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How privatization affects public service quality: An empirical analysis of prisons in England and Wales, 1998-2012

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ABSTRACT: The impact of privatization on public service quality is an enduring issue in public policy and management. Advocates of privatization suggest that market forces prompt private firms to provide better quality services, while opponents point towards the potential for quality to be traded off against profits. Drawing on incomplete contract and capability theories, we explore a more nuanced possibility: that private providers of public services perform better on dimensions of public service quality that are easier to measure and monitor, and vice versa. Using panel data on service quality in prisons in England and Wales in the period 1998 to 2012, we find that privately-managed prisons do perform better on dimensions of quality, such as confinement conditions and prisoner activity, that are more easily measured, whereas public prisons perform better on dimensions of quality, such as levels of order and prisoner safety, that are less easily measured and managed.

INTRODUCTION

Private provision of public services has long been part of the business of managing government efficiently and effectively. In the wake of the New Public Management (NPM) reforms that spread across the globe from the 1980s onwards though, there has been increasing interest in the private management and ownership of key public services at all levels of government (Kettl 2000; O'Toole and Meier 2004). A critical question for governments considering the privatization of public services is whether private firms provider better quality services than their public sector counterparts (Hodge 2000; Warner and Clifton 2014). In comparison with the performance of private sector organizations, the quality of the outputs provided by public services is notoriously difficult to measure and monitor (Walker et al. 2010). For these reasons, it is sometimes thought that private firms may not have the capabilities required to deal with all of the complexities of effectively managing public services.

According to incomplete contract theories, in particular, privatization should be restricted to public services for which there are clear and transparent indicators of performance and for which it is straightforward to specify service quality standards within a contract (Hart et al. 1997). However, given that most public service organizations pursue multiple goals, some of which are easier to measure than others, few services may meet the easy-to-specify criteria in full. Hence, the quality of public and private service provision may vary considerably depending on the dimension of performance being measured. Moreover, since organizations from different sectors may bring distinctive sectoral advantages to service provision, sector-specific capabilities too may shape service quality. To evaluate whether sectoral differences in performance might be related to output measurability and to differential organizational capabilities within the public and private sectors, we systematically analyze multiple dimensions of

the quality of confinement in publicly and privately-managed prisons in England and Wales between 1998 and 2012.

Prisons represent an especially relevant setting for investigating the relationship between privatization and service quality. Incomplete contract theorists regard the provision of prison services as a paradigmatic example of a public service for which it is likely to be difficult to specify quality standards (Hart et al. 1997). Moreover, the private management of prisons has become a hotly debated issue in many countries across the world, such as Australia, Brazil, Canada, France, the United Kingdom (UK) and the United States (US) (see Cabral and Saussier 2013; English 2013; Moore et al. 2003). Some of these countries have a long history of privately-managed prisons of one sort or another stretching back into the 19th Century and beyond (Jones and Newburn 2005). Even so, privatization as a tool of penal policy grew rapidly alongside the emergence of NPM during the 1970s and 1980s, primarily in an effort to contain fast growing service costs and to solve overcrowding issues (Schicor 1995). In the UK, the involvement of large corporations in the management of prisons was firmly established when the first prison run by the company Group 4 (now G4S) was opened in 1992 (Boin et al. 2006). However, despite the apparent acknowledgement of the potential role the private sector can play in prison services, questions continue to be raised about the suitability of prisons as a candidate for contracting out (Price and Morris 2012).

The conventional arguments made by advocates of privatization focus on the way in which the profit-incentive drives greater cost-consciousness, service orientation and "customer responsiveness" in business firms (Hodge 2000). At the same time, strategic management theorists increasingly emphasize the potential for private involvement in public services to generate 'sustainable value' by bringing public and private interests closer together (Mahoney et al. 2009). Both perspectives point toward

the notion that the private sector may possess distinctive capabilities that are much less evident in public organizations, especially the capacity to innovate by identifying and pursuing new opportunities for service provision, which, may, in turn generate positive sectoral spillover effects (Klein et al. 2010). Nonetheless, theories of comparative sectoral advantage highlight that public sector organizations too may have distinctive capabilities, especially the authority and experience required to address complex or 'wicked' social issues (Selsky and Parker 2005).

