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School Dropouts and the Local Labor Markets: The Role of the Skills Structure of the Employment

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Abstract

A small number of studies have examined the impact of local labor market conditions (unemployment) on school dropout rates. However, none of them have considered the role of the employment structure (skilled vs. non-skilled). In Spain, there exist a high degree of regional heterogeneity in both the type of employment and the school dropout behavior. In this paper we stablish a link between these two phenomena. We construct data for a panel of Spanish regions and identify the effect of local labor (regional) markets using the variation in the share of employment by industry and gender across regions and over time. In contrast with the previous literature, we use a model with regional fixed effects and region-specific slopes, which allows us to control for not only for time-constant, but also for time-varying unobserved heterogeneity across regions. We show that, respect to models than only include the commonly used region fixed-effects, estimated effects of the employment variables vary substantially if we also include region-specific slopes. We find a sizable impact of the employment structure and observe that, in markets with a larger share of low-skill employment, the school dropout rate is significantly larger, though the industries affecting boys and girls are different. Our results suggest that the supply of skilled employment in the economy may allow an important share of school dropouts to be kept in school.

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1. Introduction

Previous research analyzing the determinants of school dropouts has mainly focused on individual characteristics, families and schools. However, studies analyzing the role of exogenous factors, such as local (regional) labor markets, are much less abundant. The scant empirical literature on this issue has shown that local labor market conditions in metropolitan areas or regions where individuals reside are at least as important as other individual/sociologic factors that have more traditionally been considered in explaining school dropout behavior. The human capital theory predicts that investment in education is countercyclical; that is, it increases (decreases) with economic downturns (upturns).[1] Whether it is true that the lack of interest in school, school disaffection and complex personal/family situations might in many cases be the underlying reason behind the dropout propensity, as the human capital theory predicts, favorable economic conditions in the labor market might be the triggering event that pushes some students to take the final decision to drop out of school. Some empirical studies suggest that the relationship between the school dropout rate and the business cycle holds for both secondary and higher education. However, the empirical evidence is not unequivocal and not all the findings point in the same direction. Some studies have found a clear negative relationship between unemployment and school dropout rates: Rees and Mocan (1997) and Dellas and Koubi (2003) in the US, , Di Pietro (2006) in Italy, Clark (2011) in the UK and Reiling and Strøm (2015) in Norway. On the contrary, other studies have found that this relationship is weak, for example Petrongolo and San Segundo (2002) in Spain. A statistically significant positive link for boys has also been identified by Jonshon (2013) in the US, but this link is not significant for girls.

[1] The incentive to acquire education is likely to be countercyclical for a variety of reasons. First, the expected real wage is procyclical (Solon et al., 1994) and thus the income foregone due to the pursuit of educational endeavors is lower during recessions.

All the analyses cited above use the unemployment rate as an indicator of the labor market conditions. While this measure is a good proxy for economic activity, it does not reflect the peculiarities of the local labor market, which may determine the sensitivity of school dropout behavior to the business cycle. School dropouts who enter the labor market are generally employed in low-skill jobs, which means that the sensitivity of school dropout decisions to a positive shock in the labor demand will differ depending on the skill composition of the employment of the local labor markets, which is mainly determined by the employment structure. We claim that the unemployment rate is not able to capture all these peculiarities regarding the industry composition of these local labor markets; therefore, it is not able to predict school dropout behavior accurately in the event of an economic (downturn) upturn. Additionally, the relationship between the unemployment rate and the school dropout rate is likely to be affected by the problem of reverse causality.

For instance, we can compare Ireland and Spain as two paradigmatic examples that substantiate our claim. Between 2000 and 2007, Spain experienced the most important economic boom of its recent history. This boom was driven by the construction industry, which is characterized by the employment mainly of low-skilled men. During that period, this industry employed more than 20% of the male workforce.[2] Although there is no empirical evidence in this regard, many analysts have indicated this phenomenon as being responsible for the dramatic increase in the school dropout rate among male teenagers.[3] On the contrary, the economic upturn experienced by the Irish economy during the 1990s was driven by the technological sector, which is characterized by the employment of skilled workers. During that period, this sector employed 20% of the Irish labor force. This phenomenon not only did not raise the school dropout rate but encouraged the demand for higher education in technological

[2] In Spain, only a little less than 1.5% of the female workforce is employed in the construction industry.
[3] Aparicio-Fenoll (2016) observed that the Spanish housing boom significantly decreased the returns to education for men while it hardly affected those for women.

fields (Wickham and Boucher, 2004). This is an example of how an economic boom may have different impacts on school dropout behavior depending on the skill composition of the labor force employed in the industry driving the economic boom. In this context, the unemployment rate is not able to capture how differentials in the skill composition of the industry may affect school dropout behavior differently. Surprisingly, despite the ability of the employment structure of an economy to determine the direction of the impact of the business cycle on the school dropout rate, literature analyzing this link is virtually nonexistent.

Another relevant and persistent issue regards the important gap in the school dropout rate between boys and girls and the gender composition of youth employment. In the event of an economic upturn, responses to investment in human capital differ between boys and girls, since, generally, employment prospects also differ across genders. Boys who drop out of school are more likely to be employed in more physically demanding jobs, such as those in the construction industry, while girls are more likely to be employed in low-skill services such as retail, commerce or those associated with the tourism industry. Indeed, the gender gap in the school dropout rate reached its maximum during the years of the boom in the construction industry.

The interest of policy makers in the issue of school failure stems from the fact that, as the literature has shown, dropping out has negative consequences for both individuals and society. Indeed, these are the two dimensions from which the problems derived from dropout behavior are usually treated. From an individual point of view, students who do not complete secondary education face bleak prospects throughout their life cycle. From a labor market perspective, dropouts are mostly at risk, with respect to their non-dropout counterparts, of higher unemployment and a lower income (e.g., Psacharopoulos and Layard, 1979) and a lower health status (e.g., Groot and Maassen van den Brink, 2007); furthermore, perhaps one of the most worrisome consequences is a generational one: they have lower-educated children (e.g., Bowles, 1972). From a social point of view, a cost exists for society in the sense that school dropouts are more likely to engage in antisocial behaviors or criminal activities (e.g., Lochner and Moretti, 2004) and result in lower social cohesion (e.g., Milligan et al., 2004) or a lower economic growth rate (Hanushek and Wößmann, 2007). Finally, there are other social costs due to lower tax revenues, higher unemployment allowances or higher health costs.[4] We deem our results to be useful for policy makers in assessing the impact of economic (downturns) upturns on education decisions and determining the amount of resources that should be allocated to the public education system. In addition, understanding the link between the local employment structure and the school dropout rate is crucial for designing policies aimed at reducing the number of school dropouts.

In this paper, we study not only how the business cycle exerts an impact on school dropout behavior but also, for the first time, how this decision is influenced by the industry composition of the local labor markets. Accordingly, we construct panel data comprising aggregated information from Spanish regions covering the period 2002–2013. Our data account not only for movements in the regional GDP per capita, as the main economic indicator, but also for the distribution of employment by gender across the different industries in the Spanish regions and some educational policy variables, such as public investment in public and private education. To estimate the causal impact of the employment structure on school dropouts, we use panel data models with regional fixed effects and region-specific slopes. With this model, we control not only for the unobserved heterogeneity in the school dropout behavior across regions, which is constant over time, but also for time-varying unobserved heterogeneity, which may violate the strict exogeneity assumption in conventional fixed-effect models. The consideration of region-specific slopes also allows us to control for the potential existence of common trends between the school dropout rate and the explanatory variables, which may lead to spurious correlations. The novelty of our study

[4] See Psacharopoulos (2007) for an extensive overview.

consists not only in considering for the first time the regional industry structure, instead of the commonly used unemployment rate, as a proxy of the local labor market conditions, but also on controlling for the first time for time-varying unobserved heterogeneity, in addition of the commonly used controls for time-constant unobserved heterogeneity (fixed-effects). Previous literature just focused on regional fixed-effects and omitted time varying unobserved heterogeneity, which may provide biased or inconsistent results. We show that estimated effects vary substantially if we control include region-specific slopes, in addition to the commonly used region fixed-effects

Our econometric estimates indicate that the composition of the industry in local labor markets is important in explaining the dropout behavior during our sample period for both boys and girls. The dropout rate tends to be higher in regions with a larger share of employment in low-skill industries, such as construction in the case of boys and commerce, hostelry and services associated with the tourist industry in the case of girls. Finally, an increase in the demand for labor in industries employing more skilled workers tends to reduce the dropout rate for both boys and girls.

