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

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August 2010

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

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

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# ABSTRACT

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

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 the labor market prospects of low educated workers motivated by the increases in employment and wages in the construction sector 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 propensity to drop out of high-school, relative to women. 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 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.

The desire to enter the labor market is one important motivation for dropping out of high-school. 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 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.

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

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[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.

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 the country with the highest incidence of high-school dropouts in the OECD (see Figure 1). This incidence has been rising in recent years, reaching 30% in 2009. 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 2). 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 3 and 4).

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[2].

This paper provides new insights to the study of the long-run effects of expansions. The empirical evidence in this field supports the theory that agents tend to devote less effort to productivity enhancing activities during expansions because production is relatively more profitable. See Bean (1990), Gali and Hammour (1992), Saint-Paul (1993), and Malley and Muscatelli (1999). This paper identifies formal education as one type of productivity

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

enhancing activity that significantly decreases in booms.

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

For the Spanish case, the early paper by Peraita and Pastor (2000) explores the determinants of primary school dropouts focusing on the role played by family background and economic conditions. They find that the unemployment rate negatively affects the probability of dropping out of primary school. Also using Spanish data, the influence of labor market conditions on the demand for post-compulsory education (ages 16 to 18) is studied by Petrongolo and San Segundo (2002). They find that the youth unemployment rate has a positive influence on the probability of staying-on while the general unemployment rate has a negative impact on that probability.

The previous two papers estimate the effect of labor market conditions on dropout behavior using cross-sectional data. Closer to this paper in terms of methodology is the study by Rees and Mocan (1997). They use a panel of districts in New York State and conclude that there is a negative relationship between the overall unemployment rate and the proportion of high-school students who drop out of school in a given year. Controlling for unobserved district characteristics is essential to reach this conclusion.

Although many papers argue that labor market conditions are important in education decisions, this is not a closed question. Using US Census data, Waren and Lee (2003) find no effect of labor market conditions for individuals aged 16 to 19 years old on high-school leaving. This is coherent with the conclusion reached by Schady (2004) for the impact of the 1988-1992 macroeconomic crisis on attendance rates of children in Peru. In contrast, Schady's paper also finds a high and significant impact of the crisis on educational attainment.

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[3]. 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 5 shows the huge increase in employment in the construction sector. Figure 6 makes apparent that construction wages have risen more than the average wage in the economy. 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[4].

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 34% are high-school dropouts. Men represent 61% of total high-school dropouts. There is notable variation across regions within Spain. The maximum is found in some Mediterranean regions like Alicante and Almería, where the ratios reach more than 42%, and the minimum in the Northern regions, i.e., Navarra and País Vasco, with ratios under 20%. Regarding the evolution over time, the high-school dropout rate has continuously decreased since 1995 when the high-school dropout rate was around 40%, until it reached a minimum of 28% in 2000. 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

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[3]This argument is made assuming a binary decision of whether to complete high-school. This is a plausible assumption in our case because Spanish high-school students rarely work.

[4]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%.

value added in each province is positive for both males and females. This is represented in Figure 7. The line that approximates the relation between high-school dropouts and construction activity is however steeper for males (0.55 versus 0.25 of females) and, moreover, the slope is not significantly different from zero for 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 8. Women have always represented a negligible fraction of construction workers.

The 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 this 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 includes some robustness checks and extensions. Finally, section 5 concludes.

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# 2 Methodology

The aim of the empirical exercise is to test whether changes in labor market conditions for low 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 males with respect to females. 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

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

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 and an indicator for living without any of the parents, $W$ represents three regional variables, namely, total value added, youth unemployment rate, and overall unemployment rate, $\eta$ is a vector of

province dummies, and $\xi$ includes year dummies[5]. Finally, $\varepsilon$ is the residual.

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[6].

Taking equation 1 as a base, I estimate the contemporaneous effect of construction activity on high-school dropouts. For those individuals that dropped out of high-school at an earlier time, the coefficient $\beta_1$ is reflecting the influence of construction activity on the probability of reinsertion to the education system. However, many individuals may have actually taken their decisions to drop out of high-school at the average age at which students are in high-school. To include this possibility, I estimate the differential effect of construction activity when the individual was 17 years old for males with respect to females. 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

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

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[7].

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[5] 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.

[6] 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.

[7] Initially, I planned to include contemporaneous total value added in the equation but it has proven to be highly collinear with total value added at 17 and hence, I have excluded it. 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, results are statistically invariant to the inclusion of contemporaneous total value added.

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, 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 potential high-school dropouts as defined by the European Union. 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 year. The time period covered comprises the years from 1995 to 2007. This is determined by the availability of the data on construction.

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[8]. 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 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 1995 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

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[8]The number of new dwellings is a good proxy of expectations about employment in the construction sector. In fact, Figure 4 shows that the number of new dwellings measure captures better the end of the housing boom than the number of constructed dwellings measure.

in Table 1. The final sample is composed by 230635 individuals. One third of them are high-school dropouts and around one half of the sampled individuals are male. They are 21 years old on average.

Regarding family characteristics, 11% of sampled individuals have a cohabiting father with high-school education and the proportion of individuals who have a cohabiting mother with high-school education is only one percentage point lower. Only 9% of sampled individuals have a university graduated cohabiting father and the proportion is 2 percentage points lower for university graduated cohabiting mothers. Additionally, 59% of individuals have a cohabiting father who is working while only 30% of them have a cohabiting mother who is working. Finally, 22% of sampled individuals do not live with their fathers. The corresponding proportion for individuals not living with their mothers is reduced to 17% and individuals not living with any of their parents are only 5%.

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 0.034.

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 number of individuals is reduced to 86953. The only remarkable differences in terms of descriptive statistics are that the high-school dropout rate is slightly lower, cohabiting parents are more educated on average, the proportion of sampled individuals with working cohabiting father is hardly reduced, the proportion of individuals with working cohabiting mother is a little higher, and the proportion of absent fathers and mothers as well as emancipated youngsters is higher as compared to the descriptive statistics for the sample included when estimating the contemporaneous effect. These differences are intuitive because the period is restricted to recent years and educational attainment, women participation in the labor market and youngsters emancipation have been continuously increasing in time.

Table 3 contains the descriptive statistics for the sample included in the regressions

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where construction activity at 17 is measured using number of new dwellings at 17. The period included is shorter and more recent on average than the period in the contemporaneous effect regressions but longer and less recent on average than the period in the regression where construction activity is measured using construction value added at 17. Therefore, the number of observations, 143440, as well as the mean values for high-school dropout rate, parents' education attainment, mother's working status and emancipated are in between those in the two tables described above.

# 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 the measure 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 prob-

ability is positive and significant. In contrast, the average effect of construction activity is positive but statistically indistinguishable from zero. This corroborates the hypothesis that labor market shocks that improve employment prospects for low educated workers significantly increases 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 2.899. This is interpreted as a one percentage point 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 individual of 0.006 (1.74%).

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, 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. However, the estimation results show that men dropout more in the presence of higher housing prices. This is counterintuitive given that 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. The results reached by Yamashita (2008) when exploring the effects of the Great Depression on educational attainment suggest that the average effect of the economic cycle is negligible. However, I still address the possibility that the general level of economic activity has an effect on high-school dropouts by including regional total value added as a control in the estimated equations. Any persisting bias is expected to be negative because women's labor supply

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is more affected by the economic cycle[9]. 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 increase 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 and 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 and then, 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[10]. However, if some individuals dropout of high-school to become construction workers in a different province where the demand of construction workers is higher, the actual impact of the housing boom on high-school dropouts is more pronounced than the estimated by defining the labor market at the province level.

Regarding the rest of coefficients in the logistic regression, 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

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[9]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.

[10]The low mobility of the sampled individuals is illustrated by the fact that more than 87.6% of sampled individuals live in their province of birth.

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. 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, in our regressions the coefficient for the overall unemployment rate is not significant. This is due to the correlation between the unemployment rate and total value added.

## 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 estimate is 1.904. This can be interpreted as a one percentage point increase in construction over total value added inducing an increase of 0.003 (1.17%) in the probability of dropping out of high-school for the average individual. This effect is consistent with the contemporaneous one in the sign, but it is smaller in magnitude. Also in consonance with the contemporaneous effect results, the average effect of construction activity at 17 on both males and females is statistically indistinguishable from zero while total value added at 17 has a positive and significant impact. In contrast, contemporaneous construction activity is positive and significant. This differs from the result obtained for the coefficient associated to this variable in the regression for the contemporaneous effect. The reason is that it contains the average and the differential contemporaneous effect and the latter is significant.

The estimated coefficients for the rest of controls are extremely similar to the ones obtained in the contemporaneous regression.

## 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 are displayed in Table 6 for the contemporaneous effect. 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 3.875. This is equivalent to a marginal effect of 0.77 when the covariates are evaluated at their mean values. This implies that one extra new dwelling per one hundred individuals aged 18-24 increases the probability of high-school dropout by 0.02 (7.03%) on average. Similarly to the results when construction activity is measured by value added, the average effect of construction activity as measured by number of new dwellings is negligible. Total value added is also positive but the estimate becomes insignificant. 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 2.126 which is equivalent to a marginal effect evaluated at the mean values of the covariates of 0.38. Intuitively, this means that one extra new dwelling at the age of 17 per one hundred individuals aged 18-24 increases the probability of high-school dropout by 0.004 (1.29%). The rest of coefficients are very similar to the ones displayed in Table 5.

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

## 4.4 Robustness checks and additional specifications

*Effects of changes in other economic sectors*

The Spanish housing boom was contemporaneous to an important economic upturn.

Production was increased and employment was generated 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 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 9 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

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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 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.

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

*Sample composed by non-migrants*

One could argue that the estimated effect is a consequence of changes in the composition of the pool of individuals in each province. This would happen if individuals with high propensity to drop out of high-school move to provinces with an increasing level of construction activity. To address this, I have repeated the analysis over individuals that live in the same province where they were born. The results, which are displayed in Table

10, are almost invariant with respect to those obtained using the full sample.

