High-School Dropouts and Transitory Labor Market Shocks: The Case of the Spanish Housing Boom

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Abstract

This paper addresses the implications of transitory changes in labor market conditions for low versus high educated workers on the decision to acquire education. To identify this effect, I use the improvement in labor market prospects of low educated workers motivated by the increases in construction employment and wages during the recent housing boom. The estimation strategy is based on the fact that changes in the labor market driven by the construction sector affect only men. Increases in construction activity are found to increase men's relative to women's propensity to drop out of high-school. According to this finding, policies promoting education should strengthen when in the presence of transitory shocks in the labor market that make dropping out more attractive.

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1 Introduction

The 2006 European Commission Progress Report on Education Policies states that "the high number of [high-school dropouts] is an obstacle to securing access to the knowledge-based society and greater social cohesion in the European Union"[1]. The European Union Government established an objective for 2010 of a 10% rate of high-school dropouts, as defined by persons aged 18 to 24 who have attained at most lower secondary education and who declare not having received any education or training in the previous four weeks. This objective was still unfulfilled in 2009, when the proportion of early school leavers in the EU-27 was more than 15%. In this paper, I show that changes in labor market conditions in recent years have prevented the achievement of a lower high-school dropout rate, specially for males.

Agents tend to abandon productivity enhancing activities and concentrate on producing when production becomes more profitable [2]. Likewise, in the context of education, individuals would decide to acquire less education when participating in the labor market is more rewarding. The recent housing boom has altered the labor market opportunities faced by youngsters and is therefore likely to be responsible for changes in high-school dropout trends.

Having a high-school diploma has been shown to reduce unemployment and increase wages. These differences are unrelated to individual characteristics as argued by Stern, Paik, Catterali, and Nakata (1989). I show that, by reducing the negative consequences of not obtaining a high-school diploma, the recent housing boom has induced more male youngsters to drop out of the educational system before getting a high-school diploma. From a policy perspective, this finding implies that creating the right incentives to get educated even in the presence of transitory labor market shocks can help to avoid high unemployment rates at the end of the economic upturn.

[1] Along this paper I will use the notion of early school leavers as defined by the European Union, but I will refer to early school leavers under the more common denomination of high-school dropouts.

[2] Some papers that find that productivity enhancing activities are reduced during economic expansions are: Bean (1990), Gali and Hammour (1992), Saint-Paul (1993), and Malley and Muscatelli (1999).

The construction sector presents two features that make it appropriate to estimate the effect of improvements in employment prospects for low educated individuals on the decision to drop out of school. First, it employs mainly men and second, the proportion of low educated workers is higher than in the rest of the economy. This implies that the upturn in construction activity will predominantly affect low educated men, and this will allow us to estimate the impact of better employment opportunities for low educated workers by comparing male to female high-school dropout probabilities. Additionally, the magnitude of the increase in construction activity and the differences in the incidence of the housing boom across regions provides the necessary variation to correctly identify the effect.

The implications of the housing boom for high-school dropouts are tested using Spanish data. The case of Spain is of special interest because of the situation of its educational system as well as the magnitude of the recent housing boom. Spain is one of the countries with the highest incidence of high-school dropouts in the OECD. This incidence has risen in the last decade, reaching 31% in 2009[3]. Additionally, while in the US house prices increased by 104% between 1997 and 2007, prices in Spain boosted by more than 190% in that same period (see Figure 1). Regarding the intensity of construction activity in the period, the ratio of construction value added over GDP and the number of new dwellings experienced a boost of 66% and 90%, respectively (see Figures 2 and 3).

In 2005, more than 29% of high-school students abandoned their studies to enter the workforce in Spain. Out of all individuals that left high-school to work, more than 23% of them worked in the construction sector. Disaggregating by gender, 32.61% of all males that leave high-school to work, do it in the construction sector, while the corresponding figure for females is negligible[4].

Some earlier papers have devoted their attention to the role of labor market conditions

[3]Data source: Eurostat. Information is publicly available at http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=tsisc060. The primary source is the EU Labor Force Survey.

[4]These data are obtained from the 2005 Spanish Education and Labor Transitions Survey (Encuesta de Transición Educativo-Formativa e Inserción Laboral (2005)).

in explaining student drop out decisions. The vast majority of previous studies have addressed this question by including macroeconomic indicators in the equation modeling the probability of dropping out.

Youth unemployment rate has been found to have a negative impact on dropouts in the studies by Peraita and Pastor (2000) and Clark (2011). The same conclusion is reached when labor market conditions are measured by the general unemployment rate in Duncan (1965) and Rees and Mocan (1997). However, the general unemployment rate displays a positive impact when both, the youth and general unemployment rate, are considered simultaneously by Petrongolo and San Segundo (2002). Regarding the effect of wages, Neumark and Wascher (1995) and Black, McKinnish, and Sanders (2005) find that wages of unskilled workers affect dropouts positively. In contrast, Schady (2004) conclude that there is no effect of labor market conditions on dropouts.

The closest paper to this one is Black, McKinnish, and Sanders (2005). They find that an increase in the earnings of low-skilled workers decreases high-school enrolment. They make use of the exogenous variation in low-skilled earnings caused by the coal boom and bust. However, gender-specific data is not available for their study. In my paper, I take advantage of gender-specific data to identify the effect of changes in labor market prospects, considered as the interaction of employment opportunities and wages, on education decisions.

The recent Spanish housing boom was caused by the confluence of financial as well as demand factors (see Gonzalez and Ortega (2009)) and had a great influence on local labor markets. It improved the labor market prospects of high-school dropouts with respect to those of more educated workers. Theoretically, the gains from leaving the school system are represented by the discounted sum of the interactions of probability of employment and expected wage in each period if one is low educated, minus the discounted sum of the interactions of probability of employment and expected wage in each period if one is highly educated[5]. This argument originated in the classical theory of Becker (1994).

[5]This argument is made assuming a binary decision of whether to complete high-school. This is a

In the last decade, both employment opportunities and wages have increased sharply in the construction sector. This raises the gains from leaving the school system for men. Figure 4 shows the huge increase in employment in the construction sector. Figure 5 makes apparent that construction wages have risen more than the average wage in the economy. In fact, the average construction wage was lower than the average wage at the beginning of the housing boom and it became higher afterwards. Given that construction employs low educated workers intensively as compared with the overall economy, agents in labor markets where the housing boom was more pronounced are expected to leave school earlier[6].

The previous hypothesis is tested using individual data from the Spanish Labor Force Survey in combination with data from the Spanish Regional Accounts and the Spanish Ministry of Housing. The sample is composed by individuals aged 18 to 24, out of which one third are high-school dropouts. Men represent 61% of total high-school dropouts. There is notable variation across regions within Spain. The highest ratios are found in some Mediterranean regions like Alicante and Almería, where they reach more than 42%, and the lowest ratios correspond to the Northern regions, i.e., Navarra and País Vasco, where high-school dropouts are less than 20%. Regarding the evolution over time, the high-school dropout rate continuously decreased since 1995 when the high-school dropout rate was around 40%, until 2000 when it reached a minimum of 28%. Since then, it has remained more or less stable until 2008, when it exceeded 30%.

The empirical correlation between the proportion of high-school dropouts and the intensity of the housing boom as measured by the ratio between construction and total value added in each province is positive for both males and females. This is represented in Figure 6. The line that fits the relation between high-school dropouts and construction activity is however steeper for males (the coefficient is 0.55 versus 0.25 of females) and,

plausible assumption in our case because Spanish high-school students rarely work.

[6]According to the data obtained from the Spanish Labor Force Survey, the average share of high-school dropouts working in construction for the period 1995-2007 is 73.4%. In contrast, the average share of high-school dropouts working in the overall economy for that same period is only 52.6%.

moreover, the slope is significant for males, not significant for females and statistically different from males and females. This illustrates the findings in the main econometric specification, where a differential positive effect of construction activity on high-school dropouts is found for males relative to females, while the average effect on all individuals is positive but insignificant.

The causal relationship between high-school dropouts and construction activity in a regional labor market is estimated by using the fact that changes in construction activity change employment prospects of men while it leaves those of women practically unaffected. The evolution of male and female employment in construction is displayed in Figure 7. Women have always represented a negligible fraction of construction workers.

Empirical results show that variations in construction activity as measured by changes in construction over total value added in a region make men more likely to drop out of high-school, while women remain unaffected. This effect is consistent with the estimations using number of new dwellings as an alternative measure of construction activity. In addition to the contemporaneous effect, I also find a significant positive effect of construction activity at the age of 17, i.e., at the time when the decision to drop out of high-school is more likely to be taken.

I conclude that changes in labor market prospects for low relative to high educated workers, even if they are transitory in nature, can have significant effects on schooling decisions.

The remainder of the paper proceeds as follows. Section 2 presents the methodology used to estimate the effect of the changes in labor market conditions as a result of the housing boom on high-school dropout rates. Section 3 describes the databases, the variables and the sample used in the analysis. Section 4 discusses the empirical results and explores the effect of changes in the level of activity in other economic sectors on high-school dropouts. Finally, section 5 concludes.

2 Methodology

The aim of the empirical exercise is to test whether changes in labor market conditions for low versus high educated workers change individual decisions to drop out of high-school.

The construction sector is characterized by employing mostly men. In fact, the average proportion of Spanish women employed in construction from 1980 to 2008 was only 5%. I take advantage of this feature of the construction sector and identify the effect of variations in labor market prospects on high-school dropout by exploring the differential effect of variations in construction activity on male with respect to female dropout probability. Thus, the explanatory variable of interest is defined as the interaction between construction activity and a male dummy.

The probability of high-school dropout is assumed to have a logistic form and is then estimated by means of the following equation:

$$y_{ijt} = \frac{\exp(\beta Z_{ijt})}{1 + \exp(\beta Z_{ijt})}$$

with

$$\beta Z_{ijt} = \beta_0 + \beta_1 C_{jt} \cdot male_{ijt} + \beta_2 C_{jt} + \beta_3 male_{ijt} + \beta_4 X_{ijt} + \beta_5 W_{jt} + \beta_6 \eta_j + \beta_7 \xi_t$$

where y is an indicator variable equal to one if individual i living in province j at year t is a high-school dropout and zero otherwise, C measures the intensity of construction activity, *male* is a dummy taking value 1 if the individual is a man and 0 if a woman, X is a vector of individual and family characteristics including age, an indicator for being an immigrant, a dummy for high-school graduated father, a binary variable for high-school graduated mother, an indicator for university graduated father, a dummy for university graduated mother, a binary variable for father working, an indicator for mother working, a dummy for absent mother, a binary variable for absent father, an indicator for living without any of the parents, number of brothers, number of sisters, number of siblings aged less than 10, number of siblings aged 11 to 15, number of siblings aged 16 to 20, number of siblings aged 21 to 30 and number of high-school dropout siblings, W represents three

variables varying at the regional level, namely, total value added, youth unemployment rate, and overall unemployment rate, η is a vector of province dummies, and ξ includes year dummies[7].

