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Estrada Real: A Natural Experiment about Commercial Skills

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Abstract

This paper documents how culture can shape the behavior of individuals toward developing skills related to math and commerce. Using the historical construction of the Estrada Real by the Portuguese colonizer in Brazil as a natural experiment, I find that individuals in affected regions demonstrate higher scores in math and commerce-related questions in present-day national standardized exams. Further, I also explore how current bancarization is affected by this historical policy. It appears to influence residents into increased savings and more responsible use of credit. These results indicate that the culture, in spite of other explanations, is long-lasting and helps to explain these results.

JEL Codes: J24, G21, G53, N00, N36, Z10

Keywords: culture, financial literacy, bancarization, human capital, commerce

I Introduction

One in three subjects can respond correctly to basic questions about finance (Klapper and Lusardi, 2020). This situation is worse in developing countries. In the so-called BRICS (Brazil, Russia, India, China, and South Africa), on average 28% of adults are able to respond the same questions. Furthermore, financial knowledge is a subset of a larger set of skills regarding negotiation, bargaining, and commerce. Many of those skills are hard to be taught, but are used on a daily basis by tradesman. This has been shown to be particularly important in developing countries, that faces a short supply of managerial skills Bruhn, Karlan and Schoar (2010). A natural question emerges: how can economists take advantage of historical events to observe its long-run effects reflected in current population abilities?

In this study, I document a persistent effect of a policy intervention by Portugal in Brazilian colonial territory. I argue in this paper that the royal road delineated by the Portuguese crown in late 17th century contributed to the growth of an expertise particularly demanded in this region: commercial skills. Due to an extensive gold exploration, the *Estrada Real* became the only legal road to transport the ores. If individuals diverted, they could be arrested by the crown's inspectors. This restriction imposed individuals to stay within this road and explore the emerging business opportunity. Analogously to the theoretical studies of Banerjee and Newman (1993) and the simplification of Ghatak and Jiang (2002), I interpret the *Estrada Real* policy as an one-time change in wealth that induced inhabitants to become entrepreneurs. Also, the probability of being captured and punished by the crown is in line with the occupational choice of inhabitants. Thus, the subjects' decisions of settlement are expected to be correlated with future returns of entrepreneurship, in line with my identification strategy. The inhabitants behavior toward commerce is consistent with a change in local culture that can be identified in recent days.

As usual in papers about culture, and given the subjectivity of the topic, I adopt the following definition for my study: Culture is the set of norms and skills individuals had to develop historically in order to prosper and that are passed through generations without significant changes. Other studies present slightly different definitions for culture (e.g. Fernandez and Fogli, 2009; Lowes, Nunn, Robinson and Weigel, 2017). In my definition, I emphasize the human behavior to respond to incentives in order to prosper in a given environment. This helps to explain why the effect of the crown intervention can still be observed to the present day and are consistent with Culture being a potential mechanism.

I demonstrate how alternative explanations, such as the institutional and geographical hypotheses, can be ruled out by empirically testing them. Therefore, the hysteresis empirically demonstrated is mostly due to a local cultural shift towards commerce.

To measure present-day human capital related to commerce, it is desirable to obtain a measure at the individual level and in a large sample. To explore this possibility, I used public micro-data from the ENEM National Exam in Brazil from 2013 to 2019¹. After re-classifying the mathematics questions in "commerce-related", one can observe each individual responses to these questions conditional on the cultural exposure of the subject. In this paper, test answers for nearly 1 million candidates in seven years are compared from municipalities crossed by Estrada Real versus the neighboring municipalities that were not.

My findings indicate that individuals that live in municipalities from Estrada Real obtain from 0.93 to 1.45 percentage points more correct Commerce-related questions in the ENEM national exam. This effect is still a sizable effect of roughly 4.3%, since on average 27.84 percent of commerce questions are responded correctly. Also in line with the literature of financial literacy, I find that individuals from Estrada Real also perform better in more general math questions. Compared to individuals that live near, but outside Estrada Real, candidates obtain 0.77 to 1.43 percentage points more correct math questions in the exam. It is also an economic meaningful effect, given that the average respondent get 28.13 percent of math questions right in the full sample. The effect is likely not by chance. As [Klapper and Lusardi \(2020\)](#) mentions that financial literacy improvements frequently translates into improvements in other disciplines such as math and language.

This study also provides evidence about the financial behavior of individuals. I test if municipalities belonging to Estrada Real are better served by the banking sector (extensive margin) and if residents are more prone to save and to obtain credit (intensive margin). Whereas the number of bank branches in both groups are statistically the same, the volume of savings and lendings substantially differ. Lending volume is 6.7% to 11.0% lower in Estrada Real municipalities. In addition, volume of savings accounts in municipalities belonging to Estrada Real municipalities is 8.4% to 10.0% higher when compared to their neighbors. Thus, my results suggests that individuals with higher commercial skills save more and are less dependent of debt to finance their needs. This result is considered posi-

¹ In the current version of this paper, the microdata is no longer available at INEP (Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira) portal. The author luckily had this data saved in a computer.

tive in a country with so low financial literacy levels. Also, no differences can be observed in the supply of banking, suggesting that it is a demand-side effect.

My contribution to the literature of culture is to show how long-term effects of a policy can shape current human capital. My findings are consistent with an idea of culture, rather than the most common alternatives. In the literature of financial literacy, I document that commercial skills - a related concept to financial skills - can explain a more responsible use of the banking sector. In particular, the higher volume of savings and lower use of the credit provide important insights for financial inclusion. Further, while most of the literature focus on an experimental settings that might suffer from external validity and lack of statistical power, I use Brazil's historical richness as an ideal setting. In this study, almost 1 million of individuals are studied using an exam that is not designed to measure commercial skills. I count with a reclassification of questions that can be explored in other settings to take advantage of already established evaluation programs. Also, suggestions are presented for policymakers in order to account for regional idiosyncrasies that can help improve the effectiveness of teaching instruments and better use of financial products.