Notwithstanding arguments about private and public organizational capabilities, incomplete contract theorists warn that private contractors of public services may have an incentive to let service quality deteriorate in order to maximize profits. According to Hart et al. (1997) this is especially likely in prisons, because firms can save money by employing less qualified staff and driving supplier costs down, which in turn may adversely affect the quality of confinement experience for prisoners. Nevertheless, it is equally possible that service quality in public and private prisons may vary depending on the measurability of the performance dimension under consideration, and the organizational capabilities that are best-fitted to good performance. For example, private prisons may invest in better quality facilities and prisoner activities, especially if they are responsible for the construction and management of an institution (Hart 2003). In part, this reflects the fact that judgements about the quality of facilities and activities are more easily made than about the quality of prison order and safety. At the same time, there may well be more scope for the development of innovative ways of providing facilities and activities, than there is for managing levels of violence and disorder. By contrast, public prisons may perform better on measures of prison order and safety, because they employ prison officers who are more experienced in making judgements

about acceptable levels of violence or misconduct and have greater authority in dealing effectively with challenging prisoners (Hart et al. 1997).

Are there incentives for private firms to allow service quality to deteriorate? Does the performance of private and public prisons vary across different dimensions of service quality? Might distinctive sectoral capabilities explain variations in performance? To answer these questions, we analyze service quality in publicly and privately-managed institutions in England and Wales for the period 1998-2012. In the next section, we explore the major theoretical arguments, which deal with the relationship between privatization and its potential effects on service quality, developing hypotheses about the relationships between ownership and service quality. Following that, we review the empirical evidence on the links between prison privatization and service quality. Thereafter, we describe our data and methods, before presenting and discussing the results of our statistical analysis. The paper concludes with an assessment of the theoretical and practical implications of our findings.

THEORETICAL PERSPECTIVES ON PRIVATIZATION AND SERVICE QUALITY

The demand for the privatization of public services has been heavily influenced by the public choice and property rights literatures, which emerged in the 1960s and 70s, and that shaped the development of NPM (Bel et al. 2010; Alonso et al. 2013). At the same time, the strategic management literature is now replete with recommendations for closer relationships between the public and private sectors, as it is arguably only through cross-sectoral collaboration that it will be possible to deal with the most pressing societal issues facing the world today (McGahan et al. 2013). All of these ideas

suggest that there is something intrinsically valuable to be gained from private involvement in public service provision.

Both public choice and property rights theory claim that public provision of services is inherently more inefficient than private (see Downs 1967; Niskanen 1968; 1971; Jackson 1982; Grossman and Hart 1986; Mueller 1989; Hart and Moor 1990; Vining and Boardman 1992; Miranda 1994; McMaster and Sawkins 1996), and that the efficiency advantage that private firms enjoy enables them to devote more time and energy to improving service quality. Public choice theory critiques government-managed provision of public services because it assumes that politicians and bureaucrats will always behave in a self-interested way (Niskanen 1968). Drawing on neo-classical economics, the public choice perspective suggests that the typical public servant will seek to maximize his or her budget and personal interests and that this will mean neglecting the citizens they purportedly serve (Niskanen 1971). Politicians and bureaucrats have the opportunity and incentive to use their control over public service provision as a tool to maximize their own utility or political power. As a result, it is likely that publicly-managed services will be over-supplied and that efficiency will suffer (Savas 1987). Privatization, public choice theorists argue, is therefore an effective policy tool to avoid or minimize such behavior. By forcing previously protected in-house activities into a new environment characterized by market discipline and competition amongst potential service providers, overall service delivery costs should be reduced, whilst the efficiency and quality of public service provision improved (Osborne and Gaebler 1992).

The property rights theory approach, associated with the classical studies by Coase (1960), Demsezt (1967), Alchian and Demsetz (1972) and, more recently developed by Grossman and Hart (1986) and Hart and Moor (1990), also predicts that

the private sector will perform more efficiently than the public sector. Private firms enjoy higher incentives to innovate and cut costs because, unlike the public sector, innovations may generate tangible benefits to the people responsible for their implementation (Shleifer and Vishny 1994). Monetary incentives, in particular, are thought to promote efficiency. For instance, if a manager personally benefits from improved performance through the issue of company shares or salary improvements then there is good reason for them to actively seek out and realize efficiency gains (Andrews et al. 2011a).

