

Opportunism in a Library

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Introdução

In this paper, I present novel evidence related to opportunism in a common-pool resource. Specifically, I study the behavior of users in a university library during a three-year period, with an emphasis on borrowing patterns.

Problema de Pesquisa e Objetivo

Which factors drive opportunistic behavior in real-world settings? Does opportunism vary through time? I want to answer the following questions: (i) Does opportunism rise in specific times of the academic year? (ii) How do different types of punishment affect opportunism?

Fundamentação Teórica

This paper dialogues with several literatures. First, the results described in this paper also add to the growing evidence related to behaviors observed in a field setting. Second, while most of the previous contributions in the literature related to common-pool resources emphasized examples related to themes such as forests, fisheries, and wildlife in general, I present an example of application related to an information commons (libraries).

Metodologia

I have access to confidential daily data related to library users of a private university in São Paulo, Brazil, during the 2004-2006 period. The dataset corresponds to an unbalanced panel of 3,303 individual users, covering 12,918 observations. I base my analysis on panel data count methods.

Análise dos Resultados

I uncover two main results. First, the frequency of opportunistic behaviors increases during recover exams' weeks, which suggests that users take advantage of the library's rivalry property. Second, the instauration of a monetary fee in a specific moment of time – an “institutional change”, in this context – exerts a negative effect on opportunistic behaviors, a result consistent with theories based on monetary incentives.

Conclusão

The results reported in this paper are important not only for providing a better understanding of the determinants of opportunism and the impacts of institutional change over common-pool resources' management, but also for shedding light on issues such as economic incentives, social norms, and corruption in real-world settings.

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Opportunism in a Library

Abstract

In this paper, I present novel evidence related to opportunism in a common-pool resource. I study the behavior of users in a university library (an information commons) during a three-year period, with an emphasis on their borrowing patterns. Since libraries are an example of common-pool resources (non-exclusive but rival), I use a measure of delay in return of specific items as a proxy for opportunistic behavior. In doing so, I want to answer the following questions: (i) Does opportunism rise in specific times of the academic year? (ii) How do different types of punishment affect opportunism? Based on panel data models, I uncover two main results. First, the frequency of opportunistic behaviors increases during recover exams' weeks, which suggests that users take advantage of the library's rivalry property. Second, the instauration of a monetary fee in a specific moment of time – an “institutional change”, in this context – exerts a negative effect on opportunistic behaviors, a result consistent with theories based on monetary incentives. The results reported in this paper are important not only for providing a better understanding of the determinants of opportunism and the impacts of institutional change over common-pool resources' management, but also for shedding light on issues such as economic incentives, social norms, and corruption in real-world settings.

Keywords: common-pool resources; information commons; opportunism.

Opportunism in a Library

1. INTRODUCTION

Which factors drive opportunistic behavior in real-world settings? Does opportunism vary through time? In this paper, I present novel evidence related to opportunism in a common-pool resource. Specifically, I study the behavior of users in a university library during a three-year period, with an emphasis on borrowing patterns. In doing so, I want to answer the following questions: (i) Does opportunism rise in specific times of the academic year? (ii) How do different types of punishment affect opportunism?

I exploit the fact that libraries are an example of a common-pool resource (non-exclusive, but rival). The non-exclusive property means that libraries cannot easily exclude specific users from the benefits generated by its services. On the other hand, the rivalry property means that different users cannot simultaneously borrow the same library item. In this case, users who do not return items on predicted dates might generate a negative externality for the population of library users. In fact, the latter property (rivalry) might induce competition among distinct users for library resources, especially during specific times of the academic year, such as final exams' week, for instance (when congestion rises). Given this possibility, I conjecture that opportunistic behavior may emerge in such situations.

If confirmed, this hypothesis has important implications for the areas of organizational economics and public policy analysis. For instance, several theories in management, accounting and economics rely on opportunistic behavior, such as principal-agent theory and team theory, just to cite a few examples. By providing additional empirical evidence related to these theories, this paper contributes to different literatures on the subject of social dilemmas inside and outside organizations.

