The Effect of Part-Time Work on Post-Secondary Attainment: New Evidence from French Data*

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Abstract

In this paper, we provide new evidence on the effect of part-time work on post-secondary attainment. To do so, we exploit samples drawn from the French Labor Force Survey for the period 1992 to 2002. These samples are restricted to students in initial education following university studies and preparing an associate, a bachelor's or a master's degree. We estimate probit models with two simultaneous equations accounting for part-time working while studying and for success at the final exam, along with the decision to be still enrolled the following year for one of the models. We take working time into account by drawing a distinction in one of the models between jobs in which more or less than 16 hours are worked per week. We exploit variations across *departements* in low-skilled youth unemployment rates and in their interaction with the father's socio-economic status in order to identify the part-time work effect. Our results suggest a statistically significant and very large detrimental effect of holding a regular part-time job on graduation probability. Still, a complementary analysis shows that working while studying does not have any significant effect on the persistence probability.

JEL classification: C35, I20, J24

Keywords: Post-secondary educational attainment, students' labor supply, bivariate Probit models

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1 Introduction

The situation of higher education in France has been the subject of much debate, covering the effects of the twofold separation between France's so-called *Grandes Ecoles* (élite schools) and universities on the one hand, and teaching and research, on the other hand, as well as the scarce resources allocated to higher education. However, one of the most worrisome characteristics of the French higher education system is the especially high dropout rate in university courses. In France, according to Ministry of National Education data covering the academic year 2006- 2007, more than a quarter of students enrolled in their first year of university studies do not enroll again in the following year. The increase in the number of students who work to finance their studies is often mentioned as one of the possible causes of these frequent failures. According to the report of the French *Economic and Social Council* on student employment (2007), 15% to 20% of students work regularly while studying. This proportion of working students increased quite significantly during the 1990s, rising by 4.4 points between 1990 and 2002, but has flattened out since then.
In this paper, we investigate the effect of part-time work on post-secondary attainment, as measured by graduation and persistence. Providing additional evidence on the impact of part-time work on post-secondary educational attainment seems especially worthwhile since the existing empirical literature mainly focuses on the effect of part-time working while enrolled in high school. Somewhat paradoxically, although the incidence of part-time work is higher at the college than at the high school level, little is still known about the impact of part-time work on college attainment. To the best of our knowledge, this article constitutes the first attempt to estimate the effect of part-time work both on college graduation and persistence, relying on data from a nationally-representative survey.[1] The only existing article relying on representative data to estimate the effect of part-time work on post-secondary academic achievement is that of Kalenkoski & Pabilonia (2009). Nevertheless the authors only consider the impact of part-time work on grade point averages by the end of the first college term, and the identification strategy they rely on breaks down for four-year college students. Our article is also the first empirical study to deal with this issue on non U.S. data. In this paper, we exploit samples drawn from the French Labor Force Survey conducted by the French National Institute of Statistics and Economic Studies (INSEE) for the period 1992 to 2002. These samples are restricted to students in initial education following university studies and preparing an associate, a bachelor's or

[1]The early paper by Ehrenberg & Sherman (1987) also consider the effect of part-time working while enrolled in college on grade point averages, on the probability to stay on in education and on postcollege outcomes. Nevertheless, they restrict their analysis to a subsample of male high school graduates.

a master's degree. We exclude from our analysis students following a course combining work and academic study. The main difficulty in identifying the causal effect of part-time work on academic attainment stems from the potential endogeneity of part-time labor supply. Indeed, the decision to work while studying is likely to be related to unobserved characteristics that are in turn related to academic attainment. For instance, students working part-time may on average have either a lower or a higher unobserved ability or motivation for schooling. In such a case, naive OLS estimates would lead either to overstate or to understate the detrimental effect of part-time work. In order to cope with this issue, we rely on an instrumental variable strategy. Namely, in a similar spirit as in Dustmann & van Soest (2007) and Montmarquette et al. (2007), we exploit variations in students' part-time labor supply induced by the local unemployment rate (at the level of the *departement*, which corresponds roughly to an U.S. county), computed for the individuals under 29 with a secondary schooling level. This local unemployment variable, which is arguably exogenous with respect to academic attainment, is used as a proxy for local labor market conditions which are faced by the students deciding to work part-time while studying. Our identification strategy also exploits the interaction between this local unemployment rate variable and the father's socio-economic status. The underlying idea for the use of the latter instrument is that the width of the social and professional network of the parents is likely to limit the negative impact of unfavorable economic conditions on the probability to find a part-time job (see Kramarz & Skans, 2007).

In order to estimate the effect of part-time work on academic attainment, we estimate probit models with two simultaneous equations accounting for part-time working while studying and for success at the final exam, along with the decision to be still enrolled the following year for one of the models. We take working time into account by making a distinction between jobs in which more or less than 16 hours are worked per week.[2] Relying on the parameter estimates, we can compute the average effect of part-time work on graduation probability, which is further decomposed by major and level of studies. Overall, our results suggest a statistically significant and very large detrimental effect of working part-time on the probability of passing the final exam. As compared with prior evidence available from American and British data, our estimates yield especially strong negative impacts of part-time work on academic achievement. Our results also highlight the need to take the endogeneity of part-time labor supply into account, with simple probit

[2]The cutoff is set at 16 hours per week consistently with the existing literature on this question, which suggests that working more than a certain number of hours between 10 and 20 hours per week is especially detrimental to the educational attainment. Descriptive evidence from our data suggests that the related break indeed occurs around 16 hours per week.

estimates strongly underestimating the detrimental effect of part-time work. Finally, a complementary analysis suggests that, despite its strong negative effect on graduation probability, working part-time does not have any significant effect on the probability to stay on in education. The remainder of the paper is organized as follows. Section 2 reviews the existing empirical literature about the effect of part-time work on academic attainment. Section 3 describes the data. Section 4 is devoted to the impact of part-time work on graduation probability, while Section 5 deals with the effect of working part-time on the probability to be still enrolled the following year. Finally Section 6 concludes.

2 A summary of previous findings

Many studies have been devoted to the situation where part-time work and studies are combined, and in particular to the effects of working while studying on academic performance and on the decision to stay on in education. However, there is still no consensus whether holding a part-time job while studying has a substantial detrimental effect on academic attainment.

A first generation of papers focused on the relationship between part-time working and educational attainment and primarily examined correlations as well as OLS estimates. Some of these articles found that working part-time while studying had no significant detrimental effect on academic attainment (Gade & Peterson, 1980; Meyer & Wise, 1982; Steinberg et al., 1982; D'Amico, 1984; Hotchkiss, 1986). Others concluded to a negative relationship between working part-time and academic achievement (Greenberger et al., 1980; Marsh, 1991). Many articles actually showed that the effects varied, according to the number of hours worked. These papers concluded to a non-linear relationship between the number of hours worked and academic achievement. When the number of hours worked per week is low, they find a non-negative and sometimes positive effect of part-time work on educational performance (D'Amico, 1984; Schill et al., 1985; Steel, 1991), while holding a regular and intensive job is found to significantly lower students' chances of success (Schill et al., 1985; Steel, 1991).

However, as the decision to work part-time while studying can be endogenous, simple OLS estimates of the effect of part-time work on academic attainment are likely to be biased. Ehrenberg & Sherman (1987) were the first to tackle this endogeneity issue. Relying on an instrumental variable approach, they found that part-time working had no significant effect on grades. Conversely, they found a significant adverse effect on the probability of staying-on in education. Lillydahl (1990) took into consideration the potential endogeneity

of part-time work in a similar way. The author came to the conclusion that there is a non-linear effect of the number of hours worked on results at standardized SAT tests: while working less than 13 hours and a half per week has a positive effect on test scores, working more than 13 hours and a half has a negative effect.

