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The Impacts of Public Hospital Autonomization - Evidence from a Quasi-Natural Experiment

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Abstract

This paper exploits the staggered rollout of Vietnam's hospital autonomization policy to estimate its impacts on several key health sector outcomes including hospital efficiency, use of hospital care, and out-of-pocket spending. The authors use six years of panel data covering all Vietnam's public hospitals, and three stacked cross-sections of household data. Autonomization probably led to more hospital admissions and outpatient department visits, although the effects are not large. It did not, however, affect bed stocks or bed-occupancy rates. Nor did it increase hospital efficiency. Oddly, despite the volume effects and the unchanged cost structure, the analysis does not find any evidence of autonomization leading to higher total costs. It does, however, find some evidence that autonomization led to higher out-of-pocket spending on hospital care, and higher spending per treatment episode; the effects vary in size depending on the data source and hospital type, but some are quite large—around 20 percent. Autonomy did not apparently affect in-hospital death rates or complications, but in lower-level hospitals it did lead to more intensive style of care, with more lab tests and imaging per case.

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The Impacts of Public Hospital Autonomization: Evidence from a Quasi-Natural Experiment

by

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I. INTRODUCTION

Frustrated with the perceived inefficiency of directly-managed budget-financed public hospitals, governments around the world have looked for new models of hospital organization. Some have resorted to outright privatization. Many have opted instead to keep their hospitals in the public sector but to grant them greater autonomy in their decision-making; at the same time, these autonomized hospitals are given a financial stake in the outcomes of their decisions. This policy of autonomization has often been combined with a pro-competition policy, forcing public hospitals to compete with one another for publicly-financed patients; some have been forced to compete with private hospitals too. In some countries, the policy of autonomization has been pushed a stage further, with hospitals being turned into public corporations. These corporatized hospitals enjoy a higher degree of autonomy, but are also made to face a higher degree of financial risk; they are, however, not private entities.

While there is considerable cross-country variation in the precise model used – the emphasis on competition, the areas in which hospitals are given autonomy, and the degree to which hospitals and their staff are exposed to financial risk – it would appear that the trend worldwide is firmly toward granting public hospitals some degree of autonomy. The field has already seen three multi-country edited volumes: Govindaraj and Chawla's (1996) study covers Ghana, India, Indonesia, Kenya and Zimbabwe; Preker and Harding's (2003) volume covers Australia, Ecuador, Hong Hong, Malaysia, Singapore, Tunisia, New Zealand, and the UK; Saltman et al.'s (2011) recent volume covers the Czech Republic, England, Estonia, Israel, the Netherlands, Norway, Portugal, and Spain. Stand-alone studies have covered several other countries, including: Brazil (La Forgia and Couttolenc 2008); Chile (Mendez

and Torres 2010); Colombia (McPake *et al.* 2003); India (Sharma and Hotchkiss 2001); Kenya (Collins *et al.* 1999); Lebanon (Eid 2001); Pakistan (Abdullah and Shaw 2007); Singapore (Ramesh 2008); Spain (Lopez *et al.* 2006); Thailand (Hawkins *et al.* 2011); Uganda (Hanson *et al.* 2002; Ssengooba *et al.* 2002); and Zambia (Hanson *et al.* 2002). There are undoubtedly more countries than those listed that have begun to autonomize their public hospitals. The World Bank, for example, appears to be supporting or has supported hospital autonomy initiatives in several other countries, including Argentina, Belize, Bolivia, Cambodia, China, Hungary, Iraq, Moldova, Morocco, Peru, and Vietnam. Doubtless many other countries are pursuing hospital autonomization without support from the World Bank.

Despite the worldwide trend toward autonomous public hospitals, and despite the relatively large literature on the subject, the evidence on the impacts of hospital autonomization is remarkably weak. There is no hard evidence in support of the hypothesis that autonomization leads to greater hospital efficiency; nor is there any hard evidence in support of the often-heard hypothesis that autonomization has adverse effects on equity and financial protection. In the introduction to their edited volume, Preker and Harding (2003) highlight the conclusions of Over and Watanabe (2003) in their chapter in the same volume: it is difficult to monitor and evaluate the impact of reforms in a complex, multiproduct organization like a hospital; none of the case-study countries featured in the volume developed an evaluation strategy in advance; and "in every case, the limited evaluation carried out later lacked a clear baseline and focused only on target hospitals, missing the opportunity for comparison, using non-reformed hospitals as a control". It is not just the case studies in the Preker-Harding volume where the evidence is weak. All the aforementioned studies focus exclusively on the hospitals that underwent the reform, and reach their conclusions about the impact of autonomization through simple before-and-after comparisons

of the reformed hospitals.[1] Writing more recently, Braithwaite et al. (2011) also conclude that there is little hard evidence on the impacts of hospital autonomization, but also suggest that the generation of hard evidence has not been helped by the rather strongly held ideological viewpoints among some of the researchers in the field. Braithwaite et al. conclude their review: "The evidence is weak, and mixed. Our review suggests … indicates that there is far more argumentation in favor of the merits of privatization and corporatization than scientific evaluation of their benefits. … [T]he debates about the merits of privatization and corporatization are often vehicles for engaging in advocacy about a range of public policy issues. … Where performance has improved after privatization or corporatization, it is possible for those in favor to argue causality, and opponents to say that the improvements would have occurred anyway. Where performance has not improved after privatization or corporatization, those who wanted it are able to claim that the idea was good but it was not implemented correctly, and those against it can say this outcome was predictable."

In this paper we present evidence on the impacts of a public hospital autonomization reform that was introduced in a staggered fashion across a developing country – Vietnam. The reforms increased the decision rights of hospital staff and managers, strengthened their residual claimant status, and forced hospitals to become less reliant on budget allocations and more reliant on user fees and income from the social health insurance agency. Parallel reforms sought to protect the poor by enrolling them in the social health insurance scheme (at the taxpayer's expense), instead of asking hospitals to exempt them from user fees (and forgo income in the process). The staggered roll-out of the reform over a period of six years starting in 2002 provides us with a quasi-natural experiment. In each year after 2002, we have some

[1] The studies of the UK's National Health Service (NHS) by Propper and colleagues (Propper 1996; Propper *et al.* 2004; Propper *et al.* 2008; Gaynor *et al.* 2011; Propper 2012) are an exception: they use data during pre-reform periods and on unreformed hospitals to generate difference-in-difference estimates of hospital reform impacts. However, Propper and her colleagues do not investigate the effects of autonomization per se, but rather the effect of competition in an environment where (some) hospitals had been granted some degree of autonomy (the degree of autonomy was increased during the 2000's).

hospitals that had already been autonomized, and others that had not. Were the experiment a pure natural experiment we could compare simply the two groups at any moment in time. However, we cannot be sure that the timing of a hospital's autonomization is entirely uncorrelated with unobservables that may influence the outcomes of interest. To get round this we employ a generalized version of differences-in-differences (DID) where, instead of having two periods ("before" and "after") and a "control" group and a "treatment" group, we have in each of several periods some "treated" (autonomous) hospitals and some "untreated" (not yet autonomized). In addition to using hospital data to get at the impacts of autonomization on hospital outcomes, we employ household data for the years 2004, 2006 and 2008 to look at the effects on household-level outcomes – use of services and out-of-pocket payments – of changes in the autonomy status of the local hospital.

We find that autonomization probably led to more hospital admissions and outpatient department visits, though the effects are not large. It did not, however, appear to affect bed stocks or bed-occupancy rates. Using a multi-product cost function specification for our differences-in-differences regression, we find no evidence that autonomization shifted the cost structure; autonomization did not apparently therefore increase hospital efficiency. Oddly, despite the volume effects and the unchanged cost structure, we do not find any evidence of autonomization leading to higher total costs. However, we do find some evidence that autonomization led to higher out-of-pocket spending on hospital care, and higher spending per treatment episode; the effects vary in size depending on the data source and hospital type, but some of our estimates are quite large. We find no evidence that autonomy affected in-hospital death rates or complications, but our results suggest that in provincial and district hospitals autonomization did lead to more intensive style of care, with more lab tests and imaging per case.