The remainder of the paper is structured as follows. In section 2, we present an overview of the existing literature. In section 3, we provide some insights into the persistence of the school dropout problem in Spain compared with other EU countries. In section 4, the data set is presented. In section 5, we describe the empirical model and report the main econometric results. Finally, in section 6, we conclude and discuss the main implications of our results.

2. Overview of the literature

For the sake of brevity, in this section, we only review the literature linking the school dropout rate and the labor market. Most of the existing empirical studies have confirmed the countercyclical nature of school dropouts predicted by human capital theory. As we have already noted above, although favorable labor market conditions are important in explaining school dropout behavior, studies analyzing this link are not abundant, and most of them have focused on the US and the UK. Using the NLSY79, Eckstein and Wolpin (1999) observed that an important share of the American youths who dropped out of high school were working while in school. However, they concluded that a policy intervention prohibiting working while in school would not reduce the dropout rate. In their descriptive analysis, they also reported that, among a sample of youths who had not graduated from high school, 14% stated that they had been "offered a good job, chose to work." Using a survey of 9,000 Spanish students of secondary education, Diaz-Serrano (2018) observed that almost 50% of the students in the last year of compulsory secondary education would immediately drop out of school if they were offered a long-term job. More interestingly, even among students in the last year of high school (pre-university), this percentage was exactly the same.

Rees and Mocan (1997) used a panel of districts in New York State and concluded 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. They highlighted that controlling for unobserved district characteristics and district fixed effects was essential to reach this conclusion. Using panel data aggregated at the age cohort level, Dellas and Koubi (2003) obtained the same result for high-school and college education in the US. However, Johnson (2013) found that enrollment in college education is countercyclical for males and acyclical for females. In contrast to the previous studies mentioned above, which used aggregated data, he used US nationwide individual data (CPS). Also using US census data, Warren and Lee (2003) did not find a link between labor market conditions for individuals aged 16 to 19 and high-school dropouts.

Beyond the US context, Rice (1999) and Clark (2011) found a positive link in the UK between the youth unemployment rate and the enrollment rate in post-compulsory secondary education and college education. The first used microdata, while the second resorted to aggregated regional panel data. Also using the latter type of data, Reiling and Strøm (2015) obtained the same result for Norway. Di Pietro (2006) used regional data to estimate a negative link between unemployment rates and university dropout rates in Italy.

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For the Spanish case, the paper by Peraita and Pastor (2000) explored the determinants of primary school dropouts, focusing on the role played by the family background and economic conditions. They found that the unemployment rate negatively affected the probability of dropping out of compulsory education. In addition, using Spanish data, the influence of labor market conditions on the demand for post-compulsory education (ages 16 to 18) was studied by Petrongolo and San Segundo (2002). They found that the youth unemployment rate exerts a positive influence on the probability of staying in education while the general unemployment rate has a negative impact on that probability. This result is a little odd, but it could be driven by the potential endogenous nature of the unemployment rate. All the literature presented in this section is summarized in Table 1.

[Table 1 around here]

3. The persistent problem of school dropouts in Spain

3.1. Spain vs. the EU

The dropout rate in secondary education has become a policy priority for the EU. It was one of the main policy issues of the EU in 2000 in the so-called "Lisbon Agenda," in which the EU established the objective of reducing the school dropout rate to 10% by 2010. In 2000, the dropout rate in the EU was about 17.3%, while in Spain this figure was 28.8%. Ten years later, the goals stated in the "Lisbon Agenda" had not been achieved in some of the EU countries, among them Spain. Therefore, the challenges of "Horizon 2020" for the EU, set in 2010, again considered the reduction of the school dropout rate, this time up to 15% in Spain. However, the dropout rate in Spain is still 20%, 5 percentage points above the objective agreed with the EU for 2020. Whether it is true that the dropout rate in Spain fell by more than 10 percentage points between 2004 and 2015, Spain was still leading the ranking of the dropout rate in the EU in 2015.[5] In contrast, Portugal, which was leading this ranking at the beginning of this century, is now in the fifth position, with a school dropout rate of 13% (see Figure 1). These figures indicate that school failure is more worrisome and persistent in Spain than in the other EU countries, since in Spain the school dropout rate is not only the highest in the EU but also decreasing much slower than in other countries.

[Figure 1 around here]

3.2. Heterogeneity across Spanish regions

A characteristic feature of the Spanish economy is the high degree of regional heterogeneity in many economic outcomes, such as unemployment (López-Bazo and Motellón, 2013), wage distributions (Motellón, López-Bazo and El-Atar, 2011), skill distribution of the employment (Consoli and Sánchez-Barrioluengo, 2018) or innovation (López-Bazo and Motellón, 2018). The educational system is not an exception and school outcomes in Spain are also very heterogeneous across regions. This heterogeneity concerns not only school dropouts but also PISA scores. In 2004, the southern Spanish regions (Andalusia, Extremadura, Castilla-La Mancha and Murcia) and the Islands (Balearic Islands and Canary Islands) had a dropout rate above 35%, some of them indeed above 40%. Even Catalonia, one of the richest regions in Spain, which represents 20% of the Spanish GDP, had a school dropout rate of nearly 35%. In

[5] The school dropout rate in Spain is twice as high as the average dropout rate in the EU. This ratio remains more or less constant over time. The same picture can be drawn regarding the unemployment rate.

the last decade, the dropout rate has fallen dramatically in most of the Spanish regions. With few exceptions, between 2004 and 2016, most of the Spanish regions reduced their school dropout rate between one-third and one-half. Still, this huge heterogeneity across regions persists. On the other hand, Spanish regions such as the Basque Country and Cantabria reported one of the lowest school dropout rates in the EU, similar to the ones observed in countries like Sweden or Netherlands. That is, some Spanish regions reported school outcomes similar to those in the most developed countries, while in some other regions we observe levels of school dropouts that are similar to or higher than the ones observed in developing countries (see Figure 2).

The Spanish education system is also characterized by having a wide gender gap in the school dropout rate, which is also twice as high as the average gap in the EU. As shown in Figure 3, between 2004 and 2016, the school dropout rate for boys fell from 39% to 23% and that for girls from 25% to 15%. This means that, between 2004 and 2016, the gender gap also decreased by almost half, from 15 to 8 percentage points; however, the gender gap in the dropout rate in Spain is still the highest in the EU.

[Figure 2 around here]

[Figure 3 around here]

Considering this evidence of such huge heterogeneity in the school dropout rate across Spanish regions, one question arises: Which part of this regional heterogeneity is structural and which part is conjunctural? One potential explanation is that the Spanish education system is highly decentralized at both the fiscal (funding) and the political level (decision making). With few exceptions, regions practically have full competence to rule their education system. If some regional educational authorities perform better than others, they will generate inequalities in school outcomes or increase the inequalities that already exist. As we show in

Figure 3, the current heterogeneity in the school dropout rate across Spanish regions already existed in 1990. In that year, only one-third of the regions had a decentralized education system, while the education system in the remaining regions was ruled by the central government.[6] This circumstance indicates that this heterogeneity in the school dropout rate across regions was already existent before the Spanish education system was totally decentralized. Therefore, decentralization cannot be the factor explaining this regional heterogeneity in school outcomes.