The high-school dropout rate in a province is likely to exhibit time dependence. To account for Bertrand, Duflo, and Mullainathan (2004)'s critique, standard errors are clustered at the province level[8].

Taking equation 1 as a base, I estimate the contemporaneous effect of construction activity on high-school dropouts. The estimated coefficient β_1 is reflecting a combination between the influence of construction activity on the probability of leaving the education system and the probability of staying out of the system. This happens because many individuals may have taken their decision to drop out before they were interviewed. In particular, some youngsters may have actually taken their decisions to drop out of high-school at the average age at which students are in high-school. As an attempt to isolate the effect on leaving high-school, I estimate the differential effect of construction activity when the individual was 17 years old for males with respect to females [9]. Therefore, the key explanatory variable in this specification is the interaction of construction activity at the age of 17 and a male dummy. The estimated equation remains as follows:

$$y_{ijt} = \frac{\exp(\beta Z_{ijt})}{1 + \exp(\beta Z_{ijt})}$$

with

$$\beta Z_{ijt} = \beta_0 + \beta_1 C_{jt}^{17} \cdot male_{ijt} + \beta_2 C_{jt}^{17} + \beta_3 C_{jt} + \beta_4 male_{ijt} + \beta_5 X_{ijt} + \beta_6 W_{jt}^{17} + \beta_7 \eta_j + \beta_8 \xi_t + \varepsilon_{ijt}$$

[7]The information on parents' education and employment status is only available for cohabiting fathers and mothers. Hence, the dummies for absent father and absent mother serve to account for the missing observations.

[8]The paper by Bertrand, Duflo, and Mullainathan (2004) calls our attention to the fact that estimated standard errors are inconsistent when outcomes are serially correlated and the estimation is done employing difference-in-differences techniques.

[9]The study of both, contemporaneous and at the age of 17, effects stablished a paralelism with the US policy indicators of h-s graduation rate. In particular, the US National Center for Educational Statistics publishes two measures of the high-school graduation rate, the high-school status completion rate (the percentage of 18- to 24- years old possessing a high-school credential) and the 17-years old graduation ratio (the number of high-school diplomas issued by secondary school each year divided by the size of the 17-years old population in that year).

where C^{17} reflects the construction activity measure when the individual i was 17 years old, W^{17}contains total value added in the province at the age of 17, youth unemployment rate, and overall unemployment rate. The rest of variables are as defined above[10].

As in the equation for the contemporaneous effect, standard errors are clustered at the province level.

3 Data and descriptive statistics

3.1 Data sources and sample definition

The data used in the estimations contains individual data from the Spanish Labor Force Survey as well as province level data from the Spanish Regional Accounts and the Spanish Ministry of Housing.

The Spanish Labor Force Survey has been collected quarterly since 1976. In practice, more than 60000 households containing around 180000 individuals are surveyed in each wave. The information contained in the survey includes individual characteristics such as age, gender and level of education as well as details about working status and family characteristics. The population of interest is formed by working age individuals, i.e., individuals aged 16 to 65 years old.

The sample selected for the analysis is composed by individuals aged 18 to 24 years old. These individuals constitute the set of relevant high-school dropouts as defined by the EU and US governments. Only the waves corresponding to the fourth quarter of each year are included. I have chosen the fourth quarter because the decision to drop out of high-school will be observed at the beginning of the academic year which starts in September and then new dropouts will only be observable in the fourth quarter of the

[10]I have excluded the contemporaneous total value added in the equation because it has proven to be highly collinear with total value added at 17. This should not be a concern because the high correlation existing between total value added and total value added at 17 assures that I am controlling adequately for the impact of economic activity on high-school dropout. Moreover, the rest of estimated coefficients are statistically invariant to the inclusion of contemporaneous total value added.

year. The time period covered comprises the years from 1997 to 2007. This is the period when the construction boom took place.

The Spanish Regional Accounting data follows the methodology established by the 1995 European System of National and Regional Accounts. The data contains information on GDP decomposed by economic sectors defined as agriculture, energy, industry, construction and services. The information is geographically disaggregated up to the province level. The data has yearly frequency and is available for the period including the years 1995 to 2007.

The Spanish Ministry of Housing collects administrative data on dwelling acquisition, sole prices and dwelling construction. In the analysis, the number of new dwellings will be used[11]. This data is obtained from a registry containing architect's construction permissions. Hence, the reported information is very accurate and comprises the whole universe of dwellings in Spain. The data is aggregated at the province and year level and covers the period 1991 to 2008.

3.2 Variable definition and descriptive statistics

The variable high-school dropout is defined according to the European Union criteria and, consequently, it is a binary indicator equal to one if an individual fulfills the following two conditions: (i) her level of education is inferior to high-school graduate and (ii) declared not to have followed any official education in the preceding four weeks, and zero otherwise.

The explanatory variable of interest is intensity of construction activity. This is measured as construction over total value added in the province of residence during the year when the individual is surveyed. This measure is interacted with a male dummy in order to address the differential effect of construction activity on males compared to females.

When exploring the effect of construction activity at the age of 17 on high-school

[11]The number of new dwellings is a good proxy of expectations about employment in the construction sector. In fact, Figure 3 shows that the number of new dwellings is the measure that best captures the end of the housing boom.

dropouts, the value assigned to each individual corresponds to the measure of construction activity at the time she was 17 years old. This restricts the time period included in the sample because the information on construction activity at 17 is not available for all individuals in the years 1997 to 2001. To avoid sample selectivity issues, only the years for which this information is available for all individuals (2002 to 2007) are included in the analysis.

The descriptive statistics for the variables included in the main regression are displayed in Table 1. The final sample is composed by 186466 individuals. One third of them are high-school dropouts and around one half of the sampled individuals are male.

Average construction over total value added assigned to individuals in the sample is around 10% and the average number of constructed dwellings per individual aged 18 to 24 is 0.037.

The reported figures are similar to the ones for the sample included in the regression estimating the effect of construction activity at age 17. These are displayed in Table 2. The figures are fairly similar to the ones presented in Table 1. Due to the shorter time spam covered, the number of individuals is reduced to 86953.

Table 3 contains the descriptive statistics for the sample included in the regressions where construction activity at 17 is measured using number of new dwellings at 17. Again, there are not significant changes with respect to the samples described in the two previous tables. In this case, the number of observations is 143440.

4 Empirical results

The objective of the empirical exercise is to test whether changes in labor market conditions that improve labor market perspectives for low educated workers make more likely that individuals dropout of high-school. The identification strategy makes use of the fact that men experience better employment opportunities as a result of an increase in construction activity while women do not. In practice, I focus on the sign of the coefficient

associated to the interaction of construction activity and a male dummy in the equation for the probability of being a high-school dropout. A positive and significant value of this coefficient is interpreted as transitory improvements in labor market prospects for low educated workers inducing a rise in the probability of high-school dropout.

4.1 Contemporaneous effect

In this section, I discuss the estimated differential effect of changes in regional construction activity over time on high-school dropout probability for males versus females. Table 4 displays the results for the estimation in which the probability of dropping out of high-school is assumed to have a logistic functional form. The impact of construction activity on male versus female high-school dropout probability is positive and significant. This corroborates the hypothesis that labor market shocks that improve employment prospects for low educated workers significantly increase the likelihood that individuals dropout of high-school. The estimated coefficient associated to the variable construction activity interacted with male in the logistic equation is 2.657. This is interpreted as a one standard deviation increase in construction activity as measured by the share of total value added that is produced by the construction sector inducing an increment in the probability of high-school dropout for the average male individual of 1.31 percentage points. The estimated coefficient is arguably robust to the inclusion of the different set of controls.

One could argue that the intensity of construction activity may affect the high-school dropout rate not through labor market conditions but through affordability of housing. The latter channel could operate such that when construction activity increases, housing prices decrease and more individuals dropout of high-school to start working and buy a house. However, in our data, the level of construction activity is positively correlated with housing prices. Hence, if the previous critique was applicable, more intense construction activity together with higher prices would induce less dropouts. Additionally, the estimation results show that men dropout more in the presence of higher housing prices. This contradicts the critique because it is male working status what usually determines

household formation. Hence, our identification strategy is assuring that the estimated effect is not a consequence of changes in affordability of housing.

Another source of concern could be that the recent housing boom is contemporaneous to an important economic upturn and, therefore, the estimated effect could be a consequence of men being differently affected by the economic cycle. In unreported regressions, I have included the interaction of total value added and a male dummy as an additional control variable. The associated coefficient is negative and insignificant. This constitutes additional evidence that the effect of the economic cycle, if there is any, is stronger on women. Additionally, previous evidence shows that women's labor supply is more affected by the economic cycle. See Sabarwal, Sinha, and Buvinic (2011) for a recent review of the evidence. This indicates that, if the economic cycle was influencing our results, the actual effect would be higher in magnitude than the estimated one.

Additionally, I discuss the potential existence of reverse causality, i.e., variations in high-school dropouts causing changes in construction activity. Our results could be explained by reverse causality if increments in the high-school dropout rate in the province reduce construction wages and therefore incentive construction activity by increasing its profitability. However, as it was previously noted, construction wages rose more than wages in other sectors during the period of study. Moreover, labor costs grew more than the rest of production costs in the construction sector. Therefore, if the labor supply of high-school dropouts has some influence on construction activity through wages, our coefficient of interest would be downward biased. Additionally, the literature on the causes of the housing boom (see Glaeser, Gyourko, and Saiz (2008) for a recent example) indicates that labor supply does not play a role in explaining the expansion of the construction sector in recent years. Therefore, I expect no impact of reverse causality in the estimations.

In the empirical analysis I define the relevant labor market for an individual at the province level. Given the low geographical mobility of the Spanish population, this is considered a reasonable assumption[12]. To assure that migration across provinces is not

[12]The low mobility of the individuals in the sample is illustrated by the fact that more than 87.6% of

determining the results, I performed two additional specifications. First, construction activity in the province of residence is substituted by construction activity in the province of birth. Second, construction activity in the province of birth is used as an instrument for construction activity in the province of residence. Both estimations lead to results that are consistent with the ones presented in Table 4.