II Related Literature

The literature in economics of culture is vast. A seminal study in this field of research is [Guiso, Sapienza and Zingales \(2006\)](#) that propose a link between culture and economic outcomes. Authors show how religion and ethnic background can be used as instruments for culture and its causal link to development and stock market participation. Also, they find that culture can dictate the probability of an individual becoming an entrepreneur, its savings, and preferences for redistribution. [Van Rooij, Lusardi and Alessie \(2011\)](#) show that individuals that obtained low scores in an financial knowledge evaluation in Netherlands are less likely to participate in stock market. [Rocha, Ferraz and Soares \(2017\)](#) finds that regions in Brazil that received more immigrants due to a policy conducted in late XIX century , presented large income and education level more than a century later. They also use religion and country of origin as proxies for culture, and rule out culture as the driver of results. Other studies are in favor of culture in partially explaining their results. For instance, [D'Acunto, Prokopczuk and Weber \(2019\)](#) analyze the historical specialization of Jews in financial services. They find that counties with more Jewish persecution in

1920-1930 have less average stock market participation from 1984 to 2011. Culture is also interrelated with banking. [Fisman, Paravisini and Vig \(2017\)](#) use the epochal caste system in India as a proxy for culture and show that loan officers from a specific bank approve lower volume of credit for clients with different cultural backgrounds. In a similar setting, [Albareto, Galardo, Mistrulli and Sorvillo \(2022\)](#) find, with Credit Registry data from Italy, that borrowers from different countries and non-catholics pays higher interest rates. In addition, the interest rate charged for foreigners is a worse predictor of default than those for natives.

Closer to my setting, a study by [Brown, Henchoz and Spycher \(2018\)](#) explore the distinction in language spoken in schools within Switzerland. By using language as a proxy for cultural differences, authors survey 649 students with questions about finance and self-assessment of finance. Given the richness of their intervention, they can also obtain students' households data. French-speaking students obtained 1 percentage point less correct questions when compared to German-speaking students. Authors defend that the mechanism through which culture influence financial knowledge is by student's parents. For instance, by receiving pocket money and access to bank accounts at an early age, notably cultural elements of some societies. [Fernandez and Fogli \(2009\)](#) show that inherited aspects of culture in fertility rates and female participation in workforce. They find that second generational immigrants in US carry a relation with their country of origin. For instance, women whose ancestry is from countries with high woman labor force participation also are more likely to work. Because authors use mothers' country of origin, their analysis must be restricted to one generation.

But the relevance of culture can be seen to be long-lasting. In a longer time-frame [Lowes, Nunn, Robinson and Weigel \(2017\)](#) provides an evaluation by using 17th century variation in Central Africa villages borders. The two villages were separated by rivers for topological reasons. Authors applied cooperative games in these regions to observe how the descendants of the former institutions from Kuba Kingdom compare to those that developed its own system of rules after their separation in 17th century. People from places with more formal institutions (taxation, policy force, and so on) allocate less money to the other part and are more likely to stole money if the other player comes from other ethnic groups. Further, this study presents one of the first evidences for the interrelation of culture and institutions, proposed theoretically by [Tabellini \(2008\)](#). I add to this literature by showing the

long-term effect between culture, trade, and finance relying on a similar setting to measure culture.

There is a consistent body of research conducting Randomized Control Trials that tries to identify the effects - not always positive - of providing financial and managerial training. In Brazil, [Bruhn, Leão, Legovini, Marchetti and Zia \(2016\)](#) explore a large RCT with nearly 25 thousand Brazilian high-schoolers. Interestingly, they find mixed evidence for students purchasing behavior. Students in treated schools are more likely to graduate and save money, but also to use to use installments plans that are typically expensive in Brazil. Papers focusing on the role of entrepreneurial skills are also found in the literature. One interesting study by [Drexler, Fischer and Schoar \(2014\)](#) show that providing financial training for entrepreneurs can be more effective if the content is kept simpler. They compare two types of interventions but only the simpler version provided positive outcomes. [Bruhn, Karlan and Schoar \(2018\)](#) conducted a RCT with micro-entrepreneurs in Mexico. Using local consulting firms, they provided advise to treated firms and found that there is positive impact in profitability and several other performance measures. Still, many of the RCT studies often lack of large samples that could help to identify small effects. A recent meta-analysis of 76 Randomized Control Trials conducted by [Kaiser, Lusardi, Menkhoff and Urban \(2021\)](#) mentions this problem. Authors collect average treatment effects from several manipulations in teaching finance and find an aggregate effect in financial knowledge, budgeting, and saving, but no significant aggregate effect in credit, insurance, and remittances. However, my results should be compared with caution since I use a broader set of questions than those used in their sample.

Other studies also explores the uniqueness of Brazilian historical context. [Naritomi, Soares and Assunção \(2012\)](#) explore the colonial (sugar and gold) and post-colonial (coffee) booms to identify the formation of institutions in Brazil. The gold boom leads to a rush of travelers trying to comb the ground, rivers, and mines for gold. Authors observed lower levels of governance and access to justice in regions strongly affected by the gold boom. Also, they report that these municipalities are less likely to have radio station, libraries, and a substantial smaller number of hospitals. [Barsanetti \(2021\)](#) uses the presence of a system of indigenous trail that crossed South America to show that municipalities emerged in its surroundings. They also investigate the historical path influence on current transportation. Presence of modern railroads, however, are not explained by the presence

of tribes. They compare the Spanish and Portuguese sides of Brazilian territory, similarly to [Fujiwara, Laudaes and Valencia \(2017\)](#). Authors use the division provided by the Treaty of Tordesilhas, that divided Brazil in half, as a spatial discontinuity. They find that current inequality in the Portuguese side is larger due to larger volume of slaves sent to the region. Minas Gerais, Rio de Janeiro, and São Paulo are the regions that most received slaves, the very same covered by the Estrada Real in my study.

III Institutional Background

The European colonizers arrived in 1500 in the South America, but it took long to explore the vast territory. Only after the 17th century that the land started to be more pioneered. The concentration of explorers remained mainly in the coast, due to the difficulty to explore deeply in the woods ([Resende, 2015](#)). Spain and Portugal divided the new lands, and Brazil was part of the Portuguese side. Only after the discovery of abundant mines of gold in Ouro Preto, that expeditions became to occur in the deeps of Brazil. The importance of gold for Brazilian history was so remarkable, that the capital moved from the extreme northeast in Salvador to the southeast in Rio de Janeiro. Because of the mining, there was a large migration of ambitious people aiming to explore the opportunity to pan for gold.

