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## Effects of Bans on Prostitution On Prevalence of Induced Abortions

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# Effects of Bans on Prostitution on Prevalence of Induced Abortions

Takahide Kobayashi, Hiroyuki Kobayashi

**Abstract—Background:** Prostitutes are at high risk of unintended pregnancy, and induced abortions are widely practised among this cohort.

**Aims:** This study examined the effects of prostitution bans on the prevalence of induced abortions. We focused particularly on the bans on juvenile prostitution, which were introduced by 32 states of Japan between 1975 and 1998.

**Methods:** This was a cross-sectional study employing event-study analyses and a difference-in-difference-in-differences methodology. We compared the changes in numbers of induced abortions before and after the bans were introduced, among women under 20 years of age and among those aged 20–24 years, over states.

**Results:** The number of induced abortions among women under 20 years of age increased after the juvenile prostitution bans were implemented. In the fifth year of implementation, the number increased by 56.79 percentage points ( $p < 0.001$ ) compared with the previous year.

**Conclusion:** The number of induced abortions among adolescents increased after juvenile prostitution was banned. As to its mechanism, the outcomes of our additional identification suggest that former juvenile prostitutes who retired due to the bans contributed to the increase.

**Index Terms—**Induced Abortion; Juvenile Prostitutes; Prostitution.

## I. INTRODUCTION

Prostitutes are at high risk of unintended pregnancy, and induced abortions are widely practised among this population [1-4]. Pregnant prostitutes are usually forced to obtain induced abortions, which, in the event of unsafe abortions, can result in negative outcomes or even death [5]. According to WHO,

between 13,685 and 38,940 lives are lost annually due to failure to provide safe abortions, with more individuals experiencing serious morbidities [6].

To protect the reproductive health of prostitutes, governments can reduce unintended pregnancy among them by implementing prostitution bans. Given that these bans should reduce the frequency of sexual intercourse between prostitutes and their clients, unintended pregnancies, as well as the resulting induced abortions, would become less prevalent in this group. However, it remains uncertain whether prostitution bans do effectively reduce the frequency of paid sex between prostitutes and their clients. It might be the case that such bans do not reduce prostitution, but only make it less visible. When Sweden criminalised the purchase of sex in 1999, although the number of female sex workers working visibly on the streets decreased, it was suggested that both female sex workers and their customers had simply chosen less visible ways of making contact [7].

This study identifies the effects of prostitution bans on the prevalence of induced abortions. It is generally difficult to conduct such identification, largely for three reasons. First, research into prostitution frequently faces a scarcity of empirical evidence because of the discrete nature of the business [8]. As to the Swedish case, researchers found little empirical evidence suggesting that prostitution really went underground [9]. Second, women are known to under-report abortions in surveys [10]. Prostitutes may do this particularly in an interview situation because induced abortion is a traumatic experience for them [11]. Third, we have only a small number of examples of prostitution bans at the country level. To the best of our knowledge, there are only seven countries that have introduced such bans in the last 30 years (Sweden, South Korea, Norway, Iceland, Canada, France, and Ireland) [12-14]. These countries are not the best examples for comparative analyses,

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because they differ in factors associated with the prevalence of induced abortions, such as race, culture, and legal regulations.

To overcome these difficulties, we use objective data to examine the effects of state-level interventions. First, to secure an adequate sample size, we focus on Japan's juvenile prostitution bans at the state level. All of the country's 47 states (prefectures) enacted, at a different point in time, an ordinance criminalising the purchase of sex from any person under 18 years of age (a 'juvenile'). The first state introduced the ban in 1952, and the last state in 2016. We thus have a relatively large sample size compared with those at the country level. In addition, we use objective data to estimate the effects of the criminalisation on the prevalence of induced abortions. This approach enables us to address the scarcity of empirical evidence related to prostitution and the suspicions over reliability of information about abortions obtained through interviews. In particular, we use data from Japan's official statistics on induced abortions. These are based on information that doctors are required, by law, to submit to a state governor.

## II. METHODS

### *Difference-in-difference-in-differences methodology*

To estimate the effects of the juvenile prostitution bans, we employ the difference-in-difference-in-differences ('triple-difference') methodology. Our triple-difference analysis compares changes in the number of induced abortions among people under 20 years of age ('minors') and among those between 20 and 24 years of age, over states. Our identification is based on the common-trend assumption that the numbers of induced abortions in the absence of a ban would all follow the same trend. This assumption can be violated when unobserved heterogeneity exists between states in trends of induced abortions. In this regard, we use triple-differences analysis to control for state-specific trends.

