DROPOUT, SCHOOL PERFORMANCE, AND WORKING WHILE IN SCHOOL

Claude Montmarquette, Nathalie Viennot-Briot, and Marcel Dagenais*

Abstract—We develop an econometric model where the determinants of working while in school, academic performance, and the decision to drop out are set in the context of two types of high school students: those who prefer schooling and those who are more likely to join the labor market. The likelihood function of this model with heterogeneous preferences for schooling is composed of 48 individual contributions of a standard quadratic normal function. Exploiting a unique Canadian microdata set of high school students and school dropouts, we show that being a female student, attending a private school, and living with educated parents are linked to having a strong preference for schooling over the labor market. We also find that working fewer than fifteen hours per week while in school is not necessarily detrimental to success in school. Our results indicate that the decision to drop out is affected by the legal age to access the labor market, high minimum wages, and low unemployment rates. Several policies that aim at reducing the number of high school dropouts are identified.

I. Introduction

The rate of unemployment for unqualified young workers is an important political preoccupation for all governments. With economies increasingly integrated at the international level, there exists a large pool of unqualified young workers that accentuates youth unemployment in many developed countries. Dropping out of high school is an important contributor to a lack of qualifications among young workers. It deprives many young people of further training as unambiguously shown by Cameron and Heckman (2001). While the decision to drop out is complex, working while in school is often considered a major obstacle to obtaining a high school diploma. Does working while in school negatively affect students’ academic achievement and ultimately lead them to dropout? Alternatively, is working while in school chosen to gain valuable experience in the labor market, or to fulfill a short-term desire to increase consumption? To answer these questions and to address policy issues on dropouts, we develop an econometric model with heterogeneous preferences. The model is estimated using an exclusive set of Canadian microdata.

Marsh (1991) and Barone (1993), with several authors, have noticed that for young people who worked more than twenty hours per week while in school, the mean level of years of schooling is inferior and reduces the probability of pursuing schooling after high school. However, Turner (1994) stressed that in 1980, the typical American high school student in his terminal year spent eighteen hours per week watching television and less than four hours studying. He suggested that a student working twenty hours a week while in school mainly reduces his or her leisure time, and reduces time spent studying by only 7.2 minutes per week. Ruhm (1997) found a positive effect on the probability of obtaining a diploma over a specific range of hours of work while in school, using a nonlinear (quadratic) specification. Neumark and Joyce (2000) considered that the School-to-Work Opportunities Program, created in the United States to provide a more successful transition from school to stable employment, has increased the subjective probabilities of obtaining a high school diploma as well as the perceived likelihood of future labor market activity for those participating. However, Hotz et al. (2002) found that the estimated returns of working while in school diminish in magnitude and are statistically insignificant when one applies dynamic selection methods.

Eckstein and Wolpin (1999) have suggested that youths who drop out of high school have lower ability, motivation, and expectations than those who graduated. They recognized that working while in school affects school performance, but concluded that prohibiting this activity would have little impact on the dropout rate of white American high school students. In this paper, we develop a model explaining students’ academic grades and students’ decisions with respect to working while in school and to dropping out. Along with Eckstein and Wolpin (1999), we assume that a student can be of two types. One type assumes that the working experience obtained while in school is the student’s main preoccupation: a student finds a job because he or she anticipates an early insertion in the labor market. The second type of student prefers schooling over working. This unobserved heterogeneity leads us to seek the best data adjustment to deduce the probability of a student with given characteristics and family factors matching one or the other of the types. This study benefits from a unique microdatabase with the 1991 Statistics Canada’s School Leavers Survey and its 1995 follow-up. The School Leavers Survey retrospectively asked participants, ranging in age from 18 to 21 in 1991, about their current and past schooling situations and about their personal and socioeconomic characteristics. The follow-up survey gathered further information on participants who were still in school in 1991. The national and temporal dimensions of the survey (the survey covers all Canadian provinces and is retrospective over a five-year period) are valuable in understanding the role of macroeconomics and institutional variables (the unemployment rate, the mini-

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mum wage rate, and the age of compulsory school attendance), which vary across provinces and time, on the participants’ decisions to drop out or to work while in school. This exceptionally rich database allows the evaluation of several policies that aim at reducing the level of dropouts at the high school level.

One of the main conclusions of this study is that gender and the education of parents matter in identifying the students’ preference for schooling over the labor market. We found that working less than fifteen hours per week while in school is not necessarily detrimental to success in school. Legal age to access the labor market is an important factor in the decision to drop out and that dropping out of school is associated with the level of minimum wage.

