SCHOOL CALENDAR AND STUDENT ACHIEVEMENT
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Dissertation presented to the Program of Pós-Graduação em Economia of the Escola de Economia de São Paulo of Fundação Getulio Vargas, in fulfillment of the degree requirements of Mestre em Economia

Field of Knowledge:
Macroeconomia Financeira

Advisor: Prof. Dr. André Portela Souza
Co-Advisor: Bruno Ferman

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Thesis Defense Committee:

Prof. Dr. André Portela Souza (Advisor) FGV-EESP

Prof. Dr. Bruno Ferman (co-Advisor) FGV-EESP

Prof. Dr. Felipe Garcia Ribeiro UFPeL
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ABSTRACT

This study aims to analyze how school calendar impacts students’ effort when studying for end of year exams and how it impacts score in the Brazilian High School National Exam (Exame Nacional do Ensino Médio – ENEM). It was verified that cities with more holidays have less students studying during these dates. When the ENEM approaches, this effect is even greater. Cities with more holidays close to the exam are associated with lower scores. Using two-sample instrumental variable and considering the hypothesis that holidays impact the ENEM score exclusively by students’ effort, it can be inferred that more studying effort prior to the exam can lead to a higher score.

Key-words: school calendar; student effort; student achievement; ENEM.
RESUMO

Este estudo tem como objetivo analisar como o calendário escolar impacta o esforço dos alunos quando estão estudando para os exames de final do ano e na pontuação no Exame Nacional do Ensino Médio (ENEM). Verificou-se que cidades com mais feriados tem menos alunos estudando nestas datas. Quando o ENEM aproxima, esse efeito se torna ainda maior. Cidades com mais feriados na véspera do ENEM estão associadas com menor nota. Usando o modelo *two sample instrumental variable* e considerando que os feriados impactam o ENEM exclusivamente por meio do esforço do aluno, estima-se que um maior esforço na véspera do exame leva a uma maior pontuação.

Palavras Chave: Calendário Escolar; Esforço do aluno; Desempenho do aluno; ENEM.
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1. Introduction

Even though Brazilian schools must have 200 school days per year, school calendar shifts significantly between states and cities. During the years of 2012 to 2015, the number of holidays in Brazil’s 5,570 cities varied from 15 to 28.

This study aims to analyze how holidays affect students’ effort whilst preparing for the Brazilian High School National Exam (Exame Nacional do Ensino Médio – ENEM), how does the approach of the ENEM and end of year school exams shift students’ behavior, and how school calendar impact students ENEM scores.

To conduct this study, two databases were necessary. The first consists of national, state and municipal holidays of 60 cities compared to students’ study effort throughout the year. The second contains holidays of 3,136 Brazilian cities and the graduates’ average ENEM score per city.

The effort is measured by the number of students that study in an online platform on their own will. The effect of school calendar in their effort is a shift in the total amount of students studying online.

When using a Difference-in-Difference (DD) strategy to regress a dummy that indicates if each weekend was regular or long (because of holiday in a weekday close to weekend) on the normalized number of users studying that particular weekend, controlling for each city and each weekend, I found that an extra holiday decreases students’ study effort by 0.36 standard deviations in a long holiday, when compared to a regular weekend. This same regression was tested with holidays happening on weekends, and don’t impact in the school calendar, but the result wasn’t statistically significant.

In a third DD regression, I added to the first regression two variables: date and the relation between date and the dummy for a holiday during a weekday. The result showed that when the exam approaches, holidays have an even more negative impact in students’ effort.

The second database was used to calculate the another DD regression, which summed the number of holidays in a year in a city that impacts a school calendar, and regressed on the ENEM score, controlled by the year and the city. The result was not statistically significant.

The final regression is similar to latter, but the number of holidays was summed per month, and not per year. The amount of holidays per month was regressed using DD on the ENEM score and controlled by city and year. The result showed that during the month prior to the ENEM, October, cities with more holidays are associated lower ENEM score.
Using two-sample instrumental variable method and supposing that holidays impact ENEM score exclusively by students’ effort, it can be inferred that effort prior to the ENEM has a positive effect on the score.

These results help understand how school calendar affects students’ behavior and achievement. This information has direct consequences in students’ academic performance and more study should be done to understand how to take advantage of this finding by policy makers, pedagogues and parents.

The literature review is divided into four parts. The first approaches research regarding students’ motivation to study because this is a key factor to increase their studying effort. The second section is about exit exams since student achievement is being calculated based on grades in a Brazilian exam. Another section pictures how technology is being used by traditional school structure as this study ‘effort’ is measured by students studying online. The last section illustrates the relationship between holidays and productivity since the holidays may shift school calendar.
2. Literature Review

2.1. Students’ motivation to study

As this study will focus on students’ studying effort during weekend and holidays, this section will overview literature about motivation.

