Regulation and Moonlighting of Public Health Professionals: Evidence from Indonesia*

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Abstract

The present paper provides new evidence that private practice of public health professionals may encourage moonlighting: over/under-provision of public health services. Since private practice is non-random, our identification strategy relies on the introduction of the 1997 health regulation 916 in Indonesia that requires health professionals to apply for license for private practice only after three years of graduation. Arguing that the timing of obtaining the license for private practice becomes random after the 1997 regulation, we use puskesmas-level IFLS data over 1993 to 2007 from their heads. Using a difference-in-RDD, we show that private practice is associated with significantly higher number of public patients seen, but lower hours worked per week. Further, the greater number of patients seen is correlated with the referral of public patients to private clinics, while lower hours worked is attributed to the weak disciplining mechanism for heads and their control on supporting staff.

JEL Classification: I10, I18, J2, J44, J45, O1

Keywords: Dual practice of health professionals, Ministry of health regulation, Moonlighting, Over and under provision of public services, Private gain, Indonesia.

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1 Introduction

Recent years have seen growing incidence of dual practice of health professionals, including doctors, nurses and paramedics, partly attributable to the rapid and mostly unregulated growth of the private health sector, especially in developing and emerging economies (Ferrinho et al., 2004). There is an intrinsic motivation for the health professionals to work in the public sector as patient's welfare enhances doctor's welfare. Work in the public sector also provides valuable benefits including career prospects, job insurance, pension and also the public facilities to work. Low public salary may, however, induce public sector health professionals including doctors, nurses and paramedics, to supplement earnings by engaging in private practice part time in countries where both public and private health care systems coexist. This is commonly known as dual practice. The existing literature (see further discussion below) seems to suggest that the work performance of dual practitioners in the public hospital sector is significantly lower than the input of public hospital physicians who are not involved in dual practice (Berman and Cuizon, 2004; Hipgrave et al., 2013). While this is not a new question as such, there is a dearth of rigorous empirical assessment of the causal effect of dual practice on public doctor's labor supply behavior. The present paper aims to bridge this gap in the literature.

Clearly, the decision to practise privately is a non-random choice and is therefore potentially endogenous to the dual practitioner's decisions about his/her labor supply behavior, e.g., the number of patients seen or the hours worked in the public hospitals. One therefore needs to devise a suitable empirical strategy to identify the causal effect of public doctor's private practice on public health provision. The present paper exploits the exogenous variation in private practice of health professionals arising from the introduction of 1997 Ministry of Health Regulation Act 916 in Indonesia.

Indonesia is an important case to study. Its rapidly growing health care workforce has put a serious dent on its fiscal manageability, and as a result, since 1992 the Ministry of Health (MoH) has relied on quasi-contractual arrangements to mobilize physicians for service in lieu of the historical practice of automatically hiring new graduates as civil servants. While there have been changes in the employment contracts of health workforce during this period, the government's mandate on conscription for public service has persisted. Given the relative low pay of civil servants, including government-employed physicians, allowing private practice for government doctors is thought to be

essential to help supplement their public service earnings, thereby making it easier to attract health professionals to rural areas and also ensuring the stability and sustainability of the government health care system. Accordingly, the MoH in Indonesia has allowed public health professionals to conduct private practice, but on the condition that such practice be conducted after the close of the official public work day (around midday). A 1994 review of the health sector workforce (World Health Organization, 1996) estimated that the private practice accounted for about 79% of total income for specialists in urban areas and varied between 25% and 70% for rural general practitioners in outer islands (non-Java/Bali) though we were unable to obtain a more recent estimate in this respect. Chaudhury et al. (2006) found that nearly 40% public doctors in Indonesia were absent during working hours, hinting their devotion to the private job because it yields extra income per unit of time without any cost to the public job, whihc in turn highlights the problems of weak incentives and lack of accountability of public health professionals (see further discussion in Section 2).

Over the years the government of Indonesia has resorted to a series of regulations to promote the quality of health services, a historical account of which is summarised in Appendix 2. The present paper focuses on the Ministry of Health Regulation Act 916 introduced in 1997 that requires health professionals to serve public institutions for at least three years after graduation, with the license to practice being granted upon completion (Berman and Cuizon, 2004; USAID, 2009). We argue that the implementation of this regulation makes the timing of the initiation of the private practice random because the precise timing depends on the administrative process involved from the time of applying for the license after at least three years of experience (since graduation) till it is approved and the license is granted. The health professionals involved are unlikely to influence the timing of getting the license for private practice. Accordingly, we make use of this regulation as a natural experiment and employ a fuzzy regression discontinuity (RD) difference-in-difference methodology to study the causal effect of dual practice on selected indices of public health provisions by the dual practitioner; we do so by comparing these public professionals' labor supply outcome variables, i.e., hours worked and number of patients seen per week, before and after the introduction of the regulation at the end of 1997.

If the public health professionals continue to work conscientiously in the public sector even after they start practising privately, there is of course no conflict of interests and no adverse

impact on public health provisions. But this is not necessarily the case: just as there are motivated professionals, there may also be some moonlighters (Biglaiser and Ma, 2007) and both these groups may indulge in dual practices. Unlike the motivated professionals, moonlighters may provide bad services in the public sector because they face stronger incentives (in terms of higher incomes) from private practice; over time, this may also affect the behavior of motivated dual practitioners subsequently. The engagement in dual practice is thus expected to increase the opportunity costs of efforts in the public sector, especially among moonlighters, which in turn are likely to affect their public labor supply behavior. Moonlighters are thus believed to become less involved in the public hospital work, for example, by neglecting some of the public practice activities and/or devoting some of the public practice hours or general work efforts to the private job (Jan et al., 2005; Ferrinho et al., 2004; Esnor and Duran-Moreno, 2002). The lower work effort of moonlighters in the public sector has been argued to result in lower quality of public health care services (World Health Organisation, 2000). Further, there are arguments that allowing dual practice results in a lower quantity of healthcare services overall. We focus on testing two hypotheses in this context. First, moonlighters may indulge in 'over-provision' of some public services, e.g., seeing more public patients, in a bid to establish one's reputation, which may then be used to whisk away public patients to private clinics (à la González, 2002). In order to test this, we consider the effect of dual practice on the number of public patients seen per week by the dual practitioner. Second, moonlighters may also spend less time in public health centres as the demand for their private practises rises. To this end, we examine the effect of dual practice on the number of hours spent per week in the public health facility by the dual practitioner. Clearly moonlighting is more likely when the incentive mechanism for the health workforce is weak in the public sector (Chaudhury et al., 2006), e.g., health professionals are unlikely to be fired even in cases of shirking in public jobs. Moreover, shirking in public jobs is more likely when health professionals are more powerful which in turn lowers their likelihood of getting fired further.

We use the health-facility (locally known as puskesmas) level panel data from puskesmas heads compiled from four rounds, namely, 1993, 1997, 2000 and 2007, of Indonesian Life Survey. The IFLS provides information on private practice only for the heads of the puskesmas who is in charge of the facility. 1997 and 2007 rounds of the survey suggest that about one third of the heads with private practice have the option of hiring and firing of his/her subordinates. The latter entails

addititional power to the heads to use his/her subordinates to cover his/her responsibilities while attending private service. The regulation pertaining to private practice was introduced in 1997 so that 1993-97 can be considered pre-reform years while 2000-2007 refers to the post-reform period. Underlying the RD design is the idea that the implementation of the medical regulation 916 was an event exogenous to all dual practitioners and their characteristics. Thus dual practitioners who were and were not exposed to the regulation should be identical in terms of both observable and unobservable characteristics and would only differ in terms of their required amount of experience. In a clean RD design, exposure to the 1997 regulation would be a defining, dichotomous event determined solely by experience. However, the private practice eligibility status of three years is unlikely to be perfectly predicted by the experience cut-off as the administrative time of processing the license application could be varying; accordingly, we use a 'fuzzy' rather than a 'clean' regression discontinuity design (see for instance Angrist and Pischke, 2009, ch. 6).

The existing literature is limited and rather diverse encompassing the economics of dual job holding as well as its implications especially for public goods (e.g., health) provision. Among the theoretical studies, Paxson and Sicherman (1996) developed a dynamic model of mobility in and out of second jobs to suggest that dual job holding is prompted by hours constraints on the main job. González (2002) developed a principal-agent model to analyze how the behavior of physicians in the public sector is affected by their activities in the private sector and found that physicians will have incentives to over-provide medical services when they use their public activity as a way of increasing their prestige as a private practitioner. Barros and Olivella (2005) analyze a model with a waiting list in the public sector to study a physician's decision to cream-skim. Biglaiser and Ma (2007) argued that unregulated moonlighting, i.e., using public job to attract private patient, may be detrimental to consumer welfare when moonlighters shirk in their public job. The related empirical literature is rather descriptive and tends to look at various case studies. For example, Berman and Cuizon (2004) review the prevalence of multiple jobholding (MJH) in the context of health systems and government policies in low and middle-income countries, including Zambia, Indonesia, Egypt, Bangladesh, India, Poland, Kenya and Mexico. The paper then summarizes recent evidence on the phenomenon and offers guidance on how policy makers can deal with both the positive and negative view of MJH. Dual practice may be associated with competition for time, since health workers engaged in dual practice may devote less time at public facilities, thereby

compromising service delivery. Ferrinho et al. (1998, 2004) suggested that workers engaged in dual practice are often unproductive, inefficient and corrupt. There is also an emerging literature that highlights the governance issues in the provision of public services in developing countries. For example, health workers are often simply absent from work (Chaudhury et al., 2006; Muralidharan et al. 2011). Doctors often spend just a few minutes with patients, providing lower quality care, and simultaneously over- and under-treating patients (see Das, Hammer and Leonard 2008 and Das and Hammer 2014 for reviews).