In the next section, we present the various components of our econometric model. In section III, we introduce the data and some descriptive statistics. The econometric results are discussed in section IV. Our conclusions and policy recommendations are found in section V.

II. The Econometric Model

As in Eckstein and Wolpin (1999), we develop a model where students differ in ability (both perceived and real), in motivation, in expectations about the rewards of high school graduation, and in their appreciation of the benefits of postsecondary school education. These factors are not generally observed, and not accounting for this unobserved heterogeneity will impair the econometric estimates of a nonlinear model and mislead policy recommendations. We assume that some students place grades above the benefits of work and that others do the opposite. Without the benefit of panel data, we develop a switching model in which for those preferring work to school, working while in school has a causal effect upon grades, while for those caring more about grades, grades have a causal impact upon hours of work. In the first case, more hours of work would have a positive effect on grades, and in the second case, grades have a causal impact upon hours of work. In the first case, more hours of work would have a negative effect upon grades. For the second situation, doing well in school frees up time to pursue the second preferred activity, work. The formal model is described below, first introducing the two types of students and the switching equation.

A. The Work, Grades, and Dropout (WGD) Type: The Main Interest of Students Is to Enter the Labor Market

If a high school student wishes to enter the labor market rather than to pursue schooling, then working while in school becomes the student’s preferred activity. This working activity might, however, negatively affect his or her grades, potentially leading to dropping out. We cannot establish the exact timing and sequence of a student’s decisions, but we assume that the main decision by the WGD-type student is to experiment with the labor market by working while in school. To represent this situation, we consider a recursive model, where only exogenous factors explain the working equation. The grades equation will depend on the number of hours worked, and the dropout equation will be affected by both the grades and the number of hours of work. The model comprises three equations.

Equation (1) is the utility of working while in school, \( W_i^* \) explained by a set of exogenous variables \( x_i \).

\[
W_i^* = x_i \beta + u_i. \quad (1)
\]

The observed counterpart variable of this latent variable is a four-category variable: no work while in school, working fifteen hours or less, working sixteen to thirty hours, and working more than thirty hours. Assuming that the error term, \( u_i \), is a standardized normal function, we generate an ordered probit.

Equation (2) is the utility of schooling performance or grades, \( G_i^* \).

\[
G_i^* = z_i \gamma + \sum_{j=0}^{3} \lambda_j A_{ij} + \nu_i. \quad (2)
\]

The utility of schooling performance is a function of the number of hours of work while in school and of a set of exogenous variables \( z_i \). Thus, \( A_j = 1 \) if \( W = j \); otherwise \( A_j = 0 \). We have three observable categories for this latent variable: the student’s grade point average (GPA) is less than 60%; GPA is 60% to 69%; and GPA is 70% or more. With \( \nu_i \), a standardized normal function error term, we obtain an ordered probit.

The third equation is the utility of dropping out of school, \( D_i^* \). Specifically:

\[
D_i^* = w_i \delta + \sum_{j=0}^{3} \prod_{k=0}^{2} A_{jk} + \sum_{k=0}^{2} \Phi_k M_k + \eta_i. \quad (3)
\]

\( D_i^* \) is latent but the decision to drop out or not is observed. Dropout is a function of the number of hours of work while in school and of school performance:

- \( A_j = 1 \) if \( W = j \); \( A_j = 0 \) otherwise;
- \( M_k = 1 \) if \( G = k \); \( M_k = 0 \) otherwise.

\( w_i \) is a set of exogenous variables. \( \eta_i \) is the error term of a standardized normal function leading to a binary probit.

B. The Grades, Work, and Dropout (GWD) Type: The Main Interest of Students Is Academic Performance

In this type, a high school student prefers to stay in school and to achieve good academic performance. However, good grades can lead to a decision to work while in school. Again a recursive specification is considered, with the grades equation explained exclusively by exogenous variables.
Equation (4) is the utility of schooling performance, $G^*_i$, with the same three GPA categories described previously, leading to an ordered probit model. Explanatory variables $y_j$ are all exogenous. $\mu_i$ is the error term of a standardized normal function.

$$G^*_i = y_i \alpha + \mu_i. \tag{4}$$

In equation (5), $W^*_i$, the utility of working while in school, is explained by a set $t_i$ of exogenous variables and the three categories of observed grades with $M_k = 1$ if $G = k$; $M_k = 0$ otherwise.

$$W^*_i = t_i \tau + \sum_{k=0}^{2} \lambda_k M_k + \vartheta_i. \tag{5}$$

With the same four observable categories of hours worked while in school defined previously and $\vartheta_i$, an error term following a standardized normal function, we have an ordered probit specification.