One example are the *tropeiros*, individuals involved in transport of goods by long routes. According to [Simonsen \(1937\)](#) they were fundamental for development of populations densities and connecting peoples of the vast colonial Brazil for the next two centuries. They strongly influenced the region with their culture and with news brought from other parts of the country. The culinary from Minas Gerais, the origin of our road, is an example of a cultural trait developed with the mix of African and Portuguese cuisine. The troop of travelers required that locals developed business to attend their demands and having to depend less and less on hunting wild animals. At the time, bartering was common and merchants had to negotiate almost every transaction. Several resting points emerged in this track and rapidly other business appeared. According to Waldemar de Almeida Pereira, a famous Brazilian historian: "Minas Gerais is, and will ever be, the captaincy of all businesses" ([Rodrigues, 2001](#)).

Along the 18th century, the gold ores extracted in Ouro Preto were transported using oxes and mules by more than 700 kilometers to the coastal city of Paraty. At that

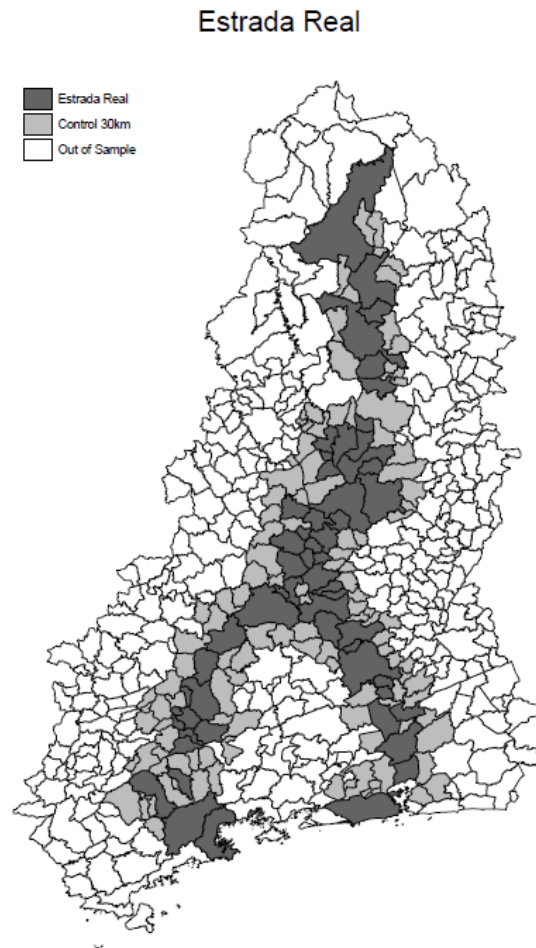
time, the exploration of gold by Portugal had monumental dimensions, but due to distance and tax avoidance, the activity presented substantial losses. After a strong fall in collected gold the Portuguese crown reacted. According to historians, the royal road was initially built to improve and control the transportation of gold ores and other precious stones from Diamantina-MG to the coastal city of Paraty-RJ (Boxer, 1969; Furtado, 1999; Chaves, 1999). In an attempt to increase inspection of the gold transported, the Portuguese Crown denoted some roads as the Royal Roads (*Estrada Real* in Portuguese). Furtado (1999) mentions that this route used to take 90 days before the royal road was constructed. In fact, small portions of the road were in fact built, being more a formal imposition than an increase in infrastructure. There are still large portions of dirt trails through the road. For instance, the first road became known as the Old Path. Along the 710km track from Ouro Preto-MG to Paraty-RJ, only 15.5% of asphalt is present in this track today.

A large concentration of commerce started to emerge within these roads. Several businesses such as inns and restaurants appeared in order to facilitate the long travel. Consequently, a concentration of human capital was required to attend the travelers' demands. Trading skills like converting unities, compute changes, weighting of goods, and so on became an ordinary activity. Gold were also used as a medium of exchange along the inhabitants. After experienced a drop in gold volume, the crown instated *o quinto* in which one-fifth of the whole gold extracted had to be payed as taxes for Portugal. This drastic policy provided incentives for illegal transport of gold. The term *descaminho* emerged as a neologism to denote the practice of those that avoided the royal roads (de Oliveira, 2016). However, if individuals were caught, they were severely punished. To evade the authorities several criative methods were developed. As cited by Naritomi, Soares and Assunção (2012), the transporters used to hide powder gold inside Catholics ornaments of saints. Religious artifacts could not be violated due to religious principles, so travelers sought it as an opportunity circumvent the taxation. They became known as the "Hollow saints" or *santo do pau-oco*. Notice that even if people tried to deceive the authorities, they did it *within* royal roads.

The Brazilian gold corresponded to fifty percent of the entire world supply from 16th to 18th century (Simonsen, 1937). This period of prosperity - mostly for the Europeans - also helped to locally develop the region. It was not before 1822 that the previous royal roads became free of abusive taxes for travelers with the Independence of Brazil. Figure

1 shows the municipalities crossed by the royal road. Nowadays, the track delineated by Portugal became the largest tourist route in Brazil comprising 1,630 kilometers crossing three States.

Figure 1: Municipalities crossed by Estrada Real



The control group represented here is composed of municipalities in which the distance of its centroid from Estrada Real's municipalities' centroids is smaller than 30 kilometers.

IV Data

The first source of data comes from the Estrada Real Institute that describes which municipalities currently belongs to Estrada Real. The Institute is responsible for the guardianship of historical elements of the track, e.g. keeping traffic signs in good state, promoting tourism, and so on. To avoid miss-characterization of municipality borders, or changing

over time, as suggested by [Giuliano and Matranga \(2020\)](#), I mailed the Institute to obtain the current definition of affected municipalities. Thus, I do not consider municipalities and districts that are not in fact crossed by the Estrada Real, or being only under its influence, to avoid inflate the number of observations. In fact, there are four distinct roads that compose the entire Estrada Real. I simplify the analysis by considering an unique road. Therefore, I use the 59 municipalities that belongs to the Estrada Real as my treated group. Those classified as "under influence" by the institute that provided the data are not considered as treated. [Figure 1](#) shows the map of the treated region.

