Who benefits when inertia is reduced? Competition, quality and returns to skill in health care markets*

Sebastian Fleitas

Department of Economics
University of Leuven

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Abstract

In health care markets, reductions of inertia in consumer choice may lead to greater incentives for firms to increase quality. With non-perfectly substitutable inputs, hospitals could increase their quality by demanding better technology and/or better physicians. However, because only persons with a medical license are authorized to practice medicine, in the short run the elasticity of supply of high quality physicians is relatively inelastic. Therefore, an increase in the demand for high quality physicians could lead to an increase in their relative wages without increasing their total hours of work. I assess these predictions using a quasi-experimental setting in the Uruguayan health care system to analyze the effects of increased competition via lock-in reductions on a market for inputs. I leverage the facts that insurance companies, hospitals and physician services are completely vertically integrated in Uruguay, and that in 2009 the government generated an exogenous change in the regulated mobility regime, increasing the competition in the market and providing incentives to increase quality. I use administrative records on wages and hours of work in all hospitals for all specialists in the Uruguayan health care system. I combine these administrative records with data on the scores that specialists obtained in the test they have to take to be admitted into the medical specialty graduate school, which I use as an exogenous measure of quality of specialists. Consistent with the idea of an inelastic relative supply in the short run, I show that the increased competition shifted the relative demand for high quality medical specialists, increasing the returns to skill. I do not find strong evidence of an increase in quality, approximated as relative hours of high-skill versus low-skill physicians.

Keywords: Competition, Inertia, Quality, Returns to Skill
JEL Classification: L15, J31, J44, I13, I18

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1 Introduction

The relationship between increased competition and quality is still a subject of debate. On one hand, there are no general results in economic theory for the impact of competition on quality in models where firms choose both price and quality. The outcome depends on various factors, including the relative elasticities of demand with respect to quality and price for different consumers and the nature of the competition between firms. On the other hand, the empirical evidence points to increases in competition improving quality. However, and although it has been growing very rapidly, this empirical literature is for the most part fairly recent and the evidence is not definitive. Overall, how reforms that generate increased competition affect quality is an empirical question not yet definitely answered, and we still need to learn more about the mechanisms by which these effects operate.

If a firm wants to increase quality it would probably need new inputs and/or technology. However, the possibility of increasing the utilization of inputs, and its costs, depend on the elasticity of the supply of these inputs. In the extreme case of an input that has a perfectly elastic supply, the increased demand would increase the quantity of the input while maintaining the price of the input unchanged. On the other hand, if the input has a perfectly inelastic supply, the increased demand for the input will only increase the cost of the input without increasing its quantity. The role of the relative elasticity of input supply is gaining importance in a context where more and more jobs are requiring a license to be performed. In the US, the workforce covered by state-level occupational licensing laws grew dramatically in the second half of the 20th century, going from less than 5 percent in the 1950s to 25 percent by 2008.[1]

This paper studies the relationship between increased competition, quality and returns to skill using a quasi-experimental setting in the Uruguayan health care system. I analyze the effects of increased competition via reductions of consumer inertia (lock-in), on the market for medical specialists. I analyze if the potential increases in consumer welfare via hospital quality are realized through an increased demand for and utilization of high-quality physician hours, or if these potential benefits are lost through an increase in costs due to the rigidity of the supply side of the input. In particular, when hospitals receive incentives to intensify (non-price) competition, does the relative

[1]See Furman (2015) for more evidence about the increasing trend in the requirement of occupational licensing and its potential impacts in rent-seeking behaviors and inequality.

demand for high-skill physicians increase? And if so, do the returns to skill increase? And finally, does this lead to the general quality of hospitals to increase?

The presence of significant consumer inertia in health care markets has been well established, and recent academic literature, policy debates and news have suggested policies to reduce inertia in these markets.[2] In health care markets, reductions of inertia in consumer choices may lead to greater incentives for firms to increase quality. With non-perfectly substitutable inputs, hospitals could increase their quality by demanding better technology and/or better physicians. However, because only persons with a medical license are authorized to practice medicine, in the short run the elasticity of supply of high skill physicians is relatively inelastic. Therefore, an increase in the demand for high skill physicians could lead to an increase in their relative wages without increasing their total work hours, and thus without changing the average quality of the health care system but increasing its costs.

The Uruguayan health care system has three characteristics that provide an excellent setting to identify these effects. First, insurance companies, hospitals and physician services are completely vertically integrated, with hospitals providing all these services. Hospitals are not specialized in the treatment of different conditions, and consumers receive all their health care from the hospital they are enrolled with. This setting allows for a very clear consumer demand for hospitals, and means that consumers have incentives to care about hospital prices and quality at the time they are making an enrollment decision. Second, physicians are hired by hospitals and receive a wage for their worked hours. Third, after nine years of complete lock-in, the government reduced the lock-in of consumers in the FONASA program, implementing a regulated mobility scheme, which increased the competition in the market.

I use administrative records on wages and hours of work in all hospitals for all specialists in the Uruguayan health care system. I combine these administrative records with information on scores in the admissions test for medical specialty graduate school, which I use as an exogenous measure of the quality of physicians. To the best of my knowledge, this is the first paper that uses test scores

[2]For example, some papers on health care markets analyze inconsistencies and learning in plan choices (Abaluck and Gruber, 2011, 2013; Ketcham et al., 2012; Heiss et al., 2013); document the presence and size of switching costs in Medicare (Nosal, 2012; Miller and Yeo, 2012); analyze its interactions with adverse selection (Handel, 2013; Polyakova, 2016); and discuss the relative importance of inattention and switching costs as sources of consumer inertia (Ho et al., 2015). Moreover, a recent body of empirical work assesses the effects of inertia on strategic pricing behavior in Medicare Part D (Ericson, 2014; Ho et al., 2015; Miller, 2014; Wu, 2016; Fleitas, 2017). Most of this literature suggests or analyzes scenarios with reductions of inertia.

of physicians in a systematic way to understand changes in returns to skills induced by competition shocks. I leverage the fact that up to 2010 there was only one school that offered medical specialty degrees, and I use the data on test scores for the cohort of graduate medical school applicants between 1996 and 2010 to analyze the effects of the increased competition on their wages and hours of work.

Methodologically, I use a strategy that combines the variation across time introduced by the exogenous change in the policy that happened in 2009, with the exogenous (to the labor market) measure of physician quality given by the test scores. The main identification assumption is that unobserved shocks in hours or wages are uncorrelated with both the quality of the physician and the timing of the reform, after controlling for physician fixed effects and specialty-by-time fixed effects. In other words, I make the assumption of parallel trends in the hours and wages of medical specialists of different levels of skill, conditional on specialty, in the absence of the competition shock. In several robustness checks I also show that the results are robust to controlling for shocks at the hospital-by-time level and also to including other controls reflecting the increase in FONASA coverage during those years.

My results are consistent with the hypothesis that the change in the regulated mobility regime intensified the competition among hospitals, and caused an increase in the demand for quality. Consistent with the existence of a relatively inelastic supply of high-skill physicians in the short run, this shock in competition generated a relatively large increase in the returns to skill. According to my preferred estimates, a change in the regulated mobility regime that increases the percentage of consumers able to switch hospitals from 0% to 60%, causes a relatively large increase of about 1 unit in the elasticity of wages to scores. In terms of test score points, after the reform, the wage premium for one standard deviation difference in test scores increased by 25 percentage points. These large effects on wages are consistent with an event-study approach and are robust to several controls.

On the other hand, there is only weak evidence of an increase in the relative hours worked by high-skill physicians compared to low-skill physicians. When the full sample of physicians is used, the effects on relative hours are smaller than the effects on wages, and they are not robust across different specifications. There is stronger evidence of an increase in the relative hours of high-skill physicians when the sample is limited to those with exclusive employment in one hospital, for whom the competition effects are likely to be stronger. For this sample of physicians, the estimates imply that the regulated mobility regime caused an increase of about 0.35 units in the elasticity of hours to scores. In terms of test scores, the differential in hours worked for a one standard deviation difference in test scores increases by 11 percentage points after the reform. Despite the increase in hours worked for this subsample of physicians, the evidence for the full sample does not support the hypothesis of the change in competition causing an increase in the total quality of the system (measured as the amount of hours weighted by quality of physicians).

Additionally, the results of the event studies are consistent with the expected effects given a relatively more inelastic supply of high-skill physicians in the short run than in the long run, as new specialists can enter the market. In this sense, the effects on relative wages are higher around the period when the reform was intensified, and fade out in the medium term. In terms of heterogeneity, specialties with higher barriers to entry seem to have larger effects on wages. The market of the capital city, where incentives to competition are higher, exhibits similar patters with a large increase in relative wages (41 percentage points for a one standard deviation difference in test scores), and a lower (and not statistically significant) increase in hours.

Overall, the results show how potential beneficial effects of competition shocks can be absorbed by cost increases in the input markets. Moreover, it highlights the differences between the adoption of capital inputs and human capital inputs, given their different supply elasticities. These differences are crucial to understanding the changes generated by increased competition in markets with occupational licenses and barriers to entry. This is of particular importance in health care markets, where recent policies, such as expansions of coverage or intensification of competition, have generated demand shocks for physicians, and therefore may have potentially increased the cost of the system via higher returns to skill.

This paper relates to three branches of literature. First, it contributes to the literature that addresses the effects of competition on quality in health care markets. Theoretical models show that the effects of competition on quality depend on whether or not prices are administered. If prices are administered, the standard result is that competition increases quality, since firms try to attract (and retain) consumers. On the other hand, there are no unambiguous results when firms choose price and quality; the outcome depends on the elasticities of demand with respect to quality and price for different consumers and the nature of competition. The empirical literature on competition and quality in health care markets is for the most part fairly recent and has grown very rapidly. Most frequently, this literature has related a measure of quality (often mortality rates) to a measure of market structure, and identification comes from the use of exogenous changes in market structure. When prices are administered, the empirical evidence suggests that increased competition increases the quality of hospitals (Kessler et al., 2000; Cooper et al., 2011; Gaynor et al., 2013; Tay, 2003; Bloom et al., 2015; Gaynor et al., 2012). When prices are market determined, the results are more mixed, but the evidence indicates that increases in competition improve hospital quality (Gaynor et al., 2015; Propper et al., 2004; Ho and Hamilton, 2000; Capps, 2005; Romano and Balan, 2011; Volpp et al., 2003). Cutler et al. (2010) is a particularly relevant reference for this paper, because they study how the entry of hospitals (increased competition) into the CABG surgery market in Pennsylvania affected the quantity and quality of CABG surgeries. They underscore that cardiac surgeons are a scarce input (supply cannot be altered easily), so increased market entry did not lead to increased quantities of CABG surgery, but it increased quality. They use a *higher share of high quality surgeons* as a measure of hospital quality, where surgeon quality is measured using data on risk-adjusted, in-hospital mortality of their CABG patients. They have to adjust this measure for patient severity using observable patient characteristics that could affect a patient's underlying probability of dying. The measure of physician quality that I use in this paper has the advantage that it is predetermined and it is independent of a hospital's allocation of patients across physicians.

A second and smaller branch of literature has studied the effects of health care reforms (expansions) on physician earnings. Finkelstein (2007) studies the effects of the introduction of Medicare on the payrolls of nurses and technicians. Dunn and Shapiro (2014) find that physician payments increased at least 10.8% in counties affected by the Massachusetts' reform compared to control areas. Finally, Buchmueller et al. (2015) find that the total number of visits to dentists and dentists' income increase when states add dental benefits to adult Medicaid coverage.

Finally, a third branch of literature studies to what extent competition affects returns to skill and wage inequality. Increased competition can lead to changes in rent sharing or union behavior (Rose, 1987; Hirsch, 1993; Card, 1996), or to changes in the technology of production (Aghion et al., 2005; Acemoglu et al., 2001). A more direct effect comes from the fact that more competition can cause more efficient firms to capture a larger share of production (Boone, 2000; Vives, 2004), and therefore the relative marginal product between two given skill levels increases, returns to skill go up, and so does wage inequality (Guadalupe, 2007; Cuñat and Guadalupe, 2009).

This paper aims to contribute to these strands of literature by studying a specific mechanism through which competition can affect quality, namely, the demand for a key input in production (physician quality). Furthermore, this paper studies these effects in the health care sector, where the effects of increased competition on quality have been broadly discussed in the literature because they have very relevant policy implications. Unlike the previous literature, it uses scores from medical specialty admissions tests as a measure of physician quality, which has the advantage of being predetermined and thus exogenous to labor demand responses to changes in the competitive environment. By focusing on the short-term effects of increased competition, while the relative supply of high-quality physicians is relatively inelastic, it can contribute to understanding the differences between the short-run and long-run responses of costs and quality with respect to an increase in competition. This paper contributes to understanding the relevance of the functioning and regulations of physician labor markets in shaping the effects of health care market reforms on health care quality, costs, and the distribution of rents.