The final equation is the dropout equation:

$$D^*_i = p_l \xi + \sum_{j=0}^{3} \varphi_j A_j + \sum_{k=0}^{2} \kappa_k M_k + \psi_i. \tag{6}$$

$D^*_i$, the utility of dropping out depends on (i) the hours worked while in school with $A_j = 1$ if $W = j$; $A_j = 0$ otherwise; (ii) the student’s grades with $M_k = 1$ if $G = k$; $M_k = 0$ otherwise; (iii) and a set $p_l$ of exogenous variables. $\psi_i$ is the error term of a binary probit.

C. The Representation of Students by the WGD or the GWD Types

The proposed modeling decisional process follows along the lines of arguments developed by Eckstein and Wolpin (1999). They argued that it is reasonable to assume that high school students differ in preferences, ability, motivation, and expectations about schooling and work. If some students want to access the labor market in the short term, while others plan to continue their schooling past the high school level, which of the two types best explains the behavior of the students in our data? Their decisions reflect their relative preferences for schooling and work, and the influence of their socioeconomic environment. This is a situation of unobserved heterogeneity because we do not know which type a particular student belongs to. However, we will assume that the determinants of the student’s preference are known.

Consider the following equation:

$$P^*_i = S_i \lambda + m_i. \tag{7}$$

$P^*_i$ is a variable not observed by the econometrician. It stands for the preference of student $i$ for schooling over the labor market and therefore being suited to the GWD type. $S_i$ is a set of determinants of this probability, and $m_i$ is an error term of a standardized normal function. Thus, the probability that student $i$ is described by the GWD type ($P^*_i > 0$) is $\int_{-\infty}^{P_i} f(m_i) dm_i$. And, with a probability $\int_{-\infty}^{P_i} f(m_i) dm_i$, student $i$ favors working and is best represented by the WGD type.

We assume that for the GWD and WGD types, the error terms of their respective three equations are correlated and are also correlated with the error term $m_i$ of the preference equation. With two observed choices for the probit preference equation, two observed choices for the probits of the dropout equations, three observed categories for the ordered probits of the grades equations, and four observed categories for the ordered probits of the working while in school equations, the likelihood function of the complete model is composed of 48 terms of a quadrivariate standard normal function. The equations are estimated jointly, and a typical element of the likelihood function is presented in appendix A.

III. Data and Descriptive Statistics

The 1991 Statistics Canada School Leavers Survey questioned participants, whose ages in 1991 ranged from 18 to 21, about their current and previous school-related situations (still in school at the secondary or postsecondary level, dropout from high school, completed high school successfully, worked while in school in their last high school year), and about their personal and socioeconomic characteristics. The 1995 follow-up survey completed the previous information on participants that were in school in 1991. Statistics Canada has oversampled the school leavers, a situation accounted for in our econometric estimates by weighting the likelihood function appropriately. Complete information was obtained for 5,163 individuals. In appendix B, we present the definition and construction of the variables used in our estimations.

A. Descriptive Statistics

Over the period considered, the dropout rate of Canadian high school students is evaluated at 12.79%. In table 1, descriptive statistics compare the full (weighted) sample and the dropouts. Relative to their size in the high school population, repeaters, male students, and female students with at least one child are over-represented among dropouts. This is also the case for students from single-parent families and those with parents lacking postsecondary education. Provinces where the compulsory school attendance age was 15 years account for an important number of dropouts. On average, compared to the full sample, we note a higher minimum-wage rate and lower unemployment rate at the time the students dropped out.

$^2$ The sampling procedure is discussed in Statistics Canada reference papers (1992, 1995).
A majority of students, 69%, have grades superior to 70%, and 8% have grades inferior to 60%. Thirty-seven percent report not working during their last year in high school, and 6% worked more than thirty hours a week. In the contingency table 2, we show the distribution of the dropouts by hours of work and grades. More than 50% of dropouts have grades inferior to 60%. Students not working while in school represent 14.61% of the dropouts compared with 6.38% of those working less than fifteen hours a week and 36.25% of students working more than thirty hours a week.

IV. Estimation Results

A. Parameter Identification

The identification of the parameters of the complete model is a tenuous exercise. In the work, grades, and dropout equations, exclusion restrictions are made, borrowing from the existing literature on these questions. For the preference equation, we rely on the nonlinearity of the model to ensure identification. In the process of calibrating the full model, we have used different instruments. This exercise has influenced decisions on final exclusion restrictions. We are comforted by the fact that in the process of estimating the model, the likelihood function has converged with different initial values for the parameters.

