

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

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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 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 hour of works. 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, 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 their relative wages. 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 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 the 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 done. 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

¹See 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 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 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

²For 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.

test scores of physicians in a systematic way to understand changes in returns to skills induced by competition shocks. I take advantage of 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 and hospital-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 and hospital, in the absence of the competition shock.

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 physicians in the short run, this shock in competition generated a relatively large increase in the returns of high quality physicians. According to my preferred estimates, a change in the regulated mobility regime that increases the percentage of consumers able to switch hospitals 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 a 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 0.5 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 16 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 an increase in the total quality of the system (measured as the amount of hours weighted by quality of the physicians) due to the change in competition.

Additionally, the results of the event studies are consistent with the expected effects given a relatively more inelastic relative supply of high-quality 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 patterns with a large increase in relative wages (43 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 where workers need a license to work and there are 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 FONASA³ 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 two thirds of the population by 2013.

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,

³Uruguay 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).

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.

Although the government has been carrying out a plan to increase the quality (and budget) of the public health care service, ASSE is seen by the population as a lower quality health care provider than the private hospitals and the majority of consumers (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 in 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 the copayment prices for all hospitals. Although this policy was relatively successful, the co-payments still represented 9% of the total revenues of the 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 with 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 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

⁴The 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.

⁵The 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.

⁶In 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.

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's 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 $\lambda = 1, \dots, N$). 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:

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

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 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).

The descriptive statistics of 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 for those I have information about scores (1197 specialists). The average age of specialists in Uruguay is 46 years old. Since I only have grades 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 women (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 less hours (123 vs. 166 hours per month) and have lower wages per hour (16 vs. 29 dollars per hour) compared with the population of specialists in Uruguay. The population of specialists also have higher standard deviations in wage per hour and hours. Some specialists receive a very high wage per hour and also report to work a very high number of hours per month. This fact is related to the fact that the 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 the time. About 65% of total specialists worked only at one hospital at a time, while the other 35% percent worked at two or more hospitals at least for one period. In the sample used in this paper, the distribution is very similar, with 66% 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 during all periods of time are very similar in characteristics to the other specialists, and that 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 in the population the specialists that work in more than one hospital have relatively lower wages per hour and fewer hours worked, in the 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 they 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 2009 to 2014. 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.

The number of people covered by FONASA increased over time, from about 1.5 million in 2009 to about 2.3 million at the end of the period. I use the percentage of people covered by FONASA who are able to switch to identify the intensity of the competition in the empirical approach. As discussed in Section 2, in 2009 only those who had been enrolled in 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 in 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 for hospitals for out-of-pocket prices 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 no 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 these 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 of the next section is that, since consumers have to receive all the health care from the hospital they are enrolled in, hospitals are not specialized in Uruguay. 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 the 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 grades 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 specially 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 the 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 ($w(g_i, \theta, \Omega_m)$):

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

where i stands for individual, k for specialty and t for the period; $\text{Log}(y)_{ikt}$ 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); $\text{Reform Intensity}_t$ 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} and γ_1 , or γ_2 and τ_{kt} . Therefore, the specification

to be actually estimated with the data is:

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

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:

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

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 quality 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 the time-by-specialty 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 quality (as measured by test scores). Note that 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-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:

$$\text{Log}(y)_{ihkt} = \tilde{\alpha}_{ik} + \tilde{\tau}_{kt} + \mu_{ht} + \beta \left[\begin{array}{c} \text{Score} \\ \text{Variable} \end{array} \right]_{ik} \times \left[\begin{array}{c} \text{Reform} \\ \text{Intensity} \end{array} \right]_t + X_{ikt}\theta + \epsilon_{ihkt} \quad (3)$$

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:

$$\text{Log}(y)_{ikt} = \tilde{\alpha}'_{ik} + \tilde{\tau}'_{kt} + \beta_k \begin{bmatrix} \text{Log} \\ \text{Score} \end{bmatrix}_{ik} \times \begin{bmatrix} \text{Reform} \\ \text{Intensity} \end{bmatrix}_t + X_{ikt}\theta_k + \epsilon_{ikt} \quad (4)$$

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.⁷

6 Results

Table 3 present the estimates of Equation 1 for the sample of 1,197 specialists. In this sample, each observation is the aggregate wage (hours) the specialist received (worked) in a particular quarter. Therefore, the information of specialists that work 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

⁷Unfortunately, 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.