2 Background about Uruguayan FONASA

The Uruguayan health care sector offers a relatively clean setting to understand the effects of competition on quality and physician wages and hours. In this section, I present the key characteristics of the Uruguayan FONASA system, and briefly discuss the main factors that are fundamental to the empirical strategy followed in this paper. The Uruguayan FONASA[3] is a public health insurance policy that aims at providing universal coverage to the population. With the goal of universalizing coverage, in July 2007 FONASA started covering everyone that was previously covered by the social security program (DISSE) plus the public workers that had no other source of coverage. From then on, FONASA gradually incorporated different groups of individuals, including workers in the banking sector, notaries, retirees, and dependent children and partners of other individuals covered by FONASA, totalizing about two thirds of the population by 2013.

[3]Uruguay has a population of 3.3 million and a GDP per capita of about 16,000 USD in PPP in 2012 (Uruguay is similar in population and size to Oklahoma State in the US, and the GDP per capita of the United States is approximately 3.25 times as large). Health expenditures represented 8.5% of the GDP in 2011. The Uruguayan population is relatively elderly and has relatively high life expectancy at birth (77 years), with population dynamics in terms of mortality and birth rates similar to developed countries. Most of the population (95%) lives in urban areas, with 40% of the total population living in Montevideo (capital city).

Once covered by FONASA, a person has the right to choose a health care provider among the public health care provider (ASSE) and private providers (hospitals). For each person covered, FONASA pays an age- and gender-adjusted per capita monthly fee to the provider. The amount of the fee is fixed by the regulator and is the same to every health care provider. Consumers make contributions to FONASA, via tax contributions on wages, that do not depend on whether they choose ASSE or any private hospital. Therefore, under FONASA, the out of pocket costs are the only differential cost for consumers when making a choice of provider, and it is the most important factor in their decisions. When making a decision about enrollment, consumers also care about the quality of the hospitals, represented mainly by the waiting times and the quality of the physicians working in the different hospitals. When not covered by FONASA, consumers can pay the premium and enroll at the hospital of their choice or can use the public health care services (ASSE). In this sense, almost all new FONASA consumers are consumers that were previously privately enrolled at a hospital or receiving health care services from ASSE (non-FONASA ASSE consumers hereafter).

Although the government has been carrying out a plan to increase the quality (and budget) of the public health care services, ASSE is seen by the population as a lower quality health care provider than the private hospitals, and the majority of consumers in FONASA (87%) choose to enroll in private hospitals. There are 38 hospitals in Uruguay, with 11 of them being in the capital city. According to the Uruguayan Department of Health, the other hospitals are distributed in 16 markets, that in general correspond to the *departamentos*.

Hospitals in Uruguay are vertically integrated, being both the insurance company and the providers of health care. In this sense, and contrary to what happens in many countries and remarkably the US, there is a direct demand for hospitals. First, there are no insurance companies working as an intermediary between consumers and hospitals. Moreover, physicians are hired by hospitals and they receive a wage for their worked hours. Therefore, consumers consider the characteristics of the hospitals (out of pocket prices, quality and waiting times) in order to choose hospitals. Second, each person receives all the health care services from the hospital they choose to enroll at for the time of the lock-in period. An important consequence of this is that hospitals are not specialized in different health conditions or medical specialties.

From the point of view of the hospitals, most of their revenues come from the monthly fees (an analog to premiums) paid by FONASA. Other sources of revenues are the out-of-pocket expenditures that consumers have to pay for doctor visits, clinical studies, and other treatments. In general, out-of-pocket expenses (co-payments) are presented as moderators of the demand, and not as a proportion of the cost of the treatment. However, these copayments represent a significant share of the total revenues of the hospitals. The price increases of these copayments are regulated, but their relative prices are determined by hospital competition. With the reforms in the social security program, the government promoted a general reduction in co-payment prices for all hospitals. Although this policy was relatively successful, the co-payments still represented 9% of the total revenues of hospitals in 2011.

In addition to out-of-pocket price competition, consumers care about the quality and the availability of physicians in these institutions, and in particular about the waiting times for appointments with professionals of certain medical specialties. Each year the Department of Public Health releases information about the out-of-pocket prices of the hospitals, the accomplishment of some goals that the regulator had previously set, and some other general information, with the purpose of making consumer decisions more information-based. However, the information provided has been changing over the years and thus it is not possible to construct consistent data series. Hospitals have very little room to use other potential drivers of competition because of the regulation. The incorporation of technology to play an "arms race" is prevented by a tight regulation of the requirements that health care organizations have to satisfy to incorporate new technology. As part of these requirements, the regulator evaluates the perceived demand on the system and the impact of the technology on consumers' health. The regulation of advertisement has also been tight, and was increasingly regulated during the reform period. Since December 2011, the regulator informs the health care organizations about the priorities that the advertisements should address, and no less than 80% of the total time of the advertisement must be about those contents.

Competition on the quality of physicians is very important in the system. It is typical for consumers to talk about the quality of physicians. In particular, since the most renowned physicians typically also work in the public university, their position at the university (assistant, associate or full professor) is typically mentioned. However, the position at the University is not an exogenous measure of quality of physicians, since it can be affected by the hospital where they work and other factors. In order to find an exogenous measure of quality of physicians, I leverage the fact that specialists have to take a test to be admitted into the medical speciality graduate school. Even more, these test scores are comparable, since until 2014 only the public university, Universidad de la República, offered medical specializations. Therefore, the scores in this test can be used as an exogenous measure of quality of the physicians.

Physicians in Uruguay have to complete a training of 8.5 years to receive a degree of non-specialized medical doctor. After that, those who want to pursue graduate studies for a specialty have to take about 4 more years of medical training. In order to enroll for this specialization, they have to obtain a minimum score in an exam. Since 1984, those who obtain the best scores receive a fellowship during the time of their studies (they get paid during the length of their residency). The other students can access to the same education but they are not paid, and usually have other jobs while studying. By compiling and digitalizing administrative records from the public university, I was able to collect exam scores for the cohorts of graduate medical school applicants between 1996 and 2010. This is the measure of quality of physicians that I use in my empirical approach.

In this paper, I leverage the changes in the lock-in rules for consumers that started in 2009, and the effects that these changes had on the competition among hospitals, to identify the effects on wages, hours and overall quality of hospitals. In 2009, the government opened an open enrollment period for the first time in nine years, during which each person covered by FONASA was allowed to switch to another provider. Before that, there was a period of nine years during which each individual that was receiving coverage through the social security program (FONASA, and formerly DISSE) was locked-in with the same provider they had at the time the lock-in policy was implemented in 2000, or when they started contributing to social security, whichever happened later.[4] In 2009, this regime was changed, and Act 65/009 established that the persons covered by FONASA would be allowed to switch to another provider in the system during the month of February 2009, if by February 1st, 2009 they had been enrolled with the same provider for at least 10 years. The act also established that once a person switched to another provider, they would have to remain enrolled at the new provider for at least three years before being able to switch again.[5] New legislation in 2010 and 2011 further reduced the requirements for being allowed to

[4]The reason declared by the government for this regulation was the fact that some hospitals were "buying" consumers, paying them to switch hospitals, but the implementation of the policy was confounding with a strong macroeconomic instability generated by a banking crisis.

[5]The Act established that the individuals who are assigned to ASSE by default (because they did not indicate a choice of provider when they obtained FONASA coverage) would be able to choose a provider on February each year.

switch providers, effectively increasing the number of people that were allowed to switch.[6] By 2011, all FONASA beneficiaries that had been enrolled with the same provider for at least three years would be allowed to switch providers in each open enrollment period.

To summarize, I use the change in the lock-in rules as a quasi-experiment by leveraging the facts that: a) hospitals are vertical integrated with physicians and insurance companies; b) until 2014, only one university was able to issue specialist titles and in order to get admitted students have to take a test, and I can use these test scores as a measure of physician quality; and c) there was an exogenous increase in competition starting in 2009 due to a reform of the lock-in rule for consumers who were not able to switch hospitals before.

3 Theoretical Framework

In this section, I offer a simple model to describe the type of effects on returns to skill and relative hours that we would expect under changes in competition generated by reductions in inertia. The main intuition behind the model is that more productive workers may be relatively more valuable as the product market becomes more competitive, because competition may increase the value of quality. This theoretical framework shows the sufficient condition under which competition increases the wage differentials for different skill levels of workers. The model adapts Guadalupe (2007) to this particular setting and also builds on previous work by Boone (2000) and Vives (2004).

Let us begin by describing the model assumptions. Suppose that higher-skill workers are a quasi-fixed factor, they are in limited supply. There are N different levels of skill (g_λ with $\lambda = 1,...,N$). Each firm hires only one worker. The non-wage unit costs ($c(g_i)$) are a decreasing function of the quality of the physician g_i. Firms compete for workers through their wage offers $w(g_i, \theta)$, where θ is the parameter for competition (number of consumers able to switch health providers). Now, let's define profits for a firm with a worker of quality g_i as:

[6] In 2010, Act 14/010 established very similar conditions to Act 65/009. However, the requirement for being able to choose a new provider was reduced to seven years instead of 10 years of being enrolled with the same provider. In January 2011, Act 03/2011 further reduced the requirement for switching providers for individuals covered by FONASA, establishing that individuals with at least 3 years of enrollment with the same provider would be able to switch providers during the open enrollment period of each February. In both cases, the requirement of the lock-in for the next three years after switching providers was kept unchanged, and people assigned to ASSE by default could also change under the same conditions.

$$\Pi(g_i,\theta) = \big[p(g_i,\theta) - c(g_i,\Omega_m)\big]y(g_i,\theta) - w(g_i,\theta) = \tilde{\Pi}(g_i,\theta,\Omega_m) - w(g_i,\theta)$$

where: price (p) and quantity (y) are functions of quality (g_i) and the competition parameter (θ), and unit costs ($c(g_i)$) are a decreasing function of the quality level of the medical specialist g_i. All the other factors of costs are included in Ω_m. Let's also normalize the cost function for the lowest quality physician (g_N) as $c(g_N,\Omega_m) = c(\bar{c},\Omega_m)$ and assume that the N^{th} ability worker in the market gets their reservation wage (their last and only outside option) $w(g_N,\theta) = b$.

Competition in the labor market implies that: (i) in equilibrium wages must be such that firms are indifferent across workers (skill levels), so that (ii) identical firms (in every sense other than the skill of their workers) make identical profits independently of whom they hire, which means that each worker captures the surplus they generate. Therefore, profits are equalized among (identical other than by the skills of their workers) firms:

$$\begin{aligned}
\tilde{\Pi}(g_1,\theta,\Omega_m) - w(g_1,\theta) &= \tilde{\Pi}(g_i,\theta,\Omega_m) - w(g_i,\theta) = \tilde{\Pi}(g_N,\theta,\Omega_m) - w(g_N,\theta) \\
&= \tilde{\Pi}(\bar{c},\theta,\Omega_m) - b \\
w(g_i,\theta,\Omega_m) &= \tilde{\Pi}(g_i,\theta,\Omega_m) - \tilde{\Pi}(\bar{c},\theta,\Omega_m) + b
\end{aligned}$$

Therefore, wage offers have the same slope as the gross profit function, but they are shifted down by a constant. In this setting, the sufficient condition for an increase in competition triggering an increase in wage dispersion is:

$$\frac{\partial^2 w(g_i,\theta,\Omega_m)}{\partial g_i \partial\theta} = \frac{\partial^2 \tilde{\Pi}(g_i,\theta,\Omega_m)}{\partial g_i \partial\theta} > 0$$

Intuitively, the sufficient condition says that if the increase in competition raises the marginal benefit between two given skill levels, it will increase returns to skill. There are different sets of conditions on the different components of the profit function that satisfy this sufficient condition. A particular set of these conditions would be that consumers are willing to pay for quality or, in other words, that the price is an increasing function of quality ($\frac{\partial p(g_i,\theta,\Omega_m)}{\partial g_i} > 0$), that consumers are willing to pay more for quality when competition increases ($\frac{\partial^2 p(g_i,\theta,\Omega_m)}{\partial g_i \partial\theta} > 0$), that hospitals increase market share by increasing quality ($\frac{\partial y(g_i,\theta,\Omega_m)}{\partial g_i} > 0$), and that this gain of market share is higher the higher is the level of competition in the market ($\frac{\partial^2 y(g_i,\theta,\Omega_m)}{\partial g_i \partial\theta} > 0$). In the empirical section, I will explore these correlations in the main market, the capital city.

Finally, in the model presented above we do not allow physicians to adjust hours of work. However, if we also think that physicians would adjust hours, then the change in demand induced by the increase in competition can potentially increase both hours and wages. Overall, the main takeaway from the model is that the increase in competition will lead to an increase in the demand for high-skill physicians, and that the relative increases in hours and wages for skilled workers will depend on the relative elasticity of supply among different levels of skill.