B. Model Fit

Before discussing how well the model predicts some broad basic statistics, we first statistically assess how much better this complex joint estimation model fits the data over simpler specifications, including running separate regression equations for each decision.

<table>
<thead>
<tr>
<th>TABLE 1.—SAMPLE COMPOSITION AND DESCRIPTIVE STATISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
</tr>
<tr>
<td>-------------------------------</td>
</tr>
<tr>
<td><strong>Personal Characteristics:</strong></td>
</tr>
<tr>
<td>Male student</td>
</tr>
<tr>
<td>Female student</td>
</tr>
<tr>
<td>Female student with at least one child</td>
</tr>
<tr>
<td>Repeater</td>
</tr>
<tr>
<td><strong>Socioeconomic Characteristics:</strong></td>
</tr>
<tr>
<td>Single parent</td>
</tr>
<tr>
<td>Biparental family</td>
</tr>
<tr>
<td>Number of schools attended</td>
</tr>
<tr>
<td>Public school</td>
</tr>
<tr>
<td>Private school</td>
</tr>
<tr>
<td>Parents with no postsecondary education</td>
</tr>
<tr>
<td>Parents with postsecondary education</td>
</tr>
<tr>
<td><strong>Institutional and Macroeconomics Variables:</strong></td>
</tr>
<tr>
<td>Province where legal age to drop out is 15 years old</td>
</tr>
<tr>
<td>Province where legal age to drop out is 16 years old</td>
</tr>
<tr>
<td>Minimum wage</td>
</tr>
<tr>
<td>Unemployment rate</td>
</tr>
</tbody>
</table>

The convergence of the final joint specification and the final specification itself would not have been possible without first estimating single equations. Our procedure has been to address the problem in a stepwise manner by adding equations and correlation coefficients to equations if the log likelihood function offered a significant improvement. We rejected the null of no correlation among residuals with usual likelihood ratio tests. When the heterogeneity in students’ preferences is added to the model, not all of the specifications are nested. From appendix A, the typical element of the likelihood function of the full model indicates that infinite values for the coefficient estimates of the preference equation are required to support a single homogeneous student’s type. In view of the estimates obtained, we can confidently reject the homogeneity assumption. Null values for the coefficient estimates are also rejected (here by likelihood ratio test), thus assuming that an equal probability that a student randomly belongs to one type or the other is not supported by the data. A simple measure of the gains in fitness of the general model over the most simple model, which restricts all the coefficients to 0 except for the constants in the three equations, is a pseudo $R^2$ obtained by comparing the log likelihood value of both models. This pseudo $R^2$ is 17.9%.

C. Parameter Estimates and Discussion

Must coefficient estimates in table 3 show the expected sign and are in accord with the descriptive statistics in table 1. From a policy point of view, it is important to identify the key factors influencing the dropout rates among high school students. We emphasize that we interpret our regression coefficients as derived from jointly estimated equations and not from a structural model.

In the first column of table 3, we have the determinants of the preference equation. It shows that female students favor schooling (the GWD type) more than males do. The probability of preferring school over work increases significantly for those attending private school and for those whose...

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3 This strategy also provides initial parameter values, which were used in the more complex models. Final estimations were done in GAUSS.

4 Obtained from the following computation: (the sum of the log likelihood values of the three equations, $\sum_{i=1}^{3} \log L_i$), minus the log likelihood value of the general model, $\log L_{general}$.

$\sum_{i=1}^{3} \log L_i - \log L_{general}$.
### Table 3.—Model Estimates

<table>
<thead>
<tr>
<th>Personal Characteristics:</th>
<th>Preference</th>
<th>Work</th>
<th>Grades</th>
<th>Dropout</th>
<th>GWD</th>
<th>Grades</th>
<th>Work</th>
<th>Dropout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male student</td>
<td>0.3036</td>
<td>-0.3963</td>
<td>0.1697</td>
<td>-0.5390</td>
<td>0.5857</td>
<td>0.1518</td>
<td>-0.0194</td>
<td></td>
</tr>
<tr>
<td>Female student</td>
<td>(5.265)</td>
<td>(-8.896)</td>
<td>(0.262)</td>
<td>(-1.568)</td>
<td>(6.875)</td>
<td>(4.199)</td>
<td>(-0.066)</td>
<td></td>
</tr>
<tr>
<td>Female student with at least one child</td>
<td>-</td>
<td>-0.5300</td>
<td>(5.126)</td>
<td>-</td>
<td>-</td>
<td>- (2.51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeater</td>
<td>-</td>
<td>-3.242</td>
<td>-</td>
<td>-1.3299</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Grades below 60%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Grades between 60% and 70%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Grades 70% or above</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Did not work while in school</td>
<td>- 0.8414</td>
<td>0.8695</td>
<td>-1.7796</td>
<td>-0.0278</td>
<td>0.0488</td>
<td>-1.224</td>
<td>-0.8883</td>
<td></td>
</tr>
<tr>
<td>1–15 hours worked while in school</td>
<td>-</td>
<td>(3.087)</td>
<td>(-8.730)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>(2.098)</td>
<td></td>
</tr>
<tr>
<td>16–30 hours worked while in school</td>
<td>-</td>
<td>(3.108)</td>
<td>(-15.476)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>(2.595)</td>
<td></td>
</tr>
<tr>
<td>30+ hours worked while in school</td>
<td>-</td>
<td>(3.059)</td>
<td>(-17.002)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>(-0.117)</td>
<td></td>
</tr>
</tbody>
</table>