3.3. The school dropout rate and the employment structure in Spanish regions

As we already explained in the introduction, our main hypothesis is that the huge heterogeneity in the school dropout rate across Spanish regions is apparently structural and could be determined, among other potential idiosyncratic factors, by the employment structure of local labor markets, which, as shown in Figures 4 and 5, are also quite heterogeneous across regions. In these figures, we depict the relationship between the aggregated regional school dropout rate and the aggregated regional employment share by industry. We present these graphs separately for boys and girls. To gain a more accurate picture, the employment shares by industry are gender specific. At first glance, we can observe very clear associations. For boys, there is a strong positive correlation between regional school dropouts and employment in the construction industry. On the contrary, the link between male school dropouts and employment in the energy and manufacturing industries is apparently strong but negative. The correlations with the remaining industries (medium/high-skill services) are also negative but more moderate.

For girls, the strongest positive association with the school dropout rate is observed for low-skill services (commerce, hostelry and the tourism industry), while the correlations with

[6] Catalonia, the Basque Country, Andalusia, Galicia, the Canary Islands and the Community of Valencia received full competences in education between 1980 and 1983, while the remaining regions did so between 1995 and 1997.

the remaining industries are negative but weak (energy, manufacturing and medium/high-skilled services) or virtually nonexistent (agriculture and construction). Some of the correlations between female/male school dropouts and employment broken down by industry and gender appear very clear at first glance. Figures 4 and 5 suggest that the impact on the male/female school dropout rate of an economic (downturn) upturn in the economy may differ depending on the skill composition of the employment in the local labor market. We will assess this causal relationship through our econometric model.

To gain an idea of the high level of heterogeneity across Spanish regions in terms of the employment structure, we can take a second look at Figures 4 and 5. In regions such as the Basque Country and Madrid, agriculture represents less than 3% of the employment, while in Murcia and Extremadura this percentage is around 15%. Manufacturing is also one of the industries in which we can observe a high level of heterogeneity across regions. In Navarra, the Basque Country or Rioja, this industry employs more than 25% of the workforce, while this figure is around 10% in the Balearic Islands, the Canary Islands, Extremadura and Andalusia. An analogous situation involving the same regions can be observed regarding low-skill services, with an employment share by region that ranges from 20% to 40%.

[Figure 4 around here]

[Figure 5 around here]

4. The data

To carry out our empirical analysis, we construct a panel of data aggregated at the regional level and covering the period 2002–2013. Our data contain various policy and economic variables collected from different sources. The *early school dropout rate* is our outcome variable and is taken from Eurostat. This variable is standardized for all EU countries and is defined as the share of individuals aged 18–24 who did not complete compulsory education or, having completed compulsory education, do not possess any school certificate for secondary post-compulsory education. Our main interest consists of evaluating the role of the employment structure in Spanish regions, as an indicator of the activity in local labor markets, in the aggregated regional levels of school dropouts; therefore, we consider a set of variables picking up the share of employment by industry and gender of the overall employment in the region. Since we carry out separate estimates for boys and girls, we consider female and male employment separately for each industry and region. To control for fluctuations in the business cycle and the level of wealth of the regions, we include the regional level of the GDP per capita. The employment share by industry and region is taken from the Spanish Labor Force Survey (EPA), while the regional GDP is taken from the Spanish National Accounts, both provided by the Spanish Statistics Bureau (INE).

As we mentioned in the previous section, the Spanish education system is very decentralized. Regional governments have partial autonomy in the political decisions affecting their education system, but they have full autonomy in the budgetary decisions and expenditures of their education system. To capture this regional autonomy in ruling their education system, we also include the regional public spending on education as a percentage of the regional GDP and the public regional spending on private education as a percentage of the total spending on education. Both variables are taken from the Spanish Ministry of Education. Finally, to capture other dimensions that are not captured by the economic and policy variables, we also consider the yearly average temperature of the region and the population density.[7]

[7] Graff Zivin et al. (2017) also observed that short-run increases in the temperature beyond 26 ºC (78.8 ºF) reduce the cognitive performance in math tests.

In Table 2, we present a description of the variables used in the analysis. The summary statistics are the averaged values for the period 2002–2014 of the regional aggregated values. Men are more likely to be employed in manufacturing (16.3%), low-skill services (22.6), construction (17.2%) and other services (17%). Women are employed in low-skill services (29.2%) and other services (41%).

[Table 2 around here]

5. Econometric analysis

5.1. The empirical model

To carry out our empirical analysis, we use a linear model with regional fixed effects and region-specific slopes. This model has the interesting feature of controlling not only for regional time-constant unobserved heterogeneity but also for regional time-varying unobserved heterogeneity. We find the inclusion of region-specific slopes necessary for two reasons. On the one hand, conventional fixed-effect models may fail because strict exogeneity is violated due to the existence of time-varying unobserved heterogeneity, which is not captured through the fixed effects.[8] On the other hand, the inclusion of region-specific slopes allows us to control for the existence of common trends between the covariates and the outcome that might cause spurious correlations. This type of model is especially suitable for the type of data and period that we use here, since employment variables as well as the school dropout rate tend to display cyclical behavior. Although the omission of time-varying unobserved heterogeneity is a common problem in studies using panel data, they seldom account for it. Our econometric model reads as follows:

[8] This problem was recognized by Heckman and Hotz (1989), Polachek and Kim (1994) and Winship and Morgan (1999), among others.

$$y_{it} = X_{it}\beta + \delta_i f(t) + u_i + \sum_{t=1}^{T} \gamma_T d_T + \varepsilon_{it}; \quad t = 1,...,T; \quad i = 1,..,N \tag{1}$$

where y_{it} is the school dropout rate in region i in year t. The individual-specific slopes $f(t)$ control for the time-varying unobserved heterogeneity across regions, where the function $f(t)$ can be either linear or polynomial. The parameters δ_i are the average growth rate over a period, while holding the explanatory variables fixed. u_i are regional fixed effects, which control for the time-constant unobserved heterogeneity across regions, and γ_T are year fixed effects capturing temporal global effects that are not picked up by our covariates and the set of regional effects, either fixed or time varying, considered in the model. Equation (1) refers to a random-growth model (Heckman and Hotz, 1989), for which the general conditions of estimation can be found in Wooldridge (2002).

5.2. The results

In Table 3 to 8 we report the results of the estimates of equation (1). We run a separate regression for each industry and gender. ç We run three different specifications for each model: with region fixed-effects (M1), with region fixed- effects with year dummies (M2), and with region fixed-effects, year dummies and region-specific linear slopes (M3). In each regression, we include each set of variables sequentially. First, we estimate a parsimonious model with just the region fixed-effects, the employment share of the corresponding industry, the population density and the annual average temperature. In the second stage, we include the remaining economic and policy variables, namely GDP pc, total expenditure on education pc expenditure on private education, and the number of classrooms of vocational secondary education pc, and finally we also include the set of year dummies and the region-specific slopes. For the sake of brevity, we only show the results regarding the models including all the covariates, with and without year dummies and with the region fixed- and time varying-effects. The inclusion of the year dummies is what causes the most substantial changes in terms of size and significance in the covariates included in equation (1). First, it has to be noted that, when we compare the models that only consider regional fixed effects with those that also consider region-specific slopes, the estimated coefficients change substantially. For some variables, these changes imply a change not only in the statistical significance but also in the sign of the coefficient. This result highlights the potential problem of endogeneity arising from not controlling for time-varying unobserved heterogeneity (Heckman & Hotz, 1989; Polachek and Kim, 1994) and the potential existence of common trends between the outcome variable and the regressors. Taking this into account, our comments will be focused on the estimated models including the region-specific slopes (M3).

Our results are fairly heterogeneous across the board and reveal that the determinants of school dropouts differ substantially between genders. The coefficients associated with the variables that are not related to the employment structure are quite sensitive to the inclusion of the year dummies and region specific-slopes. The impact of population density is positive and statistically significant at 10% level for boys; however, the estimated coefficients for girls are not statistically significant. Population density can be taken as a proxy of the level of urbanization in the region. Therefore, this finding suggests that the dropout rate for boys is probably higher in urban than in rural areas.