Clearly there is lack of systematic effort to assess the causal effect of dual practice on public health provision. In an attempt to bridge this gap, we integrate these strands of the literature and contribute to it in a number of ways. First, we consider the case of Indonesia where the government has been committed to public provision of health services over a long period of time but have been facing challenges including predominance of dual practitioners. Second, we devise an innovative strategy for identifying the causal impact of private practice of health professionals on public labor supply behavior of dual practitioners in Indonesia. In this respect, we make use of the 1997 medical regulation that requires health professionals to have at least three years of experience before applying for a license to practice, exploiting the variation in private practice before and after the introduction of the regulation. Our identification relies on the fact that health professionals are unlikely to affect the timing of getting the license for private practice as it depends on the underlying administrative process. Accordingly, we adopt a two-stage instrumental variable approach. First we determine the likelihood of private practice using the threshold level of experience between 2-6 years since the graduation year; this exercise shows that only an exogenous experience threshold at 5 years ($exp5$) is associated with a significant discrete jump in the likelihood of private practice among sample health professionals in the post-1997 years ($post97$).[1] The latter perhaps reflects the fact that the maximum length of compulsory service is 5 years as dictated by the government regulation number 1 year 1988 (http://www.searo.who.int/entity/human_resources/data/Indonesia_profile.pdf). The strength of the relationship between the experience threshold and the likelihood of private practice in the post-1997years validates the use of the instrument ($exp5 \times post97$) for determining

[1]Since 1997, medical graduates are required to have three years of compulsory public services right after their graduation at the end of which they can do private practice, join the civil service or continue with their higher education (WHO, 1996). Given that our sample comes from the heads (doctors or other health professionals) of the puskesmas, it is fair to assume that they had chosen the option to continue with their medical profession, thus eliminating other possibilities, e.g., post graduate education, to delay the start of private practice.

the private practice likelihood. Data also confirm that the covariates are balanced at the threshold experience level in the post regression years. At the second stage we determine the number of patients seen per week and the number of hours worked per week by puskesmas heads as a function of the predicted value of private practice generated from the first stage estimates, among other covariates. Within a RDD, we focus on individuals with less than or equal to ten years of experience since graduation and use a weighting scheme (a la Fajnzylber, Maloney and Montes-Rojas, 2011) such that the weights of individuals further away from the cut-off of 5 years of experience are less and less important. We also identify the heterogeneous impact of the regulation in rural and urban regions as expected, which in turn allay concerns about omitted factors and confounding events around 1997.

First, the likelihood of private practice declined by five percentage point, from 77% to 72% in the post-regulation years. Although the effect seems small, it is not unexpected as we are only doing a RD analysis around the neighborhood of experience 5 years (we tried other cut-offs below and above 5 years though none of them worked; see further discussion in section 2). The regulation was also successful to shift the distribution of experience to the right (see Figure 1). Second the results appear robust and provide support to our hypotheses: we find a positive and significant effect of private practice on the number of patients seen per week, but a reduction in the number of hours worked per week. This evidence would be more compelling if we could demostrate that the subgroup where we would expect stronger responses are the subgroups driving the average effects. The latter would help undermining any concerns about omitted variables or confounding events as they would have to exchibit the same heterogeneity in impact as the outcomes we model. Undoubtedly, 1997 and its immediate aftermath was an eventful time in Indonesia's history that marked the end of Suharto's regime, country being hit by the worst financial crisis and also initiation of widespread reform. Chomtiz et al. (1997) note that government had struggled to recruit and retain health professionals in rural Indonesia and has therefore given various exemption to health professionals working in rural regions. As such, we expect the regulation to be more effective in the urban region. Accordingly, we compare the public labour supply behaviour of dual practioners in rural and urban regions which confirms our expectation that the regulation was more effective in the urban areas only, thus eliminating the concern about omitted and other confounding factors in this respect.

The fact that these dual practitioners are able to work less when they also practise privately

can be attributed to the lack of incentives to work (especially as the administrative heads of health facilities) in the public sector in developing countries. Chaudhury et al. (2006) found that higher-ranking and more powerful providers are more likely to be absent and less likely to work even when they are found in the facility; this is because a large proportion of these health professionals have the authority to hire and fire all puskesmas staff while they themselves are extremely unlikely to be fired for absence for private practice. Heads of puskesmas may have more power and flexibility to shirk in the public jobs if they have greater tenure in the same puskesmas; there is indeed some confirmation that dual practitioner heads tend to have greater tenure in the same puskesmas in our sample, which may, in turn, allow them to establish greater rapport and influence over the supporting staff in the puskesmas. Not surprisingly, shirking in the public job by the puskesmas heads gets easier, if they have more supporting doctors and nurses in the puskesmas who can help the heads to cover the duties. Finally, there is confirmation from our sample that the higher number of patients seen per week by the dual practitioners is significantly linked to greater likelihood of referral of public patients to the private clinics from the same puskesmas; the latter can be seen as evidence of using the public job for private gain among dual practitioners.

In general, the health economics literature advocates for a regulatory response to limit dual practice in the form of a ban or restrictions on the involvement of public hospital physicians in dual practice (González 2005; Biglaiser and Ma, 2007; Brekke and Sørgard, 2007; García-Prado and González, 2007). Our results however question the effectiveness of regulations to curb opportunistic behaviour among dual practitioners without strengthening the incentive mechanisms. Evidently, the regulation 916 lowers dual practice likelihood to some extent, while dual practice is still associated with significantly higher number of patients seen and lower number of hours worked per week by the dual practitioners, especially in urban areas and we attribute it to the weak incentive structures to discipline health workforce, especially in developing countries. Unfortunately we do not observe the health outcomes of patients treated by the dual practitioners and others; as such we are unable to assess the effect of dual practitioners' opportunistic behavior on public patient's health outcomes. We hope future research will address this. With the growing privatisation of many public services across the globe, dual practice of health professionals is rising alarmingly, especially in many emerging economies and in many cases the private medical sector remains totally unregulated. Results of our analysis have thus important implications for countries beyond

the border of Indonesia.

The paper is developed as follows. Section 2 describes the data and background while section 3 explains the methodology. Section 4 presents and analyzes the results and the final section concludes.

2 Background, data and empirical strategy

2.1 Background

In most developing countries, government actions in health have largely focused on setting up publicly-financed and government-operated health service delivery programmes to provide a basket of health care services to the population as a whole. Indonesia follows a vertical hierarchy of its health administration at the regional level. That is, it is a geographically organized pyramid of health care facilities in a vertical hierarchy, with health sub-centers and health centers at the lower levels and several levels of hospitals above them. A more basic set of ambulatory care services is provided at the lower level facilities, with increasingly specialized services provided moving up the pyramid.

Our analysis focuses on the sub-district level health centers, called puskesmas, run by the Government, usually headed by a medical doctor though any other health professionals including nurses/midwives/paramedics may also act as a head; about 63% of puskesmas heads are doctors in our sample. Given the nature of the available data, our analysis focuses on the heads of the puskesmas.

The size of the Indonesian health sector workforce has grown rapidly over the decades. In 1974, there were fewer than 50,000 health workers employed in government health institutions. After a decade, by 1983, this figure had grown to 84,000. Another decade still, by 1992, the figure ballooned to 178,000. The rapidly growing health care workforce has put a serious dent on fiscal manageability, and as a result, since 1992 the Ministry of Health (MoH) has relied on quasi-contractual arrangements to mobilize physicians for service instead of the historical practice of automatically hiring newly graduate health professionals as civil servants. In this sense, many government physicians are now in fact private contractors to the government. While there have been changes in the employment of physicians during this period, the government's mandate on

conscription for public service has still continued.

Given the relative low pay of civil servants, including government-employed physicians, allowing private practice for government doctors is thought to enable them to augment their public service earnings, thereby making it easier to attract people to rural areas and ensuring the stability and sustainability of the government health care system. Accordingly, the MoH in Indonesia has allowed public health professionals to conduct private practice, but on the condition that such practice be conducted after the close of the official public work day (around midday). Monthly and hourly salaries of public doctors, midwives and nurses appear to compare favorably with those of other workers of similar education, but incentives are needed for them to provide quality services to the poor. A 1994 review of the health sector workforce estimated that private practice accounted for about 79% of total income for specialists in urban areas and varied between 25% and 70% for rural general practitioners in outer islands (non-Java/Bali). The possibility of nurses and midwives obtaining the same proportion of their incomes from private practice is much lower as they are generally deployed in poorer areas of the country, although there is less information on this issue for these health cadres (World Health Organisation, 1996). Unfortunately, there is no systematic records of public doctors' private practice and as such a more up-to-date information of public and private salaries of health professionals is not available.

The following section describes the data and explains the empirical strategy that we adopt.

2.2 Data and identification

We have health facility/puskesmas-level (not doctor-level) panel data from four Indonesian Family Life Survey (IFLS) rounds (1993, 1997, 2000 and 2007) for over 300 communities. The IFLS contains information for the head of the puskesmas (who could be a doctor or other health professional) and other administrative data who constitutes the units of assessment in our analysis.

Since the introduction of the Pegawai Tidak Tetap (PTT) in 1991, the MoH required from them a compulsory period of sthe ervice in underserved areas. We study the impact of the 1997 MoH regulation 916 that requires all health professionals to serve public institutions for three years after the completion of their medical studies. After their first 3 years, these health professionals had the opportunity to continue their post-graduate education, go into the private sector, or become civil servants by taking the national civil service examination (usually, the PTT doctors who had

served in remote or very remote areas through the PTT scheme would receive priority in the subsequent civil service recruitment process). In case these professionals choose to get into the private sector after three years of experience in the government facility, they need to apply for certification, registration and licensing, all of which may take some time because of the underlying administrative process. We argue that the timing of obtaining the license for private practice is likely to be beyond the influence of individual professionals and can therefore be treated as random. Accordingly, the key variable for identifying the effect of private practice on selected outcome variables is the years of experience since graduating as a medical doctor. In order to understand the effect of the regulation, we split our sample between pre- and post- 1997 reform: while IFLS rounds 1993 and 1997 correspond to the pre-1997 period, rounds 2000 and 2007 correspond to the period after the introduction of the regulation in the subsequent analysis. We also distinguish between eligible (with ≥ 3 years of experience) and non-eligible (with < 3 years of experience) dual practitioners.

Table 1 summarizes the descriptive statistics for the selected outcomes and other variables for the full sample and separately for pre-1997 and post-1997 subsamples. About 75% of health professionals practise privately and the proportion declined somewhat in the post-1997 years. On average, they work 20 hours a week seeing about 84 patients and they spend about 15 minutes per patient; note however that hours worked per week declined somewhat while number of patients seen increased in the post 1997 years. Finally, the average incidence of referral of public patients from puskesmas to private practice is reported to be around 32% in our sample.

The presentation of the raw data establishes the transparency of the research design and thus justifies the choice of the cut-off points for the assignment variable 'experience' measured in years in this case. Figure 1 shows the proportion of number of heads for each value of experience between 0-20 years, analyzing separately 1993-1997 (pre-regulation) and 2000-2007 (post-regulation) surveys. We show the distribution of experience for all heads and also for heads with/without private practice. In general, these figures highlight that there is a shift in the distribution of experience to the right in the post-reform years in our sample indicating that the pool of puskesmas heads seemed to be more experienced in the post-1997 years. While there are some professionals practising privately with less than 3 years of experience (11% and 5% respectively for pre- and pos-regulation years), an overwhelming majority tend to have more than 3 years of experience. Incidence of

professionals with experience less than 3 years and practising privately primarily pertains to rural (often remote) placement where government often offers some exemption from general rules in an attempt to ensure steady supply of trained doctors in these areas.