I have access to confidential daily data related to library users for the 2004/2006 period. The data contains information on users' socioeconomic characteristics, as well as their borrowing behavior during the period over analysis. Based on this data, I am able to track users' daily behavior over time, which allows me to analyze the impacts of different "rules of the game" over distinct agents' behavior. In particular, by adopting a specific definition of institutions (North, 1990, 1991), this novel data allows me to study the effects of institutional change on agents' behavior in a setting involving a common-pool resource¹. In fact, similar to a few recent studies, the main advantage of this dataset is the possibility, for the researcher, to perfectly observe rule compliance in a real-world setting (Apesteguia, Funk, & Iriberry, 2013; Haselhuhn, Pope, Schweitzer, & Fishman, 2012)².

¹ Although I adopt North's (1990, 1991) definition, I am aware that this is a very specific definition of institutions. See Eggertsson (1990) and Hodgson (2006) for alternative definitions and related discussions on this theme. Commons (1931) correspond to a seminal contribution related to Institutional Economics, while Williamson (2000) describes some of the main concepts related to the New Institutional Economics.

² Haselhuhn et al. (2012) follow a similar approach when analyzing the impacts of personal experience with fees faced by video-rental users. The authors employ a dataset on video store transactions from 10,000 customers during a two-year period (2003/2004). On the other hand, Apesteguia et al. (2013) report the results of a randomized field experiment in public libraries located in Barcelona during the 2009 year.

Using panel data count models, I uncover two main results. First, the frequency of opportunistic behaviors increases during recover exams' weeks, which suggests that users take advantage of the library's rivalry property during specific moments of time. Second, the instauration of a monetary fee in the 2006-year – an “institutional change”, in this context – exerts a negative effect on opportunistic behaviors, a result consistent with theories based on monetary incentives (Becker, 1968). These results are important not only for providing a better understanding of the impacts of institutional change over common-pool resources' management, but also for shedding light on issues such as economic incentives, social norms, and corruption in real-world settings.

This paper has four additional sections. In the next section, I present definitions related to public goods, club goods and common-pool resources, as well as the main testable hypotheses used in the empirical analysis below. The third section describes details related to data construction and the econometric models employed in the analysis. The fourth section presents the main results of the empirical analysis, as well as robustness' tests. Finally, the fifth section concludes and discusses future directions of research.

2. BACKGROUND AND HYPOTHESES

This paper dialogues with several literatures. As stated above, opportunism came as an important behavioral assumption in previous research, over the last decades. When associated to other hypotheses – such as bounded rationality (Simon, 1955) and asset specificity (Williamson, 1985) – opportunism had important implications for areas such as transaction cost economics (Williamson, 1985, 1996, 2010). On the other hand, the literature on common-pool resources, although extremely rich and insightful, has not relied on opportunism as one of its main ingredients (Cárdenas, 2003; Fehr & Leibbrandt, 2011; Ostrom, 1990, 1999). The present paper attempts to bridge the gap between these two areas, while providing related empirical evidence³.

The results described in this paper also add to the growing evidence related to behaviors observed in a field setting (Cárdenas & Ostrom, 2004; Fehr & Leibbrandt, 2011). Specifically, this paper contributes to a growing body of research related to observed behavior in field settings involving common-pool resources (Cárdenas & Ostrom, 2004; Cárdenas, 2003). Although I do not perform a field experiment *per se*, I present results related to behavior in the field, along the lines suggested by other authors (Apestequia et al., 2013; Haselhuhn et al., 2012; Levitt & List, 2009; Levitt, 2006; List, 2011). Additionally, these results emphasize the importance of culture for economic outcomes (Alesina & Giuliano, 2015), as well as social norms (Coleman, 1990; Gneezy, Leibbrandt, & List, 2013; Ostrom, 2000), and corruption (Fisman & Miguel, 2007; Glaeser & Goldin, 2006; Mauro, 1995; Svensson, 2005).