Appendix A presents the rest of coefficients in the logistic regression. One observes that males are more likely to drop out of high-school. The influence of age could be represented using an inverted U-shape with a maximum in 21 years old. Immigrants are significantly more likely to drop out. Individuals are less likely to drop out if their parents are more educated and if their parents are working. This is coherent with the findings of Maani and Kalb (2007) that economic resources play a significant role in school leaving decisions. Finally, those living without their fathers are less likely to drop out of high-school while living without their mothers or on one's own are associated to a higher probability of being a high-school dropout. Having more brothers and sisters is negatively correlated with the probability of dropout. The effect is less pronounced for younger siblings. The probability of dropout is positively correlated among siblings. Higher total value added in the province is positively associated with dropouts. The positive coefficient associated to the youth unemployment rate and the negative coefficient for the general unemployment rate are coherent with the findings of Petrongolo and San Segundo (2002). However, the coefficient for the youth unemployment rate is not statistically significant due to the correlation of youth unemployment rate with the time dummies.

4.2 Effect of construction activity at the age of 17

The estimation results for the impact of construction activity at age 17 on the probability of high-school dropout are displayed in Table 5. The differential impact of construction activity at 17 on males with respect to females is positive and significant. The point

sampled individuals live in their province of birth.

estimate is 1.836. The estimated coefficient remains relatively stable as we include more and more controls in the regression. This can be interpreted as a one standard deviation increase in construction over total value added inducing an increase of 0.75 percentage points in the probability of dropping out of high-school for the average male individual. This effect is consistent with the contemporaneous one in the sign, but it is smaller in magnitude. The estimated coefficients for the rest of controls are extremely similar to the ones obtained in the contemporaneous regression.

In unreported regressions, the impact of construction activity at 18 is estimated. Results show an slightly smaller point estimate with respect to the effect of construction activity at 17.

4.3 Construction activity measured by the number of new dwellings

In order to test the consistency of the results under different measures of construction activity, the analysis is repeated substituting construction over total value added by number of new dwellings over population aged 18-24 in the province. The estimation results for the contemporaneous effect are displayed in Table 6. The point estimate for the differential effect of construction activity as measured by number of new dwellings over population aged 18 to 24 on males versus females is 3.222. This is equivalent to a marginal effect of 0.6 when the covariates are evaluated at their mean values. This implies that one standard deviation increase in the ratio of new dwellings over number of individuals aged 18-24 increases the probability of high-school dropout by 1.37 percentage points on average. The rest of coefficients have extremely similar magnitudes and significance levels to the ones reported for the contemporaneous effect of construction activity as measured by construction value added.

The results for the estimation of the effect of construction activity at 17 as measured by number of new dwellings can be found in Table 7. The point estimate for the differential effect of construction activity at 17 on males versus females is 1.873 which is equivalent to a marginal effect evaluated at the mean values of the covariates of 0.3. Intuitively, this

means that an increase by one standard deviation in the ratio of new dwellings at the age per one hundred individuals aged 18-24 increases the probability of high-school dropout by 0.57 percentage points. The rest of coefficients are very similar to the ones displayed in Table 5.

In general, the estimations of the contemporaneous and at age 17 effects are robust to the use of different measures of construction activity.

4.4 Effects of changes in other economic sectors

The Spanish housing boom was contemporaneous to an important economic upturn. Production increased and employment was created, not only in construction but also in the rest of economic sectors. Hence, other sectors may have played a role in explaining education decisions. This is partly taken into account in the previous estimations by including total value added, youth unemployment rate and unemployment rate as controls in the specifications. However, as all other sectors affect differently males and low educated workers, if some other sector's share in total value added is correlated with the construction share, the evolution of that other sector could be behind our results.

The empirical exercise is repeated for each of the other economic sectors including each sector' share in total value added instead of the construction share. Given the correlations between sector shares in total value added displayed in Table 8, other sector's level of activity could explain the results found for the construction sector in the following cases: (i) agriculture activity has a positive impact on high-school dropouts for males versus females, (ii) industry activity has a negative effect on male with respect to female dropout, (iii) energy activity increases the likelihood of dropout for males versus females and, (iv) services activity has a positive and strong impact on male relative to female high-school dropouts.

Figure 8 represents, for each economic sector, the share of male workers as well as the proportions of male and female workers that are high-school dropouts. The agriculture, energy and industry sectors are characterized by the prevalence of male workers while

the service sector employs the majority of working women. Regarding male high-school dropouts, agriculture and industry have relatively high incidence of male high-school dropouts while energy and services have relatively low male high-school dropout rates. Female dropouts rates are high in agriculture, medium in services and low in energy and construction.

Given the employment composition described above, other sectors' effect in the probability of high-school dropout are supportive of our main hypothesis and, therefore, consistent with the results found for the construction sector in the following cases: (i) the agriculture and industry sector have a positive impact on high-school dropouts for males versus females (an increase in agriculture or industry activity constitutes and improvement in labor conditions for low educated men), (ii) the energy sector have a negative impact on high-school dropouts for males versus females (an increment in energy activity enhances employment opportunities for highly educated men), or (iii) the service sector has a negative impact on high-school dropouts for males versus females (services growth is associated with better labor market prospects for highly educated men and better employment opportunities for all low and highly educated women).

Table 9 displays the results of the estimations using other sectors' level of activity and their interaction with male as alternative explanatory variables. I find that the coefficients for agriculture, industry and energy are statistically insignificant while the service sector has a negative influence on high-school dropouts. Hence, the alternative explanation in which other sectors are responsible for the effect found for construction does not apply in this context. However, the results found for the service sector could support the hypothesis that improvements in labor market perspectives for low educated workers induce more dropouts while increases in expected gains of education cause less dropouts[13].

The regression simultaneously including estimates for the differential effect of construction and services activities on males versus females gives almost indistinguishable

[13]One should interpret this last result with caution given that, differently from the construction sector, the variation experienced by services is not argued to be exogenous

estimates from the ones found when studying the construction and services effects separately. This can be explained by the low correlation between the construction and service share in value added. It constitutes additional evidence that changes in the service sector are unlikely to have any impact in our results for construction but have their own effect instead.

5 Conclusion

The European Commission in its 2010 Report on Education Policies states that "targeted measures for preventing [high-school dropout] should be further mainstreamed". To guarantee the efficiency of education policies that aim at reducing the incidence of high-school dropout, it is important to understand the determinants of the decision to drop out. This paper shows that labor market shocks that improve potential labor earnings for low educated relative to high educated workers increase the probability of dropping out from high-school.

The effect is identified by means of the increase in employment opportunities for low educated male workers provoked by the housing boom in Spain. The housing boom constituted a worldwide phenomenon caused by financial and demand factors that affected local labor markets. The Spanish housing boom is a great opportunity to identify labor market changes due to the big magnitude of the boom and its heterogenous incidence across regions.

The estimated effect is such that a one percentage point increase in the construction share in total value added increases the probability of high-school dropout for males by 1.31% while it leaves the probability of high-school dropout for females unaffected. Additionally, a one percentage point increase in construction activity at the age of 17, i.e., when the individual was more likely to be in high-school, increases the probability of high-school dropout for males from 18 to 24 years old by 0.75% while it leaves the probability of high-school dropout for females unchanged. These findings are consistent

with the estimations obtained using number of new dwellings as an alternative measure of construction activity. I have ruled out the possibility that the estimated results are the reflection of changes in other economic sectors. Additional results for the impact of services activity on male versus female probability of high-school dropout provide additional support for my hypothesis.

These conclusions suggest that individual schooling decisions largely respond to labor market conditions even when the changes in those conditions are transitory. Hence, policy designers should strengthen their efforts to incentive individuals to get more education in the presence of booms in economic sectors that use low educated workers intensively.