*Sample composed by different age groups*

The sample used in the previous regressions is composed by individuals aged 18 to 24 years old. This has been chosen in order to be coherent with the European Union definition of high-school dropouts. Additionally, 18 years old is the minimum age to have finished high-school. However, the group of individuals aged 18 to 24 years old is relatively broad and the effects of labor market conditions may be different for younger relative to older individuals. The effect of construction activity on males versus females is estimated on four different subsamples composed by individuals aged (i) 18 to 20, (ii) 21 to 24, (iii) 18 to 22 and (iv) 23 to 24. As it can be seen in Table 11, all the estimated coefficients are significant and consistent with the existence of a positive impact of better employment prospects for low educated individuals on high-school dropouts. The magnitudes of the effects are slightly larger for older samples, indicating that those are the ones more affected by labor market conditions when taking their decisions on education.

*Effects of construction activity at the age of 18*

In our previous analysis I have taken into account the possibility that individuals take their decisions to drop out of high-school influenced by labor market conditions at 17, the average age in high-school. However, grade retention is severe in Spain. This means that individuals could have taken their decision to drop out of high-school influenced by labor market conditions later, at 18. This is also the age at which they are legally allowed to start working in construction[11]. To account for this possibility, the equation for the probability of high-school dropout is estimated including the interaction of construction activity at the age of 18 and male as key explanatory variable.

The results displayed in Table 12 are consistent with the findings for the impact of construction activity at age 17. However, they are slightly smaller in magnitude[12].

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[11]The Spanish legislation states that workers under 18 are not allowed to perform certain tasks. Those tasks comprise almost all the tasks that are required in building. However, data shows that more than 20% of total number of 16-17 aged individuals that work do it in the construction sector. This figure almost doubles the average ratio of construction over total number of workers (11.5%).

[12]A similar exercise is performed including construction activity at the age of 16 interacted with male

*Placebo test*

Gender is assigned randomly to each individual by nature in a way such that the population is expected to be composed 50% by males. In this section, I randomly assign a fictitious gender to sampled individuals and repeat the analysis by assuming that fictitious males are affected by the housing boom while fictitious females do not. This exercise is repeated several times and the coefficients are close to zero and mainly insignificant. This shows that it would have been extremely difficult to have found a positive relationship if males were not differently affected by construction with respect to females.

# 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 to reduce the incidence of high-school dropout is important to understand the determinants of the decision to drop out.

This paper shows that labor market shocks that improve prospects 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

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as key explanatory variable. The point estimate for the differential effect of construction activity on males is positive. However, the effect is statistically insignificant due to the reduction in the sample which covers only the years 2003-2007.

by 1.74% 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 1.17% 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 to 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 incentivate 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: High-school dropouts across countries
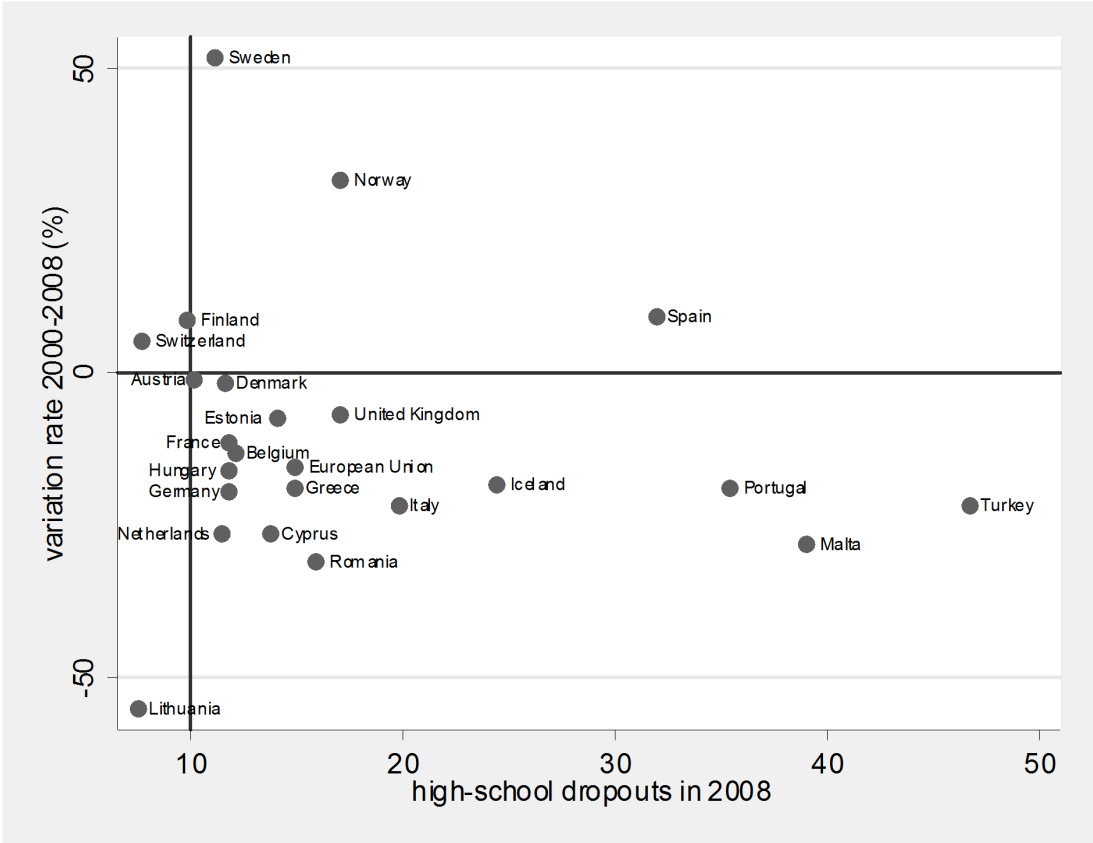


Data source: Eurostat. Information available at http://epp.eurostat.ec.europa.eu/tgm/table.do? tab=table&init=1&language=en&pcode=tsisc060. The primary source is the EU Labor Force Survey. The y-axis refers to the variation rate in the proportion of high-school dropouts from 2000 to 2008 and the x-axis represents the value of the high-school dropout rate in 2008. The vertical line depicts the EU objective established for 2010.

**Figure 2: House prices over time**
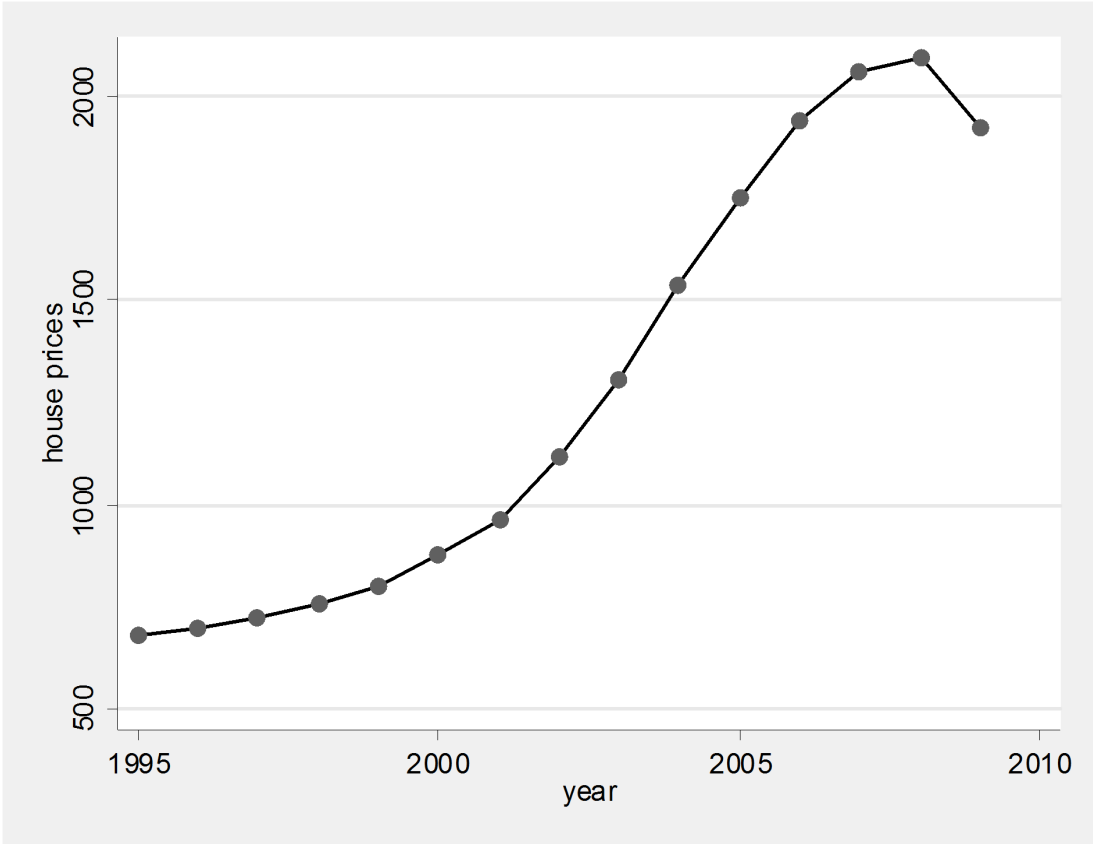


Data source: Spanish Ministry of Housing. Each data point corresponds to average house prices in the second quarter of the year for the period 1995 to 2009.