Finally, while most of the previous contributions in the literature related to common-pool resources emphasized examples related to themes such as forests, fisheries, and wildlife

Although there are similarities between these contributions and the present paper, their focus is not on opportunistic behavior.

³ For examples of studies aimed at testing different aspects of transaction-cost theory, see Joskow (1987), Poppo and Zenger (1998), and Zylbersztajn and Lazzarini (2005). Macher and Richman (2008), Masten (1996), and Ruester (2010) correspond to surveys related to empirical studies in transaction-cost economics.

in general (Cárdenas, 2003; Dietz, Ostrom, & Stern, 2003; Ostrom, 2007; Zylbersztajn, 2010), I present an example of application related to an information commons (libraries). The simplicity of this unique setting constitutes a major strength of the present paper. I study an everyday situation where I can observe the way the library creates its rules and enforcements, which allows me to focus my analysis on specific aspects of users' behaviors.

As far as I know, this is probably the first attempt to study opportunistic behavior in a specific type of common-pool resource, an information commons. In this sense, the present paper also contributes to the literature in the library and information studies field, especially in terms of thinking new ways to identify opportunistic behavior as well as to preserve libraries' stocks and flow of services⁴. While most economists' contributions in the latter field either tried to (i) understand alternative ways to finance libraries, or (ii) estimate libraries' costs and/or production functions (Van House, 1984), this paper uses libraries as a real-world example of a common-pool resource and tries to estimate the impacts of distinct institutional arrangements over users' behavior (Hess & Ostrom, 2007)⁵.

Given the rivalry property of a common-pool resource and/or information commons, I conjecture the following hypothesis:

H1: devolution delays (lateness) will be higher during exam weeks.

Specifically, since the rivalry property means that different users cannot simultaneously borrow the same library item, I propose that it might induce competition among distinct users for library resources, especially during final exams' week, for instance.

Additionally, because the library implemented a monetary fee for delayed items in 2006, I consider it a proxy for "institutional change" in this context (where institutions are seen as "rules of the game"). Based on this information, I propose two additional hypotheses:

H2: types of punishment based on non-monetary factors (such as suspension days) will decrease devolution delays (lateness).

H3: the instauration of a monetary fee for library items will also decrease devolution delays (lateness), but by a larger volume.

⁴ Today there is a large – although scattered – volume of contributions related to the economic importance of libraries. Part of this literature uses the term "learning commons" to refer to a new working model for libraries that "...integrates library, information technology and other academic support services to provide a continuum of services to the user ... It is a dynamic place that encourages learning through inquiry, collaboration, discussion and consultation." (McMullen, 2008). See also Getz (1989), Koechlin (2010) and Van House (1984) for detailed discussions related to the economic importance of libraries.

⁵ In terms of terminology, I follow Hess and Ostrom (2007) by employing the terms "information commons" and "knowledge commons" as synonyms. Specifically, they define "commons" as "...a resource shared by a group of people that is subject to social dilemmas." (Hess & Ostrom, 2007, p. 3). According to the authors: "Libraries ... have been the quintessential strongholds of democracy. Traditionally, libraries have been the 'protected areas' of the knowledge commons and librarians are the stewards." (Hess & Ostrom, 2007, p. 13).

3. STUDY: METHODS

3.1. *Sample*

I have access to confidential daily data related to library users of a private university in São Paulo, Brazil, during the 2004-2006 period. The dataset corresponds to an unbalanced panel of 3,303 individual users, covering 12,918 observations (this is an unbalanced panel because each user may borrow different quantities of specific library items). It contains information on users' socioeconomic characteristics – such as gender and date of birth – as well as library's confidential information, such as each user's identification number and his or her university category (undergraduate student, master's student, professor, employee, etc.). The data covers distinct undergraduate and graduate courses (Master's Programs), as well as MBA courses. This dataset also contains the dates when each user borrowed specific items from the library, as well each item's code (books, theses, CDs, DVDs, etc.). In this case, when a user borrows an item, the library's electronic system automatically generates a devolution date based on the user's university category and the item he or she borrows.

