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evidence from a natural experiment

by Giovanni Mastrobuoni and Paolo Pinotti

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# LEGAL STATUS OF IMMIGRANTS AND CRIMINAL BEHAVIOR: EVIDENCE FROM A NATURAL EXPERIMENT

by Giovanni Mastrobuoni\* and Paolo Pinotti\*\*

## Abstract

We estimate the causal effect of immigrants' legal status on criminal behavior exploiting exogenous variation in migration restrictions across nationalities driven by the last round of the European Union enlargement. Unique individual-level data on a collective clemency bill enacted in Italy five months before the enlargement allow us to compare the post-release criminal record of inmates from new EU member countries with a control group of pardoned inmates from candidate EU member countries. Difference-in-differences in the probability of re-arrest between the two groups before and after the enlargement show that obtaining legal status lowers the recidivism of economically motivated offenders, but only in areas that provide relatively better labor market opportunities to legal immigrants. We provide a search-theoretic model of criminal behavior that is consistent with these results.

**JEL Classification:** F22, K42, C41.

**Keywords:** immigration, crime, legal status.

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# 1 Introduction<sup>1</sup>

Concerns about the effects of immigration on crime are widespread. As a matter of fact, foreigners are heavily over-represented among the prison population of all developed countries. In recent years the share of foreigners over official residents barely reached 10% in the US (and it was significantly lower in most other countries), while their incidence over incarcerated individuals was many times larger (Figure 1). Such numbers increase support for migration restrictions, which prevent part of the prospective immigrant population from (legally) residing in the host countries. At the same time, if enforcement is loose, migration restrictions might also create a pool of unauthorized immigrants that are able to (illegally) cross the frontier but, once in the host country, do not enjoy legal status and therefore cannot work in the official sector.

The implications of migration barriers for crime are then ambiguous. On the one hand, restrictive policies prevent a number of immigrants (that would be potentially at risk of committing crime) from entering the country, or expel them after entry; on the other hand, those that manage to enter anyway face worse income opportunities in official markets, which raises their propensity to engage in criminal activity. Empirically identifying the overall effect is difficult as immigrants determine, at least in part, their legal status. The decision about whether to reside legally or illegally into the destination country may in fact respond to several individual characteristics (e.g. working ability) that are also likely to enter the decision about whether to commit a crime. In addition to this problem, the size of the illegal immigrant population is usually not reported in official statistics, so their crime rate remains also unobserved.

In this paper we exploit exogenous variation in legal status, provided by the last round of the European Union (EU) enlargement, and detailed criminal records on a sample of pardoned immigrants in Italy to address these issues. After August 1, 2006, more than 9,000 foreigners were released from Italian prisons upon approval of a Collective Clemency Bill passed by the Italian Parliament; five months later, on January 1, 2007, about 800 of them acquired the right to legally stay in Italy as their origin countries, namely Romania and Bulgaria, entered the EU. We thus exploit the asymmetric effect of the EU enlargement across nationalities to estimate the effect of legal status on criminal behavior, as measured by the post-release criminal record of pardoned foreign individuals.

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The empirical strategy is grounded on a search-theoretic model of crime that relates legal status to the probability of committing a crime. In the tradition of economic models of crime, agents choose between legitimate and illegitimate activities by comparing the economic costs and benefits between the two. Granting access to the official sector, legal status raises the returns to legitimate activities (or the opportunity cost of illegitimate ones), which in turn lowers the probability of engaging in crime. However, there is also another effect that goes in the opposite direction. Immigrants without legal status may in fact be deported back to their own country with some positive probability, which mechanically reduces the pool of individuals in this group that are at risk of committing an offense.

The model does also allow for self-selection into legal status. In particular, migration policy imposes some fixed cost on official entrants, so that only immigrants with higher (legitimate) income opportunities in the host country will decide to comply with it; the other ones prefer to enter unofficially and face the risk of being expelled in the future. Therefore, self-selection at the frontier implies that the distribution of individual characteristics potentially correlated with criminal activity differs systematically between the groups of legal and illegal immigrants; this will also be the main threat to the identification of the causal effect of legal status.

To address this issue, we focus on the difference-in-differences in the probability of (re)arrest between pardon inmates from new EU member countries and a control group of inmates from candidate member countries, before and after the EU enlargement. While there are significant differences between the average characteristics of the two groups, weighting observations by the (inverse) propensity score of belonging to each group eliminates such differences, as well as differences in pre-enlargement outcomes. Baseline estimates suggest that the average probability of rearrest over a six-month period declines from 5.8% to 2.3% for Romanians and Bulgarians after obtaining legal status (as a consequence of the EU enlargement), relative to no change in the control group. Distinguishing between different categories of potential offenders, the effect is significant only for pardoned inmates that were previously incarcerated for economically-motivated crimes and the reduction is stronger in areas characterized by better income opportunities for legal (relative to illegal) immigrants. These results are robust to alternative estimation techniques and to several robustness checks.

We contribute to the literature on social and economic effects of immigration. Until very recently, this research area has traditionally emphasized the labor market competition between immigrants and natives (surveys include Borjas, 1994; Friedberg and Hunt, 1995; Bauer et al., 2000; Card, 2005), as well as the effects of immigration on fiscal balances (Storesletten, 2000; Lee and Miller, 2000; Chojnicki et al., 2005) and prices (Lach, 2007; Cortes, 2008). Drawing on survey evidence from 21 European countries in 2002, Card et al. (2009) show that, besides these (“economic”) issues, natives’ support for migration restrictions is shaped also (and indeed mostly) by other “compositional amenities”, among



which crime plays a major role.<sup>2</sup>

Partly as a consequence of this increasing awareness, a few previous papers have examined the empirical relationship between immigration and crime. At the aggregate level, Butcher and Piehl (1998a), Bianchi et al. (2008) and Bell et al. (2010) document some correlation between- and within-local areas in the US, Italy and the UK, respectively, but conclude that the causal effect is not different from zero (maybe with the exception of asylum-seekers in the UK).<sup>3</sup> At the micro level, Butcher and Piehl (1998b, 2007) use Census data to show that, keeping other individual characteristics constant, current immigrants have lower incarceration rates than natives, while the opposite was true for former immigrants at the beginning of the XX century (Moehling and Piehl, 2007). Yet, no previous study has investigated the role of legal status; this is precisely the contribution of the present paper.

We also add to a huge empirical literature on the relationship between legitimate income opportunities and criminal career. Indeed, the fact that the propensity to engage in crime should decrease with outside options in official markets is one of the key results of the economic model of crime (Becker, 1968). Over the years, several papers have examined the empirical validity of this prediction, finding in general a good deal of evidence consistent with it: a non-exhaustive list includes Witte (1980), Meyers (1983), Grogger (1998), Gould et al. (2002) and Machin and Meghir (2004). We contribute to this strand of literature by showing that, also in our sample of pardoned foreigners, access to better legitimate income opportunities (through the acquisition of legal status) lowers the individual propensity to engage in crime.

In the next section we summarize the main features of immigration in Italy, paying particular attention to the gap between legal and illegal immigrants in terms of labor market outcomes and crime. In Section 3 we provide a theoretical framework that captures these elements in a very simple way, studies the channels through which legal status may impact on crime and clarifies which are the main threats to identification. Then, Section 4 describes in detail the natural experiment while Section 5 derives the estimating equations. Finally, in Section 6 we discuss the empirical results and Section 7 concludes.

## 2 Legal and illegal immigrants: preliminary evidence from Italy

After centuries of massive emigration, Italy became a recipient of positive net inflows only in the late 1980s. As a consequence, the legislative framework in this respect is also very recent, the first migration law being enacted in 1990 and later amended in 1995 and 2002. Throughout these changes, Italian migration policy remained firmly grounded

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<sup>2</sup>See also Bauer et al. (2000)

<sup>3</sup>Partly in contrast with these findings, Borjas et al. (2010) argue that migration has indeed an effect, but a very indirect one: by displacing black males from the labor market, immigration increases the criminal activity of this latter group.

on the institute of the *residence permit*, which establishes a direct link between working condition and legal residence: the main condition for eligibility is receiving a job offer in Italy. However, the total number of residence permits issued each year is fixed on the basis of migration quotas decided by the government.

## 2.1 Official migration

Over the last two decades, the number of valid residence permits rose from less than 1 million at the beginning of the 1990s to more than 2 million in 2005, slightly declining thereafter; the number of foreign (official) residents increased even more steeply, from less than 600 thousands to almost 4 million (in the face of an otherwise declining population), see Figure 2. Official residents include immigrants holding a valid residence permit (and possibly their close relatives), as well as foreigners enjoying legal status in Italy for other reasons, such as being citizen of a EU member country. The divergence between the two measures (permits and residents) toward the end of the period is indeed explained by the EU enlargement, which starting in 2004 relieved an increasing number of Eastern European citizens from the need of a residence permit to legally reside in Italy.

Notwithstanding the spectacular growth of the official immigrant population, the number of newly issued residence permits fell systematically short of total demand over the years, often by a large extent. For instance, 170,000 permits were issued in 2007 in front of more than 740,000 demands; the following year, the number of new residence permits even decreased to 150,000, to be primarily assigned to applications left pending the year before (thus increasing the gap between current demand and supply of permits). In addition to that, the 2002 reform of migration policy requires prospective immigrants to find a job contract before entering the country, thus hampering further the match of foreign workers with Italian employers. Stringent requirements on permit eligibility and tight rationing of migration quotas, coupled with weak border enforcement (also due to the geographic configuration and location of the Italian peninsula), resulted in an increasing number of undocumented immigrants illegally crossing the border or overstaying tourist visas.

## 2.2 Unofficial migration

While the very nature of unofficial migration prevents accurate estimates of its size, amnesties of formerly undocumented immigrants provide some information in this respect. During these episodes, immigrants illegally present in Italy can apply for a valid residence permit under very mild conditions, with clear incentives to report their illegal status.<sup>4</sup> General amnesties have been enacted every 4-5 years since 1986, growing in size from 100 to 200-250 thousand individuals during the 1990s, and reaching a peak of 700

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<sup>4</sup>Bianchi et al. (2008) and Fasani (2009) also use applications for amnesty to estimate the size of the illegal population in Italy, while several studies adopted the same methodology to count the number of undocumented immigrants in the United States after the amnesty passed with the Immigration Reform and Control Act in 1986 (see, e.g., Winegarden and Khor, 1991).

thousand in 2002. The acceleration in official migration observed during the last few years was thus accompanied by an analogous one in unofficial inflows; see Figure 3.

The graph reports also the number of illegal immigrants expelled from the country. In Italy illegal immigrants apprehended by the police are *not* incarcerated. Rather, they are accompanied at the frontier and deported back to their origin country. In some cases, deportation is not enforced and the individual receives just an injunction to leave the country.<sup>5</sup> While the fraction of immigrants that are deported is not large, it isn't negligible. Looking again at the years in which there was an amnesty, the ratio of expulsions over demands for amnesty by unofficial immigrants were 17% in 1986, went up to 28% in 1998, and down again to 15% during the last amnesty program of 2002.

### 2.3 Criminal and labor market outcomes

Even though foreigners cannot be incarcerated for breaking migration laws, they are nevertheless overly represented in Italian prison population. The number of foreign inmates more than doubled since the early 1990s, from less than 10 thousand to more than 20 thousand in 2008, in the face of just a slight increase of total prison population. As a result, the share of foreigners in prison population has reached one third (Figure 4), an order of magnitude greater than the share of immigrants in the whole population. Of course, such imbalance is not necessarily driven by differences in criminal behavior, as it might also depend on statistical discrimination in law enforcement against foreigners (Becker, 1957). Yet, it is hard to believe that such a huge difference in incarceration rates between natives and foreigners is the sole product of discrimination.

However, an important distinction between official and unofficial immigrants seems to suggest that discrimination is not the whole story. While detailed statistics on convicted foreigners disaggregated by legal status are not publicly available, the Italian Ministry of Internal Affairs (2007) claims that legal immigrants represented about 6% of all individuals reported by the police to the judiciary authority in year 2006, which is in line with their share over total population. The disproportionate incidence of foreigners in prison population is entirely due to undocumented immigrants, who account for 70% and 80% of foreigners reported for violent and property crimes, respectively.

Then, legal status seems to have profound implications for immigrants' criminal careers. There are several reasons why this might indeed be the case. In particular, legal and illegal immigrants may face very different (legitimate) earning profiles, which in turn affect the opportunity cost of crime. Most likely, the administrative and penal sanctions (including the possibility of incarceration) faced by employers who hire undocumented immigrants, in addition to the risk of job destruction due to the expulsion of the worker, adversely impact on the demand for illegal immigrants (relative to those holding a valid

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<sup>5</sup>In 2002 the last reform of migration policy (Law 189/2002) introduced the possibility of incarceration for those that did not comply with a previous injunction to leave and were later re-apprehended by the police. However, such norm was never enforced because it was deemed Anti-Constitutional by the Constitutional Court.

residence permit). This effect could be amplified by selection into legal status. Far from being randomly distributed, legal status is strongly correlated with other individual characteristics, which are known to be important determinants of criminal activity.