Hidi and Harackiewicz (2000) in their literature review about academic motivation point out that interest is an important motivational variable to affect an individuals’ academic performance. There are two types of interest: one focused on individual interest, which has a relative stability and can be developed over time, and a situational interest, which is a consequence of stimuli of the environment and may be a short-term interest in a specific subject.

Interest is key to academic motivation and, as a consequence, to learning (HIDI AND HARACKIEWICZ, 2000). This happens when an individual has a particular interest in a determined activity, he or she will spend a longer period of time and effort getting more involved with the topic than others that lack such interest.

Some researchers call interest and intrinsic motivation synonymous, thus, Hidi and Harackiewicz (2000) believe interest is a pre-condition for intrinsic motivation since it determines the strength of the motivation. Intrinsic motivation is when a student is interested in a particular subject and is willing to invest time to learn. On the contrary, situational interest can be considered extrinsic motivation, or an externally controlled motivation. When situational motivation is held for some period of time, it can become an intrinsically motivated state.

As pointed out above, having the correct reward structure is key to helping create a situational interest in students, especially if initially they do not have a particular interest in the activity. The effect of the reward depends on the complexity of the assignment and the duration of the involvement (HIDI AND HARACKIEWICZ, 2000).

These reward structures, when applied to the school environment, must have the right classroom incentive structure according to what is expected of students. Covington (2000) compares a classroom structure with a game which students need to maximize the points they receive or their grades. The rules applied to the game will be the way the children are evaluated and how the rewards are distributed. The classroom structure is very important because it represents the relationship between achieving goals and academic performance. In fact, academic goals are led by the classroom control system in force.
There are studies to understand the best reward structure a classroom may have around the world. For example in Kenya, school dropout rates for girls were very high, so an experiment was set to reward the girls who scored well in academic exams with scholarships and grants. Girls showed a substantial improvement in their exam scores and even had a spillover to boys, even though they were not eligible for this scholarship (KREMER, MIGUEL, AND THORNTON, 2009).

Another experiment took place in Israel (AGRIST AND LAVY, 2009), where financial compensation was given to students in low-achieving schools that passed exit exams. The results showed a substantial increase in girls’ certification rate but had no effect on boys’. This experiment also showed that girls increased their time studying for exams in the pre-exam holiday period.

In addition to these studies, other school programs have been conducted in this area of study, such as teacher incentive program (GLEWWE, ILIAS, KREMER, 2003), Flipchart program (GLEWWE et al., 2004) and the effects of decentralization of schools (KREMER, MOULIN, NAMUNYU, 2003).

2.2. Exams

2.2.1. Exams in the world

Hidi and Harackiewicz (2000) point out that rewards, competition, deadlines, and evaluation could undermine intrinsic motivation. This means that the presence of high stake exams can have deep consequences in the educational structure. Bishop (1999) argues that exit examinations are a form of certifying and of signalizing school achievement. Being so, it affects how teachers teach and how students study.

Curriculum-Based External Exit Examination (CBEEE) is an exit exam based on content and has the objective of giving higher importance to academic achievement, as colleges and employers have access to scores prior to selection (BISHOP, 1997).

Since CBEEEs is a sign of the schools’ reputation to outsiders, it impacts on the schools’ structure. Being so, schools’ staff invest in high-quality learning as a priority, better teacher qualification, increase the time dedicated to examination disciplines, more homework to students, parents demanding better science labs and more rigorous education (BISHOP, 1997).

Whilst CBEEEs are evaluating the content of a specific course sequence (BISHOP, 1997), Program for International Student Assessment, also known as PISA, evaluates ones’ fluency...
in solving problems and communication ability of 15 and 16-year-olds internationally. The exams’ objective is to measure the advanced thinking and communication skills that children would need to succeed in the modern world, instead of children’s memorization skills (RIPLEY, 2013).

These assessments are very different in terms of subjects and objectives. This means that each one of them causes a particular incentive in the classroom.

PISA defenders, criticize other exams, such as CBEEEs, because it rewards students’ memorization ability, or that learn how to solve the exam, and not necessarily the student that knows how to think, or those who are ready for the obstacles life will bring, as evaluated by the PISA (RIPLEY, 2013).

2.2.2. Exams in Brazil

The Exame Nacional do Ensino Médio (ENEM) had its first edition in 1998 and was created to assess Brazilian students’ performance at the end of basic education, so students could evaluate themselves compared the rest of the country. It was only in 2009 when the exam became a shortcut to enter University and started becoming more popular every year. In 2009, 4.1 million Brazilians subscribed for the exam. This number rose to 7.7 million in 2015, according to Instituto Nacional de Ensino e Pesquisa (INEP). ENEM has expanded so significantly that even private universities, which mostly select their students by a specific exam, started to accept ENEM score as a direct way of entry.