The two adjacent age-groups have a number of similarities; this allows us to assume the same trends in prevalence of induced abortions in the absence of any intervention affecting either group.

In this regard, our specification can effectively account for different dynamics of outcomes across states.

### *Event-study analysis*

We use an event-study analysis to identify the dynamic effects of the bans. Our event-study equation is as follows:

$$\ln(Y_{a,i,t}) = \alpha \text{Minor}_{i,t} + \sum_{t=-P}^T \beta_t \text{Time}_{i,t} + \sum_{t=-P}^T \gamma_t (\text{Minor}_{i,t} * \text{Time}_{i,t}) + \nu Z + FE_t + \mu_{a,i,t} \quad (1)$$

where  $\ln(Y_{a,i,t})$  is the logarithm of the number of induced abortions performed to age-group  $a$  (under 20 or 20-24 years of age) in state  $i$  in year  $t$  (per 1,000 population);  $\text{Minor}_{i,t}$  is a dummy variable equal to one if the number is of induced abortions performed to minors;  $\text{Time}_{i,t}$  is a dummy variable identifying the distance of year  $t$  from the year in which the ban was implemented in state  $i$  (The estimation window is from the year -5 to the year 5, and the year -1 is the baseline omitted period.).  $\mathbf{Z}$  is a vector of control variables. We use year-fixed effects  $FE_t$  to control for time-invariant shocks, whereas state fixed effects are not included due to collinearity. Standard errors are clustered at the year level.

The parameter of interest is  $\gamma_t$ . The coefficients  $\{\gamma_1, \dots, \gamma_5\}$  identify dynamic effects of the ban on changes in the number of induced abortions among minors relative to the number among people between 20 and 24 years of age, compared with states which have not yet introduced it.

### *Target period*

The study focuses on induced abortions performed between 1975 and 1998, for the following reasons. First, the statistical data are not available for our control variables prior to 1975. Second, Japan implemented the juvenile prostitution ban at the country level in 1999. We therefore need to omit data from 1999 and later to exclude the impact of the national ban from our estimation. Out of Japan's 47 states, 32 introduced the juvenile prostitution ban within the target period.

### *Dependent variables*

Data on induced abortions were obtained from

the ‘Report on Maternal Health’, a statistical report covering induced abortions and sterilisation. This report has been published annually by the Japan’s Ministry of Health, Labour and Welfare since 1970. Specifically, we use the annual numbers of induced abortions by state and by age-group. The report includes data for eight age-groups: under 20, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, and over 50 years of age. We abstracted the data of two age-groups, under 20 and 20-24 years of age, and created a dataset covering each of the 32 states.

*Independent variables*

Municipal data were obtained from the state governments. We asked all 32 state governments, by email, for the dates of implementation of their bans, and all of them provided the requested information.

*Control variables*

We include six variables which extant research

commonly suggests influence women's decisions to obtain an induced abortion: poverty, educational status of women, relationship problems, maternal and foetal health, and accessibility to abortion facilities [15-21]. Data on these variables were obtained from the Regional Statistics Database, which has been updated annually by Japan’s Ministry of Internal Affairs and Communications since 1975.

*Summary statistics*

Table 1 provides a summary of statistics and description of variables. Panel A presents the dependent variables, the numbers of induced abortions performed in the two age-groups (per 1,000 population) and their logarithm. Panel B shows the year of criminalisation at state level, used as independent variables in our specification. Lastly, Panel C presents the six control variables included in our estimation.

**Table 1.** Summary statistics and description of variables (Equation 1)

	Count	Mean	SD	Min	Max	Descriptions
<b>Panel A: Dependent variables</b>						
Induced abortions among minors	1032	0.2068	0.1009	0.0238	0.6391	Number of induced abortions performed in people under 20 years of age (per 1,000 population)
(logarithm)	1032	0.4131	0.4518	2.6165	0.8024	
Induced abortions among people aged between 20 and 24 years	1032	0.7285	0.3198	0.0731	2.2310	Number of induced abortions performed in people aged between 20 and 24 years (per 1,000 population)
(logarithm)	1032	1.7127	0.5587	3.7387	0.4477	
<b>Panel B: Independent variables</b>						
Year of criminalisation	32	1979	2.5963	1976	1986	Year of effectuation of state ordinance criminalising paid sex with a juvenile
<b>Panel C: Control variables</b>						
Poverty	1032	0.0168	0.0095	0.0047	0.0608	Rate of family units receiving public assistance
Educational status of women	1032	0.3711	0.0949	0.1734	0.6075	Rate of female graduates of local high schools newly enrolled at a university
Relationship problems	1032	0.0131	0.0034	0.0063	0.0273	Number of divorces (per 1,000 population)