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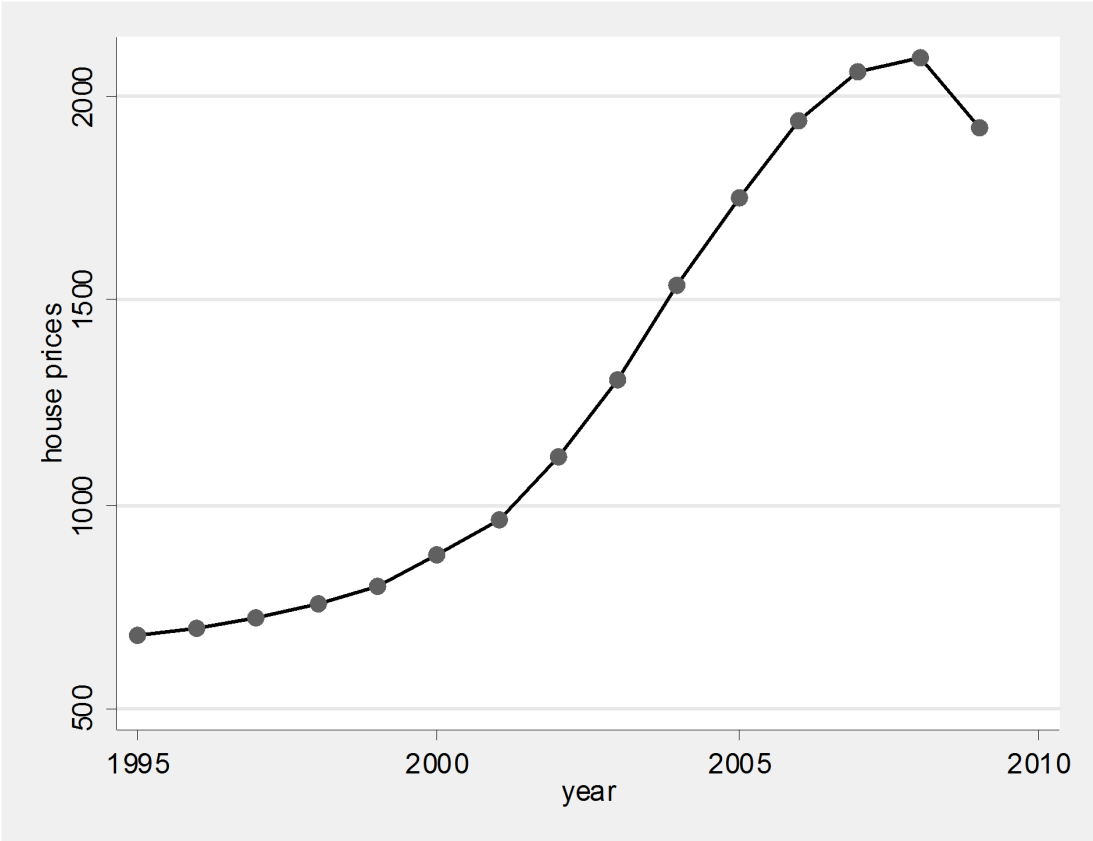
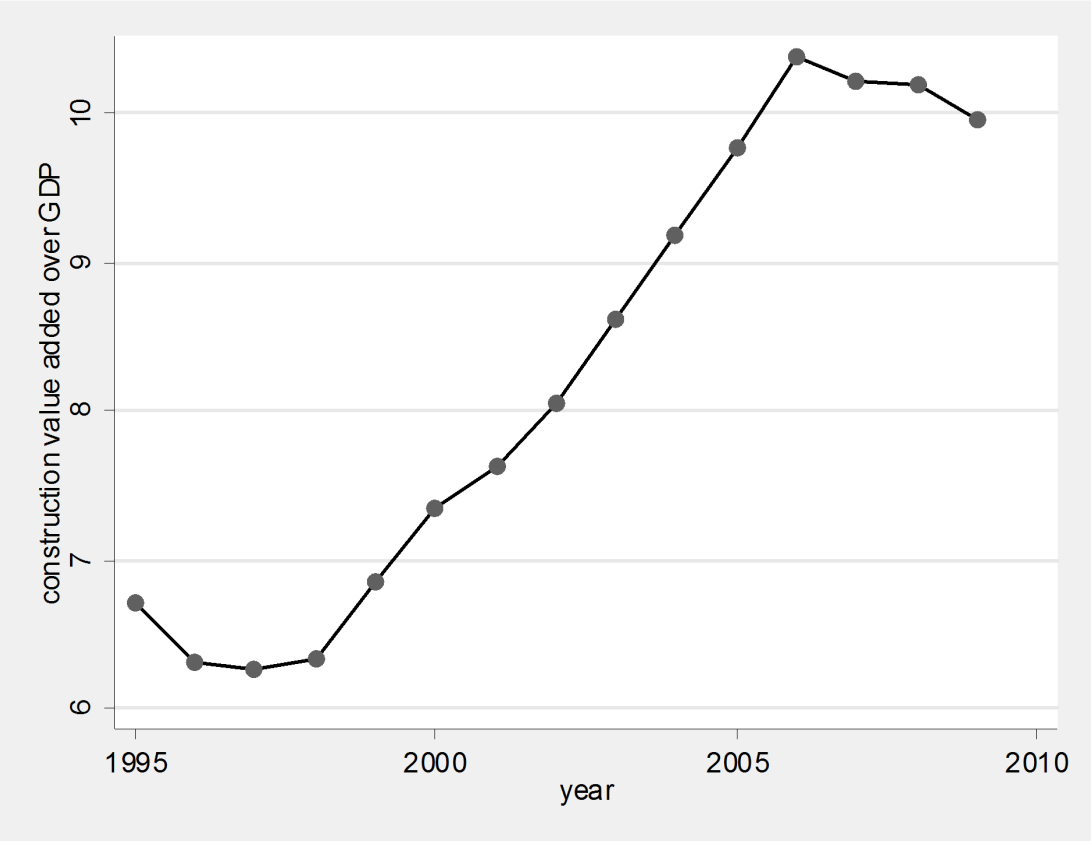
Figures

Figure 1: House prices over time



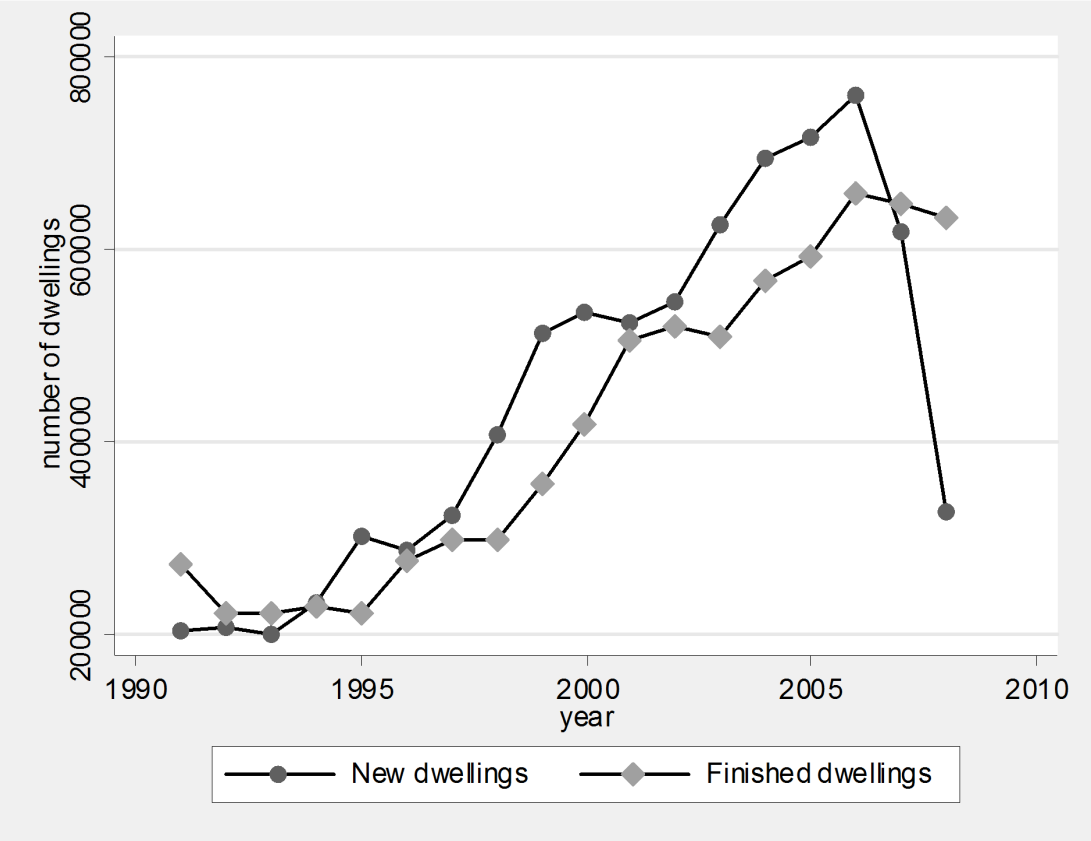
Data source: Spanish Ministry of Housing. Each data point corresponds to average house prices in the second quarter of the year for the period 1995 to 2009.

Figure 2: Ratio of construction value added and GDP over time



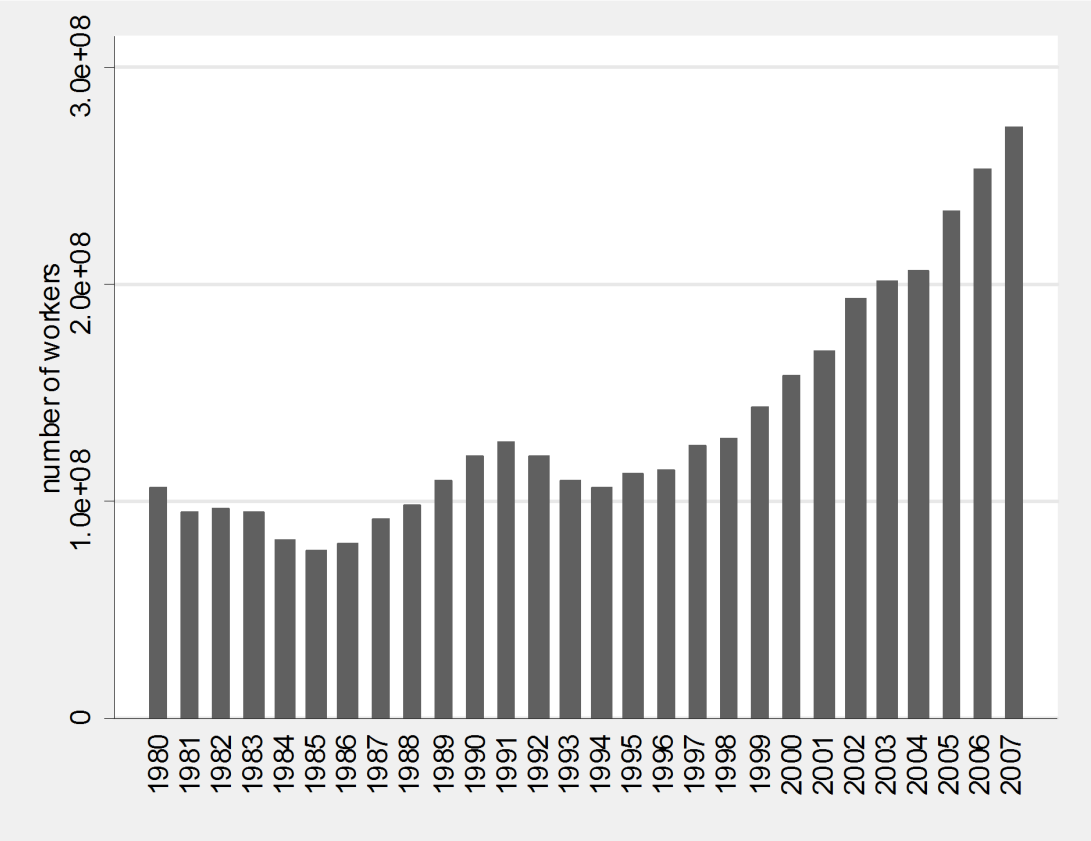
Data source: Spanish National Accountings. This information can be found at the National Statistics Institute webpage at the address http://www.ine.es/jaxiBD/tabla.do?per=03&type=db&divi=CNTR&idtab=1. Each data point corresponds to the second quarter of each year for the period 1995 to 2009.