While information in this respect is not available for a representative sample of (legal and illegal) immigrants in Italy, survey evidence from a region in the North-West is consistent with this conjecture. Starting in year 2001, the NGO ISMU has conducted yearly interviews on a sample of about 9,000 immigrants in the Lombardy region. The data contain information on labor market outcomes, along with several individual characteristics, including legal status. Sampling of illegal immigrants is attained through the “center-sampling technique” devised by the statistical team of ISMU in the early 1990s. The main idea is to exploit the social networks among the foreign population and base sampling on a number of “aggregation centers” that are attended by both legal and unauthorized immigrants (care centers, meeting points, shops, telephone centers, etc.), as opposed to administrative sources that cover only official residents; the methodology is described at length in Blangiardo et al. (2004) and Blangiardo (2008).<sup>6</sup>

Table 1 compares the characteristics of legal and illegal immigrants in the 2006 round of the survey (that is, immediately before the EU enlargement of 2007). It turns out that unauthorized immigrants are on average younger, less educated, disproportionately single males and have fewer kids. Most importantly, they tend to be employed in occupations with lower skill content and earn significantly lower wages; notice also that the wage gap is relatively more severe among the high-skilled.<sup>7</sup>

While restrictions imposed by migration laws on the employment of illegal immigrants certainly explain part of the wage gap, the striking differences in other observable characteristics point at the importance of selection into legal status. In particular, immigrants could voluntarily self-select when deciding whether to comply or not with migration policy; for instance, individuals with better income prospects in the host country could exert greater effort in dealing with the bureaucratic difficulties imposed by (legal) entry procedures. On the other hand, selection could also be involuntarily (on the part of the immigrant), whenever less skilled individuals have lower chances to receive a job offer eventually entitling them to apply for a permit. Whatever the reasons are, the differences reported in Table 1 suggest that legal status is not randomly distributed across immigrants, which considerably hampers the empirical identification of its effect on criminal behavior.

We next present a model of crime that is consistent with the stylized facts described above and clarifies which are the main threats to identify the causal effect of legal status

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<sup>6</sup>Using the ISMU data to estimate the determinants of immigrants’ earnings in Italy, Accetturo and Infante (2010) examine the reliability of the information on legal status by comparing the results of the 2002 survey with the demands for amnesty presented during the same year, concluding that the extent of under-sampling of unauthorized immigrants and/or misreporting of legal status is modest.

<sup>7</sup>Drawing on several rounds of the ISMU survey, Accetturo and Infante (2010) confirm these findings in a multivariate regression analysis. Extensive empirical evidence on the wage gap suffered by illegal immigrants is available also for the US, see for instance Bratsberg et al. (2002), Kossoudji and Cobb-Clark (2002) and Kaushal (2006).

on crime.

### 3 Theoretical framework

Consider a population of infinitely lived, risk-neutral prospective immigrants. If they decide to actually move to the destination country they incur a travel cost  $T$ . In addition, official entry in the host country imposes an upfront cost  $B$  on legal immigrants ( $L$ ); such cost may include, for instance, the time and money spent to deal with paperwork, acquire health certifications, pay head taxes and so on. Alternatively, immigrants may decide to cross the border illegally. In this way, illegal immigrants ( $I$ ) avoid the burden imposed by migration policy, but face the risk of being apprehended and deported back to their home country at the beginning of any subsequent period.

Once in the host country, both legal and illegal immigrants may engage in crime. Criminal activities deliver an immediate payoff  $z$ , which is randomly distributed across agents in each period according to the cumulative density  $F(z)$ ; however, those committing a crime are arrested and sent to jail in the following period with probability  $\pi$ . Assuming a constant discount factor  $\rho < 1$ , the expected utility of seizing a crime opportunity  $z$  for immigrants of type  $k = I, L$  is then

$$C_k(z) = z + \rho[\pi P + (1 - \pi)EV_k] \quad (1)$$

where  $P$  is utility associated with incarceration,  $V_k$  is the utility when not in prison and  $E$  denotes expectations over (future) values of  $z$ ; without loss of generality, we may impose  $P$  equal to zero.

Apart from criminal proceeds, immigrants have access to labor earnings that vary with individual skills and the returns to skills for different groups of immigrants in the labor market. In particular, letting  $h$  denote the (heterogeneous) level of human capital, the wage of each immigrant is  $w_L h$  if (s)he holds a residence permit and  $w_I h$  otherwise, with  $\Delta w = w_L - w_I \geq 0$ .<sup>8</sup> While the strict inequality would be consistent with the empirical evidence discussed in the previous section, the conservative assumption that  $w_L$  is no lower than  $w_I$  is sufficient for all the results that follow.

The utility of legal immigrants is

$$V_L = \max \{C_L(z); \rho EV_L\} + w_L h, \quad (2)$$

which depends both on the decision about criminal activity (the first term on the r.h.s.) and on legitimate income (the second term). The utility of illegal immigrants is similar except for the fact that, with probability  $\delta > 0$ , they are apprehended and deported back

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<sup>8</sup>From now on the notation  $\Delta$  will always refer to the difference between the (potential) outcomes of an individual when legal and illegal.

to their origin country,

$$V_I = \delta V_H + (1 - \delta) [\max \{C_I(z); \rho EV_I\} + w_I h], \quad (3)$$

where  $V_H$  is utility in the home country. The latter depends, positively, on the labor market income  $w_H h$  and we posit that  $w_H < w_I \leq w_L$ .<sup>9</sup> From now on we assume for simplicity that those expelled from the country do not try anymore to migrate.

Individuals face three decisions: whether to migrate or not; in case they do, whether to cross the border legally or illegally; finally, once in the host country, they must choose whether to accept or reject the crime opportunities available in each period. The latter problem is at the core of the economic model of crime first proposed by Becker (1968), in which individuals choose whether to engage or not in crime depending on the relative return of legitimate and illegitimate activities.<sup>10</sup> Admittedly, our framework is very stylized in this respect, reducing such problem to a discrete choice between crime and lawfulness. In this way, we prevent continuous time-allocation choices between legitimate and illegitimate activities (Grogger, 1998), as well as ex-ante investments in human capital (Lochner, 2004). However, these simplifications are inconsequential for the empirical analysis, given that our data do not contain such information. The present model captures the institutional features of Italian migration policy that are common to most other countries, namely that legal aliens face a substantial bureaucratic and economic burden upon entry and that illegal aliens may be deported back to their origin country. We next describe in greater detail the trade offs involved in each decision and solve the problem backward, starting from the choice about criminal activity.

### 3.1 Criminal behavior

In deciding whether to engage or not in criminal activity each individual of type  $k = I, L$  compares the expected returns from criminal activity,  $C_k(z)$ , with their opportunity cost,  $\rho EV_k$ . Since  $C_k(z)$  depends, positively, on the value  $z$  of illicit income opportunities available in each period (while  $\rho EV_k$  does not) there must exist a reservation value  $z_k^*$  such that each individual of type  $k$  commits a crime if and only if  $z \geq z_k^*$ .<sup>11</sup> Imposing the expected payoffs from crime equal to its opportunity cost for both legal and illegal immigrants,  $C_k(z_k^*) = \rho EV_k$  ( $k = I, L$ ), and substituting into (1) delivers the reservation

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<sup>9</sup>Since in most cases human migration is an economic phenomenon, it seems natural to assume that wages in the destination country are higher than in the origin country. In our formulation, this occurs through higher returns to human capital, which might be at odds with standard factor proportion explanations of migration. On the other hand, it is consistent with more recent models stressing the effect of skill-biased technical change on labor market outcomes in destination countries, which affects in turn the relative returns of more and less educated migrants (Acemoglu, 2002, provides a survey). Also, it is consistent with extensive empirical evidence on the positive selection of immigrants; see Grogger and Hanson (2010) for a recent study.

<sup>10</sup>See also Ehrlich (1973), Grogger (1998) and Machin and Meghir (2004) for later developments; Burdett et al. (2003), Lochner (2004) and Lee and McCrary (2009) provide extensions in dynamic settings that are most similar to ours.

<sup>11</sup>Notice the analogy with the notion of “reservation wage” commonly adopted in equilibrium search models of labor (see Rogerson et al., 2005, for a survey)

values

$$z_k^* = \rho\pi EV_k. \quad (4)$$

Conditional on legal status, the reservation value completely characterizes criminal behavior. In particular, the probability of committing a crime for legal immigrants simply equals the probability of receiving a crime opportunity worth more than  $z_L^*$ ,

$$c_L = 1 - F(z_L^*); \quad (5)$$

for illegal immigrants, we must first condition the probability of committing a crime on the risk of deportation,

$$c_I = (1 - \delta)[1 - F(z_I^*)]. \quad (6)$$

The log-probability of committing a crime for each individual, conditional on legal status, may be written compactly as

$$\ln c(h) = \ln c_I(h) + \beta(h)L,$$

where  $L = 1$  if the immigrant is legal and  $L = 0$  otherwise, and  $\beta(h) \equiv \Delta \ln c(h)$  is the causal effect of legal status conditional on  $h$ ; using equations (5) and (6),

$$\beta(h) \approx \delta - [F(z_L^*) - F(z_I^*)]. \quad (7)$$

The sign of (7) depends on two effects. On the one hand, holding constant the propensity to engage in criminal activity, deportation of illegal aliens (at rate  $\delta$ ) lowers the number of crimes they commit relative to legal immigrants. This is the *incapacitation* effect of migration restrictions, which is apparent from the first term on the right hand side, moving the crime rate upward after the removal of migration restrictions. On the other hand, the propensity to criminal behavior does also change with legal status, because different labor market opportunities for legal and illegal immigrants entail also a difference in terms of opportunity cost of crime. This second effect, which is apparent from the last term of the equation (namely the change in the probability of accepting a crime opportunity for formerly unofficial immigrants) increases with the wage premium to legal status,  $\Delta w \geq 0$ . However, its sign and strength, as well as the direction of the overall effect in (7), depend crucially on the equilibrium distribution of  $h$  across legal and illegal immigrants, which we examine next.

### 3.2 Equilibrium

In the remainder of this section we provide a graphical representation of the equilibrium and the intuition behind all results; formal proofs are presented in the Appendix. First notice that  $w_H < w_I$  implies that there exists a threshold for  $h$  above which individuals decide to leave the origin country. In particular, Figure 5a shows that all individuals characterized by  $h \geq h_I$  prefer to unofficially cross the border rather than staying home.

What about the option of entering the destination country by complying with migration policy? Notice that, once in the host country, all immigrants prefer to be legal rather than illegal, i.e.  $E\Delta V = E(V_L - V_I) > 0$ . By a simple revealed-preference argument, in fact, all those willing to (illegally) migrate prefer to live in the destination than in the origin country; therefore, these same individuals are better off avoiding the risk of being deported back. Moreover, the differential  $E\Delta V$  increases with  $h$ ; intuitively, better labor market opportunities in the destination country mean a greater utility loss in case of expulsion.<sup>12</sup>

After arrival, legal immigrants are thus better off holding a valid residence permit; however, upon arrival, they must bear the entry cost  $B$ , so they apply for legal status if and only if  $E\Delta V \geq B$ . Since  $E\Delta V(h)$  is upward sloped, the latter condition must hold beyond some threshold  $h_L$ ; see Figure 5b. The diagram clearly illustrates the self selection of immigrants at the frontier: individuals in the upper tail of the distribution of skills comply with migration policy, while those in the intermediate range  $[h_I, h_L]$  enter unofficially in the country.

Therefore, labor skills sort out immigrants from non-immigrants and, among the former, legal from illegal entrants. Figure 5c shows then how the equilibrium distribution of  $h$  determines within- and between-group differences in criminal behavior. The probability of committing a crime for legal immigrants,  $c_L$ , is inversely related to the reservation value  $z_L^*$ , which in turn is proportional to expected utility  $EV_L$ ; the same is true for illegal immigrants, *conditional on not being deported*. Therefore,  $EV_L(h) > EV_I(h)$  implies that, conditional on  $h$ , unauthorized immigrants that are not deported commit more crimes than legal immigrants:  $\tilde{c}_I = 1 - F(z_I^*) \geq 1 - F(z_L^*) = c_L$ . However, the unofficial population includes also those that are deported at the beginning of each period (before committing a crime), so deportation shifts the crime rate for this group down from  $\tilde{c}_I$  to  $c_I$ .

The causal effect of legal status on crime is then the average (log) difference between the curves  $c_L$  and  $c_I$  over the interval  $[h_I, h_L]$

$$\beta \equiv E[\beta(h) | h_I \leq h \leq h_L] = E[\ln c_L(h) | h_I \leq h \leq h_L] - E[\ln c_I(h) | h_I \leq h \leq h_L]. \quad (8)$$

The sign of (8) is a priori ambiguous, depending upon whether the average (relative) reduction in criminal activity by formerly unofficial immigrants after the concession of legal status,  $E[(F(z_L^*) - F(z_I^*)) | h_I \leq h \leq h_L]$ , is strong enough to counterbalance the increase in crime brought by the end of deportations. Therefore, determining the effect of legal status on criminal activity is ultimately an empirical issue.

### 3.3 Identification

Assuming to have data on criminal activity for a sample of legal and illegal immigrants, the main threat to empirically identify  $\beta$  is that each individual is commonly observed only in one state (either with or without legal status), so the first term on the right hand side of

<sup>12</sup>The Appendix presents the formal proof that  $E\Delta V \geq 0$  and  $\frac{\partial E\Delta V}{\partial h} \geq 0$  for  $h \geq h_I$ .



equation (8), namely the (counterfactual) log probability of committing a crime for illegal immigrants conditional on obtaining legal status, is not observed (in the terminology of Rubin, 1974, it is the “potential outcome”). Missing this element, one could alternatively conduct a naive comparison between legal and illegal immigrants,

$$\tilde{\beta} = E[\ln c_L(h)|h_L \leq h] - E[\ln c_I(h)|h_I \leq h \leq h_L];$$

however,  $E[\ln c_L(h)|h_L \leq h] \leq E[\ln c_L(h)|h_I \leq h \leq h_L]$  (because crime decreases with  $h$ ), so  $\tilde{\beta}$  would provide a downward biased estimate of  $\beta$ ,

$$\tilde{\beta} = \beta + \underbrace{E[\ln c_L(h)|h_L \leq h] - E[\ln c_L(h)|h_I \leq h \leq h_L]}_{SELECTION\ BIAS} < \beta,$$

see the last diagram in Figure 5.