Maternal health	1032	0.0001	0.0001	0	0.0006	Number of maternal deaths (per pregnancy)
Foetal health	1032	0.0430	0.0112	0.0234	0.0850	Number of foetal deaths (per pregnancy)
Access to facilities	1032	0.0111	0.0176	0.0011	0.1141	Number of abortion facilities (per square kilometre)

Notes: The variables are from the states of Japan which provided us with the requested information (see Section 2.5). The variables cover the target period of this study (1975 to 1998).

### III. RESULTS

#### Baseline results

Figure 1 presents our event-study estimates. The coefficients in the post-event period  $\{\gamma_1, \dots, \gamma_5\}$  are all positive. Particularly, the first three show a linear rise. These coefficients show that the number of induced abortions among minors gradually increased compared with that of the 20-24-year age group after the bans were implemented. The coefficients are statistically significant, except for that of year 1. In year

5, the number of induced abortions among minors relative to women aged 20-24 increased by 56.79 percentage points ( $p < 0.001$ ), compared with year 1. Furthermore, Figure 1 shows the absence of pre-trends in changes to the number of induced abortions among minors. The coefficients prior to criminalisation (excluding year -1)  $\{\gamma_{-5}, \dots, \gamma_{-2}\}$  are distributed over both positive and negative and are not statistically significant. The result suggests that the timing of criminalisation is exogenous to changes in the number of induced abortions among minors.

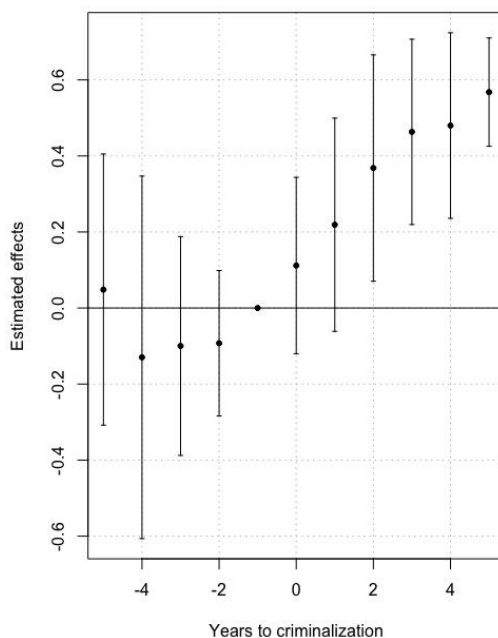


Figure 1. Estimated effects of prostitution bans on changes in the number of induced abortions among minors

#### Additional identification - Potential mechanism

The baseline results are contrary to our prediction that prostitution bans would reduce induced abortions among prostitutes. It was plausible that bans like criminalisation of paid sex would reduce the frequency of sexual intercourse between prostitutes and their clients, because potential clients are

deterred from purchasing sex for fear of criminal punishment [see 22]. One possible explanation is that former juvenile prostitutes contributed to the outcomes. Given the implemented bans, some juvenile prostitutes would cease prostitution and no longer have sex with paying clients. Among prostitutes, the rates of condom and other contraceptive

use are consistently lower with emotional (non-paying) partners than with paying clients [23]. Thus, it might be the case that juvenile prostitutes who quit prostitution following the bans had more frequent unprotected sex with emotional partners, resulting in a greater prevalence of unintended pregnancy and therefore abortions in this group after the bans were implemented.

*Methods and data*

To examine the potential mechanism, we conducted additional identification. More specifically, we estimated the effects of the bans on changes in the number of deliveries by minors. If more retired juvenile prostitutes became pregnant through unprotected sex with emotional partners, it follows that the number of deliveries would increase alongside the number of induced abortions. That is because some would choose to terminate their pregnancies while others would choose to have a child with their emotional partner. On the other hand, if more active prostitutes fell pregnant due to unprotected sex with paying clients, the number of deliveries would not change because they are usually forced to obtain an induced abortion [5].