Strategic management scholars advocating greater cross-sectoral collaboration focus on the promise of value creation through complementarity in capabilities when private firms and public organizations are brought together to pursue the public interest (Argawal et al. 2009; Mahoney et al. 2009). From this perspective, private provision of public services is generally thought to have the advantage of merging the comparative strengths and capabilities distinctive to the private sector – innovation, financial capacity, knowledge of technologies, and entrepreneurial spirit - with the social responsibility, environmental awareness, and probity characteristic of the public sector. Hence, prison privatization may, where appropriately monitored by public agents, facilitate the development of new capabilities that are central to continuous improvements in service quality across the system (Cabral et al. 2013).

Despite the popularity of the ideas advocating greater private involvement in public service provision, there are still many scholars who are skeptical about the potential for private management of public services to result in the kind of improved performance that its advocates assume. On the one hand, Davies (1971), for example, argues that, private property rights are simply not as strong when firms are involved in public service provision, calling into question the potential for financial incentives to

motivate service improvement. On the other hand, Williamson (1999) asserts that any attempt to incentivize the provision of public services runs the risk of harming probity (and by extension equity and quality) by encouraging autonomy at the expense of administrative control. More recently, skepticism about the consequences of privatization for service quality has largely drawn on the idea that private provision of public services would be plagued by incomplete contracts (Jensen and Stonecash 2005). In particular, the incomplete contracts model in Hart et al. (1997) suggests that profit maximization incentives may actually have a downward effect on service quality, particularly when quality is difficult to measure because this makes it much harder to fully specify and monitor contractual obligations.

Hart et al. (1997) apply the theory of incomplete contracts to situations in which (a) the government can deliver a certain service in-house, such as prisoner confinement, or (b) the government can contract with a private firm for the service delivery. Assuming that contracts cannot specify *ex-ante* each and every quality aspect, Hart et al. (1997) show that private firms may still have an incentive to simultaneously reduce costs and increase quality as the two dimensions of performance are not necessarily mutually exclusive. However, the incentive to cut costs may be so strong that firms ignore the adverse consequences on quality of cost reductions. According to Hart et al. (1997, 1128), "in the case of prisons, concern that private providers hire unqualified guards to save costs, thereby undermining safety and security of prisoners, is a key objection to privatization".

Hart et al. (1997) argue that incomplete contracts invariably give room to private contractors to reduce costs and quality – what is usually referred in the contracting literature as the "quality shading hypothesis" (Domberger and Jensen 1997). This problem may become even more severe if those drafting the contract (say politicians,

policymakers or public managers) make a mistake or have some kind of incentives to draft a contract favoring the private contractor (Hart et al. 1997, 1153; Lopez de Silanes et al. 1997, 449). On the face of it then, it seems likely that privatization will result in a deterioration of service quality in prisons, especially as contracts specifying quality standards are difficult to draft and enforce (Hefetz and Warner 2004). However, despite the challenges of measuring output quality in prisons (see Lundahl et al. 2009), it also conceivable that some dimensions of confinement quality may be more easily measured and monitored than others, and that where output measurability is higher, privately-managed prisons outperform their publicly-managed counterparts.

Johnston and Romzek (1999, 394) emphasize that contract management and performance accountability "do not take care of themselves". Rather, government has to invest time and effort in ensuring both that contracts are well-specified and that arrangements are in place to ensure that it is possible to compare "quality and quantity of product or service delivered against contract specification" (Prager 1994, 179). The development of a suite of performance measures that can form the basis for gauging whether appropriate service standards are being met is therefore of great importance. However, public service outputs vary considerably in how easily they are measured (Andrews et al. 2011b), which makes it hard for government to tightly specify and monitor contract performance across the multiple dimensions of quality for any given service.

Due to the variability in the measurability of public service outputs, private contractors may have an incentive to focus more attention on those quality dimensions where output measurability is higher simply because the management and monitoring costs associated with meeting the service standards for those dimensions may be lower. At the same time, more easily measured aspects of service quality may also be more

susceptible to the kinds of "quick wins" that the fresh approach and innovative capabilities of a private contractor can bring to the provision of public services, especially where technological innovations can be brought to bear. By contrast, for quality dimensions where output measurability is low, contractors (and government) may be less willing to invest the additional time and money required to monitor and manage contract performance to an optimum level. In these circumstances, the traditional virtues of public sector organizations, such as high-reliability, transparency and mandated authority, may be especially likely to come to the fore. Broadly speaking then, in this paper, we seek to test two complementary hypotheses:

Hypothesis 1: Private contractors will perform better on easy-to-measure dimensions of service quality compared to public providers

