Rationalizable suicides: Evidence from changes in inmates' expected length of sentence

Rationalizable Suicides: Evidence from Changes in Inmates' Expected Length of Sentence*

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Abstract

Is there a rational component in the decision to commit suicide? Economists have been trying to shed light on this question by studying whether suicide rates are related to contemporaneous socioeconomic conditions. This paper goes one step further: we test whether suicides are linked to forward-looking behavior. In Italy, collective sentence reductions (pardons) often lead to massive releases of prisoners. More importantly, they are usually preceded by prolonged parliamentary activity (legislative proposals, discussion, voting, etc.) that inmates seem to follow closely. We use the legislative proposals for collective pardons to measure changes in the inmates' expectations about the length of their sentences, and find that suicide rates tend to be significantly lower when pardons are proposed in congress. This suggests that, amongst inmates in Italian prisons, the average decision to commit suicide responds to changes in current expectations about future conditions. At least partially, therefore, the decision seems rationalizable.

Keywords: Suicides, Rationality, Prisons, Collective Pardons
JEL classification codes: I1, D1, K4

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1 Introduction

According to the *US Center for Disease Control and Prevention* (www.cdc.gov) in 2013 suicides were the 2nd leading cause of death for the age groups 15-24 and 25-34 (homicide ranking 3rd) as well as the 10th leading cause of death across all age groups (homicide ranking 16th), with the corresponding estimated annual medical and work loss being nearly $35 billion. Based on the last survey by the *Substance Abuse and Mental Health Services Administration*, in the United States alone about 8 million adults had suicidal thoughts in 2008, while about 1 million attempted suicide (with 1 in 25 attempts being successful).[1] The picture is not that different if we look at Europe. Suicide is a significant cause of death in many EU member states, with approximately 60,000 such deaths in 2010 (OECD, 2012). In Italy more particularly there were about 3000 suicides in 2010, or 6 for every 100,000 inhabitants (ISTAT, 2012).[2]

Suicide is a relevant and highly complex issue, largely studied in social sciences as the end result of the interaction of several factors. In sociology and economics especially there is a long history of relating suicide patterns to more universal socioeconomic phenomena.[3] The very aim in Durkheim (1952) - widely considered as the pioneering work on sociology - was to explain suicide as the product of social conditions and structures, a line of approach that has henceforth influenced heav-

[1] More Americans successfully commit suicide each year than die in motor accidents - see Daly et al. (2011).

[2] Among European countries, Italy has one of the lowest suicide rates. Because of a social stigma, however, the official statistics might be underreporting the real number of suicidal events.

[3] There is an equally long history in psychology behind the so-called "psychiatric thesis." Namely, that suicide is always the product of some psychopathological condition, effected by causes that are biological rather than social, to be found amongst the relevant types of mental disorder. This thesis has not been born out by empirical findings: there is no systematic evidence for the contention that suicide is universally associated with identifiable forms of mental illness - see Giddens (1965) but also WHO (2014). As a result, nowadays most psychologists concede that suicides are not isolated acts but a spectrum of activities related to a diversity of risk factors. See Barzilay and Apter (2014) for a comprehensive review of the predominant psychological theories of suicidal phenomena.

ily an important part of the sociological literature.[4] Though far less comprehensive, following the seminal studies in Hamermesh and Soss (1974) and more recently Becker and Posner (2004), treatments in economics have also viewed suicide as potentially a social phenomenon, affected by the interplay of societal and individual factors.

Despite the relevance of the issue and the wide interest in social sciences about the topic, our understanding of the socioeconomic components of suicidal behavior remains convoluted, to say the least. The most significant theoretical insights are often at odds with one another, while the conjectured causal relations are far from clear. The empirical evidence is mixed, with the relevant literature suffering from a dramatic lack of methodological rigor.[5] The aim of this paper is to shed light upon a systematic dimension in the aetiology of suicide via means of a clean identification method.

In what follows, we test whether new information about the future influences the decision to commit suicide in a particular social environment, Italian prisons. This is not meant to imply that psychopathological conditions do not matter for suicides.[6] Attempts towards systematic explanations between one's current state of mind and one's expectations of the future state of affairs are by no means exclusive to sociology or economics. There is a consensus amongst psychologists that hopelessness (i.e., the inability to change "burdensomeness" and "thwarted belongingness") is an

[4]Durkheim contended that in modern societies three types of social structure produce particularly high rates of suicide: egoism, altruism, and anomie. The first two refer, respectively, to excessively-low and excessively-high levels of social integration (i.e., the extent to which individual members subordinate themselves to a social group by adhering to shared rituals, practices, and beliefs), while the third to a dearth of regulative norms. The many, and to a large extent equally important, sociological studies that Durkheim's analysis inspired have been reviewed in Giddens (1965) and more recently in Stack (1982).

[5]For critical reviews on the issues with the theory and empirics of the relevant literature, see Andres (2005), Stack (1982), Gvion and Apter (2011), Koo and Cox (2008), or Ruhm (2000).

[6]Ludwig, Marcotte, and Norberg (2009), for example, based on country-level data, find strong evidence that the use of anti-depressants reduces suicide rates.

important predictor of suicide - see, for instance, Van Orden et al. (2010).

In sharp contrast to existing empirical studies, however, the environmental confines within which we conduct our test render our investigation immune to the main methodological problems when it comes to measuring expectations about environmental conditions. More importantly, they allow us to measure *exogenous changes* in expectations. Even though expectations are hard to measure and highly diverse across individuals, prisons and suicides in prisons represent, respectively, almost ideal experimental grounds and events.

On the one hand, as the environment in which the experiment takes place, prisons are closed and isolated - which reduces the influence of external factors (family, friends, career prospects, current socioeconomic conditions, etc.) that might be latent or hard to measure consistently across individuals and over time. As events, on the other hand, suicides in prisons are fully recorded, while changes in the typical underlying individual expected utility depend almost exclusively upon changes in one's expected length of sentence.[7]

The existing empirical research on the causes of suicides has been limited to two distinct approaches. The sociological investigations have almost universally relied upon simple correlational studies between suicide rates and a rather limited range of socioeconomic variables. The psychological studies of suicide have been based almost wholly upon psychiatric case-histories, either from observations of individuals who have made unsuccessful attempts at suicide or from post factum analysis of records of mental-hospital patients who subsequently committed suicide (see McMillan et al.,

[7]As typically the case in a prison system, Italian prisons hold also inmates awaiting trial. For these individuals, other things being equal, one's expected length of sentence is obviously the relevant variable. With respect to the already sentenced criminals, it is the actual length of sentence that really matters. For, to quote from Kaminski (2004), "an inmate's dream is to fall asleep one day and wake up half a year later." But even in these cases expectations do come into play, since the actual time one will eventually serve might be significantly shorter than the nominal sentence itself.

2007, Kovacs and Garrison, 1985). While undoubtedly innovative and useful, either approach is subject to its own fundamental methodological issue. Lacking reliable identification strategies, the correlational evidence is generally weak, if not misleading. While one can try to measure expectations or hopelessness (using the scale in Beck, Kovacs, and Weissman, 1975, Beck et al., 2014), it is difficult, if not impossible, to consistently measure and compare (exogenous) changes in expectations using psychiatric data across individuals and over time.

Applied economists but also policy makers have tried to establish whether the actual decision to commit suicide includes a rational component.[8] That is, whether incentives and changes at the margin (of the kind typically addressed in economic analysis) do matter, even though the underlying decision-making situation is as extreme and the choice itself as irreversible as suicide. To this end, the economic intuition predicts that individuals decide to commit suicide when this appears to be the most preferred alternative - in the sense that the discounted expected lifetime utility falls below a certain threshold.

The evolution of the underlying theoretical framework started with simple comparisons of net present values in Hamermesh and Soss (1974), followed by more comprehensive efforts towards incorporating the various elements utility might depend upon - see, for instance, Koo and Cox (2008) and Becker and Posner (2004).[9] It culminated with the elaboration of models in which the very irreversibility of

[8]Interestingly, many ancient cultures - such as the Greeks, the Romans, the Japanese, and the Indians - also considered rational dimensions in suicide. They often viewed suicide as a rational response to illness, disgrace, or other pain and suffering. See the relevant discussion (as well as the extracts from Hume and Schopenhauer) in Becker and Posner (2004).

[9]In Hamermesh and Soss (1974) the main predictions were that suicide risk ought to be significantly related to age and decreases in permanent income. On the one hand, since one's utility increases with income, an increase in permanent income reduces suicide risk. On the other, since expected lifetime utility decreases with age, other things being equal, suicide risk increases with age. In Koo and Cox (2008), human capital is another determinant of expected utility. As human capital depreciates during spells of unemployment (due to the lack of continuous on-the-job training), unemployment increases suicide risk - by having an adverse effect not only on current income levels, but more importantly on expectations about future income streams.

committing suicide generates an option value to waiting (i.e., postponing suicide) when the uncertainty about the future is high - see Dixit and Pindyck (1994), Cutler, Glaeser, and Norberg (2001), or Miao and Wang (2011).[10]

There have been several attempts to test these theories empirically, or at least test whether suicides respond to economic incentives.[11] The most common approach, adopted by the grand majority of the literature in question, has been to look for correlations between suicides and current socioeconomic factors.[12]. A few more recent papers use individual-level data on suicides.[13] Either approach restricts attention to contemporaneous correlations, which makes the identification of a causal relationship between the socioeconomic variables and the suicide rate difficult. Even though the respective results might be capturing, at least to some

[10]In Dixit and Pindyck (1994) suicide is approached from the perspective of a real option: under conditions of irreversibility and uncertainty, an investor may opt for delaying undertaking an investment project while waiting to see what the future brings about. The authors argue that people thinking of committing suicide have a similar choice to make. They are comparing the irreversible action of suicide against the "option value" of staying alive ("delaying" suicide) and waiting to see if the situation will improve. The model is extended in Cutler, Glaeser, and Norberg (2001) to a three-stage dynamic one, in which the agent is endowed with the suicide option at each stage. This explains for instance the observed increase in youth suicide rates in recent US data by showing that, under hyperbolic discounting and random-walk uncertainty, suicide risk changes non-monotonically with age. In Miao and Wang (2011), the analysis is extended to the case in which the underlying uncertainty is Knightian.

[11]See Goldsmith et al. (2002) for a wide and comprehensive overview of the literature on suicides, and Chen et al. (2009) for a thorough survey of the empirical literature.

[12]These range over a diverse spectrum that includes social contagion (the phenomenon where one suicide precipitates suicide attempts by others), income, income growth, income inequality, economic growth or recession, education (as an important determinant of current as well as expected future income), unemployment, age and gender, monetary incentives (e.g., insurance), female labor-force participation, alcohol consumption, divorce and marriage rates, fertility rates, social isolation, household size, population density and growth, migration rates, health and health care, cultural factors/norms (such as ethnicity, religion, social capital, or the social sigma that suicide may carry), homicide rates, geographical and climatic conditions, lifestyle, civil liberties and quality of government. Typically, the data are aggregated over time and space, and a positive correlation between suicides and adverse economic conditions emerges - see Ruhm (2000), Cutler, Glaeser, and Norberg (2001), Brainerd (2001), or Andres (2005).

[13]In Daly and Wilson (2009) suicides are shown to share the same socioeconomic determinants as subjective measures of wellbeing. In Daly, Wilson, and Johnson (2013) the likelihood of suicide, which is taken to be a choice variable that depends on the present and expected future utility, is shown to decrease with own income but increase with reference-group income, highlighting the importance of relative status. See also Daly et al. (2011) as a related paper.

degree, the forward-looking behavior of the underlying theoretical framework, they cannot rule out reverse causality.

And, to make matters worse, it takes but the reformulation of Durkheim's conjectures (recall footnote 4 above) in Pope (1976) to establish that economic conditions are often difficult to disentangle from their sociological correlates. Consider for example the relation between unemployment and suicide risk. It could well be that individuals who suffer from (unobserved) mental disorders tend on average to be also less productive. But, as pointed out in Stack (1982), it could also be that we can relate suicide with unemployment rates by viewing the unemployed as "anomic," because of low incomes that cause a gap between goals and means, as well as "egoistic," because of the severing of ties to co-workers. Moreover, it is often even more difficult to disentangle the effect of socioeconomic factors from that of psychopathological ones. For instance, those suffering from mental problems might perceive their socioeconomic conditions as bad (e.g., depressed people may be less hopeful about future income and employment prospects) precisely because they suffer from mental problems.

Moreover, the data itself might fail to accurately capture the underlying latent variable of interest, utility. One one hand, when survey questions are deployed to elicit information about individuals' subjective "states" (feelings, attitudes, opinions, beliefs, etc.), they introduce systematic as well as non-systematic measurement errors - making it in turn difficult to compare answers across individuals or over time. On the other hand, when non-subjective, outcome-based data (e.g., on unemployment, crime, obesity, mortality, status, or the consumption of positional goods) is used, it tends to embody also many potential determinants of suicide that are unrelated to preferences.[14]

[14]It could well be that none of the factors listed in footnote 12 above is related to preferences directly. On top of that, these factors will typically operate concomitantly, and in different direc-

Having these concerns in mind, in what follows we do not deploy measures of current economic conditions to test for the existence of a rationalizable component in suicides. Our identification strategy hinges instead upon changes in current expectations about future conditions - changes brought about by new information that renders certain future outcomes more probable than before, without altering one's current wellbeing. Our focus is on changes in expectations due to "good" news. We exploit the fact that collective sentence reductions (pardons) in Italy often lead to massive releases of prisoners. More importantly, they are usually preceded by prolonged parliamentary activity (legislative proposals, discussion, voting in subcommittees, etc.) that inmates seem to follow closely.[15]

The contribution of the present paper is to use legislative proposals for collective pardons during the period 2002-2015 to measure changes in the inmates' expectations about the length of their sentences, and to show that suicide rates tend to be significantly lower when pardons are proposed in the Italian Chamber of Deputies or Senate. We also provide empirical evidence that the parliamentary activity features prominently in Italian news media, and anecdotal evidence that the relevant news spread quickly within the prison walls by means of a dedicated radio station.