4 Data and Descriptive Statistics

In this paper I use two main sources of data. The first source of data is the SCARH database, an administrative database from the Uruguayan Department of Health, which has hours worked and wages for each medical specialist in Uruguay. This dataset is at the medical specialist and quarter level, and spans from the second quarter of 2007 to the second quarter of 2014. Note that this period covers the change in the lock-in 2009. The data also contain information about medical specialty, gender, age and hospital(s) where the medical specialist works.

The second source of data is a database with the test scores that physicians obtained in the exam to enter the medical graduate school to become specialists. To the best of my knowledge, this is the first time that medical graduate school test scores are used as a measure of quality in the health care economics literature. I obtained and digitalized data on 1197 medical specialists, which covers the cohorts that took the exam between 1996 and 2010 and represents about 22% of the total stock of medical specialists in Uruguay. Different specialties have different exams, but all exams are graded over 40 points (with a minimum passing score of 10 points). In order to evaluate if these test scores are a proxy for quality, I analyzed the correlation between the scores and the pre-reform wages by regressing wages on scores. The hypothesis is that if higher scores are a good proxy for quality, physicians with a higher score will have higher productivity and thus higher wages. While I cannot estimate the causal effect of an increase in the score on wages because the score may be correlated with other characteristics of physicians and their employers, regressing wages on scores allows me to obtain an estimate of the association between them. I find a strong and positive correlation between wages and scores, with one additional score point being associated with 3% higher wages.[7] Another piece of evidence that points in the direction of scores as a good measure of quality is the correlation between scores and the placement as professors and assistants in the public university where physicians study medicine and specialties. I find that the individuals who enter the academic career obtained very high test scores.[8]

The descriptive statistics for specialists are presented in Table 1. The first three columns present the information about the population of specialists in Uruguay reported in the SCARH database (5401 specialists), while the other three columns present information about the sample of those for whom I have information on scores (1197 specialists). The average age of specialists in Uruguay is 46 years old. Since I only have scores for exams between 1996 and 2010, the average age in my sample is 35 years old, which is considerably lower. Regarding gender, specialist in Uruguay tend to be female (62%) and this situation is even more clear in my sample where 70% of specialists are women. For the same reason of being younger and with less experience in the labor market, the specialists in my sample work fewer hours (123 vs. 166 hours per month) and have lower wages per hour (16 vs. 29 dollars per hour) compared to the population of specialists in Uruguay. The population of specialists also have higher standard deviations in wage per hour and hours worked. Some specialists receive a very high wage per hour and also report to work a very high number of hours per month. This is related to the fact that hospitals compute on-call hours as hours worked. Figure 1 shows histograms of the distribution of wages per hour and hours worked for the population and the sample. Finally, the average score in the exam for the sample is approximately 27 with a standard deviation of 7 points.

Specialists in Uruguay sometimes work for more than one hospital at a time. About 65% of total specialists worked only at one hospital at a time, while the other 35% worked at two or more

[7] I proceed by regressing the log pre-reform wages on the test scores of specialists. Note that it is impossible to estimate the effect of the scores on wages controlling for a fixed effect by person. Therefore, I tested the correlation between scores and log pre-reform wages in different periods of time before the reform (cross sections), and also for the whole period of time before the reform (as a panel) using random effects. In both cases, there is a strong an positive correlation between wages and (log and levels of) scores. According to the estimates for both the cross sections and the random effects specifications, the elasticity of wages to scores is 0.80 (regression over log score), and one extra score point is associated with 3% higher wages (regression over score in levels).

[8] In order to explore this, I obtained the directory of all professors and research and teaching assistants, and I checked what were the scores that these individuals obtained in their exam. Note that because I am working with cohorts after 1996, many of the academics that are in this sample are in the first stages of their academic career (teaching and research assistants positions, which in this university are not associated with being a graduate student), and among the professors there are mainly assistant and associate professors.

hospitals at least for one period. In the sample used in this paper, the distribution is very similar, with 69% of specialists working only at one hospital during each period of time. When we compare the descriptive statistics for these two groups of specialists, the specialists who work at one hospital in each period of time are very similar in characteristics to the other specialists, and this is true for both the population of specialists and the sample. Some differences can be found in wages per hour and in hours worked. While the population the specialists that work in more than one hospital have relatively lower wages per hour and fewer hours worked, in my sample these differences are relatively reversed. However, the differences are relatively small and they are consistent with the idea of having the best specialists working at only one hospital as their careers develop.

I use an additional source of data that refers to the regulated mobility regime, and includes the total number of FONASA beneficiaries, the number beneficiaries able to switch hospitals during each open enrollment period, and the number of beneficiaries that decide to switch in each year. This information is available at the website of the Department of Public Health. Table 2 shows the evolution of these variables in the period 2007 to 2014. The number of people covered by FONASA increased over time, from about 754.000 in 2007 to about 2.3 million at the end of the period. These new FONASA consumers are a combination of individuals that were before privately enrolled at the hospitals paying the premium, or consumers that were enrolled at ASSE (non-FONASA ASSE consumers).

As mentioned above, mobility was prohibited from 2001 to 2008 under the social security system, and around 2011 the percent of people able to switch hospitals peaked. In my empirical approach I use the percentage of people covered by FONASA who are able to switch to identify the intensity of the competition. As discussed in Section 2, in 2009 only those who had been enrolled at the same hospital for at least ten years were allowed to switch, which represented 424,000 people (28.4%). In 2010, the requirement was lowered to having been enrolled in the same hospital for at least seven years, and therefore the number of people able to switch increased to 528,000 (34%) that year. From 2011 on, the requirement for being able to switch during each open enrollment period was to have been enrolled in the same hospital for the last three years, which represented about 1.2 million people (around 60%) per year (Panel (a) in Figure 2). From those beneficiaries able to switch, not everyone actually switches hospitals. The number of people switching hospitals was higher during the first years after the reform, reaching a maximum of 159,000 people in 2011 and staying stable around 77,000 on average during the last years of the sample period.

The implementation of the regulated mobility scheme generated more incentives for firms to compete. Each year many beneficiaries were able to choose a new hospital after being locked-in at the same hospital for a long time. A way to check the existence of increased competition is to check the evolution of out-of-pocket prices. Fleitas (2016) computes a price index of out-of-pocket prices for hospitals from the first quarter of 2009 to the second quarter of 2013. Panel (b) in Figure 2 shows the evolution of this price index for a sample of the five highest price hospitals in the capital city. The graph shows that, at the same time that the regulated mobility regime was modified to allow many more consumers to switch hospitals in 2011, the out-of-pocket prices responded with some hospitals decreasing their prices and some other hospitals moving to a better relative position and increasing their out-of-pocket prices. One limitation of this information is that, since it starts in 2009, it does not allow us to check the evolution of prices before and after the change that allowed beneficiaries to switch hospitals. Although this is not proof of the increased competition, the changes in prices that correlate with the changes in the regulated mobility regime suggest changes in the competitive nature of the industry around this time. Unfortunately, and although advertising and investments of hospitals is heavily regulated, the information about the magnitudes of their expenditures on these items is not available.

Additionally, an important fact for the identification strategy described in the next section is that, since consumers have to receive all the health care from the hospital they are enrolled at, hospitals in Uruguay are not specialized. This fact is true even in the market of Montevideo, which has the largest number of hospitals. Panel (c) in Figure 2 shows the distribution of visits to the hospitals of Montevideo for the year 2012, suggesting that there is no systematic specialization in terms of the treatment of different conditions across hospitals.

In the next section I present the empirical approach used to estimate the causal effect of increased competition on the returns to skills and relative hours of physicians. Before that, this section presents raw data on the differential evolution of the wages per hour of high-skill and low-skill specialists. In order to do that, I start by computing in which percentile of the distribution of scores the specialists are. Panels (a) and (b) of Figure 3 present the evolution of the average log wages per hour over time for the specialists in the top and bottom 10% and 30% of the distribution of scores, respectively. These graphs show that before 2009, the evolution of log wages per hour was relatively similar, but that after 2009 (and especially around 2011) the wages of high-skill specialists increased more than the wages of low-skill specialists. Although this descriptive evidence is clearly in line with the hypothesis that the increased competition had a causal effect on returns to skill, there can be other factors affecting this comparison. The next section presents the empirical approach and the identification strategy that allows me to establish the causal effect of increased competition on returns to skill.

5 Empirical Approach

My theoretical model suggests that wage offers are a function of the skill of the medical specialist, the level of competition and other factors like the technology of the firm and other individual level factors ($w(g_i, \theta, \Omega_m)$):

$$\text{Log(y)}_{ikt} = \underbrace{\alpha_{ik} + \gamma_1 \begin{bmatrix} \text{Score} \\ \text{Variable} \end{bmatrix}_{ik}}_{\tilde{\alpha}_{ik}} \underbrace{+\gamma_2 \begin{bmatrix} \text{Reform} \\ \text{Intensity} \end{bmatrix}_{t} + \tau_{kt}}_{\tilde{\tau}_{kt}} + \beta \begin{bmatrix} \text{Score} \\ \text{Variable} \end{bmatrix}_{ik} \times \begin{bmatrix} \text{Reform} \\ \text{Intensity} \end{bmatrix}_{t} + X_{ikt}\theta + \epsilon_{ikt}$$

where i stands for individual, k for specialty and t for the period; $Log(y)_{ikt}$ is, alternatively, log wages per hour or log hours worked; Log Score$_{ik}$ is the log score obtained in the exam by individual i to be admitted in his/her specialization (k); Reform Intensity$_t$ is the share of consumers that are able to switch hospitals in quarter t; τ_{kt} is a set of dummies for time-by-specialty fixed effects; X_{ikt} is a matrix of control variables (age and age squared); and ϵ_{ikt} is an i.i.d. idiosyncratic shock for physician, specialty and time. In this equation, β is the main coefficient of interest, representing the effect of the increased in competition on the relative log wages or hours.

Unfortunately, I cannot separately identify α_{ik} andγ_1, or γ_2 and τ_{kt}. Therefore, the specification to be actually estimated with the data is:

$$\text{Log(y)}_{ikt} = \tilde{\alpha}_{ik} + \tilde{\tau}_{kt} + \beta \begin{bmatrix} \text{Score} \\ \text{Variable} \end{bmatrix}_{ik} \times \begin{bmatrix} \text{Reform} \\ \text{Intensity} \end{bmatrix}_{t} + X_{ikt}\theta + \epsilon_{ikt} \tag{1}$$

where $\tilde{\alpha}_{ik}$ is the combined effect of the individual fixed effect plus the effect of the level of skill of the individual, and $\tilde{\tau}_{kt}$ is the combined effect of the time-by-specialty fixed effect plus the effect of the intensity of the reform.

A different way to capture the effect of the intensity of competition on returns to skills and relative hours is to non-parametrically estimate the effect of the score variable by year. The specification is very similar to Equation 1 but now the main variable of interest is substituted by a combination of effects by year. Formally, the equation to be estimated is:

$$\text{Log(y)}_{ikt} = \tilde{\alpha}_{ik} + \tilde{\tau}_{kt} + \sum_{j=2008}^{2014} \beta_j \times 1(j=t) \times \begin{bmatrix} \text{Score} \\ \text{Variable} \end{bmatrix}_{ik} + X_{ikt}\theta + \epsilon_{ikt} \qquad (2)$$

where β, the main coefficient of interest, is the effect of the increased in competition on the relative log wages (or hours). Note, however, that the interpretation of the coefficient β is different now from the previous specification. In this specification, β is allowed to vary non-parametrically for each year, to capture in an "event study" the effects of the reform intensity over the years.

A third possibility is to estimate the average effect of the reform, by estimating the effects of the scores before and after 2009, by interacting the score variable with a dummy after reform. In this specification, the set of controls is the same as in Equations 1 y 2. However, the coefficient β now captures the average effect of the reform over all the years after the policy change was introduced.

In all the previous specifications, the identification comes from the fact that both the skill of a physician and the timing of the reform are assumed to be uncorrelated with the shock (ϵ_{ikt}), after controlling for characteristics of the specialists and the specialist and time-by-speciality fixed effects. In other words, identification relies on the assumption that there are no unobserved factors that are correlated in time with the reform and that differentially affect the wages and/or hours worked by specialists of different relative skill (as measured by test scores). Note that the characteristics of the individuals that are fixed over time are captured by the individual fixed effects, while everything that affects the specialties over time, such as technological changes in the specialty or changes in the priorities across specialties in the health care system, are captured by the specialty-by-time fixed effects.