**Figure 3: Ratio of construction value added and GDP over time**
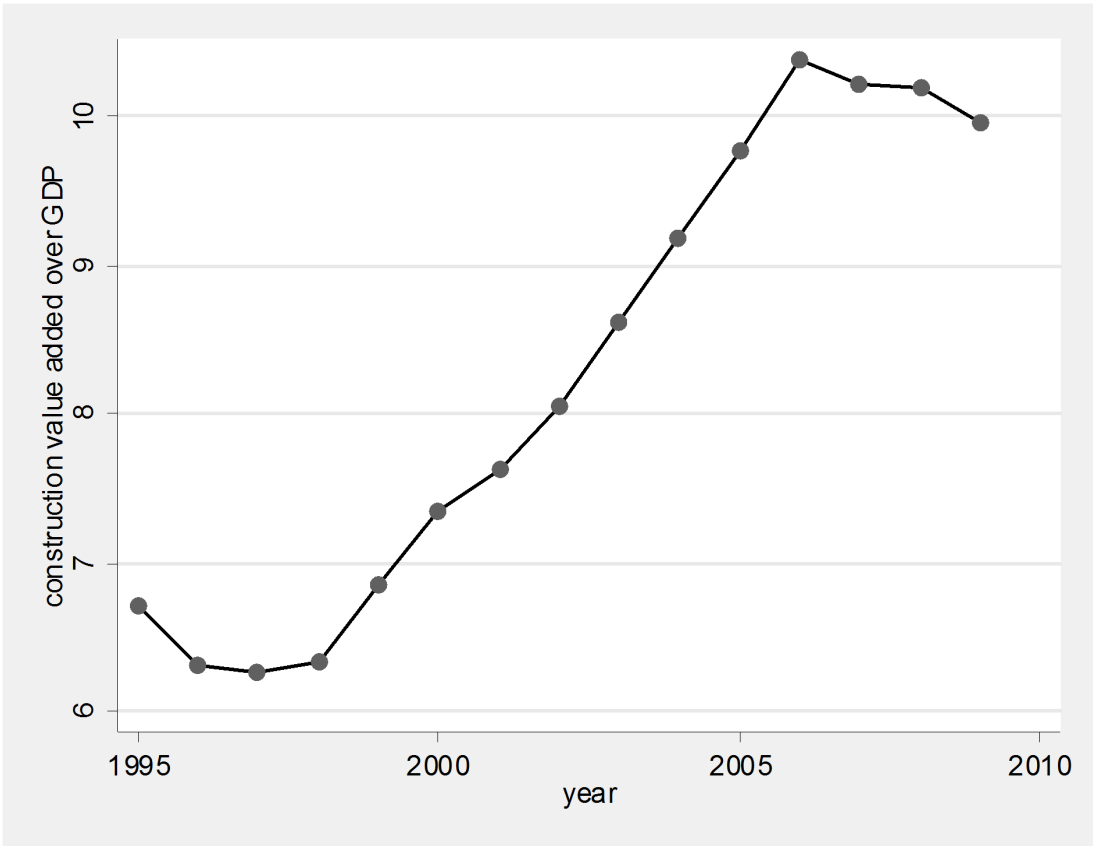


Data source: Spanish National Accountings. This information can be found at the National Statistics Institute webpage at the address http://www.ine.es/jaxiBD/tabla.do?per=03&type=db&divi=CNTR&idtab=1. Each data point corresponds to the second quarter of each year for the period 1995 to 2009.

## Figure 4: Number of constructed dwellings over time
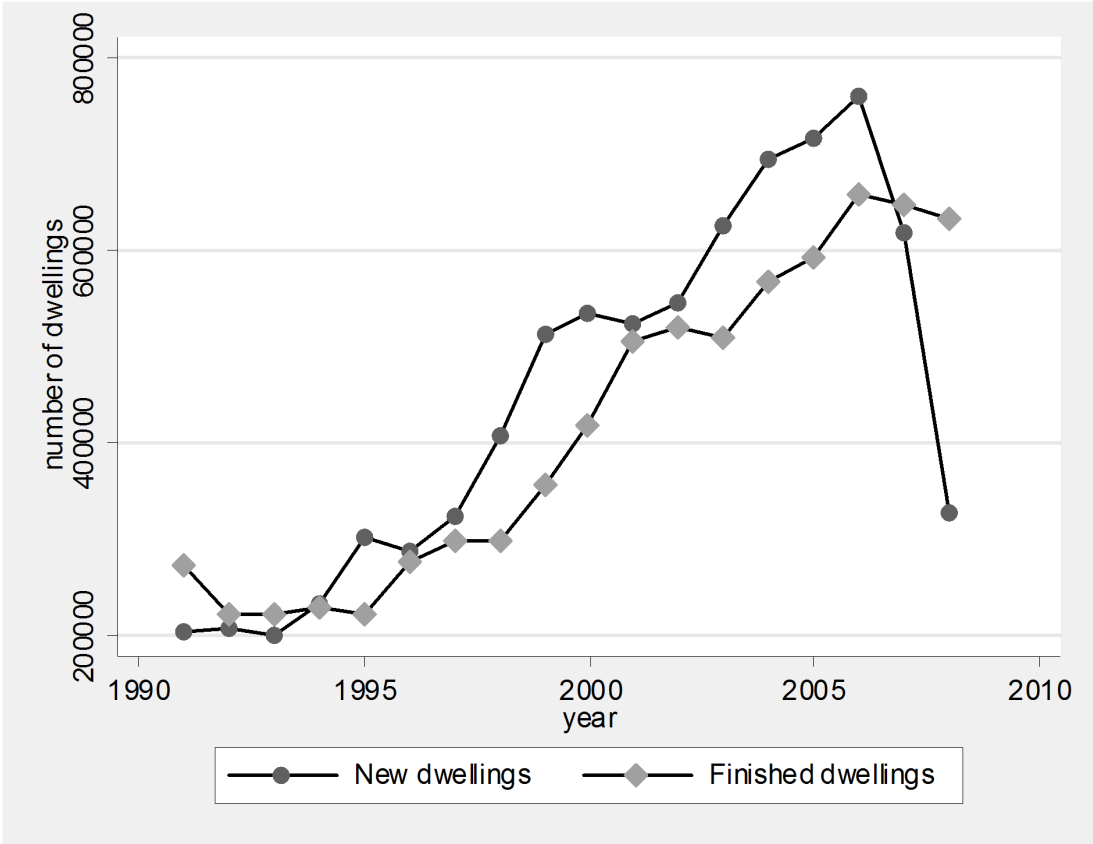


Data source: Spanish Ministry of Housing. The data points are the result of adding up non-subsidized and subsidized dwellings. Information on non-subsidized dwellings is accessible online from http://www.mviv.es/es/index.php?option=com_content&task=view&id=379&Itemid=434 and data on subsidized dwellings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

**Figure 5: Number of workers in the construction sector over time**
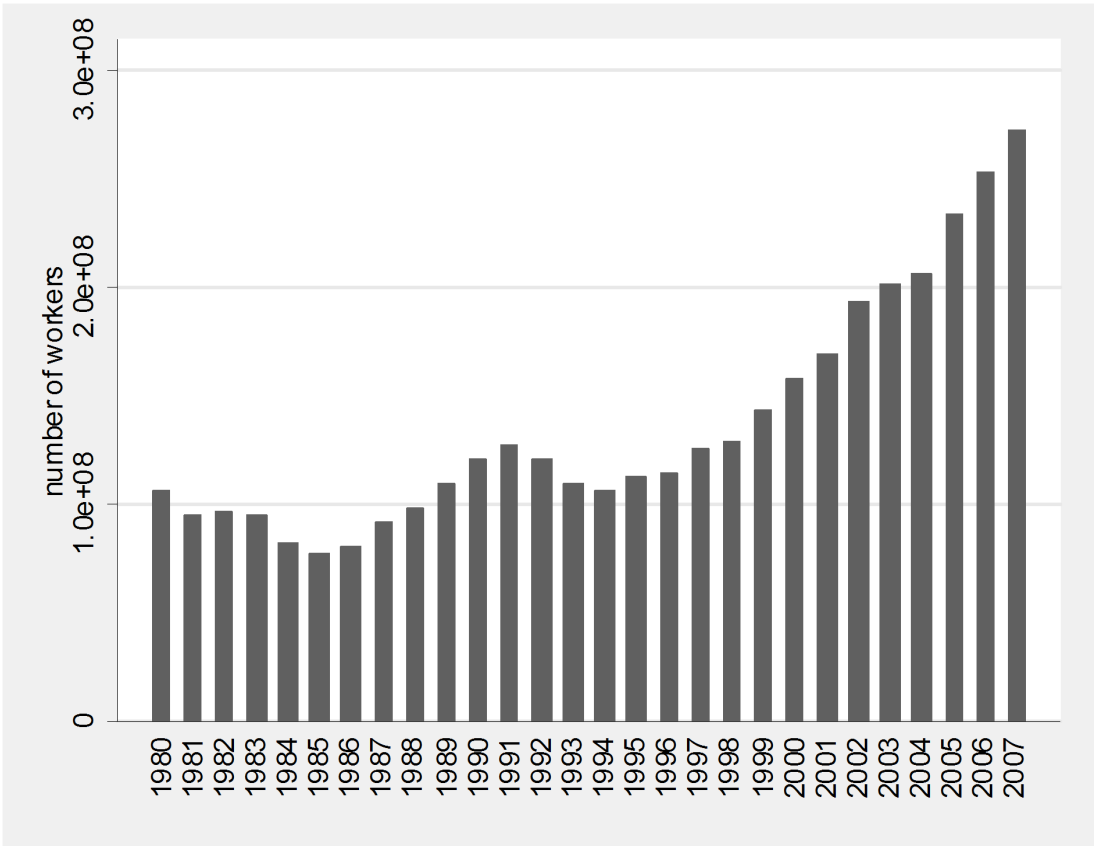


Data source: Spanish Labor Force Survey. Each data point corresponds to the second quarter of each year for the period 1980-2007.