The annual average temperature is also one of the few variables that is able to resist the inclusion of the year dummies and the region specific-slopes and is statistically significant for both boys and girls at the 10% and 5% significance levels, although the direction of the effect differs between genders. In regions with a higher average temperature, the school dropout rate among boys is higher, whereas this effect is negative for girls. However, the difference between the maximum and the minimum annual temperature has turned out to be statistically significant only for girls. This result suggests that for girls the annual maximum temperatures, which are registered in summer coinciding with the peak of the touristic activity, will increase the probability of dropout. The positive relationship between the temperature and the school dropout rate for boys is in line with what Graff Zivin and Neidell (2014) observed. These authors found that an increase in the temperature tends to increase outdoor leisure and non-leisure activities. The implication of this circumstance is that those boys who are more potentially prone to drop out will effectively drop out in warmer regions. However, we do not have a plausible explanation for the negative link between the annual average temperature and the school dropout behavior of girls.[9]

Economic and policy factors are also quite sensitive to the inclusion of region specific-slopes. For boys, region slopes kill the effect of the GDP per capita, while for girls the impact of this variable switches from positive to negative and is statistically significant at 10% level in all the models. That is, in richer regions, the dropout rate for girls is smaller, while no effect is observed for boys. The effect of the public total expenditure on education becomes negative and statistically significant at 10% level after including the year dummies, but loses the statistical significance after including the region-specific slopes. However, the public expenditure on private education and the number of classrooms for vocational secondary education, become not statistically significant after the inclusion of the year dummies. These results are particularly suggestive, since it indicates that, in a highly decentralized education system like the Spanish one, the autonomy of regional educational authorities to manage their own budgets does not have an impact on the educational outcomes of their students, at least as far as school dropouts are concerned.

[9] For a sample of children in the NLSY79, Graff Zivin et al. (2017) also observed that short-run increases in the temperature beyond 26 ºC (78.8 ºF) reduce the cognitive performance in math tests but not in reading.

[Tables 1 to 8, around here]

We finally comment on the results regarding our variables of interest, namely the employment share in each industry. It is worth noting that the estimated marginal effects associated with the employment share by industry are quite robust to the inclusion of the economic and policy variables. With few exceptions, the difference in the estimated parameters before and after including the economic variables is fairly small. Contrary to what we observed for the other covariates, these estimated coefficients are also quite robust to the inclusion of the year dummies and the region-specific slopes. With one exception, the estimated coefficients associated with the employment variables that were statistically significant before including the year dummies and the region slopes keep their statistical significance after including them. This result confirms the strong effect that some industries exert on the school dropout rate. The sum of all the industry shares is 100 in every region and period; therefore, the interpretation of the coefficients associated with each industry must be made with respect to the industries that are left out of the regression. In our case, since we estimate a separate regression for each industry, each coefficient must be interpreted as the difference with respect to all the remaining industries.

Our estimates report quite sizable effects of the employment share of some industries on the school dropout rate for both boys and girls. Since the school dropout rate and the employment share by industry are both expressed in percentages, estimated marginal effects can be interpreted as an elasticity. The demand for medium/high-skill services has a negative and statistically significant impact on the school dropout rate for both boys and girls. This type of services is mainly dominated by banking, insurance, services to firms and public services, representing more than 50% of the employment women and 26% of the employment for men. According to our estimates, an increase of 1 percentage point in the employment share of skilled services reduces the school dropout rate by -0.25 percentage points for girls and -0.42 percentage points for boys.

Employment in low-skill services is also an important factor in explaining the school dropout behavior of girls. This type of services is mainly associated with commerce, hostelry and services associated with the tourism industry. This type of services represents almost one-third of the female employment in Spain. An increase of 1 percentage point in the employment share of low-skill services increases the school dropout rate among girls by 0.49 percentage points. For boys, the most important economic activity influencing the school dropout behavior is the construction industry: an increase of 1 percentage point in the employment share in this industry increases the school dropout rate by 0.42 percentage points.

6. Conclusions

In this paper, we estimate for the first time the impact of the employment structure of local labor markets on school dropout behavior. With this aim, we construct a regional panel data set covering the period 2002–2013 containing information on Spanish regions. Our data contain accurate regional measures of employment by industry and gender. We use a linear model with regional fixed effects and region-specific slopes that allows us to control not only for time-constant unobserved heterogeneity across regions, which can be considered as structural, but also for the time-varying unobserved heterogeneity that is not controlled for with our covariates, which can be considered as conjunctural. This empirical strategy allows us to overcome the potential problems occurring if the strict exogeneity assumption is violated, which may arise if we only control for regional fixed effects.

Our empirical results are robust, and we report an unequivocal causal impact of the employment structure of local labor markets on school dropout behavior. It is worth noting that, although in this type of analysis, time dummies tend to capture an important part of the movements in the outcome variable, the school dropout rate in our case, most of the coefficients associated with the employment structure keep their statistical significance not only after including regional fixed effects and region-specific slopes but also after including year dummies. This circumstance indicates that the link between the employment structure of local labor markets and the regional levels of school dropouts that we estimate here is quite robust. Unfortunately, we cannot compare our results with any other previous evidence.

The estimates generated by our empirical models suggest an important role of the employment structure in regional labor markets; however, the estimated effects differ between boys and girls. The demand for high-skill services, which has a negative impact on school dropouts for both boys and girls, is smaller, while a rise in the demand for low-skill services (e.g. tourism) and workers in the construction industry increases the dropout rate for girls and boys, respectively. The estimated effects for these industries are not only statistically significant but also quite sizeable.

Our results are of interest to Spanish policy makers, who until now have not been able to tackle the persistent problem of school dropouts. This issue is even more relevant if we consider the fact that, as our results indicate, higher expenditure on education does not seem to improve the school dropout problem in Spain. Our results suggest that, for a large number of school leavers, non-skilled labor is more attractive than the classroom. Our results indicate that increasing the supply of skills in the economy may allow an important share of school dropouts to be kept in school. However, in Spain we are moving in the opposite direction, since as Consoli and Sánchez-Barrioluengo (2017) shows, during last two decades there have been in Spain a significant reduction of the medium-skill jobs in favor of a rise of the low-skilled services jobs.

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Table 1
Summary of previous literature

Authors	Country	Type of data	Type of estimation	Proxy of bussiness cycle	Dropout	Enrollment rate	Type of education
Rees and Mocan (1997)	New York State (US)	Aggregated at district level	Panel	District average unemployment rate	Negative		High school
Card and Lemioux (2001)	US	Age cohort aggregated	Cross-section	State unemployment rate		Positive (modest)	High school
Warren & Lee (2003)	US	Age cohort aggregated	Cross-section	% youth (16-19) working by area	No effect		High school
Dellas & Koubi (2003)	US	Age cohort aggregated	Cross-section	Unemployment rate by age cohort	Negative	Positive	High school and College
Johnson (2013)	US	Individual (Current Population Survey)	Cross-section	State unemployment rate (20-24, 25-34)		Negative for girls, no impact for boys	College
Rice (1999)	UK	Individual (Youth Cohort Studies)	Cross-section	unemployment rate in local market		Positive	Post-compulsory education
Clark (2011)	UK	Aggregated by region	Panel	Regional youth unemployment		Positive	High school and College
Reiling & Strøm (2015)	Norway	Aggregated by region	Panel	Regional Unemployment	Negative		Upper secondary
Peraita & Pastor (2000)	Spain	Individual (Living Conditions Survey)	Cross-section	Regional Youth unemployment (16-19)	Negative		Primary education
Petrongolo & San Segundo (2002)	Spain	Individual (Labor Force Survey)	Cross-section	Province Youth unemployment (16-18)	Negative		Lower secondary
Di Pietro (2006)	Italy	Aggregated by region	Panel	Regional Unemployment	Negative		Higher education