However, a potential concern in these specifications is that, as was discussed in the data section, some physicians work in more than one hospital, and the previous specification aggregates all hours and wages of physicians at the individual level. In order to address this concern, another possibility is to define the observations at the individual-by-hospital level, having a specialist working in two hospitals at the same time as two observations. In addition to the previous controls, this specification allows us to also control for all the things that are changing in the same hospital over time. Formally, the equation to be estimated is:

$$\text{Log(y)}_{ihkt} = \tilde{\alpha}_{ik} + \tilde{\tau}_{kt} + \mu_{ht} + \beta \begin{bmatrix} \text{Score} \\ \text{Variable} \end{bmatrix}_{ik} \times \begin{bmatrix} \text{Reform} \\ \text{Intensity} \end{bmatrix}_{t} + X_{ikt}\theta + \epsilon_{ihkt} \quad (3)$$

where all the variables and subindexes represent the same as before and now we incorporate the subindex h to represent each hospital at which specialists work. Additionally, μ_{ht} represents a hospital-by-time fixed effect that captures all the factors that are common for the same hospital at each period of time. Note that specialty-by-time fixed effects are also included. In this specification, the coefficient β is estimated only with variation after controlling by individual fixed effects, time variant shocks that happen at the specialty level, and time variant shocks that happen at the hospital level. The remaining concerns about endogeneity come from the potential presence of some time variant shocks that happen at the hospital-specialty level. However, and as it was discussed in Section 2, hospitals in Uruguay are not specialized and consumers have to receive all the medical attention from the same hospital, so there are no incentives to overdevelop some specialties over others as a way to compete for consumers.

Finally, it is also possible to test heterogeneous effects across different specialties. This specification is relevant because: (a) different specialties could have different substitutability between labor and capital; and (b) different specialties could have different bargaining power through their professional associations. In that sense, the following specification is estimated for each specialty k separately:

$$\text{Log(y)}_{ikt} = \tilde{\alpha}'_{ik} + \tilde{\tau}'_{kt} + \beta_k \begin{bmatrix} \text{Score} \\ \text{Variable} \end{bmatrix}_{ik} \times \begin{bmatrix} \text{Reform} \\ \text{Intensity} \end{bmatrix}_{t} + X_{ikt}\theta_k + \epsilon_{ikt} \quad (4)$$

where all the subscripts and variables represent the same as in the previous specifications.

As it was discussed, the identification strategy leverages the exogenous change in competition induced by the change in the regulated mobility regime and the fact that the scores are obtained before entering the labor market and therefore exogenous to any endogenous factor, conditional on individual characteristics and a rich set of fixed effects by individual and by specialty-by-time. It is important to notice that using a contemporaneous measure of quality of the specialist would introduce endogeneity, because it could be correlated with hospital factors, for example related to on-the-job training.[9]

6 Results

Table 3 presents the estimates of Equation 1 for the sample of 1,197 specialists. In this sample, each observation is the aggregate wage per hour (or hours) the specialist received (worked) in a particular quarter. Therefore, the information for specialists that worked at more than one hospital during a period is aggregated across the different hospitals. Columns I to III present the estimates using Log(Wages) as the dependent variable, while Columns IV to VI present the estimates using Log(Hours) as the dependent variable. In all panels and columns, standard errors (in parenthesis) are clustered at the specialty level.

In Panel A I use the log score as a measure of skills. Columns I and II present estimates with individual and time fixed effects, and they differ in the inclusion of the age controls. Column III is the preferred specification, where age controls as well as individual and time-by-specialty fixed effects are included. This last specification allows to control for factors that can change differently over time for different specialties. All the estimates show a positive effect of the intensified competition on returns to skill. To understand the magnitude of these effects, note that the percentage of consumers able to switch went from 0% to about 60% because of the reform. Therefore, the change in the regulated mobility regime that intensified competition caused an increase of about 1 unit ($1.7661 \times 0.6 = 1.0596$) in the score elasticity of wages. Therefore, compared to the situation before the reform, after the reform an increase of 1% in the score would increase the relative wage by an extra 1%. Columns IV to VI follow an analogous presentation, with the first two columns using time individual and time fixed effects and the last column using individual and specialty-by-time fixed effects. The intensified competition caused an increase of about 0.6 units ($0.8182 \times 0.6 =$

[9]Unfortunately, in this paper I do not have a reliable measure of contemporaneous quality of specialists. With such a measure at hand, it would be possible to use the test scores as an instrument for contemporaneous quality of the physicians in a two-stage least squares strategy, in order to estimate the effect of the increase in competition on the returns to skills and relative hours by skill.

0.4909) in the score elasticity of hours.

In Panel B, the score is used as a measure of skill, instead of the log score. In this specification we can estimate the effect of one additional point in the score on the increase of returns to skills or relative hours. Again, note that the percentage of consumers able to switch went from 0% to about 60% because of the reform. Therefore, according to my preferred specifications (Columns III and VI for wages and hours, respectively), compared to the situation before the reform, after the reform an increase of one score point generates a relatively large effect of 3.5% in wages ($0.0590 \times 0.6 = 0.0354$), while it generates an increase in relative hours of 2% ($0.0327 \times 0.6 = 0.0196$). Since the standard deviation of the scores is 7.09 points, these estimated effects imply that after the reform, an difference of one standard deviation in scores is associated with a wage premium 25 percentage points higher ($0.0354 \times 7.09 = 0.2509$), and an difference in hours worked 13.89 percentage points higher ($0.0196 \times 7.09 = 0.1389$).

Let us now analyze the non-parametric estimate of the effect of the log-score variable by year, by interacting the log score variable with year dummies as in Equation 2. I present the results for the estimates of the effect by year, in specifications using a full set of controls, in Figure 4. The top graph in Figure 4 shows the timing of the effects on returns to skills. First, it is possible to see that the increase in relative wages coincides with the increase in the intensity of competition (measured as the percent of beneficiaries able to switch, see Panel A in Figure 2). The largest effects are observed around 2011 and 2012, when more people were able to switch hospitals. In addition, this analysis suggests that the effect on wages is a short-run effect. While the estimated effect has its peak around 2012, it decreases in the two years after, and it is not significant in 2014. This reversion to zero in the medium run is expected because of at least two factors. On one hand, the intensity of the reform is lower in the last two years because the number of people able to switch shows some decline at the end of the period. On the other hand, it is expected that in the long run, as more physicians are able to enter the specialties, the relative supply of high-skill specialists is more elastic, reducing the effect of the demand shock. The bottom graph in Figure 4 shows the size and the timing of the effects on relative hours. The results show that the estimated yearly effects of intensified competition on hours are not statistically significant, and are only positive after 2012. A slower response of the hours worked is consistent with an inelastic labor supply in the short run, and a relatively more elastic supply in the long run.

Finally, I present an alternative way to approximate the effects of the reform by interacting the log score (or the score) with a dummy indicating the period after the reform of 2009. Table 4 presents these results for the preferred specification (with individual and specialty-by-time fixed effects, among other controls) in the sample at the individual level. The results in terms of wages and hours are qualitatively similar to the main results. Regarding relative wages, after the reform there is an increase of 0.6 units in the score elasticity of wages, and an increase of almost an additional 2.3 percentage points of wages for each additional point in the score. Regarding hours, once again the results do not reject the null hypothesis of no effect of log scores or scores on hours after the reform. The point estimates suggest that the reform generated an increase of 0.1 units in the score elasticity of hours, and an additional 0.31% increase of hours per test score point. These results suggest again a relatively large effect on wages and a small (if any) effect on hours. The fact that the estimates are smaller than the results when we introduce the intensity of the reform is consistent with the timing of the reform, whose effects are larger around 2011 and fade out in the last years after the reform, when the supply of specialists can begin to respond.

Overall, the previous evidence points to a positive and strong effect of increased competition on the returns to skill, and a less clear (if any) effect on relative hours. In the case of wages, the event-study and the regressions point to a very similar effect, and clearly show that the effect fades out over time. Regarding the hours, the event study and the pre and post specification do not reject the hypothesis of a null effect of intensified competition on hours, although the parametric regression analysis showed a significant (but smaller than for wages) effect. In this sense, the evidence in this subsection is consistent with the existence of an inelastic supply, where at least most of the effect of the increased competition leads to increases in returns to skills, with only weak evidence of increases in quality (relative hours of better physicians). In the next subsection I present robustness checks to discuss these results.

6.1 Robustness Checks

One of the main concerns with the previous specifications is the possibility that there may be changes at the hospital level over time that affect the wages and hours of the physicians working in each hospital. For example, the reform may cause changes in market shares, the competitive positioning of hospitals, and the technology they use, that may differentially affect the earnings and hours worked for all physicians working in the same hospital. This would be a concern for my identification strategy if high-skill physicians are distributed differentially across different hospitals. However, the introduction of hospital-by-time fixed effects would allow me to control for these potentially confounding effects. This was not possible in the previous specifications, because they use the data aggregated at the specialist level across the different institutions where they worked in each period, and some specialists work in more than one hospital at a time. In order to evaluate if this introduces a concern for identification, I construct a new database where the observation is at the level of specialist-by-hospital at each period of time. Therefore, if a specialist works in two hospitals in a particular period of time, this database includes two observations, one per hospital. Organizing the database in this way still allows me to control for the specialist fixed effect, the characteristics of the specialists (age and age squared), and the specialty-by-time fixed effects. In addition, in this database it is possible to also control for hospital-by-time fixed effects, absorbing all the factors that happen at the hospital level in different periods of time.

The results of this exercise are presented in Table 5. The organization of the table in panels and controls by columns is analogous to the previous table, with the difference that all columns include time-by-hospital fixed effects. The estimated effects of increased competition on relative wages in this new sample are almost the same as with the sample at the individual level. The estimates of the preferred specification imply that the increased competition increases the elasticity of wages to scores by about 1 unit ($1.7689 \times 0.6 = 1.0613$), and that after the reform, a difference of one point in the test score is associated with an additional increase of 3.4 percentage points in wages ($0.0562 \times 0.6 = 0.0337$). On the other hand, the effects on hours are not significant in this sample. In my preferred specification, the effect of the increased competition on the elasticity of log hours is about 0.2 ($0.2366 \times 0.6 = 0.1420$) but it is not statistically significant. A similar result is found when I analyze the effect of score in levels, where after the reform, the effect of one additional score point is about 0.6 percentage points increase in hours ($0.0112 \times 0.6 = 0.0067$). The results in this robustness check are similar to those found in the event-study, with a large effect on wages and a non-statistically significant effect on hours, which is consistent with a very inelastic relative supply of high-skill physicians in the short run.

A second potential threat to identification would be if there are confounding effects of the increased demand caused by the FONASA expansion that differentially affect high- and low-skill workers. To be an identification concern, the increase in demand would need to have two characteristics. First, the timing of the increased demand caused by the FONASA expansion has coincide with the timing of the increased competition. Second, the expansion of FONASA would have to increase the demand for high-skill physicians, for example because of the characteristics of the population obtaining coverage or other factors. It is important to note that if the shock of the FONASA expansion increases the demand proportionally for both high-skill and low-skill physicians, the effects would be captured by the structure of hospital-by-time and specialty-by-time fixed effects. If something, we would expect the expansion of FONASA to increase relatively more the demand for low-skill physicians. FONASA went from a program that covered formal workers to expanding over time to cover groups that have a lower income and are therefore likely to have a relatively lower willingness to pay for quality. Additionally, it was shown in Table 2 that the main increase in FONASA consumers took place in 2008, while the increase in competition peaks in 2011 and 2012. However, this concern still requires a more formal approach to check for robustness.

Using the information on the number of FONASA beneficiaries and number of non-FONASA ASSE consumers it is possible to formally test the robustness of the effects of increased competition to the expansion of FONASA. The idea of the robustness check is to include in the regression an interaction between the score and the variable of FONASA expansion and to check if the estimated effect of the increased competition changes in the presence of this new variable. I implement two versions of the test using two variables that represent the expansion of FONASA. The first variable to include in the regression, interacted with the test scores of the physicians, is the actual number of beneficiaries covered by FONASA. While representing the increase in FONASA beneficiaries, the shortcoming with this variable is that there are many consumers that entered FONASA who were already enrolled at a hospital. In this sense, although this is a first proxy for the demand increase, not all the new FONASA beneficiaries represent a demand pressure for the hospitals. Another way to approximate the demand shock is to use the number of non-FONASA consumers in ASSE. Most of the consumers that are leaving the non-FONASA part of ASSE are going to the hospitals. Additionally, the individuals that were previously in ASSE are more homogeneous, so the reductions in the non-FONASA ASSE consumers is somehow a better measure of the demand pressure for hospitals.