**Figure 6: Average wages over time**
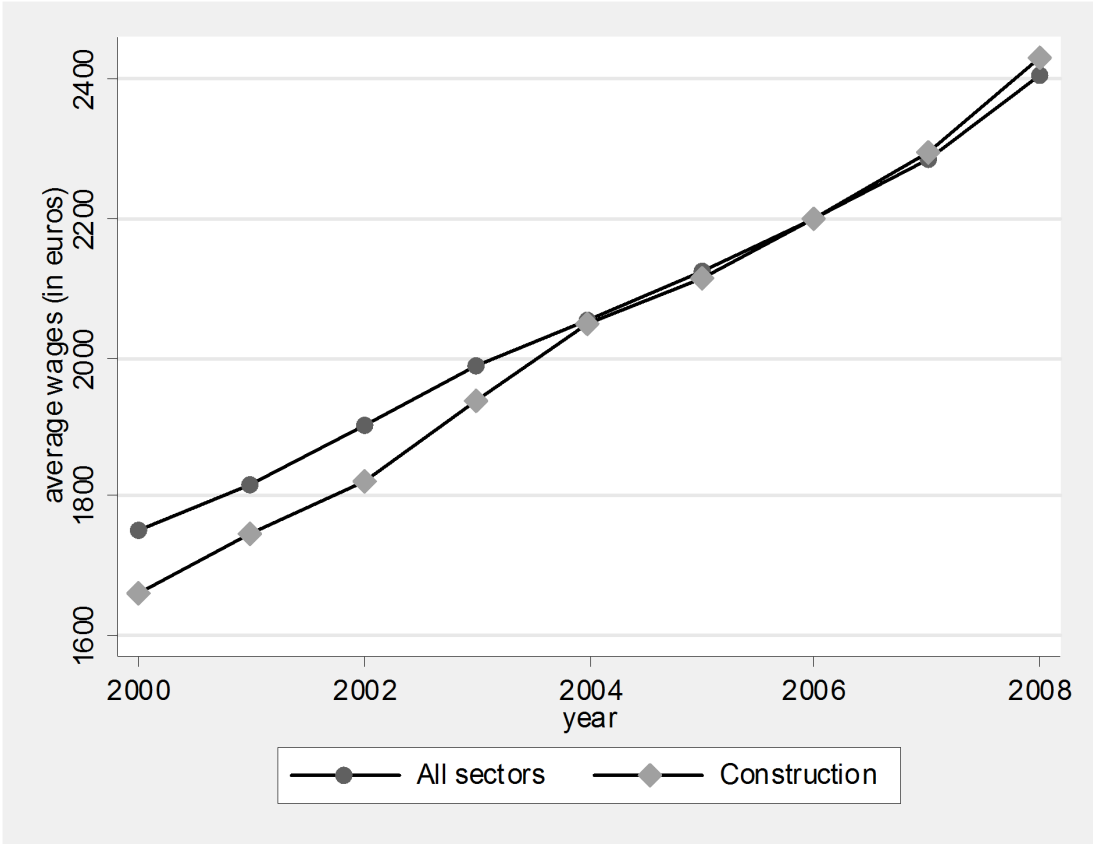


Data source: Labor Costs Quarterly Survey (Encuesta Trimestral de Coste Laboral). Each data point corresponds to the second quarter of each year for the period 2000 to 2008.

# Figure 7: Correlation between dropout rate and construction activity averaged by province
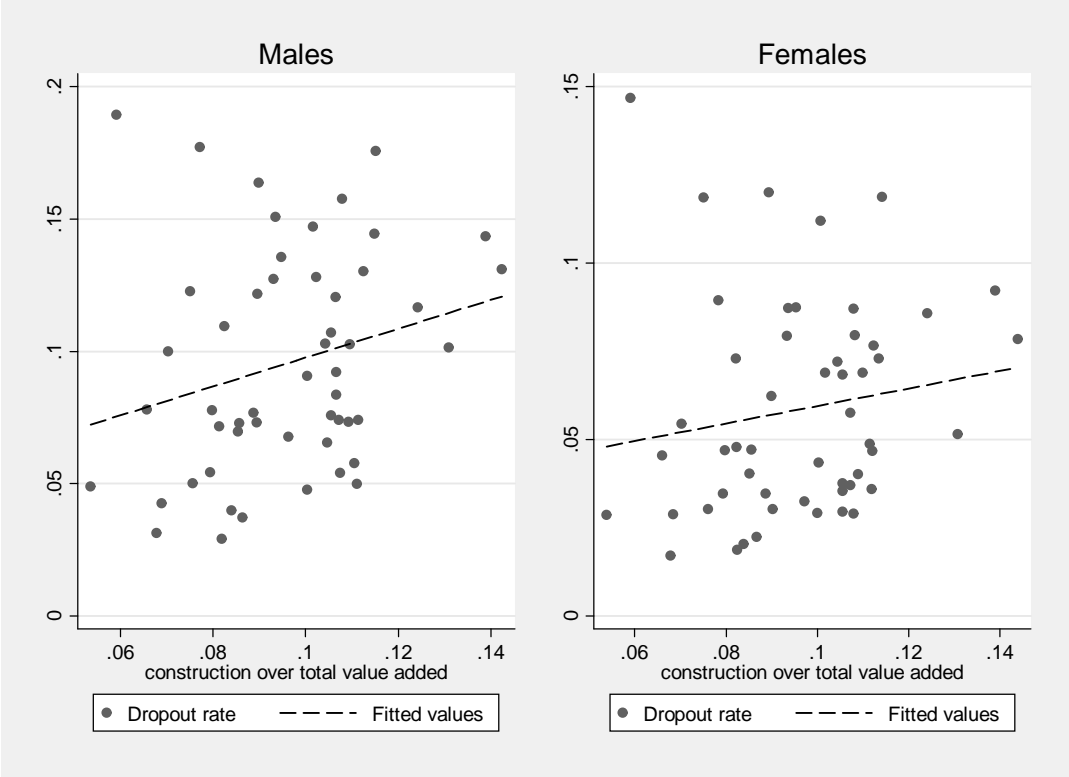


The estimated slope for men is 0.55 and is significant at the 10% level while the estimated slope for women is 0.25 and is statistically indistinguishable from zero. The data on dropout rates is computed using the Spanish Labor Force Survey. The data on construction over total value added is obtained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

**Figure 8: Number of male and female construction workers over time**
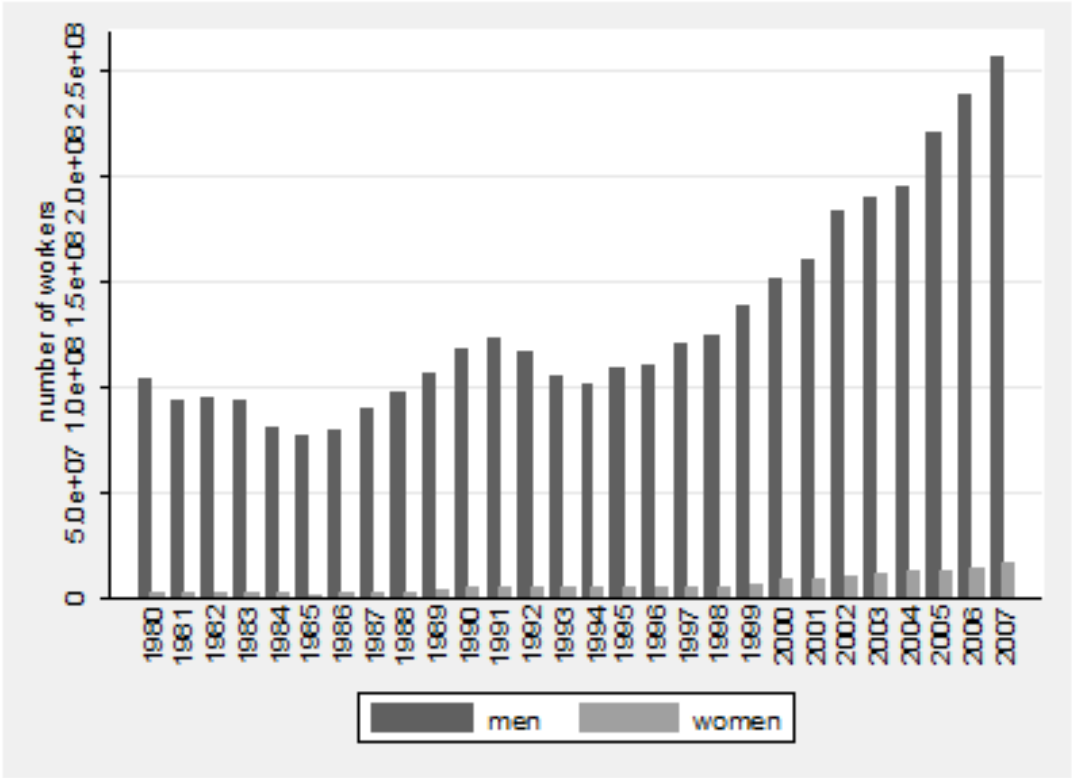


Data source: Spanish Labor Force Survey. Each data point corresponds to the second quarter of each year for the period 1980 to 2007.