**Socioeconomic Characteristics:**

| Single family              | 0.1349 | 0.0984 | 0.2311 | 0.0342 |
| Biparental family         | (3.055) | (1.456) | (2.954) | (0.633) |
| Number of schools attended | 0.5403 | 0.9343 | 0.0107 | 0.4551 | 0.4604 | -0.0800 | -0.9139 |
| Public school             | (5.417) | (4.074) | (0.008) | (0.760) | (3.268) | (-1.548) | (-0.697) |
| Parents with no postsecondary education | 0.5278 | 0.2562 | 0.0015 | -0.0087 | 0.2186 | 0.2739 | -0.1681 |
| Parents with postsecondary education | (8.069) | (4.720) | (0.002) | (-0.097) | (1.981) | (2.594) | (-0.314) |

**Institutional and Macroeconomics Variables:**

| Province where legal age to drop out is 15 years old | Ref. | Ref. | Ref. | Ref. |
| Province where legal age to drop out is 16 years old | Ref. | Ref. | Ref. | Ref. |
| Minimum wage | 0.3849 | 0.5333 | -0.0702 | 1.9506 |
| Unemployment rate | (-8.550) | (-12.243) | (-4.454) | (-3.433) |
| Unemployment rate × living outside MCR | (-2.017) | (-1.358) | (-5.051) | (2.814) |
| Unemployment rate × Parents with postsecondary education | 0.0215 | -0.0104 | 0.1746 | (-0.389) |
| Unemployment rate × Biparental family | (-0.091) | -0.8963 | -0.5050 | -1.2444 |
| Newfoundland | (1.483) | (-0.061) | (3.382) | (-0.100) |
| Prince Edward Island | (1.091) | (-0.298) | (1.882) | (0.323) | (-0.350) | (0.322) |
| Nova Scotia | 0.0909 | -0.1415 | 0.6740 | -0.1882 | 0.7091 |
| New Brunswick | 0.1675 | -0.1699 | -0.0011 | 0.8102 | -0.1619 | -1.4216 |
| Quebec | (-8.777) | (2.490) | (-5.737) | (10.180) | (0.476) | (-2.831) |
| Ontario | (-6.722) | (1.244) | (-7.248) | (9.882) | (2.560) | (-2.262) |
| Manitoba | -0.5975 | -0.0863 | -1.0697 | 0.9390 | 0.1034 | -2.6114 |
| Saskatchewan | -0.3935 | 0.1884 | 1.6768 | 0.4834 | -0.1854 | -5.6062 |
| Alberta | 0.3491 | -0.2607 | -0.1705 | -0.0462 | -0.1960 | 0.0696 |
| Others: | -0.2801 | 0.3025 | 2.5986 | 1.6305 | -0.4113 | 2.6910 |
| Constant | (-4.330) | (7.148) | (0.137) | (2.244) | (8.699) | (-1.530) |
| σ (Education of parents) | (-8.745) | (-1.191) | (-3.583) | (1.780) | (-7.673) | (-1.269) |
| ε₁ | 0.6261 | (14.847) | - | - | - |
| ε₂ | 1.1872 | (31.655) | 0.7951 | - | - |
| θ₁ | (3.266) | - | - | - | - |
| θ₂ | - | - | - | - | - |
| θ₃ | - | - | - | - | - |
| θ₄ | - | - | - | - | - |

**Note:** t-statistics are in parentheses.

**Correlation coefficients:**

- p (work, grades) = -0.1954 (-3.2289)
- p (work, dropout) = 0.9355 (18.4802)
- p (grades, dropout) = 0.4320 (1.2805)
- p (grades, preference) = -0.0048 (-0.0271)
- p (work, preference) = -0.0517 (-0.1188)
- p (grades, preference) = 0.3332 (0.0346)
- p (dropout, preference) = 0.0326 (0.0184)

**GWD:**

- p (work, grades) = -0.0296 (-0.7399)
- p (work, dropout) = 0.1518 (4.199)
- p (grades, dropout) = 0.8488 (1.1735)
- p (grades, preference) = 0.0014 (0.0081)
- p (dropout, preference) = 0.0591 (0.0759)
parents completed postsecondary education. Those results are coherent with the descriptive statistics in table 1.