The results of these tests are presented in Table 6. Panel A presents the effect of the log scores and Panel B the effect of the scores. Columns I and II present the effects when the number of FONASA beneficiaries interacted with the score variable is added to my preferred specification, for wages and hours respectively. The estimated effects of increased competition on relative wages in both panels are almost the same in magnitude and statistically significance as in the main specifications. The estimated effects on hours are also qualitatively similar as before, since there are no robust effects on the relative hours worked by high-skill physicians. However, in this specifications the effect on hours is negative although not statistically significant, while the effect of the number of FONASA beneficiaries interacted with the score is positive and significant (although not very large). Columns III and IV present the effects when the number of non-FONASA ASSE consumers interacted with the score variable is added to the specification. Again, the effects of increased competition on skill premiums in both panels are almost the same in magnitude as before when we control for the effect of the expansion of FONASA. Note that the statistically significance in these specifications is affected due to an increase in the standard errors (of about 50%) because we are using the cross-sectional variation in the scores to estimate two separate time effects (increased competition and expansion of FONASA). Regarding hours, once again the effects are qualitatively similar as before with no robust effects on hours. Overall, the results of these tests show that the effect of increased competition on returns to skill are robust to controlling for the expansion of FONASA. Regarding hours, these robustness tests show that there is no effect on relative hours.

6.2 Heterogeneity

Analyzing the data at the individual-hospital level also allows me to check whether there are heterogeneous effects of intensified competition for specialists who work at only one hospital at a time during the sample period. If the mechanism of increased competition is at work, we would expect higher effects for those specialist that work at only one hospital, i.e. those who have exclusive employment with one hospital. Table 7 presents the results for the 826 specialist who work at at most one hospital during each period. Again, the organization of the table in panels and controls by columns is very analogous to previous tables. Note that here, and in addition to specialist characteristics, we can control for specialist fixed effects, specialty-by-time fixed effects, and hospital-by-time fixed effects. Consistent with what we expected, the size of the point estimates for this group of physicians is larger than the previous estimates, both in terms of wages and hours, although the differences are not statistically significant. For this group, the increased competition increases the elasticity of wages to scores by about 1.74 units ($2.8951 \times 0.6 = 1.7371$). A difference of one point in the test scores is associated with a large additional effect of 6 p.p. in wages ($0.1 \times 0.6 = 0.06$) after the reform. The effects on hours are now statistically significant in this sample, with a magnitude of 0.35 units for the elasticity of hours to scores ($0.5793 \times 0.6 = 0.3476$). A one-point increase in the score generates an additional effect of 1.6 p.p. on hours ($0.0271 \times 0.6 = 0.0232$), although this is only statistically significant at the 10% level. These estimated effects imply that after the reform, a one standard deviation difference in scores is associated with a wage premium 42 percentage points higher, and an hours-worked difference 11 percentage points higher. These results are consistent with the idea that physicians who behave as if they have exclusive employment at one hospital receive a higher return to skill on their wages. At the same time, they are more flexible in terms of work hours after the reform. The latter result is also consistent with the fact that these specialists work fewer hours on average (120.5 hours per month) than the specialists that work at more than one hospital (129.5 hours per month).

Among the specialists who worked in only one hospital, some of them switched hospitals and some others worked all the time for the same hospital. This is an endogenous decision, and assuming that the wage offers received by physicians who switch and do not switch are similar, making the marginal physician indifferent between changing hospitals or not, we would expect the effects of competition to be very similar for these two groups of people. Table 8 presents the results for the sample of specialists (717) that worked at the same hospital during the whole period. The results on wages and hours under different specifications and controls are very similar as for the full sample of specialists that worked in only one hospital at a time. The point estimates for wages are almost identical while the point estimates for hours are slightly higher, but not statistically different than the results for all the physicians that worked at one hospital a time. Overall, conditional on working at one hospital at a time, this evidence suggests that there are no differences between the effects for those specialists that change hospitals or those who remain in the same hospital the whole time showing the expected arbitrage among job offers. However, it should be noted that the sample of physicians who work at one hospital at a time but ever switch jobs is quite small, so even if there were any differences between these two groups, I have very low power to identify them.

Finally, the effects of the reform may be heterogeneous across specialties, both in terms of wages and hours. As discussed before, we can expect these differences for at least two reasons. On one hand, different specialties may have different demand shocks, and therefore demand shocks may affect them differently. One possible reason for this is that different specialties have different degrees of substitutability between capital and labor. Another reason could be that the reform puts more pressure on the demand for certain specialties, such as those related to primary care. On the other hand, different specialties may have different levels of barriers to entry, for example due to different quotas in each specialty's graduate studies. Therefore, this scarcity and lag in (or lack of) response on the supply side could be expressed in larger effects on wages of the demand increase.

One way to approximate this is to run our regressions separately by specialty, and to compare the size of the estimated effects. The results of this exercise are presented in Table 9. First, the larger increases of wages are associated to specialties with more scarcity, in which there are higher barriers to entry. For example, anesthesiology is a specialty with one of the largest wage increases (5.6 units in the elasticity) and it is an specialty where all the anecdotal evidence and the news point to large barriers to entry. Second, typically large effects on wages are present in some specialties that are likely to have received a stronger demand pressure after the reform. One example of this are areas related to primary care, such as pediatrics, which has an increase in the score elasticity of wages of 2.5 units. However, one limitation of this analysis is that the sample is reduced when it is split by specialty, and therefore some of these estimations are done with small samples.

6.3 Effects for the capital city

The capital city, Montevideo, offers a particularly good setting to understand the effects of competition, since more than 50% of the population lives there and it has the largest number of hospitals (11) competing for FONASA consumers. In this sense, the competitive pressure for quality should be even more clear in this setting than in the full sample of specialists. The sample includes only hours and wages that specialists received (worked) in Montevideo in a particular quarter. There are 987 specialists working at hospitals in Montevideo, which represents 75% of the total number of specialists. This large percentage can be explained by the fact that many specialists work most of their hours in Montevideo but also work some hours in hospitals outside the capital city, typically one day during the week.

Figure 5 presents the event-study for wages (Panel A) and hours (Panel B). The results for Montevideo are qualitatively similar to the results when all the markets are included: increased competition increases the score elasticity of wages and the effect of the score on returns to skill, but it does not have significant effects on hours worked. Additionally, the timing of the effect is also similar. The results of the event-study are confirmed with the regression analysis for Montevideo, presented in Table 10. Consistent with the idea of a higher competition in this market, the effects on wages are higher. For an increase in the percentage of consumers able to switch from 0% to 60%, the estimates imply an increase of 1.68 units in the score elasticity of wages, and of 5.9 p.p. in relative wages per extra score point (41 p.p. for a difference of one standard deviation in scores). On the other hand, in Montevideo it is not possible to reject the null hypothesis that the reform did not increase the hours of the relatively high skilled, and therefore did not increase the total quality of the health care system. The results of the specification using a dummy for post-reform interacted with the scores (available upon request) are consistent with the previous results.

Finally, the characteristics of the market in the capital city allow us to at least explore the mechanisms behind the effects of the increased competition. Recall that the main result from the theoretical analysis in Section 3 is that the wage offers have the same slope as the gross profit function, but they are shifted down by a constant. In this context, the sufficient condition for an increase in competition to trigger an increase in wage dispersion is that the increase in competition should raise the marginal benefit between two given skill levels ($\frac{\partial^2 w(g_i,\theta,\Omega_m)}{\partial g_i \partial \theta} = \frac{\partial^2 \tilde{\Pi}(g_i,\theta,\Omega_m)}{\partial g_i \partial \theta} > 0$). As discussed before, a particular set of conditions on the different components of the profit function that would satisfy this sufficient condition is that consumers are willing to pay for quality or, in other words, that price is an increasing function of quality ($\frac{\partial p(g_i,\theta,\Omega_m)}{\partial g_i} > 0$), that consumers are willing to pay more for quality when competition increases ($\frac{\partial^2 p(g_i,\theta,\Omega_m)}{\partial g_i \partial \theta} > 0$), that hospitals increase their market share by increasing quality ($\frac{\partial y(g_i,\theta,\Omega_m)}{\partial g_i} > 0$), and that this gain of market share is higher the higher is the level of competition in the market ($\frac{\partial^2 y(g_i,\theta,\Omega_m)}{\partial g_i \partial \theta} > 0$).

Most of the markets in Uruguay only have two or three hospitals, so there is little to be gained by aggregating the information at the hospital level and estimating within-market correlations for those hospitals. Montevideo has 11 hospitals during the 18 quarters of the sample, so it is more appealing for aggregating the information at the hospital level and estimating the correlations of quality and competition with market shares and prices. Although the analysis cannot go beyond the estimation of correlations, it allows us to check if the correlations present in the sample are consistent with the story of increased competition.

Table 11 presents the results of this correlation analysis. Column I presents a regression where the log of the out-of-pocket price index is used as a dependent variable. The right-hand-side variables are the mean quality of specialists, which is the weighted (by hours) average of the scores of the specialist that are in sample and work at a hospital, and the mean quality of specialists interacted with the percent of people able to switch. The regression also includes fixed effects by hospital and by time. Both correlations, between log price and quality and between log price and quality interacted with competition, are positive, although none of them are statistically significantly different from zero. Column II presents a regression where the log market share is regressed on the quality, the interaction of quality with the percentage of people able to move, and the log price. The correlations are again consistent with the expected effects, a positive (and statistically significant) correlation between quality and market share, and a positive (but not statistically significant) correlation between the market share and the interaction of quality and percentage of people able to switch. Note also that in this regression, and although it includes hospital fixed effects, the price coefficient is positive, which is a strong signal of endogeneity problems in the regression. Overall, these correlations are consistent with the signs of the derivatives that are required for the sufficient condition, although they cannot be taken as proof of any of these conditions.

7 Conclusions

In health care markets, reductions of inertia in consumer choices may lead to greater incentives for firms to compete in quality. The effect of this higher demand for physician quality depends on the elasticity of the relative supply of high-skill and low-skill physicians. If the relative supply is inelastic, an increase in the demand for high quality physicians would lead to an increase in their relative wages without increasing their total work hours, and thus without changing the average quality of the health care system, but increasing its costs.

In this paper, I assess these predictions using a quasi-experimental setting in the Uruguayan health care system. I leverage a change in the regulated mobility scheme as a shock that increases the competition in the market to estimate the effects on returns to skill and relative hours for specialists with different levels of skills. I use information on scores in the admissions test for medical specialty graduate school as an exogenous measure of the quality of physicians. To the best of my knowledge, this is the first paper that uses test scores of physicians in a systematic way to understand the effects of competition shocks on returns to skill.

The results of this paper are consistent with the hypothesis of increased competition generating incentives to increase quality, together with a relatively inelastic supply of physicians. Intensified competition caused a relatively large increase in the returns of high-skill physicians. However, there is not robust evidence of an increase in the relative hours worked by high-skill physicians compared to low-skill physicians. In this sense, the reform generated only small (if any) increases in the total quality of the system, measured as the amount of hours weighted by quality of the physicians. Overall, the results show that in a context of inelastic supply, the potential benefits of increased competition in terms of quality can be absorbed by increases in wages. In particular, it underscores the differences between the strategies of adopting more capital, with a relatively more elastic supply, and the adoption of human capital, which in the short run has a very inelastic supply in professions that require licenses.

From a policy point of view, this paper sheds light on the importance of paying attention to labor markets when the product market that demands these human resources has an increased competition or receives a demand shock in sectors with regulations or licenses. In particular, it underscores the importance of understanding the labor markets of physicians and their regulations, and especially the quotas for entrance to graduate school and the role of professional associations. This is crucial for understanding how the markets for human resources in health care work, and how costs may increase and the distribution of rents change with the implementation of a public policy that generates demand shocks for physicians. Examples of these policies have been common in the last decade, when public health care policies were oriented to either expand or universalize coverage (like the Affordable Care Act), or to implement changes in competition or the design of these markets in terms of public and private providers.

References

Abaluck, J. and Gruber, J. (2011). Heterogeneity in choice inconsistencies among the elderly: Evidence from prescription drug plan choice. *American Economic Review*, 101(3):377.

Abaluck, J. and Gruber, J. (2013). Evolving choice inconsistencies in choice of prescription drug insurance. Technical report, National Bureau of Economic Research.

Acemoglu, D., Aghion, P., and Violante, G. L. (2001). Deunionization, technical change and inequality. In *Carnegie-Rochester conference series on public policy*, volume 55, pages 229–264. Elsevier.

Aghion, P., Bloom, N., Blundell, R., Griffith, R., and Howitt, P. (2005). Competition and innovation: An inverted-u relationship. *The Quarterly Journal of Economics*, 120(2):701–728.

Bloom, N., Propper, C., Seiler, S., and Van Reenen, J. (2015). The impact of competition on management quality: evidence from public hospitals. *The Review of Economic Studies*, page rdu045.

Boone, J. (2000). Measuring product market competition. *CEPR Working Paper 2636*.

Buchmueller, T. C., Orzol, S., and Shore-Sheppard, L. D. (2015). The effect of medicaid payment rates on access to dental care among children. *American Journal of Health Economics*.

Capps, C. S. (2005). *The quality effects of hospital mergers*, volume 5. US Dept. of Justice, Antitrust Division.

Card, D. (1996). The effect of unions on the structure of wages: A longitudinal analysis. *Econometrica*, pages 957–979.