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 ($1.7604 \times 0.6 = 1.0562$) 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 ($1.0055 \times 0.6 = 0.6033$) 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 more 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 point in the score generates a relatively large effect of 3.5% in wages ($0.0588 \times 0.6 = 0.0353$), while it generates an increase in relative hours of 2.5% ($0.0414 \times 0.6 = 0.0248$). Since the standard deviation of the grades is 7.09 points, the estimated effects imply that after the reform, an difference of one standard deviation in scores is associated with an wage premium 25 percentage points higher ($0.0353 \times 7.09 = 0.25$), and an difference in hours worked 17.61 percentage points higher ($0.0248 \times 7.09 = 0.1761$).

Let's now analyze the non-parametric estimate of the effect of the log-score variable by year, interacting the log score variable with dummies by year 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 presents the results for log wages and the bottom graph present the results for log hours.

The top graph in Figure 4 shows the timing of the effect 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 number of people able to switch, see Panel A in Figure 2). The largest effects are around 2011 and 2012, when more people were able to switch hospitals. In addition, this analysis suggest 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 the 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 more people enter to the specialty and that the response of the supply side makes the elasticity of the supply curve less inelastic in the long run, reducing the effect of the demand shock.

The bottom graph in Figure 4 shows the size and the timing of the effect on relative hours. Similar as in the case of wages, the effect is stronger around 2011 when the regulated mobility regime was amplified. However, the graph shows 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.

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 of the intensified competition in 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 does 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 and other specifications to discuss these results.

6.1 Robustness Checks and Heterogeneity

One of the main concerns with the previous results is the fact that specialists can work in more than one hospital at a time. The previous analysis aggregates the wages and hours worked at the specialist level, aggregating across the different institutions where a specialist worked in each period. In order to evaluate if this introduces a concern for the identification, I construct a new database where the observation is at the level of specialist-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 square), 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 4. The organization of the table in panels and controls by columns is analogous to the previous table. 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 ($1.7515 \times 0.6 = 1.0509$), and that after the reform, a difference of one point in the test score is associated with an additional increase of 3.3 p.p. in wages ($0.0557 \times 0.6 = 0.0334$). 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 units ($0.3897 \times 0.6 = 0.2338$) but it is not statistically significant. A similar result is found when I analyze the effect of one point in the score on hours after the regulated mobility reform, which is about 1% ($0.0177 \times 0.6 = 0.0106$). The results in this robustness check are similar to those found in the event-study, with a large effect on wages and non-statistically significant effect on hours, which is consistent with a very inelastic supply of labor in the short run.

Analyzing the data at the individual-hospital level also allows me to check whether there are heterogeneous effects of intensified competition for specialists that work at only one 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 5 presents the results for the 826 specialist who work in at most one hospital at 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 effects for this group of physicians is larger than the previous estimates, both in terms of wages and hours. For this group, the increased competition increases the elasticity of wages to scores by about 1.75 units ($2.9277 \times 0.6 = 1.7566$). A difference of one point in the test scores is associated with a large additional effect of 6.2 p.p. in wages ($0.1039 \times 0.6 = 0.0623$) after the reform. The effects on hours are now statistically

significant in this sample, with a magnitude of 0.5 units for the elasticity of hours to scores ($0.8313 \times 0.6 = 0.4987$). A one-point increase in the score generates an additional effect of 2.3 p.p. on hours ($0.0387 \times 0.6 = 0.0232$). These estimated effects imply that after the reform, a one standard deviation difference in scores is associated with a wage premium 44 percentage points higher, and an hours-worked difference 16 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 specialist work less hours on average (164 hours per month) than the specialist that work on more than one hospital (207 hours per month).

An alternative way to approximate the effects of the reform is to interact the log score (or the score) with a dummy indicating the period after the reform of 2009. Table 6 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 before. Regarding relative wages, after the reform there is an increase of 0.5 units in the score elasticity of wages, and an increase of almost an additional 2% 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 after the reform. The point estimates suggest that the reform generated an increase of 0.2 units in the score elasticity of hours, and an additional 0.75% increase of hours per point of test scores. 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.