Our findings indicate that, amongst inmates in Italian prisons, the average decision to commit suicide does depend upon current expectations about an anticipated

tions with respect to their effects on suicide rates. For a detailed discussion of these concerns see Daly and Wilson (2009) and Chen et al. (2009).

[15]New information about future conditions may generally reflect not only "good" but also "bad" news. Within the context of prisons, the typical profile of suicide that criminologists and psychologists have tried to build shows that "bad" news often lead to extreme self-harming behavior. Despite lack of data and small-sample issues, their research has concluded, among other things, that the period around the time of a court appearance is associated with high suicide risk amongst pretrial inmates, especially when a guilty verdicts and harsh sentences are anticipated. For sentenced prisoners, on the other hand, negative legal dispositions (such as loss of an appeal or the denial of parole) may act as triggers for suicide - see Liebling (1995), Liebling (1999), Wicks (1972), Hayes (1995), as well as WHO (2000). Unfortunately, the very nature of the test in the present paper precludes the study of a direct effect of "bad" news. For, more often than not, proposals that are expected to be unsuccessful are not even brought to the parliament floor, but rather kept on hold indefinitely. In Section 5.5 we devise an indirect way of measuring bad news.

release. We estimate that one additional pardon proposal reduces the number of suicides in the subsequent two or three months by about 10% over a period of two to three months. When we measure the effects in terms of news coverage about such proposals, we find that one standard deviation increase in the number of good news reduce the number of suicides by about 18% over a period of two months. As a placebo test, we also find that future proposals, which are thus not yet known to the inmates, do not induce any changes in suicidal behavior - a result that alleviates in addition concerns about reverse causality. These findings necessitate that more often than not the underlying decision-making process has at a minimum some component which does respond to informational incentives, and can be thus rationalized.[16]

In an ideal world we would test the relation between individual expectations about future pardons and the individual decision to commit suicide. More precisely, whether prisoners, whose own remaining sentence is most likely to be significantly reduced by a pardon, are the ones least likely to commit suicide during periods of increased parliamentary activity on pardon proposals.[17] In the real world, being as always constrained by the unavailability of the perfect data, we cannot but resort to the study of aggregates - in our case the suicide rate and, hence, the average decision to commit suicide.

Regarding this decision, the identification strategy in the present paper has two major advantages stemming, respectively, from the context and the instrument of

[16]It should be noted that our findings do not by any means render the decision to commit suicide rational per se. They do point out, however, that some of its constituting components may be rational. As an assertion, this has been made before in the literature albeit in decision-making contexts that differ sharply from the one under consideration here. See DellaVigna (2009) for an overview of decision-making situations that reflect potential departures from perfect rationality, yet in which the agents do respond to informational incentives. See also Drago, Galbiati, and Vertova (2009) and Barbarino and Mastrobuoni (2014) for another use of collective pardons as a policy instrument - to identify deterrence and incapacitation, respectively.

[17]For instance, an optimal test would be to regress the probability of a prisoner committing suicide on an interaction term between the number of pardon proposals in recent months and the length of the prisoner's remaining sentence.

our test. Since within the prison environment information about parliamentary activity on pardon proposals cannot exert any systematic change in the inmates' living conditions (other than through changes in expectations about future conditions) while the access to this information is unlikely to vary systematically across prisoners (at least as far as the potential determinants of suicide are concerned), pardon proposals are an exogenous instrument for assigning subjects to changes in expectations. Equally importantly, since almost all prisoners can expect to be eligible for sentence reduction under a potential pardon while all of them ought to regard their sentence being reduced as a desirable outcome, pardon proposals can be used as an instrument for positive changes in expectations without significant loss of generality with respect to the well-known issues that arise when effects are aggregated across subjects.[18]

As usual, however, one concern is that our evidence might be consistent also with explanations that have nothing to do with the suicidal prisoners' current expectations about an anticipated release. Alternative hypotheses as to why suicide rates and pardon proposals might be related to each other are laid out in Section 3 and tested in Sections 4 and 5. Our tests exploit the findings that suicide rates in the Italian prisons are related to past and present, but not future, activity on pardon proposals in the Italian parliament. The correlation in question is negative. The tests account in addition for the way the suicide rate in prisons responded to the amnesty law of August 2006 (the only actual pardon in our sample), as well as for the fact that all of the alternative explanations operate at some level through the

[18]The first such issue that comes to mind is the so-called "ecological fallacy:" the problem, described formally in Hanan (1958) (where the term was coined to emphasize a critical review of Durkheim's empirical methodology), that correlations computed from data on aggregated variables (group means, proportions, etc.) are often not valid estimates for the correlations that would have been obtained from individual data. The issue arises whenever the aggregation obscures significant heterogeneity in individual correlations. This cannot be the case, at least for the sign of individual correlations, under our implicit assumption that all (or almost all) prisoners dislike staying in prison.

current conditions in prison. Our proxy for prison conditions is overcrowding and, using province-level data on prison suicides, we show that if anything our results are even stronger when controlling for prison overcrowding. The next section describes our quasi-experimental setup while Section 6 concludes.

2 Collective Pardons

2.1 The Legislative Process

The policy instrument we will use to measure changes in the prisoners' current expectations about their future conditions are legislative proposals for collective pardons in the Italian Parliament (*Amnistie e Indulti*). These are sentence reductions, typically by 2-3 years, for crimes committed before the law gets passed, and lead to the immediate release of all inmates whose remaining sentence is less than the reduction itself. For a collective pardon to become Italian law it has to be proposed first by a member of parliament and then assigned to a parliamentary committee (*Commissione Parlamentare*). From there, once the proposal has been discussed and appropriately prepared, it is sent to the parliamentary chamber that currently sets the agenda. To be approved, the proposal has to be voted without further changes in both chambers of parliament, the *Camera dei Deputati* and the *Senato della Repubblica*, by an absolute majority of two-thirds (Constitutional Law 6/1992).[19]

Collective pardons in Italy have not been part of any systematic prison reform. In the recent past especially, they rather represent isolated and ad-hoc attempts to address pressing problems of prison overcrowding.[20] In this sense, legislative

[19]Before 1992, a simple legislative majority sufficed for collective amnesties and pardons to become Italian law. Notice also that collective pardon proposals can be made in addition by the government, the regional councils (*Consigli Regionali*), and the citizens themselves (as long as at least 50,000 signatures are collected so as to constitute an *iniziativa legislativa popolare*). More often than not, however, and in line with most legislative proposals in Italy, collective pardon proposals are initiated in parliament.

[20]To give a historical perspective, between the unification of Italy in 1865 and Mussolini's defeat

proposals for collective pardons reflect by themselves good news for people that are behind bars. For they are not only necessary for an amnesty law to be passed, but their very number is correlated with the likelihood that this happens.

This is depicted vividly in Figure 1 with respect to the period 1980-2013.[21] Shortly before an amnesty law gets passed (an event shown by a vertical line in the figure), the number of proposals for such a law increases dramatically.[22] More specifically, between January 1980 and December 2013, the introduction of at least one pardon proposal in the Italian Parliament in a given month increases the log-odds that an amnesty law is passed by 220% ($SE = 0.94$). Each proposal by itself increases the log-odds by 58% ($SE = 0.12$).[23]

Equally importantly for the purposes of our study, pardon proposals are noisy signals of parliamentary activity on collective pardons - for they do not make it into law all the time. In June and July of 2000, the year of the Great Jubilee, Pope John Paul II asked policy makers to pardon inmates while visiting the Roman prison of Regina Coeli, one of the largest in the country. This led to a surge in pardon proposals. Nevertheless, no actual law was passed and in November 2002 the Pope went to visit the Italian Parliament asking again for a pardon. This led to a second surge in proposals. Given how easy it was to predict the Pope's request, the surge actually anticipated his visit - exhibiting 4, 2, and 4 pardon proposals in September,

in 1943, there have been approximately 200 pardons or amnesties. Some of these were fiscal pardons or amnesties for very specific crimes. Others were aimed at easing social tensions or magnifying the royal family. Between 1945 and the present, however, approximately a dozen of collective clemency acts have been passed. Initially, they were aimed at reconciling a politically-divided nation. More recently, the main goal has been to alleviate severe overcrowding in prisons.

[21] For the period 1987-2001, our data on proposals has been gathered from the Italian Parliamentary Library (*Biblioteca della Camera dei Deputati*). For more recent years, it was obtained from the Italian Senate's web site (www.senato.it). We are indebted to Tommaso Nannicini for providing the former set of data.

[22] For example, the number of pardon proposals in the sample peaks at 6 and 12 in June and July 2006, respectively, anticipating the amnesty law of August 2006.

[23] The regression results in question are based on logistic regressions (preferred to linear probability models as pardons are rare events). They are shown in Table A3 of the Appendix.

October, and November 2002, respectively. Alas, again no amnesty law was passed.

There is also another reason rendering pardon proposals noisy signals of parliamentary activity on collective pardons. From the Italian Parliamentary Library (*Biblioteca della Camera dei Deputati*) and the Senate's TESEO search engine one can obtain the last recorded status of each pardon proposal. Even though proposals can be in one of 9 possible statuses, Table 2 shows that, no matter how far back in time proposals go, more than 50% are still recorded as either assigned to a parliamentary committee or under discussion in one.

Eventually, only a handful of proposals ever make it to the voting stage. It is much more common for a proposal to be put on hold, or (one might say) forgotten in some drawer. As a result, it is very difficult, if not impossible, for inmates (as well as researchers) to know the point in time when a given proposal finally fails to make it into law. Between 2001 and 2015 only in one occasion were proposals voted down - on January 12, 2006. The proposals that were dismissed on that day had been on hold for several months, some even for several years.

2.2 The Media Coverage of Proposals

Claiming descriptive evidence of a relationship between pardon proposals and changes in suicide rates assumes at a minimum that inmates follow the parliamentary activity on pardons from within the prison confines. To corroborate this, we gathered data on news regarding pardons and amnesties from the main Italian news agency, *Agenzia Nazionale Stampa Associata* (ANSA), the second most important Italian press agency (AdnKronos), as well as the newspapers *Il Corriere della Sera* and *La Stampa*. We also downloaded data on the distribution of searches on *www.google.it* based on the word "Indulto" using Google Trends.[24]

[24]Table A2 in the Appendix lists the data sources, and the period for which the data are available.

Using the month in which the individual news or Google searches that cover pardons or amnesties appeared - the same level of aggregation we will be using in our main regressions, - one observes that news and searches are highly correlated with the timing of the pardon proposals (see Table 3).[25] A strong correlation emerges also when comparing the time-series of the number of proposals with that of the number of individual news or Google searches (see Figure 2).

The data from ANSA are particularly rich being based on their internal database DEA (*Documentazione Elettronica ANSA*).[26] During the period 2002-2015, there are on average 71 news items per month about Italian pardons and amnesties, and ANSA would also produce photos and videos that media outlets can purchase. The agency is known to follow Italian parliamentary activity like no other media source, while all of the important Italian newspapers, TV stations, and radio stations are registered users of the ANSA wire service, using its news feed to plan their own coverage.

The time series of ANSA news on pardons is highly dependent on pardon proposals. This is shown in Figure 3 where we separate months depending on whether there were some proposals, and follow the lags and leads in the number of news items about pardons. While the distribution of news around months without a proposal is flat, the number of news about pardons increases as one gets closer to the month the proposal is presented, and drops steadily over the following months. The increased media coverage seem to last for about 2 to 3 months.

Evidently, pardon proposals feature prominently in the Italian news. To conclude the validation of our assumption, it remains to establish whether the news

[25] As a robustness check, Figures A1 and A2 in the Appendix present the entire scatter plot diagrams for the pardon proposals against the ANSA news in levels and logs, respectively. Either shows clearly that the correlation is not driven merely by the proposals between June and August 2006, the period that immediately preceded the amnesty law of 2006.

[26] ANSA is one of the leading world news agencies together with Reuters, Associated Press, Agence France Presse, and Deutsche Presse-Agentur.

make it into prisons. While data on inmates' use of news media are not available, conversations with Francesco Morelli and Riccardo Arena, the respective directors of the monthly prison magazine *Ristretti Orizzonti* and the weekly prison radio program *Radio Carcere*, revealed that either medium covers extensively any news about pardon proposals, and that inmates are well aware of such news. Moreover, news inside prisons are likely to travel very fast by word of mouth.[27]

Later, in Section 5.5, we are going to explicitly test the importance of such information transmission, by looking at the effect the news in question have directly on suicides.

2.3 The Expected Pardon "Treatment"

Pardon proposals being our measure of "good" news, it is important to understand how favorable and for whom amongst the Italian prisoners the corresponding event is likely to be. The period under consideration (January 2002 to March 2015) saw only one amnesty law, on 1 August 2006, and individual-level data of inmates pardoned on that date shows the average reduction in the length of their sentence to be 15 months.[28] This means that on average 45% of one's total sentence was pardoned.