Cooper, Z., Gibbons, S., Jones, S., and McGuire, A. (2011). Does hospital competition save lives? evidence from the english nhs patient choice reforms. *The Economic Journal*, 121(554):F228–F260.

Cuñat, V. and Guadalupe, M. (2009). Globalization and the provision of incentives inside the firm: The effect of foreign competition. *Journal of Labor Economics*, 27(2):179–212.

Cutler, D. M., Huckman, R. S., and Kolstad, J. T. (2010). Input constraints and the efficiency of entry: Lessons from cardiac surgery. *American Economic Journal: Economic Policy*, 2(1):51–76.

Dunn, A. and Shapiro, A. H. (2014). Do physicians possess market power? *The Journal of Law and Economics*, 57(1):159–193.

Ericson, K. M. (2014). Consumer inertia and firm pricing in the medicare part d prescription drug insurance exchange. *American Economic Journal: Economic Policy*, 6(1):38–64.

Finkelstein, A. (2007). The aggregate effects of health insurance: Evidence from the introduction of medicare. *The Quarterly Journal of Economics*, 122(1):1–37.

Fleitas, S. (2016). The costs of lock-in in health care markets: evidence from hospital choice in uruguay.

Fleitas, S. (2017). Dynamic competition and price regulation when consumers have inertia: Evidence from medicare part d.

Furman, J. (2015). Occupational licensing and economic rents. *The Brookings Institution*.

Gaynor, M., Ho, K., and Town, R. J. (2015). The industrial organization of health-care markets. *Journal of Economic Literature*, 53(2):235–284.

Gaynor, M., Moreno-Serra, R., and Propper, C. (2013). Death by market power: reform, competition, and patient outcomes in the national health service. *American Economic Journal: Economic Policy*, 5(4):134–166.

Gaynor, M., Propper, C., and Seiler, S. (2012). Free to choose? reform and demand response in the english national health service. Technical report, National Bureau of Economic Research.

Guadalupe, M. (2007). Product market competition, returns to skill, and wage inequality. *Journal of Labor Economics*, 25(3):439–474.

Handel, B. R. (2013). Adverse selection and inertia in health insurance markets: When nudging hurts. *American Economic Review*, 103(7):2643–2682.

Heiss, F., Leive, A., McFadden, D., and Winter, J. (2013). Plan selection in medicare part d: evidence from administrative data. *Journal of Health Economics*, 32(6):1325–1344.

Hirsch, B. T. (1993). Trucking deregulation and labor earnings: Is the union premium a compensating differential? *Journal of Labor Economics*, 11(2):279–301.

Ho, K., Hogan, J., and Morton, F. S. (2015). The impact of consumer inattention on insurer pricing in the medicare part d program. Technical report, National Bureau of Economic Research.

Ho, V. and Hamilton, B. H. (2000). Hospital mergers and acquisitions: does market consolidation harm patients? *Journal of Health Economics*, 19(5):767–791.

Kessler, D. P., McClellan, M. B., et al. (2000). Is hospital competition socially wasteful? *The Quarterly Journal of Economics*, 115(2):577–615.

Ketcham, J. D., Lucarelli, C., Miravete, E. J., and Roebuck, M. C. (2012). Sinking, swimming, or learning to swim in medicare part d. *American Economic Review*, pages 2639–2673.

Miller, D. P. and Yeo, J. (2012). Estimating dynamic discrete choice models of product differentiation: An application to medicare part d with switching costs.

Miller, K. (2014). Do private medicare firms have lower costs.

Nosal, K. (2012). Estimating switching costs for medicare advantage plans.

Polyakova, M. (2016). Regulation of insurance with adverse selection and switching costs: Evidence from medicare part d. *American Economic Journal: Applied Economics*, 8(3):16530.

Propper, C., Burgess, S., and Green, K. (2004). Does competition between hospitals improve the quality of care?: Hospital death rates and the nhs internal market. *Journal of Public Economics*, 88(7):1247–1272.

Romano, P. S. and Balan, D. J. (2011). A retrospective analysis of the clinical quality effects of the acquisition of highland park hospital by evanston northwestern healthcare. *International Journal of the Economics of Business*, 18(1):45–64.

Rose, N. L. (1987). Labor rent sharing and regulation: Evidence from the trucking industry. *Journal of Political Economy*, 95(6):1146–1178.

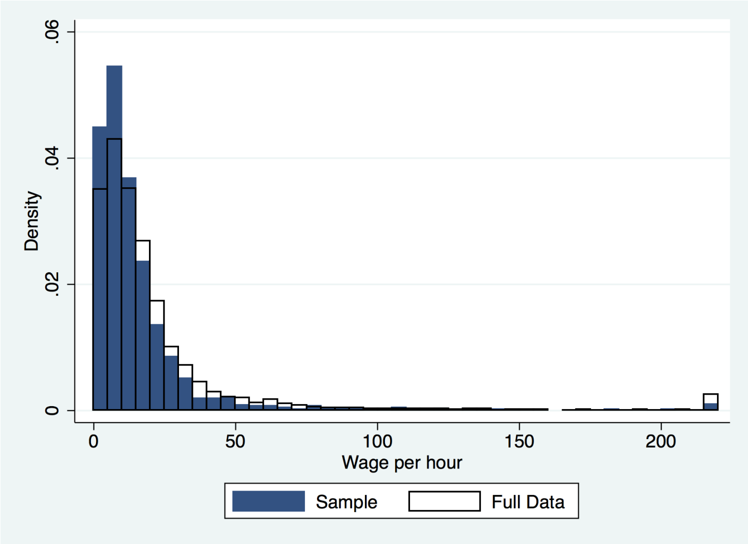
Tay, A. (2003). Assessing competition in hospital care markets: the importance of accounting for quality differentiation. *RAND Journal of Economics*, pages 786–814.

Vives, X. (2004). Innovation and competitive pressure. CEPR Discussion Papers 4369, C.E.P.R. Discussion Papers.

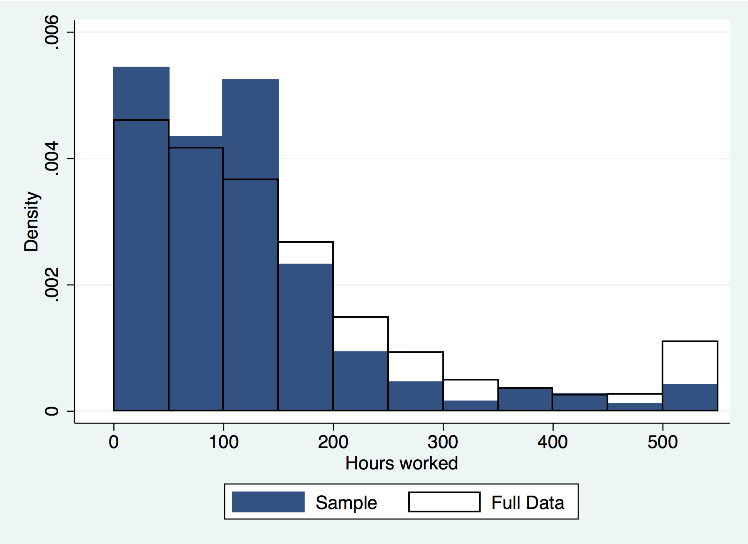
Volpp, K. G., Williams, S. V., Waldfogel, J., Silber, J. H., Schwartz, J. S., and Pauly, M. V. (2003). Market reform in new jersey and the effect on mortality from acute myocardial infarction. *Health services research*, 38(2):515–533.

Wu, Y. (2016). Supply response to consumer inertia: Strategic pricing in medicare part d.

Figure 1: Histograms of full data and sample

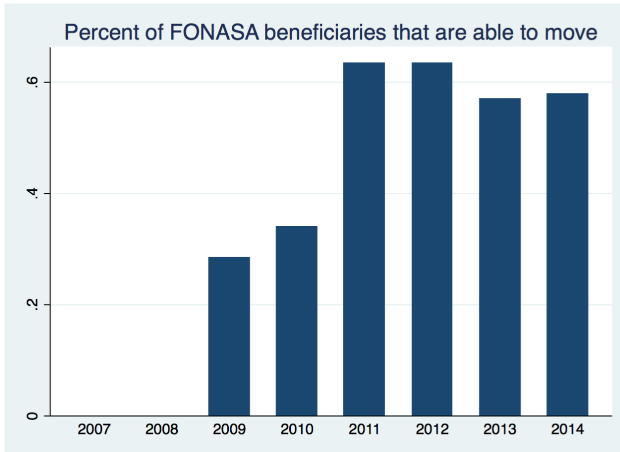


(a) Histogram of wage per hours

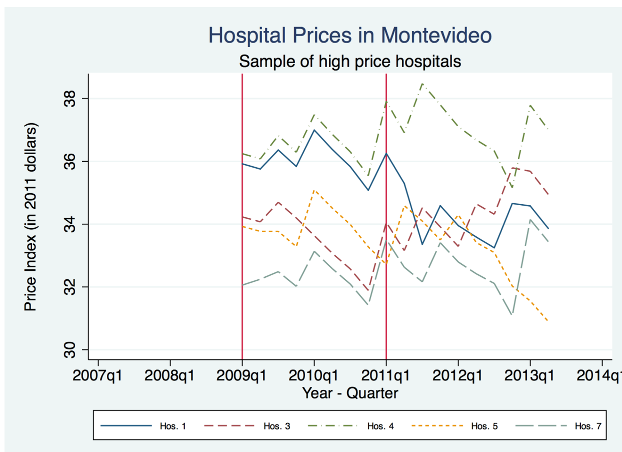


(b) Histogram of hours worked

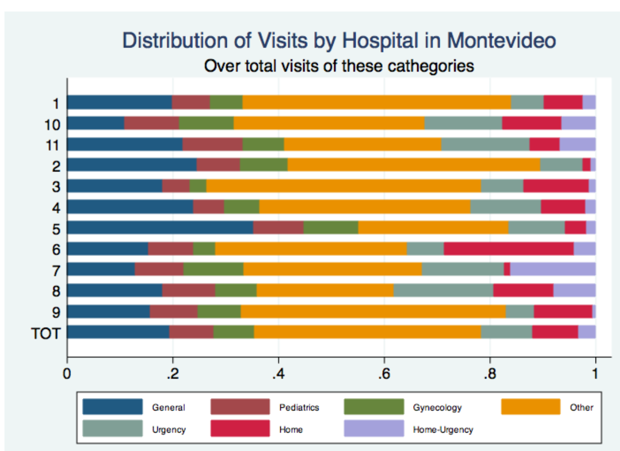
Figure 2: Regulated mobility and increased competition



(a) FONASA consumers able to switch hospitals



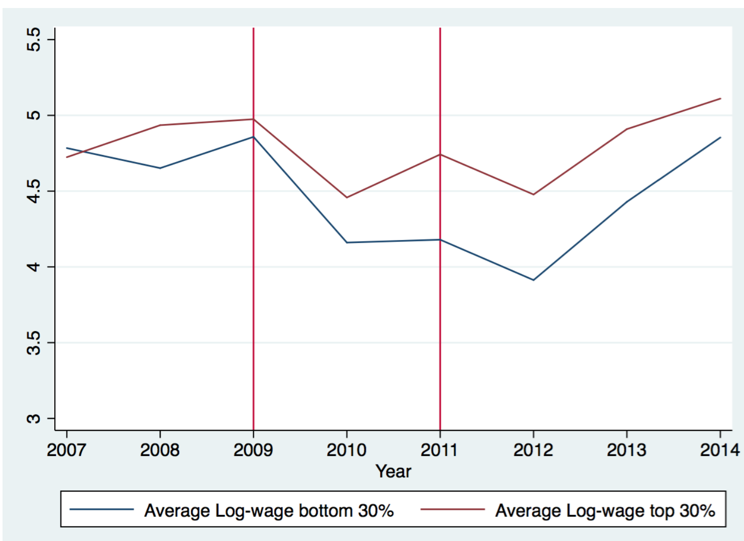
(b) Out-of-pocket prices and increased competition



(c) Distribution of visits in Montevideo, Year 2012

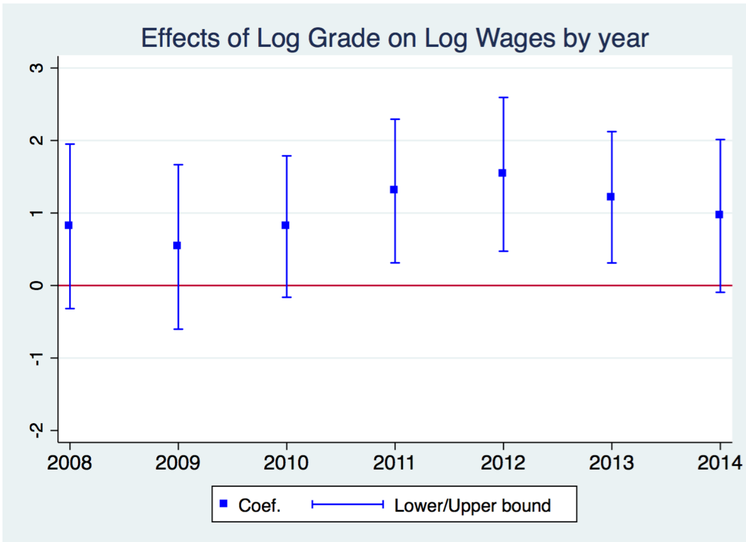
Figure 3: Evolution of log-wage for different levels of skills