The second source of data is obtained from INEP (National Institute of Studies and Educational Research Anísio Teixeira) that makes available the micro data about the ENEM (analogous to the SAT in US) exam. I collect data about the mathematics exam from 2013 to 2019. During this period, the examination had the same format, with 45 mathematics questions. I used the yellow exam color for simplicity. All colors have the exact same content, but in a different order to avoid cheating. The yellow exam covers roughly 60% of all participants in a given year and it was used due to coding limitations. A research assistant² classified the math questions into three subsets: financial, commercial, and doubtful. The financial questions are a subset of the commercial questions. Doubtful questions were re-validated but became all dropped. Examples of questions can be seen in the [Appendix A](#). I focus on the commercial questions due to three reasons: i) they are closely related to my definition of culture; ii) the number of questions identified as finance-related is too small; and iii) finance questions from ENEM are too different from the questions used in other papers (e.g. [Kaiser, Lusardi, Menkhoff and Urban, 2021](#); [Klapper and Lusardi, 2020](#); [Lusardi and Mitchell, 2014](#); [Brown, Henchoz and Spycher, 2018](#)). [Table I](#) shows the number of commerce questions per year, out of the 45 math questions per exam. It shows little variation in the initial years and a large number of questions in the last available exam before 2020 pandemics. Also, it shows that despite the number of participants falling through years, the proportion of candidates in the municipalities of my study are practically the same, avoiding concerns about self-selection. At least 2 questions are present in every year, which allows to explore the whole time-series without gaps.

An important aspect of ENEM from recent years is that during the first day of

² I asked another person to classify the questions to avoid including biased decisions and end up inflating my results. I thank Raphael Vasconcelos for superb research assistance.

Table I: Exam Characteristics

This table shows the number of questions and participants per year for the yellow exam only. I consider the sample with the control group of municipalities within a radius of 60 kilometers from the Estrada Real municipalities' centroid. Every year has 45 questions in "Mathematics and its Technologies". The proportion of participants consider the total number of participants in the country for a given year.

Year	2013	2014	2015	2016	2017	2018	2019	Total
# Commerce	5	3	2	4	3	4	10	31
Proportion (%)	11.1	6.7	4.4	8.9	6.7	8.9	22.2	68.9
# Participants	150,516	180,965	170,933	156,783	121,698	109,217	98,636	988,748
Proportion (%)	11.5	11.7	11.7	10.5	11.0	11.2	10.7	11.2

examination the attendees respond a questionnaire about their social and economic conditions. Among these questions, respondents were asked which school they studied and did the exam, and in which municipality born and currently lives. The exam is not applied in all Brazilian municipalities, so it allows to identify where the subject obtained its cultural background, even in the case where she does not realized the exam in her current municipality. Thus, I merged the data based on the municipality of residence to capture more recently exposure to cultural traits ³. The sample is composed mainly by young adults doing the exam, so using current municipality seems appropriate. Further, I keep only those that fully completed the exam and compute the proportion of correct questions each individual responded correctly. The data offers the possibility of calculating the level of commercial skills at a large scale. This is the main dependent variable for this study.

Third, I collect data from Estban (Estatística Bancária) to obtain the number of bank branches and the volume of lendings and savings account. The balance-sheet data is available at a monthly frequency, so I considered the values of December as the year value. It worth saying that I cannot link individual data to branches data, but I can observe lending and savings from branches of municipalities affected by Estrada Real.

Fourth, I obtain annual data from IBGE Cidades about GDP per capita and the volume of taxes paid from 2013 to 2019 for all Brazilian municipalities. Shapefiles and geographical variables from 2019 municipalities are also obtained from IBGE's website. The two compiled datasets' variables can be observed in Table II. All variables computations can

³ Results are qualitatively the same if I split the sample to those that still lives in the municipality they were born or not.

be seen in Appendix B.

Table II: Descriptive Statistics

This table shows the descriptive statistics for the two datasets used in this paper.

Panel A: ENEM Microdata - Individual Level Data					Panel B: ESTBAN - Branch Level Data				
	Estrada Real		Control _{60km}			Estrada Real		Control _{60km}	
	Mean	S.D.	Mean	S.D.		Mean	S.D.	Mean	S.D.
Correct Commerce (%)	28.747	27.372	27.291	26.707	Branch Size	19.977	1.920	18.978	1.918
Correct Finance (%)	24.520	31.535	23.587	31.099	Cash Holdings (%)	1.154	1.015	1.705	1.614
Correct Math (%)	29.013	13.152	27.597	12.319	Log (Provisions)	9.867	7.443	6.644	7.294
Age	22.423	8.261	22.466	8.164	Longitude	-43.952	0.598	-43.975	0.852
Gender (Man = 1)	0.428	0.495	0.410	0.492	Latitude	-21.079	1.181	-21.164	1.358
White	0.445	0.497	0.368	0.482	Taxes	10.273	2.174	9.290	2.223
Black	0.162	0.368	0.169	0.374	GDP per Capita	25.788	22.880	21.397	27.548
Brown	0.351	0.477	0.417	0.493	# Branches	33.694	176.786	8.173	34.497
Yellow	0.016	0.127	0.021	0.144	Log (Savings)	18.676	1.634	17.876	1.563
Indigenous	0.004	0.065	0.004	0.066	Log (Lendings)	18.622	2.161	17.723	1.988
Longitude	-43.535	0.322	-43.815	0.646					
Latitude	-22.327	1.050	-21.233	1.416					
Taxes	16.102	2.857	13.782	2.275					

V Empirical Analysis

To test whether cultural aspects can explain present day subject's commercial skills, I take the municipalities that currently belong to Estrada real, and compare with near municipalities that are expect to be unaffected. Hence, I employ Equation 1 to estimate the long-term effect of culture in commercial knowledge. The same equation is used in subsequent analysis at the branch and municipality-level.

$$Y_{imt} = \alpha + \beta Real_{im} + \Gamma X_{imt} + \delta_t + \varepsilon_{imt} \quad (1)$$

where Y_{imt} is the dependent variable; δ_t is a set of cohort or year fixed-effects; X_{imt} is a vector of control variables; ε_{imt} is the error term; and $Real_{im}$ is an indicator variable that assumes value of 1 if the municipality belongs to the Estrada Real, and zero if belongs to one of the control groups. To define the control group I used two criteria: i) if the municipality is contiguous; and ii) if the distance from two municipalities' centroid is smaller than some value. I use 30km, 45km, 60km, and 100km as thresholds in this study, although I report only 30km and 60km to conserve space. The results are the same and can be obtained

upon request. In all regressions I used double-clustered standard errors at the municipality-year level to address spatial and temporal correlation (Petersen, 2008). In municipal level regressions I cluster at the municipality level solely. Recall that the model does not support fixed-effects at the cross sectional dimension because we do not have the same individual over time and my treatment variable varies solely in the cross-section.