Figure 4 depicts the relative frequency of the length of the total initial sentence amongst the Italian prisoners on 1 August 2006, and the fraction of this length that was pardoned on that date (either variable as a function of one's total sentence). On average, an inmate whose total sentence did not exceed 4 years (48 months) saw it being reduced by half. Inmates with longer remaining sentences had their sentence reduced by a smaller fraction. But, on average, this fraction almost never falls below

[27] *Ristretti Orizzonti* (Limited Horizons) was established in 1998 while *Radio Carcere* (Radio Prison) has been broadcasted since 2002 by *Radio Radicale* (Radical Radio), a well-known Italian radio station. *Ristretti Orizzonti*'s website has about 4,000 unique visits per day.

[28] Our data on suicides in Italian prisons goes back to only January 2002. As a result, our study of the effect of pardon proposals on suicides refers to the period between January 2002 and March 2015.

10%, while the measure of these cases in the total population decreases sharply as the remaining sentence length increases. Based on the August 2006 amnesty law, we may safely assert that pardons induce sizable reductions in one's remaining time in prison.

Regarding which inmates in particular are likely to receive a sentence reduction, Barbarino and Mastrobuoni (2014) show that pardons generate almost no selection: inmates are released almost indiscriminately based on just their residual sentence. There is obviously some uncertainty about receiving a pardon. As a rule, and to prevent abnormal increases in crime just prior to the introduction of an amnesty law, collective pardons in Italy apply only to crimes committed up to a specific date - usually three to six months before the date on which the law is signed. As a result, for those who happen to have committed a crime too close to the latter date, the pardon is likely to bring nothing but the psychological burden of seeing their fellow inmates released while they stay behind. Nevertheless, based again on the August 2006 amnesty law, many inmates ought to expect to be released immediately following an amnesty law, whereas the vast majority of them ought to expect a significant anticipation of their release date.

3 Suicides in Prison

The yearly suicide rate in Italian prisons is close to 10 per 10,000 inmates. This is about 10 times higher than that amongst the male population, slightly above the average across the prisons of other European countries, and twice the current average suicide rate across the U.S. penitentiary institutions. As the number of inmates fluctuates around 60,000, there are about 60 suicides per year (i.e., on average 5 per month) generating a relatively noisy evolution of suicides (the demeaned and

deseasonalized suicide rate is shown in Figure 6).[29]

The relatively high suicide rates in Italian prisons may seem paradoxical in the face of the claim that the decision to commit suicide exhibits a rational component. After all, if being imprisoned is very likely to lead to the ultimate penalty, a rational agent should have foreseen and avoided this contingency at all costs - including not becoming a criminal in the first place. At first glance, this seems to suggest that suicides in Italian prisons could be driven by error, in the sense that some criminals might not be able to foresee how harsh prison conditions can be.

The apparent paradox may be explained also by the hypothesis that criminal behavior reflects the choice to accept a gamble of high returns from crime against committing suicide if apprehended and convicted. Theoretically, this hinges upon the idea - formulated explicitly in Becker and Posner (2004) - that individuals assess their current and expected future (lifetime) utility, and compare the resulting present value of life to that of exit. For the vast majority of the population, the former value never even nears the threshold defining the latter. For the marginal person, however, the threshold in question is binding and the evaluation becomes critical.[30]

Following this line of thought, we may view suicide as revealing a choice made by individuals who have examined the present value of continuing to live as opposed to exiting, conditional on exogenous risk factors that reflect one's assessment of current and expected future utility. But within the closed environment of a prison, there is no reason for the exogenous risk factors in question to vary systematically across individuals. Taking this view, therefore, means that prison suicide data have the advantage of measuring directly, through revealed preference, the assessment of expected lifetime utility in a systematic way.

[29]Section 4 provides a detailed description of the data.

[30]For the marginal individual, moreover, it is precisely the gambles offering a large gain albeit with a small chance that are particularly attractive - see Becker and Posner (2004), pp.10-11.

There are a few possible explanations for the focal relation of the present study: the one between the expectations in question and the observed parliamentary activity on pardon proposals. They amount to different hypotheses regarding the underlying latent mechanism via which inmates perceive the parliamentary activity as a signal for a possible improvement in their living environment and future prospects.[31] Each hypothesis corresponds to a specific prediction as to how the suicide rate in prison ought to respond to the parliamentary activity on pardon proposals, as well as to whether or not the activity itself results in an actual amnesty law.

3.1 Forward-looking Hypotheses

The explanation that comes first to our minds is based upon the important role uncertainty about the future plays on a decision such as whether or not to commit suicide from the perspective of the option-value theory of investment. Namely, the irreversibility of the act generates an option value to waiting (i.e., postponing suicide) when the uncertainty about the future is high. Regarding the suicides under study in particular, the possibility for receiving a significant anticipation of their release in the near future could make (at least some) individuals who are currently at risk to commit suicide willing to endure another unpleasant month or more in prison. Their decisions are governed by what is called "Bernanke's good news principle" in Dixit (1992): the option value of continuing to live is determined primarily by the

[31] None of these hypotheses is meant to imply that psychopathological conditions do not matter for suicides in prisons. The pertinent literature is large (see Fazel and Baillargeon (2011), Hayes (1995), or Gvion and Apter (2011) to name but a few), albeit outside the scope of our analysis. For our focus is upon the relation between the suicide rate in Italian prisons, on the one hand, and the activity on pardon proposals and amnesty laws in the Italian parliament, on the other. Even though the inmates' psychopathological states could affect their assessment of expected lifetime utility - in much the same way as they would affect their perceptions of current socioeconomic conditions (e.g., depressed people may be less hopeful about future income and employment prospects) - we see no reason for this effect to be *systematically* related to the activity in parliament. We would expect that inmates who suffer from serious psychopathological conditions are less responsive to "good news from parliament" -which, if anything, would imply that our estimates ought to be biased towards zero.

potential for good news, which induces one to ride out bad periods.

In what follows, we will call this the "early-release hypothesis:" inmates perceive news about parliamentary activity on pardon proposals as increased odds that they will be released soon. This hypothesis would generate a negative correlation between the suicide rate in prisons and pardon proposals to result from a time series where suicides are observed with a lag relative to proposals.[32]

Furthermore, the hypothesis predicts an increase in the suicide rate following the amnesty law of 2006. For the option-value theory leads also to the assertion that suicide rates would be relatively high amongst individuals who recently experienced "bad news." Hence, with respect to the prisoners who do not qualify for pardon under the law, inferring from the history of the parliamentary activity on pardon proposals that another amnesty law will probably not be coming for some period, they may well become more suicidal (see Figure 1)- especially, as they are also likely to be envious of the other prisoners benefitting from the pardon (which would be in line with evidence on relative comparisons, as in Daly, Wilson, and Johnson, 2013).

Perceiving parliamentary activity on pardon proposals as a signal for a possible improvement in one's future utility is by no means an exclusive characteristic of the inmates who are at risk to commit suicide. Those who are not at risk could be even more responsive in updating their expectations upwards when pardon proposals increase. It could be that only the prisoners who are not at risk to commit suicide are forward-looking in this respect. As this subset of inmates become more hopeful, less angry, less prone to violence, the prison environment could turn less unpleasant

[32]Equally importantly for the purposes of the present study, the theoretical intuition behind the hypothesis suggests that the correlation in question ought to be significant even though (or rather precisely because) the suicide rate in question is small. As pointed out in Becker and Posner (2004), the very fact that only a small fraction of the prisoners' population commits suicide implies that the inmates whose option value of waiting falls below the "exit" threshold are located in the extreme left-hand tail of the distribution. As the extreme tails of most distributions are very sensitive to changes in the mean, other things being equal, even moderate changes in the expected future lifetime utility could have very large effects on the fraction of inmates that fall below the threshold.

for all prisoners - including those who are at risk to commit suicide, and who might as a result become less likely to do so.

There is yet another possible dimension in the relation between parliamentary activity on pardon proposals and the inmates' perceptions of their future living conditions in prison. A prisoner's improved expectations about the future may reflect increased odds that poor conditions in prison (such as overcrowding for instance) will be alleviated by the early release of others - even if an own early release is improbable. This reasoning may apply also with respect to forward-looking behavior by the prison guards and personnel, rather than the prisoners themselves. Following a pardon proposal, guards may expect their working conditions to improve, becoming consequently less stressed and nicer to the prisoners. This may have a concomitant effect on the behavior of those inmates who are at risk to commit suicide.[33]

To accommodate either of the interpretations above, we will refer to this as the "prison-environment hypothesis."[34] Similarly to the early-release hypothesis, it implies a negative correlation between the suicide rate in prisons and pardon proposals to result from a time series where suicides are observed with a lag relative to proposals. Since the new hypothesis relates to suicides via the living conditions in prisons the correlation in question ought to be larger in magnitude at more overcrowded prisons. Equally importantly for the purposes of our study, the hypothesis predicts a decrease in the suicide rate following the amnesty law of 2006. For, other things being equal, the conditions in prisons ought to have become if anything better shortly after August 2006.[35]

[33]Nothing in this reasoning prevents the behavior of the inmates who are at risk to commit suicide to be also forward-looking. In conjunction even with the option-value theory, they may choose to postpone suicide because of improved expectations due to the prospect of improved conditions in prison (rather than that of their own release). Even this interpretation, however, points towards the same correlational pattern between suicides, pardon proposals, and amnesty laws as that stemming from the forward-looking behavior of the non-suicidal prisoners or the prison guards and personnel.

[34]We are indebted to an anonymous referee for bringing either interpretation to our attention.

[35]Regarding in particular the interpretation based upon the behavior of the non-suicidal inmates,

3.2 Other Hypotheses

The conditions in prison may also affect the behavior of the inmates who are at risk to commit suicide more directly and concurrently. It is rather well-established in the relevant literature that overcrowding in prisons exerts severe adverse effects on the psychological and behavioral well-being of inmates. Several studies suggest in particular that overcrowding - by intensifying competition for resources, space, and personal autonomy, increasing the potential for violence and victimization, or forcing cell sharing with unknown and potentially unpredictable cohabitants - heightens the stress of imprisonment and thus the likelihood of suicide.[36]

3.2.1 Prison overcrowding as trigger for suicides

Prison overcrowding is an issue in Italy, where many prisons routinely operate at overcapacity. It often becomes political matter - to such an extent that parliamentary activity on pardon proposals cannot but be viewed as politicians responding to overcrowding conditions in prisons. Under this perspective, which will be called henceforth the "overcrowding hypothesis," we should expect a positive correlation between the suicide rate in prisons and pardon proposals to result from a time series where proposals are observed with a lag relative to suicides. We are to expect also a decline in the suicide rate following the amnesty law of 2006 with its concomitant alleviation of prison overcrowding.

in contrast to the early-release hypothesis, the adverse psychological effects of not qualifying for pardon under the law are of limited import here. For the issue concerns inmates who have entered the prison not long before August 2006. As recent entrants, they are less likely to have established themselves high enough within the prisoners' hierarchy to be affecting dramatically the living conditions of other prisoners.

[36] Additional explanations point towards the fact that access to rehabilitation, education, and other beneficial programs are bound to be more limited in overcrowded settings. This may add in turn to inmate idleness and frustration - thus, strengthening the likelihood of suicide. For detailed discussions of the theory and literature on prison overcrowding see Mullen (1985), Huey and McNulty (2005), and Sharkey (2010).

3.2.2 Prison overcrowding as preventive force

Another commonly-held view in the literature points out the difficulty of committing suicide in multiple-occupancy cells.[37] More precisely, as prisons become more crowded and the number of inmates who reside in single cells decreases, cell sharing - by facilitating companionship and observation - may actually be a preventive force against suicides. We will be referring to this view as the "less-alone hypothesis." Maintaining the assumption that parliamentary activity on pardon proposals depicts the politicians' response to overcrowding in prisons, this suggests a negative correlation between suicides and pardon proposals to result from a time series where proposals are observed with a lag relative to suicides. This hypothesis predicts also an increase in the suicide rate following the amnesty law of 2006.

3.2.3 Unintentional suicides

Another relevant theme from the literature on suicides in prisons examines the linkages between attempted and actual suicides. In prison, attempted suicides tend to be 10 times more than actual ones. Such a multiple cannot but be related to the fact that committing a successful suicide is not the easiest of tasks, especially in overcrowded prisons. It may also depict though (desperate) attempts by inmates to induce their transfer to the hospital, to a different cell, or even their eventual release. Since penitentiary authorities are aware of these incentives, the attempts themselves need to be credible - which intensifies the risk of them turning into actual suicides. We will refer to the possibility for such unintentional suicides as the

[37] Evidence that suicidal attempts are more likely to fail in multiple-occupancy units compared to single cells or cells with few inmates is shown in Spinellis and Themeli (1997), Franklin, Franklin, and Pratt (2006), Anson (1984), or Anno (1985). In the latter study for example, out of 38 suicides in Texan facilities during an almost six-year period, 37 lived alone in single cells.

"hyper-rational suicides hypothesis."[38] Clearly, if parliamentary activity on pardon proposals depicts the politicians' response to overcrowding (or, more generally, a sharp deterioration of conditions) in prisons, this induces the same correlational pattern between suicides, pardon proposals, and the amnesty law of 2006 as the overcrowding hypothesis.

To fix ideas about the hypotheses above, the following table summarizes the respective predictions regarding the correlational patterns between the suicide rate in Italian prisons, on the one hand, and the news about pardon proposals in the Italian parliament, the actual amnesty law of August 2006, or the extent of prison overcrowding on the other.