We conducted an event-study analysis to identify the dynamic effects, using the following equation:

$$\ln(Y_{a,i,t}) = \delta Minor_{i,t} + \sum_{t=-p}^T \varepsilon_t Time_{i,t} + \sum_{t=-p}^T \zeta_t (Minor_{i,t} * Time_{i,t}) + vZ + FE_t + \mu_{a,i,t} \quad (2)$$

where  $\ln(Y_{a,i,t})$  is the logarithm of the number of deliveries in age-group  $a$  (under 20 or 20-24 years of age) in state  $i$  in year  $t$  (per 1,000 population). Year fixed effects  $FE_t$  are included, whereas state fixed effects are not, due to collinearity. The parameters of interest are  $\{\zeta_t\}$ . Standard errors are clustered at the year level.

Table 2 provides a summary of statistics and description of variables. Panel A presents the dependent variables, and Panel B the control variables. Our control variables are population density, age, marriage and divorce rates, age at first marriage for women, poverty, educational status of women, labour force participation of women, and infant and child mortality [24-28]. All data were obtained from the Regional Statistics Database.

**Table 2.** Summary statistics and description of variables (Equation 2)

	Count	Mean	SD	Min	Max	Descriptions
<b>Panel A: Dependent variables</b>						
Deliveries by minors	1032	0.1376	0.0660	0.0298	0.8542	Number of deliveries by people under 20 years of age (per 1,000 population)
(logarithm)	1032	-2.0565	0.3665	-3.5149	-0.1575	
Deliveries by people aged between 20 and 24 years	1032	2.2784	0.8987	0.8303	6.1620	Number of deliveries by people aged between 20 and 24 years (per 1,000 population)
(logarithm)	1032	0.7568	0.3544	0.1860	1.8184	
<b>Panel B: Control variables</b>						
Population density	1032	0.6570	1.1098	0.1021	5.6744	Population per square kilometre
Age	1032	0.1023	0.0108	0.0765	0.1370	Rate of women aged between 15 and 30 years in population
Marriage rate	1032	6.0812	0.8296	4.3796	9.5233	Number of marriages (per 1,000 population)

Divorce rate	1032	1.3074	0.3396	0.6258	2.7339	Number of divorces (per 1,000 population)
Age at first marriage for women	1032	25.4889	0.6613	23.7	27.7	Mean age at first marriage for women
Poverty	1032	0.0168	0.0095	0.0047	0.0608	Rate of family units receiving public assistance
Educational status of women	1032	0.3711	0.0949	0.1734	0.6075	Rate of female graduates of local high schools newly enrolled at a university
Labour force participation of women	1032	4.7338	2.3473	1.2267	18.6034	Number of newly employed women (per 1,000 population)
Infant and child mortality	1032	0.1055	0.0572	0.0291	0.3461	Number of deaths of children under 5 years of age (per 1,000 population)

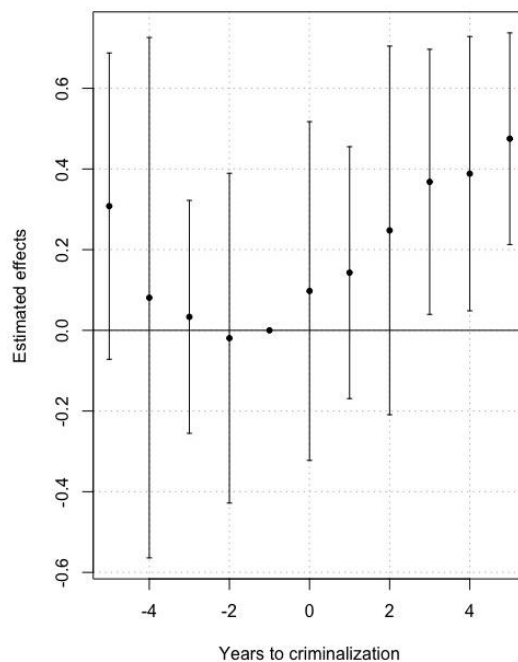
Notes: The variables are from the states of Japan which provided us with the requested information (see Section 2.5). The variables cover the target period of this study (1975 to 1998).