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 at least for 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 7. First, the larger increases of wages by specialties 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 a specialty where all the anecdotal evidence and the news highlight 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. In general, the effects on hours are larger where the effects on wages are larger, which is consistent with the fact that some specialties faced stronger demand pressure after the change in regulated mobility than other specialties. However, one limitation of this analysis is that the sample is reduced when we split it by specialties, and therefore some of these estimations are done with small samples.

6.2 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 specialist 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 specialist 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, showing a peak of the effect around 2011. The results of the event-study are confirmed with the regression analysis for Montevideo, presented in Table 8. 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 1.72 units in the score elasticity of wages, and of 6 p.p. in relative wages per extra point in scores (43 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.

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 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 9 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 log price and quality interacting 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 against the quality, the interaction of the 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 the 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 level 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 quality physicians. However, there is no strong 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 the labor markets when the product market that demands these human resources receives demand shocks 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.

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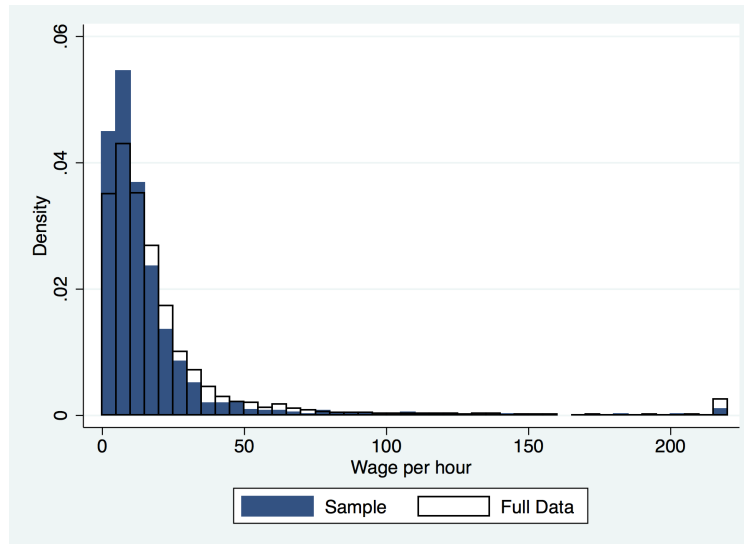
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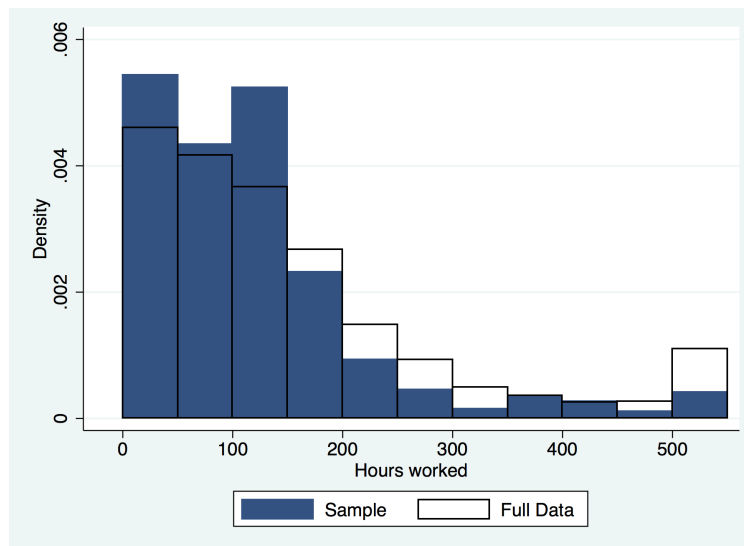
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Figure 1: Histograms of full data and sample