The paper is organized as follows. Section II presents an overview of hospital autonomization in Vietnam using the conceptual framework proposed by Harding and Preker (2003). Section III considers the likely effects of hospital autonomization on several key health sector outcomes, including hospital efficiency, use of inpatient care and hospital outpatient services, and households' out-of-pocket spending on hospital care. Sections IV, V and VI present our methods data and results respectively, and section VII contains a discussion.

II. HOSPITAL AUTONOMIZATION IN VIETNAM

Harding and Preker (2003) provide a useful conceptual framework for describing and classifying hospital autonomy reforms, built up around five elements: (a) the allocation of decision rights vis-à-vis labor and other inputs, pricing of services, activity mix, clinical management, financial management, etc.); (b) the distribution of residual claims (in particular whether the hospital is allowed to retain surpluses); (c) the degree of market exposure (the idea that hospitals have to compete with one another for at least some of their revenue rather than relying on budget allocations); (d) the structure of accountability mechanisms (with autonomization typically comes a decreased emphasis on a hierarchical line-of-command model and an increased emphasis on the use of market pressures to hold hospitals accountable); and (e) provisions for social functions (to counterbalance the effects of high-powered incentives often comes the introduction of mechanisms to protect unprofitable services). Harding and Preker suggest that if autonomization is to have its intended effects, action is required across all elements (a)-(d).

The Vietnam hospital autonomization reforms that we focus on in this paper are decrees 10 and 43, which were introduced from 2002 and 2006 respectively in a staggered

fashion across the country. These two decrees were part of a larger reform agenda in which service delivery units across the entire public sector were granted considerably more autonomy than in the past, with the explicit objective of making them more self-sufficient financially. In the hospital sector, these decrees built upon earlier reforms that had begun to create a more autonomous hospital sector. There is, nonetheless, a perception that decrees 10 and 43 were landmark decisions that substantially changed the rules governing public hospitals. Indeed, what marks decrees 10 and 43 out the previous reforms is their comprehensiveness and coherence: rather than operating on just one or two of the Harding-Preker elements, and hence risking not being coherent, they operate across all of (a)-(d) above and provide a fully coherent policy on hospital autonomy. The most striking example of this shift is the fact while hospitals could – as early as 1995 – retain financial surpluses and use them as incentive payments, it was not until 2002 when decree 10 was introduced that hospitals acquired the power to change their input mixes. Thus in contrast to the situation that often prevails where hospitals have the power to change input mixes but no incentive to do so, in Vietnam until 2002 hospitals had the incentive to change input mixes but did not have the authority to do so.

Decision rights

Hospitals in Vietnam have always enjoyed a very high degree of autonomy in their clinical decision-making; even now, there are very few official clinical guidelines, and little external verification of compliance. There is – even today – no credible quality assurance mechanism. By contrast, in other spheres hospitals started with minimal autonomy. Hospitals up to the late 1980s could not charge fees. They had very little scope to change inputs, being restricted by staffing norms, bed norms, and very tight norm-based capital budgets. Basic

salaries were fixed, and hospitals could not borrow. Decision-making in most of these areas has gradually changed.

First to change was the restriction on hospitals charging fees. In 1989 under Circular 14, hospitals were allowed to collect user fees covering part of the cost of providing services. In addition, when conditions allowed, they were allowed to provide health services on a contract basis with fees negotiated with the service user/purchaser for full cost recovery although it is unclear how many hospitals were able to benefit from this early autonomization. The rules on user charges changed again in 1995 when the government introduced a fee schedule – a mix of per-item and per-diem charges – that hospitals had to adhere to. Decree 43, introduced in 2006, allowed public hospitals to set up revenue-generating units. These units can set their own fees, billing patients for the difference between the fee charged and the government-set fee paid by the insurer.

Freedom to change inputs did not change until decree 10, introduced in 2002. Up to then, hospitals had enjoyed virtually no latitude over their input choices, with line-item operating budgets including payroll allocated according to bed norms loosely linked to population numbers and capital for infrastructure and equipment allocated according to centrally determined plans. They were required to obtain higher level approval for hiring and firing decisions and to pay staff according to a government-set wage schedule, although some performance rewards were allowed according to the user fee policy (see below on residual claims). Decree 10 in 2002 gave hospitals greater freedom over their input mix. They were allowed to hire temporary workers, and to operate like state-owned enterprises with their own seal and bank account; they were allowed to borrow and invest in equipment and infrastructure. Decree 43 in 2006 further increased the hospital's decision rights, with

hospital directors being given full autonomy in hiring and firing decisions. In addition, decree 43 gave hospitals the right to mobilize capital from private organizations and individuals.

Residual claims

In terms of residual claims, prior to the *doi moi* reforms of the 1980s there was no residual, as hospitals received budgets linked to the expenditure commitments implied by their input mixes which were in turn determined by the ministry of health. The introduction of user fees in the 1980s was a response to falling government revenues, as the government found itself increasingly unable to find sufficient resources to finance its hospitals. User fees, as in China, were intended – at least initially – to enable the hospital to cover the shortfall between the costs implied by its authorized input mix and its revenue through the State budget. There was not intended to be any surplus.

This changed in 1989 when the government aimed to allow hospitals to earn and retain surpluses. The rules governing financial surpluses have changed over time. It is not so much that incentives have become more high-powered, but rather that the rules have become clearer and more realistic – some of the earlier rules seem a little naïve in terms of the underlying economics.

As mentioned above, under Circular 14 hospitals were allowed in 1989 to collect user fees based on costs of inputs and government-set examination and bed fees, and to negotiate contracts to provide services with full cost recovery if conditions allowed. Hospitals were told they had to submit 5 percent of their user fee revenues to the center for redistribution to other facilities, and could retain the rest with 60 percent needing to be used to cover costs and 35 percent for performance bonuses to staff. Quite how the 35 percent was to be recovered is unclear given the low examination and bed fees. The rules changed again in 1995 with the

introduction under decree 33 of the service fee schedule. At this time hospitals were told to submit to the center to 2-5 percent of user fee revenues, and were told they could use 25-28 percent of the revenues for incentive payments to staff. Again the economics is not entirely clear. Presumably the belief was that the fee schedule was set high enough for every facility to earn a surplus, or that there would always be some unallocated spending from the budget received by the hospital through its subsidy. Both views seem a little naïve.

Decree 10 in 2002 put in place clearer rules governing the link between user fee revenues and the incomes of hospital staff. First, it switched the focus to *net* revenues, i.e. user fee revenues less recurrent expenditures. Second, it required that some net revenues be used for facility upgrades. Third, the net revenue allocated to staff benefit funds would not all be used to supplement incomes: some would be used to stabilize income in the event of a reduction in revenue, some would be used to provide emergency support, and some would be used to reward individual performance. Fourth, caps were placed on allowances and bonuses.

Decree 43 in 2006 tried to sharpen provider incentives. It required that a minimum of 25 percent of net revenues would be used for facility upgrading, and that staff could have a claim on the remaining 75 percent for additional income, although for hospitals receiving subsidies these payments were to be subject to the same cap as under decree 10. Levels of additional income, bonuses and allowances were to be decided by the hospital director (based on the internal expenditure regulation approved by the local leadership, labor unions and higher authorities). Any net revenues still left are to be contributed to the same staff funds specified in decree 10.