Giuliano and Matranga (2020) recalls that region's borders usually change in historical studies and Ehrl (2017) describes how drastic it is for Brazil. Therefore my variable for the Estrada Real can have measurement error despite being provided by the institution responsible for management, preservation, and tourism of the royal road. Assuming $Real_{im}$ being measured with an iid error term independent of the true value, $Real_{im} = Real_{im}^* + \eta_{im}$, it can be show there is an attenuation bias in β . Because the number of observations is usually smaller in treatment group, then it would be less credible to rely on consistency of the estimator. Thus, it may be harder to find significant results in the presence of measurement error. However, if estimates are significant, it indicates the ATE (Average Treatment Effect) is strong even if measurement error is present in the variable. Moreover, I use a large number of individual level data that increases substantially the number of observations in comparison to other studies.

If the variable indicating municipalities belonging to Estrada Real is exogenous, then the difference in means captured by β can be interpreted as the Average Treatment Effect of the Estrada Real. As previously mentioned, four roads were created at different periods of time. The intention was to connect important mines of Minas Gerais to the coast in Rio de Janeiro. Thus, even if these cities were endogenously selected, the ones between then are not⁴. If the $Real_{im}$ variable can be predicted by covariates, it means that some component of the treatment might not be exogenous. For instance, Rocha, Ferraz and Soares (2017) used the 1872 Brazilian census' variables to predict municipalities affected by a public policy a few years later in a cross-section. Unfortunately, no data is available for periods that comprises the creation of Estrada Real. Thus, I use current measures to predict the probability of a municipality being crossed by the royal road. The OLS regression can be seen in Table C1 and the results are as expected. None of the 10 regressors in the three models appear significant at 5% level. It suggests that it is reasonable to believe that the coefficients

⁴ Rio de Janeiro, Paraty, Diamantina, and Ouro Preto, are responsible for 253,738 candidates in seven years of data. All coefficients are qualitatively similar to, if not stronger than, the corresponding all-municipalities coefficients.

for Real variable captures the effect of culture in subjects' affinity with trade questions.

VI Results

This section presents the main results in this paper followed by a brief discussion and placing my results in contrast to literature findings. I reserve another section to scrutinize alternative explanations and supply- versus demand-side effects. I start with individual level regressions, moving to branch level and ending with municipality level data.

In Table III one can see that municipalities covered by the Estrada real present positive and significant coefficients. The difference from the Estrada Real municipalities to the control group ranges from 0.94 to 1.45 percentage points more correct answers in questions related to commerce in ENEM. The evidence is presented regardless of which definition is used for the control group and is also robust to addition of individual and geographical control variables. This evidence suggests that municipalities attended by Estrada Real have better knowledge of commercial-related skills.

I also investigate if differences can be observed in math questions. I find that the proportion of correct math questions is also higher in Estrada Real's municipalities. Candidates from Estrada Real scores 0.77 to 1.43 percentage points more than control group in math questions. Thus, local culture appears to not only explain commerce questions, but also to have spillovers to related areas, similarly to the literature in financial education.

Despite the problems previously discussed about the finance questions, I test whether Estrada Real has predictive power in explaining students' responses. Table C2 presents the results. The coefficients are slightly lower than those for commerce and math questions, but possibly due to the very restrictive sample, no significant results were observed. Still, in comparison with studies that propose interventions in students financial literacy, my sample is way larger. Therefore, one can be enough confident that no differences can be observed in general math performance.

To further ascertain whether individuals culturally affected have better financial decisions, I use branch level data to explore the intensive margin in branches' balance sheet. In other words, I investigate if individuals from municipalities in Estrada real demand more or less heavily the services provided by local branches. Table V shows that branches in municipalities belonging to Estrada Real have lower volume of lendings and higher volume

Table III: Estrada Real effects in the proportion of correct commerce questions.

This table shows the differences in the proportion of correct questions categorized as "Commerce" in my analysis. Real indicate 1 if the municipality belongs to the treated group, and 0 if it pertains to one of the three control groups: contiguous, municipalities' centroids distance of 30km or 60 km. Controls include: municipalities volume of taxes paid, latitude, longitude, individual gender, age, ethnic group (in a set of five dummies). All regressions include cohort fixed effects. Standard errors are heteroskedasticity robust and double-clustered at the municipality-cohort level. Standard errors are reported in parenthesis and *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Percentage of Correct Commercial Questions (%)					
	Contiguous		30km		60km	
Real _{Contiguous}	0.925 (0.581)	1.161*** (0.333)				
Real _{30km}			1.443** (0.581)	1.212*** (0.317)		
Real _{60km}					1.454*** (0.421)	0.942*** (0.333)
Constant	27.831*** (0.552)	2.827 (8.940)	27.310*** (0.543)	-0.784 (7.971)	27.292*** (0.359)	20.036*** (6.943)
Observations	703,604	703,594	763,460	763,450	988,748	988,732
Municipalities	188	188	182	182	338	338
R-squared	0.067	0.089	0.066	0.088	0.066	0.085
Controls	No	Yes	No	Yes	No	Yes

of savings. This evidence goes in line with a more responsible use of money. This effect might translates into gains in welfare for these individuals.

Savings accounts in Brazil often provide returns below inflation. Therefore, one might think that investing in savings accounts might indicate that the average Brazilian is not sophisticate enough to realize it is a bad investment, thus expecting a negative coefficient. On the other hand, considering the level of financial knowledge of the average Brazilian, saving in a savings account is still better than keeping money under the mattress. In a country where only 1 million of residents (roughly half percent of population) allocate their money in more sophisticated options like stocks or in Brazilian treasuries, having a savings accounts means a substantial first step. Thus, I interpret the positive coefficient as a positive outcome. Although I am not measuring financial knowledge per se, this behavior

Table IV: Estrada Real effects in the proportion of correct math questions.