The last round of the EU enlargement provides an exogenous source of variation in legal status that allows us to remove the selection bias. The next section describes in detail this quasi-experimental setting.

## 4 The natural experiment

### 4.1 The EU enlargement

With the fall of the Eastern Bloc and the EU enlargement toward the east, immigrants from central and eastern Europe became a large and growing share of total inflows in Italy (see Figure 2). A first round of the enlargement took place in 2004 with the admission of Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia. Then, on January 1<sup>st</sup>, 2007, Bulgaria and Romania also joined the EU; and the process of enlargement is far from over, as several countries are “candidate members” of the EU. In particular, Croatia, Turkey and the Former Yugoslavian Republic of Macedonia are already negotiating admission conditions, while such negotiations should start soon for Albania, Bosnia and Herzegovina, Kosovo, Montenegro and Serbia. New member and candidate member countries are shown in Figure 6.

Article 39 of the European Commission Treaty would in principle allow citizens of new member countries to i) look for a job in any other country within the EU, ii) work there without needing any permit, iii) live there for that purpose, iv) stay until the end of the employment relationship, v) enjoy equal treatment with natives in access to employment, working conditions and all other social and tax advantages that may help to integrate in the host country. In practice, however, several countries in Europe maintained significant restrictions to the free movement of immigrants from new member countries.

The application of the EU directives was at the center of a heated public debate also in Italy until the very last weeks before the enlargement, mostly because of the alleged impacts on crime. However, in the end (on December 28, 2006) the center-left government

led by Romano Prodi guaranteed free movement to all new EU citizens and completely liberalized access to the labor market in the following sectors: agriculture, hotel and tourism, managerial and highly skilled work, domestic work, care services, construction, engineering and seasonal work. These sectors account for the bulk of foreign employment, both before and after the enlargement. And in the rest of the official economy (basically the manufacturing sector) migration quotas were also eased in order to accommodate the larger number of workers from Romania and Bulgaria.

The removal of migration restrictions led to sharp changes in the composition of foreign population in Italy. The left graph of Figure 7 compares the number of (official) residents coming from new member and candidate member countries before and after the EU enlargement. Until 2006, the combined size of Romanian and Bulgarian communities was about half of the other group, the difference between the two remaining constant over the period. Then, in the wake of admission to the EU, the number of Romanians and Bulgarians officially residing in Italy nearly doubled, while the size of the other group continued to grow at approximately the same rate as in the previous years.

A similar pattern arises among the individuals arrested by the Italian police between 2006 and 2007. However, the (differential) increase was much less pronounced in this case, so the ratio of arrested over total official residents actually declined for Romanians and Bulgarians, while no significant change is observed for the control group; see the right graph in Figure 7. At a first sight, one might be tempted to conclude that the removal of migration restrictions favored a decline in criminal activity. Yet, the increase in Romanians and Bulgarians between 2006 and 2007 includes both inflows from abroad and acquisitions of legal status by (formerly unofficial) immigrants already in Italy, the two components being undistinguishable from each other. Figure 7 would be indeed consistent with a decline in the crime rate if the sharp increase in the left graph was driven largely by inflows of new immigrants after the EU enlargement. On the other hand, if it was caused by changes in legal status of foreigners already residing in Italy before 2007, the decline in the incidence of arrests would be due to the fact that formerly unofficial immigrants impact, positively, on total official population only after 2007, but affect the number of crimes both before and after that period.

One way to circumvent this problem is to focus on a sample of immigrants that were already present in Italy before the enlargement.

## 4.2 The July 2006 Collective Pardon

Italian collective pardons eliminate part of the sentence, typically 2 or 3 years, to all prison inmates; then, all those whose residual sentence is below such length are immediately released. In this way, pardons generate sudden releases of large numbers of inmates. The only ones excluded are Mafia members, terrorists, kidnappers, and sexual offenders, but even violent criminals like murderers and robbers can be pardoned. Whenever a pardoned prisoner recommit a crime within five years, the commuted prison term gets added to the

new term.

Collective clemency bills are deeply rooted in Italian history; over the last 40 years there has been on average a pardon every 5 years (Barbarino and Mastrobuoni, 2010). The last one was voted by the Italian Parliament in July 2006 and enacted shortly after (on August 1). About 22,000 individuals, corresponding to more than one third of total prison population, were freed within a few days. More than 8,000 of them were foreigners, reaching the figure of 9,642 by the end of 2006.

We were granted access to the criminal records, from August 2006 through December 2007, of all prison inmates released with the Collective Clemency Bill.<sup>13</sup> The most important information for our purposes is the nationality and the date of rearrest (if any). Figure 8 shows that, among foreigners, a large number of pardoned inmates were rearrested over the following year and a half. In particular, 795 individuals were back to jail by the end of 2006, before the EU enlargement, growing to 1654 one year later, after the EU enlargement. The main idea behind our empirical strategy will be then to exploit differences in the probability of rearrest, before and after the EU enlargement, across different nationalities in our sample.<sup>14</sup>

## 5 Empirical strategy

In this section we devise a difference-in-differences estimator that exploits the unique characteristics of our sample to estimate the effect of legal status on the probability of committing a crime. If legal status does indeed affect the criminal behavior of immigrants, we should observe a change in such probability for Romanians and Bulgarians after the EU enlargement. In terms of our theoretical model, the average log probability for this group in year 2006 (before the policy change) is

$$E[\ln c(h)] = E[\ln c_I(h)|h_I \leq h < h_L]G(h_L) + E[\ln c_L(h)|h_L \leq h][1 - G(h_L)], \quad (9)$$

where  $G(\cdot)$  is the cumulative density of  $h$  among the immigrant population in the host country.<sup>15</sup> Then, in year 2007 (after the enlargement) everybody in this group obtains legal status, so

$$E[\ln c'(h)] = E[\ln c'_L(h)]. \quad (10)$$

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<sup>13</sup>These data are similar to those used by Drago et al. (2009) to study the deterrence effect of residual sentence.

<sup>14</sup>While looking at former prisoners may at a first sight limit the external validity of our results, it allows indeed to focus on the group of individuals that is at the margin between a criminal career and legitimate activity; at the opposite, the great majority of the population at large never engages in any type of (serious) crime. For this and other reasons, previous offenders have been widely studied in the empirical literature on crime, see for instance Witte (1980) and Lee and McCrary (2009).

<sup>15</sup>Letting  $\Gamma(h)$  denote the cumulative distribution of  $h$  over the entire population in the origin country (including migrants and non-migrants),  $G(h) = 0$  for  $h \leq h_I$  and  $G(h) = \frac{\Gamma(h) - \Gamma(h_I)}{1 - \Gamma(h_I)}$  for  $h > h_I$ .

Subtracting (9) from (10) delivers the change after the extension of legal status to all (formerly illegal) immigrants from new EU member countries,

$$E [\ln c'(h) - \ln c(h)] = \beta G(h_L) + \Psi, \quad (11)$$

where  $\Psi$  is the (unobserved) counterfactual change between the two periods absent the policy shock,

$$\begin{aligned} \Psi = & E [\ln c'_I(h) - \ln c_I(h) | h_I \leq h < h_L] G(h_L) \\ & + E [\ln c'_L(h) - \ln c_L(h) | h_L \leq h] [1 - G(h_L)]. \end{aligned} \quad (12)$$

Equation (11) clarifies which are the main estimating issues, which we examine next.

### 5.1 The control group

To isolate any causal effect  $\beta$  from common trends and time-specific shocks in  $\Psi$ , we rely on a control group that is as close as possible to Romanians and Bulgarians except for the change in legal status between 2006 and 2007. Pardoned inmates from candidate EU member countries naturally provide such a control group.

As we described in the previous section, in fact, candidate members are countries that have either started access negotiations or that are going to do so in the near future. Therefore, this group of countries should be most comparable to new EU members along the economic and political criteria required for admission to the EU. As a matter of fact, they all belong to the same geographical area and most of them (possibly with the exception of Turkey) share a great deal of linguistic, cultural and historical heritage.

Our sample includes about 800 Romanians and Bulgarians, as well as 1,800 immigrants from candidate member countries; restricting to the subsample of males (in order to reduce heterogeneity), we are left with 725 and 1,622 individuals, respectively. Using the change in crime for the the control group between 2006 and 2007 to estimate the right hand side of equation (12) and substituting into (11) we obtain

$$\beta G(h_L) = E [\ln c'(h) - \ln c(h)] - E [\ln c'_0(h) - \ln c_0(h)], \quad (13)$$

where the subscript 0 denotes the control group.

Equation (13) will constitute the basis for our empirical analysis. Moving to its sample analogue requires to address some important measurement issues.

### 5.2 Measurement

The first issue concerns the measurement of criminal activity, which remains partly unobserved. This happens either because of under-reporting of criminal offenses or because, even for the recorded ones, the identity of the offender cannot always be determined. One observes incarceration, though, which is often used as a proxy for unobserved criminal

activity (see, e.g. Ehrlich, 1996; Levitt, 1996). Consistently with this approach, our model maintains that the probability of being arrested after a crime is constant and equal to  $\pi$ , which implies that  $\frac{\pi c_L(h)}{\pi c_I(h)} = \frac{c_L(h)}{c_I(h)}$ . It follows that the relative log probability of incarceration for legal and illegal immigrants is exactly equal to the relative log probability of committing a crime, which remains unobserved; since the former is instead observable, we will use it as our main dependent variable. The confounding effect of departures from this assumption will be discussed as we present the empirical results.

The second measurement issue concerns the term  $G(h_L)$ , namely the fraction of illegal immigrants in (prison) population. Since illegal status is not by itself a valid reason for incarceration, administrative criminal records do not report the legal status of the individuals in our sample. Nevertheless, a valid estimator for the right hand side of equation (13) would still be informative about the sign of  $\beta$  and would bound its magnitude from below. Moreover, as we already point out in Section 2, the fraction of illegals is very high (between 70% and 80%) among the foreign prison population, so the attenuation bias induced by  $G(h) < 1$  is going to be small.

### 5.3 Propensity score weighting

Longitudinal data on (re)arrests of former inmates from new EU member countries and candidate member countries over the period 2006 and 2007 allow us to estimate equation (13) using the difference-in-difference between the log probability of arrest for the two groups before and after the EU enlargement. The identifying assumption is that in the absence of the policy shock the hazard rates for the two groups would have followed parallel paths. Such condition may be implausible in presence of significant differences in individual characteristics that are possibly correlated with criminal activity (Abadie, 2005).

The left columns of Table 2 compare the two groups in terms of the observable characteristics that are reported in our data, namely age, gender, marital status and education, the latter being available only for a very restricted subsample; the type of crime for which the individual was first incarcerated before the Pardon (possibly more than one, so the group means of economic and violent crimes do not add up to one); finally, the length of sentence and the amount commuted with the pardon.<sup>16</sup> While marital status is not significantly different, Romanians and Bulgarians appear to be on average younger (31 vs. 33 years of age) and more educated than individuals in the control group; they are also more (less) likely to commit violent (economic) crimes but, despite this, they are charged to lighter sentences. One reason may be that migration waves from such countries are more recent, while immigrants from some countries in the control group (primarily Albanians) came earlier in time and are more likely to have recidivated.

If we are willing to assume that deviations from the “parallel paths” depend solely on differences in observable characteristics, conditioning on such differences does remove all

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<sup>16</sup>The data report also the prison from which the individual was released (167 institutes in total), which will be used later in the analysis.

biases. This assumption, which is alternatively referred to as unconfoundedness, conditional independence, selection on observables or ignorability of treatment, constitutes an important special case in the econometrics of program evaluation (Imbens and Wooldridge, 2009). While unconfoundedness may be a strict requirement, notice that we are imposing it on *changes* over time of the crime rate (as opposed to *levels*); that is, we allow for (time-invariant) differences between groups to persist even after conditioning on observable characteristics. Moreover, the availability of longitudinal data over repeated periods before the policy change provides us with the opportunity to investigate the plausibility of unconfoundedness.

One simple way of adjusting for differences between the two groups is to weight observations based on the *propensity score* of assignment, i.e. the conditional probability of belonging to each group conditional on observed covariates.<sup>17</sup> Specifically, we weight each unit by

$$new\ EU_i \frac{p}{P(X_i)} + (1 - new\ EU_i) \frac{1 - p}{1 - P(X_i)}, \quad (14)$$

where  $new\ EU_i$  is a dummy equal to 1 if the  $i$ -th individual is citizen of new EU member countries and 0 otherwise,  $p$  is the unconditional probability of belonging to the *new EU* group and  $P(X_i)$  is the same probability conditional on the vector of individual characteristics  $X_i$ .