With correlated error terms among the endogenous variables of the model, the effect of the endogenous variables on grades, working while in school, and dropout decisions cannot be easily deduced from the coefficient estimates. To determine the effect of hours worked while in school on the probability of dropping out, we need the conditional probabilities. Some results are presented in figure 1. We observe that the probability of male students dropping out of school (other variables taken at mean value) increases to over 14% when the number of hours of work is above thirty. This probability is less than 1% for male students who have not worked, and 3% if they have worked fewer than fifteen hours while in school.

The probability to drop out for female students with parental responsibilities increases significantly to reach 20% for those working more than thirty hours. Female students with children working less than fifteen hours while in school have a lower probability of dropping out than those not working at all. For female students with no children, dropout rates are low even for those working more than thirty hours (drop rate of 5%). We can show that the conditional probability for a representative student, to have grades inferior to 60%, increases with the hours of work, while its probability to have grades superior to 70% declines with working while in school.

How well do these results match actual observations? These simulations underestimate the effect of working more than thirty hours on the dropout rate. When we decompose the numerous elements behind the conditional probabilities (see footnote 5), we observe that the GWD type is the principal source for underestimating the probability of dropping out. The difficulties with those simulations or with any

\[ P(D, L_1) = \frac{\sum_{k=0}^{2} P(D, W, L_1, G_k)}{\sum_{i=0}^{1} \sum_{j=0}^{2} \sum_{k=0}^{2} P(D, W, L_1, G_k)} \]

\[ P(D, L_2) = \frac{\sum_{k=0}^{2} P(D, W, L_2, G_k)}{\sum_{i=0}^{1} \sum_{j=0}^{2} \sum_{k=0}^{2} P(D, W, L_2, G_k)} \]

\[ L_1 \] represents the WGD model and \( L_2 \) the GWD model.

\[ 5 \] This conditional probability of dropping out is \( P(D/W) = P(D, L_1/W) + P(D, L_2/W) \), with

\[ 6 \] We do not know if a female student had a child while in school, but individuals in our 1991 sample were all less than 21 years old.
predictions derived from the model is in the setting of the other variables in the regressions at their weighted mean values to obtain a representative student. It is reasonable to think that the representative GWD student type is different from the representative WGD student type in terms of family and personal characteristics and exogenous situations they face. We have a substantial number of coefficient estimates in the regressions that are statistically different from 0, which might influence the dropout decision in complement with variables for grades achievements and hours of work while in school. Thus, many different predictions and contingency tables can be considered with the model that will differ in quality to match actual data. Therefore, we feel that it is more appropriate to stress the quality of the model in terms of yielding results in the direction of the observed statistics and to avoid being selective in the presentation of the simulations and predictions of the model.

The exogenous variables affecting work, grades, and dropout variables for both the GWD and WGD types are organized in subgroups of personal and socioeconomic characteristics, as well as institutional and macroeconomic variables. Some of the variables have different effects on the probabilities of the decision variables produced by the two types. Female students with and without children have the same probabilities of dropping out if they favor schooling (the GWD type), but in the WGD type those with children have a greater probability of dropping out. Comparable female and male students have similar grades in the WGD type, but female students show better grades in the GWD type. In the WGD type, female students work less while in school than their comparable male counterparts, while they work more than males in the GWD type. This last result reflects the fact that female students with better grades spend more time working while in school. For both types, failing at least a year in primary school has the same negative effect on grades at the secondary level.

The socioeconomic variable “attending a private school” increases the probability of working in the WGD type, but has no effect in the GWD type. Students with parents who completed postsecondary education have a higher probability of working while in school in both types. This variable positively influences grades in the GWD type but has no effect on grades in the WGD type. However, the estimated coefficients of this variable are insignificant in the dropout decisions, produced by both types while, as noted earlier, it is an important determinant of work versus school preference in the preference equation. Its influence on dropout is indirect and not homogenous among all subjects. Students from two-parent families work more in the WGD type and have better grades in the GWD type. While frequently changing schools shows no influence in the GWD type, it increases the probability of dropping out and improves grades in the WGD type. These results are consistent with Tinto’s (1993) well-known environmental fit and interaction effects in explaining dropout and grades.