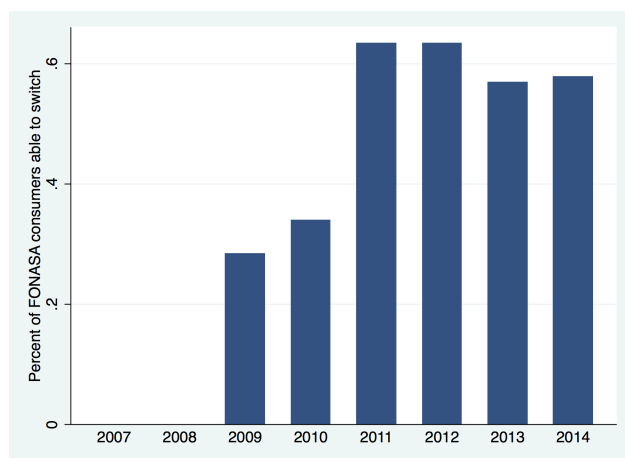


(a) Histogram of wage per hours

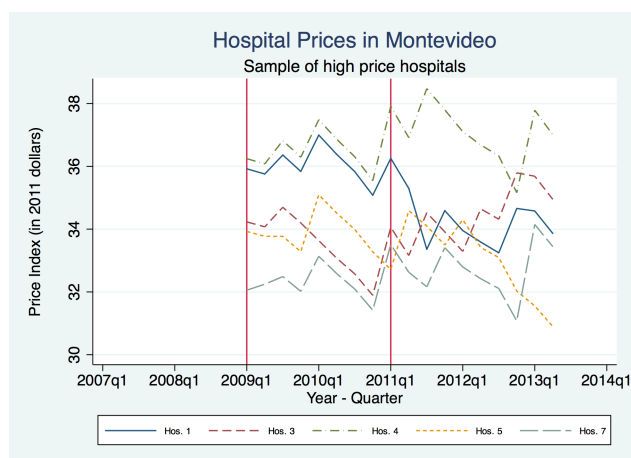


(b) Histogram of hours worked

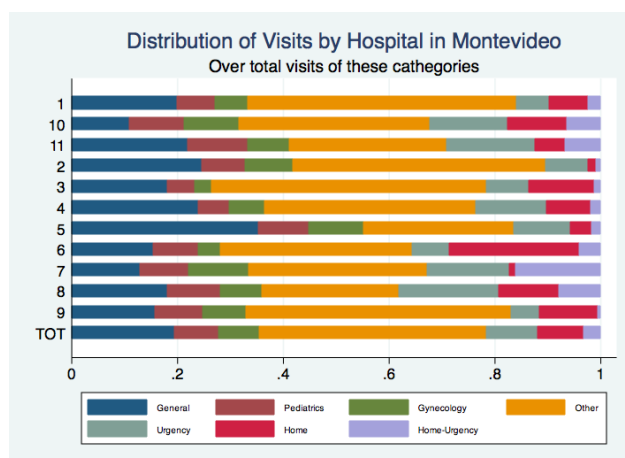
Figure 2: Regulated mobility and increased competition



(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

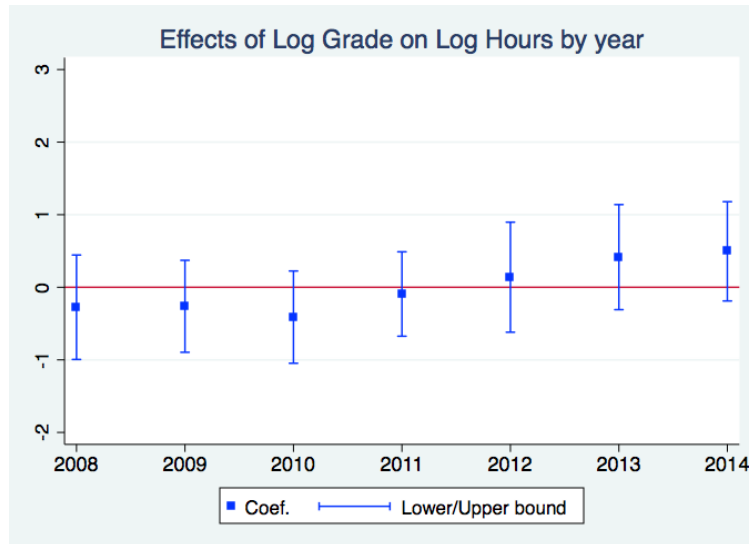
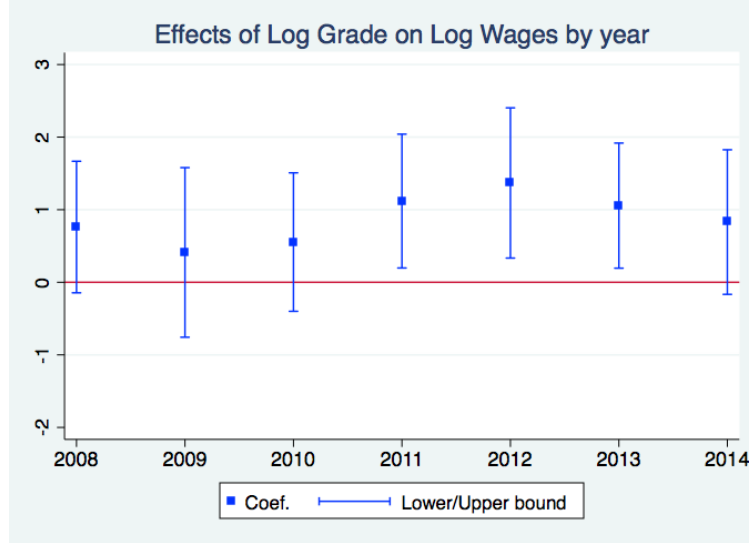