Table 1: Hypotheses and Predicted Correlational Patterns

	$\Delta S_t / \Delta PP_{t+k}$	$\Delta S_t \vert$2006 Amnesty Law
Early Release	-ve	+ve
	for some $k < 0$	
Prison Environment	[-ve]	[-ve]
	for some $k < 0$	
Overcrowding/	[+ve]	[-ve]
Hyper-rational Suicides	for some $k > 0$	
Less Alone	[-ve]	[+ve]
	for some $k > 0$	

Note: ΔS_t and ΔPP_t depict, respectively, the changes in the suicide rate and the number of pardon proposals for month t. The brackets mean that the corresponding effect ought to be stronger under prison overcrowding.

[38] Our terminology here is inspired by Kaminski (2004), where it is argued that the stakes can be so high in prison to render "hyper-rational" even what appears to be inhuman and bizarre behavior.

4 Data and Preliminary Evidence

4.1 Data and Identification Strategy

Our identification strategy uses detailed information on the timing of (i) actual suicides in Italian prisons, and (ii) proposals for collective pardons in the Italian Senate or House of Representatives, over a 13-year period (2002-2015). We obtained the data on the prison population from the Italian Penitentiary Administration (DAP) while that on the legislative proposals for collective pardons can be found on the Italian Senate's *TEsauro SEnato per l'Organizzazione dei documenti parlamentari* (TESEO) database (available at www.senato.it). Regarding the dates of individual deaths, our data comes from the research group *Ristretti Orizzonti* (www.ristretti.it) - unfortunately, it does not include any information about the actual or expected length of sentence of the respective inmates.[39]

As pointed out in Section 2.1, pardons are nationwide policies while only a few criminals would not benefit from sentence reductions in a typical pardon. This implies that any individual information about inmates who committed suicide is orthogonal to the dates in which pardon proposals are presented. Equally importantly for the purposes of our study, before making it into law pardon proposals are not inducing any changes in prison condition by themselves - which dismisses again possible threats of omitted-variable bias.

For these reasons, the main variation we are going to exploit is temporal: we will compare the suicide rates between the periods of intensive parliamentary activity on pardons and the periods when pardons are not on the table. To this end, given that news about pardon proposals seem to spread over a period of a few months (recall

[39]The same data have been used by Drago, Galbiati, and Vertova (2011) to look at the relationship between prison conditions (as proxied by deaths in prison) and recidivism (see also Katz, Levitt, and Shustorovich, 2003). The official statistics on prison deaths are only available at the yearly level, but the *Ristretti Orizzonti* data tracks the yearly official statistics on suicides and natural deaths very closely (see Figures A3 and A4 in the Appendix).

Figure 3), and might take even more time to spread by word of mouth within the prison walls, we aggregate the data at the monthly level. This empirical strategy identifies the average effects of pardon proposals on suicide rates. Nevertheless, one might expect these effects to be different according to prison conditions as well as with the number of years the proposals are supposed to pardon.[40]

Regarding the former consideration, the single most relevant prison condition is certainly overcrowding. Since we have information about the prison where inmates committed suicide, we can match such a prison to its overcrowding status. There are 166 prisons in Italy, and the data on overcrowding at the prison level is available from the Italian Ministry of Justice (www.giustizia.it) biannually starting in 2010. To match this with the *Ristretti Orizzonti* data (on which many prison names are not as accurate as in the judicial statistics) on deaths, we aggregate the prison-level data at the province level for all provinces that had at least one suicide event - there are 93 such provinces in total.[41]

The relevant statistics at the province level are shown at the bottom of Table 4. The average overcrowding rate during the period 2010-2015 is 141%, with more than 50% of all provinces exhibiting an overcrowding rate that is larger than 150%. Even though there are too few pardon proposals during the period, there is little variation (just 30%) in prison overcrowding within provinces over time. Most of the variation (61%) is cross-sectional, with the rest (9%) being driven by the variation over time that remains the same across provinces. Given this, it is without significant loss

[40]Even though a successful pardon proposal will anticipate the date of release for almost all inmates, the corresponding effect on expectations is likely to be larger for those inmates with residual sentences that are lower than the proposed reduction in sentences - for they would expect to be released immediately. Unfortunately, information on residual sentences is not available at the prison level.

[41]The aggregation of the prison-level data at the province level is only minor in extent since there are on average less than 2 prisons per province. It is meant to avoid certain data-consistency issues at the prison level (given that during the period 2010-2015 some prisons were closed, some changed name, while some new ones were opened).

of generality to average the information about overcrowding across the 2010-2015 period before matching it with the data on suicides for the entire period 2002-2015.

Over the 158 months of the latter period, according to the summary statistics in Table 4, there are on average more than 4 suicides and about 1.5 natural deaths per month.[42] On average there is also one proposal every three months, with a tendency for minor and minority parties to present more proposals (something we do revisit later). Finally, with respect to the number of years that proposals are supposed to pardon, the mode and median is 3. In Section A.1 of the Appendix we test explicitly whether the content of pardons proposals matters, and we find that the semi-elasticities are more negative the larger the number of years to be pardoned.[43]

4.2 Preliminary Evidence

Comparing suicide rates between periods with and without a sizeable parliamentary activity on pardons reveals important differences. Figure 5 shows that the average suicide rate is close to 9 per 10,000 inmates when no proposals were presented in parliament over the last 3 months, while it is close to 7 per 10,000 when at least 2 proposals were presented. The figure shows also a preliminary placebo test, using natural deaths rates as the main outcome. While some of these deaths might be responding to the possibility of an early release, overall we expect smaller or no changes. The natural deaths are less frequent than suicides; more importantly, there are no significant differences across the periods with intensive parliamentary activity on pardons and the periods when no such activity takes place.

[42] There are also another 1.5 deaths per month that cannot be classified. Nevertheless, this does not affect our analysis (see in particular Section 5.4) as they are unlikely to be homicides. Notice for instance that, during the period 2000-2008, there were a total of 8 homicides or 0.07 homicides per month.

[43] Interestingly, other dimensions of the proposals (e.g. the political affiliation of the proponents) matter less.

Controlling for seasonality in suicides and for August 2006, the month that the amnesty law was passed, reduces the confidence intervals of our estimates and slightly lowers the suicide rate when proposals are presented. The main reason is that August 2006, the month that saw inmates been released in large numbers, coincides with a spike in the suicide rate. This can be seen in Figure 6 which depicts the simple time-series of suicides and a moving-average of pardon proposals. The vertical bar indicates August 2006 at which point either series spikes. The spike can be taken as preliminary evidence against both the "prison-environment" as well as the "overcrowding" (and, thus, also the "hyper-rational suicides") hypotheses, but in favor of the "early-release" and "less-alone" ones. For, while prison conditions most likely improved following the massive release of prisoners, the inmates are those who did not get released themselves (amongst whom many did not even receive a sentence reduction) and had to cope with the psychological burden of seeing their fellow inmates released, as well as face the historical regularity that following an actual pardon the next one might be a decade or more away.

5 Regression Analysis

5.1 Benchmark Results

Given that we have only anecdotal evidence about how information flows into prisons, we proceed with the deployment of regression analysis to test whether pardon proposals lead to significant differences in suicide rates. Since legislative proposals are bound to be orthogonal to any individual characteristic that might affect an inmate's suicidal behavior, parsimonious regression specifications are sufficient.

Monthly suicide counts are best modeled using Poisson regressions, where the exposure or offset variable is the total prison population (which in Italy is measured

by semi-annual census). Including the prison population as the offset variable, we are de facto modeling the suicide rate and not just the counts. We are implicitly assuming, thus, that suicides are approximately proportional to the prison population. Towards the end of this section, when using province-level data, we are going to take into account that the prison population influences the overcrowding status of the prisons, potentially introducing some nonlinearities between prison population and suicides.

Our estimation is based on Poisson quasi-maximum likelihood (i.e., Poisson with robust standard errors, clustered at the monthly level when using province-level data).[44] This is consistent as long as the conditional mean is correctly specified, even if the true data-generating process is not Poisson. To control for seasonality in suicidal behavior, our regressions include monthly fixed effects. To account, moreover, for the fact that the actual pardon in August 2006 might be "bad news" for those inmates who did not receive a sentence reduction, each regression includes also a dummy equal to one for August 2006.

Table 5 presents the results from different specifications, which control for different lags and leads of the number of proposals. The first specification (Column 1) is the most demanding: it controls for the number of proposals over a six-month window around (from $t-3$, three months preceding, to $t+3$, three months following) a given month. While only the semi-elasticity on month $t-2$ is significantly different from zero, all current and past number of proposals have semi-elasticities that are between -2.5% and -4.4%. More importantly, the p-value on the joint test that all the coefficients on the lagged variables are equal to zero is always below

[44]The expected number of suicides in month t is given by $\mathbb{E}\left[S_t|\mathbf{PP}_t\right] = Le^{\theta^{\intercal}\mathbf{PP}_t}$, where L represents the prison population (measured via semi-annual census during the period under study) while $\mathbf{PP}_t$ the array of pardon proposals per month during a six-month window around the month t. The coefficients can be interpreted as simple semi-elasticities: $\theta_k = \mathbb{E}\left[S_t|\mathbf{PP}_t\right]^{-1} \partial \mathbb{E}\left[S_t|\mathbf{PP}_t\right] / \partial PP_{t+k}$ where $k = -3, -2, -1, 0, 1, 2, 3$.

5%. The sum of the semi-elasticities implies that a *single* pardon proposal during the preceding three months reduces the number of suicides by about 14%. In sharp contrast, the coefficients on the leads are very close to zero - even when including only one lead $(t+1)$ the coefficient is basically zero.

Starting with Column 3 of the table, therefore, our regressions ignore the pardon proposals from the lead months. The same applies also for the proposals from the current month. Even though this makes little difference for the results, the deployment of only lags in the specifications reduces the concern of reverse causality - which would bias the estimated coefficient upwards if members of congress were more likely to propose collective pardons when suicide rates are particularly high.[45] For all Columns 3-7, the two model selection criteria at the bottom of the table, the Akaike Information Criterium (AIC) and the Bayesian Information Criterium (BIC), are noteworthy. They establish that the most preferred model uses just the sum of proposals presented in the preceding two or three months (Columns 6 and 7). The coefficients in Columns 6-7 indicate that each pardon proposal during the preceding two [resp. three] months reduces the number of suicides by about 5.8% [resp. 4.3%]. Finally, in all specifications of Table 5, the coefficient on the August 2006 pardon is always significant and positive - approximately equal to two. That is, amongst those inmates who had to remain behind bars while nearly 20,000 of their fellow inmates were released following the amnesty law of August 2006, suicide rates were 200% higher than expected, despite a significant reduction in overcrowding.

In line with the preliminary evidence, our results are corroborative for the "early-release" but detrimental for all other hypotheses. More precisely, the fact that suicides in prison fall with the number of pardon proposals presented in the preceding two or three months but do not respond to future proposals is completely at odds

[45] Using just lags accounts also for the possibility that it might take on average several days for the information about legislative proposals to reach all inmates within the prison walls.

with both the "less-alone" as well as the "overcrowding" (and, thus, also the "hyper-rational suicides") explanation. It does not go against the "prison-environment" hypothesis, but the fact that the suicide rate increases following an actual amnesty law certainly does. In sharp contrast, either fact is consistent with the "early-release" hypothesis.

In the comparison of the "early-release" and "prison-environment" hypotheses our evidence thus far is based but upon a single event, the actual pardon of August 2006. In what follows (see Section 5.3), we enhance significantly the power of our test by exploiting the variation in prison conditions (namely, prison overcrowding) across different provinces. Before proceeding, however, we must examine first the robustness of our analysis.

5.2 Robustness Checks

To this end, Table 6 presents several checks. Column 1 shows our benchmark regressions: the Poisson model with the sum of proposals in the preceding two months.[46] In Column 2, we model instead the log of the suicide rate (loosing 6 observations due to months without any suicides). The results are extremely similar. They remain so if one adds year fixed effects (Column 3) or does not control for exposure in the Poisson model (Column 4). Similarly, the results do not change if one includes the monthly suicide rate of the entire Italian male population between the ages of 18 and 64 (Column 5) - which shows that we are not just capturing an overall trend in suicides that happens to be correlated with the presence of pardon proposals.[47]

Another important robustness check is depicted in Column 6. It consists of including past suicide rates, so as to control for reverse causality. More precisely,

[46] The respective coefficients in Table 6 differ slightly from those in Table 5 because we have 156 observations in the former but 152 in the latter.

[47] We were able to find the monthly suicide rate of the Italian male population between the ages of 18 and 64 for about half of the total number of months in our sample.

if past suicide rates were correlated with past proposals, the coefficient on past proposals might just capture autocorrelation between present and past suicide rates. However, this does not seem to be the case. The autoregressive coefficient is precisely estimated as being close to zero, while the coefficient on past proposals is only slightly lower than before. Column 7 on the other hand tests a specification in differences for the number of pardon proposals. While short-term changes (for example, the number of proposals in the month t minus the number in the previous month) have a negative but negligible effect,[48] more long-term changes in the number of pardon proposals, namely the variable $1/3\left(\sum_{k=0}^{2} PP_{t-k} - \sum_{k=3}^{5} PP_{t-k}\right)$, are statistically significant: the suicide rate in a given month tends to decrease when the average number of proposals increases between the two most recent quarters. Either observation is consistent with the previous evidence, as well as with the view that the effects of pardon proposals materialize but also persist over the span of a few months. Finally, Column 8 restricts the sample to only the first 53 months - that is, to the period before the August 2006 pardon. Focussing the analysis on pardon proposals that were eventually successful leads to even larger reductions in suicides.