Hypothesis 2: Private contractors will perform more poorly on difficult-to-measure dimensions of service quality compared to public providers

EVIDENCE ON PRISON PRIVATIZATION AND SERVICE QUALITY

Prisons represent an especially good context for evaluating the role that output measurability plays in shaping the privatization-service quality relationship. Penal institutions are not simply facilities for the incarceration of criminals, but are also sites for the humane treatment and potential rehabilitation of offenders (Morris and Rothman 1998). Hence there are some dimensions of prison service quality, such as the number of escapes or the number of individuals held within each available cell that are comparatively easy to measure and monitor, but others, such as the number of violent incidents, that are much more difficult to capture accurately, and even more difficult to manage effectively. A review of the evidence on prison privatization and service quality

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can therefore provide us with an indication of whether the hypotheses we advance are likely to be borne out in the case of English and Welsh prisons.

The existing evidence on prison privatization and service quality can be categorized into three main types: case study approaches; meta-analyses of case studies; and, more recently, regression-based quantitative empirical studies. This literature, however, is not extensive, and is mainly focused on the United States. Initially, the bulk of empirical work followed mainly a case study approach. Case studies such as those from Brakel (1988), Urban Institute (1989), Logan (1992), Archambeault and Deis (1997), and Thomas (1997) suggested that privately managed prisons perform as well or better than publicly managed prisons on confinement quality. Moore's (1998) review of the early privatization research argued that market pressures and the competition for contracts might explain this finding. However, these early case studies suffer from small sample size, poor data reliability and validity, and limited generalizeability (Gaes et al. 1998; Perrone and Pratt 2003).

A number of subsequent studies used large-N surveys to compare the quality of confinement in public and private prisons. Austin and Coventry (2001), drawing on a survey of 1565 US prisons in 1997, found that both kinds of prisons performed similarly across multiple dimensions of service quality, with two important exceptions: private facilities employed (up to fifteen per cent) fewer staff and the rate of violent assaults seemed to be significantly higher. Camp and Gaes (2002) suggested that privately operated prisons have higher staff turnover rates and "systemic problems in maintain secure facilities (2004, 244)", when analysing a 1999 survey of administrators monitoring private prisons in the US. Armstrong and MacKenzie's (2003) study of 48 young offender institutions in 19 US states finds that any "differences in environmental quality between private and public juvenile correctional facilities are attributable to

characteristics other than operating sector (2003, 557)." Perrone and Pratt's (2003) review of the case-study and survey-based evidence suggests that though private prisons seem to perform as well or better than public ones in terms of prison order and prisoner care, they perform equally well or worse in terms of prisoner safety. Lundahl et al's (2009) subsequent review identified better facility conditions, staff working conditions and prisoner safety in private prisons, with publicly managed prisons performing better on security (number of escapes and visitors being harmed) and inmate grievances.

　　　With growing interest in prison privatization, much of the research on this topic has now shifted to regression based studies. Lukemeyer and McCorkle (2006) compared violent assaults in private, federal and state prisons, using the US 1995 *Census of State and Federal Adult Correctional Facilities*, finding that private and state facilities were less likely to experience violence than federal prisons. Makarios and Maahs (2012), drawing on the 2000 *Census of State and Federal Adult Correctional Facilities,* find that US private, state and federal prisons performed similarly across many dimensions of quality. However, private facilities were less overcrowded than federal and state prisons, while federal prisons do better in terms of work opportunities, treatment and education of prisoners. Nevertheless, these two US studies are both cross-sectional, and so do not adequately account for unobserved heterogeneity in the cases analyzed. By contrast, Cabral et al's (2010; 2013) analysis of the performance of prisons in the Brazilian state of Paraná utilises panel regression techniques that can account for unobserved heterogeneity. This research finds that private prisons that are overseen by state-appointed wardens perform better on several dimensions of confinement quality.

[Table 1 about here]

The findings from all of the studies reviewed are summarised in Table 1. To organize those findings according to different dimensions of service quality we draw upon Logan's (1992) eight dimensions of prison confinement quality: security, safety, order, care, activity, justice, conditions, and management. The evidence presented in the summary table is suggestive of the possibility that privately-managed prisons may do well on some dimensions of confinement quality rather than others. In particular, private prisons seem to perform better than public ones on dimensions of quality that are easier to measure, such as the conditions of confinement and the activities available for prisoners. Perhaps more surprisingly, they also seem to outperform public prisons on the more difficult to measure quality dimension of prison order. While these outcomes are, for the most part, largely in line with the theory of incomplete contracts advanced above, the methodological weaknesses of most of the existing studies mean that the findings from prior research should be treated with great caution.

