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Abstract

Prostitution in the EU countries is a controversial issue as regards the typology of policy regimes - prohibition, regulation and abolition, as well as the inclusion of sex work within the national accounts. Economics literature tackles this typology from the perspective of both free sex work and victims of sexual exploitation trafficking. Scarce empirical investigations build up upon inconsistent data and no overall investigation has addressed so far the magnitude of coerced and non-coerced prostitution in the EU-28. We compile the data sources on the demand-side and the supply-side based on HIV prevalence among female sex workers, on sources from NGOs, and on victims of sexual exploitation trafficking recorded by Eurostat and the UNODC. We calculate the very first five estimates of prostitution in France and in the EU-28 as of 2010. With both OLS and probit models, we test the determinants of prostitution according to the five estimates, wherein the EU policy regimes play a major role. With respect to average prices for sexual encounters on both the demand and the supply sides, we assess which might be the best estimates as regards French and EU national accounts adjustment for illegal production and consumption expenditure including prostitution. Two estimates are most likely to capture the lower and upper bound for prostitution. According to the average turnover and revenue that match the lower bound, there is a premium on earnings for prostitution.

Keywords: Cross-section; European Union; Female sex workers; France; National Accounts; Non Observed Economy; OLS; Probit.

JEL: E26, J46, J47

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1. Introduction

Prostitution, the controversial so-called "oldest profession", raises moral and economic issues such as social stigma, health risks and tax evasion, echoing the economists (Mandeville, 1724; Malthus, 1798; Stuart Mill, 1870) whose doctrines inspired current legislation regarding prostitution in the European Union (EU-28). Advocacy for *laissez-faire* (Hakim, 2015) confronts the virtuous stance on abolition (Charpenel, 2013).

Prostitution is back again on the agenda: the EU political arena (Mendes Bota, 2014; Schulze, 2014) alongside French Parliament discussed the issue, which also deserves special attention from Eurostat in as much as illegal production and prostitution should be included into adjusted the national accounts since 2010. Strangely enough no assessment has been yet applied to varied expert calculations. It is our purpose to fill the gap and provide a tentative benchmark for the EU-28, wherein three different policy regimes rule prostitution: *prohibition*, *regulation* and *abolition*, which all ban human trafficking for sexual exploitation.

Prohibition makes prostitution illegal as well as the prostitute liable to penalties in four Member States (Croatia, Lithuania, Malta and Romania until decriminalisation in 2013), which account for 1.63 percent of EU GDP and 5.5 percent of total population of the EU-28 in 2010.

As for *regulation*, in line with Mandeville (1724), prostitution is a legal trade in brothels that includes tax collection and labour contracts for sex workers in four Member States (Austria, Germany, Greece and the Netherlands), contributing 29.2 percent EU GDP and almost one fourth (23.26 percent) of total population in 2010.

Abolition, in line with Stuart Mill (1870) and the Universal Declaration of Human Rights (UN, 1948), advocates that sexual exploitation should be extinct as well as non-coercive sex trade. Pimps and brothels managers should be prosecuted, but not the prostitutes themselves. This policy regime applies to the remaining 20 Member States[3] that account for 69.1 percent EU GDP and 71.2 percent of total population in 2010.

There are two distinct but related approaches. One addresses the issue of prostitution as legal sex work, a market economic activity that deserves thorough analysis in terms of supply and demand. The other one addresses the issue of coercive prostitution in terms of victims of sexual exploitation or forced labour within a given country as well as cross-border migration; it is used as an approximation in order to estimate overall prostitution including both coerced and non-coerced sex work that actually blurs such distinction.

Our paper brings in value added in as much as it contains first ever estimates of prostitution for overall EU-28, which are tested with OLS and probit models; it provides consistent lower and upper bound estimates, the former being checked against national accounts as of 2010..

The paper is structured as follows. Section two reviews the economics literature with respect to sex work and sexual exploitation. Section three records the data sources on the demand-side. Section four compiles five estimates on the supply-side: two from HIV prevalence amongst female sex workers, two others from data collected by international NGOs and the fifth one from victims of sexual exploitation trafficking according to Eurostat and the UNODC in 2010. Section five designs an OLS model to test the five Estimates for prostitution according to GDP per capita, policy regimes, supply-side and demand-side variables, highlighting the most likely Estimates. Section six checks the lower bond Estimates of prostitution that fits best national accounts adjustment for illegal production as well as for consumption expenditure in 2010, computing turnover, revenue and premium on earnings. Conclusion recapitulates the main findings and limitations of the paper.

2. Literature review on prostitution

Two strands in the recent economics literature address prostitution. One explores various theoretical models based upon and extending the general assumption of rational choice behaviour from sex workers towards the social welfare issue, the last model being the only one that also takes into account coerced sex work. The other one focuses on victims of sexual exploitation addressing coerced prostitution and tackling the empirical issue.

Edlund and Korn (2002) design the standard model of occupational choice involving voluntary prostitution according to rational choice. They state the prostitution puzzle as "low-skilled, labor

[3] It is worth mentioning that Northern Ireland (2015), France (2016) and the Republic of Ireland (2017) joined the *Neoabolitionism* regime focused on the prosecution of customers that Sweden (1999) pioneered.

intensive, female, and well paid" and explain that sex workers draw a compensating differential due to the foregone opportunity to "sell'' their fertility on the market for marriage.
Della Giusta et al. (2009) extend the standard model, including social interactions and social sanctions. Stigma as a loss of reputation, affects social standing for both clients and sex workers. Attitudes towards the exchange of paid sex shape the dynamics of demand and supply and the resulting markets.
Farmer and Horowitz (2013) include intermediaries into a theoretical analysis of market structure with heterogeneous buyers and sellers as well as information asymmetry. The market is segmented into separating equilibria and intermediaries affect the distribution of surplus. If brothels are authorized, they are likely to reduce information asymmetry and costs as well as promote economies of scale and quality.
Immordino and Flaviano Russo (2015) set up an equilibrium model of prostitution wherein potential clients and sex workers simultaneously interact under three different legal regimes and the harm associated to each. An application to Italy documents a tradeoff between equilibrium and social optimum. Prohibition is more effective at decreasing the total quantity of prostitution services than regulation and laissez-faire regimes. Regulation is more effective than prohibition in alleviating the harm associated with prostitution.
Lee and Persson (2015) model a semi-coerced market with voluntary prostitutes and trafficking, investigating whether prostitution laws can reach the socially optimal outcome that would arise in a decriminalized market free from trafficking. Although no current regime achieves this goal, authors speculate that a combination of the "Dutch" regulatory and the "Swedish" neo-abolitionist regimes would. In as much as it is the only one that includes both coerced and non-coerced prostitution, this paper provides the closest framework to our own paper.
Four papers address the issue of sexual exploitation trafficking with respect to policy regimes.
Akee et al. **(**2011) use a game-theoretic model to explore the human trafficking market and estimate a gravity model of trafficking upon a sample of 190 countries. They find that domestic and foreign enforcement do mutually reinforce one another, due to mobility, there is partial bargaining power of traffickers and buyers, and demand.is inelastic. Legal prostitution exerts no effect on trafficking in a two-country pair cross-sectional sample (country source to host country); whereas there is a negative effect when using instrumental variables.
Cho et al (2013) address the effect of legalising prostitution upon a dataset of 150 countries. It will increase demand as well as some potential sex workers (or their pimps) to enter the market. Supply may decline due to tax collection, although prostitutes unwilling to comply with tax payment can operate illegally. The legalisation of prostitution has two opposite effects on the incidence of trafficking, a substitution effect away from trafficking and a scale effect increasing trafficking. Hence, the overall effect is theoretically indeterminate and becomes an empirical issue. In addition, Cho (2016) points out that the liberal prostitution regime .proposes to fight human trafficking by implementing anti-trafficking measures, while allowing prostitution. Using a sample of data from 149 countries over 2001-2011, such a regime proves at best irrelevant if not negative as for victim protection.
Jakobsson and Kotsadam (2013), using a cross-sectional dataset of 31 European countries from the ILO and UNODC, find a positive effect of legal prostitution on trafficking. Sexual exploitation trafficking of women is least prevalent in countries where prostitution is illegal, most prevalent in countries where prostitution is legal, and in between in those countries where prostitution is legal but procuring illegal. Case studies of Norway and Sweden, which prosecute buying sex, support the possibility of a causal link from harsher prostitution laws to reduced trafficking.
It is common knowledge that data on prostitution are scant and expert's calculations are 'guesstimates'. To the best of our knowledge, there is no empirical paper assessing how large is the market for non-coerced and coerced prostitution in the European Union, which is our concern.
There are various criteria to gauge this market depending on prices (See Box 1 in the Appendix), premises and working schedules. Prostitution encapsulates three broad distinct segments: the upper tier (escorts and call girls), the intermediate category (brothels, bars, clubs, massage parlours and other indoor prostitution) and the lower tier (outdoor or street prostitution). Furthermore, some students and housewives participate on a part time basis in addition to full time professionals. Hereafter, we assume that prostitution is an equivalent full-time activity, the magnitude of which we measure, compiling data issued from primary as well as secondary sources. First, we start with the demand side.