Figure 3: Number of constructed dwellings over time



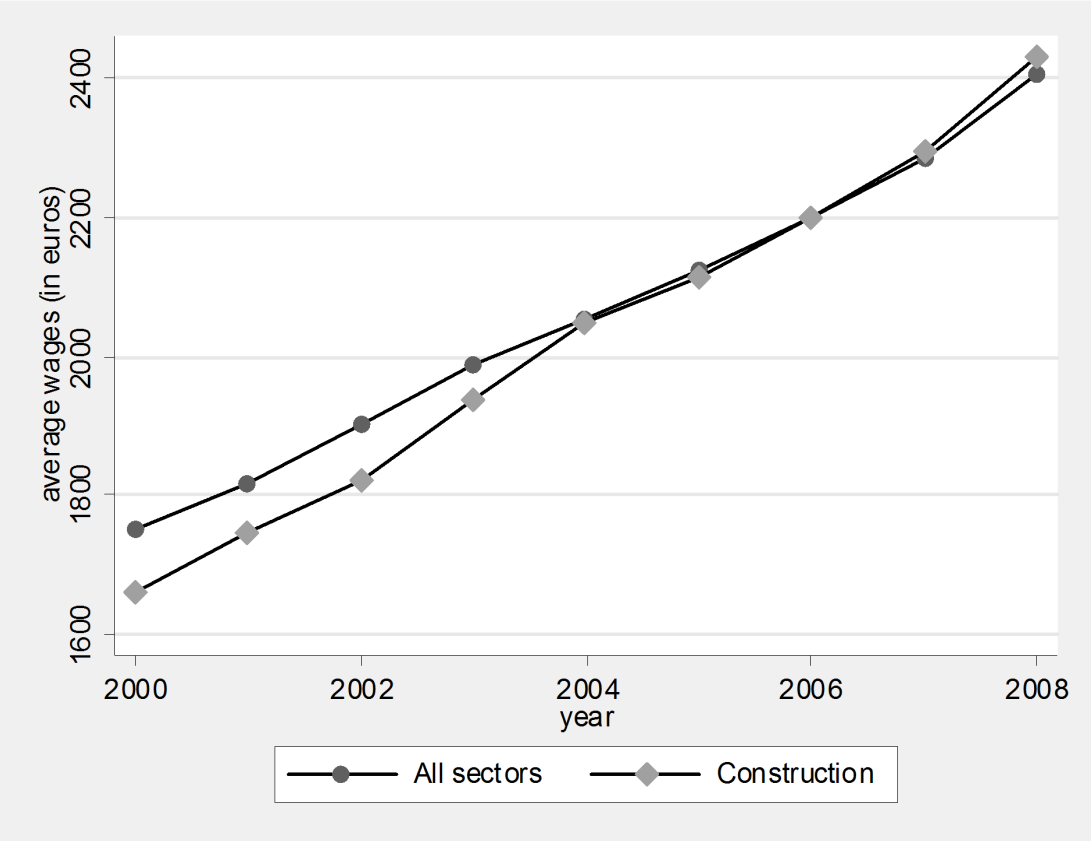
Data source: Spanish Ministry of Housing. The data points are the result of adding up non-subsidized and subsidized dwellings. Information on non-subsidized dwellings is accessible online from http://www.mviv.es/es/index.php?option=com_content&task=view&id=379&Itemid=434 and data on subsidized dwellings can be found at http://www.mviv.es/es/index.php?option=com_content&task=view&id=318&Itemid=431. This data covers the period 1991 to 2008.

Figure 4: Number of workers in the construction sector over time



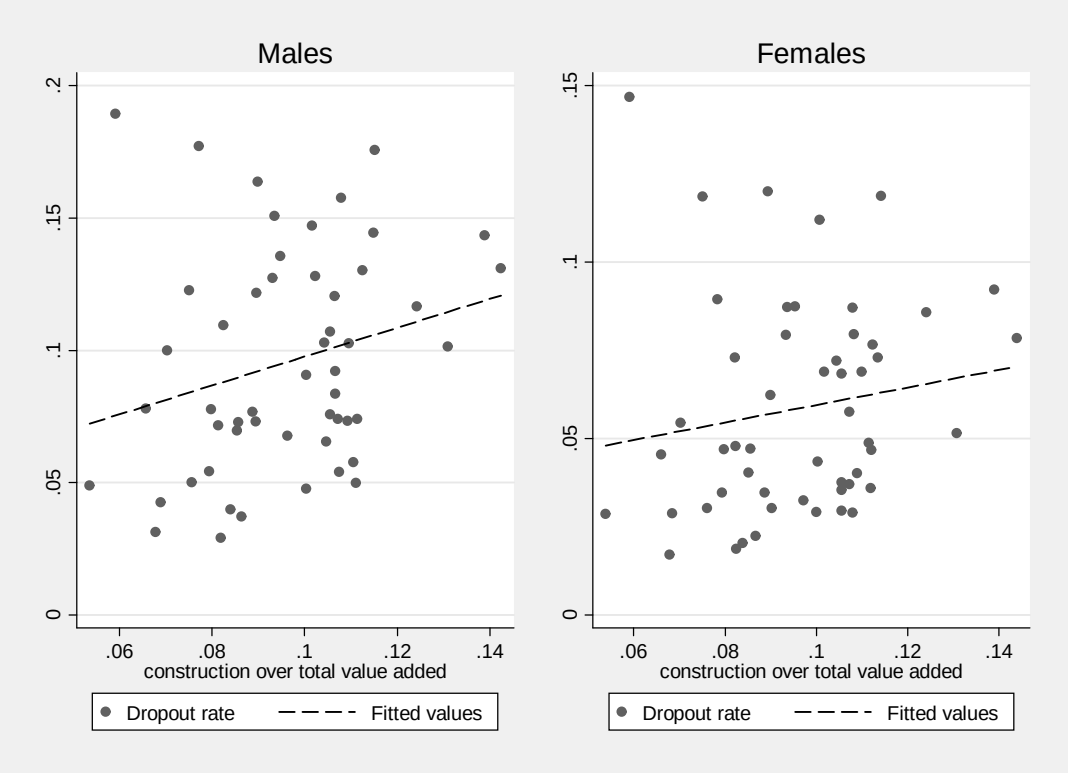
Data source: Spanish Labor Force Survey. Each data point corresponds to the second quarter of each year for the period 1980 to 2007.

Figure 5: Average wages over time



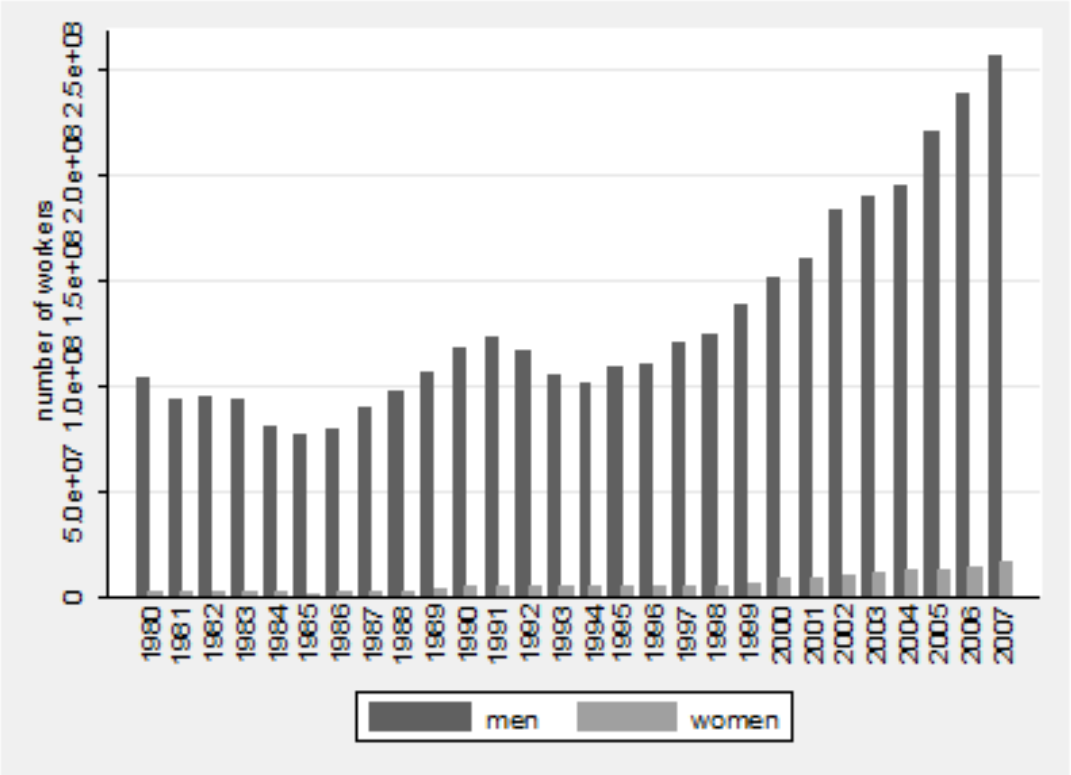
Data source: Labor Costs Quarterly Survey (Encuesta Trimestral de Coste Laboral). Each data point corresponds to the second quarter of each year for the period 2000 to 2008.

Figure 6: Correlation between dropout rate and construction activity averaged by province



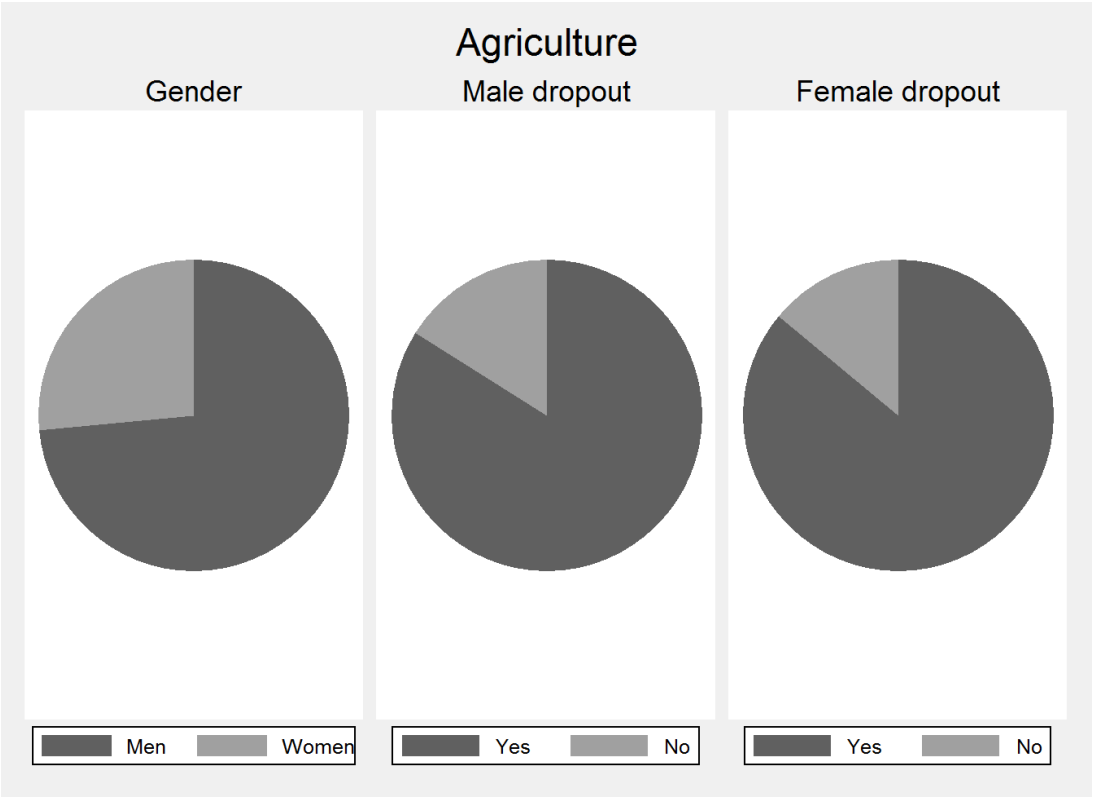
The estimated slope for men is 0.55 and is significant at the 10% level while the estimated slope for women is 0.25 and is statistically indistinguishable from zero. The data on dropout rates is computed using the Spanish Labor Force Survey. The data on construction over total value added is obtained from the Spanish Regional Accounts. Averages by province are computed over the period 1995 to 2007.