The seminal work of Hahn et al. (2001) has established local linear nonparametric regression as a standard approach for estimating the treatment effect in a regression discontinuity (RD) design. Hahn et al. (2001) chose the local linear estimator over the local polynomical for its smaller order of asymptotic bias. Figure 2 shows the smooth local polynomial regressions of mean likelihood of private practice among puskesmas heads with different levels of experience (since graduation), abreviated by *exp* for pre and post-1997 years in our sample. Here we use Epanechnikov kernel with a polynomial of degree 1 (see upper panel) and also degree 2 (see lower panel). Evidently, the Figure highlights the difference in the private practice likelihood in pre- and post-1997 years after the introduction of the health regulation. In the pre-regulation years, the likelihood of private practice increases monotonically while in the post-regulation years there is a discrete jump in the private practice likelihood at around the experience cut off of 5 years in our sample. The question is why the threshold is turns out to be five years and not three years as entailed by the medical regulation. It can be argued that even after one applies for the license right after the expiration of three years of experience (since the graduation), one needs to allow for the time taken for administrative processing of applications. More importantly, by virtue of a government regulation 1 of 1988, the maximum period of compulsory service after graduation is five years which dictates that the professionals need to have the license for practice before completing the five years of service at the maximum. The latter perhaps rationalises the presence to discrete discontinuity at the experience cut-off of five years. As such, we label health-professionals with at least 5 years of experience to be eligible and those with less than five years as non-eligible for private practice. Our empirical strategy is then to compare these two groups before and after the introduction of the regulation in 1997. Clearly, the difference between eligible and non-eligible tends to be blurred in the pre-regulation years. Accordingly, we argue that professionals with private practice were distributed continuously across this threshold before the policy was implemented. In this case, there should have been no unobservable differences, on average, between heads that were just above and just below the experience threshold (which is also supported by the insignificant t-statistic of mean comparisons of private practice likelihood between eligible and non-eligible professionals before

1997; see Table 3 and discussion below). In the post-reform period, however, there is a discrete jump in private practice likelihood from 0.74 at exp= 4 years to 0.80 at exp=5 and thereafter it stabilises, thus justifying the use of a RD design. The graph also highlights that the post-regulation treatment status does not align perfectly with the 5-year experience threshold, thus justifying a case for fuzzy regression discontinuity design.

Since 1997, medical graduates are required to have three years of compulsory public services right after their graduation at the end of which they can do private practice, join the civil service or continue with their higher education. Note that our sample comes from the heads (doctors or other health professionals) of the puskesmas who had choses to continue with their medical profession. Further, a comparison of sample professionals' private practice preferences in the pre- and post-regulation years suggests that private practice peaks up after five years of graduation in the post-97 years. Taken together, we argue that the sharp discontinuity at around five years of experience in the post-regulation years (relative to the pre-regulation years) is likely to be the effect of the regulation rather than the personal career choice of sample health professionals.

This graphical inference corresponds to the mean comparisons of selected variables shown below and above these chosen cut-off points 3 and 5 years as respectively summarized in Tables 2-3. In particular, Table 2 summarizes the mean comparisons of the outcome variables at the cut-off point of 3 years and above while Table 3 shows the same at the cut-off point of 5 years and above; in each case we distinguish between pre-1997 and post-1997 subsamples as indicated above. First note that for the post-1997 period, the unconditional likelihood of having a private practice is significantly higher for professionals with $\geq$ 5 years (see Table 3) experience (78% as opposed to 71% for those with exp<5 years); the mean difference in the likelihood of private practice is, however, not significant when we consider the cut-off point of 3 years in the post-97 years (see Table 2). Taken together, we find that the likelihood of having a private practice is significantly higher at cut-off points $exp = 5$ (Table 3), but not at cut-off point $exp = 3$ (Table 2), and this applies to post-1997 years only. The latter is further suppored by Figure 2 that the cut-off point 5 is associated with sharper discontinuity, suggesting random timing of obtaining license for private practice after the completion of first three years of compulsory servicec after graduation and before the expiration of the compulsory service of five years (by virtue of government regulation 1 of 1988). Accordingly, the rest of our analysis makes use of the cut-off at 5 years of experience, using a fuzzy regression

discontinuity design. The underlying rationale is that it may take some time for doctors to obtain the licensing from the time of application after at least three years of medical practice and in this respect the effective cut-off point turns out to be greater than the stipulated 3 years. Later we provide further evidence that there is evidence of a significant discontinuity only at experience$\geq$ 5 years in the post-1997 years, but not at experience=3,4,5 or 6 years.

Among the outcome variables, on average, the number of patients seen is significantly higher for professionals with more than 5 years of experience. The latter may highlight the aspect of over-provision of services in a bid to whisk away public patients to private service. However, the hours worked per week appear significantly lower, on average, for heads with experience greater than or equal to 5 years. Finally, there is suggestion that health professionals with more than 5 years of experience are less likely to hold private practice in the public clinic and this difference is statistically significant. We, however, do not have information on the health outcomes of patients treated by these dual practitioners and hence the current paper focuses on testing the effects of private practice on labour supply behaviour of public doctors only, using relevant outcome variables: number of hours worked during the week, number of patients seen during the week.

Having explored the data in terms of simple descriptive statistics and diagrams, we shall now move on to the regression analysis to systematically examine if these bivariate comparisons hold when we control for other factors that may also influence the selected outcome variables.

2.3 Empirical strategy

The basic model of public doctor's labor supply decisions that we want to estimate is as follows:

$$y_{it} = \alpha_0 + \alpha_1 pp_{it} + f(exp5_{it}, exp_{it}) + \alpha_2 X_{it} + C_i + T_t + u_{it}, \tag{1}$$

where pp is a dummy variable indicating if a health professional holds a private practice while y refers to selected outcome variables ($hours\_wk$ and $n\_patient\_wk$) pertaining to the labor supply behavior of the head of the puskesmas (doctor or other health professional) i in year t. Our key explanatory variable is pp which indicates the likelihood of private practice of the head. The set of variables X contains other covariates that may also influence y. In this respect, we include a dummy variable for urban puskesmas ($urban$), and a dummy variable $llang$ that takes a value of 1

if the doctor's knows the local language and 0 otherwise. As indicated above, there are pronounced rural-urban differences in the placement of health professionals and also their private practice. As such, the urban dummy would account for the differential effect of urban regions on the outcome variables, if any. Second, there are about 500 different dialects spoken in Indonesia's multicultural society and as such the knowledge of local language is an essential quality of a doctor to be able to converse with his/her patients which is an essential prequisite for practising privately in the community. Inclusion of this binary variable would thus allow us to account for the differential effect of the knowledge of local language on public health provision. Since all health professionals included in our sample are the heads of the puskesmas, which constitutes a civil servant position in Indonesia, we assume that they are on a comparable payscale for the public job and hence we do not control for their income, which is also potentially endogenous to their private practice. We also include a polynomial (linear, quadratic or cubic) $f(exp5, exp)$ on experience, separately for $exp <5$ and $exp \geq 5$, and $exp5 = 1$ if $exp \geq 5$ years and 0 otherwise. C refers to districts (Kabutapen) fixed-effects and T to survey year fixed-effects to account for unobserved district and year-specific factors that may also influence the likelihood of private practice.

Given the potential endogeneity of pp, we first need to find an instrument for pp and we do so by using the cut-off experience $exp5$ as follows:

$$pp_{it} = \beta_0 + \beta_1 exp5_{it} + \beta_2 post97_{it} + \beta_3(exp5_{it} \times post97_{it}) + f(exp5_{it}, exp_{it}) + C_i + T_t + \upsilon_{it}, \quad (2)$$

where $post97$ is a binary variable that identifies pre- and post-1997 reform observations, and it takes values 0 for years 1993 and 1997, and 1 for 2000 and 2007. Note that in practice $post97$ is collinear with T, and it is thus redundant.

We do not observe the precise timing of the start of private practice for each professional. But in view of MoH Health Regulation 916 of 1997, we argue that these professionals opting for private practice can apply for a license after at least three years of experience, but they have little control on the timing of the initiation of private practice because the latter depends on the administrative process involved, at the end of which doctors actually obtain the license for private practice. In practice, we follow our initial data description in section 2 to rationalize using an assignment based

on the years since graduation within a regression discontinuity (RD) environment. In view of the discussion in the previous section, we will use $exp5$ for identification where we observe the sharpest discontinuity among the possible values of experience. Thus, our identification for determining the likelihood of private practice rests on the randomness of the threshold variable $exp5$ in the post-1997 years as it relies on the administrative procedure to process the license.

Accordingly, model (2) follows a differences-in-differences (D-in-D) strategy to identify the effect of private practice pp on dual practitioner's public labor supply indices with a view to test the moonlighting hypotheses pertaining to the hours woked and number of patients seen per week, using $z = exp5 \times post97$ as an IV for pp in equation (1). Since the validity of the instrument depends on comparing observations close to the $exp = 5$ cut-off, we also adopt a regression discontinuity (RD) design, where larger weights are attached to observations with $|exp - 5|$ being small.

There is a limitation in the RD design to the intuition that "the closer to the cut-off you examine, the better" (Lee and Lemiux, 2010). In practice, one cannot "only" use data close to the cut-off. The narrower the area that is examined, the less data there are. Moreover, there are other covariates that should be controlled for, and a na ive analysis of observations close to the cut-off would not control for important heterogeneity in the data. Thus, in order to produce a reasonable guess for the treated and untreated states around the preferred cut-off point $exp5$ with finite data, one has no choice but to use data away from the jump or discontinuity. We generate results using the full sample of observations with experience close to the cut-off, weighted in a scheme that amplifies those closer to it. In doing so, we assume that the unobservables (including variance) is the same before and after the discontinuity about the cut-off, which constitutes our identification mechanism.

An important challenge is to identify the correct functional form of the relationship between the assignment variable experience and the outcome measure in the absence of treatment. To the extent that the specified functional form is correct, the estimator implied by the regression discontinuity will be an unbiased estimator of the mean program impact at the cut-point $exp5$. If the functional form is incorrectly specified, treatment effects will be estimated with bias, because the identification could be solely based on misspecifying the functional form. For example, if the true functional form is highly nonlinear, a simple linear model can produce misleading results. There are two theoretical reasons for a nonlinear relationship between outcomes and ratings. One is that the relationship

between mean counterfactual outcomes and ratings is non- linear, perhaps because of a ceiling effect or a floor effect; the other is that treatment effects vary systematically with ratings. Consequently, we test a variety of functional forms in $f(.)$ — including linear, quadratic models, and cubic models to make sure the functional form that is specified is as close as possible to the correct functional form.