Market exposure

It was, as already stated, an explicit intention of decrees 10 and 43 – and of the earlier user fee reforms – to make hospitals more self-sufficient financially. This meant they were expected to compete with one another for user fee income to supplement their budgets; as in China, the hospital needed to generate user fee income to be able to cover its costs. As hospitals have become less reliant on budget allocations, their total revenue has become increasingly linked to their success at attracting patients and staff capable of developing service lines that attract patients; this process has allegedly led to central and provincial hospitals poaching top staff from other urban hospitals.

At the same time as forcing public hospitals to compete with one another for user fee income, the government made the hospital sector more competitive by permitting private hospitals from 1989 onwards. It was not, however, until 1996 that the first private hospital opened in Vietnam (Binh Dan hospital in Da Nang). The development of private hospitals has been slow, but there are now over 100 private hospitals in Vietnam. Nonetheless, competition has been limited, especially across different levels of facilities, because of differential quality, the high costs associated with going to a higher level facility without permission, and high transport costs. Nonetheless, some competition exists, not least because Vietnam's health insurance agency, VSS, is slowly rolling out a policy of contracting with private hospitals. By 2011, 53 of the 100 private hospitals had health insurance contracts.

Accountability

As hospitals have grown less reliant on budget allocations and more reliant on revenues from user fees and health insurance, the methods by which they are held accountable has inevitably changed. There has been a shift from the old command-and-

control approach associated with directly-managed and budget-financed hospitals toward a mix of accountability mechanisms involving the market (hospitals, as indicated above, are expected to earn part of their income from sources other than the budget) and oversight exercised by the health ministry. This oversight has developed faster in some areas than others. Decree 43 required the development of internal expenditure regulations that lay out explicitly each facility's rules for payment of supplementary income or specific spending norms, to be approved by the labor union and leadership of units within the hospital, but also from government health sector administration. By contrast, the accountability mechanism related to the quality and efficiency of care remains weak. The recently passed decree on penalties for administrative violations in medical examination and treatment includes penalties for violations such as "prescribing use of medical services for profit reasons" and "violating technical professional regulations", but it lacks the details needed for operationalization.

Social functions

Finally, in terms of social functions, the relevant concern in Vietnam has been that of ensuring that hospital care remains affordable for the poor. Initially this involved the Commune People's Committee issuing letters to specific individuals requesting them to exempt the person from user fees. While intended to be focused on the poor, these exemptions apparently benefitted the nonpoor almost as much, and were not applied consistently across hospitals (World Bank 2001 p.151). These exemptions had to be financed by the hospital – in the form of forgone revenue – and had the scheme persisted concerns would have arisen about the likelihood of the poor being underserved by autonomized hospitals. In any event, this policy was replaced in the late 1990s by a policy of 'health cards for the poor', where local governments either enrolled the poor in the social health insurance

scheme or reimbursed hospitals directly for the care they provided to card-holders. The scheme was not considered a success, because it was financed by local governments themselves, and jurisdictions with large numbers of poor people were unable to find the resources. In its place, the largely centrally-financed 'health care fund for the poor' program was introduced over the period 2003-06. This has been tightly targeted on the poor (Wagstaff 2010), and those covered have been enrolled in the social health insurance program, which pays hospitals through the fee schedule at the same rate it pays for other enrollees. The same approach has been adopted to cover children under the age of six. In terms of revenue, hospitals ought now to be indifferent between treating any kind of insured patient whether they are covered through the 'health care fund for the poor' program or through the regular contributory social health insurance program.

III. LIKELY EFFECTS OF VIETNAM'S HOSPITAL AUTONOMIZATION

In this section we discuss the possible impacts of Vietnam's autonomization policy on the hospital and household outcomes that we investigate in our empirical work. The changes we are concerned with are those initiated by the autonomization policy, which in Vietnam's case involve the expanded decision rights of hospital managers and staff, the increased claims that staff and private investors have over the hospital's residual, and the hospital's consequent increased market exposure. We also need to bear in mind the relevant policy change vis-à-vis social functions, specifically the change from requesting hospitals to grant fee exemptions to poor patients to giving poor households health insurance coverage at the taxpayer's expense. This change likely considerably increased the hospital's willingness to treat poor patients. In other respects the ways that hospitals are paid remained largely unchanged during the autonomization period. Hospitals continue to receive their revenues through a mix of budgets

and (per-item and per-diem) fees paid by the state insurer and "uninsured" patients.[2] What autonomization has done is to give hospitals increased incentives and greater options for mobilizing funds to make investment and spending choices that maximize net revenues, and aligning objectives of hospital management and staff towards achieving this goal.

Modeling the effects of autonomization

Autonomization affects the hospital's objective function, as well as the variables that it has control over in its optimization problem. An autonomized hospital is clearly going to be motivated in part by profit.[3] An autonomized hospital might also be motivated by patient benefits or quality of care, as is assumed to be the case in some of the US literature that models hospital behavior in an environment where the hospital can make a profit or a loss (cf. e.g. Hodgkin and McGuire 1994). In practice, this means assuming that patients derive more benefit the greater the intensity of resource usage during their treatment; as Hodgkin and McGuire (op cit) remark, hospitals may value intensity because they are altruistic and believe that greater intensity brings greater benefit to the patient, or because intensity adds to the hospital's technological prowess and reputation. Insofar as greater intensity entails a higher cost per case, a concern over patient benefit will blunt the hospital's drive for profit.

An unautonomized hospital would be unlikely to be motivated by profit, given that net revenues cannot be distributed to staff or private investors. It might, however, be motivated by patient benefit just as an autonomized hospital might be; after all, in both cases the link between staff pay and quality of care is just as blurred. What might an unautonomized hospital care about instead of profits? Early models of hospital behavior in

[2] We say "uninsured" because the budget allocations to hospitals ensure that even uninsured patients do not pay the full cost of care.

[3] Hodgkin and McGuire (1994) note that the introduction by Medicare in the US of prospective payments in the form of diagnosis-related groups led to a change in the way economists modeled hospital behavior, with an objective function that included profit appearing in the literature only after the introduction of DRGs.

the US (cf. Newhouse 1970; Feldstein 1971) assumed that the hospital would derive utility from quality and quantity. This makes some sense in the pre-DRG US context since hospitals needed to attract patients to survive. But in the context of the Vietnam's pre-autonomized hospital system, it is less obvious why the size of the hospital's throughput should have contributed positively to the utility of the hospital's management and staff; in fact, insofar as extra throughput means more work with no extra pay, higher throughputs might have been seen as a source of *disutility*.

Given the lack of clarity as to how to model the pre-autonomized hospital, we have opted not to develop a formal theoretical model, but instead to present a set of informal arguments explaining our hypothesized effects of autonomization on our variables of interest. These include indicators of hospitals' throughput, use of resources, costs and revenues, as well as households' use of services and out-of-pocket spending.

Hospital admissions, length of stay, and outpatient visits

We hypothesize that autonomization is likely to increase admissions and outpatient visits, at least insofar as the extra revenues that hospitals can earn from fee-paying and insured patients do not exceed the extra costs. The reason is simply that the autonomized hospital cares about profit while the unautonomized hospital does not. Since the fee schedule is a mix of per-item and per-diem fees, we hypothesize that autonomization is also likely to increase average length of stay (ALOS) – again insofar as the extra revenues associated with the extra days exceed the extra costs involved. It is unlikely that admissions, ALOS and outpatient visits will all increase the same percentage: the marginal revenues and marginal costs are likely to differ; and the hospital is likely to have more control over some variables

than others – the variable most under the control of the hospital is likely to be ALOS, while the variable least under the hospital's control is presumably outpatient visits.