3. The figures of prostitution in the EU from the demand side

All studies agree that demand for prostitution comes overwhelmingly from men[4].

Male behaviour remains a controversial issue. In line with Stuart Mill (1870), abolitionists contend that demand should -and actually can be curbed (See Jakobsson and Kotsadam, 2013), whereas Cho et al (2013) assume that demand is inelastic (Malthus, 1798).

Table 1 records demand from National surveys on sexual behavior (Natsal) in Europe that developed between 1990 and 2000 (Leridon et al, 1998; Johnson et al, 2001) and addressed the proportion of men reporting having commercial sex in the past 12 months. This gauges regular demand, whereas other surveys addressing the question 'have you ever paid for sex' provide inconsistent data we discarded.

Table 1. Proportion of men reporting having commercial sex in the past 12 months

Country	Year	Clients of Female Sex Workers: adult male population (%)?	Source
France	*1992*	*1.1*	*Natsal*
France	*1998*	*0.7*	*NEM*
Germany (West)	1990	4.8	Natsal
Germany	1998	0.0	NEM
Greece	1998	5.3	NEM
Italy	1992	2.0	Natsal
Italy	1998	1.7	NEM
Netherlands	1989	2.8	Natsal
Portugal	1991	5.4	Natsal
Portugal	1999	2.4	NEM
Spain	1990	11.0	Natsal
UK	1990	2.0	Natsal-1
UK	1998	1.0	NEM
UK	2010-12	1.1	Natsal-3

Source: Carael et al (2006), Jones et al (2015)

In the early nineties, surveys on sexual behaviour were conducted in seven Member States upon a sample including only 18–49 years old age group. There are large discrepancies in reported contact with a sex worker: 1.1 per cent in France and 11.0 per cent in Spain. The median value is 4.95 per cent, with a mean of 4.1 per cent.

In the late nineties, surveys based upon the EU New Encounter Module (NEM) upon a sample of all adult age groups cover only five Member States and provide much smaller estimates: the median value is 2.22 per cent, with a mean of 2.65 per cent.

It is worth noticing there is a bias in the early 1990s surveys due to age concentration and small sample size for some countries; hence, one cannot conclude that demand is diminishing. In line with Malthus (1798), our assumption is that demand is rather inelastic. However, a robust variable that would gauge EU demand overtime is still lacking. For instance, the prevalence of paying for sex over the past year among men resident in Britain remains stable over a decade (Jones et al, 2015). However, the case for the UK should not be extrapolated to overall EU-28.

4. The figures of prostitution in the EU from the supply side

As for 2008, women would constitute 87% of the entire sex worker population in Europe; men accounting for seven per cent and transgender people for six per cent (TAMPEP 2010). In as much as country level data are lacking for the two last categories (Beyrer et al, 2015), we focus upon female sex workers.

4.1. Estimates of female sex workers from HIV prevalence

Table 2 records the number of female sex workers from data on HIV prevalence provided by the World Health Organisation, UNAIDS and Eurosurveillance as well as field investigations. Platt et al (2013) emphasize the paucity of data on HIV prevalence that include 14-20 EU countries (9,646-14,548 female sex workers) spanning from 2001 up to 2011. Country samples sometimes prove too small (below one hundred individuals) and biased with respect to specific categories (street prostitution) or location (capital city) that may overestimate HIV among sex workers; conversely, stigma and restrictive health policies

[4] Beyond anecdotal evidence concerning female sex tourism, an Internet survey including a sub-sample of 22 EU countries finds out that two out of five male escorts provide paid sex to women and couples (Scott and Minichiello, 2017). However, male escorting is a very small market niche and no aggregate data proved available.

towards migrants may drive underestimation (See Table A1 in the Appendix). However, HIV data collection for female sex workers is much better documented than other sexually transmitted infections whereby only eight EU countries provide coverage and syphilis is strongly biased with male overrepresentation (ECDC, 2014).

Table 2. Estimates of female sex workers (FSW) from HIV prevalence (2011 and early 2000s)

Country	Female +15 years old (2011)	FSW as a % of females +15 years old (2011)[a]	Estimate 1A Number of FSW (2011)	FSW as a % of females aged 15-49 (early 2000s)[b, c]	Estimate 1B Number of FSW (early mid-2000s)
Austria	2,831,855	0.5 (2009)	14,160	1.03 (2000)	29,060
Belgium	3,599,767	0.2 (2011)	7,200	0.47 (2000)	16,972
Bulgaria	2,500,139	0.3 (2011)	7,500	0.52 (2004)	12,962
Croatia	1,438,394	0.2 (2006)	2,877	0.52 (2004)	7,480
Cyprus	304,272	N/A (0.3)*	913	N/A (0.43)*	1,317
Czech Rep	3,622,042	0.2 (2005)	7,244	0.38 (2004)	13,842
Denmark	1,801,669	0.2 (2006)	3,603	0.35 (2000)	6,370
Estonia	455,730	0.5 (2006)	2,278	0.72 (2004)	3,302
Finland	1,753,497	0.1 (2009)	1,753	0.32 (2000)	5,625
France	*20,608,570*	*0.1 (2006)*	*20,608*	*0.17 (2000)*	*35,21*
Germany	26,666,646	0.7 (2006)	186,666	1.45 (2000)	387,719
Greece	3,676,071	0.2 (2006)	7,352	0.34 (2000)	12,446
Hungary	3,472,528	0.3 (2000)	10,417	0.52 (2004)	18,018
Ireland	1,539,528	N/A (0.3)*	4,818	N/A (0.43)*	6,666
Italy	19,567,814	0.2 (2006)	39,136	0.33 (2000)	64,468
Latvia	724,906	0.7 (2007)	5,074	1.04 (2004)	7,545
Lithuania	1,063,308	0.4 (2008)	4,253	0.47 (2004))	4,951
Luxembourg	172,648	0.2 (2008)	345	1.64 (2000)	2,828
Malta	141,449	N/A (0.3)*	424	N/A (0.43)*	612
Netherlands	5,538,148	0.3 (2002)	16,614	0.43 (2000)	23,979
Poland	13,580,266	0.3 (2006)	40,741	0.34 (2004)	45,968
Portugal	3,582,038	N/A (0.3)*	10,746	0.27 (2007)	9,695
Romania	6,866,235	0.4 (2006)	27,465	0.47 (2004)	32,065
Slovakia	1,938,685	0.2 (2006)	3,877	0.39 (2004)	7,642
Slovenia	689,707	0.7 (2004)	4,828	0.92 (2004)	6,323
Spain	15,637,867	0.3 (2008)	46,914	0.4 (2000)*	61,868
Sweden	3,006,611	0.05 (2007)	1,503	0.1 (2000)	2,976
UK	20,882,796	0.3 (2006)	62,648	0.4 (2000)	83,043
EU-28	168,316,690	*0.3**	541,957	*0.43**	911,164

Source: [c] Platt et al (2013); [a] Prüss-Ustün et al (2013); [b] Vandepitte et al (2006) and authors' calculations.
N/A: Not available. * Median value

Estimate 1A of the number of female sex workers (542,000) is based on data collection for 24 EU countries throughout the 2000s (Prüss-Ustün et al, 2013). Authors used multilevel modeling and multivariate linear regression; they acknowledge the survey coverage for female sex workers was adjusted for injection drug use, which makes it a conservative estimate; we completed missing data with the median value of HIV prevalence in the EU (0.3 per cent).