Table 2

Description of the variables

	Boys		Girls	
	Mean	s.d.	Mean	s.d.
Agriculture	7.09	4.31	3.52	2.73
Energy	5.81	4.65	1.44	1.30
Manufacturing	16.31	7.15	8.23	3.85
Construction	17.17	4.23	1.59	0.46
Low skill services (1)	27.47	5.87	31.48	4.88
Medium/high skill services (2)	26.15	4.29	53.73	4.89
Population density	157.55	172.59		
Average temperature (ºC)	15.68	2.17		
Max temp – Min temp (ºC)	33.79	9.80		
# Classrooms voc. pc/1000	2.12	0.46		
GDP pc (€)	23,400	4,606		
Public expenditure in educ. pc (€)	5,783	1,213		
Public expenditure in private educ. as % of the public expenditure in education	13.62	6.39		

(1) Commerce, reparation, transportation and whorehouse, hostelry

(2) Financial, Insurance, real estate, professional and scientific activities, services to firms, public administration and defense, social security, education, health and social services, artistic and leisure activities, home production of goods and services, international organizations, other services

Table 3

Estimates of the determinants of school dropout (regional data)

	Agriculture					
	Boys			**Girls**		
	< M1	M2	M3	M1	M2	M3
Employment share	0.0342	-0.218	-0.316	0.0519	0.130	-0.0201
	(0.232)	(0.224)	(0.249)	(0.229)	(0.252)	(0.361)
GDP pc	0.0011***	0.0017***	-0.00061	0.00018	0.00071*	-0.0011*
	(0.00028)	(0.00040)	(0.00072)	(0.00023)	(0.00039)	(0.00064)
Expenditure pc	-0.00077	-0.0012	0.0011	4.56e-05	-0.0014*	-0.00082
	(0.00053)	(0.00078)	(0.0011)	(0.00046)	(0.00074)	(0.0010)
Exp. Priv. (%Tot Exp.)	-0.722***	-0.127	0.272	-0.263	-0.219	-0.443
	(0.194)	(0.206)	(0.344)	(0.172)	(0.196)	(0.325)
# Classrooms voc. pc	-4.278***	-0.916	2.036	-2.555***	-1.517	-1.506
	(1.100)	(1.126)	(1.921)	(0.929)	(1.065)	(1.779)
Population density	0.00686	0.0402	0.184**	0.0123	0.0111	-0.0337
	(0.0240)	(0.0255)	(0.0900)	(0.0205)	(0.0240)	(0.0814)
Average temperature	0.742**	0.482	0.677**	-0.607**	-0.742**	-0.722**
	(0.336)	(0.346)	(0.341)	(0.282)	(0.325)	(0.311)
Max temp – Min temp	0.0891*	0.0250	0.123	0.0627	0.112	0.214**
	(0.0471)	(0.101)	(0.110)	(0.0397)	(0.0957)	(0.102)
Region fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	No	Yes	Yes	No	Yes	Yes
Region specific slopes	No	No	Yes	No	No	Yes
Observations	204	204	204	204	204	204
R-squared	0.621	0.732		0.332	0.400	
Number of regions	17	17	17	17	17	17

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Variables:

GDP pc: Annual GDP pc in the region

Employment share: % of employed workers in that industry overall employment

Expenditure pc: Public expenditure in primary and secondary education per capita (population aged 16-24)

Exp. Priv. (%Tot Exp.): % of public expenditure in private education (primary and secondary) overall public expenditure in education (primary and secondary)

Classrooms voc. pc: number of classrooms devoted to secondary vocational education per capita (population aged 16-24)

Average temperature: Annual average temperature in the region

Max temp – Min temp: Difference between the annual maximum and the minimum temperature in the region

Table 4

Estimates of the determinants of school dropout (regional data)

	Energy					
	Boys			Girls		
	M1	M2	M3	M1	M2	M3
Employment share	0.0413	-0.0290	0.0975	-0.467**	-0.324	-0.836
	(0.0778)	(0.114)	(0.212)	(0.233)	(0.319)	(0.556)
GDP pc	0.0010***	0.0016***	-0.00059	0.00026	0.00065*	-0.0012*
	(0.00028)	(0.00041)	(0.00074)	(0.00023)	(0.00037)	(0.00066)
Expenditure pc	-0.00063	-0.0014*	0.00094	-0.00039	-0.0014*	-0.00091
	(0.00059)	(0.00078)	(0.00110)	(0.00047)	(0.00074)	(0.00)
Exp. Priv. (%Tot Exp.)	-0.683***	-0.135	0.232	-0.360**	-0.229	-0.336
	(0.209)	(0.208)	(0.345)	(0.166)	(0.195)	(0.321)
# Classrooms voc. pc	-4.338***	-0.754	1.694	-2.330**	-1.136	-1.071
	(1.095)	(1.201)	(1.916)	(0.917)	(1.120)	(1.763)
Population density	0.00457	0.0386	0.154*	0.00913	0.0141	-0.0442
	(0.0244)	(0.0266)	(0.0887)	(0.0201)	(0.0238)	(0.0805)
Average temperature	0.567	0.456	0.720**	-0.601**	-0.732**	-0.636**
	(0.358)	(0.347)	(0.338)	(0.278)	(0.325)	(0.314)
Max temp – Min temp	0.0853*	0.0155	0.123	0.0830**	0.118	0.207**
	(0.0474)	(0.103)	(0.112)	(0.0399)	(0.0958)	(0.100)
Region fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	No	Yes	Yes	No	Yes	Yes
Region specific slopes	No	No	Yes	No	No	Yes
Observations	204	204	204	204	204	204
R-squared	0.621	0.730		0.346	0.403	
Number of regions	17	17	17	17	17	17

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Variables:

GDP pc: Annual GDP pc in the region

Employment share: % of employed workers in that industry overall employment

Expenditure pc: Public expenditure in primary and secondary education per capita (population aged 16-24)

Exp. Priv. (%Tot Exp.): % of public expenditure in private education (primary and secondary) overall public expenditure in education (primary and secondary)

Classrooms voc. pc: number of classrooms devoted to secondary vocational education per capita (population aged 16-24)

Average temperature: Annual average temperature in the region

Max temp – Min temp: Difference between the annual maximum and the minimum temperature in the region

Table 5
Estimates of the determinants of school dropout (regional data)

	Manufacturing					
	Boys			Girls		
	M1	M2	M3	M1	M2	M3
Employment share	0.0726	0.111	0.0849	0.107	-0.0435	0.106
	(0.0898)	(0.137)	(0.186)	(0.183)	(0.207)	(0.227)
GDP pc	0.0011***	0.00167***	-0.00065	0.00018	0.00067*	-0.0011*
	(0.00029)	(0.00040)	(0.00072)	(0.00023)	(0.00038)	(0.00066)
Expenditure pc	-0.0011*	-0.0014*	0.00081	2.11e-05	-0.0015**	-0.0008
	(0.00060)	(0.00078)	(0.0011)	(0.00043)	(0.00074)	(0.00101)
Exp. Priv. (%Tot Exp.)	-0.790***	-0.170	0.231	-0.264	-0.231	-0.415
	(0.209)	(0.213)	(0.345)	(0.164)	(0.196)	(0.320)
# Classrooms voc. pc	-4.219***	-0.565	1.810	-2.399**	-1.577	-1.343
	(1.095)	(1.183)	(1.923)	(0.972)	(1.131)	(1.781)
Population density	0.0134	0.0493*	0.164*	0.0141	0.0131	-0.0312
	(0.0253)	(0.0297)	(0.0889)	(0.0203)	(0.0239)	(0.0810)
Average temperature	0.778**	0.497	0.664*	-0.584**	-0.746**	-0.714**
	(0.337)	(0.350)	(0.353)	(0.283)	(0.328)	(0.311)
Max temp – Min temp	0.0949**	0.0119	0.110	0.0639	0.110	0.215**
	(0.0469)	(0.102)	(0.111)	(0.0391)	(0.0956)	(0.101)
Region fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	No	Yes	Yes	No	Yes	Yes
Region specific slopes	No	No	Yes	No	No	Yes
Observations	204	204	204	204	204	204
R-squared	0.622	0.731		0.333	0.399	
Number of regions	17	17	17	17	17	17