This table shows the differences in the proportion of correct math questions in my analysis. Real indicate 1 if the municipality belongs to the treated group, and 0 if it pertains to one of the three control groups: contiguous, municipalities' centroids distance of 30km or 60 km. Controls include: municipalities volume of taxes paid, latitude, longitude, individual gender, age, ethnic group (in a set of five dummies). All regressions include cohort fixed effects. Standard errors are heteroskedasticity robust and double-clustered at the municipality-cohort level. Standard errors are reported in parenthesis and *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Percentage of Correct Math Questions (%)					
Real_Contiguous	0.922*	1.062***				
	(0.489)	(0.171)				
Real_30km			1.430***	1.085***		
			(0.485)	(0.163)		
Real_60km					1.403***	0.765***
					(0.329)	(0.229)
Constant	28.086***	2.818	27.577***	3.516	27.602***	23.522***
	(0.475)	(5.372)	(0.472)	(5.113)	(0.309)	(5.324)
Observations	703,604	703,594	763,460	763,450	988,748	988,732
Municipalities	188	188	182	182	338	338
R-squared	0.004	0.114	0.006	0.115	0.006	0.106
Controls	No	Yes	No	Yes	No	Yes

points towards a desirable goal.

Further, a smaller volume of lending can be thought as individuals having less access to credit. In this rationale, one should desire a positive coefficient rather than a negative one. However, [Demirgüç-Kunt, Klapper, Singer and Van Oudheusden \(2015\)](#) mentions that 88% of individuals receive Brazilian's government conditional cash transfers, and it made via formal banking accounts. Also, the program targets one third of the population, suggesting a high level of bancarization of subjects in my sample. Unfortunately, it is not followed by higher financial knowledge in Brazil, as cited by [Klapper and Lusardi \(2020\)](#). I argue that, for the Brazilian context, obtaining lower volume of loans might indicate a favorable result. By not getting formal loans, those subjects are also facing less risk of becoming over-indebted and having their names registered as having bad credit in credit bureaus.

Therefore, this result is interpreted as positive given the country's low level of financial knowledge.

Table V: Estrada Real effects in banking intensive margin.

This table shows the differences in the usage of formal financing in my sample of bank branches. Real indicate 1 if the municipality belongs to the treated group, and 0 if it pertains to one of the three control groups: contiguous, municipalities' centroids distance of 30km or 60 km. Controls include: municipalities' latitude, longitude, and volume of taxes, branch size, cash holdings, provisions, and market-share(%). All regressions include year fixed effects. Standard errors are heteroskedasticity robust and double-clustered at the municipality-year level. Standard errors are reported in parenthesis and *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Log(Lendings)			Log(Savings)		
Real _{Contiguous}	-0.067** (0.027)			0.099*** (0.021)		
Real _{30km}		-0.077*** (0.024)			0.090*** (0.021)	
Real _{60km}			-0.109*** (0.025)			0.084*** (0.018)
Constant	-3.566*** (0.983)	-1.877* (0.976)	-4.552*** (0.682)	6.147*** (0.709)	6.239*** (0.804)	6.091*** (0.551)
Observations	15,019	15,145	18,848	14,214	14,332	17,907
Branches	825	770	1,478	825	770	1,478
R-squared	0.545	0.549	0.558	0.413	0.417	0.445
Controls	Yes	Yes	Yes	Yes	Yes	Yes

VII Discussion and Alternative Explanations

As explained by [Fernandez and Fogli \(2009\)](#) and [Alesina and Giuliano \(2015\)](#), the inability of separating culture from other economic factors has prevented economists to address culture in their studies. On the other hand, some researchers explicitly test one mechanism versus the other (e.g. [Rocha, Ferraz and Soares 2017](#)). In this session, I do an effort to avoid alternative explanations in my results and to compare to other evidence presented in the literature.

The institutional hypothesis is a possible explanation for my findings. This hypothesis suggests that institutions are responsible for economic development of regions. For instance, [Acemoglu, Johnson and Robinson \(2001\)](#) instrument institutions with difficulty to settler a colony and finds that stronger institutions leads to more prosperous economies. The authors' analyze are conducted at the country level, where institutions are expected to vary. The states in Brazilian federation have less policymaking capabilities than, for instance, American states in American federalism. Even without a proper econometric way of testing this hypothesis, this interpretation seems unlikely since institutions of treated municipalities have no observable reasons to develop stronger institutions than those around. If it was the case, in places where the state is stronger, parents feel less necessity of teaching good behavior and rule following to their children, as shown by [Lowes, Nunn, Robinson and Weigel \(2017\)](#). But no significant differences are observed in their study when testing for other types of questions such as: imagination, independence, self-expression, and determination/perseverance. In addition, my result appears to be in line with the potential substitution between institutions and culture described by [Tabellini \(2008\)](#).

Analogously, effects can be driven by a long-term stock of capital in these municipalities rather than an inherent skill developed by locals. This would reflect into a larger GDP per Capita in present days. However, my results does not support the interpretation that Estrada Real's municipalities developed more than their counterparts. In all three specifications my coefficients are not distinguishable from zero as shown in Table C3. According to [Naritomi, Soares and Assunção \(2012\)](#) there was less provision of public goods in 2000 in areas affected by the gold boom of the 17th century. One can extrapolate this finding into Estrada Real, that become the main gold flow source in 18th century. Therefore, it makes more sense to think of culture playing its role to develop individuals' intellect rather than to generate differences in the wealth of these two groups. The proposed mechanism takes culture as the fuel for residents to demand for commercial knowledge.

Despite the road being constructed to link the gold mines to the sea, one might expect that the municipalities between the two extremes have better geographic conditions. The geographical hypothesis mention that natural aspects - such as temperature - are responsible for higher long-term development with respect to other regions ([Dell, Jones and Olken, 2012](#); [Barreca, Clay, Deschenes, Greenstone and Shapiro, 2016](#)). To avoid the geographic hypothesis of development, I included longitude and latitude as controls for the

regressions. As cited by [Acemoglu, Johnson and Robinson \(2001\)](#), countries closer to the Equator Line are usually poorer. However, after controlling for countries location, their results suggests that Africa is poorer than the rest not purely by geographical and cultural reasons, but due to weak institutions. This is particularly important in Brazil given its continental dimension. In my case, the coefficient for Estrada Real maintain even controlling for municipalities location, suggesting that the geographical hypothesis does not eliminate the importance of culture in such region. Both regions are under the same historical institutions, so culture seems to play a relevant role in explaining the results.