More recently, Oettinger (1999) also stressed that one needs to take into account the endogeneity of student work. Exploiting the longitudinal dimension of U.S. data from the NLSY-79 (*National Longitudinal Survey of Youth*) by estimating fixed-effect models, the author concluded to a very small detrimental effect of part-time work on high-school achievement.[3] Stinebrickner & Stinebrickner (2003) showed that different estimation methods of the effect of part-time work on college attainment (namely OLS, double least squares and fixed-effects) led to significantly different results, thus highlighting once again the need to take into account the endogeneity issue.[4] Tyler (2003) uses an original instrumental strategy in order to identify the causal effect of combining working and studying on academic achievement at the level of high schools. Taking advantage of differences between child labor laws across U.S. states, Tyler found a significant detrimental effect of part-time work on twelfth-grade achievement. His results also suggest that OLS underestimate the negative impact of working part-time while studying. Rothstein (2007) and Buscha et al. (2008) exploited the panel dimension of U.S. data from the NLSY-97 and the NELS:88 (*National Education Longitudinal Study*) with fixed-effects estimators and difference-in-differences combined with propensity score matching, respectively. These two papers conclude to a non significant effect of working part-time while studying on achievement at the high school level. Very recently, Kalenkoski & Pabilonia (2009) exploit data from the NLSY-97 to estimate the effect of working part-time on academic performance at the college level. Using the net price of schooling and the local unemployment rate as instruments for the number of hours worked, they conclude to a negative and significant effect of part-time work on grade point averages.[5]

[3]Aside from the papers considering the effect of part-time work on academic attainment, several articles focus on its longer-term effects on labor market outcomes. Relying on the same dataset (NLSY-79), papers by Ruhm (1997) and Light (1999) suggest positive wage returns to working part-time in high-school, while Hotz et al. (2002) conclude to non-significant wage returns to working part-time in high school or college. Dealing with the endogeneity of part-time work is also a major issue in this strand of the literature.

[4]Most existing studies look into the effect of part-time on high-school attainment. Among the articles presented in this literature review, Ehrenberg & Sherman (1987), Stinebrickner & Stinebrickner (2003) and Kalenkoski & Pabilonia (2009) are the only ones to consider the effect of part-time work on university level achievement.

[5]An original feature of the model estimated in Kalenkoski & Pabilonia (2009) lies in the fact that the parental financial transfer is an endogenous determinant of students' part-time labor supply.

Other studies rely on a more structural approach. Relying on the NLSY-79, Eckstein & Wolpin (1999) estimate a dynamic structural model of high school attendance and part-time work decisions. Their model is based on the assumption that the effort made by high-school students during their studies varies in the opposite direction to their labor supply. By simulating the impact of public policies curtailing the possibilities of combining work and study, Eckstein and Wolpin conclude to a negative, albeit quantitatively weak, effect of working while studying on high-school achievement.[6]

Finally, a few articles study the impact of part-time employment both on educational performance and on the decision to stay on in education. This is the case in particular of Eckstein & Wolpin (1999) who estimate the impact of part-time work on persistence rate. Montmarquette et al. (2007) also estimate the effect of part-time work on school performance as well as on the probability to drop-out. They show that, for Canadian high school students, an intensive regular job (more than 30 hours per week) significantly reduces the probabilities of performing well at school and staying-on in education. Conversely, working very few hours per week has a small, actually non-significant impact when less than 15 hours are worked per week, on school performance and on the probability of dropping out. Finally, Dustmann & van Soest (2007) estimate on British data a model with three simultaneous equations accounting for part-time labor supply, school performance and for the decision to drop-out. The authors conclude to a negative effect, albeit fairly weak, of student work on school performance as well as on the decision to stay on in education beyond the minimum age for leaving the educational system. These last two articles exploit variations in the local unemployment rate as well as in the level of parental education in order to identify the impact of working on school performance and on the decision to stay on in education.

3 Data and identification strategy

The data we use are from the annual Labor Force Survey (LFS) conducted by the French National Institute of Statistics and Economic Studies (INSEE) from 1992 to 2002. The French LFS is a rotating nationally-representative panel in which households are surveyed for three consecutive years. Our sample was built as follows: for any year t ranging between 1992 and 2001, we selected students belonging to households who had just entered the panel, who were enrolled in university studies for initial education, and who were preparing

[6] According to their estimates, if high school students could not work part-time, the success rate at the high school diploma would improve only from 82% to 84.1%.

an associate, a bachelor's or a master's degree. Only students who also answered the survey in year t + 1 were kept. We also restricted our sample to those who were younger than 29 in year t and who were born in mainland France. Furthermore, we excluded students following a course combining work and studies: this category comprises apprentices under contract as well as medical interns. The determinants of this kind of part-time work are indeed not the same. We are finally left with a sample of 1,603 students.[7]

The employment variable we choose corresponds to the concept of a working member of the labor force (at the time of the survey, i.e. in March) as defined by the International Labor Organization. We allow the probability to work part-time while studying to depend on the level of studies currently followed and the subject studied, two dummies for school delay taking the value 1 (0 otherwise) when the student's age is one year or at least two years higher than the usual age at the level under consideration (20 years old or younger for an associate degree, 21 years old or younger for a bachelor's degree, and 22 years old or younger for a master's degree), gender, matrimonial status, a dummy for residence in the Greater Paris Area, the number of individuals and the presence of children aged 18 or younger in the household.[8] Finally, we also control for year-specific effects.

We also rely on instrumental variables that are supposed to affect the graduation probability only through part-time work. These variables ensure the non-parametric identification of the models we estimate. They include the unemployment rate in the *departement* for low-skilled individuals aged 15 to 29,[9] the father's social status[10] and its interaction with

[7]Note that this sample does not provide findings covering students who changed their residence between years t and t+1 since the LFS covers housing units and not individuals. Similarly, our results cannot be generalized to students who are not following a university course. Note, however, that failure rate at the level of higher education in France is particularly high at the university level, and in this respect it seems relevant to restrict our sample to students enrolled in university.

[8]In this case, it is the household the surveyed student belongs to. In fact, the dummy for residence in the Greater Paris Area, the number of individuals and the presence of children aged 18 or younger in the household, do not have a significant effect on the probability of passing the year-end exam, but they do have one on the propensity to work part-time. These variables are therefore excluded from the equation accounting for success at the exam, but are introduced into the employment equation. Therefore, they contribute to the overidentification of our models.

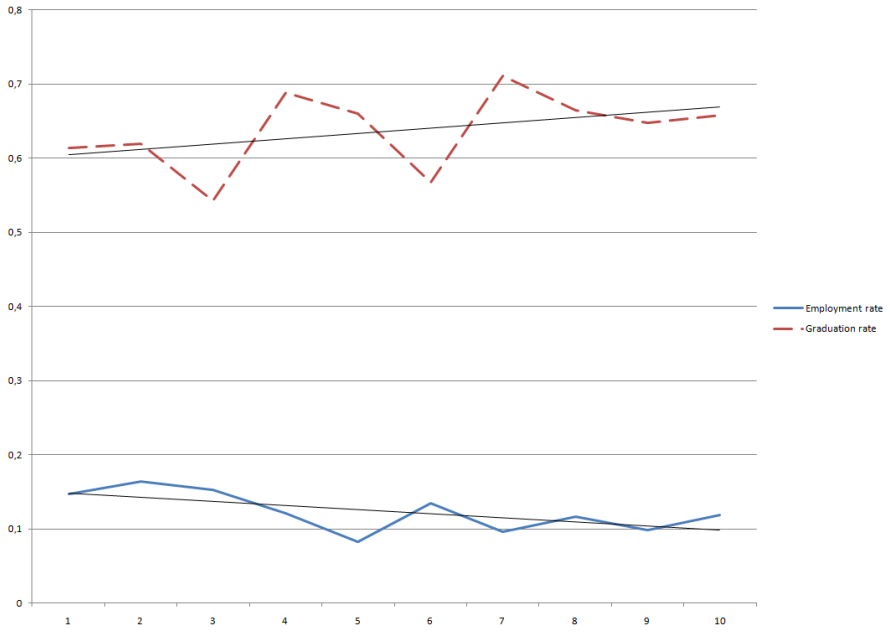
[9]Low-skilled youth refers to individuals with a high school educational level. This local unemployment variable was computed from the French Censuses (1990 and 1999) as the local unemployment rate averaged between 1990 and 1999. We exploit the spatial variation in local unemployment rate to identify the effect of part-time work on graduation and persistence.

[10]This variable is binary. The first value corresponds to higher socio-economic status, which include managers of companies with 10 employees or more in their payroll, professions, administrative and business managers of companies, as well as engineers and technical managers of companies. The second value covers all other socio-economic status, in particular intermediate occupations, workers and employees.

the local unemployment rate.