Beds and bed occupancy rates

Since an autonomous hospital still receives some revenue through a budget based on "planned" or authorized beds, which are in turn based on population norms, it shares with the non-autonomous hospital an incentive to have a high number of planned beds. Both types of hospital can try to get the local authorities to increase their planned bed number either by working its planned bed stock hard (i.e. raising the bed-occupancy rate) or by adding unofficial beds in wards and corridors to make itself look under-resourced. An autonomous hospital presumably has an added incentive to do this, because in addition to increasing its chances of getting an increase in planned beds and hence a larger budget in the future, it can also earn additional fee revenue today that can be used to top up staff salaries. Of course, any changes in admissions (N), ALOS (S), the (actual) number of beds (B), and the bed-occupancy rate (R) all have to be consistent with the bed-occupancy constraint:

(1) $$N \cdot S = B \cdot R \cdot 365.$$

We would expect the acquisition of new beds to be more costly than using existing beds more intensively, and in any case what we measure in the data is the number of planned beds which are harder to change than actual beds; so we would expect autonomization to have a larger proportionate effect on the bed-occupancy rate than on planned beds. Of course, the bed-occupancy rate will, after a point, reach a practical maximum; however, since inpatients are spread across planned and unplanned beds, and since in Vietnam people often share a bed for at least part of the day, the bed occupancy rate calculated on planned beds could far exceed 100 percent.

Revenues, costs, and efficiency

We expect autonomized hospitals to have a greater incentive to increase their net revenues, since this means more money to be distributed to staff and (under decree 43) to private investors.

One way to do this would be to increase efficiency, by increasing technical efficiency or by shifting toward the cost-minimizing input mix. If autonomization does lead to efficiency improvements, we would see a downward shift in the hospital's cost curve and hence a reduction in its marginal costs *at each combination of inpatient admissions and outpatient visits*. The hospital's actual total, average and marginal costs could, however, increase: it may increase the number of inpatient admissions or outpatient visits it produces, and it may already have fully exploited its economies of scale.

If a newly autonomized hospital does increase its output levels, its total revenues will also increase, of course. Its average revenues, on the other hand, may well decline, though this will not necessarily be the case. A newly autonomized hospital might find ways to raise average revenues by focusing on profitable procedures: it might perform more diagnostic tests, or more surgery, or at least more of those tests and surgeries where the net revenue is positive. The autonomized hospital may also work harder to select the more profitable patients for admission, and to discharge unprofitable ones early. The autonomized hospital's focus on profitable procedures and profitable patients would be tempered by any utility it derives from the degree of sophistication of the care it delivers. A hospital might be willing to forgo some profit by selecting procedures that are not particularly profitable but whose technological sophistication brings health benefits to patients and adds to the reputation of the hospital.

Quality

Even if the pre-autonomized hospital and the autonomized hospital are motivated equally by patient benefit and the quality of care, autonomization could still impact on quality of care. One possible mechanism is that autonomization gives hospitals greater decision-making in areas that matter to the quality of care. They can hire new staff, acquire new equipment, and so on. In this sense, autonomization might be expected to lead to an improvement in the quality of care. But there is a second mechanism that will work to reduce the quality of care, namely that once autonomized hospitals have an incentive to focus on profit – this may be tempered, as mentioned above, by any motivation the hospital has to increase the degree of sophistication of its care, assuming that this is positively correlated with the quality of care. On balance, therefore, the effect of autonomization on the quality of care is ambiguous.

IV. METHODS

As already mentioned, we have two datasets – a hospital dataset, and a household dataset. The former is a panel, albeit unbalanced, while the latter is a series of cross-sections. We use somewhat different methods in the two cases.

Hospital-level analysis

In econometric terms, our analysis of the impacts of autonomization on hospitals is based on a generalized differences-in-differences analysis. We have multiple years. In each year some "units" have been "treated", and others not. Let y_{ht} be the outcome of interest in hospital h at time t, X_{ht} be a vector of covariates, and $AUTON_{ht}$ be a dummy variable taking

on a value of 1 if hospital *h* has been autonomized at time *t*. Our estimating equation takes the form:

$$(1) \qquad y_{ht} = X_{ht}\gamma + \delta AUTON_{ht} + \alpha_h + \theta_t + \varepsilon_{ht}.$$

where θ_t is a period-specific intercept, α_h is a hospital-specific effect which captures time-invariant unobservables that are potentially correlated with autonomy status, and ε_{ht} is an idiosyncratic error term (iid over *h* and *t*). In the special case where the X_{ht} are omitted, eqn (1) collapses to the standard difference-in-differences (DID) estimator (cf. e.g. Wooldridge 2002 p.284).[4] Our interest is in the coefficient δ which gives the impact of autonomization on the outcome y_{ht}.

To test the hypothesis that autonomization increases efficiency, the specific equation we estimate in eqn (1) is a multi-product cost function of the type introduced by Granneman et al. (1986), and used by Weaver and Deolalikar (2004) in their analysis of economies of scale and scope in Vietnamese hospitals. The outcome y_{ht} in this case is the natural log of total costs, and the X_{ht} vector includes the numbers of inpatient admissions and outpatient visits, their squares, their cubes, and their interactions. Like Weaver and Deolalikar, we also include the number of beds in the X_{ht} vector, but we also report results without beds included. We also control for various other influences on cost as explained in section V below.

Our other equations are essentially reduced-form difference-in-difference regressions where we look at the effect of autonomization on the outcomes of interest discussed in

[4] As Bertrand et al. (2004) have shown, many outcome variables used in published policy impact analyses generate positive serial correlation in the ε_{ht}. If ignored, and the model is estimated as a fixed-effects specification, this positive serial correlation results in standard errors that are too small, and t-statistics that are too large—possibly dramatically so. In such a case, first differences may be preferred. Of course, if the ε_{ht} in eqn (1) are serially uncorrelated, the error term in the first-differenced version may well be subject to negative serial correlation, in which case the standard errors would be overestimated. An obvious strategy is to report standard errors that are robust to any type of serial correlation (and heteroskedasticity), whether one uses fixed effects or first differences. This is what we do below in all our models.

section III, holding constant factors that may be correlated with the timing of autonomization and unobservables influencing outcomes.

Individual-level analysis

There are two major differences between our hospital-level and individual-level analyses: first, the hospital data are panel data, while the household survey data are a series of cross sections covering the years 2004, 2006 and 2008; second, in the hospital analysis our unit of analysis is the entity that has been autonomized while this is not the case in the individual analysis.

In the household survey data, we know the district that the household lives in. We construct from the hospital-level autonomy dataset a hospital autonomy dummy variable for the household's district for each of the three years covered. If the district has just one hospital – which is typically a district hospital but is sometimes a provincial hospital or a central hospital – we simply define autonomy as 1 when the hospital in question has been autonomized. If there are multiple hospitals in the district – this mostly happens when there is a district and a higher-level hospital in the same district, but sometimes we find multiple district hospitals in a district – we explore various options for defining the autonomy of the local hospital district – these are explained below in section V.

Although we know whether a visit or inpatient admission was to a district, provincial or central hospital, we do not try to link utilization to the autonomy status of the hospital used. This is in part because we know only the level of hospital used not the name of the hospital; we cannot be completely sure, for example, which provincial hospital was used. More importantly, however, we want to know whether the autonomy status of the hospitals in a person's district affects the likelihood of them making an outpatient visit and being

admitted as an inpatient, not just the number of visits and admissions conditional on at least one occurring. It is only the latter we can examine if we link the autonomy status of the hospital being used to the person's number of visits and number of admissions.