In 2009 the ENEM also changed the score metrics, and the exam became scaled scores. This kind of score permits comparing results in different years (KARINO, 2011).

The ENEM is similar to the PISA, since both exams evaluate abilities, and work with a scaled measurement for grading. The Brazilian exam aims to evaluate the quality of Brazilian High School. For the students, it can serve as a high school certificate for dropouts or for selecting students for Federal Universities.

The ENEM can be used as access to Universities in Brazil in four different ways. First, by the Programa Universidade para Todos (Prouni) program, which the government offers scholarships for students in private universities based on the ENEM grade and the students’ socio-economic conditions. Second, the Sistema de Seleção Unificada (Sisu) program selects students for State and Federal Universities based on their ENEM score. The third way is using the ENEM score to complement the University’s exam score. And the last way is to apply to a private university exclusively with the ENEM score -some universities designate a specific
number of seats exclusively to students applying through ENEM. Despite the ENEMs importance, no student is obliged to take the exam. The ENEM is also very important to schools because, together with other metrics, the exam scores it is one of the forms of signalizing to students’ families their quality.

2.3. Use of technology for learning

Technology has transformed the service in almost all industries. One of the only industries that hasn't been transformed is education (VALENTE, 2015).

Blended learning is a formal study program where students learn partially on-line and partially in a supervised physical place away from home. In this modality, students have certain control of the time, place, learning path and rhythm. The modalities a student faces during his learning path of a course or subject are connected to form an experience of integrated learning (HORN AND STAKER, 2015).

With the use of technology, schools can keep up with students in a more individualized way. The students gain autonomy over their own learning and teachers can act to help the classroom or the individual student in real time (ALVAREZ, 2015).

In this study, the effort is measured by the number of students studying online by blended learning. Moran (2015) points out that blended learning combines both intrinsic and extrinsic motivation. It has bigger meaning when students see value in what is being studied when their personal motivations are being considered, and when they engage themselves in a creative and socially relevant activity. Horn and Staker (2015) say that blended learning will not disrupt school structure, but will disrupt traditional classrooms within a school.

2.4. Holidays and Productivity

According to Stathis (1999), among the benefits of having Holidays on Mondays, there was: increasing the opportunity for families to be together with longer weekends; enable people to spend more time with recreational activities; increase participation in historical events – allowing people to come from further cities; incentive greater industrial and commercial production, by reducing employees absenteeism and reducing midweek holidays.

Brazilian holidays are either civic (national holiday) or religious. Civic holidays are approved by federal law. Until 1930, Brazil had 12 national holidays motivated by the feeling of universal brotherhood. In this year, the president understood that it was possible to sustain the same feelings having more working days, so he reduced the number of holidays to 6, but soon increased to 7, in 1933.
Apart from the national holidays, the magno state day can also become a holiday when approved by state law. The cities’ anniversary is considered as a municipal holiday. Religious holidays are determined by municipal laws and are limited to 4 per year.

As it will be shown in the following section, holidays in Brazil can vary significantly from one city to another.
3. Data and Descriptive Statistics

3.1. Motivation

Brazilian school year starts between January and March and ends in December. By law, national students must have 200 school days, divided by vacations (generally in July) into two semesters. Each school can choose the best way to distribute these days and establish their own calendar: when school begins, vacations days, and end of year exams. The school must also respect national, state and municipal holidays, which cannot be used as a teaching day. Even though the school has its’ own calendar, the ENEM, as it is a national exam, happens on the same date all over the country.

This scenario brings up a couple of questions, such as: Do students take advantage of Holidays to study? Does this provide some cities with an advantage over others according to their holiday calendar? During vacations, do students study? How does student engagement change throughout the year? Do holidays impact in a cities’ achievement in examinations?

This study strives to answer these questions using two databases. The first contains observations of high school students study effort in 60 Brazilian cities during a year, matched with the cities’ calendar – that consequently affects the schools’ calendar. The second database brings the holidays in 3,136 Brazilian cities and the ENEM score of these cities each year. The next sections will deepen into motivation, how the databases were built and descriptive statistics.

3.2. Student Effort

Online study habits were used to build the variables related to student engagement. This information is key to building the first database. These observations were extracted from an online studying platform that contains courses and exercises with all high school’s content. For the students to have access to this platform, the school buys a yearly license with unlimited access in or outside the school, by desktop, tablet or smartphone.

Teachers and coordinators can keep up with students’ effort and performance online. They can also assign online homework. This allows schools to adopt blended learning, as suggested beforehand. Each school and teacher use the platform in a different way, so it is not possible to set a standard use. It can be inferred that students use the platform as much as they desire, either to study on their own or to do homework.
Via Google Analytics, it is possible to access reports such as the number of students who study each day, the number of new users, number of sessions, bounce rate and average session time.