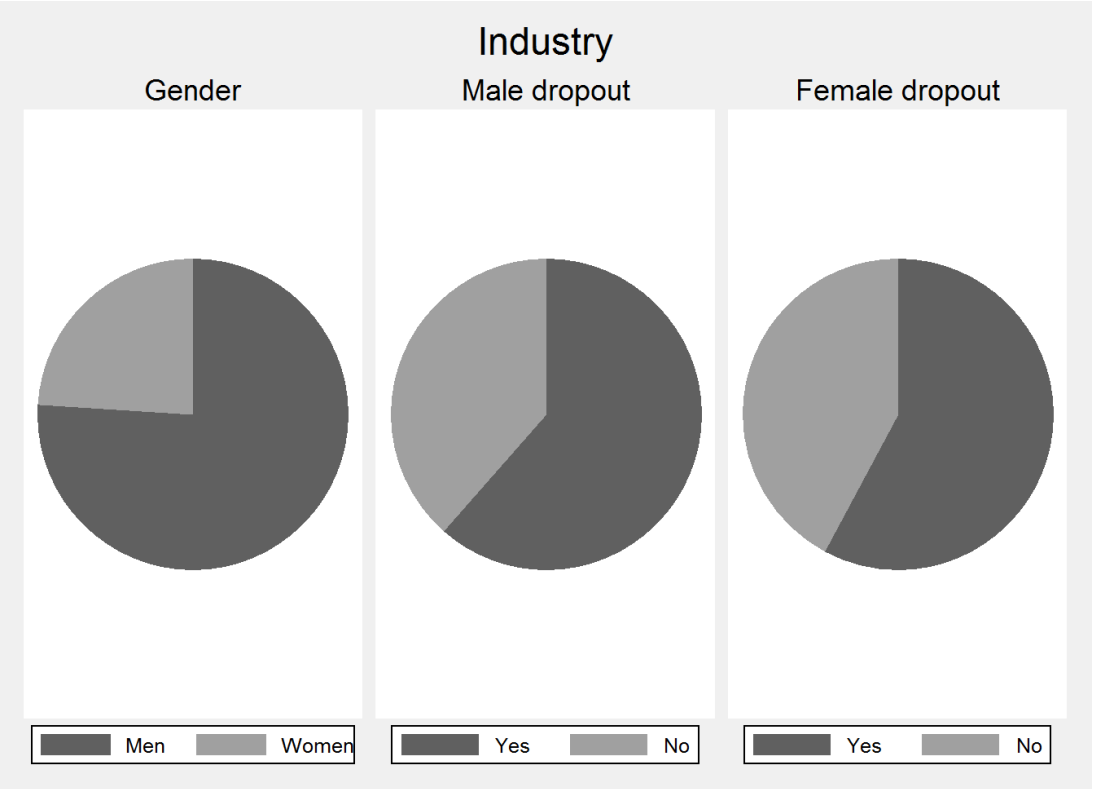
Figure 7: Number of male and female construction workers over time

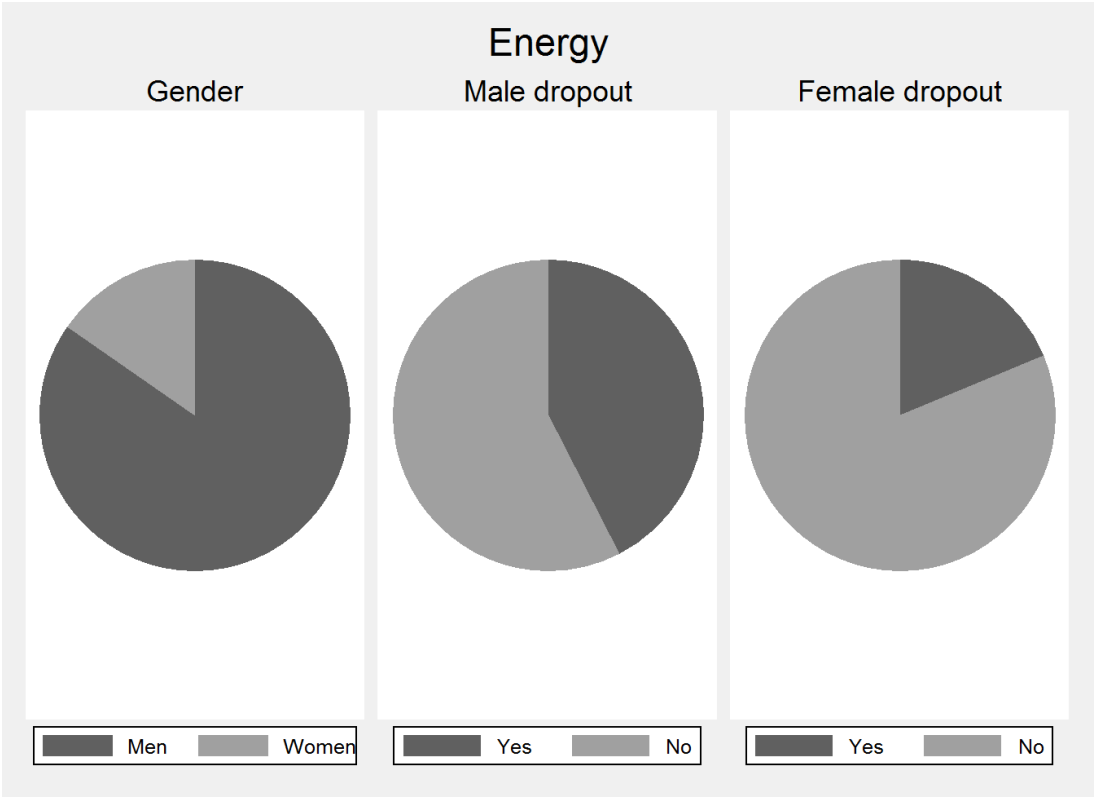


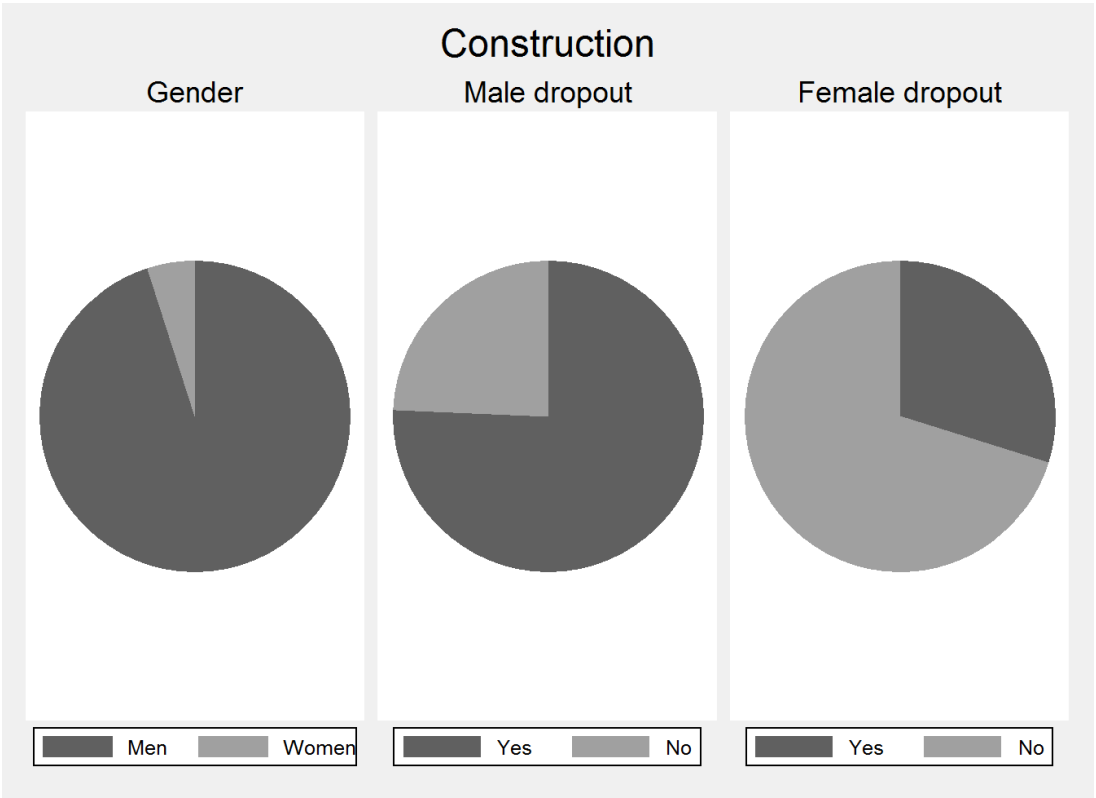
Data source: Spanish Labor Force Survey. Each data point corresponds to the second quarter of each year for the period 1980 to 2007.