(a) Log-wage difference between top and bottom 10 percent



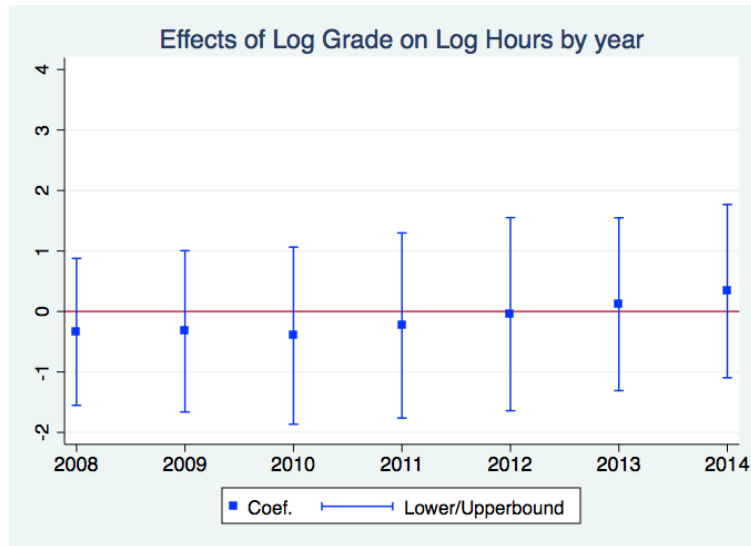
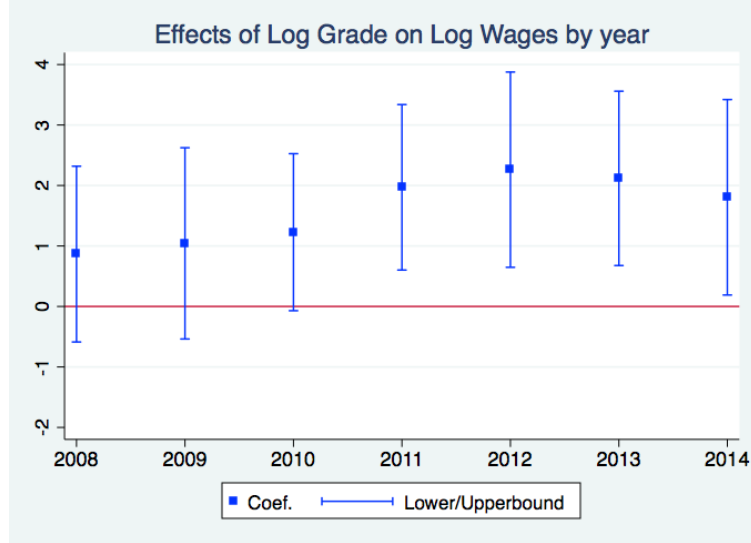
(b) Log-wage difference between top and bottom 30 percent