Besides these dates, I also have access to the dates when each user actually returned each item, which allows me to build a measure of delayed returns, named “lateness” (more details below). I complement this data with information related to exams' weeks occurred in the university in the sample period. In the latter case, official exams occur during a two-week period every six months (named “exames”, in Portuguese). If a student does not pass these exams, he or she has the chance to take a “recover exam” (“reaval”), which takes place one week after official exams.

Additionally, based on internal reports from the library, I build an indicator variable, named “D2006”; in order to capture the change occurred in the type of penalty for late delays, when users started paying a monetary fee of R\$ 1.00 for each delayed item. This penalty started in 1/1/2006 (in previous years, users with late items faced a non-monetary fee: the library would suspend them for a specific number of days). As described above, I consider the instauration of this monetary fee as a proxy for “institutional change” in the inner workings of the library (where institutions are seen as “rules of the game”).

3.2. *Variables*

3.2.1. *Dependent Variable*

Since I am interested in obtaining correlations among delayed items in the library and specific regressors, I build a measure related to the time patterns of devolutions of specific library items (books, CDs, DVDs, etc.) for all users in the sample. Specifically, I build the following index:

$$\text{Lateness} = \text{item loans' effective duration (days)} - \text{item loans' predicted duration (days)} \quad (1)$$

Basically, “lateness” corresponds to the number of days that a user takes to return specific items to the library. This is a discrete, non-negative variable, which makes it suitable for

the use of count-based models (more details below) (Blevins, Tsang, & Spain, 2015; Cameron & Trivedi, 2009)⁶.

3.2.2. Independent Variables

Here I describe the main specification employed in the econometric estimations below (this specification might be subject to minor modifications, according to the econometric method considered). I do this in order to describe each regressor, as well as its expected sign on the dependent variable (lateness). My main specification is the following:

$$\text{Lateness}_{it} = \alpha_i + \beta_1 * (\text{'Punishment Days}_{it}\text{'}) + \beta_2 * (\text{'Exam Week'}) + \beta_3 * (\text{'Recover Exam Week'}) + \beta_4 * (\text{'D2006'}) + \beta_5 * \text{Controls}_{it} + \varepsilon_{it} \quad (2)$$

In the above specification, the dependent variable is “lateness”, while the term “Punishment Days” describes the number of days that each user was forbidden to use the library’s services for previous items’ delays. On the other hand, the terms “Exam Week” and “Recover Exam Week” denote the university’s official dates for exams. In the case of the first variable, it corresponds to an indicator variable that assumes a unit value for days corresponding to official exams. In the case of the second variable, it corresponds to an indicator variable that assumes a unit value for days corresponding to official recover exams.

In the latter case, the university policy allows students to retake exams if they do not meet the minimum standards for approval in their first attempt. The term “D2006” corresponds to an indicator variable that assumes the unit value for the period between January 1st, 2006 and September 21st, 2006, when a monetary fee was implemented in the library for delayed items⁷. I control for users’ characteristics in the regressions described above by including some of their personal information, such as age, age squared and gender. In doing so, I want to verify if there are significant differences among users based on gender and life-cycle characteristics⁸.

4. STUDY: RESULTS

In this section, I describe the main results of the empirical analysis conducted. The section contains two subsections: one related to descriptive statistics, and another related to the estimation of econometric count models.

4.1. Descriptive Statistics

⁶ When analyzing corruption practices among United Nations’ diplomats, Fisman and Miguel (2007) also employ models of this kind. See Blevins et al. (2015) for an extended treatment on the estimation of count models.

⁷ When surveying part of the literature related to the economics of libraries in the 1980s, Van House (1984) cites that the evidence related to the introduction of user fees in libraries was still inconclusive at the time. See Haselhuhn et al. (2012) for an analysis of the impact of fines on the behavior of users of a video rental store.

⁸ The main motivation for including these users’ characteristics is to analyze behavioral differences in terms of gender and age, as suggested by previous experimental and field research (Antonovics, Arcidiacono, & Walsh, 2005; Apesteguia et al., 2013; Levitt, 2004; Niederle & Vesterlund, 2007).