Firstly, few previous quantitative studies have utilised a research design that is able to fully account for unobserved heterogeneity within the data or long-run effects of contracting decisions. Panel regression techniques that can capture the effects of unit heterogeneity and within-variations in the dependent and independent variables offer the most effective method for identifying substantive statistical relationships. Yet only two studies (Cabral et al. 2010; 2013) adopt such a methodology for studying how privatization affects service quality in prisons, both of which are undertaken in the same organizational setting. Most of the previous research draws upon cross-sectional data, and much of it utilises only bivariate or descriptive statistics. In this study, we apply quantitative multivariate regression techniques to longitudinal data on prison service quality.

Secondly, most of the evidence on public and private differences in prison service quality originates from the Brazil and the United States, which may make it difficult to generalize the findings outside that context, particularly to the UK system where the contracts for private prisons are extremely detailed in comparison with those in other countries, covering multiple dimensions of service quality. In this respect, empirical evidence from an enthusiastic adopter of private prisons, but one that seeks to monitor contract performance very closely, would cast valuable new light on the generalizeability of the theory of incomplete contracts.

DATA AND METHODS

To explore variations in service quality across privately and publicly-managed prisons, we draw upon an unbalanced panel of English and Welsh prisons from the period 1998/1999 to 2012/2013. There are 152 prisons in England and Wales of six main types: dispersals, training, local, open and semi-open prisons, and young offender institutions, of which sixteen were privately managed at some point of time during the study period. Each of the different types of prison reflects the criminal profile of the individuals who are held there. For example, dispersal prisons hold the most difficult and dangerous prisoners, known as Category A prisoners, closed training prisons, hold Category B and C prisoners – individuals for whom escape must be made very difficult, with local prisons being temporary holding stations and open prisons housing Category D prisoners – individuals considered to be low risk to the public. Table 1A in the Appendix provides full definitions of the different categories of prison, and the types of offences leading to prisoner categorisation can be found at: http://www.prisonersadvice.org.uk/DOCS/INFORMATION/CATEGORISATIONMale .pdf).

For the purposes of our analysis, we include only those prisons that hold adult inmates who cannot be trusted in open conditions, namely dispersals, and male and female training prisons and local prisons in the statistical models. The final sample for our analysis thus consists of 114 prisons, of which fifteen were privately managed at some time during the study period. Data on the quality of the service provided by prisons in England and Wales and on relevant prison characteristics were taken from the *Prison Performance Statistics* database provided by the British Ministry of Justice (MOJ).

Dependent variables

Theories of public service performance emphasise the multiplicity and complexity of organizational goals in the public sector and the ways in which the measurement of these goals reflects the perspectives of different stakeholders (Walker et al. 2010). Aside from providing secure confinement facilities, English and Welsh prisons are typically required to meet a range of potentially conflicting goals, from safe and decent living accommodation to 'purposeful activities' for prisoners. The achievements of prisons in meeting these goals are judged by a diverse array of constituencies, such as taxpayers, advocacy groups and politicians, with the weighting, and interpretation of the available prison performance information all subject to ongoing debate and contestation amongst key stakeholders (see http://www.bbc.co.uk/news/uk-23923321). The analysis presented here focuses on publicly available measures of service that are collected and published by the primary external stakeholder on the performance of English and Welsh prisons: UK central government.

To assess the relative service quality in publicly versus privately managed prisons, we draw upon measures of five key dimensions of confinement quality.

Measuring the quality of confinement is not a simple task, since it may involve many different dimensions (Lundahl et al. 2009) and, it seems that there is no agreed way to conceptualise and operationalise it in the academic literature (Perrone and Pratt 2003). Following Perrone and Pratt (2003, 306), Logan's (1992) approach seems to have become the most widely accepted among researchers when conceptualising service quality in prisons. Logan (1992) identifies eight dimensions of quality of confinement: security, safety, order, care, activity, justice, conditions, and management. Here, we focus on those dimensions of quality in English and Welsh prisons for which measures are publicly available, namely conditions, activity, security, order and safety.