We implement the two-stage least-squares difference-in-differences regression discontinuity (2SLS-D-in-D-RD) estimator of Fajnzylber, Maloney and Montes-Rojas (2011) in which observations close to the proposed discontinuity are given a greater weight than those far away from the discontinuity. The estimator builds on a weighted 2SLS methodology with analytical weights given by a Gaussian kernel with a given bandwidth. Let Y be a $N \times 1$ vector with the outcome variable, P a $N \times 1$ vector containing the private practice indicator (endogenous variable), X a $N \times k$ matrix containing the k exogenous regressors (including the district and year fixed-effects, *llang*, *urban*, and a polynomial of *exp* interacted with *exp*5), Z a $N \times q$ matrix with the q instrumental variables, given by $exp5 \times post97$. We consider weights constructed using a normal density function $\omega \sim N(0, \sigma)$ with density function $\phi(\omega)/\sigma$ where the standard deviation (σ) in years of experience used to standardize the difference in years of experience with respect to the break-point of experience equal to $\omega = (exp - (5 - \epsilon))/\sigma$ with $\epsilon = 0.5$. In this case, the bandwidth parameter corresponds to the values of σ. Let W be a $N \times N$ diagonal matrix with the squared root of the N weights (i.e. $\sqrt{\phi_{it}}$, where $\phi_i = \phi((exp - (5 - \epsilon))/\sigma)/\sigma$ in its diagonal. Define $Y^* = WY$, $P^* = WP$, $X^* = WX$, $Z^* = WZ$ and let $B^* = [P^*, X^*]$, $K^* = [X^*, Z^*]$. The weighted least-squares estimator for the effect of Z and X on P is thus given by $\beta_{OLS} = (B^{*\prime}B^*))^{-1} B^{*\prime}Y^*$ and the 2SLS-DinD-RD estimator for the effect of X and P on Y $\beta_{2SLS} = \left(B^{*\prime}\left(K^*(K^{*\prime}K^*)^{-1}K^{*\prime}\right)^{-1}B^*\right)^{-1} B^{*\prime}\left(K^*(K^{*\prime}K^*)^{-1}K^{*\prime}\right)^{-1}Y^*$.

2.4 Heterogenous effects

So far we find that the effect of the regulation on private practice likelihood in the post-1997 years for experience level >=5 years was pronounced in the full sample. This evidence would be more compelling if we could demostrate that the sub-group where we would expect stronger responses are the subgroups driving the average effects. The latter would help undermining any concerns about omitted variables or coincident events as they would have to exhibit the same heterogeneity in impact as the outcomes we model.

Note that 1997 and its immediate aftermath was an eventful period in Indonesia's history. High levels of economic growth in the country during 1987–1997 had masked a number of structural weaknesses in Indonesia's economy. Growth came at a high cost in terms of weak and corrupt institutions, severe public indebtedness through mismanagement of the financial sector, the rapid depletion of Indonesia's natural resources, and a culture of favours and corruption in the business elite, thus paving the way for the crisis that hit Indonesia badly around mid-1997; President Suharto was forced to resign in May 1998. In August 1998, Indonesia and the IMF agreed on an Extended Fund Facility (EFF) under President B.J Habibie that included significant structural reform targets. President Abdurrahman Wahid took office in October 1999, and Indonesia and the IMF signed another EFF in January 2000. The new program also has a range of economic, structural reform and governance targets, paving the way for large scale fiscal decentralisation early in the millennium. In this context, we are particularly interested in understanding the variation in the treatment effect between rural and urban regions; this is because the government of Indonesia struggles to recruit and retain health professionals in remote rural regions (Chomitz et al. 1997). We thus expect that the full sample effect of the 1997 regulation would be driven by that for the urban sample where we expect the treatment effect to be stronger, thus eliminating concerns about the result being driven by omitted factors or confounding events.

3 Findings

In this section we shall present and analyze the results of both equations (1) and (2).

3.1 First-stage: effect of the 1997 administrative rule on private practice likelihood

We start by analyzing the effect of the proposed discontinuity variable 'experience' (exp) on the likelihood of puskesmas' heads doing private practice (pp) as in equation (2). In this respect we use $exp5$ interacted with the $post97$ dummy that allows us to exploit the variation in private practice among eligible health professionals (those with $exp \geq 5$ years of experience) before/after the introduction of the health regulation 916.

In order to evaluate the D-in-D RD local effect of the administrative rule on *pp* we implement the weighted least squares estimation procedure described in Section 3 in eq. (2). We consider the coefficient estimates of $exp5 \times post97$ on *pp*, using $exp5$, $post97$, X and district level fixed-effects as additional covariates. Note that we cannot use year fixed effects here as it would be collinear with the $post97$ dummy. In Figure 5, we implement it for different bandwidth choices, using a cubic polynomial in *exp* with interactions with $exp5$. Moreover we report the point estimates together with the 95% confidence interval using White-heteroskedasticity-robust standard errors. We consider bandwidth values in {1,1.1,...,2} (for $\sigma < 1$ standard errors increase considerably and all specifications deliver statistically insignificant results). The figures show that the local effect is the largest for $\sigma = 1$, and its magnitude decreases monotonically as the bandwidth increases. Overall they suggest that if a D-in-D RD strategy were to be implemented with $exp5$ and $post97$, only a local effect with $\sigma = 1$ delivers a statistically significant effect.

Table 4 reports the weighted least-squares estimates of the likelihood of private practice for this selected bandwidth of $\sigma = 1$ for eq. (2) using linear (column 1), quadratic (column 2) and cubic (column 3) polynomials for $exp5$ interacted with $post97$. The results indicate that $exp5$ and $post97$ are not individually statistically significant for determining the likelihood of private practice. However, the interaction ($exp5 \times post97$) turns out to be positive and significant and the coefficient estimates is quite stable as we compare the estimates using linear, quadratic and cubic poliynomial in columns (1)-(3) of the table; it suggests the effect of the regulation on private practice likelihood has been about 0.21 higher amoong those with experience$\geq$ 5 years in the post-1997 years in our sample. is not

Table A1 estimates further tests that the validity of the treatment (exp5*post97) at any other cut-off values of experience between 2-6 years. A comparison of results shown in columns (1)-(4) of the table confirms that the chosen instrument, i.e., ($exp\ k$ * $post97$) remains statistically significant when $k = 2, 3, 4$ or 6 years in our sample. In other words, $exp5$ in the post 1997 years is the only instrument where we identify a statistically significant effect of the regulation on the likelihood of private practice.

Finally we follow Lee and Lemieux (2010) to formally test the covariates balance around the treatment ($exp5 \times post97$) in our sample. These results are summarised in Table 4a where we regress each of the covariates, namely, *llang* (i.e., the head speaks the local language), *headdoc*

(i.e., head is a doctor), *urban* (the puskesmas is located in an urban region) on $exp5$, $post97$,and ($exp5 \times post97$) including linear polynomials and the district dummies. The joint p-value provides the p-value from a test of joint significance of exp5 (treatment) and (exp5*post) coefficients in columns (1) to (3), which rejects the joint significance of the treatment in the post-97 year on the covariates. Figure 3 shows the confidence interval for the effect of experience on the likelihood of private practice. Figure 3 presents the coefficient estimates of ($exp5 \times post97$) for different values of bandwidths in {1,1.1,...,2} and shows that the effect is significant only for a small bandwidth. As we move away from the discontinuity it becomes insignificant.

3.2 Second Stage: Effect of Private Practice on Selected Public Health Provision Measures

Our next step is to evaluate the effect of private practice on indices of public health provision, namely, hours worked per week ($hours\_wk$) and number of patients seen in a week ($patients\_wk$) by the puskesas head at the puskesmas. To this end, we use the first stage procedure described in section 3.1 to instrument private practice (pp) by ($exp5 \times post97$). OLS (i.e. non instrumented) regression results are shown in the Appendix Table A2. These non-IV OLS estimates indicate that private practice does not exert any statistically significant effect either on hours worked or patients seen per week by the public health professionals (who are heads of puskesmas) in our sample. We argue that these insignificance is attributed to the simultaneity bias between the likelihood of private practice and the resultant labor supply by the dual practitioner. This justifies the need to look at the 2SLS IV-DinD-RD estimates that we show in Tables 5 and 6.

Table 5 shows the 2SLS-DinD-RD estimator coefficients for equation (1) where the outcome of interest is $hours\_wk$, i.e., hours worked per week by the heads with at most 10 years of experience. Columns (1)-(3) show the estimates for all health professionals while columns (4)-(6) show those for the doctors only subsample. Controlling for all other factors, we find that dual practice is associated with significantly lower hours worked per week irrespective for the type of health professionals (doctors or others). Clearly, the effect is independent of the choice of the polynomials linear, quadratic and cubic, especially for all health professionals. Note that the effect is still negative for doctors for quadratic and cubic polynomials while it turns out to be insignificant (though still negative) for linear polynomial (see column 4). Clearly, the size of the effect is the

largest for linear polynomial and then falls as we move from linear to quadratic and then to cubic polynomials; we see similar pattern for any health professional. Overall these estimates suggest that dual practice of health professionals (relative to those without any private practice) reduces hours worked by 18 hours a week on average. Figure 4 presents the corresponding coefficient estimates of *pp* for different values of bandwidths in $\{1, 1.1, ..., 2\}$, which emphasizes that the effect is only significant on a local interval about the $exp = 5$ cut-off. In this case, the effect becomes insignificant for a bandwitdth value >1.

This finding that the dual practitioners are able to shirk in their public jobs highlights the lack of incentive compatibility; the latter is linked to the fact that these health professionals are extremely unlikely to be fired for absence or working less hours than required (also see Chaudhury et al., 2006). The problem is likely to be worse for the heads of the puskesmas in our sample. The 2000 and 2007 IFLS data provides information on whether the heads of puskesmas has authority to hire and fire staff (unfortunately this information is not available for 1993 and 1997 rounds of the survey), which indicates that a significantly higher proportion of puskesmas heads with private practice (33% as opposed to 29% of those without private practice) has this authority. In other words, it is possible to argue that the head's authority to hiring/ firing of puskesmas staff enables rather than they being sacked by the higher authority may help explain a total absence of a disciplining device in public sector jobs, thus providing the opportunity to work in the private practice. There are two possibilities here: (a) head's tenure in the puskesmas, i.e., the number of years the puskesmas head is in the same puskesmas. Table 1 suggests that average tenure (i.e., number of years spent in the current puskesmas) of health professionals is higher in the post-1997 years. This is especially true for those puskesmas where the head practises privately. This means the heads continue to remain in the same puskesmas for longer in the post-1997 years, thus helping them to establish their influence and authority there. (b) We also consider the number of supporting doctors and nurses in puksemas where the head may or may not be practising privately. We find that the number of supporting doctors and nurses are significantly higher in puskesmas where the head is practising privately (relative to those where the head is not doing so). In other words, it is easier for the heads of puskesmas to shirk from the public job with a view to pratise privately when there are supporting doctors and nurses to cover them in the puskesmas; the latter can be facilitated by the fact that many of these heads practising privately also have the authority to hire/ fire these

supporting staff.

