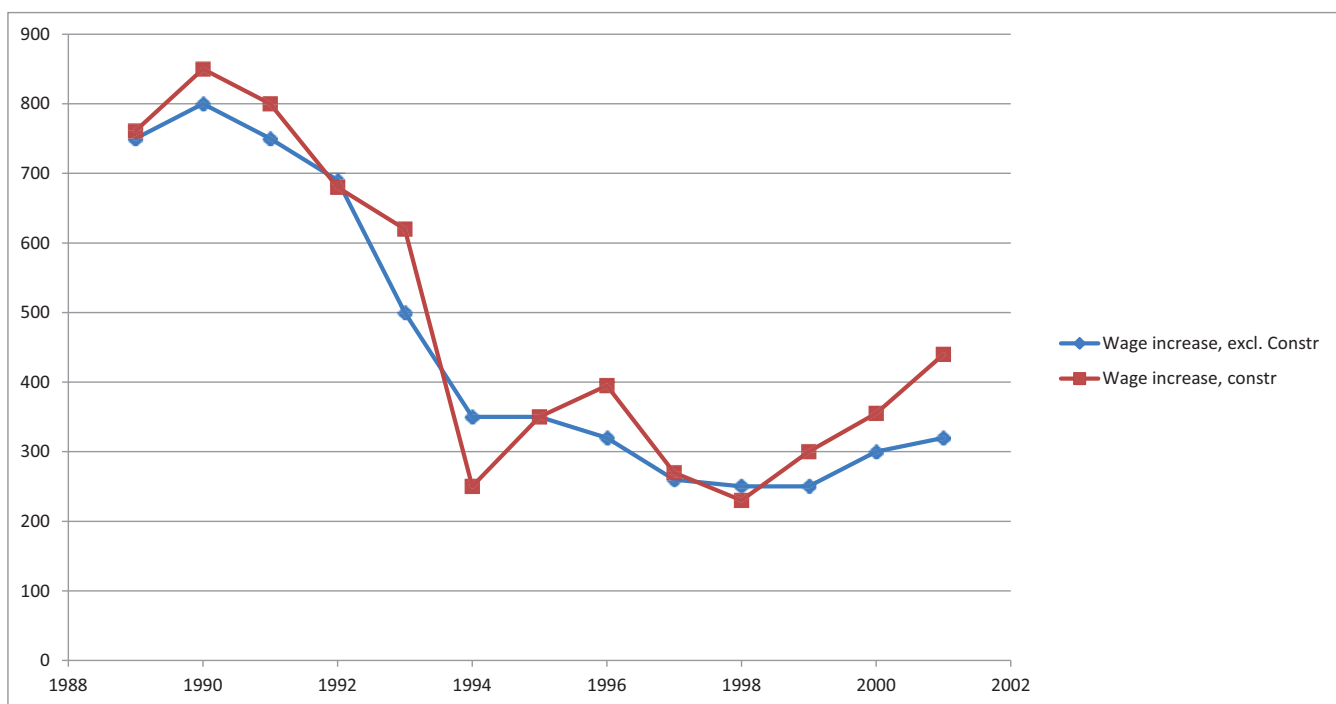


Figure 5: Bargained nominal wage growth in construction and in the rest of the industries

Source: Registry of Collective Agreements 1990-2001

Figures A.1: Schooling distribution by preferences of the youth, the impact of an increase in low skilled wages.