5.3 Overcrowding and Pardon Proposals

Our evidence of a relationship between pardon proposals in the Italian parliament and suicide rates in Italian prisons is far more than merely descriptive. Nevertheless, it could be that the observed correlation is driven by some other underlying factor to which both pardon proposals and suicides in prison respond. The first such factor that comes to mind has to do with living conditions in prisons - in particular, overcrowding.[49] While most Italian prisons tend to be overcrowded, there is considerable

[48] The results are not shown here but are available from the authors upon request.

[49] Recall our two dimensional interpretation of the "prison-environment" hypothesis in Section 3.1. That the second dimension should relate directly to prison overcrowding is immediate. As for the first dimension, it relies fundamentally upon the premise that the (aggressive) behavior of

geographical variation, even when averaging over the 5-year period 2010-2015 of our data on prison overcrowding. This is shown in the right panel of Figure 7. The left panel shows instead the geographical variation in the average suicide rate over the period 2002-2015 of our data on suicides. Comparing the two panels, if anything, the shades of gray appear to be negatively correlated.

In Table 7, we replicate the Poisson time-series analysis using province-level panel data. The dependent variable is now the number of monthly suicides in a given province, while the main variable of interest is the number of pardon proposals over the past two or three months. Since the number of proposals is the same across provinces in a given month, we cluster the standard errors at the monthly level. The main advantage of using province-level data is that we can assess whether overcrowding influences our results, either as an omitted variable or by generating heterogeneity in the effects. We deploy two measures of overcrowding, the overcrowding rate (the number of inmates in the province over the capacity of the province's prisons), and a dichotomous variable equal to one when the overcrowding rate in the province is above the national median (which corresponds to an overcrowding rate of 150%).

Our regressions include either one of the two measures of overcrowding or province fixed-effects, on the one hand, and the interaction between overcrowding and pardon proposals on the other. When using the overcrowding rate, we interact the demeaned rate so that the main effect measures how proposals influence suicides when prisons have an average degree of overcrowding. The coefficients show mainly that overcrowding i) reduces the suicide rate, and ii) attenuates the effect of pardon proposals on suicides (albeit most coefficients on the interaction terms are not

certain inmates affects decisively the living conditions of others. The latter relation is obviously to be enhanced in overcrowded prisons - where the prison authorities' capacity for supervision gets stressed to the limit while the competition amongst inmates for resources, space, and personal autonomy intensifies dramatically.

significantly different from zero). The first result leans against the "overcrowding" (and, thus, also the "hyper-rational suicides") hypothesis but in favor of the "less-alone" one. It indicates that suicidal attempts are more likely to fail in multiple occupancy units compared to single cells or cells with few inmates. The second result, in agreement with our previous evidence, favors the "early-release" over the "prison-environment" hypothesis. For overcrowding does not significantly alter the effects of pardon proposals on suicides. If anything, it seems to attenuate them through the presence of protective peers.[50]

5.4 Placebo Regressions

Nevertheless, another dimension of the "prison-environment" hypothesis could be that pardon proposals in the Italian parliament are decreasing the levels of violence inside Italian prisons, so that suicides in prisons might not be the product of forward-looking considerations, but of the resulting reduced levels of violence.

Unlike in the United States though, deaths from unnatural causes in Italian prisons seem to be very rare. During the period 2000-2003 there were no recorded homicides, while in the following 5 years the series was 3, 2, 1, 1, 0. That is, between 2000 and 2008 there were a total of 8 homicides or 0.07 per month. During the same period the number of official suicides was 483 so that the ratio of homicides to suicides was less than 2%. The same ratio calculated for the US, using data for the period 2000-2006 from state prisons and jails, is 14%.

As a result, the best we can do with respect to the "violence" explanation is to test whether deaths related to causes other than suicides (deaths from natural or unknown causes) depend on pardon proposals. Table 8 presents Poisson regressions

[50]Prison peers have shown to be important in influencing inmates' post-release behavior in less protective ways (see, for example, Bayer, Hjalmarsson, and Pozen, 2009, Chen and Shapiro, 2007, Drago and Galbiati, 2012).

with respect to suicides and deaths that are not categorized as suicides, using different sums of leads and lags. The coefficients on the leads of suicides, even when aggregating two or three leads together, are always precisely estimated to be zero. Those on the lags are always precisely estimated to be between -4 and -6 percentage points. For the other deaths, the coefficients vary considerably more and are of much smaller magnitude. Most importantly, none of the coefficients on the lags is significantly different from zero, while some of coefficients on the leads are actually negative albeit significant at the 10% level.

5.5 Pardon News and Suicides

It remains to check whether inmates do follow the parliamentary activity on pardon proposals from within the prison confines. The news items on pardon proposals and the respective parliamentary activity in the month t (N_t for "news") can be partitioned between those that are negatively (B_t for "bad news") and positively (G_t for "good news") inclined towards the likelihood of an actual amnesty: formally, $N_t = B_t + G_t$. As we do not have access to the main body of the news items themselves, we devise an instrumental variable strategy to isolate the positively-inclined items. To this end, we use the ANSA news items, our most comprehensive measure of information over the 2002-2015 period.

Our working hypothesis is that information about pardon proposals can reach the prison population only if this is featured in the ANSA news. This should not be far from the truth given that ANSA journalists consistently cover not just the main assemblies of the Italian Chamber of Deputies and Senate but also all the activity in the smaller committees. Under this assumption, we can estimate the marginal effect of news coverage that is positively inclined towards pardons or amnesties, deploying the number of proposals as instrument. We can exploit that is the positive-message

component of pardon proposals to isolate positive news. For if pardon proposals (PP_t) generate only positive news, it cannot but be

$$\begin{aligned} N_t &= B_t + G_t \\ &= \alpha + (0+\beta)\, PP_t + \epsilon_t = \alpha + \beta PP_t + \epsilon_t \end{aligned} \tag{1}$$

As a result, the change $\Delta\hat{G}_t = \hat{\beta}\Delta PP_t$ in the predicted value measures the change in positive news, while the change in the predicted residual $\Delta\hat{\epsilon}_t = \Delta N_t - \Delta\hat{G}_t$ will measure the change in the predicted negative news $\Delta\hat{B}_t$ (as well as any potential endogeneity in the news items). To test this model, we estimate in one-step the following Poisson "control function"

$$S_t = \exp\left(a + b_1 N_t + b_2 \hat{B}_t\right) + \varepsilon_t \tag{2}$$

where, conditional on $\hat{B}_t$, changes in ANSA news measure changes in positive news (observe that (1)-(2) together give $\partial S_t/\partial N_t = \partial S_t/\partial G_t$). We model the intercepts, a and α, as linear functions of the monthly fixed effects and the pardon dummy. To ease the interpretation of the coefficients, we divide the number of news items by its standard deviation.

Column 1 of Table 9 shows that a standard deviation increase in the news on pardons produced in the previous month reduces the number of monthly suicides by about 20%. The coefficients are slightly smaller regarding the news on pardons produced in the previous two (Column 2) or three (Column 3) months. The implied combined effect across Columns 2-3 is even more negative than that in Column 1 - implying that the effect of positive news persist for at least two months. Clearly, our instrument is relevant and the results consistent with the evidence shown in Section 2.2. There is also evidence from the coefficient on the residual of ANSA carrying

negative news, and that the negative news have lead to an increase in the suicide rate.

6 Concluding Remarks

By falling on average when the legislature proposes new pardons, suicide rates in Italian prisons do respond to changes in expectations about future conditions. Pardon proposals constitute "good news" for the inmates, who might expect reductions in their length of sentence, but also improvements in their living conditions via an alleviation of overcrowding in prisons. Overall, our analysis provides evidence of forward-looking behavior in the decision to not commit suicide. In this sense our findings are consistent with two different strands of the literature: the one on the rationality of suicides, and that on the rationality of criminals (see for example Becker, 1992).

To arrive at this conclusion we exploited variations in inmates' expectations, as measured by legislative proposals for collective pardons. Methodologically, our main underlying assumptions have been that (i) actual amnesty laws are preceded by several pardon proposals, (ii) inmates follow the respective parliamentary activity, and (iii) all this modifies their expectations about the likelihood of an actual amnesty law. With respect to the first two assumptions, we provided evidence in support of (i) and showed that (ii) can be defended on the basis that the national press, a prison magazine, and a weekly radio program devoted to life in prison all cover parliamentary activity on pardon proposals extensively.

Regarding assumption (iii), the precision of our measure of changes in expectations is hardly verifiable and prone to error. For example, inmates might not get immediately informed about a given proposal or have additional information about its likelihood of turning into amnesty law. Given this, and since we do not

have data on the underlying heterogeneity in expectations, we undertook several robustness checks and tried different ways in our treatment of pardon proposals with respect to their origin (in time but also in parliament). Overall, our analysis points towards a significant and rather quick adjustment in inmates' expectations about their future in prison following legislative pardon proposals.

The adjustment in expectations might not have to do solely with an anticipation of the date of release. Perhaps the hope of early release makes family re-engage or engage more with prisoners (and, thus, affect them psychologically for the better), or independently improve the psychology and moral in prison (turning it temporarily into a less unpleasant place). In either case pardon proposals ought to be "good news" for those behind bars, and the presence of any rationality in their decision to commit or not suicide should force them to respond accordingly.

But pardon proposals that do not make it into a law may at some point turn from "good news" into "bad news," crushing inmates' hopes. Using a control-function approach to classify news into "good" and "bad," we find evidence of asymmetric effects on suicides, respectively negative and positive. What would really matter then would be the net effect of pardon proposals on inmates' expectations. For example, under certain types of preferences (such as habit-formation, ambiguity- or loss-aversion), more pardon proposals could lead to an increase in suicides as agents prefer no news to a variety of good and bad ones. Ultimately, whether the net effect of pardon proposals on inmates' expectations is positive or negative cannot be but an empirical question - alas, there is no readily available *direct* measure of "bad news."

Given the noise that pardon proposals entail as signals of future amnesty laws, our analysis agrees broadly with the option-value theory of rational suicides. The latter predicts that the value of postponing suicide should increase when the un-

certainty about future conditions increases. In this sense our results indicate that suicides in Italian prisons would probably be higher if there were no amnesty laws, even if these were to be replaced by a mean-preserving reduction in the variability of the length of sentence.

This does not imply that pardons should be used as policy instruments to reduce suicides in prisons. While this is obviously a central policy question (if amnesties are to be treated more seriously than simple ad hoc measures to reduce overcrowding in prisons), the relevant cost-benefit analysis is beyond the reach of the present study. For we do not have the required data to estimate parameters such as the number of lives saved per year of sentence pardoned, the potential crimes that criminals released ahead of schedule might commit, or the corresponding social benefits and costs.

It is equally hard to draw conclusions regarding the effect of parliamentary activity on pardon proposals. If the numbers of proposals were to be increased without altering the number of actual pardons, the perceived impact of the typical proposal on one's expectation about the likelihood of an amnesty law should diminish. In the absence of the necessary data to estimate in any meaningful sense the size of the effect proposals exert on the likelihood of an actual pardon (and in turn on the suicide rate in prison), the present paper has little to say in terms of the implications of fewer or more pardon proposals.

Our scope has been to establish that the average decision whether or not to commit suicide in prison includes at a minimum some rational component: expectations about future conditions do play a role, and do respond to relevant public information. In this context, our analysis constitutes a conservative test of rationality in suicides. Since criminals are often viewed as boundedly-rational or even irrational individuals, our estimates ought to be biased toward zero. Our results suggest that

providing inmates with hope (perhaps through programs of "early release for good behavior") can reduce the risk of suicide in prison. They also call for caution in the design of policies to reduce prison overcrowding. The possibility that overcrowding limits the opportunities to kill oneself in prison should be taken into account while, following mass releases, the prison authorities should increase supervision and programs of support for the remaining inmates.

References

Andres, Antonio Rodriguez. 2005. "Income Inequality, Unemployment, and Suicide: a Panel Data Analysis of 15 European Countries." *Applied Economics* 37 (4):439–451.

Anno, Jaye B. 1985. "Patterns of Suicide in the Texas Department of Corrections 1980-1985." *Journal of Prison & Jail Health* 5 (2):82–93.

Anson, Richard H. 1984. "Overcrowding and Inmate Fatalities." *International Journal of Comparative and Applied Criminal Justice* 8 (1-2):93–99.

Barbarino, Alessandro and Giovanni Mastrobuoni. 2014. "The Incapacitation Effect of Incarceration: Evidence from Several Italian Collective Pardons." *American Economic Journal: Economic Policy* 6 (1):1–37.

Barzilay, Shira and Alan Apter. 2014. "Psychological Models of Suicide." *Archives of Suicide Research* 18 (4):295 – 312.

Bayer, Patrick, Randi Hjalmarsson, and David Pozen. 2009. "Building Criminal Capital behind Bars: Peer Effects in Juvenile Corrections." *The Quarterly Journal of Economics* 124 (1):105–147.

Beck, Aaron T, Gary Brown, Robert J Berchick, Bonnie L Stewart, and Robert A Steer. 2014. "Relationship between Hopelessness and Ultimate Suicide: a Replication with Psychiatric Outpatients." *The American Journal of Psychiatry* 2 (147):190–195.

Beck, Aaron T, Maria Kovacs, and Arlene Weissman. 1975. "Hopelessness and Suicidal Behavior: an Overview." *Jama* 234 (11):1146–1149.

Becker, Gary. 1992. "Crime and Punishment: An Economic Approach." *Journal of Political Economy* 76:169–217.