The father's socio-economic status is likely to be correlated with the parental income, which is not observed in the data. Students whose father has a higher social status will likely have to work less often to finance their studies, because of the higher level of financial support they can benefit from. Besides, although some empirical evidence suggest that the parental socio-economic status has an impact on primary and secondary schooling attainment, there is no clear reason why the father's socio-economic status should still have a direct effect on academic performance at the higher education level. We nevertheless discuss more in details in Section 4 the validity of this exclusion restriction, with robustness checks exploiting in particular the fact that we are in an overidentified setting. The unemployment rate in the *departement* of low-skilled youth is an indicator of the problems met by students deciding to work part-time while studying. Indeed, working students very often hold low-skilled jobs, notably in retail trade and the hotel-catering sector. Hence, when the local unemployment rate of low-skilled youth is high, these jobs in services will be less frequent, which will in turn lower the probability to work part-time while studying. Figure 1 below reports the relationship in the sample between the deciles of local low-skilled youth unemployment rate and part-time employment rate as well as graduation rate.

Figure 1: Part-time employment and graduation rate according to low-skill local unemployment rate



From a descriptive point of view, this figure suggests that there is indeed in the data a

slightly negative relationship between the local low-skill unemployment rate for the individuals under 29 and the students' part-time employment rate, consistently with the kind of mechanism discussed above.[11] As detailed in the following, this negative relationship, which is characterized by a correlation only significant at the 10% level, is actually strengthened when controlling for other characteristics affecting the probability to hold a part-time job. Conversely, there is no clear reason why the local unemployment rate of low-skilled job seekers should have any direct effect on individual probabilities of being successful at university exams.[12] Nevertheless, a concern about the validity of this instrument could be that students living in *departements* where the local unemployment rate is higher have on average a lower motivation for academic achievement. In such a case, our identification strategy could lead to underestimate the detrimental effect of holding a part-time job on academic achievement. We address this concern in Section 4 by including a proxy for students' motivation for schooling in the set of regressors. We show that our results are robust to this additional specification, thus implying that it does not appear to be any no support in the data for the latter relationship. We exploit the positive relationship, illustrated in Figure 1, between the local low-skilled unemployment rate and the graduation rate in order to identify the causal effect of part-time work on academic attainment.

Furthermore, several studies have shown that the socio-economic status of parents, an indirect measure of their income but also of the width of their network of social relationships, facilitates the access of youth to jobs, in particular when unemployment is high (see, in particular, Kramarz & Skans, 2007). This is why we introduce an interaction between the socio-economic status of the student's father and the unemployment rate in the *departement* of low-skilled youth, as the detrimental effect of unemployment rate could be lower for students whose father belongs to a higher socio-economic status. Finally, the exogenous variables which are used to explain graduation, are made up of all the previous variables, apart from the instrumental variables.

In the complementary analysis of the effect of working part-time on the probability to stay on in education, the variables excluded from the academic attainment equation accounting both for graduation and persistence are the unemployment rate in the *departement* of

[11] The deciles of local low-skill unemployment rate for the individuals under 29, averaged over the period 1990-1999, are equal to 16.2%, 17.3%, 18%, 19.9%, 20.7%, 21.5%, 23.6%, 25.4%, 28.7% and 32.7%.

[12] This hypothesis, and the exclusion restriction it results in, are also drawn upon by Dustmann & van Soest (2007) and Montmarquette et al. (2007). The latter also exploit changes in the level of the real minimum wage to identify the effect of combining working and studying on the student's success. Probably due to its relatively small fluctuations in France during the period of interest (9%), the level of the real hourly minimum wage here had no significant effect on the probability of working while studying.

low-skilled job seekers aged 15 to 29, as well as the interaction between the father's socal status and the unemployment variable. Unlike in the preceding specification, the global unemployment rate in the *departement* is used to explain graduation and persistence, but it is excluded from the employment equation.

The sample is composed of 1,603 individuals, 202 of whom work part-time while studying. The graduation rate stands at 63.4% in the whole sample, while it is equal to 66% for students who do not work and 45.5% for working students. Among the 202 students who hold a job, 86 students work less than 16 hours per week and 116 more than 16 hours. The average graduation rate stands at 55.8% for students who work less than 16 hours per week, and 37.9% for those who work more than 16 hours, respectively.[13] Furthermore, in the whole sample, 88.5% of students are still enrolled the following year.[14] The proportion of students who stay on in education is 89.9% for students who do not work and 79.2% for those who do. In particular, 86.1% of students who work less than 16 hours, but only 74.1% of students who work more than 16 hours per week, stay on in education.

Table 1: Descriptive statistics

%	Proportion	Success	Enrollment year $t+1$
Working students (more than 16 hours)	7,2	37,9	74,1
Working students (less than 16 hours)	5,4	55,8	86,1
Non working students	87,4	66	89,9
Total	100	63,4	88,5

4 The impact of part-time work on graduation probability

In this section, we seek to estimate the effect of part-time work on success at the final exam. To do so, we first rely on a bivariate probit model and subsequently on a model that takes into account the number of hours worked per week.

[13]The number of hours worked corresponds to the usual number of hours of work per week. For students who state they do not have a steady working week, the number of hours worked in the week prior to the questioning is used.

[14]Note that among the respondents who stay on in education, 34.6% do so after failing the final exam and repeat the year, while 65.4% are accepted into the following year.

4.1 A bivariate probit model

We first estimate a probit model with two equations. The first equation accounts for part-time working while studying, while the second one accounts for success at the final exam. So far, the decision to stay on in education, as well as the one to repeat the academic year in the case of failing the exam, are not taken into account.

The student works part-time while studying (in which case $Y_1 = 1$, $Y_1 = 0$ otherwise) if the latent variable Y_1^*, defined by the equation $Y_1^* = X_1\beta_1 + \varepsilon_1$, is positive. This latent variable can be interpreted as the individual propensity to combine working and studying. It depends on a set of individual characteristics X_1 and on a random term ε_1, which is supposed to follow a standard normal distribution $\mathcal{N}(0,1)$.

Success at the final exam is supposed to be determined by a latent variable Y_2^* that is positive if the student graduates in the year (in this case, $Y_2 = 1$), negative otherwise (in which case $Y_2 = 0$). This individual propensity to succeed, that can be interpreted as the difference between the individual score and the score corresponding to the average of grades ensuring the student passes the exam, is defined by a linear equation $Y_2^* = Y_1\beta_{20} + X_2\beta_{21} + \varepsilon_2$. This propensity is therefore supposed to depend first on the dummy variable for part-time work (Y_1), which is a potentially endogenous variable, but also on a vector X_2 of individual characteristics such as the university major, gender, etc. The random term ε_2 is once again supposed to follow a normal standard distribution $\mathcal{N}(0,1)$, and it is allowed to be correlated with the residual ε_1 of the graduation equation.

Specifically, we denote σ_{12} the covariance (here equal to the correlation coefficient) between the residuals. In other words, $(\varepsilon_1, \varepsilon_2)$ follows a normal bivariate distribution $\mathcal{N}(0, \Sigma)$ whose covariance matrix Σ is equal to:[15]

$$\Sigma = \begin{pmatrix} 1 & \sigma_{12} \\ \sigma_{12} & 1 \end{pmatrix} \tag{4.1}$$

Note that if the covariance σ_{12} is equal to zero, then the dummy variable for part-time work Y_1 is exogenous in the success equation, and the maximum likelihood estimation of this single equation yields consistent estimates of parameters $\beta_2 = (\beta_{20}, \beta_{21})'$. Otherwise, Y_1 is endogenous and the separate estimation of the success equation yields biased estimates of β_2. The two equations then have to be simultaneously estimated.