Estimate 1B of the number of female sex workers (over 910,000) is based on data collection for 23 EU countries related either to 2000 or 2004 (Vandepitte et al, 2006), actually 24 when Portugal is added (Platt et al, 2013); by the same token, we completed missing data with the median value of HIV prevalence in the EU (0.43 per cent). Authors acknowledge these are 'only very rough estimates' and do not explain the estimation methods beyond the use of a multiplier, namely the ratio of adjusted HIV prevalent FSW upon HIV prevalent females times female population aged 15-49 for a given year.

In as much as sources and methods differ, we have no strong clue to decide whether Estimate 1A (over half a million) understates versus Estimate 1B (below one million) overstates the magnitude of female sex work. Hence, we test these estimates later on. Prostitution patterns did change throughout the 2000s and keep going throughout the Internet (Charpenel, 2016), although change may not being captured by HIV prevalence in the EU, which remains roughly stable since the early 2000s (Likatavicius & van de Laar, 2011), whereas data collection and HIV reporting improved over time (ECDC, 2014). The decline in numbers from early 2000s up to 2011 could be driven by a shift in risk behaviour towards safer sex

practices from prostitutes (UNAIDS, 2012) alongside with the extension of indoor prostitution. In contrast, the no use of condom may be due to the increasing share of migrants among (street) prostitutes. Last, legislation upon prostitution influence the supply side. In this respect, the ban on buying sex in Sweden (1999) harmed the supply side; conversely, the regulatory prostitution regime enacted in the Netherlands (2000) and Germany (2002) has promoted sex work; thereupon raising the number of prostitutes throughout EU during the 2000s.

4.2. Estimates from NGOs

An international NGO defending sex workers (TAMPEP, 2010) sent 600 standardised questionnaires to key organisations among its network in 2008, mostly NGOs and Health Services in direct contact with sex workers. It collected 380 responses that helped building up reports for 23 EU countries; Croatia, Cyprus, Ireland, Malta and Sweden are missing (See Table 3). Some answers regarding earnings suggest that the questions were misunderstood and estimates were not checked. Almost two thirds of sex workers in Europe work indoor. Twelve EU countries wherein the share of migrants among sex workers is above 50 per cent are net importers. Conversely, ten EU countries wherein the share of nationals among sex workers is above 50 per cent are most likely to be exporters. One third of migrants came from EU countries, Romania and Bulgaria being the most mentioned countries of origin. The distribution of sex workers is respectively 30 per cent and almost 70 per cent for nationals and migrants. Migrants are highly mobile and more vulnerable as regards working conditions and risks (including HIV as well as deportation); two thirds are prone to be exploited by third party (pimps and brothel managers), whereas the share is one third as for nationals. Hence, most sex workers especially migrants is trapped in forced labour.

In order to fill in the vacuum for the five missing countries from TAMPEP and do justice to other estimates, we collected the figures from the abolitionist Scelles foundation (Charpenel, 2013) and the UNODC (2014) that are recorded in Table 3.

Table 3. Female Sex Workers (FSW) in the EU circa 2010: Estimates 2A and 2B from NGOs

Country	Outdoor	Migrants	Number of FSW		Estimate 2A:	Estimate 2B:
		(TAMPEP)[a]		(Charpenel)[b, c]	(*maximin*)	(*minimax*)
Austria	15%	78%	27,000-30,000	5,500-10,000	10,000	27,000
Belgium	34%	60%	15,000-20,000	10,000-15,000	15,000	20,000
Bulgaria	33%	2%	6,000-10,000	8,000-10,000	10,000	10,000
Croatia	N/A	N/A	N/A	6,700	6,700	6,700
Cyprus	N/A	N/A	N/A	N/A	915	1,446
Czech Rep.	19%	41%	10,000-13,000	5,000-25,000	13,000	25,000
Denmark	25%	65%	5,560	5,500	5,500	5,500
Estonia	2%	5%	1,000-1,200	1,000	1,000	1,200
Finland	10%	69%	5,000-6,000	12,000-15,00	6,000	15,000
France	*61%*	*61%*	*18,000-30,000*	*18,000-20,000*	*20,000*	*30,000*
Germany	13%	65%	400,000	150,000-400,000	150,000	400,000
Greece	60%	73%	10,000	1,200-20,000	10,000	20,000
Hungary	40%	25%	10,000-15,000	8,000-10,000	10,000	15,000
Ireland	N/A	N/A	N/A	1,000	1,000	1,000
Italy	60%	90%	50,000	50,000-100,000	50,000	100,000
Latvia	40%	12%	2,000-3,000	15,000-20,000	3,000	20,000
Lithuania	57%	10%	1,250–1,550	N/A	1,550	1,550
Luxembourg	30%	92%	5,000	N/A	5,000	5,000
Malta	N/A	N/A	N/A	N/A	467	467
Netherlands	11%	60%	10,000-15,000	20,000-30,000	15,000	30,000
Poland	40%	34%	10,000	12,000	10,000	12,000
Portugal	45%	56%	9,700	28,000	9,700	28,000
Romania	64%	2%	2,500-3,800	2,000-23,000	3,800	23,000
Slovakia	73%	2%	7,500	N/A	7,500	7,500
Slovenia	2%	30%	1,500-3,000	N/A	1,500	3,000
Spain	46%	90%	6,000	300,000-400,000	300,000	400,000
Sweden	N/A	N/A	N/A	1,500	1,500	1,500
UK	23%	41%	58,000-80,000	80,000-100,000	80,000	80,000
EU-28	N/A	N/A	693,000-730,000	740,400-1,253,700	747,970	1,309,634

Source: [b] Charpenel (2013); [a] TAMPEP (2010); [c] UNODC (2014) and authors' calculations.

These figures come from miscellaneous sources (NGOs, the police, etc.) and no information is available as regards coverage and time period for data collection. We compiled all estimates whatever sources for 26 EU countries and completed the missing data for Cyprus and Malta with the median value of the sample. We designed Estimate 2A as the highest of the lowest figures (*maximin*) amounting to 748,000 prostitutes for EU-28, whereas Estimate 2B from the lowest of the highest figures (*minimax*) reaches 1,310,000 prostitutes.

4.3. Forced labour, sexual exploitation trafficking and prostitution

The ILO (2012), Eurostat (2013a) and UNODC (2014) provide fragmented information on the patterns of prostitution and its magnitude in the EU. Data available across countries cover the characteristics of victims and trafficking routes. Their main limitation is that recording depends on judicial and police effectiveness. Databases do not collect necessarily from the same source: neither UNODC nor Eurostat collect primary sources, whereas the ILO uses both primary and secondary sources.

4.3.1. Estimate of forced sexual labour trafficking from the ILO

The ILO (2009) designed from experts a list of 67 indicators related to trafficking with respect to recruitment, working conditions and coercion. The subset of indicators for sexual exploitation encapsulates very bad working conditions (including excessive working time and hazardous work), low or no salary (including wage manipulation) and no compliance with labour regulations (including the absence of contract signed and social protection). It leaves room for non-coerced prostitution (including casual activity) that should not be confused with sexual exploitation trafficking (Butcher, 2003).

The ILO (2012) computed a global estimate of forced labour for the 2002-2011 reference period from a capture-recapture investigation based on reported cases from different sources (research institutes, NGOs and the media). Forced sexual exploitation amounts to 270,000 female victims (98 per cent) and the average duration for sexual exploitation turnover is below 18 months. This Estimate 3A does not gauge the magnitude of overall prostitution (including non-coerced sex work) and provides no country distribution.

4.3.2. A Eurostat-UNODC Estimate of sexual exploitation trafficking in the EU

Eurostat (2013a) collected data on human beings trafficking over the period 2008-2010. It is acknowledged that the EU currently lacks reliable and comparable statistical information on trafficking in human beings. This is mainly due to the differences between the Member States in the criminal codes, in the reporting and monitoring systems as well as for the rates of reporting cases to the police, NGOs and other entities. In the year 2010, 24 EU Member States reported a total number of 9,528 identified and presumed victims of trafficking, whereas the total number of identified victims is 5,535. Data are broken down between other forms of forced labour and sexual exploitation, which amounts to the largest share of victims (62 per cent) that are predominantly female (96 per cent). Sexual exploitation includes all forms of forced prostitution whether indoor or outdoor. Most victims detected in EU Member States are citizens from Romania and Bulgaria. Suspected traffickers for sexual exploitation represent approximately 84 per cent of the total number of suspected traffickers over the three reference years.