Tables 1 and 2 contains descriptive statistics and correlation coefficients among the main variables of interest, respectively:

Table 1
Main Variables' Descriptive Statistics

Variables	Observations	Mean	Std. Deviation	Minimum	Maximum
Lateness	12,918	9.486	19.77	0	386
Age	12,918	26.46	7.984	14	67
Gender	12,618	0.4452	.497	0	1
Exam Week	12,918	0.0725	0.259	0	1
Recover Exam Week	12,918	0.0284	0.166	0	1
Predicted Duration	12,918	8.337	4.792	-1	122
Effective Duration	12,918	17.77	20.39	1	393
Penalty Days	12,918	19.36	52.59	0	762
D2006	12,918	0.355	0.478	0	1

Source: author's calculations, based on library data. Notes: (a) "Gender" and "Age" corresponds to each user's gender and age, while "(Age)²" is the squared value of users' ages. "Exam Week" corresponds to an indicator variable that assumes value 1 for exams' weeks ("exame") and 0, otherwise, and "Recover Exam Week" corresponds to an indicator variable that assumes value 1 for recover exams' weeks ("reaval") and 0, otherwise. "D2006" is an indicator variable that assumes value 1 for the period between 1/1/2006 and 9/21/2006, when the library instituted a monetary fee.

A few interesting patterns emerge from a first look at the data. First, these descriptive statistics reveal that exams' weeks cover 7.25% of the total sample period, while recover exams' cover 2.84%, only. This result makes sense given the time allocated for the former type of exam by the university, when compared to the latter.

Second, when comparing the predicted and effective duration of the library's items that users borrow, the statistics show a clear pattern of delays over time: while the predicted duration is, on average, around 8.34 days, the effective duration is more than two times larger (17.77 days). Additionally, one notes the disparity between maximum durations in this case, since the maximum predicted duration is 122 days (around four months), while the maximum effective duration is longer than a year (393 days). At first, these results suggest the occurrence of delay patterns over time. In fact, the main variable of interest ("lateness") presents a mean value of 9.49 days, as well as a maximum value of 386 days, which is also longer than a calendar year.

Third, when the type of penalty imposed by the library to delayed items by specific users is measured in days (for the 2004/2005 years), the average penalty is around a month (30.01 days), although there is a lot of dispersion in this kind of punishment (standard deviation of 63 days). During the total sample period, it ranged from two days to more than two years (762 days).

In the case of cross-correlations among variables, although most of them are not statistically significant, one notes that the variable "lateness" is strongly correlated with "effective duration" and "penalty days" (correlation coefficients of .97 and .99, respectively). This result is expected since the first variable was built based on effective duration (lateness = effective duration – predicted duration), while both types of punishment (in days and in monetary terms) are increasing functions of lateness. This is

probably the reason why “penalty days” also strongly correlates with “effective duration” (correlation coefficient of .5).

Interestingly, “lateness” does not present a statistically significant correlation with “predicted duration”. Another interesting result is the estimated correlation coefficient between predicted and effective durations (.24), which suggests a weak correlation between both types of duration. Finally, it is worth noting that the indicator variable representing each user’s gender presents a significant (but weak) correlation with both “lateness” and “effective duration” (correlation coefficients of -.03). At first, this could be an indication of gender differences in terms of opportunistic behavior in this setting, although formal tests are more adequate for such an inference.