Since during weekdays and Saturdays teachers may assign online mandatory activities to be done at school during classes, this study compares study habits only during Sundays and does not consider other days, minimizing schools’ influence over the students’ studying habit. This restriction was made to guarantee that the observation is a consequence of the students’ own action. While on weekdays students study for mandatory purposes, on Sundays, the time spent studying is based on their own interest.

The access and study data on the platform are only available from the end of May of 2015. For this reason, the analysis initiates on the 21st week of the year and the first Sunday considered is the 24th of May. In 2015, the ENEM took place on the 24th and 25th of October. Past the exam, I expect that the students studying effort decreases. For this reason, observations were considered until the 42nd week of the year. The last observation is the 1st of October, first Sunday before the exam.

Holidays shift which days students would be at school with teachers, but doesn’t impact the number of school days each student will have since there is a law determining that each school must have 200 school days. Being so, this study did not analyze student’s exposure to teachers, because, regardless the number of holidays, each student has the same amount of days exposed to teachers during the year.

### 3.3. Cities, Holidays and ENEM Score

The 60 cities which had the largest amount of students studying online during the whole year were the ones chosen to be analyzed in the first database. To complete the study, it was necessary to collect information about all the holidays of each city. These holidays could be national, state or municipal.

To analyze the impact of holidays in each observed Sunday, I created a dummy for each day, being 0 the absence of a holiday, and 1 a holiday for each city. I consider that the holidays taking place before that specific Sunday (Thursday, Friday, and Saturday), Sunday, and the days after (Monday and Tuesday) impact the behavior of the students that specific Sunday. The impact of the holidays was considered this way because generally holidays on these week days mend with the weekend and the student has a long weekend. Holidays that happen
Wednesdays were set aside in this study because they don’t affect directly any weekend specifically.

The dummies representing holidays on Thursday, Friday, Monday, and Tuesday near the same Sunday were grouped in another dummy, that keeps information if there was or there wasn’t a holiday on a weekday that specific week.

The dummies representing holiday on a Saturday or Sunday in the same weekend were grouped in another dummy, that keeps information if there was or wasn’t holiday during the weekend.

After collecting the dependent and independent variables, they were combined in the same spreadsheet, completing the data that will further be analyzed.

For this study, a few special days were considered as holidays, such as Mother and Fathers day – which take place on the second Sunday of May and August, respectively. Easter was also considered a Holiday, since Brazil follows a catholic calendar. Even though these celebrations take place on a Sunday every year and students won’t have a long weekend, they are not regular Sundays. Being so, they were also considered a holiday.

For the second part, where the number of holidays per city was compared to the ENEM score, I used information about the holidays in 3,136 Brazilian cities in the years 2012, 2013, and 2014. This information is published by each city and was consolidated by a website called calendario.com.br. I extracted all the holidays from this website into a spreadsheet by coding a program. The holidays are in a long form, where there is a column containing all the years, and each holiday is a line.

Anyone can take the ENEM, so I used the ENEM score per school, to make sure the study was only considering student’s grades. The students are not obliged to take the exam either. The grade per school is published when more than 50% of the high school’s graduates take the exam, or the number of students is greater than 10. After gathering this information per year, I calculated the average of the ENEM score per city, weighting per school. I did not consider the school’s size, because I am interested in the schools’ calendar, and the number of students shouldn’t influence its’ calendar (from now on, when I mention ‘ENEM score’, I am referring to this average score of schools per city per year).

I combined the school’s calendar information with the ENEM average score of the city each year. So each row represents a holiday in 2012, 2013 or 2014 in a city and has the ENEM average score of that city and year.
While analyzing the holidays’ dataset, I found a few inconsistencies, so I treated them in a dofile in Stata. These inconsistencies were holidays that should take place every year, but they weren’t in the database.

Not all the holidays’ impact school calendar, such as valentine’s day, April fools, or holidays that take place during a weekend. These holidays were discarded.

After selecting the relevant holidays for the study, the sum of relevant holidays in each year was kept in variables. One variable saves the total amount of relevant holidays in a city during a year. Other variable saves the sum of holidays per month, and each two months of a city during the year. This information will be used to check if the impact of a holiday changes throughout the year.

The database was then collapsed by city and year, keeping the information of the ENEM scores of each city and the sum of relevant holidays in different months of the year.

### 3.4. Descriptive Statistics

In the first database in 2015 in the 60 cities analyzed, 24.7% of the weeks had holidays during Monday, Tuesday, Thursday or Friday, and 9% of the weekends had a holiday on average. There were 5 cities with 15 holidays during weekdays, the biggest amount of holidays in weekdays this year. The smallest amount of holidays during week days was 11 holidays, 6 cities followed this pattern.