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Variables:
GDP pc: Annual GDP pc in the region
Employment share: % of employed workers in that industry overall employment
Expenditure pc: Public expenditure in primary and secondary education per capita (population aged 16-24)
Exp. Priv. (%Tot Exp.): % of public expenditure in private education (primary and secondary) overall public expenditure in education (primary and secondary)
Classrooms voc. pc: number of classrooms devoted to secondary vocational education per capita (population aged 16-24)
Average temperature: Annual average temperature in the region
Max temp – Min temp: Difference between the annual maximum and the minimum temperature in the region

Table 6
Estimates of the determinants of school dropout (regional data)

	Construction					
	Boys			Girls		
	M1	M2	M3	M1	M2	M3
Employment share	0.409***	0.325**	0.422**	0.0559	-0.380	-0.882
	(0.127)	(0.129)	(0.170)	(0.531)	(0.556)	(0.546)
GDP pc	0.00048	0.0015***	-0.00046	0.00017	0.00067*	-0.00117*
	(0.00032)	(0.00039)	(0.00071)	(0.00024)	(0.00038)	(0.00065)
Expenditure pc	-0.00038	-0.00106	0.00143	-2.74e-06	-0.0015**	-0.0010
	(0.00051)	(0.00078)	(0.00110)	(0.00043)	(0.00074)	(0.00101)
Exp. Priv. (%Tot Exp.)	-0.556***	-0.126	0.481	-0.279*	-0.207	-0.431
	(0.195)	(0.203)	(0.351)	(0.164)	(0.197)	(0.313)
# Classrooms voc. pc	-3.408***	-0.555	1.707	-2.569***	-1.589	-1.409
	(1.098)	(1.113)	(1.878)	(0.933)	(1.072)	(1.740)
Population density	0.00975	0.0480*	0.173**	0.0133	0.00932	-0.0450
	(0.0234)	(0.0252)	(0.0867)	(0.0204)	(0.0243)	(0.0804)
Average temperature	0.774**	0.511	0.802**	-0.604**	-0.710**	-0.686**
	(0.326)	(0.339)	(0.341)	(0.282)	(0.327)	(0.309)
Max temp – Min temp	0.0615	0.0406	0.117	0.0636	0.118	0.230**
	(0.0462)	(0.0997)	(0.108)	(0.0395)	(0.0963)	(0.101)
Region fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	No	Yes	Yes	No	Yes	Yes
Region specific slopes	No	No	Yes	No	No	Yes
Observations	204	204	204	204	204	204
R-squared	0.641	0.740		0.331	0.401	
Number of regions	17	17	17	17	17	17

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Variables:
GDP pc: Annual GDP pc in the region
Employment share: % of employed workers in that industry overall employment
Expenditure pc: Public expenditure in primary and secondary education per capita (population aged 16-24)
Exp. Priv. (%Tot Exp.): % of public expenditure in private education (primary and secondary) overall public expenditure in education (primary and secondary)
Classrooms voc. pc: number of classrooms devoted to secondary vocational education per capita (population aged 16-24)
Average temperature: Annual average temperature in the region
Max temp – Min temp: Difference between the annual maximum and the minimum temperature in the region

Table 7
Estimates of the determinants of school dropout (regional data)

	Low-skill services					
	Boys			**Girls**		
	M1	M2	M3	M1	M2	M3
Employment share	-0.207	-0.114	-0.0641	0.558***	0.480***	0.488***
	(0.148)	(0.168)	(0.189)	(0.161)	(0.171)	(0.174)
GDP pc	0.00094***	0.0017***	-0.00061	9.63e-06	0.00038	-0.0014**
	(0.00029)	(0.00040)	(0.00075)	(0.00023)	(0.00038)	(0.00065)
Expenditure pc	-0.00068	-0.00136*	0.00085	5.43e-05	-0.00145**	-0.00084
	(0.000516)	(0.00078)	(0.00111)	(0.00041)	(0.00072)	(0.00098)
Exp. Priv. (%Tot Exp.)	-0.698***	-0.160	0.234	-0.276*	-0.269	-0.473
	(0.193)	(0.212)	(0.345)	(0.157)	(0.192)	(0.308)
# Classrooms voc. pc	-4.215***	-0.950	1.658	-2.711***	-1.734*	-1.381
	(1.089)	(1.134)	(1.926)	(0.890)	(1.045)	(1.711)
Population density	0.0186	0.0445	0.157*	0.000794	-0.00245	-0.0506
	(0.0254)	(0.0278)	(0.0883)	(0.0199)	(0.0239)	(0.0790)
Average temperature	0.748**	0.469	0.635*	-0.603**	-0.627*	-0.538*
	(0.333)	(0.346)	(0.342)	(0.272)	(0.320)	(0.310)
Max temp – Min temp	0.0748	0.0365	0.119	0.0671*	0.154	0.235**
	(0.0476)	(0.104)	(0.111)	(0.0379)	(0.0948)	(0.0990)
Region fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	No	Yes	Yes	No	Yes	Yes
Region specific slopes	No	No	Yes	No	No	Yes
Observations	204	204	204	204	204	204
R-squared	0.625	0.731		0.374	0.426	
Number of regions	17	17	17	17	17	17

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Variables:
GDP pc: Annual GDP pc in the region
Employment share: % of employed workers in that industry overall employment
Expenditure pc: Public expenditure in primary and secondary education per capita (population aged 16-24)
Exp. Priv. (%Tot Exp.): % of public expenditure in private education (primary and secondary) overall public expenditure in education (primary and secondary)
Classrooms voc. pc: number of classrooms devoted to secondary vocational education per capita (population aged 16-24)
Average temperature: Annual average temperature in the region
Max temp – Min temp: Difference between the annual maximum and the minimum temperature in the region

Table 8

Estimates of the determinants of school dropout (regional data)

	Medium/High-skill services					
	Boys			Girls		
	M1	M2	M3	M1	M2	M3
Employment share	-0.870***	-0.494***	-0.425**	-0.220*	-0.259*	-0.261*
	(0.154)	(0.184)	(0.186)	(0.117)	(0.145)	(0.151)
GDP pc	0.00064**	0.0016***	-0.00052	9.30e-05	0.00051	-0.0013*
	(0.00026)	(0.00039)	(0.00071)	(0.00023)	(0.00038)	(0.00066)
Expenditure pc	0.00046	-0.00098	0.00118	0.00039	-0.00143*	-0.00064
	(0.00052)	(0.00078)	(0.00109)	(0.00047)	(0.00073)	(0.00100)
Exp. Priv. (%Tot Exp.)	-0.277	-0.0862	0.397	-0.166	-0.220	-0.376
	(0.195)	(0.203)	(0.346)	(0.171)	(0.194)	(0.315)
# Classrooms voc. pc	-2.206**	-0.358	2.030	-2.172**	-1.418	-1.017
	(1.073)	(1.119)	(1.888)	(0.936)	(1.056)	(1.758)
Population density	-0.000666	0.0315	0.154*	0.00988	0.000121	-0.0363
	(0.0222)	(0.0248)	(0.0868)	(0.0201)	(0.0247)	(0.0800)
Average temperature	0.571*	0.388	0.614*	-0.591**	-0.658**	-0.651**
	(0.310)	(0.338)	(0.334)	(0.279)	(0.325)	(0.310)
Max temp – Min temp	0.0273	0.0142	0.0914	0.0474	0.123	0.214**
	(0.0444)	(0.0991)	(0.109)	(0.0398)	(0.0951)	(0.100)
Region fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	No	Yes	Yes	No	Yes	Yes
Region specific slopes	No	No	Yes	No	No	Yes
Observations	204	204	204	204	204	204
R-squared	0.678	0.741		0.344	0.410	
Number of regions	17	17	17	17	17	17

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Variables:

GDP pc: Annual GDP pc in the region

Employment share: % of employed workers in that industry overall employment

Expenditure pc: Public expenditure in primary and secondary education per capita (population aged 16-24)