Becker, Gary S. and Richard A Posner. 2004. "Suicide: An Economic Approach." *mimeo.*

Brainerd, Elizabeth. 2001. "Economic Reform and Mortality in the Former Soviet Union: a Study of the Suicide Epidemic in the 1990s." *European Economic Review* 45 (4-6):1007–1019.

Chen, Joe, Yun Jeong Choi, Kohta Mori, Yasuyuki Sawada, and Saki Sugano. 2009. "Socio-Economic Studies on Suicide: A Survey." *Journal of Economic Surveys* .

Chen, M. Keith and Jesse M. Shapiro. 2007. "Do Harsher Prison Conditions Reduce Recidivism? A Discontinuity-based Approach." *American Law and Economics Review* .

Cutler, David M., Edward L. Glaeser, and Karen E. Norberg. 2001. "Explaining the Rise in Youth Suicide." In *Risky Behavior among Youths: an Economic Analysis*, edited by Jonathan Gruber. University Of Chicago Press, 219–270.

Daly, Mary C., Andrew J. Oswald, Daniel Wilson, and Stephen Wu. 2011. "Dark contrasts: The paradox of high rates of suicide in happy places." *Journal of Economic Behavior & Organization* 80 (3):435 – 442.

Daly, Mary C. and Daniel J. Wilson. 2009. "Happiness, Unhappiness, and Suicide: an empirical assessment." *Journal of the European Economic Association* 7 (2-3):539–549.

Daly, Mary C, Daniel J Wilson, and Norman J Johnson. 2013. "Relative Status and Well-being: Evidence from US Suicide Deaths." *Review of Economics and Statistics* 95 (5):1480–1500.

DAP. 2006. "Popolazione Detenuta e Risorse dell'Amministrazione Penitenziaria. Confronto Situazione Prima e Dopo l'Indulto." Tech. rep., Ministero della Giustizia, Dipartimento dell'Amministrazione Penitenziaria.

DellaVigna, Stefano. 2009. "Psychology and Economics: Evidence from the Field." *Journal of Economic Literature* 47 (2):315–72.

DellaVigna, Stefano and Matthew Gentzkow. 2010. "Persuasion: Empirical Evidence." *Annual Review of Economics* 2 (1):643–669.

Dixit, Avinash K. 1992. "Investment and Hysterisis." *Journal of Economic Perspectives* 6 (1):107–132.

Dixit, Avinash K. and Robert S. Pindyck. 1994. *Investment Under Uncertainty*. Princeton University Press.

Drago, Francesco and Roberto Galbiati. 2012. "Indirect Effects of a Policy Altering Criminal Behavior: Evidence from the Italian Prison Experiment." *American Economic Journal: Applied Economics* 4 (2):199–218.

Drago, Francesco, Roberto Galbiati, and Pietro Vertova. 2009. "The Deterrent Effects of Prison: Evidence From a Natural Experiment." *Journal of Political Economy* 117 (2):257–280.

———. 2011. "Prison Conditions and Recidivism." *American Law and Economics Review* 13 (1):103–130.

Durkheim, Emile. 1952. *Suicide (trans. George Simpson and John A. Spaulding)*. London: Routledge and Kegan Paul.

Fazel, Seena and Jacques Baillargeon. 2011. "The Health of Prisoners." *The Lancet* 377 (9769):956–965.

Franklin, Travis W., Cortney A. Franklin, and Travis C. Pratt. 2006. "Examining the Empirical Relationship between Prison Crowding and Inmate Misconduct: a Meta-analysis of Conflicting Research Results." *Journal of Criminal Justice* 34 (4):401 – 412.

Giddens, Anthony. 1965. "The Suicide Problem in French Sociology." *The British Journal of Sociology* 16 (1):3 – 18.

Goldsmith, Sara K., Terry C. Pellmar, Arthur M. Kleinman, and William E. Bunney. 2002. *Reducing Suicide: A National Imperative*. The National Academies Press.

Gvion, Yari and Alan Apter. 2011. "Aggression, Impulsivity, and Suicide Behavior: A Review of the Literature." *Archives of Suicide Research* 15:93–102.

Hamermesh, Daniel S. and Neal M. Soss. 1974. "An Economic Theory of Suicide." *The Journal of Political Economy* 82 (1):83–98.

Hanan, Selvin C. 1958. "Durkheim's Suicide and Problems of Empirical Research." *American Journal of Sociology* 63 (6):607 – 619.

Hayes, Lindsay M. 1995. "Prison Suicide: An Overview and a Guide to Prevention." *The Prison Journal* 75 (4):431–456.

Huey, Meredith P. and L. McNulty, Thomas. 2005. "Institutional Conditions and Prison Suicide: Conditional Effects of Deprivation and Overcrowding." *The Prison Journal* 85:490–514.

ISTAT. 2012. "I suicidi in Italia: tendenze e confronti, come usare le statistiche." Nota informativa, Istituto Nazionale di Statistica.

Kaminski, Marek. 2004. *Games Prisoners Play: The Tragicomic Worlds of Polish Prison*. Princeton University Press.

Katz, Lawrence, Steven D Levitt, and Ellen Shustorovich. 2003. "Prison Conditions, Capital Punishment, and Deterrence." *American Law and Economics Review* 5 (2):318–343.

Koo, Jahyeong and W. Michael Cox. 2008. "An Economic Interpretation of Suicide Cycles in Japan." *Contemporary Economic Policy* 26 (1):162–174.

Kovacs, Maria and Betsy Garrison. 1985. "Hopelessness and Eventual Suicide: A 10-year Prospective Study of Patients Hospitalized with Suicidal Ideation." *American Journal of Psychiatry* 1 (42):559–563.

Liebling, Alison. 1995. "Vulnerability and Prison Suicide." *British Journal of Criminology* 35 (2):173–187.

———. 1999. "Prison Suicide and Prisoner Coping." *Crime and Justice* 26:283–359.

Ludwig, Jens, Dave E. Marcotte, and Karen Norberg. 2009. "Anti-depressants and Suicide." *Journal of Health Economics* 28 (3):659–676.

McMillan, Dean, Simon Gilbody, Emma Beresford, and Liz Neilly. 2007. "Can we predict suicide and non-fatal self-harm with the Beck Hopelessness Scale? A meta-analysis." *Psychological Medicine* 37 (06):769–778.

Miao, Jianjun and Neng Wang. 2011. "Risk, Uncertainty, and Option Exercise." *Journal of Economic Dynamics and Control* 35 (4):442–461.

Mullen, Joan. 1985. "Prison Crowding and the Evolution of Public Policy." *Annals of the American Academy of Political and Social Science* 478:31–46.

OECD. 2012. "Health at a Glance: Europe 2012."

Pope, Whitney. 1976. *Durkheim's Suicide: a Classic Reanalyzed*. The University of Chicago Press.

Ruhm, Christopher J. 2000. "Are Recessions Good for Your Health?" *Quarterly Journal of Economics* 115 (2):617–650.

Sharkey, Lauren. 2010. "Does Overcrowding in Prisons Exacerbate the Risk of Suicide among Women Prisoners?" *The Howard Journal* 49:111–124.

Spinellis, Calliope D and Olga Themeli. 1997. "Suicide in Greek prisons: 1977 to 1996." *Crisis: The Journal of Crisis Intervention and Suicide Prevention* 18 (4):152–156.

Stack, Steven. 1982. "Suicide: a decade review of the sociological literature." *Deviant Behavior* 4 (1):41 – 66.

Van Orden, Kimberly A, Tracy K Witte, Kelly C Cukrowicz, Scott R Braithwaite, Edward A Selby, and Thomas E Joiner Jr. 2010. "The Interpersonal Theory of Suicide." *Psychological Review* 117 (2):575.

WHO. 2000. "Preventing Suicide: A Resource for Prison Officers." Tech. rep., Mental and Behavioural Disorders Department of Mental Health World Health Organization.

———. 2014. *Preventing Suicide: a Global Imperative*. World Health Organization.

Wicks, Robert J. 1972. "Suicide Prevention: A Brief for Corrections Officers." *Federal Probation* 36:29–31.

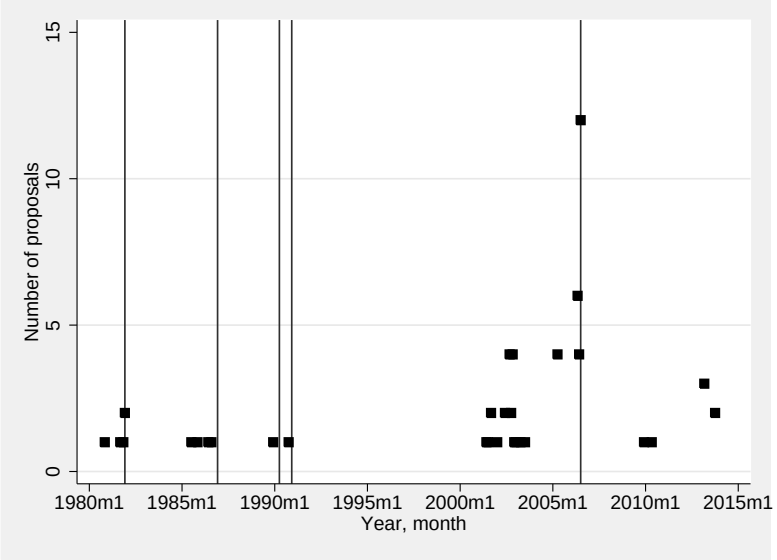

Figure 1: Pardon Proposals and Pardon Laws

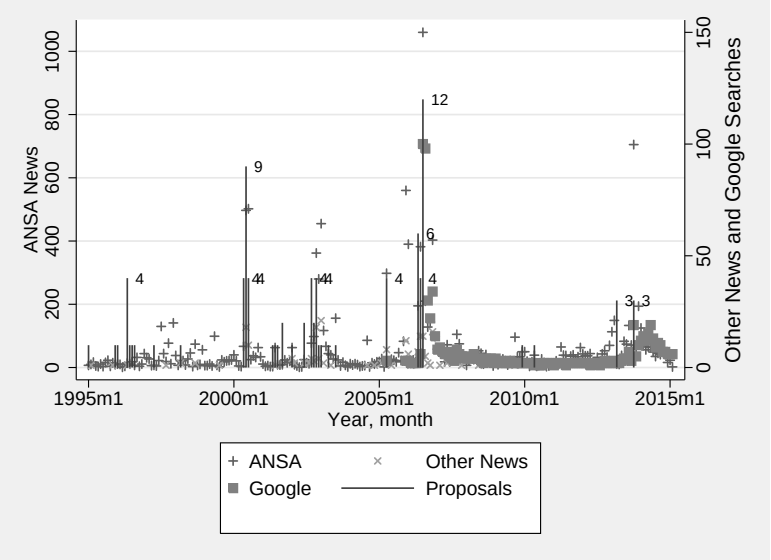

Figure 2: Pardon Proposals and Pardon News

Note: In the left panel, the vertical lines indicate the passing of the amnesty laws while the squares indicate the number of pardon proposals. In the right panel, the vertical lines indicate the pardon proposals (the numbers indicating how many proposals were presented) while the other symbols indicate the distribution of news and Google searches related to pardons or amnesties. The list of data sources and the period for which the data is available are shown in Table A2 of the Appendix.

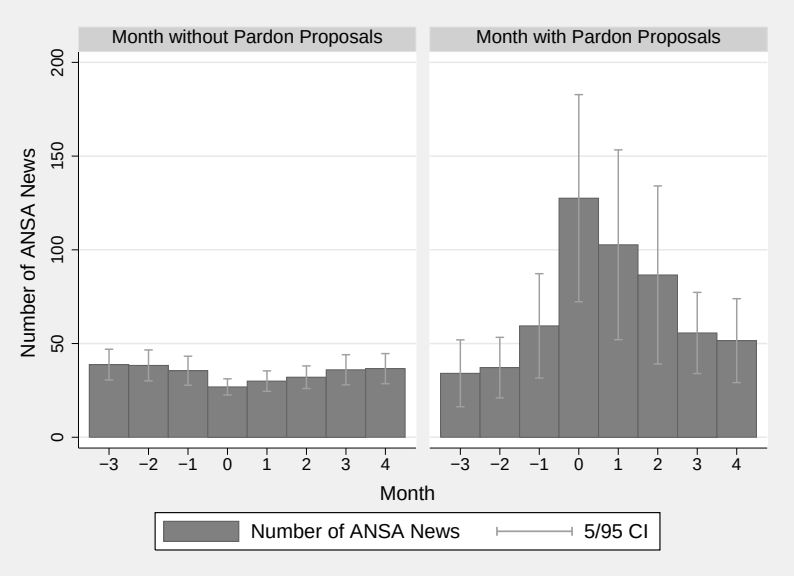

Figure 3: Number of ANSA Pardon News and Pardon Proposals

Note: Months with and without proposals are classified depending on whether there was a proposal at time 0. The vertical lines indicate the 95th percent confidence intervals.