Prison *conditions* are evaluated by means of the overcrowding rate calculated as the share of prisoners held in a cell where the number of occupants exceeds the stipulated uncrowded capacity (i.e. two prisoners in a one person cell or three prisoners in a two person cell). This measure has been an important component of the performance management system for prisons in England and Wales since the 1980s when the Prison Service started to publish performance information in its annual reports (Boin et al. 2006). Overcrowding measures of this sort have been used frequently in prior studies of quality of confinement (see, for example, Makarios and Maahs 2012), giving us confidence that we are able to capture a relevant aspect of the conditions that prisoners experience. Nearly identical results for overcrowding to those presented below were observed when using a more tightly defined measure of "doubling", or the percentage of one person cells occupied by two people in each establishment (available on request).

We include a measure of the purposeful activity undertaken by prisoners, as an outcome variable that captures Logan's (1992) dimension of confinement *activity*. This is measured as the average number of hours per week per prisoner spent engaged in

activities, such as educational classes, offender behaviour programmes, vocational training, and production workshops. Again, measures similar to this have been used in prior research examining public-private differences in the quality of confinement in prisons.

Security is measured as the total number of escapes from each institution per year; again, a measure that has been used in other studies of prison service quality. More specifically, escapes are defined in the prison service performance management framework as incidents where a prisoner is not recaptured within 15 minutes, or is recaptured earlier but not before committing a further offence. The indicator does not include prisoners who abscond without having to overcome any physical security restraints or the presence of a guarding officer (Solomon 2004).

To assess Logan's (1992) prison *order* dimension, we employ the rate of random positive Mandatory Drug Tests (MDT), which serves as a proxy for drug misuse and its associated implications within prisons. MDTs were introduced for all prisons in England and Wales in 1996, and are carried out by the Drug Strategy Unit of the Prison Service. MDTs have three main aims: i) to deter the use of drugs; ii) to identify prisoners to treat and prisoners to punish; and, iii) to provide information on the level and type of drug use within a prison. All prisons are required to randomly test 5–10% of their population each month, with urine samples being sent to a central laboratory for testing. A positive drug result may result in an automatic loss of remission and privileges (McDonald 1997).

Finally, the number of serious assaults each year within each prison is used to evaluate the *safety* dimension of service quality. This measure is again an integral part of the performance management system for prisons in England and Wales, and is collected with a view to gauging how safe inmates are likely to feel within confinement

(Solomon 2004). In this respect, it largely reflects the skill with which prison officers are able to deal with and manage the challenging interpersonal relationships that evolve within prisons (Bottoms 1999). The rate of assaults is another indicator that has been used in several previous studies investigating prison performance (e.g. Archambeault and Deis 1997; Lukemeyer and McCorkle 2006).

As noted above, all of these measures of service quality are ones that matter to external stakeholders, especially the National Offender Management Service, the regulatory agency responsible for collecting this data and using it to determine annual prison performance ratings. They are also used by nonprofit prison reform advocacy groups, such as the Prison Reform Trust and the Howard League for Penal Reform to campaign for prisoners' rights, and frequently "hit the headlines" in the UK national media (e.g. http://www.bbc.co.uk/news/uk-28582622; http://www.bbc.co.uk/news/uk-23923321; http://www.bbc.co.uk/news/uk-england-south-yorkshire-28760630). Because measures like these have been used in several previous studies and because they are important to external stakeholders, we believe that our dependent variables have a high degree of face validity as proxies for the service quality in prisons in England and Wales.

Independent variables

The primary independent variable of interest is prison management type; a dummy variable is included in the model to capture whether each prison is privately or publicly managed (private=1; public=0). This approach is used in nearly all regression-based analyses of contracting out and public service quality (see Andrews et al. 2011a). Ideally, it would be important to evaluate whether selection into management type occurred on the basis of prior performance (or other relevant prison characteristics).

However, since only two prisons switched management type during the period under study, our ability to address selection effects is somewhat limited. Moreover, all privately managed prisons are newly built facilities, so there is no information on past performance, and those prisons that were subsequently returned to public management did so as a result of a competitive bidding process based on costs rather than quality (Panchamia and Gash 2012). To ensure that our models are well-specified, nevertheless, we include a set of control variables which may affect prison quality, as identified by previous research: prison size, prisoner profile and the degree of overcrowding in the models predicting the other four dimensions of service quality (see, for example, Perrone and Pratt 2003; Lukemeyer and McCorkle 2006; Makarios and Maahs 2012).