UNODC (2014) provides some similar patterns for the period 2010- 2012. Among the detected victims trafficked to EU countries, sexual exploitation is prevalent (66.25 per cent). Focusing on economic gains involved in exploiting people, domestically or abroad and according to the gap with the country of origin, the richer the destination country, the higher the profits from sexual exploitation. The price of women depends on the expected profit and the perceived risk associated with carrying out the crime, as well as the demand for sex services in the destination country. In Central Europe and the Balkans, domestic trafficking accounts for about 80 per cent of the detected victims in accordance with previous findings (TAMPEP, 2010).

Table 4 records data for victims of sexual exploitation in 2010 from Eurostat (2013a) and UNODC (2014). With regard to consistency, we first checked both series of data upon 20 EU countries, out of which the data for 18 EU countries did match, whereas they did not match for Spain. We computed the missing data thanks to the average share of victims according to the UNODC series. At last, we completed the series for all 28 EU countries, using Eurostat series when available and UNODC otherwise.

Table 4. Victims of sexual exploitation trafficking (VSET) and prevalence in the EU as of 2010

EU Member States	Number of inhabitants (100,000)	Compliance with Palermo Protocol	Number of VSET as of 2010[a]	Average number of VSET over period[b]	Number of VSET as of 2010[a or b]	Number of VSET/100,000 inhabitants	Estimate 3B Prostitution extrapolated from VSET (x20x7)
Austria	83,751	Tier 1	N/A	49	49	0.585063	6,860
Belgium	110,006	Tier 1	43	N/A	43	0.390886	6,020
Bulgaria	73,694	Tier 2	366	406	366	4.966462	51,240
Croatia	42,898	Tier 2	2	6	4	0.093243	560
Cyprus	8,397	Tier 2	24	24	24	2.85799	3,360
Czech Rep.	104,867	Tier 1	3 (15)	36	45	0.429114	6,300
Denmark	55,606	Tier 1	50	70	50	0.899179	7,000
Estonia	13,296	Tier 2	N/A	16	20	1.504144	2,800
Finland	53,752	Tier 1	26	20	26	0.483696	3,640
France	*649,787*	*Tier 1*	*726*	*702*	*726*	*1.117289*	*101,640*
Germany	817,516	Tier 1	610	419	610	0.746163	85,400
Greece	111,233	Tier 2	N/A	69	71	0.638295	9,940
Hungary	99,857	Tier 2	5	68	48	0.480686	6,720
Ireland	45,708	Tier 1	56	44	56	1.225147	7,840
Italy	593,646	Tier 1	N/A	61	57	0.096017	7,980
Latvia	20,746	*Tier 2*	4	4	4	0.192808	560
Lithuania	30,525	*Tier 2*	N/A	15	13	0.425868	1,820
Luxembourg	5,118	Tier 1	6	N/A	6	1.172241	840
Malta	4,149	Tier 2	4	N/A	4	0.963881	560
Netherlands	166,558	Tier 1	749	900	749	4.496932	104,860
Poland	380,622	Tier 1	N/A	169	169	0.444004	23,660
Portugal	105,727	Tier 2	N/A	10	17	0.160791	2,380
Romania	201,990	Tier 2	482	520	482	2.38625	67,480
Slovakia	53,924	Tier 1	21	13	21	0.389434	2,940
Slovenia	20,501	Tier 1	30	22	30	1.46328	4,200
Spain	466,671	Tier 1	1,605	207	1,605	3.439248	224,700
Sweden	9,41557	Tier 1	19	34	19	0.201793	2,660
UK	630,225	Tier 1	170	173	170	0.269745	23,800
EU-28	5,044,944		4,981	4,057	5,484	1.161416	767,760

[a] Eurostat; [b] UNODC

Source: Authors' compilation from Eurostat (2013a) and UNODC (2014).

We used the Palermo Protocol[5] classification as a loose proxy for law enforcement. Unfortunately, large countries such as Italy and Poland did not provide data although they belong to the Tier 1. In the EU-28, the average number of victims of sexual exploitation is over one (1.16) for a thousand hundred inhabitants as of 2010. Bulgaria, Estonia, and Romania as well as Cyprus do not fully comply with the Palermo Protocol and stand above average; such is also the case for Slovenia that is compliant. Fully compliant countries from Western and Southern Europe such as Ireland, Luxembourg, the Netherlands and Spain also stand above EU average and France is pretty close to average. According to UNODC (2010) the detection ratio is one in 20 victims of sexual exploitation trafficking and one sex worker in seven would be a trafficking victim[6]. If we use these figures, there would be a flow 100,000 victims for

[5] The United Nations Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, coined as the Palermo Protocol (2000) entered in force in 2003, setting the minimum standards for the elimination of trafficking of human beings in terms of prosecuting traffickers and supporting victims. The United Nations Office on Drugs and Crime (UNODC) is in charge of the implementation and records the victims (UNODC, 2014). The Palermo Protocol states that exploitation of prostitution and trafficking cannot be separated, albeit it does not apply to non-coerced prostitution. Tier 1 gathers the 17 EU Member States that fully comply with the minimum standards. The remaining 11 EU Member States that do not fully comply belong to Tier 2, which gathers countries from all three-prostitution policy regimes.

[6] The multiplier of 20 for every victim detected comes from a pilot survey tested in Spain, Italy and Finland in the early 2000s. The share of victims among sex workers remains unexplained.

sexual exploitation in the EU 28 in 2010 (5,000 recorded victims times 20) and over 750,000 sex workers. However, UNODC calculates a stock from a flow, ignoring how large is the flow that leaves the market (replacement) or just moves across countries. If net inflow increases, the stock of prostitutes may be rising over time and this should lower prices, unless there is an increase in demand.
We apply the multiplier (times 20 times seven) to the number of victims of sexual exploitation in each country and extrapolate the magnitude of prostitution (see last column in table 4): we come up with our Estimate 3B, an overall figure of 767,760 prostitutes for EU-28. Some results are obviously odd as regards country distribution: for instance, Germany counts less prostitutes than the Netherlands albeit five times larger a population. Hence, one may be very skeptical as for this proxy to gauge accurately prostitution at country level (Savona and Stefanizzi, 2007).

5. Testing the estimates of prostitution

We test our five Estimates thanks to an OLS regression based on cross-section data for 28 EU countries as of year 2010. The aim of the test is to identify the most relevant estimates for prostitution with the following model:

$$Y_i = \alpha + \beta_1 Prostitution_i + \beta_2 Xi + \varepsilon_i \quad (1)$$

Y_i represents the various estimates for sex work in country *i*: Estimates 1A and 1B from HIV prevalence, Estimates 2A and 2B from NGOs and Estimate 3B from extrapolated number of victims of sexual exploitation. $Prostitution_i$ is our dummy variable indicating whether prostitution is legal or not. *X* is the vector of explanatory variables and ε_i is the error term.
Our theoretical background inspires from the semi-coerced prostitution model (Lee and Persson, 2015) and one main assumption is that policy regimes (criminalisation, abolition and regulation) shape the magnitude of prostitution. As for $Prostitution_i$, we test separately the legal status for prostitution and for brothels in country *i* with two dummy variables. First, whether prostitution is legal or not, being 1 in this case and 0 otherwise; second, whether or not third-party involvement (such as brothel manager or pimp) is legal, being 1 whenever brothels are allowed and 0 otherwise. In both cases, the sign is expected to be positive.
We impute a number of *explanatory country* variables X_i[7] . *GDP per capita* takes into account the level of economic development that should influence the presence of a high number of sex workers. We include *Total adult population* to take into account the scale effect and we disentangle *Adult female population* on the supply-side from *Adult male population* on the demand-side. Focusing on the supply side, *International female migrant stock per 100 thousand of population* takes into account the importance of female migration in Western and Southern European countries; its sign is expected to be positive. *Unemployment rate of females below 25* tackles the assumption that the higher is unemployment, the more women may become sex workers; its sign is expected to be negative. *Rate of female part-time workers* tackles the assumption that prostitution may be a part-time job; its sign is expected to be negative.
As we use a cross-section dataset, we cannot control for unobserved country heterogeneity by including country fixed effects. The variables *Legal prostitution* and *Legal brothels*, *Adult female population* and *Adult male population* as well as *Total adult population* were tested separately to avoid multicollinearity. All continuous variables were taken in logarithms.
Table 5 records the results we comment hereafter.