The geographical and temporal dimensions of our data are important in exploring the role of institutional and macroeconomic variables on students’ decisions to work while in school and to drop out. Descriptive statistics show a significant level of variability in these decisions, thus eliminating any concern as to the effects of clustering on the standard estimates of the regression coefficients.

Over the time period covered in our study, 69% of students were living in provinces where the legal age to leave school was 16 years. For the 31% remaining students, the legal age was 15. Our results strongly support those of Angrist and Krueger (1991) on compulsory school attendance laws. Students facing the 16-years-old rule have a lower probability of dropping out, with the reduction being particularly strong in the GWD type. This is an interesting result since we know from the preference function that students having at least one parent with a postsecondary education are more likely to be represented by the GWD type. To be effective the law must be known, and this is most likely to be the case for educated parents who also are more likely to use the law as an argument to keep a teen in school as long as possible.

The effect of minimum wage (measured in real terms) on dropout is highly significant. Students who are at the margin in deciding whether to finish high school or not tend to assume that not much will be gained by continuing their education when they can earn a high minimum wage in the labor market. It is worth stressing that the coefficient estimate for this variable in the GWD type is more than three times the coefficient estimate in the WGD type. This is also the case for the unemployment rate variable: a high (low) unemployment rate significantly decreases (increases) the probability of dropout, particularly for the GWD type.

The fact that the institutional and macroeconomics variables appear so much more important in affecting the decision to drop out for the GWD type of students relative to the WGD type is coherent given the inherent preference for an early work career path over schooling for students of

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7 For example, we have compared the actual and the predicted values of the decisions to persist in high school or to drop out in relation to grades achievements and hours of work while in school (derived from the coefficient estimates of table 3 and by aggregating over all individuals). The predictions are acceptable for persistence, but less accurate when we consider the decision to drop out. Compared with table 2, the probabilities to drop out are overestimated, in particular for students who work while in school between fifteen and thirty hours. One compounded difficulty lies in the weighting of the estimated probabilities to account for the oversampling of dropouts in the original survey. This could amplify some errors. Indeed, when we compare the actual and predicted values with the original sample data, the fitting to the data appears better.

8 See Dagenais et al. (2000/1) for a formal theoretical model developing this idea. Goux and Maurin (2000), studying the decline in the demand for unskilled labor in France, discuss various policies such as raising minimum wage to prevent wage inequality with skilled labor. However, if higher minimum wage increases the number of dropouts, downward pressures on the wages of unskilled workers will result.
the last type. For policy considerations, it is also an important result because it creates incentives for students who are not particularly inclined to leave school to do so under specific conditions. Finally, these results help to explain the lack of contributions to the probability of dropping out from the GWD type, as was noted earlier in some of our simulations, because it could not come from focusing on only the variables for grades achievements and working while in school.

The effect of minimum wage on work while in school is positive in the WGD type, but negative and less important in absolute value in the GWD type. Card and Krueger (1995) have shown the possibility of the positive effect of higher minimum wage on employment in the fast-food sector where many high school students are likely to work while in school. This is the case for students of the WGD type. However, a higher minimum wage allows students of the GWD type to work slightly less to earn the same income, a situation more favorable to their schooling objectives.

The probability of working a high number of hours while in school is affected by the unemployment rate. However, considering the coefficient estimates for all of the employment variables (including the interaction variables “unemployment rate and parents with postsecondary education” and “unemployment rate and biparental family”), we find that students of the GWD type with postsecondary-educated parents and from a biparental family are rather insensitive to the level of unemployment with respect to their decision on whether to work while in school.9

Dummy variables have been used to introduce provincial particularities not accounted for by our institutional or macroeconomic variables. In the province of Quebec, for example, completing high school requires eleven years compared with the twelve years needed elsewhere. Thus, it is not surprising to find that the probability of dropping out is lower for that province, all other things being equal.

Finally, in both types, we have substituted the conventional unit residual standard error associated with ordered and binary probits with a heterogeneous residual standard error that depends on the variable postsecondary-educated parent. Coefficient estimates are always negative and generally statistically significant, suggesting that the residual variance is smaller when one of the parents has more than a high school diploma.

V. Conclusion and Policy Issues

Exploiting a unique Canadian microdata set, we study the determinants of work while in school, grades, and dropout in the context of two types of students. In the GWD type, a student favors schooling over a near full-time participation in the labor market. A WGD-type student, on the contrary, is more inclined to limit schooling to rapidly access the labor market. Assuming correlated error terms within both types and a correlation with the error term of a type identification or preference equation, we were able to obtain robust parameter estimates with a rather complex likelihood function corresponding to our model.