Still in the first database, 24 of the 27 Brazilian states were represented in the study. From these states, 14 of them were represented by only one city, 9 states had between 2 to 4 cities, and one state had 23 cities on its own. In each city, the number of students that studied each weekend oscillated quite significantly. For this reason, the number of users studying online was normalized by the city.

The second database shows that 2012 and 2013 had in average 18 holidays per city, and 2014 had 21. The year of 2014 had three more holidays because of the Brazilian games in the world cup when schools stopped.

In 2013 two cities had only 15 days of holidays, whilst all the rest have more. Sooretama (ES) usually has 16 days of Holidays, but in 2013 the cities’ municipal holiday happens to take place the same day as Easter. The second City, Taio (SC), which generally has 17 days of holidays, in 2013, had only 15 because a municipal and a state holiday happened to take place on the same day as a religious holiday.
Every following year the ENEM had more students applying for the exam. This also reflected on the number of cities with ENEM score per school, which grew bigger every year. In 2012 2,518 cities had high school graduates applying for the exam. This number rose to 2,963 in 2013 and 3,137 in 2014. The average ENEM score between years went from 499 in 2012 to 493 and back to 499 in 2013 and 2014, respectively, as can be seen in Table 1.

<table>
<thead>
<tr>
<th>Table 1 - Descriptive Data</th>
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<tbody>
<tr>
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<tr>
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<tr>
<td><strong>2015</strong></td>
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<tr>
<td>Number of Cities</td>
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<td>Average holidays in a City</td>
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<td>Min Holidays in a City</td>
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<td>Max Holidays in a City</td>
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<td>Average holidays in a City</td>
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<td>Average number of</td>
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<td>normalized Users per week</td>
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<tr>
<td>Average ENEM Score per city</td>
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<td>Min average ENEM Score per</td>
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<td>City</td>
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<tr>
<td>Max average ENEM Score per</td>
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<td>City</td>
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</tbody>
</table>
4. Econometric Framework

Do students take advantage of holidays and extra free time to study? How do students change their study effort over the year? I will use the first database to try to answer these questions. The following sections will describe these hypotheses and the regressions that will be run.

How do holidays impact students’ achievement? The second database will be used to try to answer this question.

(i) School Calendar and students effort

As was showed above, 24.7% of the weeks in 2015 had holiday close to a weekend. When this holiday happens in a Tuesday or Thursday, normally schools mend the holiday with the weekend and students have a long weekend. Being so, students have extra spare time then they would normally have. Are students using this extra time to study?

In all the regressions model presented, I used the Difference-in-Difference strategy, controlling the fixed effect of the city and by time (weeks or years, for the first and second database).

I expect that students’ face long weekends as a leisure time, so they study less during these events. To answer this question, I will run the following regression:

\[ U_{it} = \alpha_{10} + \beta_{11}DHolidayw_{it} + \gamma_i + \theta_t + \epsilon_{it} \]  

(1)

Where \( U_{it} \) is the normalized users that studied by the online platform that \( t \) Sunday in the city \( i \); \( \alpha_0 \) is the intercept; \( DHolidayw_{it} \) is the dummy for holiday in a weekday (Thursday, Friday, Monday or Tuesday) closest to the Sunday; \( \gamma_i \) is the variable used to control the fixed effect of the 60 cities, which \( i = 1 \) to 60 cities analyzed; \( \theta_t \) represents the fixed effect of the week, which \( t = 22 \) to 41 weeks of 2015 analyzed; and \( \epsilon_{it} \) is the error.

I will also run this regression to understand the effect of the holiday being on a weekend, so I change the dummy \( DHolidayw_{it} \) for \( DHolidaywend_{it} \), which is when the holiday is on Saturday or Sunday:

\[ U_{it} = \alpha_{20} + \beta_{21}DHolidaywend_{it} + \gamma_i + \theta_t + \epsilon_{it} \]  

(2)

When the holiday happens on the weekend, this has no impact on the school calendar, because it doesn’t have shorter weeks or, consequently, longer weekends. Being so, it is expected that holidays in weekends do not impact students studying habits.

Another effect I wish to study is how students change their studying habits in holidays throughout the year. I expect that when the end of year exams and the ENEM approaches,
students’ study more, so they will get good grades. This study pattern during the year will be analyzed using the graph of coefficients of regression 1.