With repeated cross-sections rather than panel data, we cannot estimate a generalized differences-in-differences model. Instead we estimate a district-level fixed-effects model:

$$(2) \qquad y_{ijt} = X_{ijt}\gamma + \delta AUTON_{jt} + \alpha_j + \theta_t + \varepsilon_{ijt},$$

where y_{ijt} is the outcome for individual i who lives in district j at time period t, X_{ijt} is a set of covariates corresponding to the same individual, $AUTON_{jt}$ is the autonomy status of district j at time t, α_j and θ_t are district- and period-specific fixed effects, and ε_{ijt} is an error term.

V. DATA

We have two main datasets – a hospital inventory, which is a panel dataset, and a household survey, which is a series of cross-sections. Our data on autonomy status of specific hospitals are derived in part from the hospital inventory, and in part from a telephone survey of provincial health bureaus conducted in 2007. Table 1 shows the descriptive statistics for our hospital data. Table 2 shows the descriptive statistics for our individual-level data.

Hospital data

We use data from the hospital inventories implemented in 2004, 2006 and 2008, each round covering two years of data. The hospital inventory is an annual survey of hospitals that was initiated in 1996, repeated in 2000, and implemented regularly since then, although the contents have only stabilized since about 2004. The earlier years of the survey involved some non-random sampling of facilities, while the 2011 survey was close to a census of all

hospitals in the country. The quality of the templates for facilities to fill in and the data cleaning process have also improved over time and a standard coding system for hospitals has recently been introduced to facilitate verification of data and comparison over time. For this study, substantial data-cleaning was required. This involved adjustment of units to VND for facilities reporting in thousand VND, identification of trend outliers of magnitude 10 times or more in the time series and adjustments by a factor of 10, identification of misrecorded aggregates, and replacement by the sum of component parts. The revenue data have been converted to real values using the Vietnam consumer price index for medical goods and services.

Autonomy

We define autonomy in terms of when a hospital was formally autonomized under decree 10 or 43. Some hospitals were autonomized earlier than others: the process started in 2003, and by the end of 2008 all hospitals had been autonomized. Figure 1 shows the pace of hospital autonomization in six districts in three provinces. The figure illustrates the point that the pace varies, even within a province.

To identify the timing of autonomization according to Decree 10 or Decree 43 we relied in part on questions in Part B of the hospital inventory, and in part on data gathered from health bureaus. The hospital inventory in 2004 and 2005 asked each facility to report whether they had implemented Decree 10 yet. In 2006 and 2007 a similar question was asked about whether the hospital had implemented Decree 43. This information was incomplete: we cannot tell from these data if a hospital was autonomized in 2002 or 2003. To fill this gap, we used data gathered from the provincial health bureaus in 2007 about the timing of autonomization according to Decree 10 and 43 in each of the government hospitals in their jurisdiction. The 2008 hospital inventory no longer asked whether facilities had implemented

Decree 43 yet. Instead the question asked whether the facility had experienced different levels of income growth due to Decree 43, with codes from zero to one or missing. To identify whether Decree 43 had been implemented, we considered any positive number to indicate implementation. In addition, hospitals with zero or missing information were coded according to whether any previous year data indicated that the facility had been autonomized.

Some inconsistencies existed in the way autonomization was reported between years of the hospital inventory, and between the inventory and the data gathered from provinces. We attribute these differences to some ambiguity in how questions about autonomization were asked or how they were understood. If a facility was asked about implementation of Decree 43, they may have indicated their timing starting in 2006 or later, even if they had implemented Decree 10 earlier. Therefore we took the earliest year that autonomization was reported for any given facility between the two datasets as the starting point for autonomization in that facility and all later years were coded as autonomized.

Outcome variables

The hospital inventory data contains data on inpatient admissions, average length of stay, and outpatient visits, as well as the number of beds – from these we can compute the number of inpatient days and the bed-occupancy rate. The inventory also includes data on revenues and costs; these were much messier, and apparently reflected inconsistent data entry across years for a given hospital, and a departure from the instructions within a year for a given hospital. Substantial efforts went into the cleaning of the financial data. In the end we constructed total revenue from its components having first cleaned them carefully. The components we included are: user fee (i.e. out-of-pocket) revenues; reimbursements from the health insurance agency (these include reimbursements associated with coverage provided by the government for children under the age of six and poor and otherwise disadvantaged

households under the aforementioned 'health care fund for the poor' program; and government subsidy revenues (supply-side subsidies received through bed-based budgets). From the data we have total costs, and costs associated with drugs. The inventory also includes several variables that we think of as quality and/or intensity-of-care indicators. We have data on the numbers of hospital deaths and complications. We also have data on the number of medical examinations, the number of imaging services (the sum of x-ray, ultrasound, endoscopy, MRT and CT scans), the number of lab tests (the sum of hematology, microbiology, biochemistry and pathology), the number of surgeries, and the share of deliveries through C-section. These variables tend to have skewed distributions, so in most cases we took natural logs to achieve a normal distribution for our regression analysis.

In addition to estimating "levels" regressions, we also estimated regressions capturing the values of some of our outcome variables "per case". The variables we seek to express on a "per case" basis are: total revenues and its components; total costs and its components; images, tests, surgeries, deaths and complications. We cannot separate these into those incurred in respect of or delivered to inpatients and those incurred in respect of or delivered to outpatients, so we divide them all by the total number of cases (inpatients plus outpatients) and then control in our "per case" regressions for the inpatient/outpatient mix.

Covariates in the estimating equation

In estimating the hospital equations, we want to control for variables that may be correlated with the outcomes of interest and the timing of the hospital's autonomization. Obvious candidates include whether the hospital is general or specialist, whether the locality is urban (urban district or provincial city) or rural (rural district or district capital), and the degree of competition from the other hospitals (which we measure by two variables: the number of general hospitals within same district, and the number of private hospitals in the

district). All of these variables were derived from information in the hospital inventory. The name of the hospital gives its location and specialization. The number of general and private hospitals reported in the inventory was used to derive an estimate of private and general hospitals in the same district, although private hospitals in earlier years may be underrepresented.

Household data

Our individual-level analysis is based on data from the 2004, 2006 and 2008 Vietnam Household Living Standards Survey (VHLSS), merged with district-level hospital autonomy data constructed from the hospital inventory. We originally planned to use data from the 2002 VHLSS, but we concluded that the health data had been collected in too different a fashion from the later surveys for them to be comparable. Thus in contrast to the hospital-level analysis, in the individual-level analysis we do not have data starting before the initial wave of hospital autonomization in 2003. The VHLSS sample covers all Vietnam's provinces but not all its districts.

Autonomy

We look to the hospital (or hospitals) in the household's district of residence when constructing our measure of hospital autonomy. Where there is just one hospital, we define the household's local hospital "market" as autonomized from the date the single hospital gained autonomy status. This single hospital will typically be a district hospital, but need not be – it could be a provincial hospital, for example. Where there are several hospitals in the household's district, we assume that the individual will be referred upwards: where there is a district hospital, we use its autonomy status to determine the district's autonomy status; where there is no district hospital but a provincial hospital, we use the provincial hospital's

status to determine the district's autonomy status; and where there is only a central hospital, we use the central hospital's status to determine the district's autonomy status. When deriving our autonomy variable, we exclude specialized hospitals for mental illness, rehabilitation, leprosy, tuberculosis, pediatrics, and traditional medicine, because they tend to provide mainly subsidized or highly specialized services.

Outcome variables

Our outcome variables include the number of hospital outpatient visits and the number of inpatient admissions. In both cases, we also estimate models capturing simply whether a visit or admission occurred. The recall period in both cases is 12 months, and the data on utilization are available for every household member. In addition, we explore the impacts of autonomization on total out-of-pocket spending on hospital outpatient and inpatient care, as well as the average out-of-pocket spending per visit and admission. The expenditure data have been converted to real values using the Vietnam consumer price index.