**Figure 9: 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
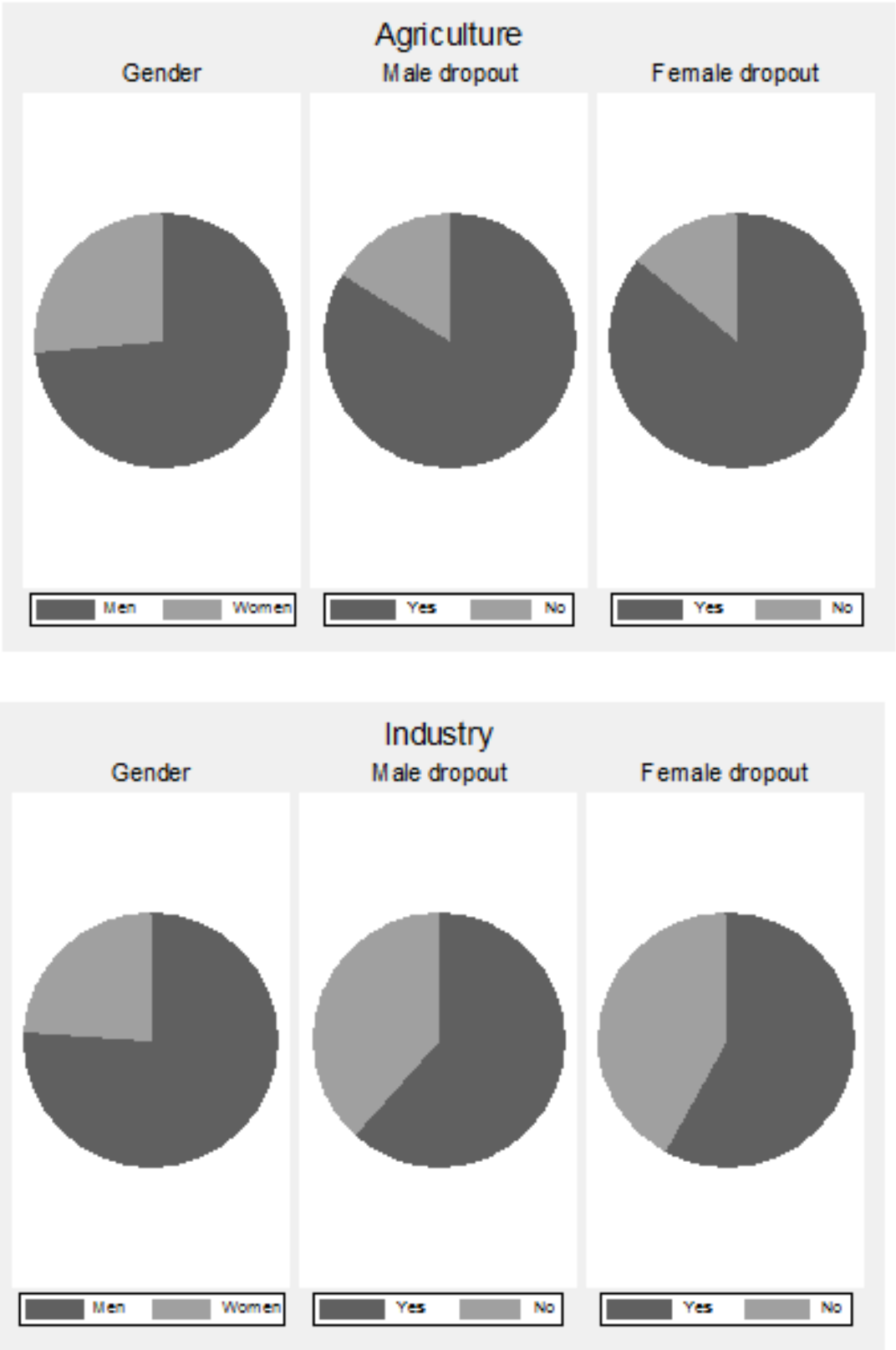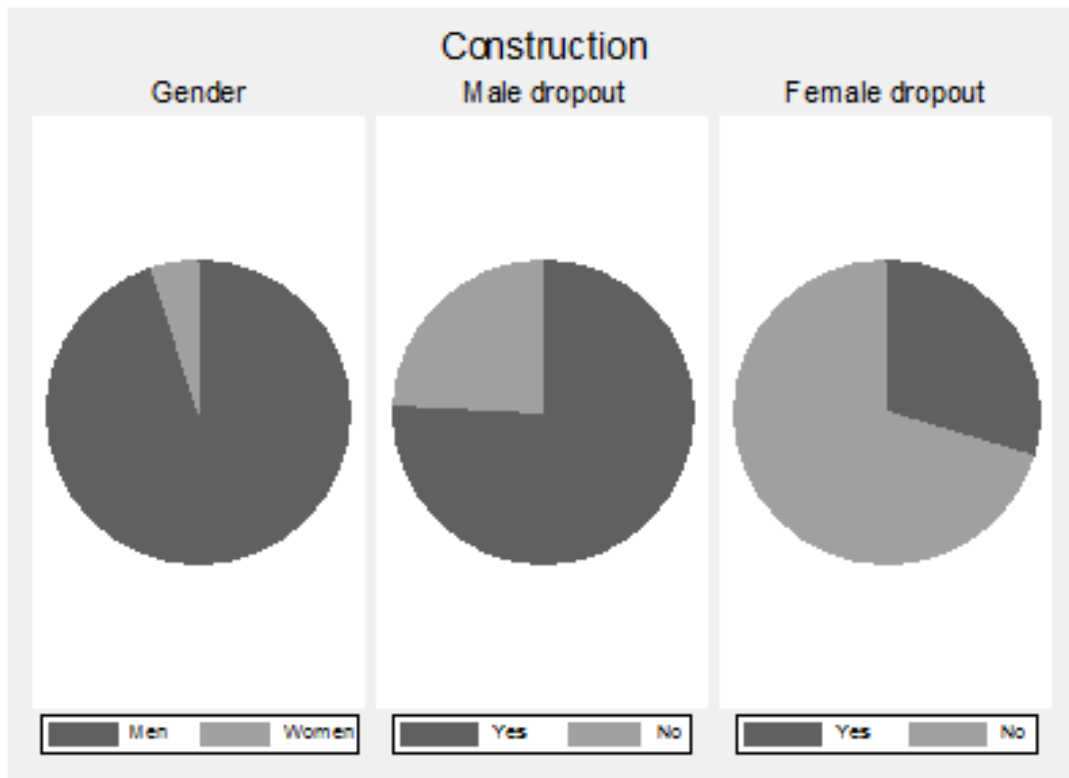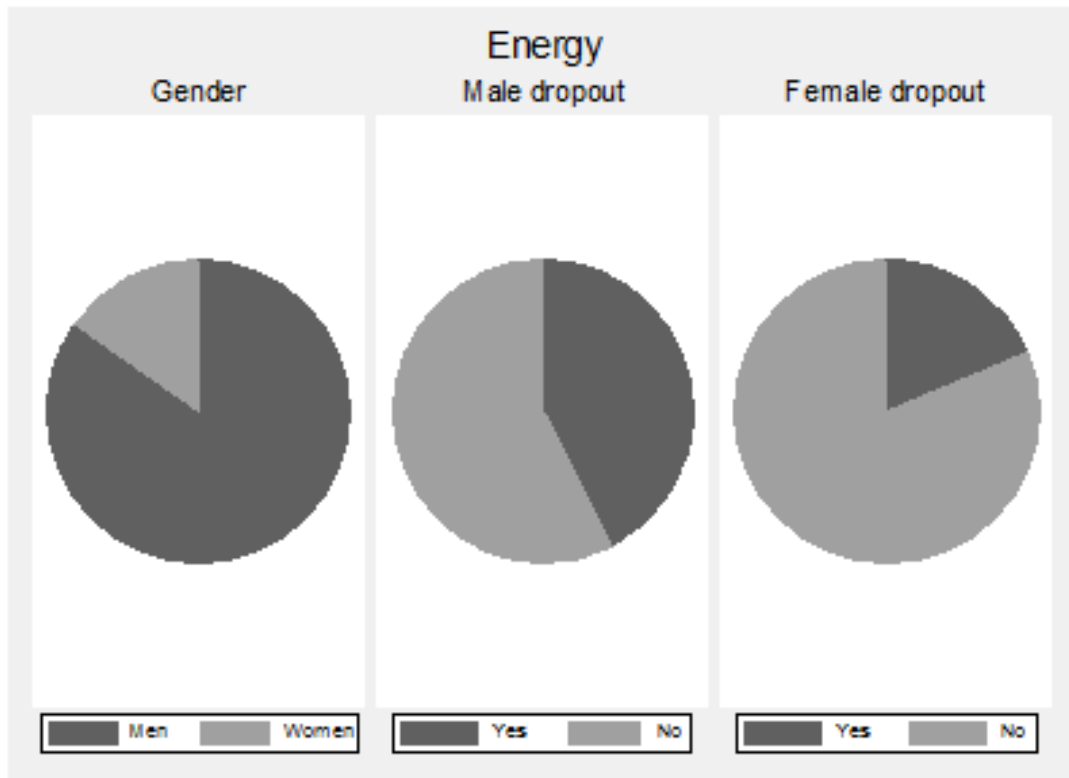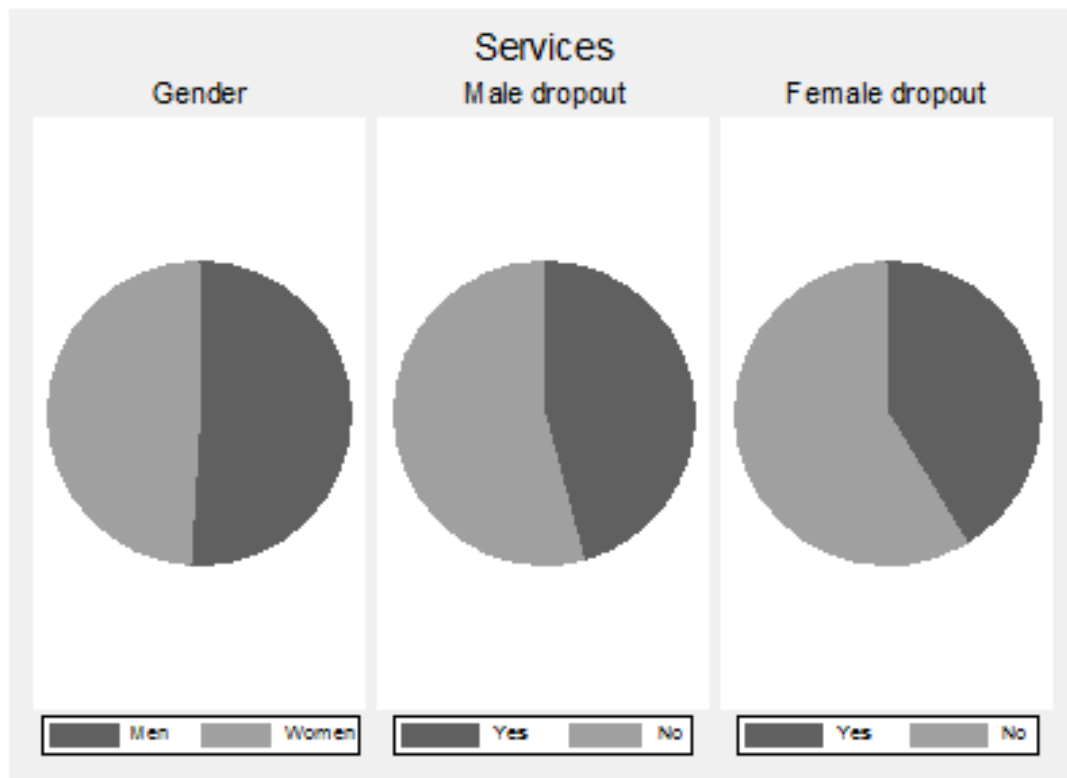
Data source: Spanish Labor Force Survey. The data corresponds to the second quarter of each year for the period 1995-2007. The share of dropouts is computed as the proportion of working age individuals that do not have a high-school degree and declare not to have received any education or training in the previous four weeks.