My study also faces a challenge that it is hard to disentangle supply- and demand-side effects, so common in banking studies. For instance, this issue is presented in [D'Acunto, Prokopczuk and Weber \(2019\)](#) that shows that demand for finance in historically persecuted regions are lower. While I find that lendings volume is lower in Estrada Real, I also find that savings volume is larger. To further explore this effect, I compare the number of bank branches in municipalities inside Estrada Real against the control group. If supply-side is responsive for my results, we should see one place being better served by banking sector. Once again, in all six specifications no significant differences can be find. This result is robust to several branch-level controls. Thus, it corroborates the rationale that individuals are equally served in both regions, so any difference in intensity of use should be due to subject's preferences. [Assunção \(2013\)](#) estimates that after 2002 the cost of entering a new market (municipality) is zero. It occurs because banking is already provided by other tools (e.g. bank correspondents), eliminating entry barriers for banks. Hence, this effect is consistent with a demand-side effect. Results are presented in Table [C3](#) to conserve space.

Although unlikely, other events may have happened in 17th century Brazil that affected exactly the regions of the study but that is not reflected in current municipalities' borders. Since 1872, the number of municipalities grew from 642 to 5565 in 2010 ([Ehrl, 2017](#)). In 2020, this number increased by five more municipalities. Most of the municipalities considered treated today were part of a larger municipality when Estrada Real was created. In other words, our control group is likely to be contaminated by splits in municipalities. If this is the case, it would go against my results, because the control group would have been exposed to the same setting as the treatment group. Hence, the statistical inference should be of no observable differences in both groups. Nonetheless, I find significant results even in the presence of such phenomena.

The entire discussion above points towards culture being the main driver of my results. However, without a controlled setting in which individuals are randomly assigned to different levels of culture, alternative explanations may remain. Not only this experiment is unpractical, but even if culture could be randomized, it would be hard to administer different doses of such intangible concept. Therefore, my results should be viewed with caution.

VIII Conclusion

Studies in financial literacy is widely explored in the literature. Research in other domains of knowledge, however, is more scarce. In this study, I explore how culture can explain current commercial knowledge. Exploring the creation of a large royal road in 18th century as a natural experiment, I show that the effects of such intervention can be observed in present day standard evaluations. The analysis points towards the reasoning that the culture of commerce has emerged within colonial trading routes. Results are robust to a set of individual, geographical, and municipal controls. The evidence points to an effect of Estrada Real in shaping young adults human capital 300 years later.

The human capital obtained through years also appears to influence the banking sector in these municipalities. Bank branches from treated municipalities present higher volume of savings and lower lending volume. Extrapolating to individuals' decisions, my results suggest that inhabitants from more commercially related cultures rely less in external capital by borrowing less but still using banks to save money. Hence, culture appears to explain why some regions have more developed banking system with a intensive and responsible financial inclusion.

Recently, several countries are offering standardized financial education for students. A recent partnership between the Brazilian Ministry of Education and the local Regulator (CVM) is training professors to teach finance for students in public schools. This ambitious project target five hundred thousand instructors to teach around 25 million students in three years⁵. My study supports the reasoning for adjusting evaluations and adapting the content to cultural idiosyncrasies. Not only the content could be adapted, but also the level of teaching in order to achieve its maximum effectiveness (Drexler, Fischer and

⁵<https://www.gov.br/mec/pt-br/assuntos/noticias/mec-lanca-programa-educacao-financeira-nas-escolas>

Schoar, 2014). In other words, teachers and students from specific regions might be more familiar to some concepts than others. For instance, in places where people rely more in savings accounts, examples of other investments can be emphasized. Analogously, in places where people borrow little from formal institutions, the benefits of third-part capital can be explored.

Future research is advised to explore other dimensions of knowledge with the respect to the environment in which participants are subject. This study focuses on data from individuals before entering universities, but further analysis can be conducted with individuals that are pursuing a career in business, economics, or even in unrelated fields. It would help highlight inefficiencies in teaching and better design of coursework. Further, I encourage research linking the stock of human capital measured in a similar fashion. As seen in this paper, further classification of standard tests can be used in several contexts and has been shown to provide useful insights.

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Appendices

A Question Classification

A research assistant reviewed every "Mathematics and its Technologies" questions from ENEM 2013 to ENEM 2019 in order to classify them into three categories: i) a Finance question; ii) a Commerce question; and iii) a Doubtful question, for whenever the research assistant was unsure about categorizing a question. All doubtful questions were later revised and dropped. Finance questions are a subset of commercial questions, that in turn are a subset of math questions. An example of two questions is presented below:

Figure 2: Example of Questions

(a) Commerce — Question 160 - 2015 - Yellow

QUESTÃO 160

Em certa loja de roupas, o lucro na venda de uma camiseta é de 25% do preço de custo da camiseta pago pela loja. Já o lucro na venda de uma bermuda é de 30% do preço de custo da bermuda, e na venda de uma calça o lucro é de 20% sobre o preço de custo da calça. Um cliente comprou nessa loja duas camisetas, cujo preço de custo foi R\$ 40,00 cada uma, uma bermuda que teve preço de custo de R\$ 60,00 e duas calças, ambas com mesmo preço de custo. Sabe-se que, com essa compra, o cliente proporcionou um lucro de R\$ 78,00 para a loja.

Considerando essas informações, qual foi o preço de custo, em real, pago por uma calça?

- A 90
- B 100
- C 125
- D 195
- E 200

(b) Finance — Question 145 - 2017 - Yellow

QUESTÃO 145

Para realizar a viagem dos sonhos, uma pessoa precisava fazer um empréstimo no valor de R\$ 5 000,00. Para pagar as prestações, dispõe de, no máximo, R\$ 400,00 mensais. Para esse valor de empréstimo, o valor da prestação (P) é calculado em função do número de prestações (n) segundo a fórmula

$$P = \frac{5\,000 \times 1,013^n \times 0,013}{(1,013^n - 1)}$$

Se necessário, utilize 0,005 como aproximação para $\log 1,013$; 2,602 como aproximação para $\log 400$; 2,525 como aproximação para $\log 335$.

De acordo com a fórmula dada, o menor número de parcelas cujos valores não comprometem o limite definido pela pessoa é

- A 12.
- B 14.
- C 15.
- D 16.
- E 17.

B Variables Computation

- Proportion of Correct Questions [ENEM Microdata]: the proportion of math questions that a given individual responded correctly for an edition of ENEM exam.