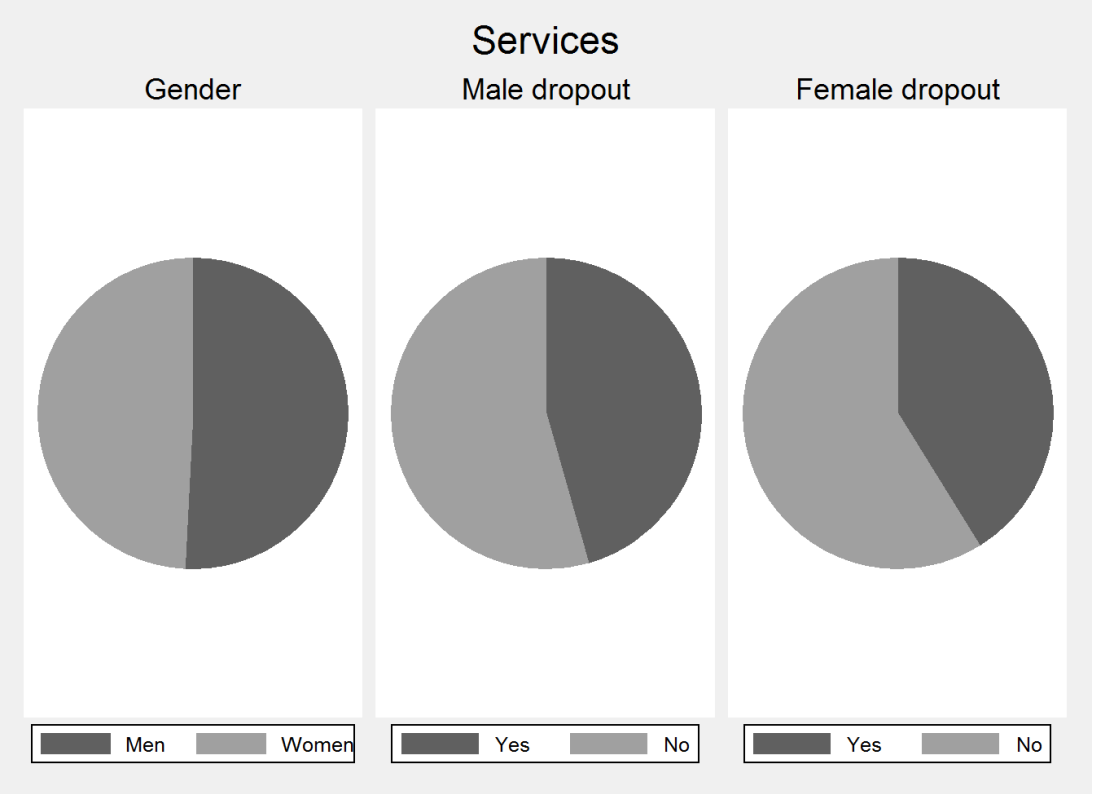
Figure 8: Gender and high-school dropout rates across sectors






Energy
Gender
Male dropout
Female dropout
Men
Women
Yes
No
Yes
No


Construction
Gender
Male dropout
Female dropout
Men
Women
Yes
No
Yes
No



Data source: Spanish Labor Force Survey. The data corresponds to the second quarter of each year for the period 1997 to 2007. The share of dropouts is computed as the proportion of workers that do not have a high-school degree and declare not to have received any education or training in the previous four weeks.

Tables

Table 1: Descriptive statistics for the contemporaneous effect estimations

Variable	Mean	Std. Dev.	Min.	Max.
high-school dropout	0.314	0.464	0	1
construction VA by male	0.05	0.053	0	0.202
construction VA	0.099	0.027	0.04	0.202
new dwellings by male	0.019	0.025	0	0.152
new dwellings	0.037	0.023	0.006	0.152
male	0.51	0.5	0	1
total VA	2.07e+07	2.98e+07	6.21e+05	1.67e+08
age	21.083	1.985	18	24
immigrant	0.03	0.172	0	1
father high-school grad	0.119	0.324	0	1
mother high-school grad	0.127	0.333	0	1
father university grad	0.094	0.291	0	1
mother university grad	0.09	0.286	0	1
father working	0.58	0.494	0	1
mother working	0.332	0.471	0	1
absent father	0.231	0.421	0	1
absent mother	0.072	0.259	0	1
emancipated	0.055	0.228	0	1
brothers	0.679	0.792	0	9
sisters	0.598	0.743	0	10
siblings aged 0 to 10	0.11	0.365	0	7
siblings aged 11 to 15	0.208	0.451	0	5
siblings aged 16 to 20	0.355	0.562	0	5
siblings aged 21 to 30	0.566	0.739	0	6
dropout siblings	0.275	0.61	0	7
youth unemployment rate	0.134	0.055	0.006	0.361
unemployment rate	0.06	0.026	0.015	0.152
province	26.334	14.334	1	52
year	2001.416	3.123	1997	2007

The number of included observations is 186466. The individual data is obtained from the Spanish Labor Force Survey. The information on value added is collected from the Spanish Regional Accounts and the data on number of new dwellings can be found in the webpage of the Spanish Ministry of Housing.

Table 2: Descriptive statistics for the effect of construction activity at age 17 estimations. Construction activity measured by value added

Variable	Mean	Std. Dev.	Min.	Max.
high-school dropout	0.294	0.456	0	1
construction VA at 17 by male	0.047	0.049	0	0.189
construction VA at 17	0.093	0.023	0.04	0.189
male	0.509	0.5	0	1
construction VA	0.116	0.024	0.061	0.202
total VA at 17	1.85e+07	2.65e+07	5.71e+05	1.56e+08
age	21.103	1.994	18	24
immigrant	0.045	0.208	0	1
father high-school grad	0.138	0.344	0	1
mother high-school grad	0.179	0.383	0	1
father university grad	0.092	0.289	0	1
mother university grad	0.111	0.314	0	1
father working	0.523	0.499	0	1
mother working	0.366	0.482	0	1
absent father	0.31	0.463	0	1
absent mother	0.087	0.281	0	1
emancipated	0.069	0.253	0	1
brothers	0.598	0.737	0	9
sisters	0.523	0.685	0	7
siblings aged 0 to 10	0.107	0.365	0	6
siblings aged 11 to 15	0.189	0.432	0	5
siblings aged 16 to 20	0.298	0.513	0	4
siblings aged 21 to 30	0.49	0.681	0	5
dropout siblings	0.21	0.525	0	7
youth unemployment rate	0.109	0.038	0.006	0.261
unemployment rate	0.048	0.018	0.015	0.119
province	26.277	14.308	1	52
year	2004.312	1.719	2002	2007

The number of included observations is 86953. The individual data is obtained from the Spanish Labor Force Survey. The information on value added is collected from the Spanish Regional Accounts.

Table 3: Descriptive statistics for the effect of construction activity at age 17 estimations. Construction activity measured by number of new dwellings

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
high-school dropout	0.297	0.457	0	1
new dwellings at 17 by male	0.014	0.019	0	0.152
new dwellings at 17	0.028	0.019	0.002	0.152
male	0.509	0.5	0	1
new dwellings	0.042	0.024	0.007	0.152
total VA at 17	1.53e+07	2.4e+07	0	1.56e+08
age	21.103	1.987	18	24
immigrant	0.035	0.183	0	1
father high-school grad	0.129	0.335	0	1
mother high-school grad	0.148	0.355	0	1
father university grad	0.094	0.292	0	1
mother university grad	0.097	0.296	0	1
father working	0.561	0.496	0	1
mother working	0.339	0.473	0	1
absent father	0.254	0.435	0	1
absent mother	0.078	0.268	0	1
emancipated	0.06	0.237	0	1
brothers	0.644	0.765	0	9
sisters	0.567	0.72	0	10
siblings aged 0 to 10	0.107	0.362	0	6
siblings aged 11 to 15	0.199	0.44	0	5
siblings aged 16 to 20	0.329	0.54	0	5
siblings aged 21 to 30	0.538	0.717	0	6
dropout siblings	0.241	0.565	0	7
youth unemployment rate	0.121	0.047	0.006	0.361
unemployment rate	0.054	0.022	0.015	0.13
province	26.332	14.324	1	52
year	2002.593	2.57	1999	2007

The number of included observations is 143440. The individual data is obtained from the Spanish Labor Force Survey. The information on number of new dwellings can be found in the webpage of the Spanish Ministry of Housing. The missing values in the variable total value added at 17 are dummied out.

Table 4: Contemporaneous effect. Construction activity measured by value added

	basic	individual	family	unemployment	province
	(1)	(2)	(3)	(4)	(5)
construction VA by male	1.946	2.060	2.871	2.829	2.657
	(0.499)***	(0.503)***	(0.68)***	(0.671)***	(0.686)***
construction VA	4.579	4.555	2.668	2.464	2.143
	(2.434)*	(2.453)*	(1.757)	(1.596)	(1.206)*
male	0.465	0.461	0.603	0.61	0.634
	(0.057)***	(0.057)***	(0.073)***	(0.071)***	(0.074)***

The dependent variable is equal to one if the individual is a high-school dropout and 0 otherwise. Construction value added is measured relative to total value added in the province. The coefficients are marked with * if the level of significance is between 5% and 10%, ** if the level of significance is between 1% and 5% and *** if the level of significance is less than 1%. All the regressions contain year dummies. The basic regression includes construction value added interacted by male, construction value added, a male dummy and total value added. The second column adds individual characteristics to the basic specification, including age binary indicators and an immigrant dummy. The third column includes, in addition to the controls in column 2, family characteristics, namely, father and mother high-school graduate dummies, father and mother university graduate indicators, father and mother working dummies, binary variables equal to one if the parent is present in the household, an emancipated dummy, number of brothers, number of sisters, number of siblings aged less than 10, number of siblings aged 11 to 15, number of siblings aged 16 to 20, number of siblings aged 21 to 30 and number of high-school dropout siblings. The fourth column adds youth and total unemployment rates. Finally, the fifth column includes all previously mentioned controls plus province binary indicators. The individual data is obtained from the Spanish Labor Force Survey. The information on value added is part of the Spanish National Accounting data and can be found in the webpage of the Instituto Nacional de Estadística. The sample contains individuals aged 18 to 24 surveyed in the fourth quarter of each year. The time period comprises the years from 1997 to 2007. Standard errors are clustered at the province level. The number of included observations is 186466.

Table 5: Effect of construction activity at age 17. Construction activity measured by value added

	basic	individual	family	unemployment	province
	(1)	(2)	(3)	(4)	(5)
construction VA at 17 by male	2.402	2.440	2.074	2.020	1.836
	(0.857)***	(0.885)***	(1.076)*	(1.059)*	(1.042)*
construction VA at 17	-8.125	-4.372	-3.934	-3.604	0.097
	(1.486)***	(2.265)*	(1.769)**	(1.796)**	(1.637)
male	0.462	0.472	0.725	0.733	0.758
	(0.09)***	(0.093)***	(0.113)***	(0.11)***	(0.109)***

The dependent variable is equal to one if the individual is a high-school dropout and 0 otherwise. Construction value added is measured relative to total value added in the province. The coefficients are marked with * if the level of significance is between 5% and 10%, ** if the level of significance is between 1% and 5% and *** if the level of significance is less than 1%. All regressions contain year dummies. The basic regression includes construction value added at 17 interacted by male, construction value added at 17, a male dummy, total value added at 17 and construction value added. The second column adds individual characteristics to the basic specification, including age binary indicators and an immigrant dummy. The third column includes, in addition to the controls in column 2, family characteristics, namely, father and mother high-school graduate dummies, father and mother university graduate indicators, father and mother working dummies, binary variables equal to one if the parent is present in the household, an emancipated dummy, number of brothers, number of sisters, number of siblings aged less than 10, number of siblings aged 11 to 15, number of siblings aged 16 to 20, number of siblings aged 21 to 30 and number of high-school dropout siblings. The fourth column adds youth and total unemployment rates. Finally, the fifth column includes all previously mentioned controls plus province binary indicators. The individual data is obtained from the Spanish Labor Force Survey. The information on value added is part of the Spanish National Accounting data and can be found in the webpage of the Instituto Nacional de Estadística. The sample contains individuals aged 18 to 24 surveyed in the fourth quarter of each year. The time period comprises the years from 2002 to 2007. Standard errors are clustered at the province level. The number of included observations is 86953.