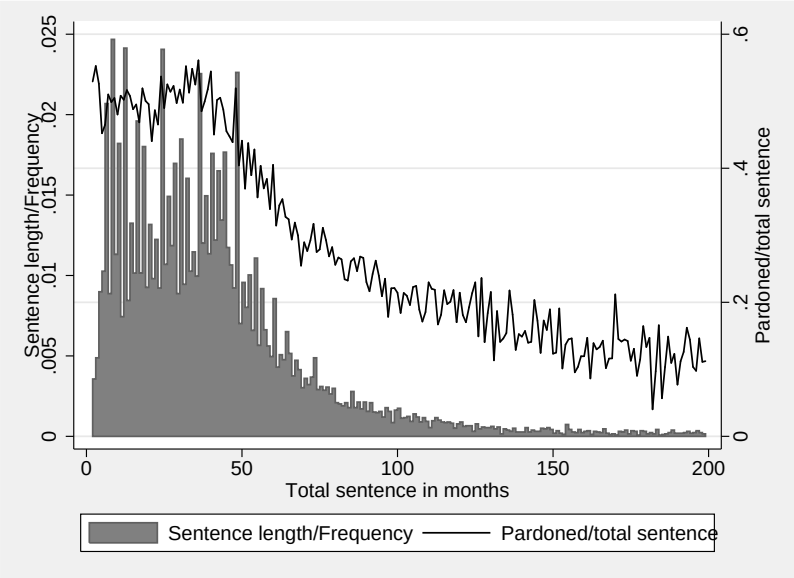

Figure 4: Fraction of Sentence Pardoned on 1 August 2006, and the Relative Frequency

Note: Based on DAP (2006).

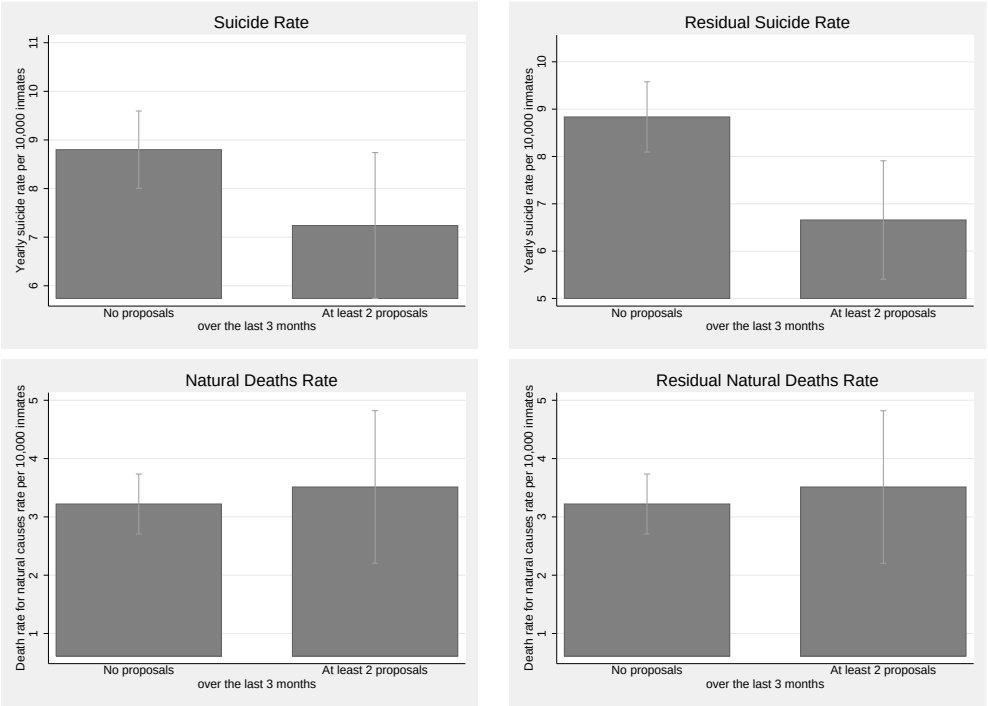

Figure 5: Suicide rates and Natural-death Rates by Proposal Status

Note: The residual outcomes are based on an OLS regression of suicide rates and natural-death rates on month fixed effects and a pardon dummy. We then add the residuals to the linear prediction of the baseline (January without a pardon). Table A2 in the Appendix contains the list of data sources.

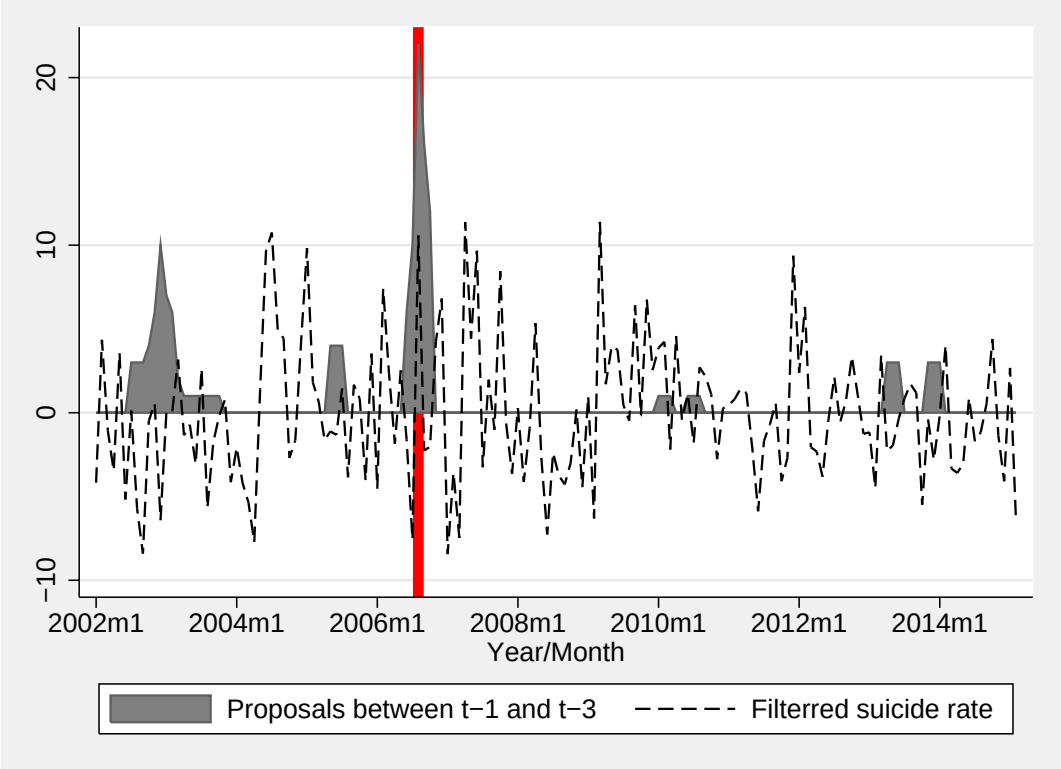

Figure 6: Demeaned and Deseasonalized Suicide Rate and Pardon Proposals

Note: The filtered suicide rate is the residual when regressing the suicide rate on month fixed effects. The vertical line indicates August 2006, when the actual pardon led to a mass release of inmates.

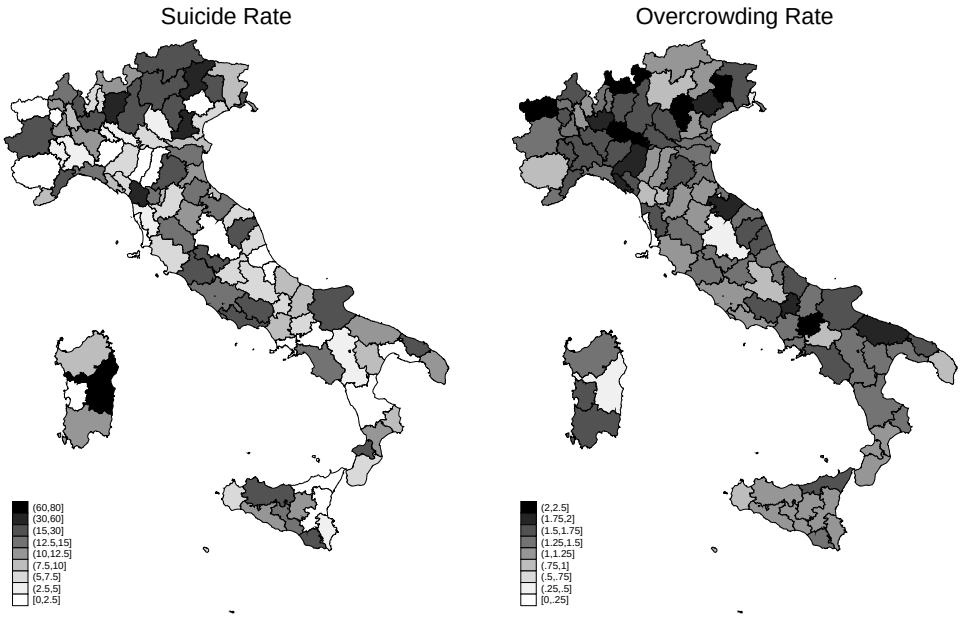

Figure 7: Suicide rates and Overcrowding Rates

Note: The overcrowding rate is based on the average overcrowding during 2010-2015, while the suicide rate is the average suicide rate in prisons during 2002-2015.

Table 2: Pardon and Amnesty Proposal Status up to the 17th Legislature

	Legislature (years)								
Legislative steps	10 (87-92)	11 (92-94)	12 (94-96)	13 (96-01)	14 (01-06)	15 (06-08)	16 (08-13)	17 (13-)	Total
1. Needs to be assigned to committee	0	1	0	3	1	0	0	0	5
2. Assigned to committee	1	2	3	9	1	4	2	1	23
3. Examined by committee	2	0	1	12	5	0	0	4	24
4. Discussion in parliament	0	1	0	0	0	0	0	0	1
5a. Examination in parliament	0	0	0	0	0	0	0	0	0
5b. Withdrawn	2	0	1	2	2	0	0	0	7
5c. Absorbed in other proposal	2	0	0	0	0	9	0	0	11
6a. Approved	3	0	0	0	0	9	0	0	12
6c. Voted against	0	0	0	0	15	0	0	0	15
Total	10	4	5	26	24	22	2	5	98

Note: The last recorded status is based on TESEO records - it was extracted in 2008 for the first four legislatures (10-13) and in 2015 for the following four (14-17). The search engine can be accessed through the Senate's web site (www.senato.it).

Table 3: Correlation Table Between Proposals and News

	Proposals	Ansa	La Stampa	Corriere	AdnKronos
Ansa	0.63*				
	292				
La Stampa	0.54*	0.63*			
	110	110			
Corriere	0.28*	0.51*	0.72*		
	102	102	102		
AdnKronos	0.64*	0.71*	0.51*	0.40*	
	225	227	110	102	
Google searches	0.53*	0.63*	0.22*	0.46*	0.67*
	118	134	86	79	120

Note: News and proposals are aggregated at the monthly level. A significance level of 5% is marked with a star (*). The numbers of monthly observations are shown below the correlation coefficients. Table A2 in the Appendix contains the list of data sources.

Table 4: Summary statistics

Variable	Mean	Std. Dev.
Prison Population	58836.873	7239.426
Number of suicides (monthly)	4.203	2.077
Number of deaths for natural cause (monthly)	1.544	1.426
Number of deaths for unknown cause (monthly)	1.5	1.386
Number of Proposals	0.31	1.276
Proposals presented by major party	0.089	0.457
Proposals presented by minor party	0.222	1.16
Proposals presented by majority party	0.12	0.59
Proposals presented by minority party	0.19	0.815
Number of Proposals pardoning 3 or more years	0.247	0.962
Number of Proposals pardoning 1 or 2 years	0.063	0.402
ANSA news items	70.816	130.842
Number of games played by Italy in the Soccer EURO Cup	0.082	0.478
Number of games played by Italy in Soccer Worldcup	0.108	0.512
N (months)	158	
Number of suicides per province (monthly)	0.047	0.226
Overcrowding rate	1.418	0.355
Overcrowding above 150%	0.495	0.5
N (93 provinces times 158 months)	14,694	

Table 5: The Effect of Pardon Proposals on Suicide Rates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Number of suicides						
Number of proposals (t+3)	0.0160						
	(0.0391)						
Number of proposals (t+2)	0.00953						
	(0.0286)						
Number of proposals (t+1)	-0.0103	0.000203					
	(0.0324)	(0.0269)					
Number of proposals (t)	-0.0415	-0.0387					
	(0.0402)	(0.0415)					
Number of proposals (t-1)	-0.0319	-0.0398	-0.0573**	-0.0583**	-0.0718**		
	(0.0377)	(0.0395)	(0.0262)	(0.0280)	(0.0345)		
Number of proposals (t-2)	-0.0440*	-0.0438*	-0.0532**	-0.0579**			
	(0.0263)	(0.0258)	(0.0263)	(0.0249)			
Number of proposals (t-3)	-0.0250	-0.0250	-0.0238				
	(0.0190)	(0.0190)	(0.0192)				
Number of proposals between t-1 and t-3						-0.0431***	
						(0.0154)	
Number of proposals between t-1 and t-2							-0.0581***
							(0.0201)
August 2006 pardon	1.663***	1.752***	1.989***	1.879***	1.817***	1.895***	1.877***
	(0.513)	(0.532)	(0.407)	(0.388)	(0.434)	(0.362)	(0.346)
Observations	152	152	152	152	152	152	152
p-value for past proposals	0.0394	0.0355	0.0299	0.0151			
Log-likelihood	-309.7	-309.9	-310.3	-310.5	-311.4	-310.4	-310.5
AIC	659.4	655.7	652.5	650.9	650.8	648.9	648.9
BIC	719.8	710.2	700.9	696.3	693.1	691.2	691.2

Note: Each column represents a different Poisson regression. The prison population measures the exposure: $\mathbb{E}[S_t|\mathbf{PP}_t] = Le^{\theta^\intercal \mathbf{PP}_t}$, where L represents the prison population (measured via semi-annual census during the period under study) while $\mathbf{PP}_t$ the array of pardon proposals per month during a six-month window around the month t. The coefficients can be interpreted as simple semi-elasticities: $\theta_k = \mathbb{E}[S_t|\mathbf{PP}_t]^{-1} \partial \mathbb{E}[S_t|\mathbf{PP}_t] / \partial PP_{t+k}$ where $k = -3, -2, -1, 0, 1, 2, 3$. All regressions control for month fixed effects. Robust standard errors are shown in parentheses. Levels of significance are shown at 10% (*), 5% (**), and 1% (***).