The weighting scheme (14) enhances the comparability between the two groups by attaching greater (lower) weight to units that are less (more) different from the other group relative to the average individual in the sample.<sup>18</sup> As it is generally the case in non-experimental settings, the propensity score is unknown, so we estimate it exploiting all information available in our data set. In practice, we compute the predicted propensity score based on a logit regression of an indicator variable for being Romanian or Bulgarian on the following vector of covariates: a quadratic polynomial in age, marriage status, education (indicator variables for illiteracy, primary and secondary school, as well as missing information on education), type of crime committed when first incarcerated (7 categories), a quadratic polynomial in sentence and commuted sentence and, finally, a full set of fixed effects for the region where the prison from which the individual was released is located.<sup>19</sup> Figure 9 shows the distribution of the estimated propensity score by group. As it should be expected, there is a large tail of individuals in the control group whose estimated propensity score is close to zero, meaning they are very different (in terms of observable characteristics) from Romanians and Bulgarians. Then, the weighting scheme will discount these observations, while it will attach greater importance to observations of both groups that lie in the middle range of the distribution. The right columns of Table 2 show

<sup>17</sup>Rosenbaum and Rubin (1983) show that, under unconfoundedness, conditioning on the propensity score and on the full set of covariates are equivalent methods of guaranteeing independence of potential outcomes across groups. One advantage of using the propensity score is that it reduces the dimensionality of the conditioning problem (from a multi-dimensional vector to a scalar).

<sup>18</sup>The idea of using the propensity score to weight observation was pioneered by Hirano et al. (2003); Abadie (2005) extends the same approach to difference-in-differences estimators.

<sup>19</sup>We dropped a few observations for which some covariates other than schooling were missing.

that weighting observations according to (14) actually eliminates differences in average group characteristics. We next examine to which extent this adds to the credibility of unconfoundedness by investigating pre-enlargement differences in outcomes, which depend on both observable and unobservable characteristics.

#### 5.4 Preliminary evidence

Figure 10 plots non-parametric estimates of daily log hazard rates of re-arrest of inmates from new EU member (solid line) and candidate member countries (dashed line).<sup>20</sup> Since we are particularly interested into the effect of legal status through legitimate earning opportunities, we focus on individuals that were first arrested (before the pardon) for economically-motivated crimes (mainly property and drug-related offenses).

The left graph shows the results obtained before applying the weighting scheme. While Romanians and Bulgarians display greater recidivism during the first months after the pardon, the opposite is true after they obtain legal status. Turning to the plausibility of identifying assumptions, the evidence from the pre-enlargement period seems broadly consistent with the hypothesis of parallel outcomes (absent the policy change). As we weight observations by the propensity score (right graph), not only the dynamics but also the levels of the hazard rates are very similar between the two groups, which provides strong empirical support for unconfoundedness of changes over time across groups. Turning to the effect of legal status, a few weeks before the EU enlargement, the probability of incarceration starts to decrease for Romanians and Bulgarians, continuing to do so during the first months of 2007.

To quantify such effect, in Table 3 we cross-tabulate the hazard rate of re-arrest for each group over the last two trimesters of 2006 and the first two of 2007, as well as the difference between the two groups in each period and the difference-in-differences across different periods. The left panel of the Table shows the results for economically-motivated offenders. The second row confirms that, after weighting by the propensity score, the two groups exhibit an identical probability of incarceration before the policy change. Then, in 2007 the hazard rate does not change significantly for the control group while it decreases, from 5.8% to 2.3%, for Romanians and Bulgarians; as a result, the difference-in-differences is also negative and very similar in absolute value (3.2%). Instead, the effect is positive and smaller in magnitude for violent offenders.<sup>21</sup>

The table does also report both robust and bootstrapped standard errors. While bootstrapping will generally lead to valid standard errors and confidence intervals for

<sup>20</sup>The hazard rate is the probability of being rearrested at each period-at-risk  $\tau$  conditional on not having been rearrested in the  $\tau - 1$  periods before. For the sake of graphical illustration, we restrict to inmates release during the first week after the Pardon (about 72% of total sample), so the duration-at-risk on the horizontal axis is the same for all individuals. The results presented in the next tables will be based instead on the total sample.

<sup>21</sup>Notice that, when we focus on violent offenders, we restrict to individuals that were previously in prison for having committed *only* violent crimes. Instead, individuals that were reported for both economic and violent crimes are included among economically-motivated offenders, in that the latter type of crime was probably instrumental to the first one (e.g. an assault during a robbery).

propensity score weighting estimators (Abadie and Imbens, 2008), Busso et al. (2009) suggest that robust regression standard errors provide a good approximation as the number of observations grows large. This is confirmed in our case, as the two estimates of the standard errors are always extremely similar. For the sake of computational efficiency, inference on the multivariate regression models presented next will be based on robust (clustered) standard errors.

Turning to inference, the effect of the EU enlargement on the recidivism of economically-motivated offenders from new EU member countries is statistically significant at conventional confidence levels, while the differences for violent crimes are not significantly different from zero.

## 5.5 Parametric and semi-parametric models

To probe these results further, in the next section we fit parametric and semi-parametric models for the probability of rearrest at each point in time. Specifically, the parametric model takes the logistic form

$$\ln \left( \frac{c_{it}}{1 - c_{it}} \right) = \text{new } EU_i + \text{post}_t + \beta \text{new } EU_i \times \text{post}_t + x_i' \gamma + \theta_t, \quad (15)$$

where  $c_{it}$  is the probability of observing the arrest of individual  $i$  at time  $t$ ;  $\text{new } EU_i$  and  $\text{post}_t$  are fixed effects for the group of new EU member countries' citizens and the period after the EU enlargement, respectively;  $x_i$  is a vector of individual characteristics reported in our dataset and  $\theta_t$  is a polynomial in (calendar) time. Therefore, in this setting  $\text{post}_t$  captures any discontinuous change in the log-odds of rearrest between 2006 and 2007 (besides the smooth trend  $\theta_t$ ), while  $\beta$  is the average differential effect for Romanians and Bulgarians after the EU enlargement.

To condition the probability of rearrest on not having being rearrested before, we follow Efron (1988) and estimate equation (15) on the weekly (unbalanced) panel of inmates that are at risk of rearrest during each period. Therefore, the cross section of observations for the first week includes all individuals released immediately after the pardon; the second week includes all those released until then and not rearrested in the first week, and so on. In this way we end up with 124,019 person-week observations for the subsample of economically-motivated offenders.<sup>22</sup>

An alternative approach is to model directly the hazard rate (as opposed to the probability) of rearrest,

$$\ln \lambda_{it\tau} = \text{new } EU_i + \text{post}_t + \beta \text{new } EU_i \times \text{post}_t + x_i' \gamma + \lambda_\tau^0, \quad (16)$$

where  $\lambda_{it\tau}$  is the probability of being rearrested in period  $t$  given that the individual has not been rearrested during the  $\tau$  periods-at-risk before. Therefore, this class of models allows

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<sup>22</sup>Lee and McCrary (2009) do also adopt this strategy to estimate the probability of re-incarceration, while Ashenfelter and Card (2002) apply the same methodology to study retirement choices.



to disentangle the effect of calendar time shocks (i.e. the EU enlargement) from that of time-at-risk (which varies across individuals depending on the exact moment at which they were released). Equation (16) is the general form of proportional hazard models, which differ from each other with respect to the specification of the baseline hazard function  $\lambda_r^0$ . The most flexible approach is to leave it unrestricted and estimate the coefficients of interest by partial maximum likelihood (Cox, 1972). Therefore, the semi-parametric model trades off efficiency for flexibility relative to the fully parametric approach.

## 6 Results

In this section we present our estimates of equations (15) and (16), along with several robustness exercises and specification tests. Observations are weighted by the (inverse) propensity score, as described in the previous section, and standard errors are clustered by Italian region and country of origin to allow for within-network correlation in criminal activity (immigrants' network being defined on the basis of nationality and geographic proximity in Italy).

### 6.1 Baseline estimates

Table 4 reports the estimated coefficients and standard errors for the subsample of economically-motivated offenders. The first columns show the results for the fully parametric model (15). Column (1) includes only group- and year-specific fixed effects besides the interaction between the two; in column (2) and (3) we add a quadratic time trend and the vector of individual controls reported in our data, respectively; in column (4) we adopt the most flexible parametric specification by controlling for a full set of weekly dummies. In line with the preliminary evidence in the previous section, the estimated coefficient of the interaction variable is negative and significantly different from 0 (at the 95% confidence level). As of its magnitude, a decrease in the log-odds of 73-74% (very stable through all specifications) is also in line with the (unconditional) change in the probability of rearrest reported in Table 3 (from 0.058 to 0.023). The coefficient changes only slightly when we move to the semi-parametric Cox model, in the last two columns of the table. Notice also that the group fixed effect *new EU* is always close to zero and non-statistically significant, further strengthening the credibility of the main identifying assumption.<sup>23</sup>

In Table 5 we report the results for violent offenders. Inference is much less precise in this case, because the sample size is much smaller.<sup>24</sup> Still, the point estimates are again consistent with the preliminary evidence in Table 3, namely that violent crime *increases* after the policy change. Therefore, the end of expulsion after the EU enlargement might have determined an increase in the number of crimes committed by this category

<sup>23</sup>As of the other explanatory variables, the residual sentence plays a deterrence role, in line with the results of Drago et al. (2009); marriage status has also a significant effect.

<sup>24</sup>For the same reason, we do not estimate the unrestricted specification, including the full set of week-specific fixed effects, for the subsample of violent offenders.

of offenders, which might be less (or not at all) responsive to economic motives when engaging in criminal activity. Instead, access to legitimate income opportunities seems strong enough to move the crime rate in the opposite direction for the subsample of economically-motivated offenders. We next explore this mechanism in detail.

## 6.2 The role of labor market opportunities

In our theoretical framework, the overall effect of legal status depends on two opposite forces: on the one hand, the end of deportations of formerly unofficial immigrants (and some potential criminals among them) increases the number of crimes they commit in the host country; on the other hand, access to legitimate income opportunities raises the opportunity cost of crime. We next confront these predictions with the data, exploiting variation in the relative importance of these factors across different regions in Italy.

Specifically, the Italian Statistical Office (ISTAT) assigns 8 regions each to North and South, and 4 to the Center; if we aggregate Center regions to the South, we obtain an area that is comparable to the North in terms of number of observations in our sample, but profoundly different in terms of economic and social development. As shown in Table 6, the North is in fact characterized by higher income and better labor market opportunities in the official sector. Actually, 6 out of 10 regions in Center-South fall into the “Objective 1” areas according to the EU classification (meaning among other things that their GDP per capita falls below the 75 percent of the EU average). At the same time, a large share of the labor force in the Center-South resorts to employment in the unofficial sector; the relative size of the shadow economy is twice as much as in the North (last column of the table).<sup>25</sup>

The relative importance of the official and unofficial sector determines in turn the income opportunities of legal and illegal immigrants, respectively. Therefore, we should expect the increase in the opportunity cost of crime after obtaining legal status to be greater in the North.

On the other hand, North and Center-South exhibit similar levels of enforcement of migration restrictions. In particular, if we estimate the number of illegal immigrants based on the applications presented during the last amnesty program (as previously explained in Section 2.2), we obtain similar ratios of unofficial over official immigrants in the two areas; see the bottom panel of the table. Therefore, the change in the probability of deportation for Romanians and Bulgarians after the EU enlargement should have been of similar magnitude between North and Center-South.

In the end, if we compare the policy effect in the North relative to that in the Center-South we are keeping approximately constant the change in incapacitation while increasing the strength of the economic channel; see also Figure 11. If the effect of legal status goes through the mechanism proposed in our theoretical framework, the magnitude of the

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<sup>25</sup>Indeed, the differential between North and Southern Italy has been widely studied over the years, see for instance Eckaus (1961) and Helliwell and Putnam (1995).

(negative) change in the criminal activity of Romanians and Bulgarians should then be greater in the North.

This is exactly the evidence emerging from Tables 7 and 8. The unconditional change in the fraction of Romanians and Bulgarians rearrested in the North between 2006 and 2007, as well as the difference-in-differences relative to the control group, are almost twice as much as the average effect in the whole country; at the opposite, no significant (differential) effect is detected in the Center-South. These results are qualitatively unaffected by conditioning on common time trends and individual characteristics in the parametric and semi-parametric models.

### 6.3 Structural break point

The estimates presented so far detect a statistically significant decrease in the criminal activity of immigrants from new EU member countries relative to the control group after the EU enlargement. Moreover, variation across areas characterized by different relative income opportunities for legal and illegal immigrants is consistent with the channel proposed in our theoretical framework.

One question is whether such estimates are really capturing the effect of this policy change as opposed to other events affecting the relative hazard rate of the two groups before and/or after that moment. In order to exclude this possibility, we run a placebo experiment at any possible date in our sample period to identify the most likely break point in the behavior of the two groups, much in the spirit of the tests of Andrews (1993) for identifying structural changes with unknown break points. If the most likely period is close to (distant from) the date of the EU enlargement, this would be evidence against (in favor of) spurious effects driving the results.

In practice, for each placebo date  $t^*$  we estimate the following linear probability models on the sample of individuals at risk of incarceration in each period  $t \leq t^*$  and  $t > t^*$ ,

$$\begin{aligned} H_0 : d_{it}^* &= \text{new } EU_i + \text{post}_t^* \\ H_1 : d_{it}^* &= \text{new } EU_i + \text{post}_t^* + \beta \text{new } EU_i \times \text{post}_t^*, \end{aligned} \tag{17}$$

where  $\text{post}_t^* = 1$  after  $t^*$  and  $\text{post}_t^* = 0$  otherwise, and  $d_{it}^* = 1$  if individual  $i$  was re-arrested in period  $t$  and  $d_{it}^* = 0$  otherwise; notice that estimating  $\beta$  by OLS is an alternative way of calculating the difference-in-differences reported in Table 3. Then, for any possible break point  $t^*$  we compute the R-squared ratio between models  $H_1$  and  $H_0$ , as a measure of the importance (in terms of explanatory power) of any differential change in criminal behavior between the two groups at date  $t^*$ .