Table 6: Contemporaneous effect. Construction activity measured by number of new dwellings

	basic	individual	family	unemployment	province
	(1)	(2)	(3)	(4)	(5)
new dwellings by male	1.838	1.980	3.222	3.310	3.222
	(0.583)***	(0.599)***	(0.988)***	(0.942)***	(0.988)***
new dwellings	2.255	1.943	-.570	2.557	-.570
	(1.839)	(1.898)	(0.592)	(1.173)**	(0.592)
male	0.587	0.589	0.776	0.766	0.776
	(0.031)***	(0.032)***	(0.043)***	(0.041)***	(0.043)***

The dependent variable is equal to one if the individual is a high-school dropout and 0 otherwise. Number of new dwellings is measured relative to population aged 18 to 24 in the province. The coefficients are marked with * if the level of significance is between 5% and 10%, ** if the level of significance is between 1% and 5% and *** if the level of significance is less than 1%. All regressions contain year dummies. The basic regression includes number of new dwellings interacted by male, number of new dwellings, a male dummy and total value added. The second column adds individual characteristics to the basic specification, including age binary indicators and an immigrant dummy. The third column includes, in addition to the controls in column 2, family characteristics, namely, father and mother high-school graduate dummies, father and mother university graduate indicators, father and mother working dummies, binary variables equal to one if the parent is present in the household, an emancipated dummy, number of brothers, number of sisters, number of siblings aged less than 10, number of siblings aged 11 to 15, number of siblings aged 16 to 20, number of siblings aged 21 to 30 and number of high-school dropout siblings. The fourth column adds youth and total unemployment rates. Finally, the fifth column includes all previously mentioned controls plus province binary indicators. The individual data is obtained from the Spanish Labor Force Survey. The information on number of new dwellings can be found in the webpage of the Spanish Ministry of Housing. The sample contains individuals aged 18 to 24 surveyed in the fourth quarter of each year. The time period comprises the years from 1997 to 2007. Standard errors are clustered at the province level. The number of included observations is 186466.

Table 7: Effect of construction activity at age 17. Construction activity measured by number of new dwellings

	basic	individual	family	unemployment	province
	(1)	(2)	(3)	(4)	(5)
new dwellings at 17 by male	1.629	1.778	1.588	2.050	1.873
	(0.788)**	(0.753)**	(0.864)*	(0.966)**	(1.009)*
new dwellings at 17	-1.866	1.417	1.334	1.765	0.608
	(2.302)	(2.077)	(1.946)	(1.421)	(1.457)
male	0.636	0.641	0.745	0.861	0.873
	(0.033)***	(0.033)***	(0.036)***	(0.039)***	(0.041)***

The dependent variable is equal to one if the individual is a high-school dropout and 0 otherwise. Number of new dwellings is measured relative to population aged 18 to 24 in the province. The coefficients are marked with * if the level of significance is between 5% and 10%, ** if the level of significance is between 1% and 5% and *** if the level of significance is less than 1%. All regressions contain year dummies. The basic regression includes number of new dwellings at 17 interacted by male, number of new dwellings at 17, a male dummy, total value added at 17 and number of new dwellings. The second column adds individual characteristics to the basic specification, including age binary indicators and an immigrant dummy. The third column includes, in addition to the controls in column 2, family characteristics, namely, father and mother high-school graduate dummies, father and mother university graduate indicators, father and mother working dummies, binary variables equal to one if the parent is present in the household, an emancipated dummy, number of brothers, number of sisters, number of siblings aged less than 10, number of siblings aged 11 to 15, number of siblings aged 16 to 20, number of siblings aged 21 to 30 and number of high-school dropout siblings. The fourth column adds youth and total unemployment rates. Finally, the fifth column includes all previously mentioned controls plus province binary indicators. The individual data is obtained from the Spanish Labor Force Survey. The information on number of new dwellings can be found in the webpage of the Spanish Ministry of Housing. The sample contains individuals aged 18 to 24 surveyed in the fourth quarter of each year. The time period comprises the years from 1999 to 2007. Standard errors are clustered at the province level. The number of included observations is 143440.

Table 8: Correlations between value added shares of economic sectors

	Agriculture	Industry	Energy	Construction	Services
Agriculture	1				
Industry	-0.1614	1			
Energy	0.0182	-0.1571	1		
Construction	*0.0934*	*-0.4416*	*0.0816*	1	
Services	-0.4906	-0.6543	-0.2342	*0.0059*	1

Data source: Spanish Regional Accounts. The correlation is computed for the sample included in the regression for the contemporaneous effect.

Table 9: Contemporaneous effect. Other sectors activity measured by value added

	agriculture	industry	energy	services
	(1)	(2)	(3)	(4)
VA by male	-.746	0.167	0.645	-.746
	(0.305)**	(0.303)	(0.718)	(0.305)**
VA	-.651	1.440	-2.034	-.651
	(0.708)	(0.876)	(1.215)*	(0.708)
male	1.383	0.871	0.876	1.383
	(0.198)***	(0.054)***	(0.034)***	(0.198)***

The dependent variable is equal to one if the individual is a high-school dropout and 0 otherwise. Each sector value added is measured relative to total value added in the province. The coefficients are marked with * if the level of significance is between 5% and 10%, ** if the level of significance is between 1% and 5% and *** if the level of significance is less than 1%. All equations include the same controls, namely, total value added, age binary indicators, an immigrant dummy, family characteristics including father and mother high-school graduate dummies, father and mother university graduate indicators, father and mother working dummies, binary variables equal to one if the parent is present in the household, an emancipated dummy, number of brothers, number of sisters, number of siblings aged less than 10, number of siblings aged 11 to 15, number of siblings aged 16 to 20, number of siblings aged 21 to 30, number of high-school dropout siblings, youth and total unemployment rates, year dummies and province binary indicators. The individual data is obtained from the Spanish Labor Force Survey. The information on value added is part of the Spanish National Accounting data and can be found in the webpage of the Instituto Nacional de Estadística. The sample contains individuals aged 18 to 24 surveyed in the fourth quarter of each year. The time period comprises the years from 1997 to 2007. Standard errors are clustered at the province level. The number of included observations is 186466.

Appendix A: Contemporaneous effect displaying controls. Construction activity measured by value added

	basic	individual	family	unemployment	province
	(1)	(2)	(3)	(4)	(5)
19 years old		0.236	0.296	0.297	0.298
		(0.016)***	(0.018)***	(0.018)***	(0.018)***
20 years old		0.33	0.395	0.395	0.403
		(0.021)***	(0.025)***	(0.025)***	(0.025)***
21 years old		0.392	0.409	0.411	0.421
		(0.022)***	(0.024)***	(0.024)***	(0.024)***
22 years old		0.398	0.374	0.377	0.387
		(0.023)***	(0.026)***	(0.026)***	(0.027)***
23 years old		0.418	0.334	0.336	0.348
		(0.025)***	(0.028)***	(0.029)***	(0.029)***
24 years old		0.454	0.314	0.317	0.329
		(0.029)***	(0.034)***	(0.035)***	(0.036)***
immigrant		0.579	0.041	0.054	0.062
		(0.093)***	(0.062)	(0.061)	(0.061)
father high-school grad			-.949	-.949	-.924
			(0.032)***	(0.032)***	(0.031)***
mother high-school grad			-.940	-.936	-.906
			(0.03)***	(0.029)***	(0.028)***
father university grad			-1.708	-1.713	-1.706
			(0.05)***	(0.05)***	(0.051)***
mother university grad			-1.885	-1.882	-1.863
			(0.058)***	(0.058)***	(0.057)***
father working			-.299	-.282	-.287
			(0.019)***	(0.018)***	(0.018)***
mother working			-.043	-.027	-.028
			(0.018)**	(0.018)	(0.017)
absent father			-.098	-.086	-.071
			(0.024)***	(0.024)***	(0.02)***
absent mother			0.327	0.337	0.354
			(0.044)***	(0.045)***	(0.047)***
emancipated			0.579	0.575	0.519
			(0.054)***	(0.054)***	(0.055)***
brothers			-.757	-.757	-.741
			(0.033)***	(0.033)***	(0.031)***
sisters			-.656	-.659	-.643
			(0.032)***	(0.032)***	(0.031)***
siblings 0 to 10			1.317	1.308	1.260
			(0.038)***	(0.038)***	(0.035)***
siblings 11 to 15			0.912	0.902	0.862
			(0.034)***	(0.034)***	(0.03)***
siblings 16 to 20			0.522	0.515	0.492
			(0.031)***	(0.03)***	(0.03)***
siblings 21 to 30			0.258	0.255	0.248
			(0.029)***	(0.029)***	(0.027)***
dropout siblings			1.319	1.316	1.292
			(0.025)***	(0.026)***	(0.025)***
total value added	-1.19e-09	-1.37e-09	4.71e-10	5.84e-10	2.78e-09
	(1.63e-09)	(1.65e-09)	(1.13e-09)	(1.03e-09)	(1.53e-09)*
youth unemployment rate				1.006	0.144
				(0.639)	(0.298)
unemployment rate				1.094	-1.606
				(1.648)	(0.964)*

The dependent variable is equal to one if the individual is a high-school dropout and 0 otherwise. The coefficients are marked with * if the level of significance is between 5% and 10%, ** if the level of significance is between 1% and 5% and *** if the level of significance is less than 1%. All the regressions contain year dummies. The individual data is obtained from the Spanish Labor Force Survey. The sample contains individuals aged 18 to 24 surveyed in the fourth quarter of each year. The time period comprises the years from 1997 to 2007. Standard errors are clustered at the province level. The number of included observations is 186466.