The sample is divided into four sub-groups: I_1 refers to the individuals who do not work and who fail the exam ($Y_1 = 0$ and $Y_2 = 0$), I_2 refers to the individuals who do not work

[15] Probit models are identified up to a scaling factor, hence the normalization to the unit of the variance of residuals.

and pass the exam ($Y_1 = 0$ and $Y_2 = 1$), I_3 refers to the individuals who work and who fail the exam ($Y_1 = 1$ and $Y_2 = 0$), and finally I_4 refers to the individuals who work and pass the exam ($Y_1 = 1$ and $Y_2 = 1$).
We denote $\Phi_2(.,.,\sigma_{12})$ the cumulative distribution function of the normal bivariate distribution $\mathcal{N}(0,\Sigma)$. The contribution to the likelihood of the individual i of the sample of size n ($i = 1, ..., n$), denoted P_{ki} (with $k = 1, ..., 4$ indexing the sub-group), can therefore take four values:

$$\begin{aligned} i &\in I_1 \quad \Rightarrow \quad P_{1i} = \Phi_2(-X_{1i}\beta_1, -X_{2i}\beta_{21}, \sigma_{12}) \\ i &\in I_2 \quad \Rightarrow \quad P_{2i} = \Phi_2(-X_{1i}\beta_1, X_{2i}\beta_{21}, -\sigma_{12}) \\ i &\in I_3 \quad \Rightarrow \quad P_{3i} = \Phi_2(X_{1i}\beta_1, -\beta_{20} - X_{2i}\beta_{21}, -\sigma_{12}) \\ i &\in I_4 \quad \Rightarrow \quad P_{4i} = \Phi_2(X_{1i}\beta_1, \beta_{20} + X_{2i}\beta_{21}, \sigma_{12}) \end{aligned} \tag{4.2}$$

The log-likelihood of the model is then expressed as follows:

$$\ln L = \sum_{i \in I_1} \ln P_{1i} + \sum_{i \in I_2} \ln P_{2i} + \sum_{i \in I_3} \ln P_{3i} + \sum_{i \in I_4} \ln P_{4i}$$

4.2 A model with working time

The second model extends the analysis by considering the number of hours worked per week. The first equation of the model now determines a variable Y_1 that takes three values, depending on whether the student does not work ($Y_1 = 0$), works less than 16 hours per week ($Y_1 = 1$), or works more than 16 hours per week ($Y_1 = 2$). The second equation still accounts for success at the final exam. However, working time Y_1 is now included in the list of explanatory variables of success at the exam with two dummy variables, according to whether working time is positive, but below or above 16 hours per week. The residuals of the two equations are once more potentially correlated, in order to account for the potential endogeneity of part-time labor supply.
Part-time work is now modeled with an ordered probit specification of the following form:

$$\forall k \in \{0, 1, 2\}, \quad Y_1 = k \Leftrightarrow s_k < Y_1^* = X_1\beta_1 + \varepsilon_1 \leq s_{k+1}$$

where Y_1^* refers to the individual propensity to work and Y_1 is a discrete variable taking three values that describes students' working time. We denote hereafter Y_1^1 and Y_1^2 the dummy variables for working respectively less or more than 16 hours per week. When the propensity to work part-time is low, i.e. when it is formally lower than the threshold s_1 ($s_0 = -\infty < Y_1^* \leq s_1$), the student does not work part-time, and in this case $Y_1 = 0$.

When this propensity reaches an intermediate level, i.e. when its value ranges between the thresholds s_1 and s_2 ($s_1 < Y_1^* \leq s_2$), the student works less than 16 hours per week, and in this case $Y_1 = 1$. Finally, when the individual propensity to work is higher than the threshold s_2 ($s_2 < Y_1^* < s_3 = +\infty$), the student works more than 16 hours per week, and in this case $Y_1 = 2$. The thresholds s_1 and s_2 are unknown and have to be estimated. In order to identify the model, we normalize the intercept to zero and the variance of the residual ε_1 to one.[16]

Success at the final exam is denoted as above by the binary variable Y_2, whose realization (0 in the case of failure, 1 in the case of success) stems from the latent propensity $Y_2^* = Y_1^1\beta_{20}^1 + Y_1^2\beta_{20}^2 + X_2\beta_{21} + \varepsilon_2$. ε_1 and ε_2 are once again supposed to follow a standard bivariate distribution $\mathcal{N}(0, \Sigma)$.

We denote I_1 the sub-sample of students who fail the exam and I_2 that of students who pass the exam. For any observation in I_1, the individual contribution to the likelihood P_1 is written:[17]

$$\begin{aligned} P_1 = \quad & \Phi_2(s_{Y_1+1} - X_1\beta_1, -Y_1^1\beta_{20}^1 - Y_1^2\beta_{20}^2 - X_2\beta_{21}, \sigma_{12}) \\ & -\Phi_2(s_{Y_1} - X_1\beta_1, -Y_1^1\beta_{20}^1 - Y_1^2\beta_{20}^2 - X_2\beta_{21}, \sigma_{12}) \end{aligned}$$

Likewise, the contribution to the likelihood of an observation of sub-sample I_2 is written:

$$\begin{aligned} P_2 = \quad & \Phi_2(s_{Y_1+1} - X_1\beta_1, Y_1^1\beta_{20}^1 + Y_1^2\beta_{20}^2 + X_2\beta_{21}, -\sigma_{12}) \\ & -\Phi_2(s_{Y_1} - X_1\beta_1, Y_1^1\beta_{20}^1 + Y_1^2\beta_{20}^2 + X_2\beta_{21}, -\sigma_{12}) \end{aligned}$$

The log-likelihood of the whole sample is then written:

$$\ln L = \sum_{i \in I_1} \ln P_{1i} + \sum_{i \in I_2} \ln P_{2i}$$

4.3 The average effect of part-time work on graduation probability

The estimates for the bivariate probit model enable us to quantify the average effect of working part-time on success at the exam, while those of the model with a variable working time allow us to make this effect vary depending on the number of hours worked per week.

[16] An alternative specification, in particular more demanding in terms of identification conditions, would have consisted in adding an equation accounting for the decision to work part-time, with the third equation accounting for success at the exam and the second one for the number of hours worked. This specification would have also required larger samples.

[17] The individual subscript i is omitted hereafter in order to alleviate the notational burden.

For students with characteristics X who hold a part-time job, the average effect of working part-time while studying on graduation is equal to, denoting by Y_2^k the potential success at the exam when $Y_1 = k$:

$$\begin{aligned}\Delta_{TT}^{1}(X) &= E(Y_2^1 \mid Y_1 = 1, X) - E(Y_2^0 \mid Y_1 = 1, X) \\ &= \frac{P(Y_2^1 = 1, Y_1 = 1 \mid X)}{P(Y_1 = 1 \mid X)} - \frac{P(Y_2^0 = 1, Y_1 = 1|X)}{P(Y_1 = 1 \mid X)} \end{aligned} \tag{4.3}$$

This effect corresponds to the treatment effect on the treated, with the treatment here corresponding to the situation of working while studying. In the model with variable working time, the effect on graduation of working less than 16 hours per week, conditional on observable characteristics X and on working less than 16 hours per week, is written:

$$\begin{aligned}\Delta_{TT}^{2}(X) &= E(Y_2^1 \mid Y_1 = 1, X) - E(Y_2^0 \mid Y_1 = 1, X) \\ &= \frac{P(Y_2^1 = 1, Y_1 = 1 \mid X)}{P(Y_1 = 1 \mid X)} - \frac{P(Y_2^0 = 1, Y_1 = 1 \mid X)}{P(Y_1 = 1 \mid X)} \end{aligned} \tag{4.4}$$

Finally, the average effect on success at the exam of working more than 16 hours per week is written:

$$\begin{aligned}\Delta_{TT}^{3}(X) &= E(Y_2^2 \mid Y_1 = 2, X) - E(Y_2^0 \mid Y_1 = 2, X) \\ &= \frac{P(Y_2^2 = 1, Y_1 = 2 \mid X)}{P(Y_1 = 2 \mid X)} - \frac{P(Y_2^0 = 1, Y_1 = 2 \mid X)}{P(Y_1 = 2 \mid X)} \end{aligned} \tag{4.5}$$

In order to estimate these average effects for students who work part-time, unconditional on their characteristics X, we compute the empirical means of the conditional effects, denoted $\widehat{\Delta}_{TT}^{j}(X_i)$ for $j = 1, 2, 3$ and $i = 1, ..., n$. We further detail our analysis by estimating the average effect of working on success at the exam over various sub-groups of students, according to a certain major or level of studies.[18]

[18]We also estimate the effect of part-time working on graduation probability for students who do not work part-time, that is the treatment effect on the untreated. These effects are simply obtained from the treatment effect on the treated by replacing in the conditioning $\{Y_1 = k\}$ ($k \in \{1, 2\}$) by $\{Y_1 = 0\}$.