GDP per capita is only significant but negative for Estimates 1A and 1B, which suggests that poorer countries tend to have more prostitutes, which may run against the intuition that higher GDP should attract more prostitutes (especially migrants).
On the supply-side, *Adult female population* (aged 15-64) is always very significant ($p<0.1$) and positive for all Estimates, making sure that prostitutes are overwhelmingly women.
Legal brothels is significant for Estimates 1A, 1B, 2B and 3B ($p<0.5$); it proves always positive, in line with the results of existing literature (Cho et al, 2013; Jakobsson and Kotsadam, 2013). However, it is

[7] In order to design the best models we run numerous regressions with several different variables such as the size of households, urbanisation, Internet use, earnings, educational attainment, status in employment and the rate of activity for females. We first included *Control of corruption* and *Tier* for country governance and compliance with the Palermo protocol, as well as $Sub\text{-}region_i$, the divide between rich Western and Southern Europe and poorer countries from Eastern Europe and the Balkans capturing the imbalance between net sex importers and net sex exporters. Eventually, we dropped these variables, which proved insignificant.

not the case for Estimate 2A, wherein which *Legal prostitution* is significant (p<0.5) and positive, as it is also for Estimate 2B.

Table 5. Testing the estimates with the OLS model

Variables	Estimate 1A HIV preval.	Estimate 1B HIV preval.	Estimate 2A *Maximin*	Estimate 2B *Minimax*	Estimate 3B Victims
Number of prostitutes[a]	542,000	911,000	748,000	1,310,000	768,000
GDP per capita	**-0.849*** **	**-0.876*** **	0.336	0.054	-0.115
Adult female population	**1.032*** **				**0.572*** **
Legal brothels	**0.571** **	**0.548*** **	0.725	**1.095** **	**1.327** **
Legal prostitution			**0.742** **	**0.836***	0.671
Female migrant stock	**0.412*** **	**0.407*** **	0.216	0.234	**-0.635***
Unemployment young females	**-0.038*** **	**-0.036*** **	-0.000	-0.010	
Part-time female workers	-0.006	-0.005	**-0.024***	**-0.025***	**0.021***
Adult male population		**1.021*** **	**0.884*** **	**0.907*** **	
Constant	11.357***	12.322***	0.716	3.856	12.191***
Observations	28	28	28	28	28
F-test (P<0.001)	0.0000	0.0000	0.0000	0.0000	0.0000
R-squared	0.931	0.936	0.816	0.792	0.747

Source: Authors. [a]: rounded figures. Robust standard errors are omitted. *** p<0.01, ** p<0.05, * p<0.1.

International female migrant stock per 100,000 of population is very significant (p<0.1) for all models regarding Estimates 1A and 1B; it is positive for all Estimates save Estimate 3B.

Unemployment rate of females below 25 is only significant for all models regarding Estimates 1A and 1B; it proves negative for all other Estimates, suggesting that unemployment does not drive prostitution.

Rate of female part-time workers is weakly significant (p<0.01) or insignificant and proves negative for all Estimates (save 3B), suggesting that prostitution is a full-time job.

On the demand-side, *Adult male population* (aged 15-64) is always very significant (p<0.01) and positive for all Estimates, making sure that customers are men.

As for the scale effect, *Total adult population* is always very significant (p<0.01) and positive for all Estimates, in line with the results of Cho et al (2013).

According to correlation coefficient and the number of significant variables, the ranking of Estimates for prostitution from most to least relevant is the following: 1B, 1A, 2B, 2A and 3B.

Unlike Cho et al (2013) and Jakobsson and Kotsadam (2013) using sex trafficking as a proxy for prostitution, we find this proxy provides the less relevant estimate (3B) for prostitution in the EU. Conversely, Estimates 1B and 1A from HIV prevalence prove most relevant. We come up with the same conclusions as for the ordered probit (Table A2 and Table A3 in the Appendix).

6. Prostitution and National Accounts adjustment

We first compile National Accounts figures for illegal production (including sex work) and prostitution itself as of 2010. Second, we apply the lower bound Estimate (1A) from both the supply side and the demand side according to prices in order to gauge turnover and revenue. Last, we check this Estimate against National Accounts figures for prostitution, which seems to match.

6.1. The Non-Observed Economy (NOE) and illegal prostitution

In search for exhaustiveness dating back to SNA 1993 and ESA 1995 (Eurostat, 2013b), Eurostat (2012b) developed a new typology of the Non Observed Economy (NOE) including seven components (N1 to N7), which can be aggregated for purpose of parsimony into four or five categories of unrecorded activities (Gyomai and Ven, 2014). The focus is upon illegal production (N2), which gathers all prohibited activities that are neither registered nor licensed and it encapsulates illegal prostitution as well as trafficking drug and smuggled or regulated goods (tobacco, alcohol, firearms, etc.).

Table 6 reports the figures for N2 as well as the share of prostitution we compiled from the supply side and the demand side, the latter being recorded in *Eurostat nama files* as CP122 in the households' final consumption expenditure by consumption purpose (COICOP). We included data for Germany from Kazemier and Rensam (2015) and we used adjusted data for France from Prostcost (2015). We calculated that N2 could amount to 0.49 percent of EU-28 GDP in 2010. Prostitution from the supply

side as of (23 EU countries plus Germany and France) covers a 76.7 per cent share of EU-28 GDP and would account for a 0.168 per cent mean. Prostitution from the demand side (19 EU countries plus France) covers only a 50.3 per cent share of EU-28 GDP and amount to a 0.178 per cent mean.

Table 6. Illegal production and prostitution contributing to GDP of EU-28 as of 2010

EU Member States	2010 GDP (€ billion)	N2 as a % of GDP	Prostitution from the supply-side		Prostitution from the demand-side	
			As a % of GDP	€ million	As a % of GDP	€ million
Austria	284	0.16	0.08	225	0.179	508.5
Belgium	353	0.37	0.09	317.7	N/A	N/A
Bulgaria	36	0.21,	0.09	32.4	0.044	16.0
Croatia	46	0.7	0.27	124.2	N/A	N/A
Cyprus	17	1.09	0.31	52.7	0.33	56.2
Czech Rep.	145	0.53	0.09	130.5	0.177	257.9
Denmark	234	0.14	0.05	11.7	N/A	N/A
Estonia	15	0.52	0.03	4.1	0.027	4.1
Finland	180	0.1	0.03	54	0.053	96.0
France	1,933	N/A *(0.21)*	N/A *(0.11)*	N/A *(2,170)*	N/A *(0.14)*	N/A *(2,712.5)*
Germany	2,499	0.1 (0.23)	N/A (0.13)	N/A (3,248.7)	N/A	N/A
Greece	230	N/A	N/A	N/A	0.19	437.0
Hungary	98	0.85	0,49	480.2	0.641	628.6
Ireland	156	0.73	0.036	56.16	0.038	59.5
Italy	1,549	1	0.22	340.8	N/A	N/A
Latvia	18	0.9	0.088	15.84	0.103	18.6
Lithuania	27	N/A	N/A	N/A	0.107	29
Luxembourg	42	0.23	0.21	88.2	0.192	81
Malta	6	0.30	0.14	9	N/A	N/A
Netherlands	591	0.38	0.085	502.35	0.192	1139
Poland	354	0.81	0.21	74.34	N/A	N/A
Portugal	173	0.35	0.29	501.7	0.367	635.4
Romania	122	0.46	0.06	73.2	0.071	86.7
Slovakia	66	N/A	N/A	N/A	0.074	49
Slovenia	36	0,36	0.13	46.8	0.225	81.3
Spain	1,063	0.87	0.35	3,720.5	N/A	N/A
Sweden	347	0.14	0.017	58.99	0.017	58.8
UK	1,697	0.58	0.3	5,939.5	0.383	6,504.7
EU-28	12,314	0.491 € 60.457,3	0.168 (25 countries)	€ 21,336	0.178 (20 countries)	€ 21,857.35

Source: Brennan (2014), Brooks-Gordon (2015), Casey (2014), Eurostat (2012b), FSO (2014), INE (2014), NAI (2014), Walton (2014). We checked figures with most the National Accounts Division of EU-28 Statistics Offices.