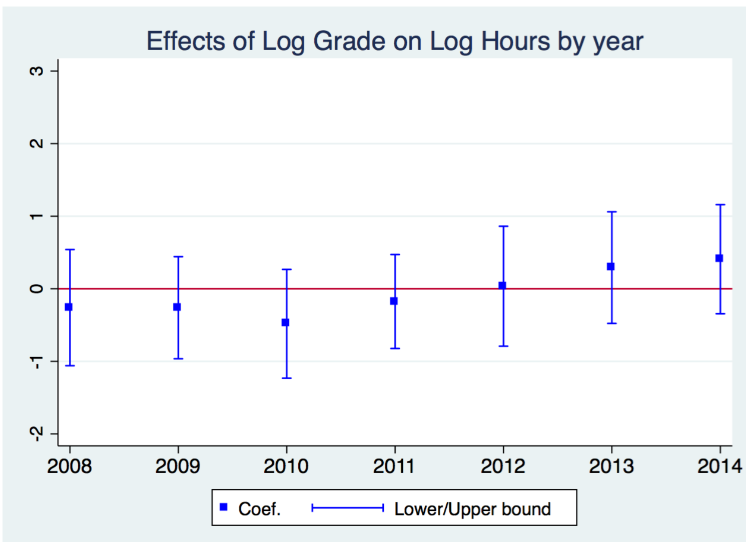
(a) Log-wage difference between top and bottom 10 percent



(b) Log-wage difference between top and bottom 30 percent

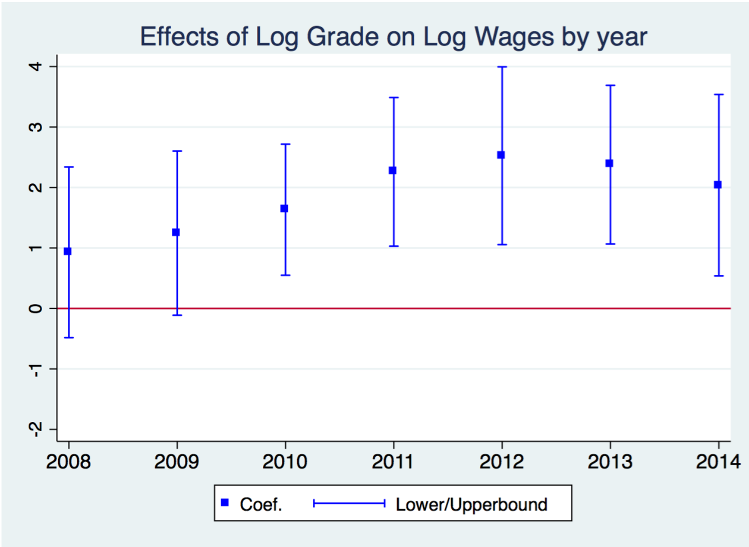
Figure 4: Even Study: All Markets

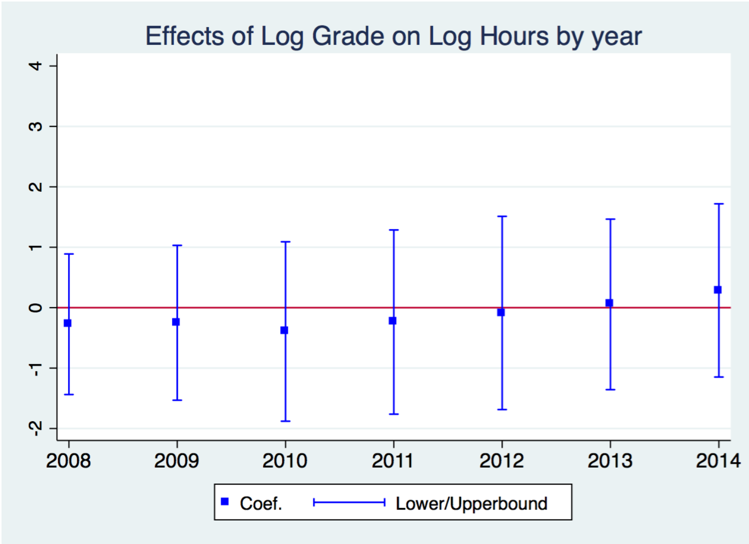




For all markets in the sample, these graphs show the point estimates for the β_j from the regression of equation 2, and their confidence intervals (with clustered standard errors). The graph on the top presents the effect on wages and the graph on the bottom presents the effects on hours.

Figure 5: Even Study: capital city Montevideo





Note: For the market of the capital city, Montevideo, these graphs show the point estimates for the β_j from the regression of equation 2, and their confidence intervals (with clustered standard errors). The graph on the top presents the effect on wages and the graph on the bottom presents the effects on hours.

Table 1: Descriptive Statistics for total number of specialists and sample

	All Specialists			Sample		
	All	One Hospital Per Period	Several Hospitals Per Period	All	One Hospital Per Period	Several Hospitals Per Period
Female	0.62	0.62	0.61	0.70	0.72	0.66
	(0.48)	(0.48)	(0.48)	(0.45)	(0.45)	(0.46)
Age	46.51	45.55	48.29	35.22	34.71	36.21
	(10.89)	(11.47)	(9.50)	(4.57)	(4.58)	(4.39)
Wage per Hour	29.03	30.4	26.49	16.43	15.89	17.5
	(135.17)	(152.79)	(94.52)	(33.77)	(39.27)	(18.66)
Hours	166.07	174.02	151.46	123.54	120.50	129.53
	(191.44)	(206.78)	(158.44)	(122.25)	(121.49)	(123.66)
Score				27.37	26.73	28.61
				(7.09)	(7.38)	(6.31)
N Specialists	5401	3498	1903	1197	826	371
%		64.77	35.23		69.01	30.99

Notes: This table presents the descriptive statistics for the full data and for the sample. The sample includes all specialists for whom the information about the test scores is available. Female is a dummy variable that takes the value of 1 if gender is female. Wage per hour is measured in constant (2011) US dollars. Score is the grade obtained in the exam to enter into graduate studies (which ranges from 10 to 40). Each of these samples is in turn split between those who work only in one hospital at a time and those who worked in more than one hospital at a time.

Table 2: Number of consumers able to change and changes

	2007	2008	2009	2010	2011	2012	2013	2014
Uruguayan population	3,358,793	3,363,059	3,378,082	3,396,705	3,412,636	3,426,466	3,440,157	3,453,690
Non-FONASA ASSE consumers	1,282,880	1,114,190	1,113,157	1,073,656	990,805	928,552	906,716	879,102
People covered by FONASA	754,484	1,412,319	1,493,051	1,555,826	1,827,881	2,108,736	2,251,362	2,333,833
FONASA beneficiaries able to switch	0	0	424,069	528,850	1,159,387	1,336,444	1,281,970	1,350,473
% FONASA able to switch	0%	0%	28.40 %	33.99 %	63.42 %	63.38 %	56.94 %	57.86 %
Stayers			341,317	417,027	1,000,084	1,204,059	1,205,492	1,272,010
Switchers			82,752	111,823	159,303	132,385	76,478	78,462
% Switchers			19.51 %	21.14 %	13.74 %	9.90 %	5.96 %	5.81 %

Note: This table presents the descriptive statistics (population in Uruguay, non-FONASA ASSE consumers, total number of FONASA beneficiaries, number of FONASA beneficiaries allowed to switch hospitals, number who switch and who stay enrolled with the same hospital) for the regulated mobility system in Uruguay.

Table 3: Effects of lock-in reduction on returns to skill and relative hours at individual level

	I	II	III	IV	V	VI
	Panel A: Effects of Log Score					
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
Log(Score$_{ik}$) $\times$	2.1739***	2.1782***	1.7661***	0.2242	0.2266	0.8182**
Able to Change$_t$	(0.5982)	(0.5832)	(0.6174)	(0.3768)	(0.3740)	(0.3853)
Indiv.FE	Yes	Yes	Yes	Yes	Yes	Yes
Age Controls	No	Yes	Yes	No	Yes	Yes
Time FE	Yes	Yes	No	Yes	Yes	No
Time-Spec. FE	No	No	Yes	No	No	Yes
Observations	12352	12352	12352	12352	12352	12352
Physicians	1197	1197	1197	1197	1197	1197
	Panel B: Effects of Score					
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
Score$_{ik}$ $\times$	0.0769***	0.0776***	0.0590**	0.0094	0.0096	0.0327**
Able to Change$_t$	(0.0261)	(0.0255)	(0.0267)	(0.0155)	(0.0154)	(0.0158)
Indiv.FE	Yes	Yes	Yes	Yes	Yes	Yes
Age Controls	No	Yes	Yes	No	Yes	Yes
Time FE	Yes	Yes	No	Yes	Yes	No
Time-Spec. FE	No	No	Yes	No	No	Yes
Observations	12352	12352	12352	12352	12352	12352
Physicians	1197	1197	1197	1197	1197	1197

This table presents the estimates of Equation 1. Each observation in the sample is the aggregate average wage (total hours) that a specialist received (worked) in a particular quarter. Columns I to III present the estimates using Log(Wages) as the dependent variable, while Columns IV to VI present the estimates using Log(Hours) as the dependent variable. In Panel A, the log of the score is used to construct the main variable of interest while in Panel B, the score in levels is used. All estimates are obtained using specialist fixed effects. Age controls (age and age squared) are included in some specifications. Columns I, II, VI and V include time fixed effects at the quarter level. Columns III and VI include time-by-specialty fixed effects. Standard errors (in parenthesis) are clustered at the specialty level. +.10 **.05 *** .01.

Table 4: Post-reform effects on returns to skill and relative hours.

	I	II	III	IV
	Dependent Variable: Log(Wages)		Dependent Variable: Log(Hours)	
Log(Score$_{ik}$) $\times$ After Reform	0.6266+ (0.3235)		0.0906 (0.2230)	
Score$_{ik}$ $\times$ After Reform		0.0234+ (0.0125)		0.0031 (0.0088)
Indiv.FE	Yes	Yes	Yes	Yes
Age Controls	Yes	Yes	Yes	Yes
Time Espec. FE	Yes	Yes	Yes	Yes
Observations	12352	12352	12352	12352
Physicians	1197	1197	1197	1197

This table presents the estimates of the effect of increased competition on returns to skills and relative hours. Each observation in the sample is the aggregate average wage (hours) the specialist received (worked) in a particular quarter. Columns I and II present the estimates using Log(Wages) as dependent variable while Columns III and IV present the estimates using Log(Hours) as dependent variable. The main variable in these regressions is the interaction between the log of the score (columns I and III) or the score (columns II and IV) and a dummy that indicates the period after the regulated mobility reform (2009). All columns include individual fixed effects, age controls (age and age squared) and time-by-specialty fixed effects. Standard errors (in parenthesis) are clustered at the specialty level. +.10 **.05 *** .01.

Table 5: Effects of lock-in reduction on returns to skill and relative hours (individual-hospital level)

	I	II	III	IV	V	VI
	Panel A: Effects of Log Score					
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
Log(Score$_{ik}$) $\times$	1.9256***	1.9861***	1.7689***	-0.3788	-0.3569	0.2366
Able to Change$_t$	(0.5054)	(0.5230)	(0.6124)	(0.4246)	(0.4212)	(0.2992)
Indiv.FE	Yes	Yes	Yes	Yes	Yes	Yes
Age Controls	No	Yes	Yes	No	Yes	Yes
Time-Hospital FE	Yes	Yes	Yes	Yes	Yes	Yes
Time-Spec. FE	No	No	Yes	No	No	Yes
Observations	15450	15450	15450	15450	15450	15450
Physicians	1197	1197	1197	1197	1197	1197
	Panel B: Effects of Score					
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
Score$_{ik}$ $\times$	0.0643**	0.0674***	0.0562*	-0.0135	-0.0124	0.0112
Able to Change$_t$	(0.0231)	(0.0241)	(0.0284)	(0.0168)	(0.0168)	(0.0126)
Indiv.FE	Yes	Yes	Yes	Yes	Yes	Yes
Age Controls	No	Yes	Yes	No	Yes	Yes
Time-Hospital FE	Yes	Yes	Yes	Yes	Yes	Yes
Time-Spec. FE	No	No	Yes	No	No	Yes
Observations	15450	15450	15450	15450	15450	15450
Physicians	1197	1197	1197	1197	1197	1197

This table presents the estimates of the effect of increased competition on returns to skills and relative hours. Each observation in the sample is the wage (hours) the specialist received (worked) in a particular quarter at a particular hospital. Columns I to III present the estimates using Log(Wages) as the dependent variable, while Columns IV to VI present the estimates using Log(Hours) as the dependent variable. In Panel A, the log of the score is used to construct the main variable of interest while in Panel B, the score in levels is used. Age controls (age and age squared) are included in some specifications. All estimates are obtained using specialist fixed effects an hospital-by-time fixed effects. Columns III and VI also include time-by-specialty fixed effects. Standard errors (in parenthesis) are clustered at the specialty level. +.10 **.05 *** .01.