4.4 Results

Table 2: The effect of part-time work on graduation probability (simple probit model)

Covariates	Estimates	St.errors
Intercept	0.718^{***}	0.090
Part-time work	-0.353^{***}	0.110
Educational level		
Associate degree	-0.760^{***}	0.213
Bachelor's degree	*Ref*	*Ref*
Master's degree	-0.183^{**}	0.071
Major		
Sciences	-0.063	0.087
Law, humanities and social sciences	*Ref*	*Ref*
Management and trade	-0.355^{***}	0.085
Other majors	-0.177	0.159
Schooling delay		
No delay	*Ref*	*Ref*
One year	-0.219^{***}	0.085
Two years or more	-0.380^{***}	0.080
Male	0.035	0.070
Married	-0.219	0.220

Source : French Labor Force Survey, 1992 to 2002 (INSEE, Paris). Sample size $N = 1,603$. Significativity levels: *** (1%), ** (5%) and * (10%). Year-specific dummies also included in the estimation.

Table 3: The effect of hours worked on graduation probability (simple probit model)

Covariates	Estimates	St.errors
Intercept	0.714^{***}	0.090
Part-time work		
Non-working	*Ref*	*Ref*
Less than 16 hours per week	-0.158	0.146
More than 16 hours per week	-0.538^{***}	0.143
Educational level		
Associate degree	-0.765^{***}	0.214
Bachelor's degree	*Ref*	*Ref*
Master's degree	-0.181^{**}	0.071
Major		
Sciences	-0.067	0.087
Law, humanities and social sciences	*Ref*	*Ref*
Management and trade	-0.358^{***}	0.086
Other majors	-0.121	0.162
Schooling delay		
No delay	*Ref*	*Ref*
One year	-0.217^{**}	0.085
Two years or more	-0.372^{***}	0.080
Male	0.034	0.07
Married	-0.216	0.22

Source : French Labor Force Survey, 1992 to 2002 (INSEE, Paris). Sample size $N = 1,603$. Significativity levels: *** (1%), ** (5%) and * (10%). Year-specific dummies also included in the estimation.

4.4.1 Parameter estimates

We first report the naive estimates (corresponding to a correlation coefficient σ_{12} equal to zero) of the equation of success at the exam which do not address the endogeneity of part-time work. Table 2 and Table 3 present respectively the effect of part-time working and the effects of working more or less than 16 hours per week. On average, working part-time significantly decreases the probability of success at the exam (Table 2). Accounting for the

number of hours worked actually suggests that this detrimental effect is only significant for intensive part-time employment, with more than 16 hours worked per week (Table 3). Nevertheless, as already mentioned, not taking into account the potential endogeneity of part-time work may bias these initial estimates. Hereafter, we will therefore focus on the simultaneous estimate of employment and success equations.

The simultaneous estimates of the parameters of these two equations are reported in Tables 4 (employment equation) and 5 (graduation equation). Those of the parameters of the two equations of the model with variable working time are reported in Tables 6 (employment equation) and 7 (graduation equation).

Once allowing for a non-zero correlation between the residuals of the employment and graduation equations, it appears that part-time working has a negative, statistically significant at the 1% level and quantitatively strong effect on the probability of passing the final exam (Table 5). This effect is in fact much stronger for students who work more than 16 hours per week than for those who work less than 16 hours per week (Table 7). The correlation coefficient between the residuals of the two equations is positive, statistically significant at the 1% level and quite large in the two models.

These results imply that working while studying is indeed endogenous. Thus, simple probit estimates reported in Tables 2 and 3 are biased. Furthermore, our results suggest positive selection effects associated with part-time labor supply. This may be due to the fact that, on average, students working part-time are actually more motivated than the others, both from an academic and a professional point of view. Noteworthy, in our case, these naive specifications severely underestimate the detrimental effect of part-time work on graduation probability. Relying on U.S. data, Tyler (2003) at the level of high school, and Stinebrickner & Stinebrickner (2003) and Kalenkoski & Pabilonia (2009) at the level of college also report positive selection effects.

Besides, our results suggest that the probability of working while studying is significantly lower for students whose father has a higher socio-economic status.[19] As expected, this probability is also lower (at the 5% level) when the unemployment rate in the *departement* among low-skilled youth is higher. In this case, however, students with a higher socio-economic background have a very significantly higher probability of gaining access to a job. Moreover, the probability of working part-time is higher for students who are studying

[19]We also estimated an alternative specification of the employment equation, including a more detailed father's socio-economic status variable making a distinction between intermediate occupations, blue-collar and white-collar workers. The only significant coefficient was that of the higher socio-economic status defined above, thus suggesting that restricting to a binary socio-economic status variable is indeed relevant in our context.

for a master's degree, who have accumulated more than two years of school delay, and for those who live in households made up of one or two persons (see Table 4). It is also higher for subjects other than Science, Social Sciences, Law and Arts, and Management[20], as well as, to a lesser extent, for those who are married. The overall findings are similar when accounting for the number of hours worked (see Table 6).

Graduation rates are significantly lower at the second year of an associate degree, as well as in Management and Trade, and for students who have accumulated some delay. Conversely, graduation rates are significantly higher, at the 10% level only, for majors in Civil Engineering, Mechanics and Electricity (cf. Tables 5 and 7). A noteworthy point is that the negative effect of studying in the second year of an associate degree, in comparison with a bachelor degree, is quantitatively fairly strong. This finding is consistent with the particularly high failure rate prevailing in France in the first years of university studies.

4.4.2 Robustness checks

In order to address further the potential concern about the validity of the local unemployment rate for the low-skilled individuals under 29, we also run additional estimations accounting for schooling motivation. More precisely, we include in the set of regressors a variable which corresponds to the average, for each *departement*, of the level of post-secondary education (in terms of years after high school, ranging between 1 and 5) the individuals want to reach when entering higher education. This variable, that we refer to in the following as the *average local educational aspiration*, was computed from the *Panel 1989* dataset (DEPP, French Ministry of Education).[21] The parameter estimates are reported in Tables 15 and 16 in the Appendix. Overall, our main results are robust to this alternative specification. In particular, in the employment equation, the parameters relative to the local unemployment rate and its interaction with the father's socio-economic status are very stable. Similarly, the parameter estimates for the graduation equation, including for the part-time work effect, are robust to this alternative specification. Note also that the parameters relative to the aspiration variable are significant, respectively at the 10% and at the 1% level for the employment and the graduation equation, thus suggesting that motivation for schooling indeed matters. Interestingly enough, the estimate for the aspiration variable is actually positive for the employment equation, a result in line with

[20]These majors, in which courses in these majors are more oriented towards the labor market, concern 5.93% of our sample and consist in multi-technology subjects (namely Civil Engineering, Mechanics and Electricity).

[21]This longitudinal dataset surveys individuals entering 6^{th} grade in 1989, who are enrolled in a French high school.

the positive selection effect which was previously found.

Similarly, one could also argue that the father's socio-economic status has also a direct effect on academic achievement, and this would be an argument against excluding it from the graduation equation. Nonetheless, the data seem to reject this hypothesis: when we estimate our models without excluding the father's socio-economic status from the graduation equation, the assumption that there is no effect due to the father's socio-economic background on passing final exams cannot be rejected at the 10% level.[22]

[22]Detailed results for this specification are available upon request.

Table 4: Bivariate probit model: determinants of the decision to work part-time

Covariates	Estimates	St.errors
Intercept	-0.787^{***}	0.283
Father's socio-economic status		
Higher	-1.953^{***}	0.590
Lower or intermediate	*Ref*	*Ref*
Local unskilled unemployment rate for the individuals aged 15 to 29	-0.025^{**}	0.011
Higher socio-economic status X unemployment rate	0.071^{***}	0.027
Educational level		
Associate degree	0.051	0.335
Bachelor's degree	*Ref*	*Ref*
Master's degree	0.34^{***}	0.097
Major		
Sciences	-0.161	0.136
Law, humanities and social sciences	*Ref*	*Ref*
Management and trade	0.145	0.118
Other majors	1.664^{***}	0.162
Schooling delay		
No delay	*Ref*	*Ref*
One year	0.110	0.127
Two years or more	0.551^{***}	0.108
Male	0.073	0.098
Children under 18 in the household	-0.048	0.153
Married	0.446^{*}	0.256
Size of the household		
Three and more	-0.437^{***}	0.103
Greater Paris	0.124	0.124

Source : French Labor Force Survey, 1992 to 2002 (INSEE, Paris). Sample size $N = 1,603$. Significativity levels: *** (1%), ** (5%) and * (10%). Year-specific dummies also included in the estimation.