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 (0.48)	0.62 (0.48)	0.61 (0.48)	0.70 (0.45)	0.72 (0.45)	0.66 (0.46)
Age	46.51 (10.89)	45.55 (11.47)	48.29 (9.50)	35.22 (4.57)	34.71 (4.58)	36.21 (4.39)
Wage per Hour	29.03 (135.17)	30.4 (152.79)	26.49 (94.52)	16.43 (33.77)	15.89 (39.27)	17.5 (18.66)
Hours	166.07 (191.44)	174.02 (206.78)	151.46 (158.44)	123.54 (122.25)	120.50 (121.49)	129.53 (123.66)
Score				27.37 (7.09)	26.73 (7.38)	28.61 (6.31)
N Specialists	5401	3498	1903	1197	794	403
%		64.77	35.23		66.33	33.67

Notes: This table presents the descriptive statistics for the full data and for the sample. The sample includes all specialists for which the information about the grades 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 separated between those who work only in one hospital at the time and those who worked in more than one hospital at the time.

Table 2: Number of consumers able to change and changes

	2009	2010	2011	2012	2013	2014
People in FONASA	1,493,051	1,555,826	1,827,881	2,108,736	2,251,362	2,333,833
Able to Switch	424,069	528,850	1,159,387	1,336,444	1,281,970	1,350,473
% People able to switch	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 (total number of consumers in FONASA, number of FONASA consumers 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
<i>Panel A: Effects of Log Grades</i>						
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
Log(Grades _{ik}) × Able to Change _t	2.2055*** (0.6307)	2.2055*** (0.6051)	1.7604*** (0.6047)	0.3523 (0.3631)	0.3541 (0.3592)	1.0055*** (0.3411)
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
<i>Panel B: Effects of Grades</i>						
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
Grades _{ik} × Able to Change _t	0.0777*** (0.0275)	0.0785*** (0.0266)	0.0588** (0.0263)	0.0155 (0.0151)	0.0158 (0.0149)	0.0414*** (0.0143)
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 (hours) the specialist received (worked) in a particular quarter. Columns I to III present the estimates using Log(Wages) as dependent variable, while Columns IV to VI present the estimates using Log(Hours) as 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 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. In all panels and columns, standard errors (in parenthesis) are clustered at the specialty level. +.10 **.05 *** .01.

Table 4: Effects of lock-in reduction on returns to skill and relative hours (individual-hospital level)

	I	II	III	IV	V	VI
<i>Panel A: Effects of Log Grades</i>						
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
$\text{Log(Grades}_{ik}) \times$ Able to Change_t	1.9598*** (0.4722)	2.0045*** (0.4823)	1.7515*** (0.5623)	-0.2520 (0.4495)	-0.2344 (0.4412)	0.3897 (0.3299)
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	15450	15450	15450	15450	15450	15450
Physicians	1197	1197	1197	1197	1197	1197
<i>Panel B: Effects of Grades</i>						
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
$\text{Grades}_{ik} \times$ Able to Change_t	0.0662*** (0.0220)	0.0687*** (0.0227)	0.0557** (0.0266)	-0.0084 (0.0184)	-0.0075 (0.0181)	0.0177 (0.0142)
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	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 dependent variable, while Columns IV to VI present the estimates using Log(Hours) as 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 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. In all panels and columns, standard errors (in parenthesis) are clustered at the specialty level. +.10 **.05 *** .01.

Table 5: Effects of lock-in reduction at individual-hospital level (only one hospital sample)

	I	II	III	IV	V	VI
<i>Panel A: Effects of Log Grades</i>						
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
$\text{Log(Grades}_{ik}) \times \text{Able to Change}_t$	2.7138*** (0.4954)	2.7140*** (0.4705)	2.9277*** (0.5181)	-0.1419 (0.4572)	-0.1407 (0.4574)	0.8313*** (0.2323)
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	6927	6927	6927	6927	6927	6927
Physicians	826	826	826	826	826	826
<i>Panel B: Effects of Grades</i>						
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
$\text{Grades}_{ik} \times \text{Able to Change}_t$	0.0952*** (0.0245)	0.0970*** (0.0237)	0.1039*** (0.0309)	-0.0045 (0.0198)	-0.0042 (0.0199)	0.0387*** (0.0128)
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	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 at each period of time. Columns I to III present the estimates using Log(Wages) as dependent variable, while Columns IV to VI present the estimates using Log(Hours) as 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 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. In all panels and columns, standard errors (in parenthesis) are clustered at the specialty level. +.10 **.05 *** .01.