Table 6: Robustness Regressions

	(1) Benchmark	(2) Sui. Rate	(3)	(4)	(5)	(6)	(7)	(8)
			Number of suicides					
Number of proposals between t-1 and t-2	-0.0568***	-0.0623**	-0.0490**	-0.0720***	-0.0668**	-0.0550*		-0.0787**
	(0.0197)	(0.0249)	(0.0236)	(0.0205)	(0.0268)	(0.0306)		(0.0314)
Long-term changes in the number of proposals							-0.0611*	
							(0.0357)	
Pardon	1.857***	2.094***	1.603***	1.674***	1.954***	1.902***	1.176***	-
	(0.340)	(0.423)	(0.352)	(0.356)	(0.395)	(0.652)	(0.454)	-
Male suicides (/100)					0.0952			
					(0.393)			
Number of games played by Italy in the Soccer EURO Cup								
Number of games played by Italy in Soccer Worldcup								
Number of suicides t-1						0.0167		
						(0.0201)		
Model	Poisson	OLS	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	No	No	Yes	No	Yes	No	No	No
Exposure	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Observations	156	150	156	156	72	156	153	53
Log-likelihood	-318.7	-	-311.4	-325.2	-145.6	-318.4	-313.8	-103.6

Note: The number of suicides in the Italian male population are restricted to the age range 18-64. Long-term changes are defined as $1/3\left(\sum_{k=0}^{2} PP_{t-k} - \sum_{k=3}^{5} PP_{t-k}\right)$, where PP_τ is the number of proposals in month τ. Robust standard errors are shown in parentheses. Levels of significance are shown at 10% (*), 5% (**), and 1% (***).

Table 7: Overcrowding and the Effect of Pardon Proposals on Suicide Rates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Number of Suicides by Province							
	X=2 months				X=3 months			
Proposals in previous X months	-0.0700***	-0.0700***	-0.0620***	-0.0620***	-0.0478***	-0.0478***	-0.0498***	-0.0498***
	(0.0227)	(0.0227)	(0.0191)	(0.0190)	(0.0166)	(0.0166)	(0.0125)	(0.0125)
Interacted with above median overcrowding	0.0172	0.0172			-0.00363	-0.00363		
	(0.0196)	(0.0196)			(0.0187)	(0.0187)		
Interacted with percent overcrowding			0.0441*	0.0449*			0.0155	0.0158
			(0.0231)	(0.0238)			(0.0242)	(0.0246)
Overcrowding above 150% (median)	-0.252***				-0.246***			
	(0.0787)				(0.0789)			
Percent overcrowding			-0.462***				-0.463***	
			(0.129)				(0.130)	
Actual pardon	1.958***	1.958***	1.949***	1.949***	2.078***	2.078***	2.075***	2.075***
	(0.343)	(0.343)	(0.346)	(0.346)	(0.320)	(0.319)	(0.319)	(0.319)
Province dummies		Yes		Yes		Yes		Yes
Observations	14,508	14,508	14,508	14,508	14,415	14,415	14,415	14,415

Note: Each column represents a different Poisson regression (see the notes in Table 5). Standard errors clustered at the monthly level are shown in parentheses. Levels of significance are shown at 10% (*), 5% (**), and 1% (***).

Table 8: Placebo Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	N. of suicides				N. of deaths not classified as suicides			
Number of proposals between t+1 and t+3	0.000633	0.00692			-0.0273*	-0.0283*		
	(0.0109)	(0.0129)			(0.0148)	(0.0165)		
Number of proposals between t+1 and t+2			-0.00261	0.00887			-0.0339*	-0.0387*
			(0.0150)	(0.0186)			(0.0186)	(0.0232)
Number of proposals between t-1 and t-3	-0.0432***				-0.0402			
	(0.0154)				(0.0291)			
Number of proposals between t and t-2		-0.0452***				-0.0119		
		(0.0141)				(0.0295)		
Number of proposals between t-1 and t-2			-0.0563***				-0.0341	
			(0.0203)				(0.0421)	
Number of proposals between t and t-1				-0.0518**				-0.00412
				(0.0202)				(0.0372)
Pardon	1.898***	1.681***	1.848***	1.585***	0.866	0.180	0.534	0.0427
	(0.362)	(0.259)	(0.351)	(0.271)	(0.664)	(0.507)	(0.693)	(0.486)
Month								
Observations	152	153	154	155	152	153	154	155
Log-like.	-310.4	-311.6	-313.9	-316.3	-311.0	-313.6	-314.7	-318.9

Note: Each column represents a different Poisson regression (see the notes in Table 5). Robust standard errors are shown in parentheses. Levels of significance are shown at 10% (*), 5% (**), and 1% (***).

Table 9: Pardon News and Suicides

	(1)	(2)	(3)
	Number of Suicides		
ANSA News at t-1 (in std.)	-0.206**		
	(0.0832)		
ANSA News between t-2 and t-1 (in std.)		-0.184**	
		(0.0866)	
ANSA News between t-3 and t-1 (in std.)			-0.156**
			(0.0734)
Pardon	2.582***	2.129***	1.781***
	(0.669)	(0.569)	(0.413)
Residual (Negative news)	0.234**	0.254**	0.228**
	(0.091)	(0.111)	(0.110)
Observations	157	156	155
First stage F-test	36.67	79.97	111.6
Endogeneity p-value	0.0103	0.0225	0.0377

Note: Each column represents a different IV control-function Poisson regression (see the notes in Table 5). The number of pardon news is divided by its standard deviation. All regressions control for month fixed effects. The instrument is the number of proposals in month t-1 (Column 1), between months t-2 and t-1 (Column 2), or between months t-3 and t-1 (Column 3). Robust standard errors are shown in parentheses. Levels of significance are shown at 10% (*), 5% (**), and 1% (***).

A Appendix

A.1 Political Heterogeneity of the Effects

Overall, our analysis is quite conclusive that the typical pardon proposal tends to be associated with a reduction in the suicide rate, but not in the rates of death due to other causes. But it may well be that not all legislative proposals are equally powerful signals in inducing inmates to adjust their expectations about the likelihood of an amnesty law.

It should be noted in particular that for a pardon proposal to become amnesty law an absolute parliamentary majority of two-thirds is required. As a consequence, the pardon proposals that are put forward by parliamentary members of the majority could be more important signals than those proposals which are presented by members of parliament who belong to the minority. The results reported in Column 1 (for proposals presented in the previous two months) and Column 4 (for proposals presented in the previous three months) of Table A1 suggest that this is indeed the case, despite the lack of statistical significance (p-values at the bottom of the table show whether the differences between the coefficients are statistically meaningful).

Another determinant of the relation between a given legislative pardon proposal and its power in signalling the likelihood of an amnesty law has to do with the "credibility" of the politician who puts it forward. As in any signalling model the receiver's belief-updating rule is bound to depend on the sender's credibility (see DellaVigna and Gentzkow, 2010, for an overview on persuasion in economics), the inmates' inferences on the likelihood of success of a given pardon proposal will depend on what they know about the proposer.

To frame the issue more precisely, the question here is whether proposals presented in parliament by politicians with a long record of such proposals (measured

by the total number of pardon proposals they have put forward in the past) induce fewer changes in suicides than proposals by members of parliament without a reputation for such initiatives. In Columns 2 and 5 we find no such evidence, although proposals presented by congressmen/women without a long history of proposals are statistically more significant.

Finally, Columns 3 and 6 highlight the only specification where coefficients are statistically different from each other: proposals that plan on pardoning 3 or more years of sentence show reductions in suicides that are much larger than proposals that plan pardoning just one or two years.

Table A1: Political Heterogeneity of the Effect of Pardon Proposals on Suicide Rates

	(1)	(2)	(3)	(4)	(5)	(6)
	Suicide rate					
Number of proposals between	t-2 and t-1			t-3 and t-1		
by parliamentary minority	-0.0425			-0.0125		
	(0.0369)			(0.0378)		
by parliamentary majority	-0.0790			-0.0809		
	(0.0633)			(0.0546)		
by congressmen/women who presented		-0.0501**			-0.0417**	
fewer than 2 proposals		(0.0239)			(0.0186)	
by congressmen/women who presented		-0.115			-0.0443	
2 or more proposals		(0.104)			(0.0895)	
with median (3) or above median number			-0.0975***			-0.0786***
of years to be pardoned			(0.0347)			(0.0267)
with below median number of years			0.0838			0.0860
to be pardoned			(0.0704)			(0.0565)
Observations	156	156	156	155	155	155
Test difference	0.691	0.572	0.0643	0.431	0.979	0.0373

Note: Each column represents a different Poisson regression (see the notes in Table 5). Robust standard errors are shown in parentheses. Levels of significance are shown at 10% (*), 5% (**), and 1% (***).

A.2 Additional Figures and Tables

Table A2: Data Sources

	Source	Available from
Ansa	ANSA's Electronic Documentation (DEA)	April 1981
Corriere	http://archiviostorico.corriere.it/	January 2002
LaStampa	www.lastampa.it/archivio-storico/	January 2002
AdnKronos	www1.adnkronos.com/IGN/Archivio/	January 1997
Google	www.google.com/trends/	April 2005
Proposals	www.senato.it	May 1996
Suicides	www.ristretti.it/	January 2002
Prison conditions	www.giustizia.it/	June 2010

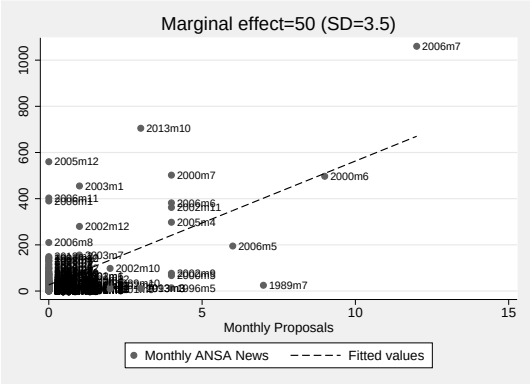

Figure A1: ANSA News and Proposals

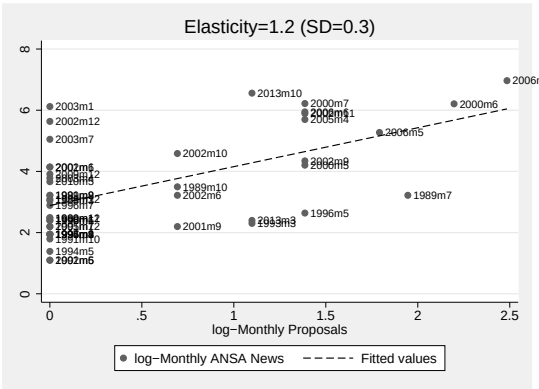

Figure A2: ANSA News and Proposals (log-log)

Note: The regression line is estimated using OLS.

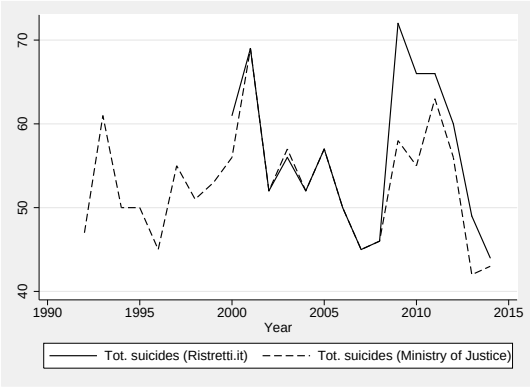

Figure A3: Ministry of Justice and Ristretti.it Suicide Statistics

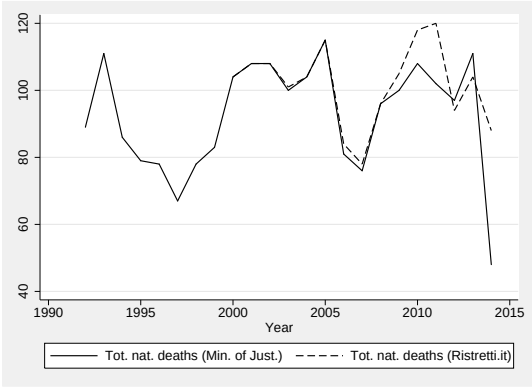

Figure A4: Ministry of Justice and Ristretti.it Natural Deaths Statistics

Table A3: Pardons and Proposals Regressions

	(1)	(2)	(3)	(4)
	Pardon is passed			
Number of proposals	0.541***	0.581***		
	(0.167)	(0.120)		
Number of proposals at t-1	0.00387		0.302**	
	(0.114)		(0.149)	
Number of proposals at t-2	0.124			
	(0.231)			
Number of proposals at t-3	0.0264			
	(0.327)			
Any proposal				2.189**
				(0.935)
Observations	405	408	407	408
Log-likelihood	-22.16	-22.24	-26.11	-24.84
Mean dependent variable		0.0123		

Note: The data refer to monthly observations between January 1980 and December 2013. The table shows Logit coefficients. Robust standard errors are shown in parentheses. Levels of significance are shown at 10% (*), 5% (**), and 1% (***).