6.2. Back to supply and demand for checking estimates in the EU and in France

We inspire from Kazemier et al (2013) to estimate prostitution as a whole, in as much as there are no available country data to compile the various segments of prostitution, whether indoor or outdoor. We assume that all prostitutes are subjected to pimps, because we ignore the share of non-coerced prostitution throughout the EU, which might be one third on average (TAMPEP, 2010).

The turnover of the prostitution industry (*P*) or receipt is the product of the number of prostitutes (*sw*), the number of customers per prostitute (*cust*) and the average price per client (*p*):

$$P = sw \times cust \times p \quad (2)$$

Turnover encapsulates domestic consumption (*C*) and exports (*E*), sexual services to customers from abroad:

$$P = C + E \quad (3)$$

The value added (*VA*) of the prostitution industry is the sum of the domestic consumption (*C*) and exports minus imports (*M*) minus intermediate consumption (*IC*). Imports are the sexual services provided by foreign prostitutes resident in the country plus the consumption of sexual services brought abroad by

residents. Intermediate consumption are the expenses of the prostitutes themselves (clothing, condoms and travel expenses) we assume to be 20 percent of turnover:

$$VA = C + E - M - IC \quad (4)$$

Gross earnings of the prostitutes is the turnover or receipt minus intermediate consumption, namely the value added (*VA*). Net earnings or income (*NI*) is gross earnings minus the share of the managers or pimps (the rent, rooms and brothels). We assume that prostitutes pay half the value added (*VA*) to the managers or pimps:

$$NI = (0.5)\ VA \quad (5)$$

Using the 0.168 per cent mean share of prostitution in GDP, overall share in EU-28 GDP would amount to € 20,687.52 million. Gross sales turnover (including intermediate consumption) would then reach € 21,857.35 million as of a 0.178 per cent mean share of prostitution in GDP.

We assume that the average price per client is € 38 (See Box 1 in the Appendix) and the average number of clients (or sex transactions) per prostitute is within the range of 1,040-1,300 over 260 working days throughout the year[8].

Hence, we divide Gross sales turnover (€21,857.35 million) with 1,040-1,300 clients that pay € 38 and we come up with a range of 442,456-553,070 prostitutes, a figure that would match with Estimate 1A (542,000).

Assuming that the pimp retains 50 per cent of total earnings (TAMPEP, 2010; Kazemier et al, 2013), each of the 542,000 prostitutes would get average net earnings per annum up to half € 40,237 (€ 20,163) and €1,680 per month. An alternative assumption is that the pimp retains 70 per cent of total earnings (Kara, 2009 and 2011, ILO, 2012). Each of the 542,000 prostitutes would get average net earnings per annum up to € 40,237 (0.3 = € 12,071.1) and € 1,005.92 per month. For both assumptions, net earnings are above minimum wages and average annual earnings for all 10 countries of Eastern and Central Europe as well as for Cyprus, Malta and Portugal (*Eurostat_earnings*); hence, there is a premium for prostitution as well as for migration towards richer European countries[9].

On the demand side, the adult male EU population is 168 million. Dividing the € 21,857.35 million total expenditure customers spend on prostitution for an average price of € 38, we come up with 575.193 million sexual services or clients. A crude assumption would be that a 6.6 per cent share of the adult male EU population (168 million) pays for sex at least once a week, a monthly expenditure of € 152. Indeed, the share of adult male customers seems quite large, according to the aforementioned figures from COICOP and surveys on sexual behavior (Table 1).

As for France, the gross turnover of prostitution (€ 3.170 billion) is based on the assumption of an average gain of € 85,700 per annum for each of 37,000 full-time prostitutes, regardless they work indoor, outdoor or via the Internet (Prostcost, 2015). Excluding 20 per cent for intermediate consumption, net sales amount to € 68,560; assuming that the pimp retains 50 per cent of the net turnover, the average net income of each prostitute is € 34,280 per annum. This makes it a net average monthly income of € 2,856.66, namely twice the amount of the gross minimum wage (€ 1,343.77). Including intermediate consumption in the pimps' share, namely 70 per cent (Kara, 2011), each prostitute would receive € 26,250 per annum and her monthly average net income (€ 2,187.5) remains well above gross minimum wage. Hence, there is a premium for prostitution, a very lucrative business for pimps in the first place.

One can be skeptical about the average gain of € 85,700 that is based on an average price of € 66, which does not match the demand. For such a price, 3.85 per cent or nearly one million of the 24 million men should pay a prostitute every week, a monthly expense of € 264 that seems unlikely (see Table A4 in the Appendix). If the average price is only € 44, the average gain of € 85,700 is the outcome of a monthly

[8] As for the UK wherein which the prostitution issue is well documented (Adair and Nezhyvenko, 2017), figures prove controversial. On the one hand, Abramsky and Drew (2014) estimate the number of clients per prostitute as four to six a day (20, 25 and 30 a week during 52 weeks per annum), hence an average of 1,300 (1,040-1,560) clients per annum. On the other hand, Kara (2011) assumes eight to ten sex encounters a day in brothel and street prostitution; hence, an average of 2,340 (2080 – 2600) clients per annum. Assumptions do not match either across countries: Kazemier et al (2013) assume that prostitutes work 40 weeks a year in the Netherlands, whereas Kara (2011) assumes 52 weeks a year in the UK.

[9] Total number of sex workers in the UK would amount to 72,800 in 2009 (Brooks-Gordon et al, 2015). Total gross annual income earned from sex work is estimated to be € 7.126 billion and € 1.722 billion as for net income (24.16% of gross income); average net income per prostitute reaching € 1,971, almost the twice minimum wage (€ 1,076.46 in January 2010).

expense of € 176 from 1.385 million weekly customers, or 5.7 per cent, a very large demand pattern indeed (see Table A4 in the Appendix). One has to combine realistic parameters for both prices and demand with prostitution figures to come up with a consistent estimate. Of course, if figures are higher for prostitutes (lower for customers), overall and individual gain will decline.

6.3. The legal and tax issues of prostitution in France and the EU

Although not an occupation in the absence of a legal job status, prostitution is subject to registration and tax payment as any other paid activity. Registration applies only possible to French or foreign prostitutes in a regular situation: either with the salaried system if they declare working in a massage parlor, a bar, or else; more likely with the self-employment regime under 'a trade activity for personal services' or 'craft personal maintenance' according to the NAF. In both cases, it is indoor prostitution, all the less visible and more numerous that operates via the Internet. NGOs assess that migrant sex workers account for 60 to 95 per cent of prostitution, a share consistent with that of 91 per cent in 2010 from the police (Prostcost, 2015). In this case, it is rather outdoor prostitution, that is more visible but less numerous. Due to rapid turnover, the share of foreign prostitutes who are in an irregular situation remains unknown.

Prostcost (2015) contends that about 80 percent of prostitutes are dependent on pimps and networks, a figure uneasy to control. According to our range of 26,160-38,200 prostituted persons, the category of self-employed would stand between 5,230 and 7,640, with an intermediate order of magnitude of 6,200 prostitutes. This category of self-employed is more likely to pay income tax: € 7,160 per prostitute, and € 44,392 million for 6,200 prostitutes. It remains unknown to what extent it is actually paid and the same comment applies to social contributions.

Based on the 31,000 prostitutes intermediate estimate, fraud upon income tax (177.568 million), VAT and social security contributions (€ 537 million) would therefore concern the gains from 24,800 non-self-employed prostitutes and their pimps (Prostcost, 2015).