The placebo estimated coefficients and R-squared ratio for Italy, as well as for the North and Center-South areas, are presented in the the left plots in Figure 12. The most likely break point for Italy as a whole is December 12, which is indeed quite close to the date of the enlargement and consistent with immigrants rationally anticipating the policy change and modifying their behavior as uncertainty about the policy change gradually unravels

(see Section 4.1).<sup>26</sup> When the same test is run separately for North and Center-South, the estimated break-points are very similar (December 1 and December 7), but while for the North the additional explanatory power is considerable, for the Center-South the R-squared increases by just a little; moreover, in the latter case the difference-in-differences effect is positive. This might be explained by the absence of significant improvements of the income opportunities of formerly unofficial immigrants after obtaining legal status, so that in Center-Southern regions the incapacitation effect prevails also for economically-motivated offenders. Another thing to notice is that the magnitude of the effect (gray line) is always higher as we let the data “choose” the break point, rather than fixing it on January 1, 2007.

The right plots in the figure provide additional visual evidence in this respect, showing the discontinuity in criminal behavior at the estimated break point. The plots are predicted (daily) hazard rates of rearrest as a function of a third order polynomial in time for Romanians and Bulgarians (solid line) and for control group (dashed line), before and after the break point. In line with the results in Tables 7 and 8, the discontinuity for the first group is particularly relevant in Northern regions, reaching 8%, as opposed to no discontinuity at all for the control group.

One interpretation of the general increase in the magnitudes is that estimating the break point addresses the measurement error induced by the fact that individuals will not in general stick to the official date of the policy change when adjusting their behavior. On the other hand, when we choose the break point by maximizing the explanatory power of the difference-in-differences, specification search bias implies that the coefficient estimated using the same data will have a nonstandard distribution (Leamer, 1978); in particular, conventional test statistics reject too often the null hypothesis that the coefficient is equal to zero. For this reason, we stick to the (more conservative) estimates reported in the regression tables.<sup>27</sup>

## 6.4 Threats to identification

In the final part of this section we discuss some additional identification issues. One first concern is that legal status affects the probability of being arrested and/or incarcerated conditional on having committed an offense. For instance, immigrants found without documents may be carefully scrutinized and additional evidence may become available at closer inspection. Also, conditional on the severity of charges, official immigrants could have easier access to sanctions alternative to institutionalization (like for instance home

<sup>26</sup>A likelihood ratio test statistic based on Cox’s proportional hazard model gives very similar results. See Ichino and Riphahn (2005) for a similar exercise.

<sup>27</sup>In a study on the dynamics of segregation, Card et al. (2008) address this source of bias by randomly splitting the sample and using different subsamples to estimate the break point and the size of the change. However, their data set includes about 40,000 census tract observations from 114 Metropolitan Areas, so even after splitting the sample into 2/3 and 1/3 subsamples for estimating the break point and the coefficient, respectively, they end up with a reasonably large number of observations in both steps. On the other hand, with just over 2000 individuals, we run into serious troubles in terms of statistical power.

detention). If this is the case, the reduction in incarceration that we observe could be explained by changes in the probability of ending up in jail conditional on criminal behavior, as opposed to changes in criminal behavior itself.

While we cannot directly address this issue (because the conditional probability of incarceration remains unobserved), there are several reasons why we believe that it is possible to exclude these alternative stories on the basis of the available empirical evidence. First of all, changes in the probability of arrest and incarceration should matter *after* the EU enlargement, while all the tests identify the break point *before* that date, which is more consistent with expectation-induced changes in (criminal) behavior. In addition, there is little or no reason for these alternative explanations to impact differentially in Northern and Center-Southern regions, or among economic and violent offenders. Finally, as to the possibility of sanctions alternative to incarceration, the pardon status precludes all individuals in our sample from accessing this opportunity.

Another issue is that legal and illegal immigrants may be characterized by a different willingness to travel back to their origin country, as they retain the right to return to Italy at any subsequent moment. While we consider at risk all individuals released with the pardon, spending less time in Italy would decrease the probability of committing a crime there for Romanians and Bulgarian after the acquisition of legal status. While this would also imply a reduction in the crime rate of this group, the mechanism would be totally different from the one proposed in this paper. However, also this alternative channel (like the ones discussed before) should work mostly after the policy change and, again, it should impact similarly on all (regardless of the type of crime previously committed and the region of residence in Italy).

A related concern is that, after obtaining the right to free movement, immigrants might consider moving to other European countries that offer relatively better labor market opportunities to legal immigrants. In addition to the usual counter-arguments in terms of break point and heterogeneity of effects (which hold true also in this case) we should notice in addition that migration to other EU states would not occur instantaneously; indeed, if this was really driving the change in re-incarceration, the effect should be *increasing* over time, as more and more Romanians and Bulgarians exit from the pool at risk. Therefore, we can investigate the empirical relevance of this alternative explanation by looking at the evolution of the differential effect over time. For this reason, we re-estimate the model (15) truncating the longitudinal dimension at each week after the EU enlargement. The results, shown in Figure 13, are remarkable stable over time, suggesting if anything that most of the action takes place in the first weeks after the enlargement, when migration to other countries plays probably little or no role.

One final issue concerns the possibility of interactions in crime between different communities of immigrants. In particular, the change in the criminal behavior of Romanians and Bulgarians after the EU enlargement could have affected the activities of the other individuals in our sample, thus “contaminating” the control group. In particular, substitution between the criminal activity of the two groups would bias our estimates upward,

in that other immigrants would increase their criminal activity in response to the decrease by Romanians and Bulgarians; the opposite is true in the case of complementarity.

While interactions in crime raise formidable estimating issues (which we do not address in this paper), descriptive evidence seems supportive of the complementarity hypothesis. Figure 14 plots the change (between 2006 and 2007) in the number of crimes committed by all Romanians in Italy against the same changes for (some of) the nationalities included in the control group, for different types of crime.<sup>28</sup> It emerges clearly a positive correlation between the two. While we can hardly attach any causal interpretation to this finding, the latter seems more consistent with the existence of complementarity in the criminal activities of the two groups (as opposed to substitution), in which case our estimates would be biased downward.

## 7 Conclusions

We use a natural experiment, namely the last round of the EU enlargement, to identify the effect of legal status on immigrants' crime. We provide a theoretical framework that illustrates the two main effects of legal status: on the one hand, it increases crime by precluding deportation of potential foreign criminals; on the other hand, it lowers the propensity to engage in crime by providing immigrants with better income opportunities. Evidence from a sample of former prison inmates released in Italy a few months before the enlargement suggests that the second effect prevails. In particular, the probability of rearrest decreases by more than half after obtaining legal status as a consequence of the EU enlargement.

Besides the effect on the pool of undocumented immigrants already in the host country, the concession of legal status (either through subsequent rounds of the EU enlargement or through amnesties) is also likely to attract new immigrants from abroad: indeed, thousands of Romanians and Bulgarians were standing along the European borders on New Year's Eve of 2007. It is then likely that changes in migration policy affect also the quantitative dimension of incoming flows, as well as their composition. Policy makers would also need an estimate of the cost and benefits of these additional consequences, but this goes beyond the scope of this paper.

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<sup>28</sup>These data are not available for Bulgarians and some other small foreign communities in the control group.

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## Appendix

In this Appendix we characterize the expected utility functions  $EV_L$  and  $EV_I$  defined in section 3, as well as the difference between the two,  $E\Delta V = E(V_L - V_I)$ .

Starting with  $EV_L$ , we may subtract  $\rho EV_L$  from both sides of equation 2 to obtain

$$V_L - \rho EV_L = \max \{C_L(z) - \rho EV_L; 0\} + w_L h.$$

Taking expectations with respect to  $z$  and recalling that  $z_k^* = \rho\pi EV_k$  (from equation 4) delivers

$$EV_L (1 - \rho) = \int_{z_L^*}^{+\infty} (z - z_L^*) dF(z) + w_L h;$$

after integrating by parts,

$$EV_L (1 - \rho) = \int_{z_L^*}^{+\infty} [1 - F(z)] dz + w_L h; \quad (18)$$

In a similar way, one obtains that the expected utility of illegal immigrants may be written as

$$EV_I (1 - \rho) = \delta [V_H - \rho EV_I] + (1 - \delta) \left[ \int_{z_I^*}^{+\infty} [1 - F(z)] dz + w_I h \right]. \quad (19)$$

**Proof that  $E\Delta V(h) \geq 0 \forall h \geq h_I$ .** By contradiction: assume that  $\exists h' \geq h_I$  such that  $E\Delta V(h') < 0$ , which implies (after combining 18 and 19)

$$\int_{z_L^*}^{+\infty} [1 - F(z)] dz + w_L h < \delta [V_H - \rho EV_I] + (1 - \delta) \left[ \int_{z_I^*}^{+\infty} [1 - F(z)] dz + w_I h \right] \quad (20)$$

Since  $[V_H - \rho EV_I] < 0$  over  $h \geq h_I$  and  $\Delta w \geq 0$ , a necessary condition for (20) to hold is that  $z_L^* - z_I^* = \Delta z^* > 0 > E\Delta V$ ; but  $\Delta z^*$  and  $E\Delta V$  having a different sign contradicts condition (4).

**Proof that  $\frac{\partial E\Delta V}{\partial h} \geq 0$ .** Using again equation (4),  $\frac{\partial E\Delta V}{\partial h} \geq 0 \Leftrightarrow \frac{\partial z_L^*}{\partial h} \geq \frac{\partial z_I^*}{\partial h}$ ; also, equations (18) and (19) become, respectively,

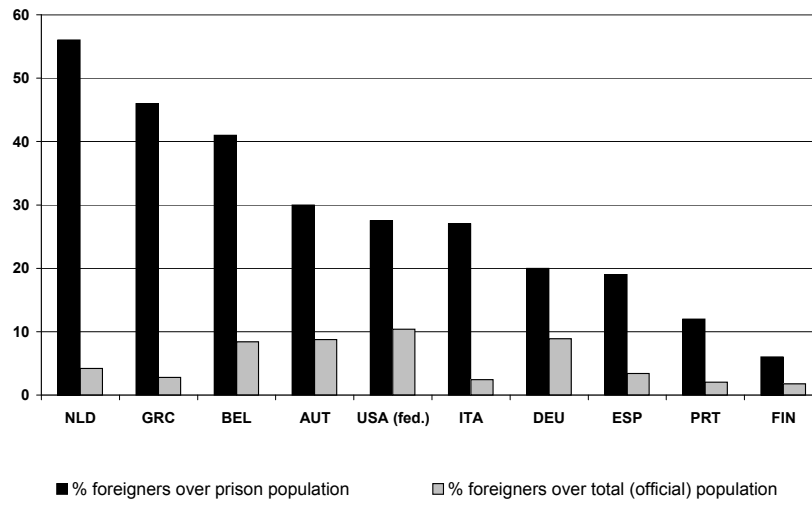
$$\begin{aligned} z_L^* \left[ \frac{1 - \rho(1 - \delta)}{\pi\rho} \right] &= \int_{z_L^*}^{+\infty} [1 - F(z)] dz + w_L h \\ z_I^* \left( \frac{1 - \rho}{\pi\rho} \right) &= \delta V_H + (1 - \delta) \left[ \int_{z_I^*}^{+\infty} [1 - F(z)] dz + w_I h \right]. \end{aligned}$$

Applying the implicit function theorem and the Leibniz rule we obtain

$$\begin{aligned}\frac{\partial z_L^*}{\partial h} &= \frac{\pi\rho w_L}{1 - \beta + 2\pi\rho [1 - F(z_L^*)]} \\ \frac{\partial z_I^*}{\partial h} &= \frac{(1 - \delta)\pi\rho w_I}{1 - \beta(1 - \delta) + 2\pi\rho(1 - \delta)[1 - F(z_I^*)]}.\end{aligned}$$

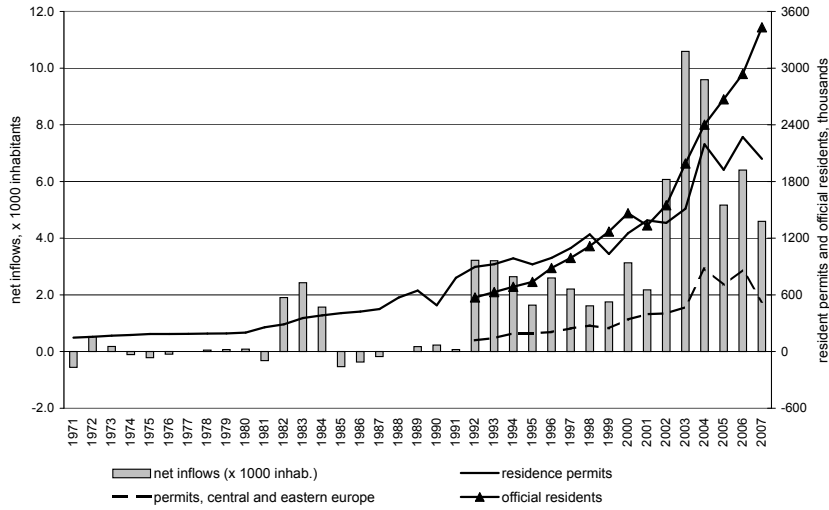
Then, a sufficient condition for having  $\frac{\partial E\Delta V}{\partial h} = \frac{1}{\pi\rho}\frac{\partial\Delta z^*}{\partial h} \geq 0$  is that  $\Delta z^* = \pi\rho E\Delta V \geq 0$ , which is always true over the interval  $h \geq h_I$ .