Table 2
Cross-Correlations among Variables

Variables	Lateness	Age	Gender	Exam Week	Recover Exam Week	Predicted Duration	Effective
Lateness	1.00						
Age	0.00 (1.00)	1.00					
Gender	-0.03* (0.09)	0.03* (0.05)	1.00				
Exam Week	-0.01 (1.00)	-0.05*** (0.00)	-0.02 (0.92)	1.00			
Recover Exam Week	0.03** (0.03)	0.00 (1.00)	0.01 (1.00)	-0.05*** (0.00)	1.00		
Predicted Duration	0.01 (1.00)	0.19*** (0.00)	0.00 (1.00)	0.01 (1.00)	-0.01 (1.00)	1.00	
Effective Duration	0.97*** (0.00)	0.05*** (0.00)	-0.03* (0.07)	-0.01 (1.00)	0.03 (0.15)	0.24*** (0.00)	1.00
Penalty Days	0.99*** (0.00)	-0.04*** (0.00)	-0.01 (1.00)	-0.01 (1.00)	0.04* (0.05)	0.00 (1.00)	0.99*** (0.00)
D2006	-0.14*** (0.00)	-0.03** (0.01)	0.03* (0.09)	0.03** (0.03)	0.04*** (0.00)	0.09*** (0.00)	-0.14*** (0.00)

Source: author's calculations, based on library data. Notes: (a) "Gender" and "Age" corresponds to each user's gender and age, users' ages. "Exam Week" corresponds to an indicator variable that assumes value 1 for exams' weeks ("exame") and 0, otherwise, a to an indicator variable that assumes value 1 for recover exams' weeks ("reaval") and 0, otherwise. "D2006" is an indicator variable between 1/1/2006 and 9/21/2006, when the library instituted a monetary fee. (b) P-values reported in parentheses. (c) The term significance at the 10%, 5%, and 1% levels, respectively.

4.2. Econometric Results

In this subsection, I present the results of estimations based on count models. The main advantage of these models is that they consider the dependent variable (“lateness”) as a discrete and non-negative variable. Additionally, it is important to emphasize that estimations which do not consider the count-based nature of the dependent variable (such as POLS, for instance) may generate biased estimates. Table 3 contains estimates obtained from negative binomial models:

Table 3
Count Models’ Estimates, Negative Binomial distribution (Dependent Variable: Lateness)

Variables	Model X	Model XI	Model XII	Model XIII
	Negative Binomial	Panel Negative Binomial	Fixed-Effects Negative Binomial	Random-Effects Negative Binomial
Gender	-0.09** (0.042)	-0.09* (0.047)	0.13*** (0.049)	-0.02 (0.021)
Age	-0.02 (0.016)	-0.03 (0.021)	0.05*** (0.016)	0.01* (0.008)
(Age) ²	0.00 (0.000)	0.00 (0.000)	-0.00** (0.000)	-0.00* (0.000)
Penalty Days	0.01*** (0.001)	0.01*** (0.000)	0.01*** (0.000)	0.01*** (0.000)
Exam Week	-0.12** (0.048)	-0.11** (0.049)	-0.07** (0.027)	-0.08*** (0.024)
Recover Exam Week	0.31 (0.217)	0.34 (0.209)	0.23*** (0.038)	0.24*** (0.034)
D2006	0.09 (0.055)	0.07 (0.054)	-0.08*** (0.018)	-0.10*** (0.015)
Observations	12,618	12,618	11,669	12,618
Log likelihood	-36341.43	--	-21939.63	-34526.28
Number of Users’ ID		3,303	2,355	3,303

Source: author’s calculations based on library data. Notes: (a) “Gender” and “Age” corresponds to each user’s gender and age, while “(Age)²” is the squared value of users’ ages. “Exam Week” corresponds to an indicator variable that assumes value 1 for exams’ weeks (“exame”) and 0, otherwise, and “Recover Exam Week” corresponds to an indicator variable that assumes value 1 for recover exams’ weeks (“reaval”) and 0, otherwise. “D2006” is an indicator variable that assumes value 1 for the period between 1/1/2006 and 9/21/2006, when the library instituted a monetary fee. (b) Estimates’ standard errors reported in parentheses. (c) The terms (*), (**) and (***) denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Once I consider count models, some interesting patterns emerge. First, users’ gender is statistically significant and presents a negative sign, suggesting that, in the case of this dataset, male users have lower expected counts of delayed items when compared to female users. Similarly, both age and age squared are statistically significant, although the estimates are not robust in terms of sign. While most specifications suggest a negative impact of age on counts of delayed items (coefficients in the -.03/.05 range), the estimated coefficients for age squared suggest the inexistence of non-linear effects of life-cycle characteristics over behavior in the current setting.