**Figure 10: Placebo test**
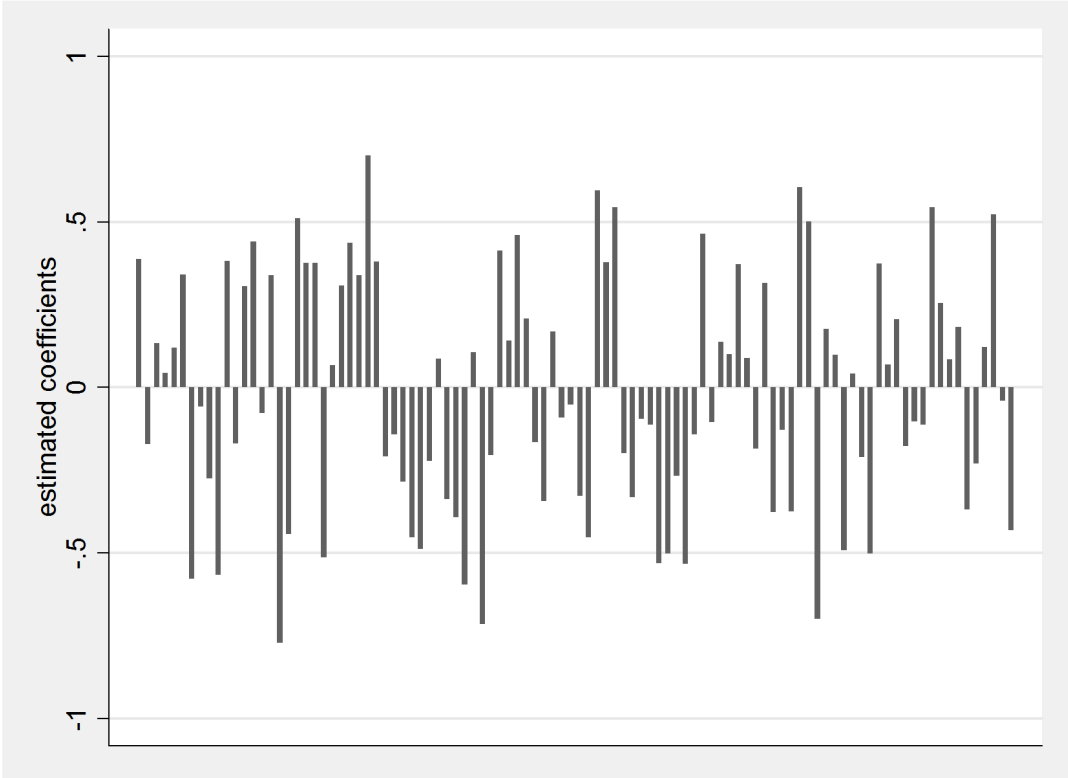


Each bar corresponds to the point estimate of the coefficient associated with the interaction of construction value added and male where male is a random variable equal to one with probability 0.5 and equal to 0 with probability 1. Therefore, the variable takes different values in each of the 100 draws. In each regression, 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. All estimations include the same controls, namely, construction value added, total value added, a male dummy, age binary indicators, an immigrant dummy, parents 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 as well as an emancipated dummy, youth and total unemployment rates, year dummies as well as 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 years old surveyed in the fourth quarter of each year. The time period comprises the years from 1995 to 2007. Standard errors are clustered at the province level.

# Tables

## Table 1: Descriptive statistics for the contemporaneous effect estimations

|  | Mean | Sd | Min | Max |
|---|---|---|---|---|
| high-school dropout | 0.33 | 0.47 | 0 | 1 |
| construction over total VA by male | 0.048 | 0.051 | 0 | 0.202 |
| construction over total VA | 0.095 | 0.027 | 0.04 | 0.202 |
| new dwellings by male | 0.017 | 0.023 | 0 | 0.125 |
| new dwellings | 0.034 | 0.022 | 0.002 | 0.152 |
| total value added | 1.95e+07 | 2.82e+07 | 570919 | 1.67e+08 |
| youth unemployment rate | 0.15 | 0.059 | 0.028 | 0.363 |
| unemployment rate | 0.066 | 0.028 | 0.015 | 0.164 |
| male | 0.511 | 0.5 | 0 | 1 |
| age | 21.054 | 1.983 | 18 | 24 |
| immigrant | 0.028 | 0.165 | 0 | 1 |
| father high-school grad | 0.111 | 0.314 | 0 | 1 |
| mother high-school grad | 0.096 | 0.294 | 0 | 1 |
| father university grad | 0.092 | 0.289 | 0 | 1 |
| mother university grad | 0.071 | 0.257 | 0 | 1 |
| father working | 0.588 | 0.492 | 0 | 1 |
| mother working | 0.296 | 0.457 | 0 | 1 |
| absent father | 0.217 | 0.412 | 0 | 1 |
| absent mother | 0.168 | 0.373 | 0 | 1 |
| on one's own | 0.053 | 0.224 | 0 | 1 |
| province | 26.341 | 14.328 | 1 | 52 |
| year | 2000.283 | 3.655 | 1995 | 2007 |
| weights | 22210.2 | 14599.69 | 1038 | 414671 |

The number of included observations is 230635. 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**

|  | Mean | Sd | Min | Max |
|---|---|---|---|---|
| high-school dropout | 0.294 | 0.456 | 0 | 1 |
| construction over |  |  |  |  |
| total VA at 17 by male | 0.047 | 0.049 | 0 | 0.189 |
| construction over total VA at 17 | 0.093 | 0.023 | 0.04 | 0.189 |
| total VA at 17 | 1.85e+07 | 2.65e+07 | 570919 | 1.56e+08 |
| male | 0.509 | 0.5 | 0 | 1 |
| 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 | 0.15 | 0.357 | 0 | 1 |
| father university grad | 0.092 | 0.289 | 0 | 1 |
| mother university grad | 0.092 | 0.288 | 0 | 1 |
| father working | 0.523 | 0.499 | 0 | 1 |
| mother working | 0.362 | 0.481 | 0 | 1 |
| father absent | 0.31 | 0.463 | 0 | 1 |
| mother absent | 0.191 | 0.393 | 0 | 1 |
| on one's own | 0.069 | 0.253 | 0 | 1 |
| youth unemployment rate | 0.111 | 0.035 | 0.028 | 0.259 |
| unemployment rate | 0.048 | 0.018 | 0.015 | 0.119 |
| province | 26.277 | 14.308 | 1 | 52 |
| year | 2004.31 | 1.719 | 2002 | 2007 |
| weights | 24197.04 | 16812.11 | 1038 | 414671 |

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**

|                               | Mean      | Sd        | 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    |
| total value added at 17       | 1.53e+07  | 2.40e+07  | 0     | 1.56e+08 |
| male                          | 0.509     | 0.5       | 0     | 1        |
| 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       | 0.126     | 0.332     | 0     | 1        |
| father university grad        | 0.094     | 0.292     | 0     | 1        |
| mother university grad        | 0.082     | 0.274     | 0     | 1        |
| father working                | 0.561     | 0.496     | 0     | 1        |
| mother working                | 0.324     | 0.468     | 0     | 1        |
| absent father                 | 0.254     | 0.435     | 0     | 1        |
| absent mother                 | 0.177     | 0.382     | 0     | 1        |
| on one's own                  | 0.06      | 0.237     | 0     | 1        |
| youth unemployment rate       | 0.122     | 0.044     | 0.028 | 0.341    |
| unemployment rate             | 0.054     | 0.022     | 0.015 | 0.13     |
| province                      | 26.332    | 14.324    | 1     | 52       |
| year                          | 2002.59   | 2.57      | 1999  | 2007     |
| weights                       | 23186.12  | 15571.18  | 1038  | 414671   |