Figure 1: share of foreigners over total and prison population



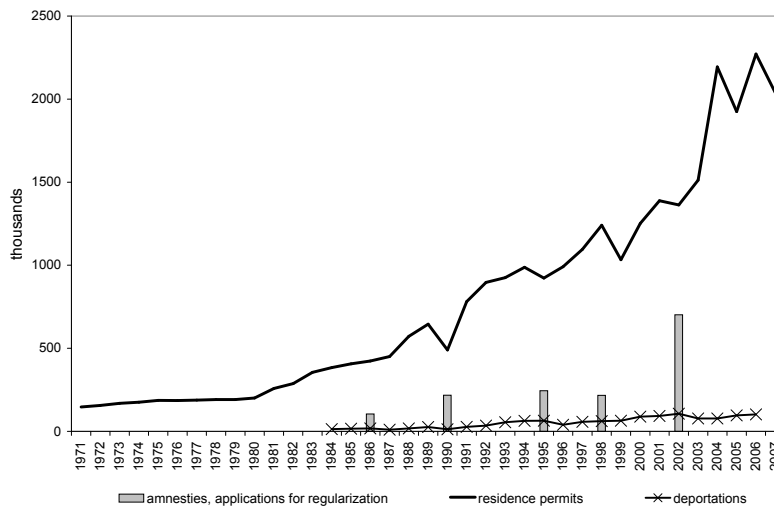
*Note:* The figure shows the incidence of foreigners over prison and total population, respectively, in some OECD countries around year 2000. The source is the OECD for all countries other than the US. The data for the US are taken from Stana (2005) and refer exclusively to federal prisons; representative data on state and local jails are not publicly available.

Figure 2: legal immigrants



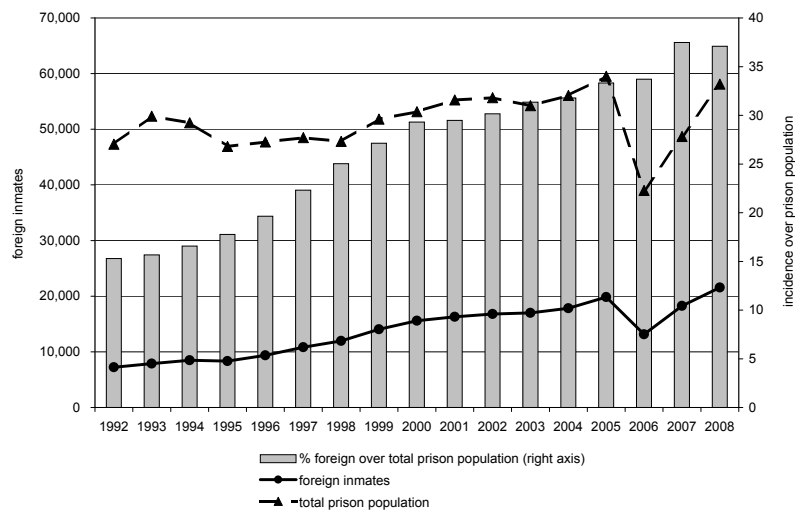
Note: The figure shows net migration inflows in Italy, as well as foreign official residents and valid residence permits during the period 1971-2007. Source: ISTAT and Ministry of Interiors.

Figure 3: illegal immigrants



Note: The figure shows the number of valid residence permits (since 1971), applications for regularization of formerly unofficial immigrants during the amnesty programs (1986, 1990, 1995, 1998, 2002) and the number of deportations of undocumented immigrants over the period 1984-2006. Source: Ministry of interior.

Figure 4: prison inmates



*Note:* The figure plots the number of native and foreign prison inmates in Italy during the period 1992-2008, as well as the incidence of foreigners over total prison population. Source: Ministry of Justice.

Figure 5: theoretical model

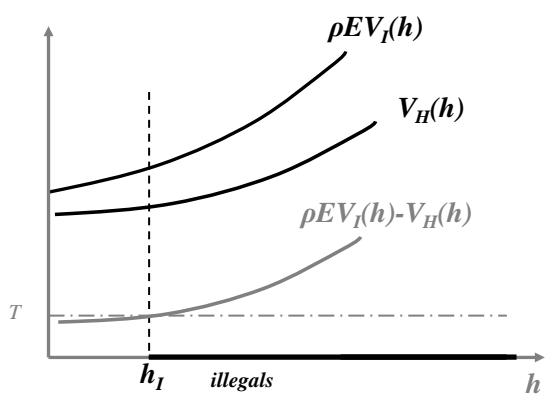


Figure 5a: illegal immigrants

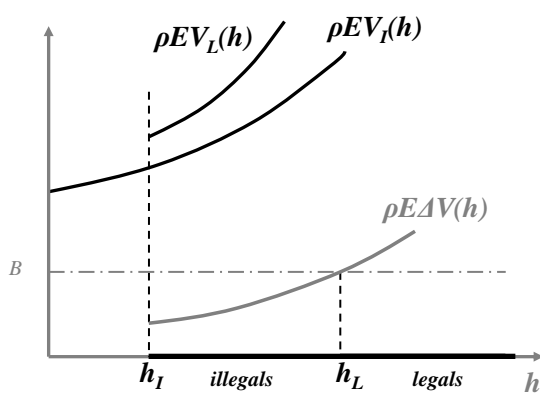


Figure 5b: self selection into legal status

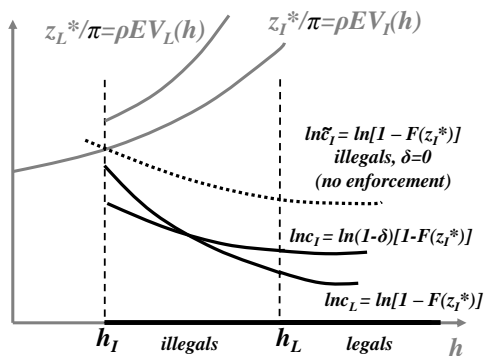


Figure 5c: criminal behavior

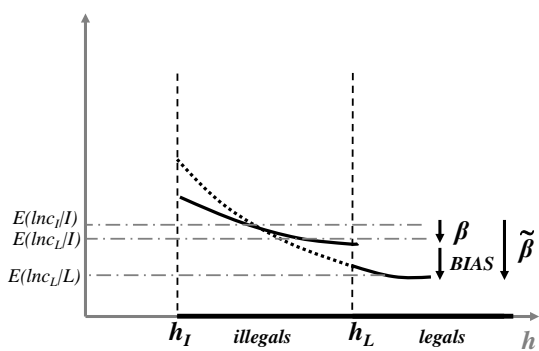
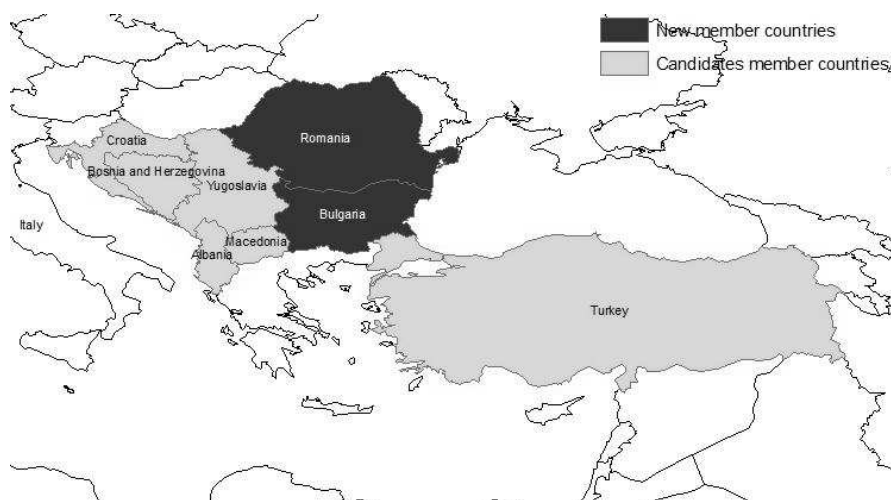


Figure 5d: selection bias

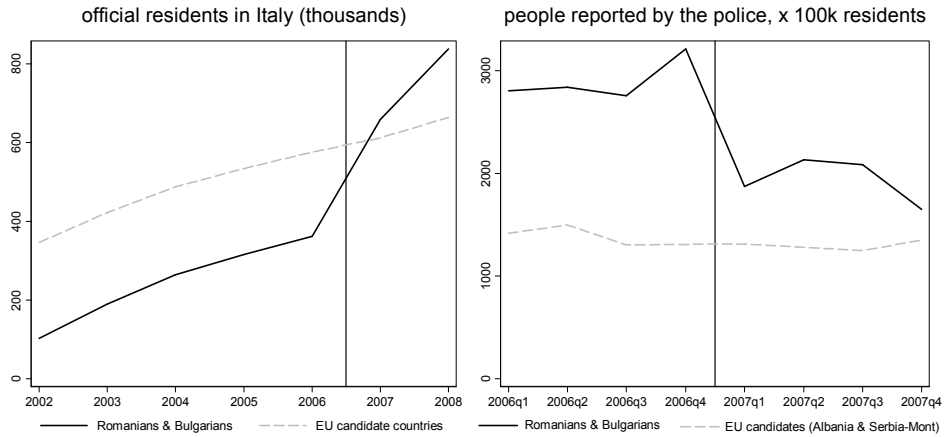


Figure 6: new EU member and candidate member countries



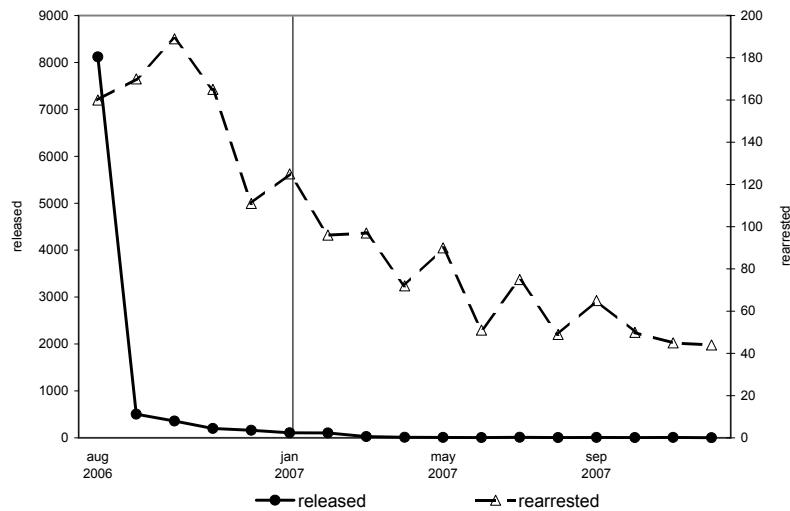
*Note:* The map shows the countries admitted to the EU during the last round of the enlargement (in black), as well as the group of candidate member countries (in gray). Source: European Commission.

Figure 7: immigrants in Italy, new EU member and candidate member countries



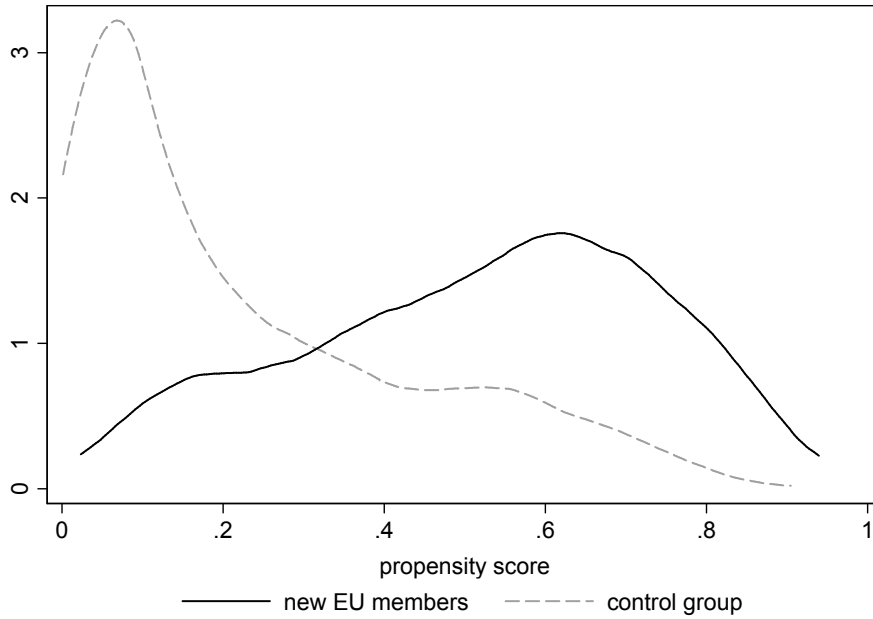
*Note:* The left graph plots the number of citizens of new EU member and candidate member countries officially residing in Italy during the period 2002-2008. The right graph shows instead the ratio of arrested by the police over official residents in each quarter during the period 2006-2007. In both graphs the vertical line refers to the date of the last EU enlargement. Source: ISTAT and Ministry of Interior.