Covariates in the estimating equation

Our covariates include two variables that are unlikely to be correlated with the autonomy status of the local hospital "market" but which we include to increase the precision of our estimates. These include the individual's health insurance status (some insurance coverage is specific to the individual in Vietnam, while other coverage applies to all household members), and the household's per capita consumption. The latter is a consumption aggregate reflecting not just market expenditures but also other elements of consumption such as the value of home-grown produce and the imputed rent of an owned house. In addition to these variables, we include whether the household lives in a rural area – this may be correlated with the timing of the autonomization of the hospitals in the household's district.

VI. RESULTS

Table 3 reports our estimates of the impact of autonomy on the hospital's cost structure. The estimates are from our generalized difference-in-difference regression, eqn (1), but specified as a multi-product hospital cost function. We report only the coefficient on the autonomy policy variable. Table 4 reports the results of the impacts of autonomization on hospital outcomes from our reduced-form hospital regression; again, we report only the coefficient on the autonomy variables. Table 5 shows the impacts for the "per case" values of the hospital outcome variables; in these regressions we control for the outpatient-inpatient mix, and again report only the coefficient on the autonomy variable. In all cases, we report results for all hospitals combined, as well as for central, provincial and district hospitals separately. Table 6 reports the estimated impacts of hospital autonomization from our individual-level analysis. The table shows the impacts of the district's autonomy status (defined as indicated in section V) on utilization and out-of-pocket spending for all hospitals combined, and for central, provincial and district hospitals separately.

Hospital admissions, length of stay, and outpatient visits

Table 4 suggests that autonomization through decrees 10 and 43 led to increases in hospital admissions, though only in the case of provincial hospitals is the effect statistically significant. For both provincial and district hospitals we see a significant effect of autonomization on inpatient days, and for district hospitals we see a significant impact of autonomization on outpatient visits as well. For district hospitals, then, autonomization appears to have led to significant increases in activity in both inpatient wards and the outpatient department; the estimates suggest a five percent increase in inpatient days and outpatient visits.

The individual-level results in Table 6 provide some support for this story – there we find a significant positive effect of autonomization on inpatient admissions only in the case of central hospitals, and a significant positive effect of autonomization on outpatient visits only for all hospitals combined, though looking at the sizes of the coefficients and standard errors it would appear that the effect is coming from impacts among the provincial and district hospitals.

Beds and bed-occupancy rates

Table 4 suggests that if anything autonomization leads to a reduction in the number of planned beds not an increase; however, the effect is not significant for any type of hospital. This likely reflects the fact that planned beds are allocated to hospitals as part of the budget-allocation process. The hint of a negative effect raises the question of whether the government may be trying to use the autonomy policy to reduce the reliance of hospitals on budget allocations, which are tied to bed numbers. In Table 4 we do not see any significant impact of autonomization on the bed-occupancy rate, likely reflecting the fact that bed-occupancy rates are already extremely high.

Revenues, costs, and efficiency

We look first at the impact of autonomization on efficiency. If autonomy leads to an increase in efficiency, we would expect to see a downward shift of the cost function, and a significant negative coefficient on the autonomy variable. In the event, whether or not we include the number of beds, in Table 3 we find no significant negative effect of autonomization; this is true for the sample as a whole, and for each type of hospital. Nor, however, is there any evidence that autonomization leads to a statistically significant *upward* shift in the cost curve, as some critics of hospital autonomization suggest may have

happened. Rather autonomization appears to have left the cost structure of Vietnamese hospitals unchanged.

Oddly, given these results and given the apparent positive effects of autonomization on patient volumes seen in Table 4, we see no significant effects – upwards or downwards – of autonomy on total hospital costs or on costs per case for any level of hospital.

Oddly too, despite the positive impacts we saw on inpatient days in provincial and district hospitals, and on outpatient visits in district hospitals, we see a significant impact on total user fee and out-of-pocket fee revenues only in the case of provincial hospitals. However, Table 5 shows that – for both central and provincial hospitals – autonomy increases user fee revenues *per case* and out-of-pocket revenues *per case*, after controlling for casemix; oddly, this is not evident for district hospitals.[5] The patterns of the individual-level results in Table 6 are not wholly consistent with the hospital-level results, but they do point to autonomization exerting some upward pressure on out-of-pocket payments. Hospital autonomization in a household's district appears to have led to higher out-of-pocket spending on hospital care: there is fairly strong evidence that this reflects higher utilization rates, and a suggestion that it may also reflect higher spending per contact.

Quality

We find no evidence in Table 4 or Table 5 of autonomization leading to changes in hospital death rates or complications. Our results suggest a mixed picture, however, on the

[5] In the case of the district hospitals, the impact on inpatient days is driven in part by an increase in length of stay; it may be that the extra length of stay has not translated into higher revenues. It may also be that that the additional outpatient visits have not translated into extra revenues. In both cases, though, the finding is a little strange. It may well be a data quality issue – even with the extensive data-cleaning that we did prior to the estimation, the quality of the revenue data may still be inadequate for the task. One would have to argue, of course, that the district hospital data are in worse shape than the central and provincial hospital data since we do see effects there, but this is not implausible.

impact of autonomization on the resource-intensity of care. Table 4 points to autonomization increasing the number of images and laboratory tests at least in provincial and district hospitals; Table 5 shows that for these lower-level hospitals, this is also true on a "per case" basis. By contrast, in central hospitals autonomization apparently led to *fewer* lab tests, as well as fewer surgeries. This might be because the fee differential between central and other hospitals is smaller than the cost differential, and autonomization stimulated managers in central hospitals to urge their staff to economize on lab tests and surgeries.

VII. CONCLUSIONS

Our results suggest then that Vietnam's autonomization policy probably led to more hospital admissions and more outpatient department visits, though the effects are not large. The policy did not, however, apparently affect bed stocks or bed-occupancy rates. Nor does it seem to have increased hospital efficiency, but rather left the typical hospital's cost structure unaffected. Oddly, despite the volume effects and the unchanged cost structure, our results do not point to autonomization leading to higher total costs. By contrast, we *do* find some evidence that autonomization probably led to higher out-of-pocket spending on hospital care, and higher spending per treatment episode. The estimated effects vary, however, in size depending on the data source and the level of the hospital. Some are quite large (around 20 percent and in some cases even larger), but the variation suggests that one should probably treat them with some caution. We find no evidence that autonomy affected in-hospital death rates or complication rates, but in lower-level hospitals it did apparently lead to more intensive style of care, with more lab tests and imaging per case.

While the results from the hospital and household data tell broadly similar stories as far as utilization and out-of-pocket spending impacts are concerned, there are differences in

the details, especially in which hospitals are affected most. There are many possible explanations of these differences. The hospital inventory is intended to be a census while the household data come from a survey; though conducted in every province, the household survey was not fielded in every district. The hospital results tell us what happened to the hospital's outcomes when its autonomy status changed, while the individual results tell us what happened to the individual's use of and spending on hospital care when the lowest-level hospital in his district was autonomized. This need not be the hospital the individual typically uses or used in the next treatment episode; indeed, the person may typically use or may have used next a hospital in a neighboring district or even neighboring province. The two datasets may also differ in their accuracy, though it is hard to say which is likely to be better. Hospitals might keep better records than households of their utilization and spending, but there again some of the hospital data – especially the financial data – were found to be problematic. Hospitals may deliberately underreport or overreport depending on the incentives they face, while households face no obvious incentive to deliberately mislead the enumerator, at least on this set of issues. Households could, however, be confused about the type of hospital they went to, while a hospital is very unlikely to be confused about whether it is a district or provincial hospital.

The bigger question worth addressing is why the results are not more clear-cut and stronger. The results point to some volume effects, but one might have anticipated stronger and more clear-cut effects. Why did the policy not lead to increases in bed numbers and bed-occupancy rates? Why did it not lead to increases in hospital efficiency? This question is clearly of some interest given the motivation for hospital autonomization worldwide. Why did we not find a stronger and more clear-cut effect on out-of-pocket spending? And why were the effects on quality and resource-intensity so muted?