Second, Table 6 summarizes the 2SLS IV-DinD-RD estimates of number of patients seen per week ($patients\_wk$) by the heads of puskesmas. Columns (1)-(3) show the estimates for all health professionals while columns (4)-(6) show those for doctors only. Note that the effect of dual practice on number of patients seen per week remains insignificant for linear polynomial among doctors, but turns out to be statistically significant for quadratic and cubic polynomials and this holds both for any health professionals and also doctors in our sample. Ceteris paribus, dual practice is associated with about 7 additional patients seen per week by health professionals; the number is much higher (about 12-13 patients per week) for doctors. As before the size of the effect is the highest for the linear polynomial and decreases continuously as we move from quadratic to cubic polynomial in our sample. Figure 5 presents the coefficient estimates of pp for different values of bandwidths in {1,1.1,...,2}. The figure shows that the effect of pp is increasing in the bandwidth, but becomes statistically insignificant for a bandwidth value above 1.5. As we increase the bandwidth, the regression discontinuity design becomes weaker. The fact that the confidence interval increases means that it only works close to the cut-off $exp5$ which also justifies the RD implementation.

Table 6 estimates thus established that the dual practice is associated with significantly more patients being seen by the heads of puskemas. It is important for us to explore why this is the case. In this respect, we consider the link between number of patients seen by the dual practitioner and the likelihood of referring public patients to private practice from the pukesmas concerned. A simple t-test of mean comparisons suggest that the likelihood of private referral is about 24% for a puskesmas run by a dual practitioner head; the corresponding figure is 18% if the head is of the puskesmas is not a dual practitioner and the mean difference is statistically significant at almost 0% level of significance. Further we regress the likelihood off referring public patients to private clinics on the likelihood of private practice and find that the estimated coefficient of referral is 0.10 with a standard error of 0.03 (see column 1 of Table 7) without any other control and about 0.0320 with a standard error of 0.0127 with other controls that may also affect private referral. There is evidence to suggest that private referral of public patients is signfiicantly higher when the head of the puskesmas practices privately, which in turn provides the motivation for seeing more patients per week by a dual practitioner in our sample.

Finally, we test the robustness of our second stage results to additional controls including number of public patients per unit of health professionals (doctors and nurses) in the puskesmas and also community's access to all-weather roads, buses and sea. We argue that these additional factors would account for the demand for public health services offered by the puskesmas in our sample: while greater access to public roads and transport would make the puskesmas more accessible, total number of public patients seen on avarage by any puskesmas health professional (rather than just by the head) would directly account for the demand for the health services provided in the puskesmas. Without much loss of generality, we argue that these additional controls would affect the labor supply indices of the puskesmas head. These estimates, as summarised in Table 8, confirm that dual practice of health professionals is still associated with lower hours worked and more patients seen per week, which in turn highlight the robustness of our baseline results (see Tables 5-6). Note, however, that the size of the private practice effect is somewhat larger for the number of patients seen while that for no of hours worked the effect is similar, when we include additional controls.

Taken together, these results provide support for the 'moonlighting' hypothesis: health professionals with dual practice (relative to those without) tend to see more patients per week and also they spend less hours per week in the public health facility. In view of the available evidence, we argue that shirking of dual practitioners in the public facilities is related to their power and authority while 'overprovisioning', i.e., seeing more patients in the public facilities is directly linked to the practice of referring public patients to private facilities.

3.3 Heterogeneity: Rural-urban estimates

Table 9 splits the sample by urban/rural regions and considers the first stage RD estimates of private practice likelihood for rural and urban regions separately using linear (columns 1-2), quadratic (columns 3-4) and cubic (columns 5-6) polynomials. Following on from Figures 3 and 4, we identify private practice by the variation in experience$\geq$5 years after the introduction of the 1997 MoH regulation. This is captured by the interaction term ($exp5 \times post97$). We find that the interaction term ($exp5 \times post97$) is statistically significant only in urban regions, but not in the rural areas irrespective of the choice of the polynomials (linear, quadratic, cubic). We therefore proceed to conduct the second stage IV estimates for the urban regions only.

Table 10 shows the 2SLS IV-DinD-RD estimates of hours/week and patients/week using quadratic polynomials for the urban region only. Evidently, these results confirm the findings from the full sample (see Tables 5-6): private practice is associated with a significantly higher number of patients seen during the week, but lower hours worked per week in urban areas. In other words, the full sample estimates discussed in the previous sectin seem to be driven by the estimates for urban regions.

We thus show that the full sample effect of the 1997 regulation was driven by that for the urban sample where we expect the effect to be bigger, thus minimising any concern about omitted variables or confounding events.

4 Conclusion

Dual practice is common among health professionals (especially doctors) and is on the rise with the rapid growth of the private health services around the world including many developing and emerging economies. Using four rounds of Indonesian Family Life Survey facility (puskesmas) level data for the period 1993-2007, the present paper examines the effect of private practice on public health professionals' labour supply decisions with a view to test the hypothesis of 'moonlighting' by heads of puskesmas our sample

Since participation in private practice is unlikely to be random, we use a novel quasi-experimental method to identify the causal effect of private practice on provision of public health services. In particular, we make use the introduction of the 1997 Ministry of Health Regulation 916 that requires health professionals to obtain a license for private practice after at least three years of graduation and exploit the variation in private practice before and after the introduction of this 1997 regulation among those eligible and non-eligible for private practice. We argue that the professionals involved are unlikely to influence the timing of obtaining the license for private practice; as such, the implementation of the regulation makes the timing of the initiation of the private practice random because the precise timing depends on the administrative process involved in applying for the license after at least three years of experience till s/he obtains the license. Accordingly, we use a fuzzy regression discontinuity difference-in-difference model to identify the causal effect of private practice.

After experimenting with different experience thresholds between 2-6 years, we find significant discontinuity in private practice likelihood only at the experience threshold of 5 years or more after the introduction of the regulation (the pattern is very different in the pre-regulation years), suggesting that it takes about 5 years to get the license for private practice even after one applies for it soon after completing three years of service after graduation; this also validates the randomness of the initiation of private practice in the post-1997 years. The latter allows us to use experience greater than or equal to five years in the post-1997 period to study its effect on the likelihood of private practice and the consequent effects on public service provision by heads of puskesmas. Adopting a two-state estimation method, we first determine the likelihood of private practice as a function of at least five years of experience in the post-1997 years and obtain the predicted value of private practice as an IV to be used in determining hours worked per week and number of patients seen per week by heads of puskesmas.

First, we find that all health professionals including doctors with at least five years of experience after graduation are significantly more likely to practice privately in the post 1997 years. Using $(exp5 \times post97)$ as the instrument for private practice, we then determine its effect on selected indices of public health provision by the heads of puskesmas in our sample. Results provides some support to the hypothesis of moonlighting - health professionals with private practice tend to work for less hours, but see more patients during the week, irrespective of the choice of polynomials. We argue that shirking in public jobs by the dual practitioners is made possible by the power and authority that they hold as the heads of puskesmas, especially when they have greater tenure in the same puskesmas and also more supporting doctors and nurses who can cover their responsibility. This is compatible with the fact that these health professionals are unlikely to be fired for their absence (Chaudhury et al., 2006). Second, we show that the higher number of patients seen by the dual practitoner is signfiicantly linked to referral of public patients from these puskesmas's to private practices. We also identify heterogeneity in the success of the new regulation. In view of the difficulties faced by the health authority to recruit and retain health professionals in remote rural areas as evidenced by Chomitz et al. (1997), we expected that the effect of the regulation would be stronger in urban areas which is confirmed in our sample. This eliminates the concern about estimation bias arising from unobserved factors or confounding events that happened in and around 1997.

Despite the growing incidence of dual practice of health professionals with the rapid growth of private health sector around the world, there is very little understanding, if at all, about its causal impact on public health provision. As far as we are aware, ours is the first study to find causal evidence of 'moonlighting' by public health professionals: public health professionals with private practice work less hours and see more public patients per week for private gain of public heads of puskesmas. While the health economics literature advocates for a regulatory response to limit dual practice of public health professionals, our analysis highlights the fact that regulation alone may not solve the underlying incentive problems, thus limiting the success of these regulations.

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Tables

Table 1. Descriptive statistics at the Puskesmas level 1993-2007

Variable	Obs	ALL Mean	Std. Dev.	Obs	1993-1997 (pre-1997) Mean	Std. Dev.	Obs	2000-2007 (post-1997) Mean	Std. Dev.
If practice privately	3411	0.74934	0.433456	1520	0.776316	0.41685	1891	0.727657	0.445283
PP in the puskesmas	3896	0.184805	0.388189	2005	0.189526	0.392024	1891	0.179799	0.384122
Head is a doctor	3893	0.591575	0.491606	2002	0.548951	0.497722	1891	0.6367	0.481077
Hours worked/wk	3234	20.45625	19.05246	1364	29.30132	12.46039	1870	14.00455	20.39464
Patients seen/wk	3038	84.21988	92.1034	1318	79.24507	77.73932	1720	88.03198	101.6049
Referral to private pr	3896	0.323409	0.467837	2005	0.581546	0.493429	1891	0.049709	0.217401
Experience (in years)	2849	11.83959	7.260543	1380	5.39	2.87	1469	5.89	2.98
Speaks local language	3293	0.947464	0.223139	1402	0.947932	0.222244	1891	0.947118	0.223857
Urban region	3896	0.598819	0.4902	2005	0.582544	0.493263	1891	0.616076	0.486468

Source: Four rounds of IFLS

Table 2: Mean comparisons of selected variables below/above 3 years of experience

Post-97 comparison	**Experience>=3yrs**	**Experience<3yrs**	**T-stat**
If holds a private practice (pp)	0.73	0.72	0.5152
Hours worked/wk	14	13	0.0258
Patients seen/wk	88	92	0.3940
Refers patients to private clinic	0.05	0.09	-1.5540
Holds private practice in the public hospital	0.17	0.30	-2.795***
Speaks local language	0.95	0.79	6.5220***
Urban region	0.63	0.41	3.8613***
Pre-97 comparison	**Experience>=3yrs**	**Experience<3yrs**	**T-stat**
If holds a private practice (pp)	0.79	0.70	2.3912**
Hours worked/wk	29.4	27.2	1.4686
Patients seen/wk	79.9	67.7	1.3428
Refers patients to private clinic	0.58	0.54	1.0233
Holds private practice in the public hospital	0.18	0.30	-3.696***
Speaks local language	0.95	0.88	2.8561***
Urban region	0.59	0.47	3.1769***