Figure 8: the Collective Clemency Bill



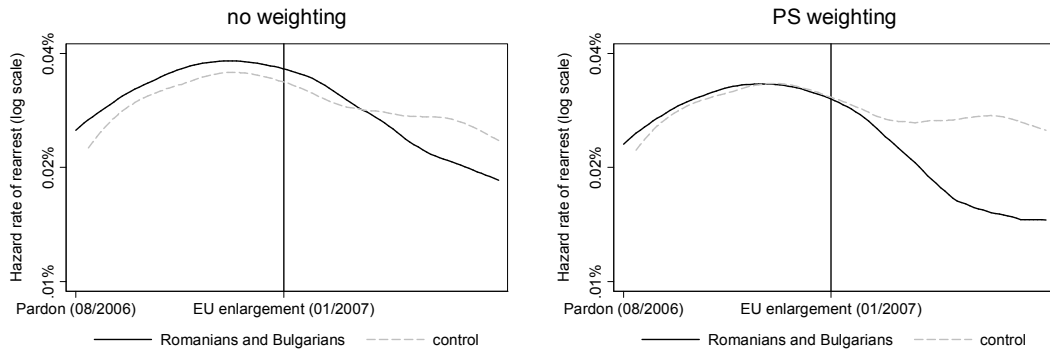
*Note:* The figure plots the number of foreign prison inmates released after the Collective Clemency Bill in August 2006 (on the left axis), as well as those rearrested until December 2007 (right axis). The vertical line refers to the moment of the EU enlargement. Source: Ministry of Justice.

Figure 9: propensity score weighting



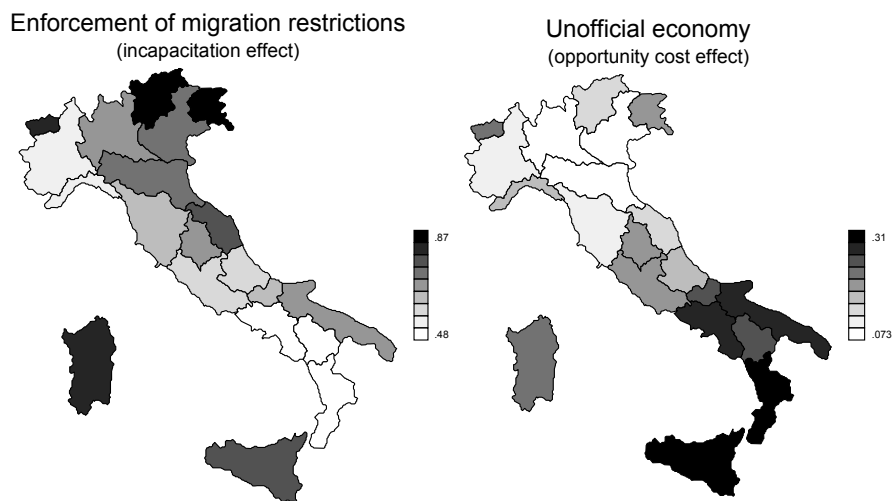
*Note:* The figure shows the kernel density of the estimated propensity score across groups. The propensity score is the probability of belonging to the groups of citizens of new EU member countries, conditional on observable characteristics. The estimate is based on a logit regression of a dummy for being Romanian and Bulgarian on a flexible specification of the individual information included in our sample.

Figure 10: hazard rates of rearrest



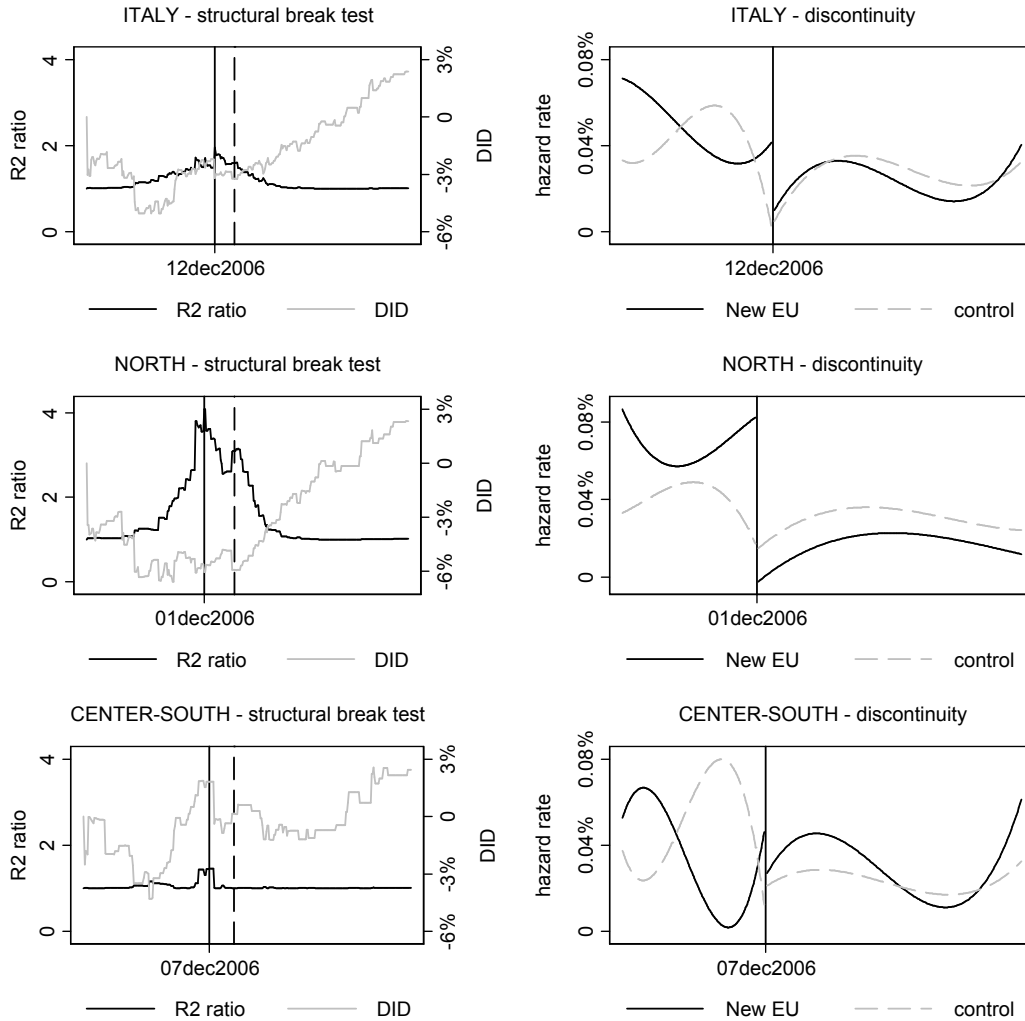
*Note:* The figure plots the non-parametric (Nelson-Aalen) estimates of daily log hazard rates of rearrest between August 2006 and May 2007 for Romanians and Bulgarians (solid line) and for the control group (dashed line). The scale on the vertical axis reports the (estimated) hazard rate of rearrest in each day. In the right graph observations are weighted by the (estimated) propensity score according to formula (14).

Figure 11: differences between north and south



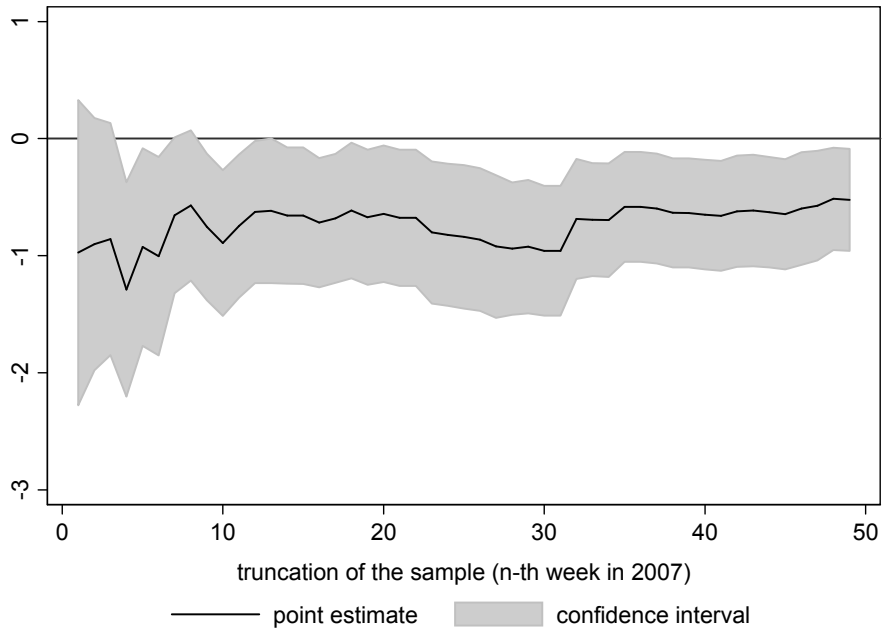
*Note:* The left map shows the ratio of legal over total (legal and illegal) immigrants across Italian regions; the right map shows instead the relative size of the unofficial economy. In both cases darker colors refer to higher values. Source: ISTAT and Ministry of Interior.

Figure 12: structural break test



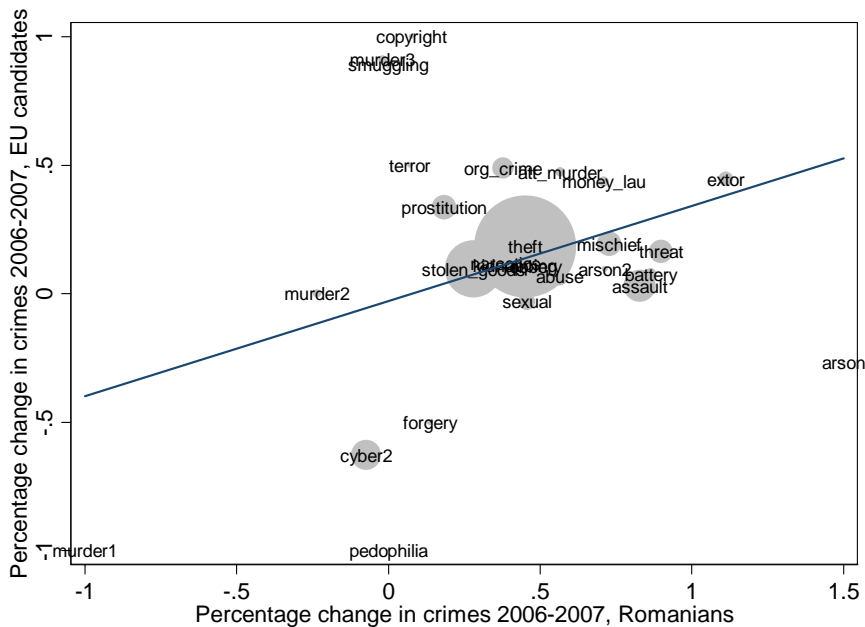
*Note:* The left graphs plot (black line and left axis) the ratio of the  $R^2$  of the difference-in-differences model  $H_1$  in (17), estimated at each possible date in the sample period, over the  $R^2$  of the restricted model  $H_0$ . The estimated coefficient of the interaction term in  $H_1$  is also shown (gray line and right axis). The vertical solid line corresponds to the day that maximized the  $R^2$ -ratio (i.e. the most likely break point), while the vertical dashed line is the official date of the EU enlargement. The right graphs plot instead the predicted (daily) hazard rates of rearrest as a function of a third order polynomial in time for Romanians and Bulgarians (solid line) and for the control group (dashed line), before and after the break point.

Figure 13: effect over time



*Note:* The graph plots the estimated  $\beta$  in model (15), namely the difference-in-differences between the log-odds of rearrest for Romanians and Bulgarians relative to the control group, before and after the EU enlargement, when the longitudinal dimension of the sample is truncated at each week during year 2007.

Figure 14: substitution of criminal activity



*Note:* The figure plots the (percentage) change between 2006 and 2007 in the number of Romanians arrested in Italy for different types of crime against the same change for citizens of candidate member countries. The area of markers is proportional to the total number of offenses committed in each category. Source: Ministry of Interior.

Table 1: legal and illegal immigrants, individual characteristics and labor market outcomes

variable	illegals		legals		diff.
	<i>obs</i>	<i>mean</i>	<i>obs</i>	<i>mean</i>	
age	1280	31.29 (8.94)	7343	34.63 (9.36)	-3.34*** (0.28)
female	1281	0.39 (0.49)	7353	0.44 (0.50)	-0.05*** (0.01)
married	1281	0.34 (0.47)	7353	0.59 (0.49)	-0.26*** (0.01)
number of kids	1279	0.76 (1.19)	7339	1.18 (1.28)	-0.41*** (0.04)
college	1281	0.14 (0.34)	7353	0.16 (0.37)	-0.02*** (0.01)
low skilled	1281	0.12 (0.33)	7353	0.09 (0.28)	0.04** (0.01)
income (euros per month)	949	824 (371)	5339	1130 (652)	-306*** (22)
college premium	949	9 (35)	5339	112 (25)	-103* (62)

*Note:* This table reports the average characteristics of legal and illegal immigrants, as well as the between-group difference in each variable. The source is the 2006 round of the ISMU survey, the sample is representative of the entire immigrant population of the Italian region of Lombardy. Robust standard errors are reported in parenthesis. \*, \*\* and \*\*\* denote between-group differences that are statistically significant at the 90% confidence, 95% confidence and 99% confidence, respectively.