6.4. Prostitution and informal employment in France and in the EU: a loose proxy

Female prostitutes should be included in the total number of women employed in informal employment, whereby the absence of an indefinite term contract is a loose proxy. Prostitution is not registered in the International Standard Classification of Occupations (ISCO) designed by the ILO: hence, female sex workers in France are not registered as employees and they come under the category of self-employed workers, although most of them are not self-employed. Among 12.161 million women employed in France in 2010, 2.615 million have no indefinite term contract, namely one in five women and the share is the same in the EU-28. According to Table 7, female prostitutes account for estimates within the range of 0.1-0.4 per cent of employed women without an indefinite term contract.

Table 7. Estimates of female prostitutes as a share of female employees without an indefinite term contract

Estimates	1A (HIV prev.)	1B (HIV prev.)	2B (Victims)	3A (*maximin*)	3B (*minimax*)
France	21 000	41 000	102,000	20,000	30,000
EU-28	542 000	976 000	768,000	748,000	1,310,000
Share of female prostitutes among female employees without an indefinite term contract					
France	0.008%	0.016%	0.039%	0.008%	0.011%
EU-28	0.024%	0.043%	0.033%	0.033%	0.06%

Source: Authors' compilation from Eurostat (2011). Rounded percentages.

Conclusion

Data sources on prostitution are scant and rather inconsistent, especially as regards country distribution. To our best knowledge, the five EU-28 estimates we have compiled are the first ones in the economic literature on prostitution. Our sample is small (28 countries) albeit consistent because EU membership is binding with respect to budget issues and the requested harmonisation of national accounts. Moreover, the EU is an open area for both labour and capital mobility, which makes cross-border trafficking easy. Recalling that the share of countries wherein brothels are legal is close to one fourth of total EU-28 population, our main finding for all models is that the regulation of legal brothels positively correlates with four Estimates; our results are in line with those of the existing literature.

We also suggest that there is a premium for prostitution, despite some mixed evidence that the upper end segment of the prostitution market may pull prices; conversely, the lower end may be far less profitable. We bring in value added, thanks to the testing of variables related to the supply side (adult females), the

demand side (adult males) and the scale effect (adult population), which all prove relevant to the number of sex workers throughout EU-28.

Thanks to an OLS test, we checked these estimates according to supply and demand, in order to avoid major inconsistencies. We acknowledge that adjusted national accounts may not capture the full magnitude of prostitution, whereas assumptions regarding both customers and prices are disputable. However, we can assess a few plausible figures for prostitution in the EU-28 as follows. Estimate 1A from HIV prevalence (542,000 prostitutes) is consistent with national accounts, with respect to the demand side and the supply side; it is likely to be a lower bound for prostitution in the EU-28 as of 2010. Although it is less robust and consistent with national accounts, Estimate 2A (748,000 prostitutes) is likely to be a middle bound for prostitution, whereas Estimate 1B from HIV prevalence (911,170) is quite robust and likely to stand as an upper bound. Estimate 3B from victims of sexual exploitation (768,000 prostitutes) is lacking both robustness and consistency. Estimate 2B (1,310,000 prostitutes) is an unreliable upper bound for prostitution in the EU-28 as of 2010, whereby national accounts would quite unlikely underestimate prostitution by factor 2.4. One additional main finding is that there is premium on earnings for prostitution according to the average turnover and revenue that match the lower bound estimate.

There are limitations in our study, which a better data collection should overcome, paving the way for research avenues. First, the scope is restricted to female sex workers; including male and transgender prostitutes could possibly enhance the overall figures by ten per cent. Second, in the absence of a reliable database for prostitution, we used cross-section analysis that does not address the structural dynamics of an expanding indoor prostitution thanks to the Internet together with a rising share of migrants among outdoor sex workers. Third, there is no robust variable on the demand side such as a proxy for customers, which deserves dedicated surveys upon sexual behavior as well as EU national accounts data for prostitution expenditure. Last, there is little evidence regarding either the share of coerced prostitution (sexual exploitation) *vs.* non-coerced prostitution, or the share of salaried *vs.* self-employed prostitutes that also calls for in-depth investigations.

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Appendix

Box 1. Prices for sex trade and earnings premium

We compiled piecemeal data for 21 EU countries (Czech Rep., France, Luxembourg, Malta, Slovakia, Slovenia and Sweden are missing) from Havoscope Black Market (www.havocscope.com) and the Wiki Sex Guide (www.wikisexguide.com). Prices for street prostitution range from € 13 up to € 63 and € 27 is the average price for twelve countries. Regarding brothels, the range is € 30-67, with an average price of € 45 (eight countries) that stands over one and a half times higher than street prostitution. Escort girls would charge from € 37 up to € 225 in five countries, with an average price of € 125 that stands more than four and a half times as high as that of street prostitution. Weighing outdoor (0.4) and indoor (0.6) prostitution (TAMPEP, 2010), average price would amount to € 38 as of 2010, which is rather conservative a figure. Admittedly, using average price is disputable. In as much as some prices were missing, we could not weight for various countries.

Assuming that these are (net) hourly prices and that prostitutes earn half of the average price, whereas the other half is the pimp's cut, we may compare with median gross hourly earnings for EU-27 employees in 2010 (Eurostat earn_ses_pub2i), namely € 11.8. There is a premium as for earnings from street prostitution (€ 13.5), brothels (€ 22.5) and escorts (€ 62.5).

Source: Authors from Havoscope Black Market and Wiki Sex Guide

Table A1. HIV prevalence among female sex workers in the 2000s (20 EU countries)

Country	Source	Year	Sample size	HIV (%) prevalence estimate
Austria[a]	STI clinics	2002	1,184	2.0
Belgium[a]	N/A	2008	1,016	0.3
Belgium[b]	Routine programme	2011	901	0.2
Bulgaria[a]	Street/off-street	2008	874	0.6
Bulgaria[b]	IBBS	2011	700	0.3
Croatia[a]	NGO	2003–2005	43	2.0
Czech Rep.[a]	Street	2000	797	0.7
Czech Rep.[b]	NGO	2010	2,566	0.1
Estonia[a]	Street/off-street (RDS)	2005–2006	227	8.0
Estonia[b]	IBBS Talinn	2011	210	6.2
France[a]	Chinese sex workers	2008	46	0.0
France[b]	*BBS*	*2011*	*166*	*1.2*
Germany[a, b]	STI clinics	2010–2011	3,380	0.2
Greece[a]	STI clinic (migrants)	2005	299	0.0
Hungary[a]	Mobile clinic	2006	500	0.0
Italy[b]	ECDC	2001	121	2.5
Italy[a]	Street SWs at STI clinics	2008	558	7.0
Latvia[a]	N/A	2004	93	18.0
Latvia[b]	IBBS	2011	117	22.2
Lithuania[a]	Street/AIDS centre	2007	101	0.0
Lithuania[b]	IBBS	2010	46	6.7
Netherlands[a]	Street and off street	2005	1,018	3.8
Poland[a]	Clinic and community	2005	650	1.0
Portugal[a]	Street (migrants)	2000–2001	96	14.0
Portugal[b]	Behavioural Survey	2010	176	7.9
Romania[a]	Street	2006	204	1.0
Romania[b]	Time location sample	2010	299	1.0
Spain[a]	Street (migrants)	2004	3,149	3.0
Spain[b]	20 urban clinics	2010	1,141	0.5
Sweden[a, b]	Prison	2006–2007	45	2.2
UK[b]	London outreach clinic	2006	120	5.0
UK[a]	Street/off-street (migrants)	2009	268	1.0

Note: (I)BBS: (Integrated) Bio-Behavioural Survey; RDS: Respondent Driven Sampling; ECDC: European Centre for Disease Prevention and Control. The sample includes 14-20 EU countries and 9,646-14,548 female sex workers. Dates span from 2001 up to 2011. Country sample prove sometimes too small (below one hundred individuals) and biased with respect to specific categories (street prostitution) or location (capital city or prison) that may overestimate HIV among sex workers; conversely, restrictive health policies towards migrants may drive underestimation. [a] (Platt et al, 2013). [b] (Reeves et al, 2017).

Source: Authors from Platt et al (2013) and Reeves et al (2017).