There appear to be two reasons why we did not find stronger more clear-cut results. One is that while decrees 10 and 43 were heralded as major autonomization initiatives, they were in fact steps – albeit important ones – in a process that started 13 years before with the 1989 reform that allowed hospitals to collect partial user fees and deliver some care on a cost recovery basis. Further reforms in the 1990s built on this process, and while decrees 10 and 43 were important, the process of autonomization had already begun. That said, it is often claimed that if autonomization is to work, policymakers have think holistically – the rules concerning decision rights, residual claims, market exposure, and accountability have to be mutually coherent. Prior to decree 10, the various elements were not really mutually coherent – most notably, it was not until 2002 that hospitals acquired the power to change their input mixes. One way to interpret our results is that the mutual coherence may matter less than often claimed – that the reforms before decree 10 had already had an effect on at least some of the outcomes we studied by the time we started measuring them.

There is another explanation, however, which is that because autonomized hospitals still receive budgets, and because these budgets are still based on planned bed numbers, there is still a lot of rigidity in and central control over a hospital's decisions, even though it is nominally autonomous. Under this interpretation, the reason for our results not being stronger and more clear-cut is that the autonomization process is incomplete and the various elements of the Harding-Preker framework not yet mutually coherent. We may, in short, have come too late or too early to see the effects. If either is true, the implication is that we may never know the true effects, since the earlier reforms were not phased out in a staggered fashion, and any future reforms may well not be either; finding a credible identification strategy to estimate the effects will therefore likely be hard if not impossible.

Figure 1: Autonomization of hospitals in selected districts

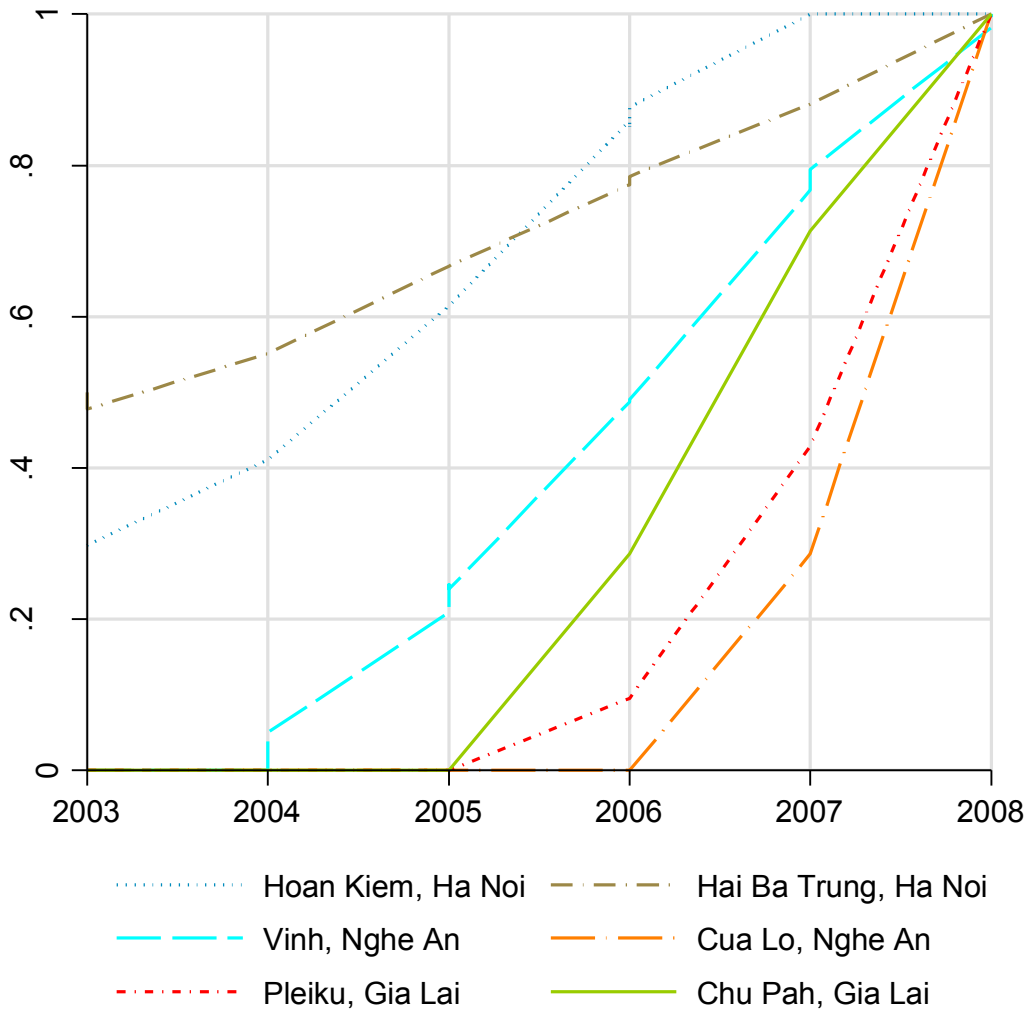

Table 1: Descriptive statistics – hospital data

	Obs	Mean	Std. Dev.	Min	Max
Inpatient admissions (log)	4325	8.54	1.07	2.08	11.58
Inpatient days (log)	4339	10.51	1.11	1.10	13.76
Av. length of stay	4290	9.39	15.79	0.00	420.10
Beds	4416	148.76	174.21	10.00	1600.00
Bed-occupancy rate	4337	1.09	0.37	0.00	3.87
Outpatient visits (log)	4317	10.92	1.28	2.08	14.29
Total revenues (log)	4385	15.56	1.15	10.64	20.57
Out-of-pocket fees (log)	3832	13.70	1.94	-0.23	19.95
Insurance revenues (log)	4103	13.98	1.77	4.95	19.75
Subsidies (log)	4288	14.85	0.92	10.92	18.47
Total expenditures (log)	4171	15.54	1.28	6.46	20.63
Drug spending (log)	4061	14.28	1.48	2.07	21.43
Images (log)	4191	9.11	1.55	1.61	13.68
Lab tests (log)	4366	10.58	1.80	3.89	16.48
Surgeries (log)	3516	6.36	1.71	0.00	10.86
Deaths (log)	3534	2.32	1.60	0.00	8.16
Complications (log)	723	1.77	1.22	0.00	6.03
Revenue per case (log)	4352	4.57	1.07	1.50	12.71
Out-of-pocket fees per case (log)	3813	2.60	1.58	-12.65	9.13
Subsidies per case (log)	4255	3.85	1.11	0.10	12.69
Insurance revenues per case (log)	4086	2.94	1.57	-4.59	10.66
Expenditure per case (log)	4160	4.54	1.19	-3.09	12.98
Drug expenditures per case (log)	4045	3.27	1.24	-6.15	15.73
Images per case (log)	4185	-1.96	1.15	-8.21	4.06
Lab tests per case (log)	4345	-0.43	1.42	-8.42	6.24
Surgeries per case (log)	3516	-4.90	1.36	-11.91	0.64
Deaths per case (log)	3534	-8.80	1.51	-13.41	-2.84
Complications per case (log)	723	-9.81	1.58	-13.26	-4.71
C-sections per delivery	1912	0.25	2.35	0.00	91.98
Autonomy	4444	0.60	0.49	0	1
Specialist hospital	4444	0.18	0.38	0	1
Urban	4444	0.36	0.48	0	1
Private hospitals	4444	2.20	2.20	1	14
No. general hospitals in district	4444	2.13	2.03	0	12