Note: *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Mean comparisons of selected variables below/above 5 years of experience

Post-97 comparison	**Experience>=5yrs**	**Experience<5yrs**	**T-stat**
If holds a private practice (pp)	0.78	0.71	2.0119**
Hours worked/wk	14	16	-1.7656*
Patients seen/wk	88	85	1.4083
Refers patients to private clinic	0.05	0.06	0.7345
Holds private practice in the public hospital	0.17	0.30	-4.5080***
Speaks local language	0.96	0.86	5.8713***
Urban region	0.64	0.41	6.4019***
Pre-97 comparison	**Experience>=5yrs**	**Experience<5yrs**	**T-stat**
If holds a private practice (pp)	0.78	0.75	1.1553
Hours worked/wk	30	27	2.1978**
Patients seen/wk	81	65	2.3501**
Refers patients to private clinic	0.58	0.57	0.5584
Holds private practice in the public hospital	0.16	0.32	-6.6978***
Speaks local language	0.96	0.88	4.0477***
Urban region	0.60	0.48	4.0797***

Note: *** p<0.01, ** p<0.05, * p<0.1

Table 4. Regression discontinuity: First stage linear probit estimates of the likelihood of private practice (PP) 1993-07

VARIABLES	(1) All *PP*	(2) All *PP*	(3) All *PP*
Experience>=5 (exp5)	-0.118	0.0108	0.280
	(0.125)	(0.171)	(0.241)
Post 1997	-0.0653	-0.0681	-0.0685
	(0.0753)	(0.0757)	(0.0758)
*exp5*post97*	0.206**	0.212**	0.214**
	(0.104)	(0.105)	(0.105)
Constant	0.873***	0.798***	0.697***
	(0.127)	(0.155)	(0.197)
Polynomial	Linear	Quadratic	Cubic
Weights	Yes	Yes	Yes
District dummies	Yes	Yes	Yes
No of observations	923	923	923
F-test on cut-off	3.93**	4.12**	4.18**
R-squared	0.136	0.139	0.140

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

The dependent variable is the private practice dummy pp. Exp5 is a binary variable indicating if the head has at least 5 years of experience since graduation. Post97 is a binary variable indicating post 1997 IFLS rounds, i.e., years 2000 and 2007. Exp5*post97 is the interaction between exp5 and post97.

Table 4a. Test of Covariates Balance

VARIABLES	(1) Llang	(2) headdoc	(3) urban
Experience>=5 (exp5)	0.0180	-0.0343	0.0849
	(0.0558)	(0.0734)	(0.0698)
Post 1997	-0.0220	0.118***	0.0487
	(0.0367)	(0.0435)	(0.0443)
*exp5*post97*	0.00944	-0.0714	-0.101
	(0.0424)	(0.0580)	(0.0660)
Constant	0.702***	0.629***	0.262***
	(0.0803)	(0.0901)	(0.0911)
District dummies	Yes	Yes	Yes
Polynomials	Linear	Linear	Linear
Joint P-value	0.85	0.21	0.19
Observations	923	923	923
R-squared	0.097	0.112	0.412

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

The table provides a test of balanced covariates (a la Lee and Lemieux, 2010). Joint p-value" provides the p-value from a test of joint significance of *exp5* (treatment) and (*exp5*post*97) coefficients in columns (1) to (3), which leads to the acceptance of the null hypothesis that these two coefficients are jointly zero.

Table 5. Regression discontinuity second stage: 2SLS IV estimates of hours worked per week 1993-07

VARIABLES	(1) All	(2) All	(3) All	(4) Doctors	(5) Doctors	(6) Doctors
Holds PP	-17.92*	-18.16*	-18.00*	-17.57	-17.65*	-17.42*
	(10.84)	(10.46)	(10.30)	(11.15)	(10.48)	(10.19)
Experience>=5	-2.360	-3.396	-2.043	-3.797**	-4.145	-0.490
	(1.731)	(3.358)	(10.00)	(1.852)	(4.114)	(11.43)
Speaks local lang	-0.610	-0.485	-0.503	2.126	2.206	2.153
	(2.470)	(2.393)	(2.365)	(4.199)	(3.951)	(3.866)
Urban region	-1.031	-1.042	-1.033	-2.827	-2.853*	-2.838*
	(1.221)	(1.231)	(1.229)	(1.749)	(1.706)	(1.686)
Head is a doctor	-3.422***	-3.406***	-3.403***			
	(1.193)	(1.204)	(1.200)			
Constant	32.02***	33.36***	34.67***	26.15***	26.93***	27.88***
	(8.597)	(8.077)	(10.10)	(8.478)	(7.357)	(8.960)
District/year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Weights	Yes	Yes	Yes	Yes	Yes	Yes
Polynomial	Linear	Quadratic	Cubic	Linear	Quadratic	Cubic
No of observations	889	889	889	656	656	656
R-squared	0.124	0.116	0.122	0.301	0.299	0.306

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
The private practice dummy *pp* is instrumented by the *exp5*post97*.

Table 6. Regression discontinuity second stage: 2SLS IV estimates of patients seen per week 1993-07

VARIABLES	(1) All	(2) All	(3) All	(4) Doctors	(5) Doctors	(6) Doctors
Holds PP	7.079**	6.786**	6.710**	13.89	12.98*	12.69*
	(3.462)	(3.337)	(3.293)	(13.92)	(6.747)	(6.530)
Experience>=5	-1.519	-20.59	-46.70	-9.398	-41.89*	-94.94
	(7.777)	(13.48)	(41.09)	(22.34)	(23.39)	(70.51)
Speaks local lang	5.785	7.385	7.632	-26.90	-22.66	-21.62
	(8.865)	(8.580)	(8.498)	(42.68)	(22.16)	(21.48)
Urban region	7.732	7.634	7.627	0.396	0.200	0.241
	(5.961)	(5.867)	(5.846)	(14.57)	(9.294)	(9.171)
Head is a doctor	23.62***	24.09***	24.10***			
	(4.635)	(4.580)	(4.563)			
Constant	1.827	18.63	34.97	3.543	30.33	50.64
	(26.87)	(25.99)	(37.97)	(94.62)	(42.72)	(58.68)
Polynomial	Linear	Quadratic	Cubic	Linear	Quadratic	Cubic
Weights	Yes	Yes	Yes	Yes	Yes	Yes
District/Year dum	Yes	Yes	Yes	Yes	Yes	Yes
No of observations	822	822	822	585	585	585
R-square	0.2143	0.2132	0.2147	0.2253	0.2245	0.2300

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

The private practice dummy *pp* is instrumented by the *exp5*post97*.

Table 7. Regression discontinuity second stage: 2SLS IV estimates of referral to private clinics 1993-07

	(1)	(2)
VARIABLES	Referral	Referral
Holds PP	0.100**	0.0320**
	(0.0494)	(0.0127)
Experience>=5		0.0172***
		(0.00436)
Speaks local lang		-0.0143***
		(0.00531)
Urban region		0.000899
		(0.00328)
Head is a doctor		-0.00269
		(0.00300)
Constant	0.384***	0.447***
	(0.0453)	(0.0192)
District dummies	Yes	Yes
Year dummies	Yes	Yes
Polynomial	Linear	Linear
Weights	Yes	Yes
Observations	923	923
R-squared	0.356	0.746

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 8. Second stage estimates of public doctors' services with additional controls

VARIABLES	(1) hours_wk	(2) n_patient_wk
Holds PP	-17.61*	33.98***
	(10.35)	(10.48)
Experience>=5	0.118	-9.378**
	(3.905)	(3.913)
Speaks local lang	-3.802**	1.168
	(1.533)	(12.34)
Urban region	-3.274**	6.917***
	(1.508)	(1.400)
Head is a doctor	-4.030***	8.355***
	(1.444)	(1.886)
Number of public patients per health professional	0.0117	0.447***
	(0.0105)	(0.119)
Access to all-weather roads	1.028	3.654***
	(1.502)	(1.359)
Access to bus	-4.517***	1.551
	(1.178)	(1.180)
Access to sea	6.692***	-0.123
	(1.542)	(3.436)
Constant	12.11***	-60.99***
	(1.237)	(11.21)
District dummies	Yes	Yes
Year dummies	Yes	Yes
Weights	Yes	Yes
Polynomials	Quadratic	Quadratic
Observations	889	822
R-squared	0.289	0.583

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
The private practice dummy *pp* is instrumented by the *exp5*post97*.

Table 9. Regression discontinuity: First stage estimates of the likelihood of private practice 1993-07 by region

VARIABLES	(1)Urban	(2) Rural	(3) Urban	(4) Rural	(5) Urban	(6) Rural
Experience>=5 (exp5)	-0.259	-0.0655	-0.230	0.127	-0.0550	0.437
	(0.170)	(0.187)	(0.247)	(0.255)	(0.366)	(0.358)
Post 1997	-0.231*	0.0285	-0.234*	0.0212	-0.235*	0.0204
	(0.121)	(0.104)	(0.122)	(0.105)	(0.122)	(0.105)
*exp5*post97*	0.310**	0.180	0.317**	0.193	0.320**	0.196
	(0.151)	(0.151)	(0.151)	(0.153)	(0.152)	(0.153)
Constant	0.835***	0.896***	0.925***	0.759***	1.018**	0.619**
	(0.285)	(0.139)	(0.325)	(0.187)	(0.403)	(0.250)
Polynomial	Linear	Linear	Quadratic	Quadratic	Cubic	Cubic
Weights	Yes	Yes	Yes	Yes	Yes	Yes
District dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	465	458	465	458	465	458
R-squared	0.207	0.186	0.213	0.192	0.216	0.193

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
The dependent variable is the private practice dummy pp. Exp5 is a binary variable indicating if the head has at least 5 years of experience since graduation. Post97 is a binary variable indicating post 1997 IFLS rounds, i.e., years 2000 and 2007. Exp5*post97 is the interaction between exp5 and post97.