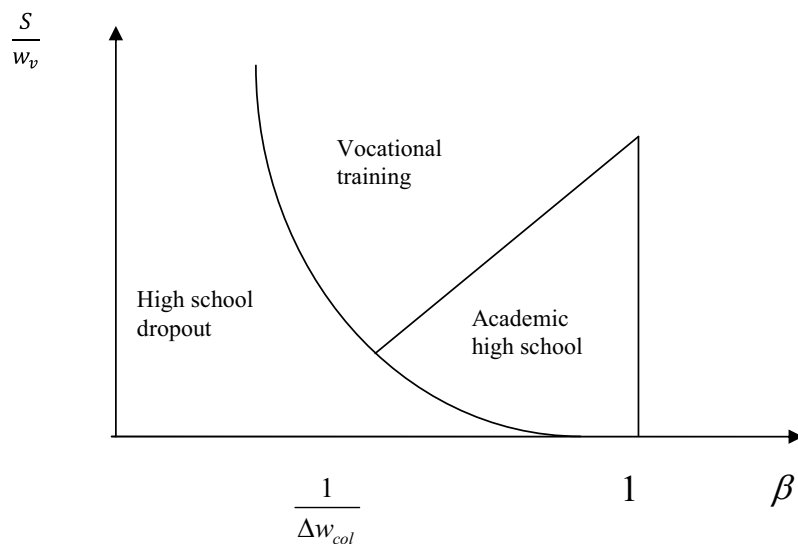


Figure A.2.: The impact in educational choices of an increase in low-skill wages

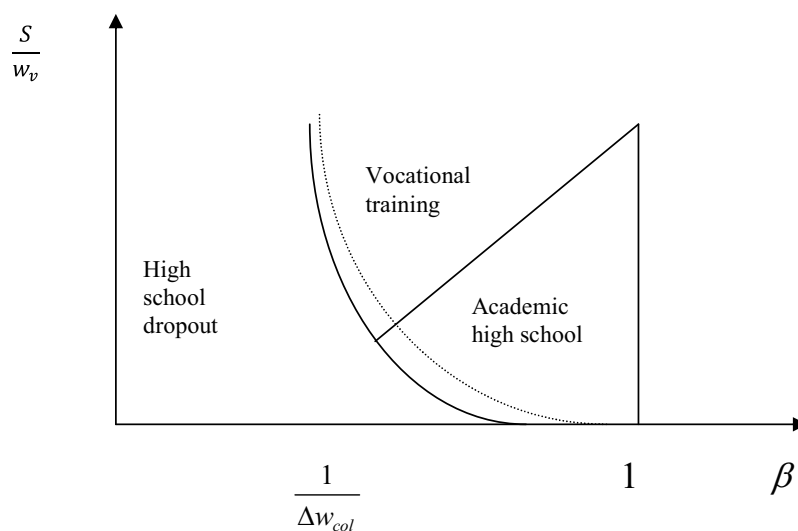
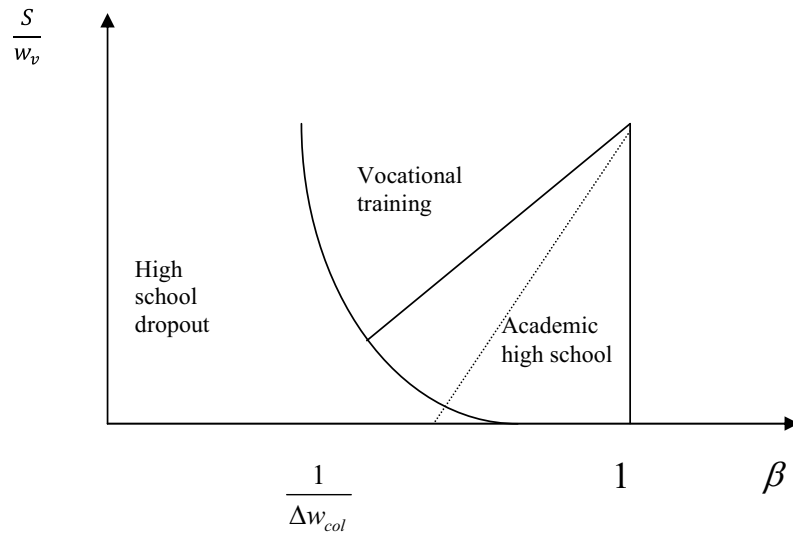


Figure A.3: The impact of a drop in the relative wages of skilled workers



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