Also to understand if students study more when approaching the end of year exams, I will run the following regression:

\[ U_{it} = \alpha_{30} + \beta_{31}DHoliday_{it} + \beta_{32}Date_{it} + \beta_{33}(Date_{it} \ast DHoliday_{it}) + \gamma_{i} + \theta_{t} + \epsilon_{it} \]  

(3)

Where \( Date_{it} \) is a linear variable that represents Sundays of the year, numbered from 1 to 52; and \( (Date_{it} \ast DHoliday_{it}) \) holds the information of how students’ behavior change during holidays in weekdays as the date increases. The fixed effect was controlled by the city \( \gamma_{i} \) and week \( \theta_{t} \).

For comparison purposes, I will regress the Date, represented by the week, on the number of normalized users, represented by regression 4. With this regression, it will be possible to compare the tendency of a regular weekend with a long weekend.

\[ U_{it} = \alpha_{40} + \beta_{41}Date_{it} + \gamma_{i} + \theta_{t} + \epsilon_{it} \quad \text{(4)} \]

For regression 5 I will add to regression 4 the variable Holidays in a Weekday to be used as control.

\[ U_{it} = \alpha_{50} + \beta_{51}DHoliday_{it} + \beta_{52}Date_{it} + \gamma_{i} + \theta_{t} + \epsilon_{it} \quad \text{(5)} \]

(ii) School Calendar and Student Achievement

The second database will be used to understand how school calendar affects student’s achievement and to measure if the effect of holidays on the achievement changes during the year. This will be measured by the following Difference in Difference regression:

\[ S_{it} = \alpha_{60} + \beta_{61}NumHolidays_{it} + \gamma_{i} + \theta_{t} + \epsilon_{it} \]  

(6)

Where \( S_{it} \) is the ENEM score per city \( i \) and year \( t \); \( \alpha_{0} \) is the intercept; \( NumHolidays_{it} \) is the number of holidays in a city \( i \) that year \( t \); \( \gamma_{i} \) is the variable used to control the fixed effect the city, where \( i = 1 \) to 4261 cities analyzed; \( \theta_{t} \) is the fixed effect of the year, where, \( t = 2012, 2013, 2014 \); and \( \epsilon_{it} \) is the error.
This regression will be run again, substituting the variable NumHolidays_{it} of the year, for HolidaysMonth_{it}, the number of holidays during a specific month. The new regression is represented by:

\[ S_{it} = \alpha_0 + \beta_1 \text{HolidaysMonth}_{it} + \gamma_i + \theta_t + \epsilon_{it} \quad (7) \]

The variable HolidaysMonth_{it} represents 10 variables, one for each month, from January to October. The regression has fixed effect of year \( \theta_t \) which \( t = 2012, 2013 \) and 2014 and the city \( \gamma_i \).
5. Results

i) School Calendar and students effort

As expected, the data used to run the regression (1) suggest that cities with more holidays on a weekday close to the weekend (Thursday, Friday, Monday or Tuesday) have less students studying online. When there is a holiday during weekday and students have a long weekend, study reduces approximately 36% standard deviations when compared to cities that did not have holiday.

<table>
<thead>
<tr>
<th></th>
<th>Users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Regression 1)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.092</td>
</tr>
<tr>
<td></td>
<td>(0.102)</td>
</tr>
<tr>
<td>Holiday in a weekday</td>
<td>-0.369 **</td>
</tr>
<tr>
<td></td>
<td>(0.144)</td>
</tr>
<tr>
<td>Holiday in a weekend</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 1192</td>
<td></td>
</tr>
<tr>
<td>R² Overall = 0.301</td>
<td></td>
</tr>
</tbody>
</table>

Notes: (1) The table reports the outputs of holidays in 2015 over high-school study habits. (2) The variable Users is normalized. (3) Robust standard errors are reported in parenthesis. (4) Control variable City was omitted for simplification purposes.

***P<0.01; **p<0.05; *p<0.1

On the contrary, if there is a holiday that takes place on a Saturday or Sunday, it has no effect on studying habit as (2) in Table 2 shows us.

To understand how students change their engagement over the year, I analyze the fixed effect of each week in regression1, as showed bellow by Graph1.
Weeks 32 and 33 are outliers because of an online exam students were submitted to. Even if these dates are removed from the Graph, the study pattern during the weeks – or the lack of a pattern - doesn’t change.