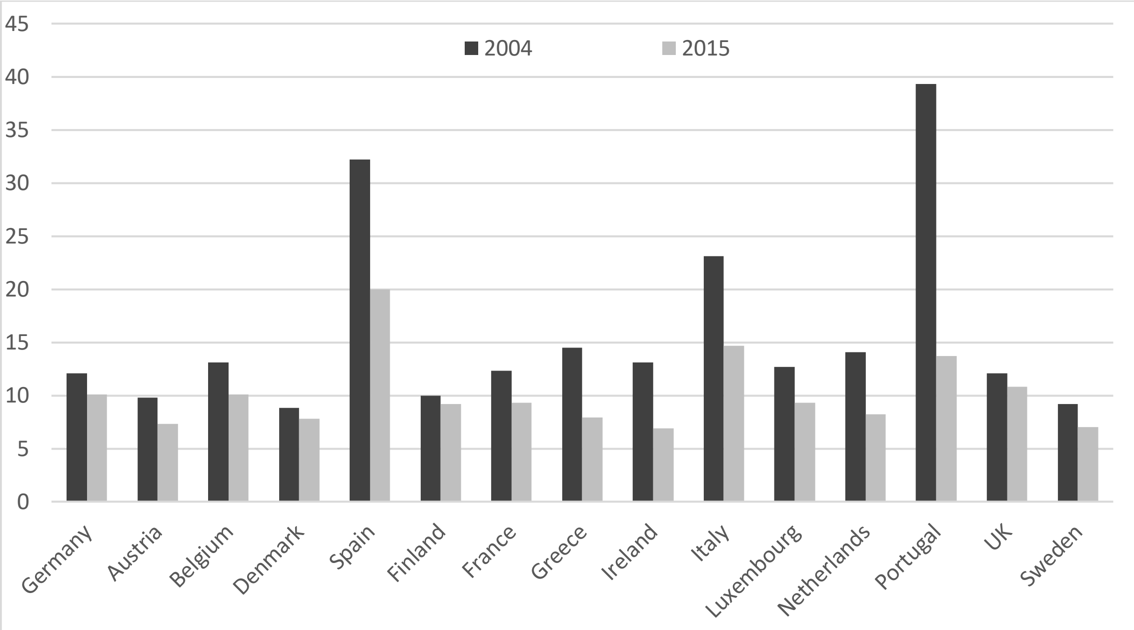
Exp. Priv. (%Tot Exp.): % of public expenditure in private education (primary and secondary) overall public expenditure in education (primary and secondary)

Classrooms voc. pc: number of classrooms devoted to secondary vocational education per capita (population aged 16-24)

Average temperature: Annual average temperature in the region

Max temp – Min temp: Difference between the annual maximum and the minimum temperature in the region