Our results show that the gender of the student, private school attendance, and the education of parents are variables that matter in identifying the students’ preference for schooling over the labor market. We found that working less than fifteen hours per week while in school is not necessarily detrimental to success in school.

Legal age to access the labor market is an important factor in the decision to drop out. Since high school is completed around the age of 17 or 18, it is surprising that the age of compulsory school attendance, currently set at 16 years across Canada, is not modified accordingly. The level of minimum wage influences the decision to drop out for many students. To reduce dropout rates, it is worthwhile to consider two sets of minimum-wage rates with a lower level for 18-year-olds. Finally, low unemployment rates encourage dropout. Thus, many policies aimed at lowering the unemployment rates of unqualified young workers might inadvertently increase the number of such workers. Those points are all more important given that we have found that institutional and macroeconomics variables matter much more as incentives in the decision to drop out for students favoring a priori school over a near full-time participation in the labor market.

Finally, with a pseudo $R^2$ of 17.9% for the overall model, it is important to stress that despite the richness of the model, we remain far from understanding all the factors intervening in the decisions to drop out. The decision is complex and as stated with respect to educational achievement in Cameron and Heckman (2001) and other authors on related educational issues, long-run factors associated with parents and family environment appear to play a major role that must be better understood.

REFERENCES


9 The interaction variable “unemployment rate and living outside MCR” is a control variable.


**APPENDIX A**

**Typical Element of the Likelihood Function of the Model**

Consider, for example, a student working fifteen hours or less while in school, reporting a grade point average superior to 70%, and who has not dropped out. Also consider the probability that this student belongs to types WGD and GWD. The individual contribution to the likelihood of observing this student in our sample is the following:

\[ P(W = 1, G = 2, D = 0) = \int \int \int \phi(d_1, d_2, d_3) \delta(0) \delta(0) \delta(0) \delta(0) \]

where

\[ \delta(0) = \begin{cases} 1, & W = 1, G = 2, D = 0, \\ 0, & \text{otherwise.} \end{cases} \]

**APPENDIX B**

**The Data—Definition and Construction**

**Grades:** Course average of the last complete trimester of high school studies. There are three categories: less than 60%, between 60 and 70%, and 70% or above.

**Work while in school:** Number of hours worked per week during the last year of high school attendance. Four categories: none, one to fifteen hours, sixteen to thirty hours, and more than thirty hours.

**Dropout:** 1 if the student has dropped out of high school; 0 otherwise.

**Female:** 1: 0 otherwise.

**Female student with at least one child:** 1: 0 otherwise.

**Repeater:** 1 if the student has repeated at least a year in primary school; 0 otherwise.

**Family with two parents:** 1 if the student lived with both parents; 0 otherwise.

**Number of schools attended:** Number of school changes during primary and high school, transition included.

**Private school:** 1 if attended a private school during primary or high school; 0 otherwise.

**Parents’ education:** 1 if one of the parents holds a college or a university diploma; 0 otherwise.

**Legal age:** Provincially compulsory school attendance age law. 1 if 16 years; 0 if 15 years.

**Minimum wage:** Real minimum wage in constant 1996 dollars applying to the student in his last year of study. If the student has studied in a metropolitan census region (MCR), the minimum wage is deflated by the appropriate regional consumer price index; otherwise the minimum wage is deflated by the appropriate provincial consumer price index.

**Unemployment rate:** Unemployment rate for those ages 15 years and over in the MCR or in the appropriate province for the student considered.

**Provincial dummies:** Binary variables indicating the province where high school studies were completed.

\[ -F = -z_1 \gamma - \sum_{j=0}^{3} \lambda_j A_j; \]

\[ -B = -w_0 \delta - \sum_{j=0}^{3} \Pi_j A_j - \sum_{k=0}^{2} \phi_k M_k; \]

\[ -E = -t_1 \tau - \sum_{k=0}^{2} \lambda_k M_k; -H = -p_0 \xi - \sum_{j=0}^{3} \varphi_j A_j - \sum_{i=0}^{2} \kappa_i M_i; \]

\[ \phi_0 \] corresponds to the density function of a quadrivariate standard normal and the \( \rho \)'s are the correlation coefficients between error terms. \( \epsilon_i, \theta_i, \Omega_i, \) \( \zeta_i \) are threshold parameters of the ordered probits.

The other 47 terms of the likelihood function are similar in nature. The full likelihood (log) function weighted for the oversampling of school leavers and including correction for heteroskedastic error terms is available upon request.