The result of regression (3), presented in Table 3, shows as the ENEM approaches, holidays have an even stronger impact in students’ effort, indicated by the coefficient of (Holiday in a weekday)*Date.
Table 3 - Study Effort in weekends while end of year is approaching

<table>
<thead>
<tr>
<th></th>
<th>Norm Users (Regression 3)</th>
<th>Norm Users (Regression 4)</th>
<th>Norm Users (Regression 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.071 *** (0.292)</td>
<td>0.483 * (0.247)</td>
<td>0.358 (0.257)</td>
</tr>
<tr>
<td>Holiday in a weekday</td>
<td>1.121 *** (0.292)</td>
<td>-0.369 *** (0.075)</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>0.005 (0.009)</td>
<td>-0.015 * (0.008)</td>
<td>-0.009 (0.008)</td>
</tr>
<tr>
<td>(Holiday in a weekday)*Date</td>
<td>-0.045 *** (0.008)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

n = 1192
R² Overall = 0.049

Robust standard errors are reported in parenthesis.
***p<0.01; **p<0.05; *p<0.1

The derivation of regression 3, \( \frac{\partial \text{users}}{\partial \text{Holidayw}} \), as presented in Graph 2, show a clear pattern between students effort in weekends with holidays as the year goes by. The number of students decreases in holidays as the weeks go by.

During weeks 22 to 24, more students take advantage of holidays to study but the end of year approaches, the number of students studying decreases.
A few assumptions can be brought up to try to explain the reason why engagement falls along the year, although some more research is needed to take any conclusions. The first one would be that students get tired along the year, so they put less effort as the end of year approaches. Following the same mindset, maybe students have already achieved good scores in the beginning of the year and don’t need to put much more effort to pass school year. In Brazil, school grades are not taken to account for the approval at University.

Another hypothesis for this result is that along the year students decreased their interest in studying online and preferred studying using regular textbooks, a variable that is not being considered in this study.

b) School Calendar and Student Achievement

Using the second database, the result of regression 6 (shown in Table 4) shows that the impact the number of holidays has in the ENEM score is not statistically significant, as showed bellow:

<table>
<thead>
<tr>
<th>ENEM Score</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>492.227***</td>
</tr>
<tr>
<td></td>
<td>(2.704)</td>
</tr>
<tr>
<td>NumHolidays</td>
<td>0.400</td>
</tr>
<tr>
<td></td>
<td>(0.188)</td>
</tr>
</tbody>
</table>

Notes: ***P<0.01; **p<0.05; *p<0.1
Robust standard errors are reported in parenthesis.

Regression 7 shown in Table 5 indicates that cities with more holidays that happen in the months of March, May, and August are associated with a higher score in the ENEM. Cities with more holidays in the months of January and October are associated with a lower ENEM score¹.

¹ I ran regression 7 once more exclusively for the 60 cities used in database 1, but the result was not statistically significant.
### Table 5 - Holidays each month and ENEM Score (Regression 7)

<table>
<thead>
<tr>
<th></th>
<th>ENEM Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holidays Jan</td>
<td>-1.546*</td>
</tr>
<tr>
<td></td>
<td>(0.887)</td>
</tr>
<tr>
<td>Holidays Feb</td>
<td>-1.364</td>
</tr>
<tr>
<td></td>
<td>(1.437)</td>
</tr>
<tr>
<td>Holidays Mar</td>
<td>5.152 ***</td>
</tr>
<tr>
<td></td>
<td>(1.032)</td>
</tr>
<tr>
<td>Holidays Apr</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>(1.499)</td>
</tr>
<tr>
<td>Holidays Mai</td>
<td>2.670 **</td>
</tr>
<tr>
<td></td>
<td>(1.072)</td>
</tr>
<tr>
<td>Holidays Jun</td>
<td>-0.324</td>
</tr>
<tr>
<td></td>
<td>(0.771)</td>
</tr>
<tr>
<td>Holidays Jul</td>
<td>0.331</td>
</tr>
<tr>
<td></td>
<td>(0.730)</td>
</tr>
<tr>
<td>Holidays Aug</td>
<td>1.787 *</td>
</tr>
<tr>
<td></td>
<td>(0.930)</td>
</tr>
<tr>
<td>Holidays Sep</td>
<td>0.657</td>
</tr>
<tr>
<td></td>
<td>(0.606)</td>
</tr>
<tr>
<td>Holidays Oct</td>
<td>-4.397 ***</td>
</tr>
<tr>
<td></td>
<td>(0.989)</td>
</tr>
<tr>
<td>Constant</td>
<td>502.385 ***</td>
</tr>
<tr>
<td></td>
<td>(3.528)</td>
</tr>
</tbody>
</table>

n = 8618
R² Overall = 0.000

***P<0.01; **p<0.05; *p<0.1
Robust standard errors are reported in parenthesis.

A hypothesis that could have led to this result is that students need time to assimilate what they learn. When studying at the end of the year, there is little time to consolidate the learning before the exam. In contrast, when studying at the beginning of the year, there is more time to assimilate and achieve a better score in exams. This hypothesis explains the reason why the $\beta_{71}$ coefficient drops over the year.