Results are also interesting in the case of exams’ and recover exams’ weeks. In the case of the first variable, it reduces the expected number of delay counts (estimates in the -.12/-.07 range), while in the case of the second variable, it raises the expected number of

delay counts (.23/.31 range), with all estimates being significant at the 1% significance level. Taken together, these results suggest the existence of significant differences among users in terms of observed behavior in the library during specific periods. Specifically, while there is no evidence of opportunistic behavior during exams' weeks, the same does not happen during recover exams' weeks.

In terms of distinct punishment forms, two results emerge. First, the variable "penalty days" presents a robust and statistically significant positive coefficient over the expected count of library delays; second, the indicator variable "d2006" exerts a negative (and statistically significant) effect over such delays (in the -.1/.09 range). These results suggest that different forms of punishment might have different impacts over users' lateness.

Although fixed-effects models have the disadvantage of eliminating part of the sample during estimation, they have the advantage of considering individual heterogeneity, which may be a major driver of my results. Overall, I see the results from these models as the most suggestive, given the importance of individual effects, as well as the non-random nature of the data⁹.

5. GENERAL DISCUSSION

In this paper, I presented the results of a study aimed at measuring opportunistic behavior in a common-pool resource. Specifically, I investigated which factors drive opportunistic practices in a real-world situation, based on the behavior of users in a university library during a three-year period (2004/2006), with an emphasis on borrowing patterns. Given the rivalry property of library services for their users, one could expect that opportunism would rise in specific times of the academic year, such as exams' and recover exams' week, for instance. Below, I discuss the main implications of these results in terms of research and practice in organizations.

Implications for Research

One important consequence of these results relates to the process of institutional change. While most contributions to the literature focused on aggregate effects of institutional change (Aoki, 2007; Greif & Laitin, 2004; North, 1990), this paper's results directly relate to research efforts focused on applied examples of institutional change taking place at the micro level (Ostrom, 2007). Although I do not discuss the detailed implications of institutional change in an information commons' setting, the main results described in this paper add to the growing evidence related to the theme.

Additionally, this paper is probably one of the first attempts to analyze individual behavior in an information commons. While most of the literature on the theme concentrated on determining precise definitions of related terms, and tried to analyze some of its main implications for relevant situations – such as the diffusion of the internet and the new role of libraries in the digital age – there were few efforts aimed at empirically

⁹ One additional possibility to consider during the estimation of count models is the presence of an excess number of zeros in the dependent variable. In such situations, zero-inflated models may be a more adequate option. I present the results of related tests in Appendix A.

testing its main insights (Hess & Ostrom, 2007). By providing results related to the hypotheses tested above, I hope to stimulate more research on empirical topics related to information commons.

The results related to the instauration of a monetary fee in a specific point in time (2006) also dialogue with previous studies related to the importance of economic incentives (Becker, 1968). For instance, when analyzing the behavior of customers of a video-rental store, Haselhuhn et al. (2012) conclude that a personal experience with monetary fees significantly boosts users' future compliance. Additionally, according to these authors, larger fines have a stronger effect over compliance than smaller fines. In this sense, the results presented in this paper confirm the authors' previous results, since the instauration of a monetary fee in the library studied generated, on average, a decrease in the expected count of delayed items¹⁰.

Implications for Practice

The results reported in this paper have direct implications for organizational behavior such as team management, hold up issues, and incentive schemes. In terms of team management, an old question, related to the impossibility of measuring distinct members' contributions in teamwork, could lead to free-riding behavior (Alchian & Demsetz, 1972; Croson, 2008). While this paper is focused on a very specific setting (a university library), it does shed light on differences in opportunistic behavior over time. In this regard, managers and decision makers could benefit from understanding the main determinants of such behaviors in their own organizational settings. For instance, a manager inspecting the performance of employees located in different plants could try to elicit differences in behavior during specific times of the day as a means to understand the determinants of cooperation in team arrangements.