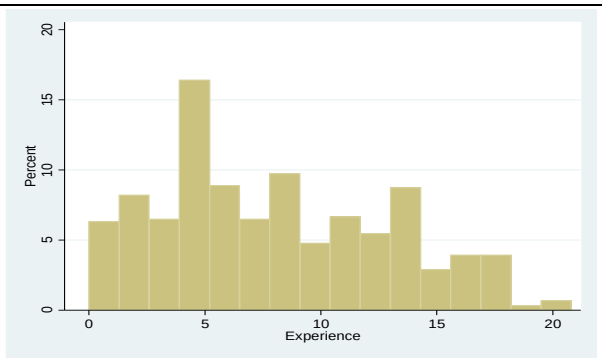
Table 10. Regression discontinuity: Second stage estimates of outcome variables, Urban

	Urban		(2) Urban & Doctors	
VARIABLES	hours_wk	patients_wk	hours_wk	patients_wk
Holds PP	-23.47***	29.80*	-24.91*	38.11
	(8.437)	(17.29)	(15.15)	(24.78)
Experience>=5	4.261	-81.12	4.819	-111.8
	(4.033)	(54.48)	(5.532)	(85.72)
Speaks local lang	-3.211	-14.85	4.656	-11.05*
	(2.139)	(28.84)	(3.640)	(6.326)
Urban region	-8.289***	12.96***		
	(2.748)	(4.446)		
Constant	33.96***	-160.4	15.01*	-14.99
	(8.979)	(147.6)	(7.780)	(117.5)
Polynomial	Quadratic	Quadratic	Quadratic	Quadratic
Weights	Yes	Yes	Yes	Yes
District/Year	Yes	Yes	Yes	Yes
No. of observations	448	438	356	345
R-squared	0.149	0.258	0.231	0.301

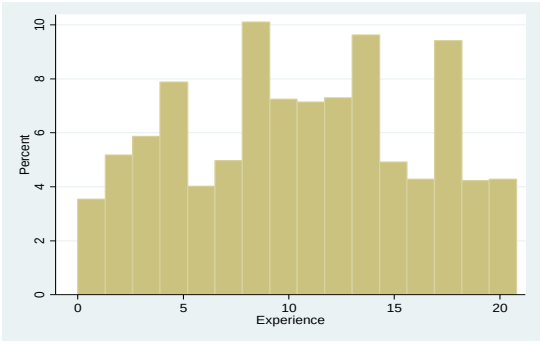
Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
The private practice dummy *pp* is instrumented by the *exp5*post97*.

Figures

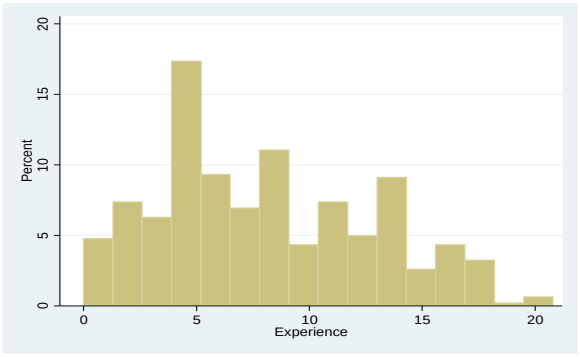
Figure 1. Frequency distribution (histogram) of experience in years before/after the regulation



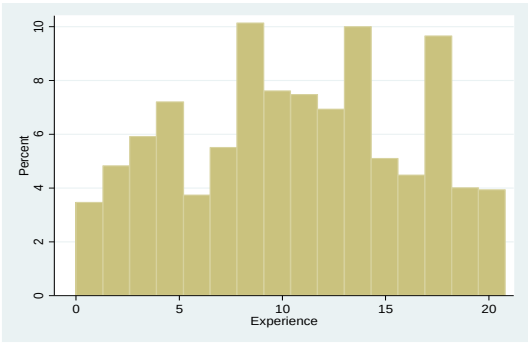
Pre-regulation – all



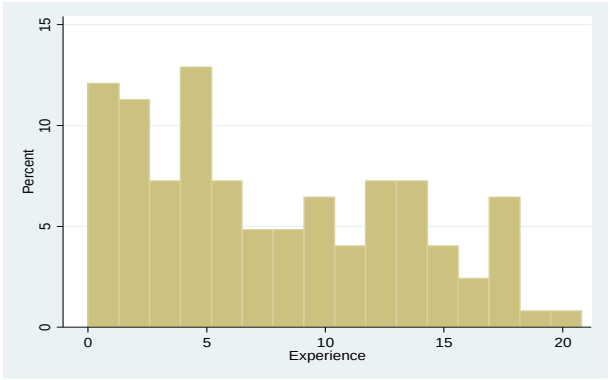
Post-regulation - all



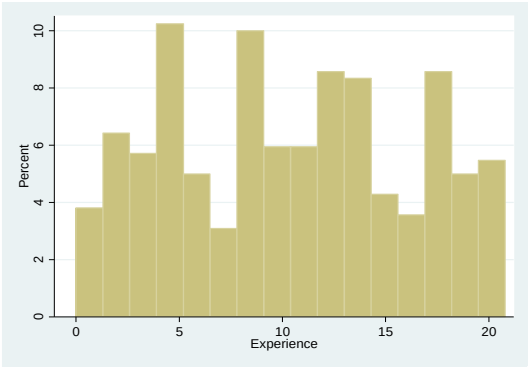
Pre-regulation- private practitioners



Post-regulation- private practitioners



Pre-regulation – non-private practitioners



Post-regulation – non-private practitioners

Figure 2. Likelihood of private practice, regression discontinuity in experience before and after the regulation (full sample)

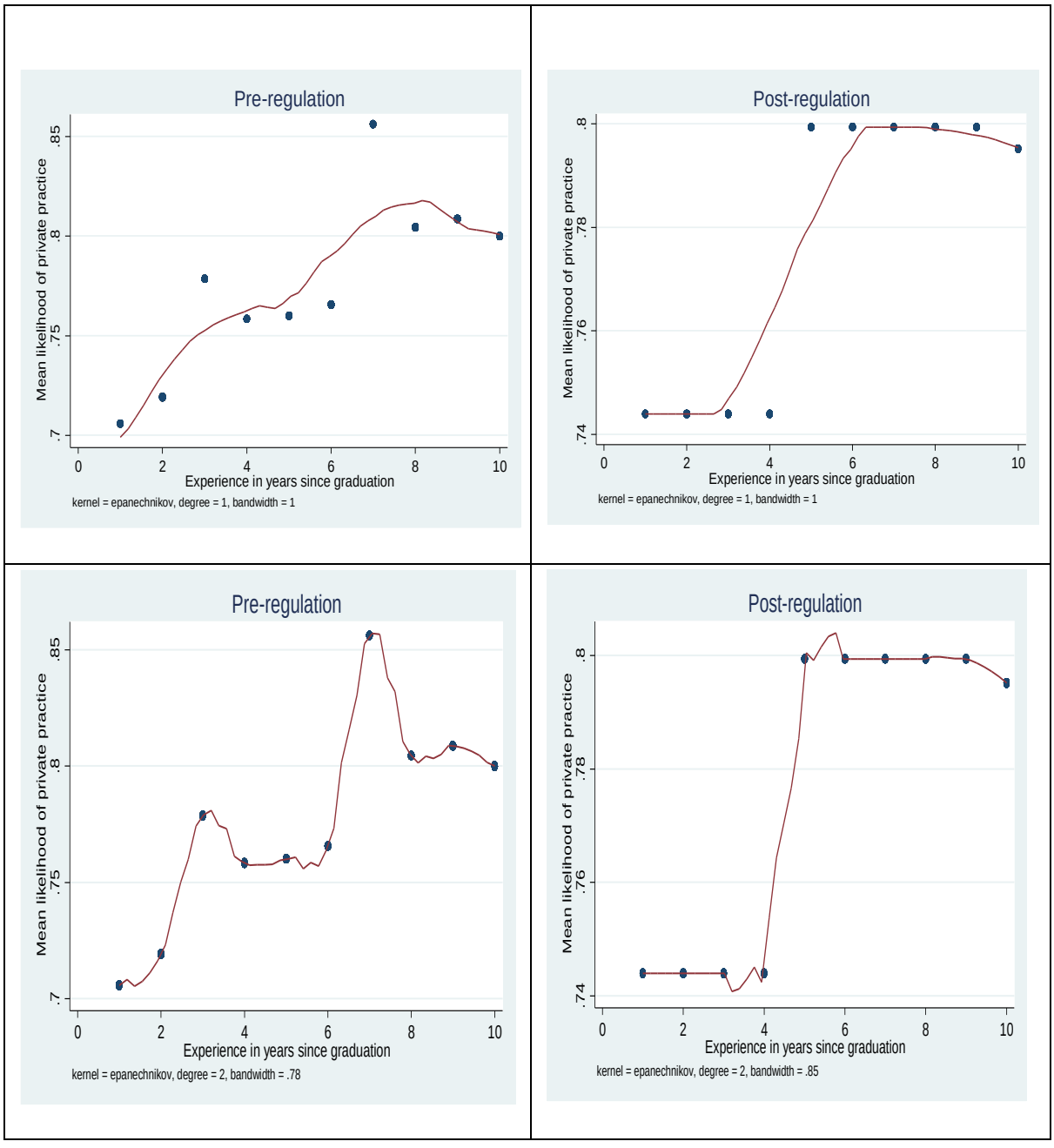


Figure 3. First stage RD estimate confidence interval: Effect of experience on likelihood of private practice

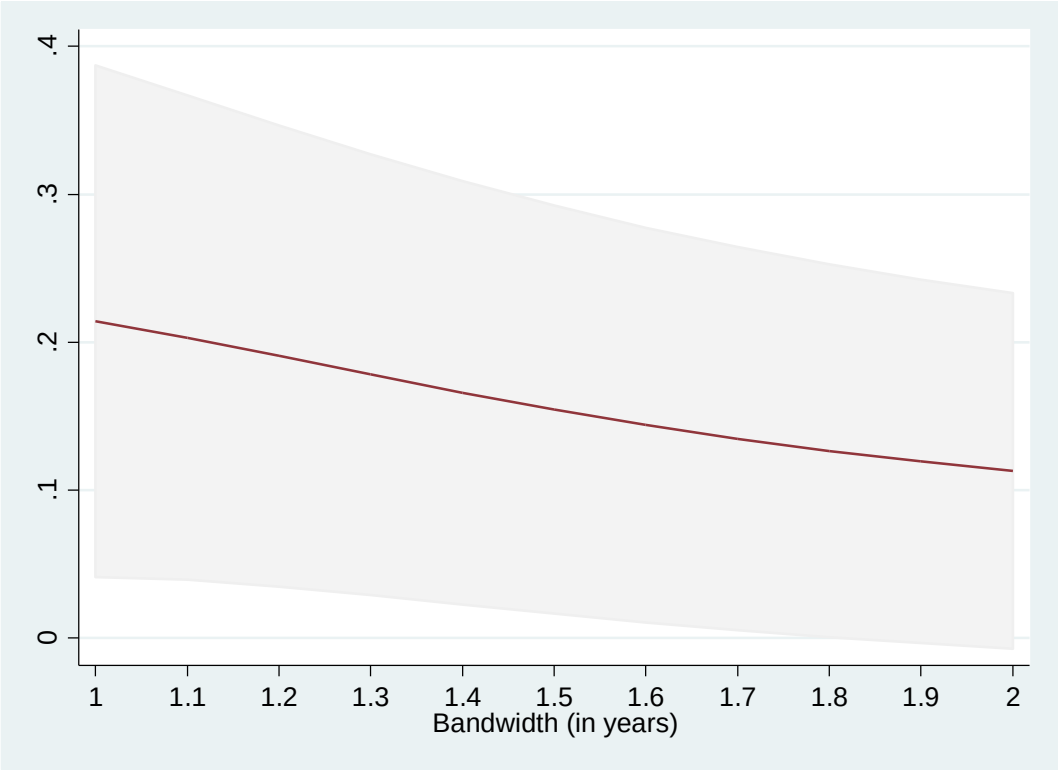


Figure 4. Second stage RD estimates: Effect of experience on hours worked per week