In line with the last hypothesis, students that study during the month prior to the exam have less time to assimilate what they study and most likely they are nervous for the examination. For this reason, even if students study during the last month, this has negative impact on ENEM score.
6. Discussion

Under the hypothesis that holidays impact the ENEM score exclusively by students’ effort, it is possible to write the following structured model:

\[
\begin{align*}
U_{it} &= \alpha_{10} + \beta_{11} DHolidayw_{it} + \gamma_t + \theta_t + \epsilon_{it} & (1) \\
S_{it} &= \beta_{80} + \beta_{81} U_{it} + \psi_i + \phi_t + \mu_{it} & (8)
\end{align*}
\]

Which regression 1 is the same as presented in the previous section: \(U_{it}\) is the number of normalized users studying online in a week, \(DHolidayw_{it}\) is the number of holidays in a weekday, \(\gamma_t\) is the fixed effect of the city and \(\theta_t\) is the fixed effect of the week. In regression 1, \(i = 1\) to \(60\), representing the cities and \(t = 22\) to 42 representing the weeks. In regression 8, \(S_{it}\) is the average ENEM score of a city in a year, \(U_{it}\) is the same as in regression 1, \(\psi_i\) is the fixed effect of the city and \(\phi_t\) is the fixed effect of the year, where \(i = 1\) to 4261 cities and \(t = 2012\), 2013 and 2014.

Substituting (1) in (8), the result is a regression equivalent to regression 7:

\[
S_{it} = \beta_{80} + \beta_{81} \alpha_{10} + \beta_{11} \beta_{81} DHolidayw_{it} + \beta_{81} \gamma_t + \psi_i + \beta_{81} \theta_t + \phi_t + \beta_{81} \epsilon_{it} + \mu_{it}
\]

Using the two-sample instrumental variable estimation, we have:

\[
\begin{align*}
\pi_0 &= \beta_{80} + \beta_{81} \alpha_{10} & (9) \\
\pi_1 &= \beta_{11} \beta_{81} & (10)
\end{align*}
\]

Equation 10 can be written as: \(\beta_{81} = \frac{\pi_1}{\beta_{11}}\). To verify the effect of the effort in the last month prior to the ENEM, I will substitute \(\alpha_{11}\) by the coefficients of regression 1 and \(\pi_1\) by the coefficient of the month of October in regression 7, we have:

\[
\hat{\beta}_{81} = \frac{-4.397}{-0.369} = 11.91. \text{ By Delta Method}^2 \text{ we have } SE(\hat{\beta}_{81}) = 2.75 \text{ and } t = \frac{11.91}{2.75} = 4.32.
\]

\[^2\text{The Delta Method was used to calculate the standard error of } \hat{\beta}_{81}\text{ and was based on the hypothesis that the covariance of } \pi_1, \alpha_{11} = 0, \text{ making the estimation inefficient.}\]

\[
\begin{align*}
SE(\hat{\beta}_{81}) &= \left\{ \frac{\partial h}{\partial \pi_1} = \frac{1}{\alpha_1} \frac{\partial h}{\partial \alpha_{11}} = -\pi_1 \right\} \left[ V(\pi_1) 0 \right] \left[ V(\alpha_{11}) \frac{1}{\alpha_1} \frac{1}{\pi_1} \right]^{\frac{1}{2}} \\
SE(\hat{\beta}_{81}) &= \left\{ \left[ \frac{-1}{0.369} \right] \left[ 0.978 \right] \right\} \left[ 0.021 \right] \left[ \frac{1}{0.369} \right]^{\frac{1}{2}} = 2.75
\end{align*}
\]
This result indicates that a city that studies 1 standard deviation more than another one month prior to the ENEM increases 12 points in the ENEM score, controlling by the effect of the city and year and considering that the number of holidays impacts the ENEM score exclusively by student’s effort.
7. Conclusion

This study aims to analyze how holidays affect students’ effort whilst preparing themselves for the Brazilian ENEM, how does the approach of the ENEM and end of year school exams shift students’ behavior, and how school calendar impacts students ENEM scores.

Analyzing students’ studying effort in 2015 by data collected from an online studying platform and how it is affected by school calendar, showed that cities with more holidays have less students studying online. This effect is stronger when comparing students’ effort during holidays closer to the ENEM.

Using a second database to compare school calendar with ENEM scores, the number of holidays in a city in a year has no impact in their ENEM grade. In oppose to this, cities with more holidays in October, weeks prior to the exam, are associated with a lower score in the ENEM.

Under the hypothesis that holidays impact the ENEM score exclusively by students’ effort, it can be inferred that more effort in October can lead to a higher score, controlling by the fixed effect of the year and city.

This information has direct consequences in students’ academic performance and more study should be done to understand how to take advantage of this finding by policy makers, pedagogues and parents.
References


Faculdades que aceitam o ENEM. Available at <www.guiadacarreira.com.br> access at 01/may/2016