**Results**

Figure 2 presents our event-study estimates. The coefficients in the post-event periods  $\{\zeta_1, \dots, \zeta_5\}$  are all positive and show a linear rise. They indicate that the number of deliveries by minors gradually increased compared with that of women aged 20-24 years after the bans were implemented. The latter three  $\{\zeta_3, \dots, \zeta_5\}$  are statistically significant;

the first two  $\{\zeta_1, \zeta_2\}$  are not. In year 5, the number of deliveries among minors relative to people aged 20-24 increased by 47.50 percentage points ( $p < 0.01$ ), compared with year -1.

Moreover, the coefficients in the pre-event periods, except for year -1,  $\{\zeta_{-5}, \dots, \zeta_{-2}\}$  are distributed over both positive and negative, and statistically insignificant. They show that no pre-trends exist.



**Figure 2.** Estimated effects of prostitution bans on changes in the number of deliveries by minors.

#### IV. DISCUSSION

This study focuses on the impacts of Japan's state-level bans on juvenile prostitution on the prevalence of induced abortions. The outcomes of our baseline specification show that the number of induced abortions among minors relative to people aged 20-24 years significantly increased after the bans were implemented. As to the mechanism, the results of our additional event-study analysis show that the number of deliveries by minors relative to people aged 20-24 also significantly increased in the post-event periods. These findings suggest that active juvenile prostitutes would not have contributed to the increase; had unintended pregnancy become more prevalent among this group, the number of deliveries would not have increased concurrently, because such pregnancies usually result in forced termination [5]. It is suggested that former juvenile prostitutes, who quit prostitution due to the bans, contributed to the increase in induced abortions. After leaving the industry, they would no longer participate in paid sex with clients, and instead have unprotected sex with their emotional partners more frequently [see 23]. Unintended pregnancy and the resulting induced abortions would consequently become more prevalent among this group.

To the best of our knowledge, this is the first study that empirically estimates the effects of prostitution bans on the prevalence of induced abortions. The results of our baseline specification reveal a significant increase in induced abortions after the bans were implemented. Moreover, given the suggested mechanism, our findings could be evidence that the criminalisation of paid sex does effectively reduce prostitution. Although it has been argued whether such bans deter prostitution, there has been no evidence to support the argument either way [7, 29]. However, assuming the mechanism, it could be said that, due to the bans, some active juvenile prostitutes ceased their engagement in prostitution. In this regard, the bans could be a solution for prostitution as a social problem, even if they might contribute to the increase in induced abortions.

As a policy implication, prostitution bans should be accompanied by appropriate support for retiring

prostitutes. The study suggests that retired prostitutes have a higher probability of unintended pregnancy and therefore abortions, due to unprotected sex with emotional partners. It is important for their reproductive health that the authorities that ban prostitution adequately provide them with the necessary instruction or guidance regarding contraceptive use. Our approach has three advantages. First, we secured an adequate sample size for identification by focusing on state-level interventions. We have 32 examples of prostitution bans at state level, while there are fewer than 10 such bans at country level. Second, Japan's states have plenty of similarities in factors affecting abortion rates. For example, Japan has a population that is relatively homogeneous in terms of race and culture. Sex education is nationally mandatory in primary schooling. Moreover, induced abortions are available under the same regulations in all the states. These similarities allow us to control for unobserved heterogeneity. Third, the reliability of our selected statistical data is secured by laws. The national acts of Japan require doctors who perform induced abortions to submit relevant information to a state governor; those who violate the obligation or submit false information are subject to criminal and administrative sanctions. Furthermore, these data cover almost all induced abortions performed in Japan, because most abortions are safe there [30]. Although these data are relatively old, their use can be justified to examine past events [31].

#### *Limitations*

This study has several limitations. First, we treated data solely from Japan. It is thus uncertain whether our findings could be applicable to other countries. Second, the study focused on juvenile prostitution, and it might be the case that prostitutes in other age-groups react differently to such interventions.

Third, as data on induced abortions specifically among juveniles (under 18 years) in Japan are unavailable, we used data on minors (under 20 years) instead. Furthermore, we have little information regarding the characteristics of Japanese juvenile prostitutes in our target period. If available, they could enable more detailed analysis. In these regards, further research is needed to advance the understanding



of the relationship between prostitution and induced abortions. Particularly, it should be a priority to estimate the effects of prostitution bans on the prevalence of induced abortions in other countries.

## V. CONCLUSION

The prevalence of induced abortions increased among minors after juvenile prostitution was banned in Japan. In addition, the number of deliveries by minors increased simultaneously. These outcomes suggest that juvenile prostitutes who had recently left the industry due to the bans contributed the increase in induced abortions.

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