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 | unemployment | parents | year | province |
|---|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) | (5) |
| construction VA by male | 2.151 (0.473)*** | 2.038 (0.468)*** | 3.060 (0.549)*** | 3.028 (0.542)*** | 2.899 (0.563)*** |
| contruction VA | -2.581 (1.524)* | 0.866 (1.455) | 0.919 (1.312) | 2.771 (1.903) | 1.186 (0.955) |
| total value added | -4.22e-09 (9.82e-10)*** | -2.45e-09 (1.12e-09)** | -7.78e-10 (8.89e-10) | -1.47e-10 (1.20e-09) | 1.90e-09 (1.42e-09) |
| male | 0.434 (0.052)*** | 0.455 (0.051)*** | 0.496 (0.059)*** | 0.5 (0.058)*** | 0.521 (0.061)*** |
| 19 years old | 0.221 (0.015)*** | 0.223 (0.014)*** | 0.218 (0.015)*** | 0.22 (0.015)*** | 0.227 (0.015)*** |
| 20 years old | 0.333 (0.02)*** | 0.339 (0.02)*** | 0.303 (0.021)*** | 0.306 (0.021)*** | 0.32 (0.021)*** |
| 21 years old | 0.393 (0.02)*** | 0.401 (0.02)*** | 0.325 (0.021)*** | 0.329 (0.021)*** | 0.347 (0.021)*** |
| 22 years old | 0.399 (0.021)*** | 0.411 (0.021)*** | 0.289 (0.024)*** | 0.296 (0.024)*** | 0.316 (0.025)*** |
| 23 years old | 0.435 (0.023)*** | 0.449 (0.023)*** | 0.257 (0.025)*** | 0.264 (0.024)*** | 0.288 (0.026)*** |
| 24 years old | 0.47 (0.026)*** | 0.489 (0.027)*** | 0.217 (0.029)*** | 0.226 (0.029)*** | 0.253 (0.031)*** |
| immigrant | 0.47 (0.089)*** | 0.524 (0.09)*** | 0.14 (0.089) | 0.128 (0.092) | 0.127 (0.087) |
| father high-school grad |  |  | -1.218 (0.037)*** | -1.203 (0.036)*** | -1.171 (0.037)*** |
| mother high-school grad |  |  | -1.007 (0.037)*** | -.986 (0.036)*** | -.948 (0.036)*** |
| father university grad |  |  | -2.055 (0.06)*** | -2.059 (0.061)*** | -2.050 (0.062)*** |
| mother university grad |  |  | -1.899 (0.069)*** | -1.895 (0.07)*** | -1.871 (0.071)*** |
| father working |  |  | -.356 (0.018)*** | -.367 (0.018)*** | -.377 (0.016)*** |
| mother working |  |  | -.041 (0.021)** | -.053 (0.022)** | -.056 (0.02)*** |
| absent father |  |  | -.432 (0.036)*** | -.458 (0.029)*** | -.434 (0.026)*** |
| absent mother |  |  | 0.127 (0.034)*** | 0.143 (0.032)*** | 0.129 (0.032)*** |
| emancipated |  |  | 1.156 (0.05)*** | 1.163 (0.05)*** | 1.116 (0.05)*** |
| youth unemployment rate |  | 2.528 (0.835)*** | 2.168 (0.73)*** | 1.189 (0.753) | 0.606 (0.273)** |
| unemployment rate |  | 3.411 (1.958)* | 2.435 (1.670) | 2.464 (1.818) | -1.544 (1.034) |

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%. The basic regression includes construction value added interacted by male, construction value added, total value added, a male dummy, age binary indicators and an immigrant dummy. The second column adds parents characteristics to the basic specification 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 as well as an emancipated dummy. The third column includes, in addition to the controls in column 2, youth and total unemployment rates. The fourth column adds year dummies. 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 years old surveyed in the fourth quarter of each year. The time period comprises the years from 1995 to 2007. Standard errors are clustered at the province level. The number of included observations is 230635.

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

| | basic | unemployment | parents | year | province |
| --- | --- | --- | --- | --- | --- |
| | (1) | (2) | (3) | (4) | (5) |
| construction VA at 17 by male | 2.428 (0.888)*** | 2.336 (0.874)*** | 2.094 (1.003)** | 2.088 (1.009)** | 1.904 (0.995)* |
| construction VA at 17 | -4.515 (2.082)** | -3.448 (2.142) | -3.622 (1.906)* | -3.904 (2.000)* | -.704 (1.605) |
| tva17 | -9.50e-10 (1.33e-09) | -2.25e-10 (1.12e-09) | 1.34e-09 (9.70e-10) | 9.18e-10 (1.01e-09) | 5.29e-09 (1.45e-09)*** |
| contruction VA | 8.075 (1.792)*** | 7.403 (1.546)*** | 7.707 (1.393)*** | 6.787 (1.655)*** | 2.571 (1.256)** |
| male | 0.473 (0.094)*** | 0.489 (0.091)*** | 0.642 (0.105)*** | 0.643 (0.106)*** | 0.67 (0.106)*** |
| 19 years old | 0.249 (0.027)*** | 0.257 (0.027)*** | 0.252 (0.028)*** | 0.251 (0.028)*** | 0.282 (0.027)*** |
| 20 years old | 0.345 (0.031)*** | 0.36 (0.034)*** | 0.33 (0.032)*** | 0.326 (0.033)*** | 0.397 (0.03)*** |
| 21 years old | 0.38 (0.046)*** | 0.405 (0.051)*** | 0.313 (0.045)*** | 0.307 (0.046)*** | 0.401 (0.038)*** |
| 22 years old | 0.355 (0.058)*** | 0.385 (0.063)*** | 0.248 (0.058)*** | 0.241 (0.06)*** | 0.358 (0.051)*** |
| 23 years old | 0.321 (0.056)*** | 0.355 (0.06)*** | 0.149 (0.053)*** | 0.14 (0.057)** | 0.278 (0.055)*** |
| 24 years old | 0.297 (0.061)*** | 0.337 (0.067)*** | 0.057 (0.058) | 0.048 (0.061) | 0.196 (0.051)*** |
| immigrant | 0.671 (0.08)*** | 0.715 (0.082)*** | 0.332 (0.078)*** | 0.325 (0.079)*** | 0.301 (0.079)*** |
| father high-school grad | | | -1.018 (0.039)*** | -1.026 (0.039)*** | -1.007 (0.037)*** |
| mother high-school grad | | | -.975 (0.043)*** | -.982 (0.043)*** | -.949 (0.044)*** |
| father university grad | | | -1.837 (0.082)*** | -1.841 (0.082)*** | -1.834 (0.086)*** |
| mother university grad | | | -1.948 (0.074)*** | -1.953 (0.074)*** | -1.931 (0.075)*** |
| father working | | | -.170 (0.03)*** | -.167 (0.03)*** | -.180 (0.029)*** |
| mother working | | | -.114 (0.027)*** | -.117 (0.028)*** | -.109 (0.023)*** |
| absent father | | | -.327 (0.04)*** | -.361 (0.039)*** | -.349 (0.038)*** |
| absent mother | | | -.011 (0.042) | 0.007 (0.042) | 0.009 (0.043) |
| emancipated | | | 0.923 (0.054)*** | 0.925 (0.054)*** | 0.908 (0.057)*** |
| youth unemployment rate | | 1.963 (0.767)** | 1.914 (0.686)*** | 1.557 (0.666)** | 0.764 (0.411)* |
| unemployment rate | | 4.902 (2.511)* | 2.286 (2.227) | 3.614 (2.100)* | -1.067 (1.489) |

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%. The basic regression includes construction value added at 17 interacted by male, construction value added at 17, total value added at 17, construction value added, a male dummy, age binary indicators and an immigrant dummy. The second column adds parents characteristics to the basic specification 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 as well as an emancipated dummy. The third column includes, in addition to the controls in column 2, youth and total unemployment rates. The fourth column adds year dummies. Finally, the fifth column includes all previously mentioned controls

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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 years old 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 | unemployment | parents | year | province |
|---|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) | (5) |
| new dwellings by male | 2.674 (0.64)*** | 2.473 (0.574)*** | 3.942 (0.801)*** | 3.893 (0.8)*** | 3.875 (0.854)*** |
| new dwellings | -4.275 (1.743)** | 1.933 (1.340) | 1.693 (1.263) | 2.810 (1.433)** | -.926 (0.692) |
| total value added | -4.18e-09 (1.03e-09)*** | -2.47e-09 (9.86e-10)** | -8.77e-10 (7.26e-10) | -6.30e-10 (8.22e-10) | 1.39e-09 (1.44e-09) |
| male | 0.549 (0.028)*** | 0.565 (0.027)*** | 0.655 (0.032)*** | 0.657 (0.032)*** | 0.666 (0.034)*** |
| 19 years old | 0.221 (0.015)*** | 0.223 (0.014)*** | 0.217 (0.015)*** | 0.219 (0.015)*** | 0.227 (0.015)*** |
| 20 years old | 0.333 (0.02)*** | 0.338 (0.02)*** | 0.302 (0.021)*** | 0.304 (0.021)*** | 0.32 (0.021)*** |
| 21 years old | 0.394 (0.02)*** | 0.401 (0.02)*** | 0.323 (0.021)*** | 0.328 (0.021)*** | 0.347 (0.021)*** |
| 22 years old | 0.401 (0.021)*** | 0.41 (0.021)*** | 0.287 (0.023)*** | 0.294 (0.023)*** | 0.316 (0.025)*** |
| 23 years old | 0.437 (0.022)*** | 0.447 (0.023)*** | 0.255 (0.025)*** | 0.262 (0.025)*** | 0.288 (0.026)*** |
| 24 years old | 0.472 (0.026)*** | 0.487 (0.027)*** | 0.215 (0.029)*** | 0.223 (0.029)*** | 0.252 (0.031)*** |
| immigrant | 0.485 (0.093)*** | 0.52 (0.09)*** | 0.14 (0.09) | 0.123 (0.091) | 0.128 (0.087) |
| father high-school grad |  |  | -1.220 (0.038)*** | -1.209 (0.037)*** | -1.172 (0.037)*** |
| mother high-school grad |  |  | -1.004 (0.036)*** | -.990 (0.036)*** | -.949 (0.036)*** |
| father university grad |  |  | -2.058 (0.061)*** | -2.062 (0.061)*** | -2.050 (0.062)*** |
| mother university grad |  |  | -1.896 (0.07)*** | -1.896 (0.07)*** | -1.873 (0.071)*** |
| father working |  |  | -.359 (0.018)*** | -.369 (0.017)*** | -.377 (0.016)*** |
| mother working |  |  | -.043 (0.021)** | -.055 (0.022)** | -.056 (0.02)*** |
| absent father |  |  | -.421 (0.031)*** | -.460 (0.031)*** | -.435 (0.026)*** |
| absent mother |  |  | 0.118 (0.034)*** | 0.141 (0.033)*** | 0.13 (0.032)*** |
| emancipated |  |  | 1.153 (0.05)*** | 1.159 (0.05)*** | 1.116 (0.05)*** |
| youth unemployment rate |  | 2.463 (0.791)*** | 2.068 (0.695)*** | 1.033 (0.765) | 0.56 (0.281)** |
| unemployment rate |  | 4.229 (2.136)** | 3.355 (1.841)* | 3.980 (1.923)** | -1.927 (1.102)* |

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%. The basic regression includes number of new dwellings interacted by male, number of new dwellings, total value added, a male dummy, age binary indicators and an immigrant dummy. The second column adds parents characteristics to the basic specification 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 as well as an emancipated dummy. The third column includes, in addition to the controls in column 2, youth and total unemployment rates. The fourth column adds year dummies. 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 years old surveyed in the fourth quarter of each year. The time period comprises the years from 1995 to 2007. Standard errors are clustered at the province level. The number of included observations is 230635.