Table 5: Bivariate probit model: effect of part-time work on graduation probability

Covariates	Estimates	St.errors
Intercept	0.746^{***}	0.088
Part-time work	-1.384^{***}	0.274
Educational level		
Associate degree	-0.738^{***}	0.211
Bachelor's degree	*Ref*	*Ref*
Master's degree	-0.116	0.072
Major		
Sciences	-0.078	0.085
Law, humanities and social sciences	*Ref*	*Ref*
Management and trade	-0.312^{***}	0.085
Other majors	0.432^{*}	0.221
Schooling delay		
No delay	*Ref*	*Ref*
One year	-0.193^{**}	0.084
Two years or more	-0.243^{***}	0.087
Male	0.035	0.068
Married	-0.091	0.216
σ_{12}	0.582^{***}	0.148

Source : French Labor Force Survey, 1992 to 2002 (INSEE, Paris). Sample size $N = 1,603$. Significativity levels: *** (1%), ** (5%) and * (10%). Year-specific dummies also included in the estimation.

Table 6: Determinants of the number of hours worked

Covariates	Estimates	St.errors
s_2	0.786^{***}	0.273
s_3	1.216^{***}	0.275
Father's social status		
Higher	-1.849^{***}	0.570
Lower or intermediate	*Ref*	*Ref*
Local unskilled unemployment rate for the individuals aged 15 to 29	-0.026^{**}	0.011
Higher socio-economic status X unemployment rate	0.067^{***}	0.026
Associate degree	0.032	0.331
Bachelor's degree	*Ref*	*Ref*
Master's degree	0.343^{***}	0.093
Sciences	-0.191	0.135
Law, humanities and social sciences	*Ref*	*Ref*
Management and trade	0.127	0.116
Other majors	1.574^{***}	0.147
Schooling delay		
No delay	*Ref*	*Ref*
One year	0.120	0.124
Two years or more	0.572^{***}	0.105
Male	0.081	0.095
Children under 18 in the household	-0.009	0.149
Married	0.361	0.238
Size of the household		
Three and more	-0.462^{***}	0.100
Greater Paris	0.101	0.120

Source : French Labor Force Survey, 1992 to 2002 (INSEE, Paris). Sample size $N = 1,603$. Significativity levels: *** (1%), ** (5%) and * (10%). Year-specific dummies also included in the estimation.

Table 7: The effect of hours worked on graduation probability

Covariates	Estimates	St.errors
Intercept	0.739^{***}	0.090
Part-time work		
Non-working	*Ref*	*Ref*
Less than 16 hours per week	-0.833^{***}	0.254
More than 16 hours per week	-1.478^{***}	0.318
Educational level		
Associate degree	-0.758^{***}	0.212
Bachelor's degree	*Ref*	*Ref*
Master's degree	-0.128^{*}	0.072
Major		
Sciences	-0.083	0.086
Law, humanities and social sciences	*Ref*	*Ref*
Management and trade	-0.328^{***}	0.085
Other majors	0.396^{*}	0.230
Schooling delay		
No delay	*Ref*	*Ref*
One year	-0.196^{**}	0.084
Two years or more	-0.259^{***}	0.088
Male	0.033	0.068
Married	-0.115	0.218
σ_{12}	0.454^{***}	0.150

Source : French Labor Force Survey, 1992 to 2002 (INSEE, Paris). Sample size $N = 1,603$. Significativity levels: *** (1%), ** (5%) and * (10%). Year-specific dummies also included in the estimation.

4.4.3 The effect of part-time work on graduation probability

The parameter estimates of the bivariate probit model enable us to compute, for each of the 202 students who work, their probability of graduating if they did not work. The actual graduation probability in the case of working part-time and the counterfactual probability that would prevail if they did not work are then compared. The differences between these two probabilities are reported in Table 8, first for the whole sample, then for each major

and each level of education.[23]

From the first bivariate probit model, working part-time is found to have a significant and very large detrimental effect on the probability of passing the exam, whatever the major and the level of studies considered.[24] If they did not work, working students would have a probability higher by slightly less than 43 points of passing their final exam (Table 8). Given the endogeneity of part-time work, the effect of working while studying is not necessarily the same when it is estimated for working and non-working students. Thus, we also estimate the effect of working while studying for students who do not hold a job (Table 9). We find similar results: on average, holding a part-time job would lower their probability of passing the exam by about 47 points. Interestingly, these estimates are especially strong relative to prior empirical evidence on the effect of part-time work on academic achievement. This may stem from the fact that, as compared in particular with U.S. higher education, most of French university courses are more theoretical and less oriented towards the labor market, and are therefore less subject to complementarities between part-time work and academic achievement.

Relying on the second model with variable working time, we also compute, for students working more or less than 16 hours per week, the counterfactual probabilities of success in the case where they would not work. Table 10 shows that the estimated effect of working is very sensitive to the number of hours worked, a result in line with the existing empirical evidence. On the one hand, working more than 16 hours per week has a very significantly negative effect (on average close to 48 points) on the probability of graduating. On the other hand, the effect of working less than 16 hours per week is much smaller, and only significant at the 10% level for those holding a part-time job (about 28 points). This suggests that a substantial volume of hours worked per week steeply reduces the time devoted to studies as well as, potentially, students' attendance, and as a result has a negative effect on graduation probability. By contrast, holding a job that requires a low number of hours worked (in this case less than 16 hours per week) seems to limit these negative substitution effects. Table 11 reports the results for the subsample of students who do not work. The results are once again similar.

[23]Note that the average effect of working while studying depends on individual characteristics *via* the non-linearity of the models. Thus, the heterogeneity of average effects according to majors reflects both a composition effect and a major-specific effect.

[24]The standard deviations are computed by bootstrap, with 500 replications.

Table 8: Average effect of part-time work on graduation probability (subsample of working students), bivariate probit model

Effect on graduation probability (percentage points)	*Est.*	*St.error*
Working students	-42.6^{***}	14.9
Major		
Sciences	-35.8^{**}	17.0
Law, humanities and social sciences	-38.6^{**}	16.4
Management and trade	-46.3^{***}	13.8
Other majors	-46.7^{***}	13.8
Educational level		
Associate degree	-45.9^{***}	12.9
Bachelor's degree	-41.0^{***}	15.0
Master's degree	-44.5^{***}	14.9

Source : French Labor Force Survey, 1992 to 2002 (INSEE, Paris). Sample size $N = 1,603$. Significativity levels: *** (1%), ** (5%) and * (10%).

Table 9: Average effect of part-time work on graduation probability (sub-sample of non-working students). bivariate probit model

Effect on graduation probability (percentage points)	*Est.*	*St.error*
Non-working students	-47.1^{***}	9.22
Major		
Sciences	-47.8^{***}	9.71
Law, humanities and social sciences	-48.3^{***}	9.72
Management and trade	-43.2^{***}	7.84
Other majors	-46.0^{***}	10.4
Educational level		
Associate degree	-34.0^{***}	8.04
Bachelor's degree	-48.1^{***}	9.65
Master's degree	-45.8^{***}	8.76

Source : French Labor Force Survey, 1992 to 2002 (INSEE, Paris). Sample size $N = 1,603$. Significativity levels: *** (1%), ** (5%) and * (10%).

Table 10: Average effect of hours worked on graduation probability (subsample of working students)

Effect on graduation probability (percentage points)	*Est.*	*St.error*
Less than 16 hours per week		
Average effect	-27.6^{*}	16.3
Major		
Sciences	-26.3	17.0
Law, humanities and social sciences	-26.0	16.6
Management and trade	-29.1^{*}	15.9
Other majors	-30.0^{*}	16.6
Educational level		
Associate degree	-27.3^{*}	15.0
Bachelor's degree	-26.7	16.4
Master's degree	-28.8^{*}	16.4
More than 16 hours per week		
Average effect	-47.5^{***}	9.86
Major		
Sciences	-38.7^{***}	13.9
Law, humanities and social sciences	-44.6^{***}	11.7
Management and trade	-49.1^{***}	8.99
Other majors	-50.1^{***}	9.03
Educational level		
Associate degree	-45.1^{***}	12.1
Bachelor's degree	-46.9^{***}	9.98
Master's degree	-48.3^{***}	9.97

Source : French Labor Force Survey, 1992 to 2002 (INSEE, Paris). Sample size $N = 1,603$. Significativity levels: *** (1%), ** (5%) and * (10%).