- Proportion of Correct Commercial Questions [ENEM Microdata]: the proportion of commercial questions that a given individual responded correctly for an edition of ENEM exam.
- $Real_{Contiguous}$ [IBGE Malha Municipal]: a dummy variable that takes value of one if a municipality belongs to Estrada Real, and zero for neighboring municipalities with common borders.
- $Real_{30km}$ [IBGE Malha Municipal]: a dummy variable that takes value of one if a municipality belongs to Estrada Real, and zero for neighboring municipalities with less than 30 kilometers from one centroid to another.
- $Real_{60km}$ [IBGE Malha Municipal]: a dummy variable that takes value of one if a municipality belongs to Estrada Real, and zero for neighboring municipalities with less than 60 kilometers from one centroid to another.
- $Longitude$ [IBGE Malha Municipal]: the longitude (x-axis) for the centroid of a given municipality.
- $Latitude$ [IBGE Malha Municipal]: the latitude (y-axis) for the centroid of a given municipality.
- $NumberOfBranches$ [Estban]: I count the number of times a different branch appears in a given municipality in a given year.
- $Log(Savings)$ [Estban]: is the natural logarithm of account `verbete_420_depositos_de_poupanca`. It indicates the total amount of reais in savings account for a given branch-year.
- $Log(Lending)$ [Estban]: is the natural logarithm of account `verbete_160_operacoes_de_credito`. It indicates the total amount of reais in credit operations for a given branch-year.
- $Size$ [Estban]: is the natural logarithm of account `verbete_399_total_do_ativo`. It indicates the amount of reais in total assets for a given branch-year.
- $CashHoldings$ [Estban]: is the ration between `verbete_111_caixa` and `verbete_399_total_do_ativo`. It indicates the proportion of total assets that is allocated in cash and cash equivalents for a given branch-year.

- *MarketShare* [Estban]: is the ratio of branch's lending volume in a given year by the sum of branches lending volume in a municipality-year. Lending volume is simply `verbete_160_operacoes_de_credito`.
- $\text{Log}(\text{LoanProvisions}+1)$ [Estban]: is the natural logarithm of `verbete_174_prov_p_oper_creditos` plus one to keep those with 0 amount. It indicates the total value that each branch-year allocates in provision with default credit.
- *GDPperCapita* [IBGE Cidades]: it is the GDP per Capita per year divided by R\$1.000 to better scale in regressions.
- *Taxes* [IBGE Cidades]: it is the natural logarithm of impostos, the total amount paid per year of taxes within a municipality in R\$1.000.

C Additional Regressions

Table C1: Covariates predicting treatment variables.

This table shows the lack of predictable power of covariates in the three treatment dummies. All regressions include cohort fixed effects. Standard errors are heteroskedasticity robust and clustered at the municipality level. Standard errors reported in parenthesis and *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	<i>Real_{Contiguous}</i>		<i>Real_{30km}</i>		<i>Real_{60km}</i>	
Size	0.073	(0.151)	0.096	(0.160)	0.119	(0.105)
Cash Holdings	-0.071	(0.058)	-0.066	(0.059)	-0.022	(0.017)
Log(Loan Provisions + 1)	0.014	(0.011)	0.006	(0.011)	0.006	(0.006)
Longitude	-0.011	(0.068)	-0.024	(0.063)	-0.003	(0.026)
Latitude	0.048	(0.035)	0.073*	(0.041)	0.033	(0.020)
Taxes	-0.024	(0.050)	-0.061	(0.046)	-0.041	(0.031)
GDP per Capita	-0.001	(0.001)	-0.001	(0.001)	-0.000	(0.001)
# Branches	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)
Log(Savings)	-0.040	(0.109)	0.010	(0.108)	-0.027	(0.066)
Log(Lendings)	-0.009	(0.065)	-0.035	(0.080)	-0.049	(0.054)
Constant	0.624	(3.053)	0.223	(2.830)	0.249	(1.276)
Observations	130		123		229	
R-squared	0.115		0.136		0.071	
F-Statistic	1.718		2.548		2.108	
F-test (p-value)	0.084		0.008		0.025	

Table C2: Estrada Real effects in the proportion of correct finance questions.

This table shows the differences in the proportion of correct questions categorized as "Finance" in my analysis. Real indicate 1 if the municipality belongs to the treated group, and 0 if it pertains to one of the three control groups: contiguous, municipalities' centroids distance of 30km or 60 km. Controls include: municipalities volume of taxes paid, latitude, longitude, individual gender, age, ethnic group (in a set of five dummies). All regressions include cohort fixed effects. Standard errors are heteroskedasticity robust and double-clustered at the municipality-cohort level. Standard errors are reported in parenthesis and *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Percentage of Correct Finance Questions (%)					
	Contiguous		30km		60km	
Real _{Contiguous}	0.420 (0.834)	0.836 (0.569)				
Real _{30km}			0.760 (0.779)	0.733 (0.549)		
Real _{60km}					0.845 (0.534)	0.553 (0.493)
Constant	24.052*** (0.796)	-14.287 (14.025)	23.711*** (0.746)	-7.711 (13.689)	23.620*** (0.487)	9.472 (9.064)
Observations	233,681	233,678	253,378	253,376	329,551	329,545
Municipalities	188	188	182	182	338	338
R-squared	0.035	0.045	0.034	0.044	0.035	0.043
Controls	No	Yes	No	Yes	No	Yes

Table C3: Estrada Real effects in municipalities.

This table shows no differences in the GDP per Capita and Number of Bank Branches at the municipal level. Real indicate 1 if the municipality belongs to the treated group, and 0 if it pertains to one of the three control groups: contiguous, municipalities' centroids distance of 30km or 60 km. Controls include: municipalities' latitude, longitude, and total volume of taxes, branch size, cash holdings, and loan provisions. All regressions include year fixed effects. Standard errors are heteroskedasticity robust and double-clustered at the municipality-cohort level. Standard errors are reported in parenthesis and *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	GDP per Capita			Number of Branches		
Real_Contiguous	-2.993 (4.890)			4.609 (18.036)		
Real_30km		-1.362 (5.428)			6.752 (21.282)	
Real_60km			1.319 (3.026)			13.113 (19.719)
Constant	153.473 (200.791)	131.414 (216.702)	140.365 (106.088)	-1183.013* (640.560)	-1454.046* (816.340)	-666.497* (375.042)
Observations	825	770	1,478	825	770	1,478
Municipalities	130	123	229	130	123	229
R-squared	0.270	0.292	0.299	0.279	0.284	0.216
Controls	Yes	Yes	Yes	Yes	Yes	Yes