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

| | basic | unemployment | parents | year | province |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| new dwellings at 17 by male | 1.806 (0.761)** | 1.804 (0.73)** | 2.337 (0.843)*** | 2.269 (0.854)*** | 2.126 (0.901)** |
| new dwellings at 17 | 0.479 (1.878) | 2.464 (1.534) | 3.163 (1.263)** | 1.848 (1.401) | 0.55 (1.400) |
| tva17 | -2.55e-09 (1.13e-09)** | -8.32e-10 (1.04e-09) | 9.85e-10 (8.24e-10) | 6.03e-10 (8.28e-10) | 2.80e-09 (7.04e-10)*** |
| new dwellings | 2.038 (1.325) | 4.055 (1.499)*** | 3.853 (1.523)** | 3.687 (1.497)** | 1.036 (0.724) |
| male | 0.639 (0.033)*** | 0.648 (0.032)*** | 0.773 (0.035)*** | 0.775 (0.035)*** | 0.789 (0.037)*** |
| 19 years old | 0.257 (0.022)*** | 0.268 (0.021)*** | 0.265 (0.021)*** | 0.26 (0.02)*** | 0.261 (0.02)*** |
| 20 years old | 0.374 (0.029)*** | 0.398 (0.028)*** | 0.368 (0.026)*** | 0.358 (0.027)*** | 0.365 (0.024)*** |
| 21 years old | 0.41 (0.035)*** | 0.444 (0.033)*** | 0.366 (0.028)*** | 0.351 (0.029)*** | 0.362 (0.027)*** |
| 22 years old | 0.384 (0.04)*** | 0.439 (0.04)*** | 0.322 (0.037)*** | 0.298 (0.038)*** | 0.306 (0.036)*** |
| 23 years old | 0.35 (0.041)*** | 0.422 (0.042)*** | 0.241 (0.038)*** | 0.208 (0.039)*** | 0.218 (0.037)*** |
| 24 years old | 0.347 (0.044)*** | 0.438 (0.048)*** | 0.188 (0.044)*** | 0.149 (0.043)*** | 0.16 (0.041)*** |
| immigrant | 0.598 (0.088)*** | 0.631 (0.086)*** | 0.229 (0.087)*** | 0.215 (0.087)** | 0.223 (0.086)*** |
| father high-school grad | | | -1.118 (0.036)*** | -1.124 (0.036)*** | -1.092 (0.035)*** |
| mother high-school grad | | | -.987 (0.039)*** | -.996 (0.04)*** | -.956 (0.039)*** |
| father university grad | | | -2.029 (0.07)*** | -2.035 (0.07)*** | -2.019 (0.072)*** |
| mother university grad | | | -1.920 (0.066)*** | -1.930 (0.066)*** | -1.909 (0.067)*** |
| father working | | | -.251 (0.02)*** | -.247 (0.02)*** | -.259 (0.02)*** |
| mother working | | | -.086 (0.024)*** | -.091 (0.024)*** | -.081 (0.021)*** |
| absent father | | | -.346 (0.034)*** | -.401 (0.035)*** | -.382 (0.031)*** |
| absent mother | | | 0.019 (0.037) | 0.055 (0.036) | 0.061 (0.035)* |
| independent | | | 1.079 (0.054)*** | 1.086 (0.054)*** | 1.053 (0.055)*** |
| youth unemployment rate | | 1.041 (0.827) | 0.814 (0.761) | 0.67 (0.768) | 0.19 (0.329) |
| unemployment rate | | 7.182 (2.467)*** | 5.870 (2.187)*** | 6.410 (2.218)*** | -1.680 (0.992)* |

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%. The basic regression includes number of new dwellings at 17 interacted by male, number of new dwellings at 17, total value added at 17, number of new dwellings, a male dummy, age binary indicators and an immigrant dummy. The second column adds parents characteristics to the basic specification 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 as well as an emancipated dummy. The third column includes, in addition to the controls in column 2, youth and total unemployment rates. The fourth column adds year dummies. Finally, the fifth column includes all previously mentioned controls

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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 years old 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     | -0.174      | 1        |        |              |          |
| Energy       | 0.011       | -0.162   | 1      |              |          |
| Construction | *0.103*     | *-0.439* | *0.054*| 1            |          |
| Services     | -0.484      | -0.649   | -0.233 | *0.009*      | 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) |
| Agriculture VA by male | 0.457 |  |  |  |
|  | (0.44) |  |  |  |
| Agriculture VA | -.777 |  |  |  |
|  | (0.58) |  |  |  |
| Industry VA by male |  | 0.158 |  |  |
|  |  | (0.279) |  |  |
| Industry VA |  | 1.273 |  |  |
|  |  | (0.803) |  |  |
| Energy VA by male |  |  | 0.672 |  |
|  |  |  | (0.62) |  |
| Energy VA |  |  | -1.539 |  |
|  |  |  | (1.174) |  |
| Services VA by male |  |  |  | -.710 |
|  |  |  |  | (0.296)** |
| Services VA |  |  |  | -.362 |
|  |  |  |  | (0.552) |

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, a male dummy, age binary indicators, an immigrant dummy, parents characteristics including father and mother high-school graduate dummies, father and mother university graduate indicators, father and mother working dummies, and binary variables equal to one if the parent is present in the household as well as an emancipated dummy, youth and total unemployment rates, year dummies as well as 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 years old surveyed in the fourth quarter of each year. The time period comprises the years from 1995 to 2007. Standard errors are clustered at the province level. The number of included observations is 230635.

## Table 10: Contemporaneous effect. Construction activity measured by value added. Sample composed by non-migrants

|  | basic | unemployment | parents | year | province |
|---|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) | (5) |
| construction VA by male | 2.251 | 2.117 | 2.999 | 2.961 | 2.816 |
|  | (0.522)*** | (0.517)*** | (0.606)*** | (0.596)*** | (0.611)*** |
| contruction VA | -2.918 | 0.948 | 1.079 | 2.994 | 1.217 |
|  | (1.679)* | (1.541) | (1.389) | (1.963) | (1.033) |
| total value added | -4.57e-09 | -2.48e-09 | -7.09e-10 | -6.06e-11 | 2.04e-09 |
|  | (9.48e-10)*** | (1.10e-09)** | (8.71e-10) | (1.19e-09) | (1.72e-09) |

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%. The basic regression includes construction value added interacted by male, construction value added, total value added, a male dummy, age binary indicators and an immigrant dummy. The second column adds parents characteristics to the basic specification 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 as well as an emancipated dummy. The third column includes, in addition to the controls in column 2, youth and total unemployment rates. The fourth column adds year dummies. 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 years old surveyed in the fourth quarter of each year who live in their province of birth. The time period comprises the years from 1995 to 2007. Standard errors are clustered at the province level. The number of included observations is 203335.

## Table 11: Contemporaneous effect. Construction activity measured by value added. Sample composed by different age groups

|  | 18-20 | 21-24 | 18-22 | 23-24 |
|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) |
| construction VA by male | 2.339 | 3.224 | 2.588 | 3.622 |
|  | (0.554)*** | (0.736)*** | (0.673)*** | (0.628)*** |
| contruction VA | 0.446 | 1.675 | 1.021 | 1.509 |
|  | (1.201) | (1.239) | (1.067) | (1.336) |
| Observations | 95668 | 134967 | 163414 | 67221 |

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%. The displayed coefficients are associated to the variables construction value added by male and construction value added. In the first column the sample is composed by individuals aged 18 to 20, in the second by individuals aged 21 to 24, in the third by individuals 18 to 22 and in the fourth by individuals 23 to 24. All equations include the same controls, namely, total value added, a male dummy, age binary indicators, an immigrant dummy, parents 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 as well as an emancipated dummy, youth and total unemployment rates, year dummies as well as 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 surveyed in the fourth quarter of each year. The time period comprises the years from 1995 to 2007. Standard errors are clustered at the province level.

## Table 12: Effect of construction activity at age 18. Construction activity measured by value added

|  | basic | unemployment | parents | year | province |
|---|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) | (5) |
| construction VA at 18 by male | 1.916 (0.707)*** | 1.838 (0.705)*** | 1.669 (0.787)** | 1.658 (0.791)** | 1.557 (0.78)** |
| construction VA at 18 | -4.693 (1.959)** | -3.925 (2.072)* | -3.888 (1.860)** | -4.144 (1.901)** | -1.662 (1.565) |
| construction VA | 8.421 (1.645)*** | 8.218 (1.485)*** | 8.549 (1.403)*** | 7.312 (1.597)*** | 2.875 (1.130)** |

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%. The basic regression includes construction value added at 18 interacted by male, construction value added at 18, total value added at 18, construction value added, a male dummy, age binary indicators and an immigrant dummy. The second column adds parents characteristics to the basic specification 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 as well as an emancipated dummy. The third column includes, in addition to the controls in column 2, youth and total unemployment rates. The fourth column adds year dummies. 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 years old surveyed in the fourth quarter of each year. The time period comprises the years from 2001 to 2007. Standard errors are clustered at the province level. The number of included observations is 104299