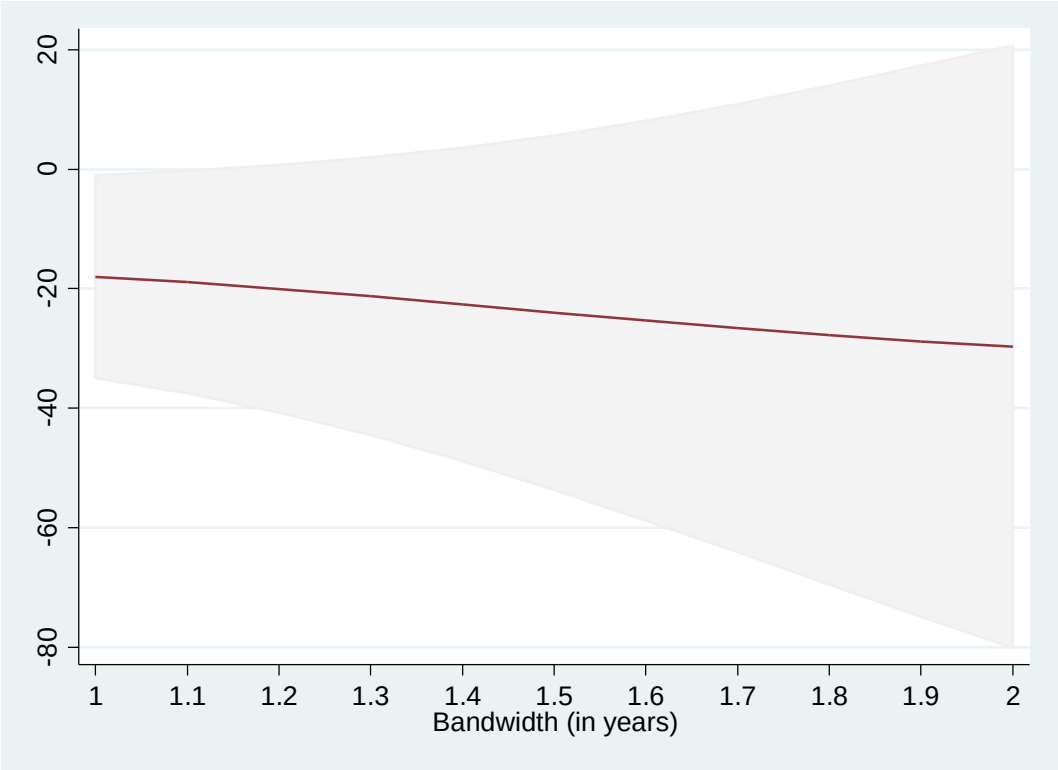
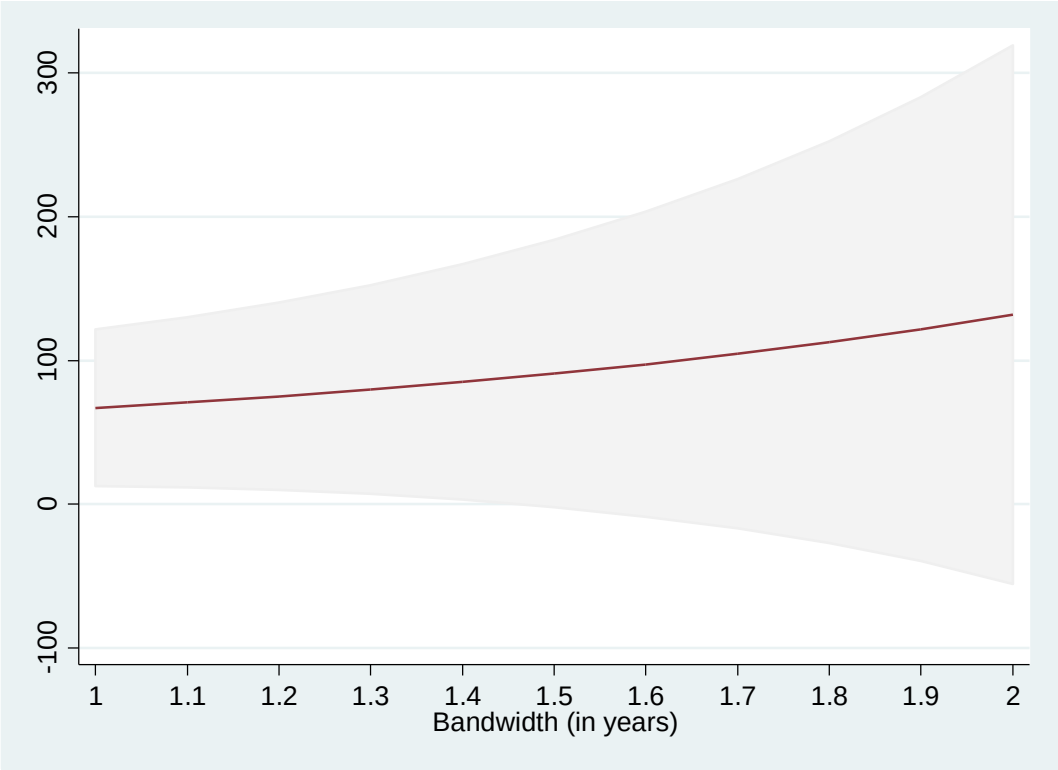


Figure 5. Second stage RD estimates: Effect of experience on patients per week



Appendix 1

Table A1. Likelihood of private practice: Placebo test at different threshold levels of experience since graduation

VARIABLES	(1) Exp=2	(2) Exp=3	(3) Exp=4	(4) Exp=6
Post 1997	0.0734	0.0184	0.0139	0.0711
	(0.331)	(0.0737)	(0.0602)	(0.0802)
Experience = 2	0.179			
	(0.329)			
(Exp=2)*Post 1997	-0.104			
	(0.337)			
Experience=3		0.172		
		(0.177)		
(Exp=3)*Post 1997		-0.0484		
		(0.102)		
Experience=4			-0.110	
			(0.164)	
(Exp=4)*Post 1997			-0.0439	
			(0.103)	
Experience=6				-0.0855
				(0.231)
(Exp=6)*Post 1997				-0.000398
				(0.111)
Constant	0.685*	0.835***	1.000***	0.777***
	(0.350)	(0.162)	(0.0928)	(0.161)
District dummies	Yes	Yes	Yes	Yes
Polynomial	Quadratic	Quadratic	Quadratic	Quadratic
Weights	Yes	Yes	Yes	Yes
F-stat (P-value)[1]	0.21 (0.89)	0.33 (0.80)	0.34 (0.79)	0.58 (0.63)
Observations	923	923	923	923
R-squared	0.216	0.196	0.148	0.116

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

[1] The reported F-statistic tests the relevance of the instrument using the following joint hypothesis: (Expk=0) (post97=0) (Expk*Post97=0) where k=2,3,4,6.

Table A2. OLS non-IV estimates of outcome variables

VARIABLES	(1) *hours_wk*	(2) *patient_wk*	(3) *hours_wk*	(4) *patient_wk*
Holds PP	1.803	-3.026	1.724	-3.288
	(2.573)	(7.032)	(2.584)	(7.168)
Speaks local lang	-2.657	13.84	-2.656	14.18
	(3.057)	(14.81)	(3.059)	(14.52)
Urban	-5.120	23.02**	-5.113	22.88**
	(4.897)	(11.02)	(4.849)	(10.93)
Head is a doctor	-10.53	38.77***	-10.56	38.76***
	(8.380)	(13.03)	(8.442)	(12.90)
Constant	22.82***	59.35**	25.33**	67.32**
	(7.561)	(23.15)	(9.327)	(27.00)
Polynomial	Linear	Linear	Quadratic	Quadratic
Weights	Yes	Yes	Yes	Yes
District & Year dummies	Yes	Yes	Yes	Yes
Observations	892	886	892	886
R-squared	0.185	0.251	0.188	0.253

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

PP is a binary variable indicating if the head of the puskesmas holds private practice.

Appendix 2

Table A1. A historical account of government regulations in the health sector in Indonesia

Regulation	Description
Constitution 1945	Guarantees "the right to health" as a realization of general welfare
Presidential Instruction 1974	Mandated that all new medical graduates serve in under-served rural districts for 1-3 years
Presidential Regulation No. 37 1991	Regulated the recruitment of doctors as temporary employees.
Health Act 23 1992	Regulates health personnel training and education as conducted by government and private sector institutions.
Government Rule No. 23 1996	Regulates type of health personnel
Ministry of Health Regulation No. 916 1997	Regulates the licensing of Medical Practitioners
Ministry of Health Decree No. 1239 2000	Nurse's Registration and Practice regulations
Ministry of Health Regulation No. 1540 2002	Regulates the placement of health doctors during the service period
Ministry of Education Act No. 20 2003	Develops standards for higher education for medical professionals
Medical Practitioner Act No. 29 2004	Regulates that every doctor and dentist has to ensure quality services and cost containment.
Social Security Law No. 40 2004	Mandates the nature of social security contributions and services
Local Government Authority Act No. 32 2004	Provides each local government the authority to recruit their own medical personnel as local government authority
Ministry of Health Regulation No. 1419 2005	Regulates the conduct of medical and dental practice

Source: USAID, 2009

Table A2. Variable definitions

Variable abbreviations	Definitions
pp	Binary variable indicating private practice of health professionals
Exp5	Binary variable indicating if experience>=5 years and 0 otherwise
Post97	Binary variable indicating the years after the introduction of the 1997 regulation and 0 otherwise
hours_wk	Hours worked per week by the head of the puskesmas
patients_wk	Number of patients seen per week by the head of the puskesmas
Referral	Binary variable indicating if any puskesmas patient is referred to a private clinic
Private practice in the public hospital	Binary variable indicating if private practice is held in the public hospital
Llang	Binary variable indicating if the health professional speaks the local language
Urban	Binary variable indicating if the puskesmas is in the urban region