Table 11: Average effect of hours worked on graduation probability (sub-sample of non-working students)

Effect on graduation probability (percentage points)	*Est.*	*St.error*
Less than 16 hours per week		
Average effect	-28.3^{**}	14.4
Major		
Sciences	-28.3^{*}	14.6
Law, humanities and social sciences	-28.7^{*}	14.8
Management and trade	-27.1^{**}	13.3
Other majors	-27.8^{*}	14.5
Educational level		
Associate degree	-22.4^{**}	11.2
Bachelor's degree	-28.6^{*}	14.7
Master's degree	-28.0^{**}	14.1
More than 16 hours per week		
Average effect	-48.2^{***}	6.35
Major		
Sciences	-48.6^{***}	6.59
Law, humanities and social sciences	-49.6^{***}	6.32
Management and trade	-44.1^{***}	7.05
Other majors	-48.3^{***}	7.18
Educational level		
Associate degree	-34.6^{***}	8.63
Bachelor's degree	-49.2^{***}	6.30
Master's degree	-47.0^{***}	6.79

Source : French Labor Force Survey, 1992 to 2002 (INSEE, Paris). Sample size $N = 1,603$. Significativity levels: *** (1%), ** (5%) and * (10%).

5 The impact of part-time work on the decision to stay on in education

The lack of financial resources can induce students to work part-time in order to finance their studies. As already seen before, working part-time while studying is found to have a detrimental impact on graduation probability, especially for intensive jobs. Nonetheless, does this situation lower a student's probability of staying on in education? One could imagine that a student who works today is building up savings that will enable her to finance more easily her studies in the following year and potentially to cope with credit constraints. From this point of view, holding a part-time job may actually have a positive effect on persistence.

In order to quantify the effect of part-time work on the decision to stay on in education, we now consider a model accounting for both success at the exam and for the decision to be still enrolled the following year.

5.1 Modeling the decision to stay on in education

The first equation accounts for part-time work ($Y_1 = 1$ when the student holds a part-time work, 0 otherwise). The second equation of the model jointly accounts for success at exam and for the decision to stay on in education or to drop-out:[25] the related variable Y_2 takes four values, depending on whether the student fails the exam and drops-out ($Y_2 = 0$), passes the exam and drops-out ($Y_2 = 1$), fails and accepts to repeat the year ($Y_2 = 2$), or passes the exam and stay on in education ($Y_2 = 3$).[26] This specification leads to a model with two equations, which are simultaneously estimated. The first one is a simple probit equation, the second one an ordered probit equation.[27]

Similarly to the previous section, the student decides to work part-time while studying (in which case $Y_1 = 1$) if the latent variable Y_1^* defined by the equation $Y_1^* = X_1\beta_1 + \varepsilon_1$, is positive. Graduation and persistence are jointly modeled by a variable Y_2 whose four

[25] When a student fails the final exam, the decision to stay on in education implies grade repetition.

[26] We have tested the sensitivity of our estimates at the order chosen for these four values, by estimating a model such that the alternative associated with dropping-out after passing the exam dominates the alternative associated with repeating the year. Our main results are robust to this alternative specification.

[27] Estimating a more complex model, taking in particular into account the number of hours worked, but also, with a supplementary equation, the decision to persist, would require to have access to instrumental variables that would affect the probability of passing the exam but not the decision to stay on in education. Unfortunately, there are no natural candidates for such instruments in our data.

values have been described above. Specifically, we rely on an ordered probit model of the form:

$$\forall k \in \{0,1,2,3\}, \quad Y_2 = k \Leftrightarrow \alpha_k < Y_2^* = Y_1\beta_{20} + X_2\beta_{21} + \varepsilon_2 \leq \alpha_{k+1}$$

where Y_2^* refers to the individual propensity to graduate and stay on in education. This propensity is supposed to depend first of all on holding a part-time job, which is a potentially endogenous variable, but also on a vector X_2 of individual characteristics such as major, gender, etc. The vector of parameters $\beta_2 = (\beta_{20}, \beta_{21})'$ associated with the explanatory variables Y_1 and X_2, must be estimated with the thresholds α_1,α_2 and α_3.[28] ε_2 is once more supposed to follow a normal standard distribution $\mathcal{N}(0,1)$.
We denote I_1 the sub-sample of students who do not work part-time ($Y_1 = 0$) and I_2 the sub-sample of working students ($Y_1 = 1$). The contribution to the likelihood of the individual i of the sample of size n, denoted P_{ki} (k indicating the student's status, that is working part-time or not), writes as follows:

$$\begin{aligned} i \in I_1 \Rightarrow \quad P_{1i} &= \Phi_2(-X_{1i}\beta_1, \alpha_{Y_{2i}+1} - X_{2i}\beta_{21}, \sigma_{12}) \\ &\quad -\Phi_2(-X_{1i}\beta_1, \alpha_{Y_{2i}} - X_{2i}\beta_{21}, \sigma_{12}) \\ i \in I_2 \Rightarrow \quad P_{2i} &= \Phi_2(X_{1i}\beta_1, \alpha_{Y_{2i}+1} - \beta_{20} - X_{2i}\beta_{21}, -\sigma_{12}) \\ &\quad -\Phi_2(X_{1i}\beta_1, \alpha_{Y_{2i}} - \beta_{20} - X_{2i}\beta_{21}, -\sigma_{12}) \end{aligned}$$

The log-likelihood for the whole sample is then written:

$$\ln L = \sum_{i \in I_1} \ln P_{1i} + \sum_{i \in I_2} \ln P_{2i}$$

5.2 The average effect of part-time work on the decision to stay on in education

The parameter estimates enable us to compute the average effect of working part-time on the decision to stay on in education. Denoting $Y_2^2(k)$ the potential persistence decision when $Y_1 = k$, the average effect of working part-time on the decision to stay on in education,

[28] We set $\alpha_0 = -\infty$ and $\alpha_4 = +\infty$.

for students who hold a part-time job, is equal to:

$$\begin{aligned}\Delta^1_{TT2}(X) = & \quad E(Y_2^2(1) \mid Y_1 = 1, X) - E(Y_2^2(0) \mid Y_1 = 1, X) \\ = & \quad (P(Y_2(1) = 3 \mid Y_1 = 1, X) - P(Y_2(0) = 3 \mid Y_1 = 1, X)) \\ + & \quad (P(Y_2(1) = 1 \mid Y_1 = 1, X) - P(Y_2(0) = 1 \mid Y_1 = 1, X)) \end{aligned} \tag{5.1}$$

with :

$$P(Y_2(k) = y_2 \mid Y_1 = 1, X) = \frac{P(Y_2(k) = y_2, Y_1 = 1 \mid X)}{P(Y_1 = 1 \mid X)} \tag{5.2}$$

5.3 Results

5.3.1 Parameter estimates

The parameter estimates of the preceding model are reported in Table 12 (success at the exam and decision to stay on in education).[29] Note first of all that the exclusion restrictions on which we rely on are not exactly the same as those introduced in the previous section. Indeed, the student's socio-economic background can directly affect the decision to stay on in education while still affecting the decision to work part-time, likely because it is a proxy for parental income and therefore for their ability to finance their children's university studies. For this reason, the father's socio-economic status should not be excluded from the equation accounting for graduation and persistence. Therefore, we only exploit variations in the local unemployment rate of low-skilled youth as well as in its interaction with the dummy for socio-economic background to identify the effect of part-time work on the success at the exam and on the decision to stay on in education. Since the decision to drop-out from university may be related to labor market conditions affecting the opportunity cost of education, we also include the local unemployment rate in the set of regressors affecting the success at the exam and the decision to stay on in education.[30]

Unlike previous estimates that did not take the decision to stay on in education into account, the correlation between the residuals of the two equations is no longer significantly different from zero: the selection bias related to the decision work part-time while studying

[29]The results for the employment equation are not reported here since the estimates are similar to those of the employment equation discussed in the previous section.

[30]This unemployment variable is also computed from the French Censuses of 1990 and 1999. It is defined, at the level of each *departement*, as the global unemployment rate for the whole working age population.

can therefore be ignored. Furthermore, the coefficient associated with part-time working while studying (-0.562) is not significant in the equation of success at the exam and decision to stay on in education.