Table 6: Post-reform effects on returns to skill and relative hours.

	I	II	III	IV
	Dependent Variable: Log(Wages)		Dependent Variable: Log(Hours)	
Log(Grades _{ik}) × After Reform	0.4956+ (0.2630)		0.2054 (0.1763)	
Grades _{ik} × After Reform		0.0182+ (0.0103)		0.0075 (0.0070)
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 to III present the estimates using Log(Wages) as dependent variable while Columns IV to VI present the estimates using Log(Hours) as dependent variable. The main variable in these regressions is the interaction between the log of the score and a dummy that indicates the period after the regulated mobility reform (2009). 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. In all panels and columns, standard errors (in parenthesis) are clustered at the specialty level. +.10 **.05 *** .01.

Table 7: 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	6.2578+	3.0917	-1.8194	3.9179	104
Anesthesiology	9.3643**	4.0227	-2.5799	3.4410	380
Cardiology	2.6364	1.9685	3.6837	2.0940+	597
Surgery	-3.7873	7.2941	-1.3037	1.7289	113
Dermatology	-0.7799	2.3969	-1.4489	1.9174	513
Endocrinology	2.3568	2.2332	2.8501	1.6490+	263
Infectious Disease	14.4462***	2.4209	-9.0220	1.9931***	56
Gastroenterology	3.5157***	1.1669	-0.3518	1.0798	162
Gynecology	12.2856	18.3891	-10.3571	5.2888+	173
Hematology	1.3849+	0.7433	1.5934	0.7676+	215
Diagnostic Radiology	-1.1509	1.7154	2.0881	2.1022	958
Internal Medicine	2.1000+	1.2277	0.3345	0.5859	1795
Hospitalist	2.5086+	1.5018	1.8386	0.7812**	2647
Nephrology	-5.6535	5.2089	4.6186	3.2026	134
Neurology	-2.8385+	1.2845	-1.7236	3.0931	104
Oncology	-1.2827	1.5083	-0.9734	2.0449	379
Pediatrics	4.2000***	1.1373	0.5873	0.5918	1436
Psychiatry	0.8496	1.4120	-0.7451	1.7754	1300
Occupational Safety	2.6858	2.9128	0.9705	1.1946	554
Physical Medicine	-0.8116	2.3607	1.3276	2.7549	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 error (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 8: Effects of lock-in reduction at individual level (Montevideo only)

	I	II	III	IV	V	VI
<i>Panel A: Effects of Log Grades</i>						
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
$\text{Log(Grades}_{ik}) \times$ Able to Change_t	3.3649*** (0.7931)	3.3281*** (0.7560)	2.8626*** (0.8965)	-0.1481 (0.5517)	-0.1619 (0.5295)	0.6874 (0.6115)
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
<i>Panel B: Effects of Grades</i>						
	Dependent Variable: Log(Wages)			Dependent Variable: Log(Hours)		
$\text{Grades}_{ik} \times$ Able to Change_t	0.1235*** (0.0374)	0.1229*** (0.0358)	0.1014** (0.0426)	-0.0030 (0.0244)	-0.0032 (0.0236)	0.0307 (0.0284)
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 dependent variable while Columns IV to VI present the estimates using Log(Hours) as 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 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. In all panels and columns, standard errors (in parenthesis) are clustered at the specialty level. +.10 **.05 *** .01.

Table 9: Correlations among price, quantity, and quality in Montevideo.

	I	II
	Dependent Variable:	
	Log(Price)	Log(Market Share)
Mean Quality of Specialists	0.0712 (0.0979)	0.3915** (0.1718)
Mean Quality of Specialists \times Able to move	0.0722 (0.1527)	0.0086 (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 the correlations with log prices while Column II presents the correlations with log market shares. All estimates include time fixed effects and hospital fixed effects. Bootstrapped standard errors are shown in parenthesis. +.10 **.05 *** .01.