On the other hand, given the importance of holdup issues for contract design and vertical integration (Klein, Crawford, & Alchian, 1978; Klein, 1990; Mesquita, Saes, & Lazzarini, 2011), one current challenge in organizations would be to understand which factors undermine such behavior. In this regard, the results reported in this paper could extend to other real-world settings involving the possibility of holdup behavior. A particularly promising direction would be to run field experiments inside organizations, as originally proposed by Bandiera, Barankay, and Rasul (2011). In this case, managers could gather valuable insights from observing situations involving social dilemmas in a real-world setting¹¹.

Finally, the result where an instauration of a monetary fee induced a reduction in opportunistic behavior calls attention to the importance of this kind of incentive in social dilemma situations in organizations. While I recognize the importance of non-monetary factors for observed behavior in organizations (Ellingsen & Johannesson, 2007), the reported results suggest that monetary incentives may still bring desired outcomes in

¹⁰ For a counter-example related to monetary incentives, see Gneezy and Rustichini (2000), who study the effects of instituting a fee in daycare centers in Israel. In this specific case, the introduction of monetary fees actually increased the number of late-incoming parents in the daycare centers (instead of decreasing it). According to the authors, such results might be a consequence of contracts' incompleteness.

¹¹ For examples of experimental studies related to holdup issues, see Antiqueira, Lazzarini, and Saes (2007), Mesquita et al. (2011) and Morita and Servátka (2013).

certain occasions, as suggested by the literature on economic incentives (Becker, 1968; Haselhuhn et al., 2012). Other than that, the application of some of the principles related to successful reports of common-pool resources' management throughout time and space might provide an innovative approach in these cases (Ostrom, 1990, 2010; Wilson, Ostrom, & Cox, 2013). For instance, when dealing with situations similar to common-pool resources' management, decision makers could think about using gradual monetary sanctions as a means to induce behaviors that could benefit the organization as a whole¹².

Limitations and Future Research

In terms of limitations of the present paper, one relates to the non-random nature of the data. Specifically, since I analyze a dataset containing users' information from a university library, one would expect that some kind of selection bias might affect my results, given that users have distinct characteristics when compared to non-users. While I try to control for this possibility by including fixed effects in some of the regressions above, I still cannot rule out explanations based on the non-randomness aspect of the data. In fact, I see the dataset's non-randomness as an additional reason for taking the results from count models with fixed-effects as the most suggestive evidence regarding users' behavior.

In terms of future research, possible extensions of the results presented in this paper would be at least three. First, a natural extension would be to build larger datasets related to users' behavior in other libraries. Given the existence of few studies of this kind, there would be no *a priori* reason to extend the present results to other settings, given the existing diversity of institutional settings, as well as their related consequences. In particular, research efforts along the lines proposed by Apesteguia et al. (2013) may represent a promising route of future research.

Second, it would be interesting to compare the behavior of users of distinct libraries in the same university, verifying the possible existence of differences based on department and/or major, for instance. An approach along these lines could generate valuable insights regarding the importance of factors such as culture (Alesina & Giuliano, 2015) and social norms (Coleman, 1990; Fisman & Miguel, 2007; Gneezy et al., 2013; Ostrom, 2000) in distinct settings, just to mention a few examples.

Finally, a promising route of research would be to run field experiments in similar settings, along the lines proposed by authors such as Apesteguia et al. (2013) and Chetty, Saez, & Sándor (2014), for instance. These studies not only correspond to seminal contributions in field experiments, but they also helped further our understanding concerning the impacts of distinct institutional arrangements and their consequences. In particular, field experiments aimed at testing some of the main insights contained in North, Wallis, and Weingast (2006), North (1990, 1991, 1994), Olson (1965), and Ostrom (2000, 2007, 2010) could bring important insights for applied researchers and policy makers in terms of a better understanding of opportunistic behavior involving common-pool resources.

¹² Masten (2000) discusses alternative theories of contract choice and design, with a special emphasis on the interaction between contract design and contract enforcement, as well as the explanatory power of alternative theories.

6. References

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