Table 12: Effect of part-time work on graduation and enrollment the following year

Covariates	Estimates	St.errors
s_2	-2.28^{***}	0.162
s_3	-1.89^{***}	0.160
s_4	-0.784^{***}	0.164
Part-time work	-0.562	0.398
Local unemployment rate	0.001	0.011
Father with a higher socio-economic status	0.086	0.084
Educational level		
Associate degree	-0.538^{***}	0.191
Bachelor's degree	*Ref*	*Ref*
Master's degree	-0.360^{***}	0.07
Major		
Sciences	0.025	0.08
Law, humanities and social sciences	*Ref*	*Ref*
Management and trade	-0.21^{***}	0.079
Other majors	0.135	0.257
Schooling delay		
No delay	*Ref*	*Ref*
One year	-0.287^{***}	0.078
Two years or more	-0.625^{***}	0.087
Children under 18 in the household	-0.018	0.089
Size of the household		
Three and more	0.063	0.074
Male	-0.134^{**}	0.064
Married	-0.444^{**}	0.196
Greater Paris	-0.154^{**}	0.078
σ_{12}	0.180	0.207

Source : French Labor Force Survey, 1992 to 2002 (INSEE, Paris). Sample size $N = 1,603$. Significativity levels: *** (1%), ** (5%) and * (10%). Year-specific dummies also included in the estimation.

5.3.2 The effect of part-time work on the decision to stay on in education

The parameter estimate of the preceding model enable us to compute, for each of the 202 students who work, the probability of staying on in education if they did not work. The actual probability of being still enrolled the following year in the case of working while studying and the counterfactual probability that would prevail in the absence of part-time work, are therefore compared. The differences between these two probabilities are reported in Table 13, by making a distinction between the majors and levels of diploma.

Consistently with the preceding parameter estimates, holding a part-time job has a non-significant effect on the persistence probability, whatever the major and the level of studies (Table 13). Similarly, if students who do not work part-time were to work, their probability of staying on in education would not be significantly modified (see Table 14). These results therefore suggest that, while holding a part-time job has a strong detrimental impact on graduation probability, it does not have any significant effect on university persistence.[31]

[31] Interestingly, such a pattern is consistent with the credit constraint explanation given above.

Table 13: Effect of part-time work on the probability to be still enrolled the following year (subsample of working students)

Effect on enrollment probability (percentage points)	*Est.*	*St.error*
Success and still enrolled		
Average effect	−18.1	15.5
Major		
Sciences	−18.8	16.3
Law, humanities and social sciences	−18.6	15.9
Management and trade	−17.4	14.8
Other majors	−17.9	15.3
Educational level		
Associate degree	−15.0	13.5
Bachelor's degree	−18.6	15.9
Master's degree	−17.7	15.1
Failure and repetition		
Average effect	4.5	6.4
Major		
Sciences	8.0	7.7
Law, humanities and social sciences	6.1	6.9
Management and trade	2.7	6.3
Other majors	2.8	6.5
Educational level		
Associate degree	−2.9	8.5
Bachelor's degree	6.4	6.7
Master's degree	2.4	6.8

Source : French Labor Force Survey, 1992 to 2002 (INSEE, Paris). Sample size $N = 1,603$. Significativity levels: *** (1%), ** (5%) and * (10%).

Table 14: Effect of part-time work on the probability to be still enrolled the following year (subsample of non-working students)

Effect on enrollment probability (percentage points)	*Est.*	*St.error*
Success and still enrolled		
Average effect	19.5	14.5
Major		
Sciences	19.9	14.9
Law, humanities and social sciences	19.7	14.6
Management and trade	18.7	13.8
Other majors	17.9	13.4
Educational level		
Associate degree	16.8	12.7
Bachelor's degree	20.1	15.0
Master's degree	18.5	13.6
Failure and repetition		
Average effect	−4.5	6.4
Major		
Sciences	−5.7	6.8
Law, humanities and social sciences	−4.9	6.4
Management and trade	−2.2	6.4
Other majors	−1.9	6.1
Educational level		
Associate degree	1.4	7.0
Bachelor's degree	−6.1	6.6
Master's degree	−1.2	7.0

Source : French Labor Force Survey, 1992 to 2002 (INSEE, Paris). Sample size $N = 1,603$. Significativity levels: *** (1%), ** (5%) and * (10%).

6 Conclusion

This paper contributes to the scarce literature dealing with the effect of part-time work on post-secondary attainment, by estimating the impact of working part-time both on college graduation and persistence, relying on data from a nationally-representative survey. The findings reported in this article suggest that working while studying significantly reduces the probability of passing the university year-end exam. Our estimates show that this detrimental effect is very large, with the average probability of success of working students being about 43 points higher if they did not work. Consistently with the existing literature, we also find that the part-time work effect depends on the number of hours worked. Working more than 16 hours per week has a negative, and quantitatively very strong effect (on average of about 48 points) on the probability of graduating. Conversely, the effect of part-time work is much smaller, although still significant at the 10% level, when the student works less than 16 hours per week. From a policy point of view, taxation reforms giving students an incentive to increase the number of hours worked, which are currently discussed in France, might therefore have a perverse effect by indirectly leading to a rise in the rate of failure at university exams. The problem is all the more acute as our estimates suggest that the detrimental effect of part-time work on attainment is especially strong in the French university context. Still, a complementary analysis shows that combining working and studying does not have any significant effect on the probability of being still enrolled the following year, whatever the major and the level of studies. It is nevertheless important to stress that in this paper, we only consider the short-term effect of part-time work on academic attainment. Given that part-time work is likely to affect the whole process of human capital accumulation, an interesting avenue for further research, that would require to follow individuals for a longer period, would consist in investigating the medium-term effects of part-time work on academic attainment, in particular on the probability to stay on in education.

7 Appendix: additional estimates

Table 15: Bivariate probit model accounting for educational aspiration: determinants of the decision to work part-time

Covariates	Estimates	St.errors
Intercept	-0.185^{***}	0.635
Father's socio-economic status		
Higher	-1.934^{***}	0.590
Lower or intermediate	*Ref*	*Ref*
Local unskilled unemployment rate for the individuals aged 15 to 29	-0.024^{**}	0.011
Higher socio-economic status X unemployment rate	0.071^{***}	0.027
Educational level		
Associate degree	0.06	0.334
Bachelor's degree	*Ref*	*Ref*
Master's degree	0.345^{***}	0.097
Major		
Sciences	-0.167	0.136
Law, humanities and social sciences	*Ref*	*Ref*
Management and trade	0.140	0.118
Other majors	1.664^{***}	0.162
Schooling delay		
No delay	*Ref*	*Ref*
One year	0.102	0.128
Two years or more	0.557^{***}	0.108
Male	0.083	0.099
Children under 18 in the household	-0.054	0.153
Married	0.449^{*}	0.257
Size of the household		
Three and more	-0.462^{***}	0.104
Greater Paris	0.324^{**}	0.163
Average local educational aspiration	0.460^{*}	0.245

Source : Labor Force Survey, 1992 to 2002 (INSEE. Paris). Sample size $N = 1,603$. Significativity levels: *** (1%), ** (5%) and * (10%). Year-specific dummies also included in the estimation.

Table 16: Bivariate probit model accounting for educational aspiration: effect of part-time work on graduation probability

Covariates	Estimates	St.errors
Intercept	-0.008	0.284
Part-time work	-1.377^{***}	0.275
Educational level		
Associate degree	-0.700^{***}	0.212
Bachelor's degree	*Ref*	*Ref*
Master's degree	-0.107	0.072
Major		
Sciences	-0.086	0.085
Law, humanities and social sciences	*Ref*	*Ref*
Management and trade	-0.317^{***}	0.085
Other majors	0.429^{*}	0.222
Schooling delay		
No delay	*Ref*	*Ref*
One year	-0.200^{**}	0.084
Two years or more	-0.237^{***}	0.087
Male	0.035	0.069
Married	-0.090	0.216
Average local educational aspiration	0.349^{***}	0.125
σ_{12}	0.577^{***}	0.148

Source : Labor Force Survey, 1992 to 2002 (INSEE. Paris). Sample size $N = 1,603$. Significativity levels: *** (1%), ** (5%) and * (10%). Year-specific dummies also included in the estimation.

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