Table 6: Robustness of increases in FONASA coverage

	I	II	III	IV
	Dependent variable:			
	Log(Wages)	Log(Hours)	Log(Wages)	Log(Hours)
	Panel A: Effects of Log Score			
Log(Score$_{ik}$) × Able to Change$_t$	1.8539**	-0.6356	1.7875+	-0.8873
	(0.8351)	(0.5650)	(0.9076)	(0.6531)
Log(Score$_{ik}$) × FONASA beneficiaries$_t$	-0.0001	0.0010***		
	(0.0004)	(0.0003)		
Log(Score$_{ik}$) × Non-FONASA in Public Hospitals$_t$			0.0001	-0.0042**
			(0.0016)	(0.0015)
Indiv.FE	Yes	Yes	Yes	Yes
Age Controls	Yes	Yes	Yes	Yes
Time-Spec. FE	Yes	Yes	Yes	Yes
Observations	12352	12352	12352	12352
Physicians	1197	1197	1197	1197
	Panel B: Effects of Score			
Score$_{ik}$ × Able to Change$_t$	0.0596+	-0.0233	0.0568	-0.0324
	(0.0344)	(0.0220)	(0.0370)	(0.0256)
Score$_{ik}$ × FONASA beneficiaries$_t$	-0.0000	0.0000**		
	(0.0000)	(0.0000)		
Score$_{ik}$ × Non-FONASA in Public Hospitals$_t$			-0.0000	-0.0002**
			(0.0001)	(0.0001)
Indiv.FE	Yes	Yes	Yes	Yes
Age Controls	Yes	Yes	Yes	Yes
Time-Spec. FE	Yes	Yes	Yes	Yes
Observations	12352	12352	12352	12352
Physicians	1197	1197	1197	1197

This table presents the estimates of the effect of increased competition on returns to skills and relative hours controlling for the expansion of FONASA. Each observation in the sample is the aggregate average wage (total hours) that a specialist received (worked) in a particular quarter. Panel A presents the effects when the log score is used and Panel B when the score in levels is used. Columns I to II present the estimates for log(wages) and log(hours) when controlling also for the number of beneficiaries in FONASA. Columns III and IV present the estimates for log(wages) and log(hours) when controlling also for the number of non-FONASA consumers in public hospitals (ASSE). All columns include individual fixed effects, age controls (age and age squared) and time-by-specialty fixed effects. Standard errors (in parenthesis) are clustered at the specialty level. +.10 **.05 *** .01.

Table 7: Effects of lock-in reduction at individual-hospital level (only one hospital sample)

	I	II	III	IV	V	VI
	Panel A: Effects of Log Score					
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
Log(Score_{ik}) ×	2.6798***	2.7077***	2.8951***	-0.3248	-0.3206	0.5793**
Able to Change_t	(0.5376)	(0.5168)	(0.5744)	(0.4645)	(0.4672)	(0.2556)
Indiv.FE	Yes	Yes	Yes	Yes	Yes	Yes
Age Controls	No	Yes	Yes	No	Yes	Yes
Time-Hospital FE	Yes	Yes	Yes	Yes	Yes	Yes
Time-Spec. FE	No	No	Yes	No	No	Yes
Observations	6927	6927	6927	6927	6927	6927
Physicians	826	826	826	826	826	826
	Panel B: Effects of Score					
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
Score_{ik} ×	0.0919***	0.0947***	0.1000***	-0.0118	-0.0114	0.0271*
Able to Change_t	(0.0256)	(0.0251)	(0.0320)	(0.0195)	(0.0199)	(0.0139)
Indiv.FE	Yes	Yes	Yes	Yes	Yes	Yes
Age Controls	No	Yes	Yes	No	Yes	Yes
Time-Hospital FE	Yes	Yes	Yes	Yes	Yes	Yes
Time-Spec. FE	No	No	Yes	No	No	Yes
Observations	6927	6927	6927	6927	6927	6927
Physicians	826	826	826	826	826	826

This table presents the estimates of the effect of increased competition on returns to skills and relative hours. Each observation in the sample is the wage (hours) the specialist received (worked) in a particular quarter at a particular hospital. The sample only includes specialists that worked at most at one hospital during each period of time. Columns I to III present the estimates using Log(Wages) as the dependent variable, while Columns IV to VI present the estimates using Log(Hours) as the dependent variable. In Panel A, the log of the score is used to construct the main variable of interest while in Panel B, the score in levels is used. Age controls (age and age squared) are included in some specifications. All estimates are obtained using specialist fixed effects and hospital-by-time fixed effects. Columns III and VI also include time-by-specialty fixed effects. Standard errors (in parenthesis) are clustered at the specialty level. +.10 **.05 *** .01.

Table 8: Effects of lock-in reduction at individual-hospital level (only same hospital sample)

	I	II	III	IV	V	VI
	Panel A: Effects of Log Score					
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
Log(Score$_{ik}$) $\times$	2.3972***	2.4412***	2.8383***	-0.2441	-0.2420	0.7387**
Able to Change$_t$	(0.6782)	(0.6621)	(0.6768)	(0.4976)	(0.4999)	(0.2745)
Indiv.FE	Yes	Yes	Yes	Yes	Yes	Yes
Age Controls	No	Yes	Yes	No	Yes	Yes
Time-Hospital FE	Yes	Yes	Yes	Yes	Yes	Yes
Time-Spec. FE	No	No	Yes	No	No	Yes
Observations	5969	5969	5969	5969	5969	5969
Physicians	717	717	717	717	717	717
	Panel B: Effects of Score					
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
Score$_{ik}$ $\times$	0.0807**	0.0845**	0.1012***	-0.0078	-0.0076	0.0345**
Able to Change$_t$	(0.0313)	(0.0310)	(0.0352)	(0.0212)	(0.0216)	(0.0153)
Indiv.FE	Yes	Yes	Yes	Yes	Yes	Yes
Age Controls	No	Yes	Yes	No	Yes	Yes
Time-Hospital FE	Yes	Yes	Yes	Yes	Yes	Yes
Time-Spec. FE	No	No	Yes	No	No	Yes
Observations	5969	5969	5969	5969	5969	5969
Physicians	717	717	717	717	717	717

This table presents the estimates of the effect of increased competition on returns to skills and relative hours. Each observation in the sample is the wage (hours) the specialist received (worked) in a particular quarter at a particular hospital. The sample only includes specialists that worked in the same hospital during the whole sample period. Columns I to III present the estimates using Log(Wages) as the dependent variable, while Columns IV to VI present the estimates using Log(Hours) as the dependent variable. In Panel A, the log of the score is used to construct the main variable of interest while in Panel B, the score in levels is used. Age controls (age and age squared) are included in some specifications. All estimates are obtained using specialist fixed effects an hospital-by-time fixed effects. Columns III and VI also include time-by-specialty fixed effects. Standard errors (in parenthesis) are clustered at the specialty level. +.10 **.05 *** .01.

Table 9: Heterogeneous effects on (log) wages and hours by specialty

	I	II	III	IV	
	Log(Wages)		Log(Hours)		N
	Coef.	S.E.	Coef.	S.E.	
Anatomic pathology	6.2579*	3.0918	-1.8194	3.9180	104
Anesthesiology	13.1609***	3.9808	-2.7202	3.1916	380
Cardiology	2.6755	1.9843	4.6668**	1.9326	597
Surgery	-3.3471	6.2588	-0.4535	1.4454	113
Dermatology	-0.5274	1.8777	-3.8945	2.5028	513
Endocrinology	1.9093	2.0968	3.2020*	1.6290	263
Infectious Disease	14.4463***	2.4209	-9.0221**	1.9932	56
Gastroenterology	3.5157***	1.1669	-0.3518	1.0798	162
Gynecology	17.1124	16.8507	-9.9534**	4.4892	173
Hematology	1.2470*	0.71640	1.7818**	0.7773	215
Diagnostic Radiology	-1.1400	1.7519	2.1427	2.1506	958
Internal Medicine	2.1148*	1.2543	0.0506	0.58697	1795
Hospitalist	3.1348**	1.4975	1.5958**	0.7856	2647
Nephrology	-5.6535	5.2089	4.6186	3.2027	134
Neurology	-2.9090**	1.2814	-1.6470	3.1258	104
Oncology	-1.3079	1.5109	-0.9664	2.0587	379
Pediatry	4.1057***	1.2506	0.4195	0.7045	1436
Psychiatry	0.6756	1.3621	-0.7867	1.7307	1300
Occupational Safety	2.6841	2.9130	0.97183	1.1946	554
Physical Medicine	-0.7835	2.3583	1.3305	2.7589	361

This table presents the estimates of Equation 4 for all different specialties. Each observation in the sample is the aggregate average wage (hours) the specialist received (worked) in a particular quarter. Columns I and III present the point estimates of the effect of scores interacted with the percentage of consumers able to switch on Log(Wages) and Log(Hours) respectively. Columns II and VI present the standard errors (clustered at the individual level) for each point estimate. All estimates are obtained using specialist fixed effects, age controls (age and age squared) and time-by-specialty fixed effects. +.10 **.05 *** .01.

Table 10: Effects of lock-in reduction at individual level (Montevideo only)

	I	II	III	IV	V	VI
	Panel A: Effects of Log Score					
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
Log(Score$_{ik}$) $\times$	3.2704***	3.2448***	2.8103***	-0.3024	-0.3107	0.5195
Able to Change$_t$	(0.8008)	(0.7668)	(0.9463)	(0.5752)	(0.5568)	(0.6360)
Indiv.FE	Yes	Yes	Yes	Yes	Yes	Yes
Age Controls	No	Yes	Yes	No	Yes	Yes
Time FE	Yes	Yes	No	Yes	Yes	No
Time-Spec. FE	No	No	Yes	No	No	Yes
Observations	9417	9417	9417	9417	9417	9417
Physicians	987	987	987	987	987	987
	Panel B: Effects of Score					
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
Score$_{ik}$ $\times$	0.1190***	0.1186***	0.0984**	-0.0089	-0.0089	0.0236
Able to Change$_t$	(0.0372)	(0.0357)	(0.0442)	(0.0252)	(0.0245)	(0.0291)
Indiv.FE	Yes	Yes	Yes	Yes	Yes	Yes
Age Controls	No	Yes	Yes	No	Yes	Yes
Time FE	Yes	Yes	No	Yes	Yes	No
Time-Spec. FE	No	No	Yes	No	No	Yes
Observations	9417	9417	9417	9417	9417	9417
Physicians	987	987	987	987	987	987

This table presents the estimates of Equation 1. Each observation in the sample is the aggregate average wage (hours) the specialist received (worked) in a particular quarter. The sample includes only wages and hours that physicians received and worked in hospitals in the capital city, Montevideo. Columns I to III present the estimates using Log(Wages) as the dependent variable while Columns IV to VI present the estimates using Log(Hours) as the dependent variable. In Panel A, the log of the score is used to construct the main variable of interest while in Panel B, the score in levels is used. All estimates are obtained using specialist fixed effects. Age controls (age and age squared) are included in some specifications. Columns I, II, VI and V include time fixed effects, and Columns III and VI include time-by-specialty fixed effects. Standard errors (in parenthesis) are clustered at the specialty level. +.10 **.05 *** .01.

Table 11: Correlations among price, quantity, and quality in Montevideo.

	I	II
	Dependent Variable:	
	Log(Price)	Log(Market Share)
Mean Quality of Specialists	0.0712	0.3915**
	(0.0979)	(0.1718)
Mean Quality of Specialists ×	0.0722	0.0086
Able to move	(0.1527)	(0.0193)
Log (Price)		0.0441
		(0.3205)
Hospital FE	Yes	Yes
Time FE	Yes	No
Observations	198	198

This table presents the estimates of correlations between quality and competition, and prices and market shares, for the market of the capital city, Montevideo. Each observation in the sample is a hospital in a particular quarter. Column I presents a regression with log prices as the dependent variable, while Column II presents a regression with log market share as the dependent variable. All estimates include time and hospital fixed effects. Bootstrapped standard errors are shown in parenthesis. +.10 **.05 *** .01.