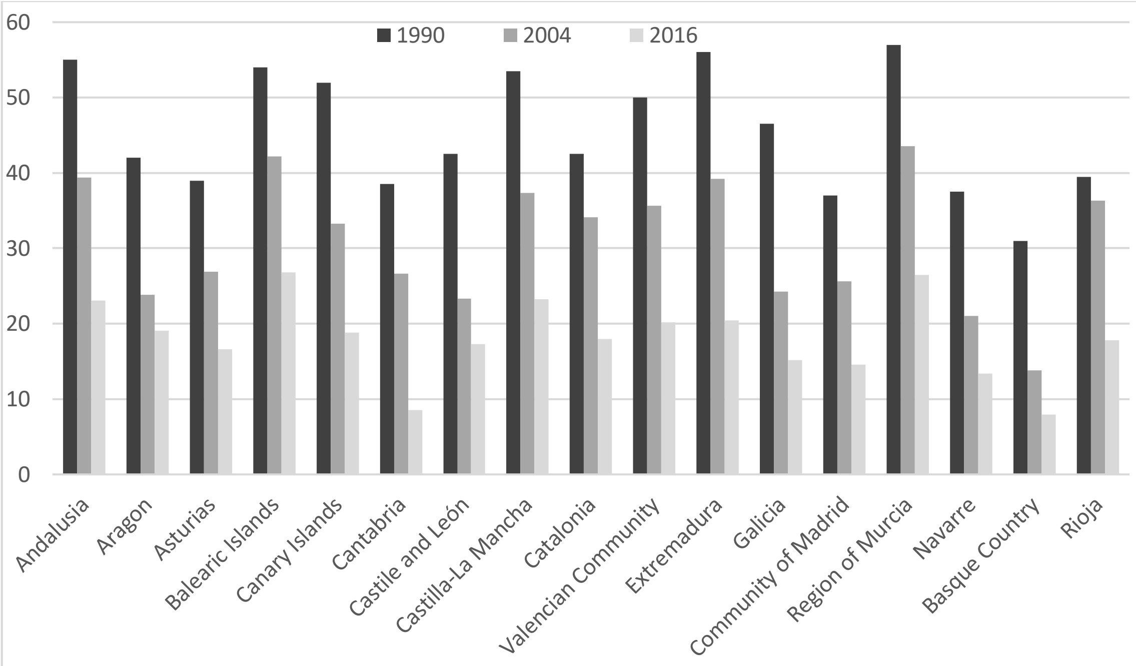
Figure 1
School Dropouts in the EU



Source: Eurostat

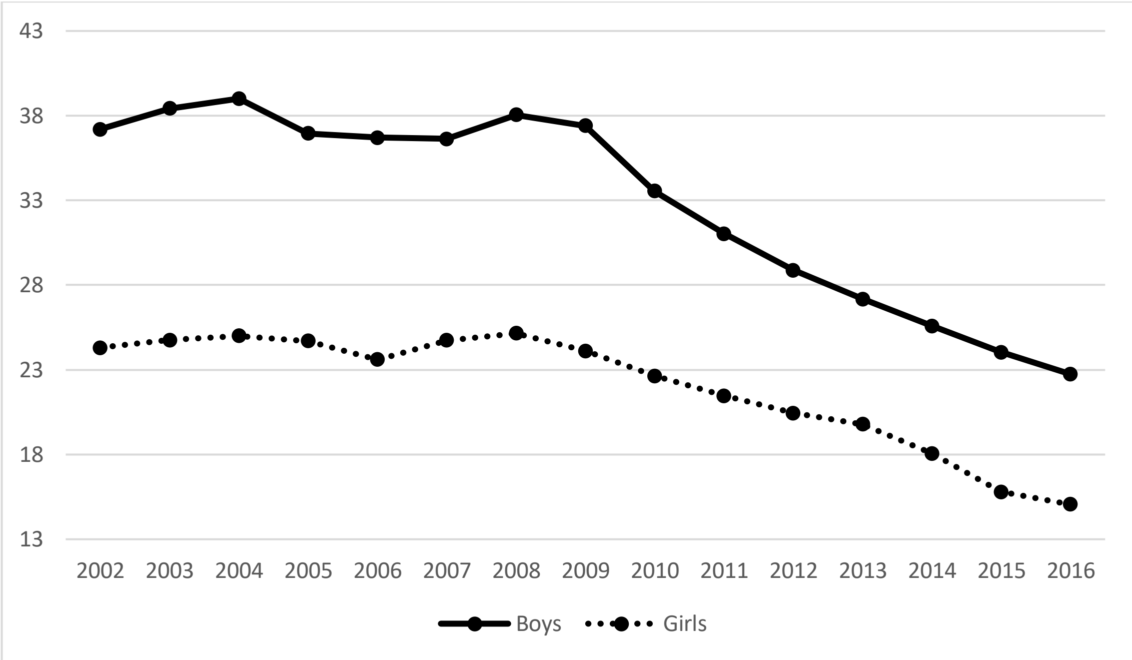
Figure 2

School Dropouts in Spanish Regions



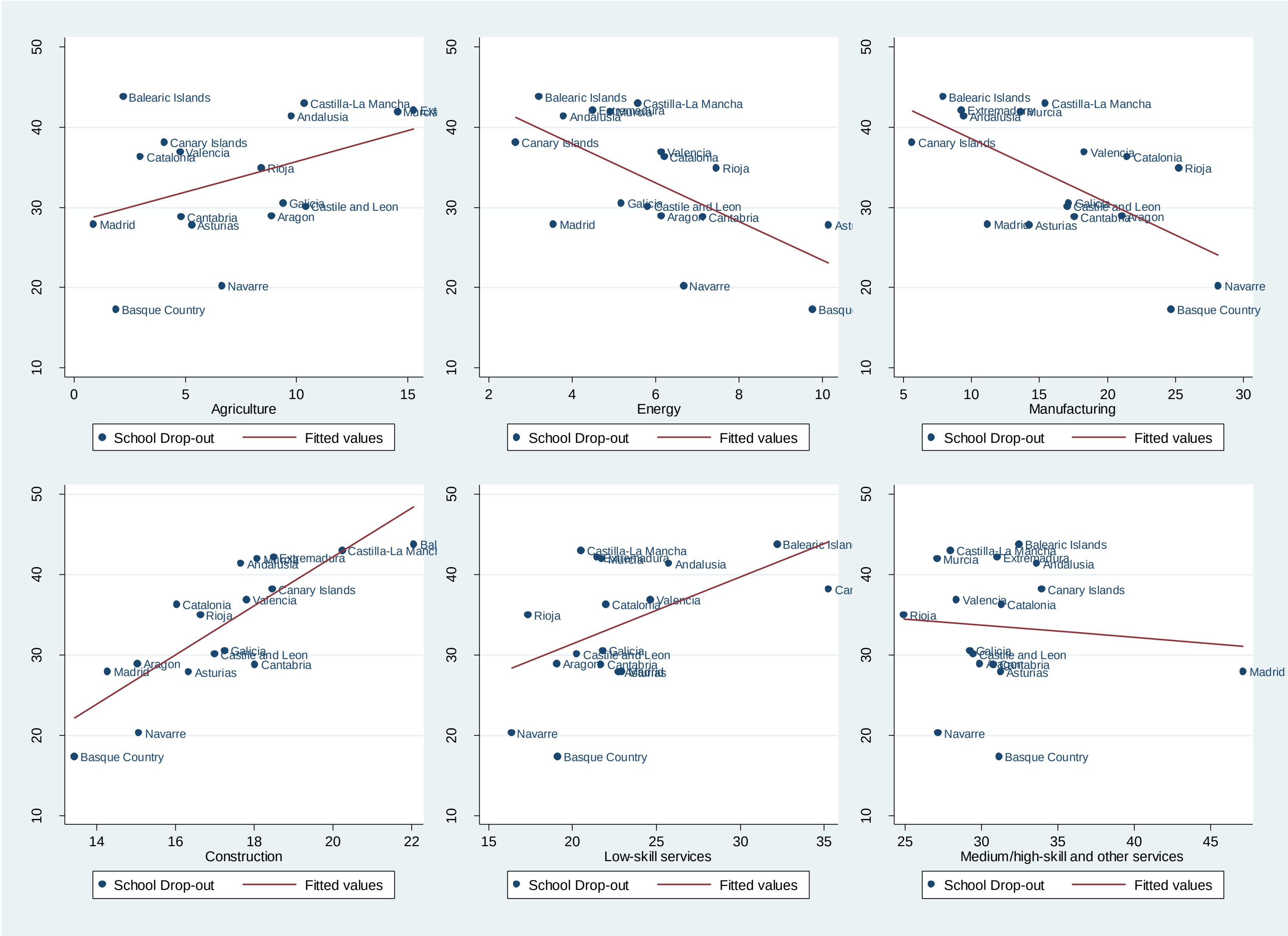
Source: Spanish Labor Force Survey (EPA) and Spanish Ministry of Education

Figure 3
Evolution of school dropouts in Spain



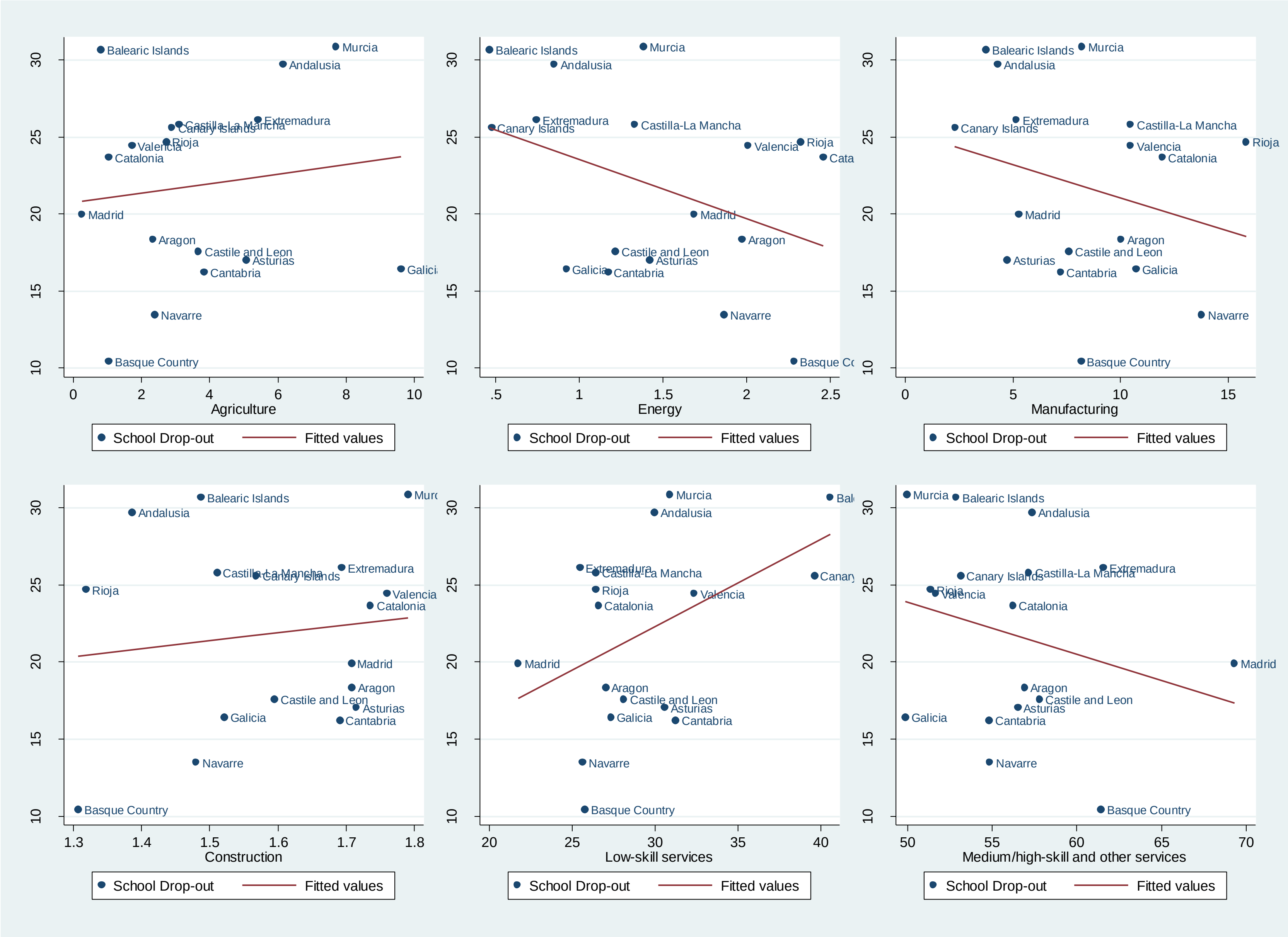
Source: Eurostat

Figure 4
Regional employment share by industry vs. school dropout (Boys)



Source: Employment (Labor Force Survey 2002-2016), school dropout (Eurostat)

Figure 5
Regional employment share by industry vs. school dropout (Girls)



Source: Employment (Labor Force Survey 2002-2016), school dropout (Eurostat)