Table 2: sample statistics by group

	NON-WEIGHTED SAMPLE					PROPENSITY SCORE WEIGHTING				
	new EU		control		diff	new EU		control		diff
	<i>obs</i>	<i>mean</i>	<i>obs</i>	<i>mean</i>	<i>mean</i>	<i>obs</i>	<i>mean</i>	<i>obs</i>	<i>mean</i>	<i>Mean</i>
<i>age</i>	725	31.083 (7.597)	1622	33.269 (8.088)	-2.187*** (0.355)	700	33.335 (8.528)	1493	32.716 (7.914)	0.619 (0.38)
<i>low education</i>	725	0.339 (0.474)	1622	0.461 (0.499)	-0.122*** (0.022)	700	0.437 (0.496)	1495	0.422 (0.494)	0.015 (0.023)
<i>no education</i>	725	0.017 (0.128)	1622	0.017 (0.128)	-0.0001 (0.006)	700	0.015 (0.122)	1493	0.018 (0.133)	-0.003 (0.006)
<i>education missing</i>	725	0.539 (0.499)	1622	0.404 (0.491)	0.135*** (0.022)	700	0.437 (0.496)	1493	0.450 (0.498)	-0.013 (0.024)
<i>married</i>	725	0.257 (0.437)	1622	0.288 (0.453)	-0.031 (0.02)	700	0.266 (0.442)	1493	0.277 (0.448)	-0.011 (0.021)
<i>economic crimes</i>	725	0.84 (0.367)	1622	0.894 (0.308)	-0.054*** (0.015)	700	0.857 (0.35)	1493	0.877 (0.328)	-0.02 (0.016)
<i>violent crimes</i>	725	0.295 (0.456)	1622	0.242 (0.428)	0.053*** (0.02)	700	0.284 (0.451)	1493	0.262 (0.44)	0.022 (0.021)
<i>sentence (months)</i>	725	20.31 (20.706)	1622	39.183 (32.33)	-18.873*** (1.306)	700	32.115 (30.63)	1493	33.269 (30.593)	-1.154 (1.435)
<i>residual sentence</i>	725	9.305 (10.615)	1622	15.727 (14.784)	-6.423*** (0.609)	700	13.349 (12.917)	1493	13.83 (14.13)	-0.481 (0.646)

*Note:* This table compares the characteristics of Romanians and Bulgarians in our sample with the group of citizens from candidate EU member countries. The first three columns report non-weighted averages for each group, as well as the between-group difference for each variable. In the last three columns observations are weighted by the inverse propensity score, according to (14). Robust standard errors are reported in parenthesis. \*, \*\* and \*\*\* denote between-group differences that are statistically significant at the 90% confidence, 95% confidence and 99% confidence, respectively.

Table 3: difference in difference

	ECONOMIC CRIMES			NON-ECONOMIC CRIMES		
	new EU	control	diff.	new EU	control	diff.
<b>post</b>	0.023	0.054	-0.031**	0.047	0.034	0.013
	(0.005)	(0.008)	(0.010)	(0.020)	(0.014)	(0.025)
	[0.006]	[0.008]	[0.010]	[0.021]	[0.014]	[0.025]
<b>pre</b>	0.058	0.057	0.001	0.033	0.043	-0.009
	(0.013)	(0.007)	(0.015)	(0.028)	(0.021)	(0.035)
	[0.014]	[0.008]	[0.015]	[0.019]	[0.022]	[0.029]
<b>diff.</b>	-0.035**	-0.003	-0.032*	0.014	-0.009	0.023
	(0.014)	(0.011)	(0.017)	(0.034)	(0.025)	([0.043])
	[0.014]	[0.011]	[0.018]	[0.028]	[0.027]	[0.039]

*Note:* This table reports the fraction of individuals in our sample that are re-incarcerated, distinguishing between citizens of new EU member countries and candidate member countries, as well as between the period before (“pre”) and after (“post”) the EU enlargement; the difference-in-differences is reported in the South-East corner of the table. The left and right panel show the cross tabulation for the subsamples of former inmates that were previously incarcerated (before the pardon) for economic and violent crimes, respectively. Observations are weighted by the inverse propensity score according to (14). Robust standard errors are reported in parenthesis. \*, \*\* and \*\*\* denote between-group differences that are statistically significant at the 90% confidence, 95% confidence and 99% confidence, respectively. Bootstrapped standard errors, based on 400 replications, are also reported in square brackets.



Table 4: economic crimes, parametric and semiparametric estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	<i>Logistic regression</i>				<i>Cox model</i>	
<i>new EU</i>	0.091 (0.219)	0.091 (0.220)	0.071 (0.222)	0.073 (0.222)	0.022 (0.218)	0.002 (0.219)
<i>post</i>	-0.404** (0.167)	-0.162 (0.354)	-0.162 (0.354)		-0.249 (0.363)	-0.277 (0.364)
<i>new EU</i> × <i>post</i>	-0.744** (0.289)	-0.740** (0.288)	-0.733** (0.289)	-0.736** (0.289)	-0.679** (0.308)	-0.668** (0.308)
<i>time</i>		-0.004 (0.011)	-0.004 (0.011)			
<i>time</i> <sup>2</sup>		-0.000 (0.000)	-0.000 (0.000)			
<i>age</i>			0.090 (0.058)	0.090 (0.058)		0.088 (0.059)
<i>age</i> <sup>2</sup>			-0.001 (0.001)	-0.001 (0.001)		-0.001 (0.001)
<i>married</i>			-0.381** (0.176)	-0.380** (0.176)		-0.283* (0.158)
<i>residual sentence</i>			-0.020*** (0.007)	-0.020*** (0.007)		-0.021*** (0.006)
Observations	124019	124019	124019	115428	3547	3547
Subjects	1918	1918	1918	1918	1918	1918
Week dummies	NO	NO	NO	YES	.	.
pseudo R <sup>2</sup>	0.009	0.010	0.016	0.042	0.003	0.009
Log Likelihood	-1704	-1702	-1691	-1631	-1797	-1786

*Note:* The table shows the results of parametric and semiparametric estimates of the probability of incarceration for immigrants from new EU member and candidate member countries before and after the EU enlargement. The parametric model in columns (1)-(4) is a logit equation for the log-odds of incarceration estimated on a panel of individual-weeks observations; the panel is unbalanced because we include only the individuals that are at risk of rearrest in any given week. The semiparametric model in columns (5)-(6) is a proportional hazard Cox model for the log hazard rate of incarceration. The sample includes all inmates from new EU member and candidate member countries released after the July 2006 collective pardon that were previously incarcerated for having committed an economically-motivated offense. The dummy  $post_t$  is equal to 1 in the weeks after the EU enlargement (January 1, 2007), while  $time$  and  $time^2$  are linear and quadratic trends in time, respectively. Regressions are weighted by the inverse propensity score according to (14). Robust standard errors clustered by Italian region and country of origin are reported in parenthesis. \*, \*\* and \*\*\* denote coefficients significantly different from zero at the 90% confidence, 95% confidence and 99% confidence, respectively.

Table 5: non-economic crimes, parametric and semiparametric estimates

	(1)	(2)	(3)	(4)	(5)
	<i>Logistic regression</i>			<i>Cox model</i>	
<i>new EU</i>	-0.281 (1.030)	-0.283 (1.030)	-0.222 (0.998)	-0.276 (0.691)	-0.215 (0.691)
<i>post</i>	-0.546 (0.585)	0.044 (0.999)	0.051 (1.005)	0.490 (0.838)	0.493 (0.845)
<i>new EU</i> × <i>post</i>	0.251 (1.144)	0.251 (1.143)	0.245 (1.138)	0.256 (0.864)	0.243 (0.865)
<i>time</i>		-0.015 (0.027)	-0.015 (0.027)		
<i>time</i> <sup>2</sup>		-0.000 (0.001)	-0.000 (0.001)		
<i>age</i>			0.223 (0.193)		0.229 (0.212)
<i>age</i> <sup>2</sup>			-0.003 (0.003)		-0.003 (0.003)
<i>married</i>			0.111 (0.588)		0.108 (0.420)
<i>residual sentence</i>			-0.008 (0.023)		-0.007 (0.020)
Observations	18105	18105	18105	531	531
Subjects	272	272	272	272	272
pseudo R <sup>2</sup>	0.004	0.008	0.015	0.002	0.012
Log Likelihood	-202.9	-202.1	-200.6	-150.2	-148.6

*Note:* The table shows the results of parametric and semiparametric estimates of the probability of incarceration for immigrants from new EU member and candidate member countries before and after the EU enlargement. The parametric model in columns (1)-(3) is a logit equation for the log-odds of incarceration estimated on a panel of individual-weeks observations; the panel is unbalanced because we include only the individuals that are at risk of rearrest in any given week. The semiparametric model in columns (4)-(5) is a proportional hazard Cox model for the log hazard rate of incarceration. The sample includes all inmates from new EU member and candidate member countries released after the July 2006 collective pardon that were previously incarcerated for having committed (only) violent offenses. The dummy  $post_t$  is equal to 1 in the weeks after the EU enlargement (January 1, 2007), while  $time$  and  $time^2$  are linear and quadratic trends in time, respectively. Regressions are weighted by the inverse propensity score according to (14). Robust standard errors clustered by Italian region and country of origin are reported in parenthesis. \*, \*\* and \*\*\* denote coefficients significantly different from zero at the 90% confidence, 95% confidence and 99% confidence, respectively.

Table 6: differences between northern and southern Italy

	North	Center-South	North/CSouth
Total sample	1244	1103	1.1
New EU	348	377	0.9
Candidate countries	896	726	1.2
<b>economic structure (labor mkt opportunities)</b>			
GDP per capita	30066	20947	1.4
shadow economy (%GDP)	9%	18%	0.5
employment rate	48%	37%	1.3
<b>illegal condition in 2002 (incapacitation)</b>			
residence permits, ths.	832	616	1.4
illegals (applications for amnesty), ths.	366	336	1.1
illegals/permits	31%	35%	0.9

*Note:* The table displays the average characteristics of Northern and Center-Southern regions, as well as the ratio between the two (in the third column). Source: ISTAT and Ministry of Interior.

Table 7: North vs. South, difference-in-differences

	northern regions			southern regions		
	new EU	control	diff.	new EU	control	diff.
<b>post</b>	0.014 (0.006)	0.061 (0.010)	-0.046** (0.012)	0.034 (0.009)	0.046 (0.013)	-0.013 (0.016)
<b>pre</b>	0.066 (0.020)	0.053 (0.009)	0.013 (0.022)	0.049 (0.017)	0.063 (0.012)	-0.014 (0.021)
<b>diff.</b>	-0.052** (0.021)	0.007 (0.014)	-0.059** (0.025)	-0.015 (0.020)	-0.017 (0.017)	0.001 (0.026)

*Note:* This table reports the fraction of individuals in our sample that are re-incarcerated, distinguishing between citizens of new EU member countries and candidate member countries, as well as between the period before (“pre”) and after (“post”) the EU enlargement; the difference-in-differences is reported in the South-East corner of the table. The left and right panel show the cross tabulation for the subsamples of former inmates that were released from a prison in the North and Center-South of Italy, respectively. Observations are weighted by the inverse propensity score according to (14). Robust standard errors are reported in parenthesis. \*, \*\* and \*\*\* denote between-group differences that are statistically significant at the 90% confidence, 95% confidence and 99% confidence, respectively.

Table 8: North vs. South, parametric and semiparametric estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	NORTHERN REGIONS				CENTER-SOUTHERN REGIONS			
	<i>Logistic</i>		<i>Cox model</i>		<i>Logistic</i>		<i>Cox model</i>	
<i>new EU</i>	0.226 (0.254)	0.246 (0.246)	0.214 (0.287)	0.234 (0.287)	-0.085 (0.355)	-0.123 (0.351)	-0.224 (0.339)	-0.256 (0.340)
<i>post</i>	0.168 (0.432)	0.170 (0.432)	-0.277 (0.477)	-0.343 (0.478)	-0.612 (0.524)	-0.612 (0.524)	-0.142 (0.560)	-0.612 (0.524)
<i>new EU</i> × <i>post</i>	-0.948** (0.413)	-0.933** (0.422)	-0.940** (0.407)	-0.923** (0.408)	-0.459 (0.348)	-0.465 (0.347)	-0.323 (0.472)	-0.331 (0.472)
<i>age</i>		0.151* (0.083)		0.151* (0.085)		0.028 (0.086)		0.022 (0.081)
<i>age</i> <sup>2</sup>		-0.002* (0.001)		-0.002 (0.001)		-0.000 (0.001)		-0.000 (0.001)
<i>married</i>		-0.605*** (0.195)		-0.599*** (0.217)		-0.087 (0.315)		0.117 (0.231)
<i>residual sentence</i>		-0.022** (0.009)		-0.022*** (0.007)		-0.019* (0.010)		-0.022** (0.009)
Observations	68151	68151	1982	1982	55868	55868	1566	1566
Time trend	quad.	quad.	flex.	flex.	quad.	quad.	flex.	flex.
pseudo R <sup>2</sup>	0.011	0.021	0.005	0.015	0.011	0.015	0.003	0.009
Log Likelihood	-989.9	-979.9	-950.9	-941.0	-710.4	-706.9	-679.6	-675.7

*Note:* The table shows the results of parametric and semiparametric estimates of the probability of incarceration for immigrants from new EU member and candidate member countries before and after the EU enlargement, distinguishing between Northern and Center-Southern regions. The parametric model (columns 1-2 and 5-6) is a logit equation for the log-odds or incarceration estimated on a panel of individual-weeks observations; the panel is unbalanced because we include only the individuals that are at risk of rearrest in any given week. The semiparametric model (columns 3-4 and 7-8) is a proportional hazard Cox model for the log hazard rate of incarceration. The sample includes all inmates from new EU member and candidate member countries released after the July 2006 collective pardon from a prison in the North (columns 1-4) and in the Center-South (columns 5-8). The dummy  $post_t$  is equal to 1 in the weeks after the EU enlargement (January 1, 2007), while  $time$  and  $time^2$  are linear and quadratic trends in time, respectively. Regressions are weighted by the inverse propensity score according to (14). Robust standard errors clustered by Italian region and country of origin are reported in parenthesis. \*, \*\* and \*\*\* denote coefficients significantly different from zero at the 90% confidence, 95% confidence and 99% confidence, respectively.

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