Table 2: Descriptive statistics – household data

	Obs	Mean	Std. Dev.	Min	Max
Inpatient admissions	96434	0.07	0.40	0.00	24.00
Inpatient admission (yes/no)	96434	0.05	0.23	0.00	1.00
Expenditure per inpatient admission	96434	82.68	828.70	0.00	79070.13
Expenditures on inpatient care	96434	112.27	1172.79	0.00	110000.00
Outpatient visits	96434	0.33	1.57	0.00	83.00
Outpatient visit (yes/no)	96434	0.12	0.32	0.00	1.00
Outpatient expenditure per visit	96434	29.87	496.27	0.00	118605.20
Expenditure on outpatient care	96434	67.04	863.98	0.00	118605.20
Total out-of-pocket expenditure	96434	179.31	1505.40	0.00	118605.20
Autonomy	93937	0.68	0.46	0.00	1.00
Health insurance	96434	0.49	0.50	0.00	1.00
Per capita consumption	96434	5525.04	4574.99	315.38	132412.40
Urban	96434	0.27	0.45	0.00	1.00
No. general hospitals in district	96434	1.50	1.28	0.00	12.00

Table 3: Autonomy impacts in multi-product cost function

	All		Central		Provincial		District	
	coef	t	coef	t	coef	t	coef	t
Beds included	0.019	0.49	0.072	0.99	-0.077	-0.78	0.035	0.78
Beds excluded	0.019	0.49	0.068	0.92	-0.077	-0.78	0.034	0.78

Note: *** p<.01, ** p<.05, * p<.1. Numbers shown are estimates of the coefficient on the autonomy variable in eqn (1) and the corresponding t-statistic. Regressions also include inpatient admissions, outpatient visits, their squares, cubes and interaction, beds (except where indicated otherwise), year dummies, a dummy capturing whether the hospital is a specialist hospital, an urban dummy, the number of private hospitals in the district, and the number of general hospitals in the district.

Table 4: Reduced-form difference-in-difference regressions – levels

		All	Central	Provincial	District
Inpatient admissions (log)	coef	0.044***	0.020	0.091***	0.025
	t	2.88	0.37	2.71	1.35
Inpatient days (log)	coef	0.067***	0.025	0.112**	0.052**
	t	3.49	0.40	2.47	2.27
Av. length of stay	coef	-0.142	0.361	-0.820	0.143
	t	-0.41	0.50	-0.60	1.41
Beds	coef	-1.620	-10.340	-1.598	0.059
	t	-0.93	-1.44	-0.30	0.04
Bed-occupancy rate	coef	0.015	0.067	0.011	0.009
	t	1.02	1.04	0.40	0.50
Outpatient visits (log)	coef	0.050**	0.045	0.059	0.048*
	t	2.23	1.02	0.99	1.89
Total revenues (log)	coef	0.013	0.083	0.019	0.007
	t	0.67	1.11	0.58	0.29
Out-of-pocket fees (log)	coef	0.003	0.181	0.324***	-0.086
	t	0.04	1.05	2.75	-1.12
Insurance revenues (log)	coef	-0.006	-0.247	-0.001	0.010
	t	-0.11	-1.01	-0.01	0.17
Subsidies (log)	coef	0.032*	0.013	0.005	0.058**
	t	1.69	0.24	0.19	2.30
Total expenditures (log)	coef	0.027	0.053	-0.033	0.042
	t	0.71	0.55	-0.39	0.95
Drug spending (log)	coef	0.067**	0.067	0.043	0.057*
	t	2.06	0.66	0.50	1.65
Images (log)	coef	0.081***	0.123	0.131**	0.056*
	t	3.25	1.29	2.32	1.84
Lab tests (log)	coef	0.087**	-0.359	0.096	0.112**
	t	2.12	-1.59	1.31	2.26
Surgeries (log)	coef	-0.047	-0.229**	0.027	-0.049
	t	-1.27	-2.55	0.44	-1.05
Deaths (log)	coef	0.032	0.080	0.071	0.018
	t	0.98	0.88	0.97	0.45
Complications (log)	coef	0.046	-0.577	0.204	0.014
	t	0.39	-0.91	1.26	0.07

Note: *** p<.01, ** p<.05, * p<.1. Numbers shown are estimates of the coefficient on the autonomy variable in eqn (1) and the corresponding t-statistic. Regressions also include year dummies, a dummy capturing whether the hospital is a specialist hospital, an urban dummy, the number of private hospitals in the district, and the number of general hospitals in the district.

Table 5: Reduced-form difference-in-difference regressions – per case

		All	Central	Provincial	District
Revenue per case (log)	coef	0.007	0.081	0.008	0.011
	t	0.24	1.35	0.12	0.30
Out-of-pocket fees per case (log)	coef	0.014	0.276*	0.408***	-0.083
	t	0.22	1.70	3.36	-1.02
Subsidies per case (log)	coef	0.027	0.001	0.007	0.060
	t	0.91	0.02	0.10	1.62
Insurance revenues per case (log)	coef	-0.001	-0.255	0.021	0.012
	t	-0.02	-1.17	0.15	0.20
Expenditure per case (log)	coef	0.024	0.035	-0.044	0.051
	t	0.55	0.44	-0.44	0.98
Drug expenditures per case (log)	coef	0.073*	0.084	0.066	0.062
	t	1.70	0.92	0.54	1.36
C-sections per delivery (log)	coef	0.083***	0.126*	0.174**	0.062
	t	2.63	1.70	2.45	1.60
Images per case (log)	coef	0.102**	-0.360*	0.179**	0.123**
	t	2.32	-1.69	2.21	2.27
Lab tests per case (log)	coef	-0.045	-0.207**	0.008	-0.039
	t	-1.08	-2.22	0.13	-0.72
Surgeries per case (log)	coef	0.033	0.047	0.077	0.024
	t	0.85	0.58	0.96	0.48
Deaths per case (log)	coef	-0.001	-0.542	0.177	-0.047
	t	-0.01	-1.30	1.01	-0.24
Complications per case (log)	coef	0.016	-0.074	0.002	0.017
	t	0.30	-1.12	0.22	0.24

Note: *** p<.01, ** p<.05, * p<.1. Numbers shown are estimates of the coefficient on the autonomy variable in eqn (1) and the corresponding t-statistic. Regressions also include year dummies, a dummy capturing whether the hospital is a specialist hospital, an urban dummy, the number of private hospitals in the district, and the number of general hospitals in the district.

Table 6: Effects of hospital autonomization on households

		All	Central	Provincial	District
Inpatient admissions	coef	0.003	0.004**	0.002	-0.003
	t	0.52	2.19	0.73	-0.81
Inpatient admission (yes/no)	coef	-0.001	0.002*	0.001	-0.004
	t	-0.30	1.85	0.44	-1.54
Expenditure per inpatient admission	coef	16.564	13.070	1.902	1.592
	t	1.44	1.47	0.26	0.57
Expenditures on inpatient care	coef	26.078*	23.735**	1.621	0.722
	t	1.72	1.98	0.19	0.19
Outpatient visits	coef	0.049*	0.003	0.021	0.025
	t	1.95	0.42	1.51	1.36
Outpatient visit (yes/no)	coef	0.015**	0.001	0.007**	0.006
	t	2.57	0.75	2.05	1.41
Outpatient expenditure per visit	coef	5.857	0.168	1.440	4.249**
	t	1.38	0.10	0.43	2.22
Expenditure on outpatient care	coef	15.095*	2.369	4.737	7.989***
	t	1.81	0.56	0.75	2.72
Total out-of-pocket expenditure	coef	41.173**	26.104**	6.358	8.711*
	t	2.26	1.98	0.56	1.75
	% change	20%	40%	7%	22%

Note: *** p<.01, ** p<.05, * p<.1. % changes are computed relative to 2008 mean.

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