Table A2. Ordered probit model

	Estimate 1A	**Estimate 1B**	**Estimate 2B**	**Estimate 2A**	**Estimate 3B**
Variables	HIV preval.	HIV preval.	*Maximin*	*Minimax*	Victims.
GDP per capita	**-0.000*** **	**-0.000*** **	0.000	0.000	-0.000
Legal brothels	**1.919*** **	**5.254** **	**2.604*** **	**1.373** **	1.174
Female population15-64	0.001	-0.001	-0.000	0.001	-0.003
Female migrant stock	**0.000*** **	**0.000*** **	-0.000	-0.000	-0.000
Unemployment young females	**-0.076*** **	**-0.148*** **	0.004	0.010	**-0.061** *
Part-time female workers	-0.005	0.011	**-0.039*** **	**-0.025** **	-0.007
Constant cut1	-4.105***	-11.875***	-1.150	-0.853	-2.710**
Constant cut2	-2.874**	-6.979***	-0.319	-0.110	-1.894
Constant cut3	-1.771	-5.444**	0.581	0.692	-1.125
Observations	28	28	28	28	28

Source: Authors. Robust standard errors are omitted. *** p<0.01, ** p<0.05, * p<0.1

Table A3. Distribution of the number of prostitutes per 100,000 EU female workers across countries (2010)

Estimate 1A HIV preval.		**Estimate 1B** HIV preval.		**Estimate 2B** *Maximin*		**Estimate 2A** *Minimax*		**Estimate 3B** Victims	
Quartile 1		Quartile 1		Quartile 1		Quartile 1		Quartile 1	
Slovenia	12,7	Latvia	27,6	Spain	55,9	Spain	42	Bulgaria	39,5
Latvia	11,5	Slovenia	25,4	Latvia	45,4	Croatia	12	Spain	31,4
Germany	11,4	Germany	23,6	Germany	24,5	Germany	9,18	Netherlands	30,8
Romania	10	Romania	21,6	Greece	16,5	Malta	8,81	Romania	24,6
Austria	8,4	Estonia	18,7	Austria	16	Belgium	8,27	Cyprus	22,1
Estonia	8,13	Austria	16	Portugal	15	Greece	8,26	Slovenia	11
Malta	8	Poland	13,6	Finland	13,8	Slovakia	8,01	Malta	10,6
Quartile 2		Quartile 2		Quartile 2		Quartile 2		Quartile 2	
Poland	7,05	Malta	13,3	Czech Rep.	13,6	Bulgaria	7,72	Estonia	10
Lithuania	6,64	Hungary	13,2	***EU-28***	13,5	***EU-28***	7,71	Ireland	9,91
Spain	6,56	Croatia	13	Italy	13,3	Czech Rep.	7,09	Luxembourg	9,44
Hungary	6,5	Lithuania	12,9	Croatia	12	Latvia	6,82	*France*	9
Ireland	6,09	Bulgaria	12,3	Belgium	11	Italy	6,64	Greece	8,21
Greece	6,07	Greece	12,1	Cyprus	*9,51*	UK	6,56	***EU-28***	7,93
Cyprus	6	Spain	10,9	Hungary	9,36	Hungary	6,24	Denmark	5,72
Bulgaria	5,79	Cyprus	10	Malta	8,81	Cyprus	*6,01*	Germany	5,22
Quartile 3		Quartile 3		Quartile 3		Quartile 3		Quartile 3	
Portugal	5,76	***EU-28***	10	Netherlands	8,81	Austria	5,94	Hungary	4,19
EU-28	5,59	Ireland	*9,73*	Romania	8,39	Luxembourg	5,61	Poland	4,09
Italy	5,2	Portugal	*9,61*	Slovakia	8,01	Finland	5,54	Austria	4
Croatia	5,17	Netherlands	9,35	Slovenia	7,87	Portugal	5,2	Czech Rep.	3,43
UK	5,14	Slovakia	8,18	Bulgaria	7,72	Denmark	4,49	Finland	3,36
Netherlands	4,88	UK	7,88	UK	6,56	Netherlands	4,41	Belgium	3,32
Slovakia	4,14	Czech Rep.	7,86	Luxembourg	5,61	Slovenia	3,94	Slovakia	3,14
Quartile 4		Quartile 4		Quartile 4		Quartile 4		Quartile 4	
Belgium	3,97	Belgium	7,47	Denmark	4,49	Estonia	3,57	Lithuania	2,84
Czech Rep.	3,95	Luxembourg	6,4	Estonia	4,28	Lithuania	2,42	UK	1,95
Luxembourg	3,88	Denmark	5,74	*France*	2,66	*France*	1,77	Sweden	1,33
Denmark	2,94	Finland	4,75	Lithuania	2,42	Poland	1,73	Portugal	1,28
France	1,82	*France*	3,41	Poland	2,08	Romania	1,39	Latvia	1,27
Finland	1,62	Sweden	1,39	Ireland	1,26	Ireland	1,26	Italy	1,06
Sweden	0,00075	Italy	1,03	Sweden	0,747	Sweden	0,747	Croatia	1
5th widest ratio	12.7/ 0.747	4th widest ratio	27.6/ 1.03	1st widest ratio	55.9/ 0.747	2nd widest ratio	42/ 0.747	3rd widest ratio	39.5/ 1

Source: Authors

We selected quartiles as cut points for each estimate, dividing the sample into four categories of equal size (seven countries) according to the share of prostitutes per one thousand female workers, from highest to lowest. Quartile 1 is the upper half above median, quartile 2 is the lower half above median, quartile 3 is the upper half below median and quartile 4 is the lower half below median. Ranking is similar as regards the first two Estimates (1A and 1B) for 24 countries (save Croatia, Ireland, Italy and Poland), the mean for EU-28 is also very close to the median. Nineteen countries display similar ranking at least for three Estimates, among which only five countries display similar ranking for four Estimates (France, Germany, Hungary, Netherlands and Sweden). With respect to Estimates, the average share of prostitutes in the EU-28 as of 2010 would amount from less than six up to over 13 per 100,000 female workers.

Table A4. Monthly spending for prostitution from regular clients in France as of 2010

Prostitutes	Transactions	Price	Clients	Adult males (%)	Monthly spending (€)	Likelihood
26,200	28.820 million	€ 44	168,000	0.7%	€ 629	Unlikely
26,200	28.820 million	€ 44	501,538	2.09%	€ 211	Unlikely
26,200	*28.820 million*	*€ 44*	*636,000*	*2.65%*	*€ 166*	*Likely*
26,200	*28.820 million*	*€ 44*	*744,000*	*3.1%*	*€ 142*	*Likely*
26,200	28.820 million	€ 66	168,000	0.7%	€ 943	Unlikely
26,200	28.820 million	€ 66	501,538	2.09%	€ 316	Unlikely
26,200	28.820 million	€ 66	636,000	2.65%	€ 249	Unlikely
26,200	28.820 million	€ 66	744,000	3.1%	€ 213	Unlikely
31,000	34.100 million	€ 44	168,000	0.7%	€ 744	Unlikely
31,000	34.100 million	€ 44	501,538	2.09%	€ 249	Unlikely
31,000	34.100 million	€ 44	636,000	2.65%	€ 196	Unlikely
31,000	*34.100 million*	*€ 44*	*744,000*	*3.1%*	*€ 168*	*Likely*
31,000	34.100 million	€ 66	168,000	0.7%	€ 1,116	Unlikely
31,000	34.100 million	€ 66	501,538	2.09%	€ 374	Unlikely
31,000	34.100 million	€ 66	636,000	2.65%	€ 294	Unlikely
31,000	34.100 million	€ 66	744 000	3.1%	€ 252	Unlikely
37,000	40.700 million	€ 44	168,000	0.7%	€ 888	Unlikely
37,000	40.700 million	€ 44	501,538	2.09%	€ 297	Unlikely
37,000	40.700 million	€ 44	636,000	2.65%	€ 235	Unlikely
37,000	40.700 million	€ 44	744 000	3.1%	€ 201	Unlikely
37,000	40.700 million	€ 66	168 000	0.7%	€ 1,332	Unlikely
37,000	40.700 million	€ 66	501 538	2.09%	€ 446	Unlikely
37,000	40.700 million	€ 66	636 000	2.65%	€ 352	Unlikely
37,000	40.700 million	€ 66	744 000	3.1%	€ 301	Unlikely

Source : Authors from Bajos et al (2006), Carael et al (2006) and Ourgaud (2014).