Prison *size* is measured as the annual average number of prisoners residing within an institution. Although large prisons may benefit from economies of scale, it seems likely that they will experience greater problems providing high quality confinement than smaller ones due to dislocation effects and the challenges of managing a big and diverse prisoner population. For example, following the 25-day riot at Strangeways prison in Manchester in 1990, the *Woolf Report* recommended that prison size be restricted for these very reasons.

The risk to the public (and to other prisoners and prison staff) that prisoners pose may influence the ability of institutions to provide a quality service. *Prisoner profile* is operationalized here by including a series of dummy variables that capture the security level of the prison in which individuals are confined (see Table 1A in the Appendix). Thus, dichotomous variable are constructed for dispersal prisons, male training, female training, and female local prisons, with male local prisons as the reference group (coded 0 in each dummy). The coefficients for the prison category variables indicate differences between the included groups and the reference group.

Finally, the level of *overcrowding* is also included as a control variable since it is an important potential determinant of other dimensions of confinement quality. Overcrowding has been shown to be related to higher levels of violence in prisons in previous studies, for example (e.g., Gaes and McGuire 1985). Again, we measure overcrowding as the percentage of inmates who are kept in a cell where the number of occupants surpass the uncrowded capacity. Descriptive statistics for all the variables included in the models are shown in Table 2.

[Table 2 about here]

Econometric specification

In order to test whether the quality of the service provided by public and private prisons in England and Wales differs, we estimate five different panel regression models predicting each dependent variable. Empirically, a panel-based approach is more adequate than a cross-section analysis because, among other reasons, omitted variables or unobserved prison characteristics for which annual data are unavailable (such as the number, training, and ability of prison officers) can be modelled by including a prison individual effect. Therefore, the baseline model specification is the following:

$$(1) \qquad y_{it} = \beta x_{it} + \delta' Z_{it} + \delta T + \mu_i + \epsilon_{it}$$

where y_{it} is a measure of one of the four dimensions of confinement quality in prison *i* at time *t*; x_{it} is the *it*th observation of the private management dummy; Z_{it} the *it*th observation on *P* control variables; T is a time trend; μ_i denotes prison unit-effects; and ϵ_{it} the remainder disturbance term. To test the proposed hypotheses about public-

private differences in service quality, the coefficient of interest is β in each of the five regression models.

A widely used approach when estimating models such as equation (1) has been the fixed effects (FE) estimator. For the purpose of our analysis, the main weakness with the FE approach is that time invariant variables cannot be estimated. This is an important concern in our study, because we need to account for the influence of prisoner profile on the quality the service provided in public and private prisons. From this perspective, using a random effects (RE) estimator may be preferable since it permits the estimation of time invariant variables. However, the RE model makes the strong assumption that all explanatory variables are uncorrelated with the individual effect, whereas the FE model allows all the explanatory variables to be correlated with the individual specific effect (μ_i). Unfortunately, then, the RE estimator is often biased and inconsistent because some explanatory variables in a regression analysis are correlated with the individual effect (Baltagi 2013).

An alternative to the kind of "all or nothing" situation posed by the choice between FE and RE estimation is the Hausman and Taylor (1981) (HT) estimator, which can estimate time invariant covariates and allow some explanatory variables to be correlated with the individual effect. The HT procedure is an instrumental variable approach that uses the model information to instrument the endogenous variables. More specifically, Hausman and Taylor (1981) considered four groups of variables: time varying variables uncorrelated with the individual effect; time varying variables correlated with the individual effect; time invariant variables uncorrelated with the individual effect; and, time invariant variables correlated with the individual effect. In this model, the endogenous time varying variables are instrumented by the deviations from their own means and, the endogenous time invariant variables are instrumented by

the individual means of the exogenous explanatory variables (for a comprehensive view of the FE, RE and HT estimators, see Baltagi 2013).

In order to test which of the three panel estimators is preferable, Baltagi et al. (2003) suggest a pretest estimator based on the traditional Hausman test. Following Baltagi et al. (2003, 362), the pretest estimator reverts to the RE estimator if the Hausman test of no difference between FE and RE estimates is not rejected. If the first Hausman test rejects the null hypothesis of no misspecification, the pretest estimator then reverts to the HT estimator if a second Hausman test of no difference between FE and HT is not rejected. Otherwise, i.e. when both Hausman tests reject the null hypothesis, the pretest estimator takes the form of the FE estimator. A major concern here might be the presence of heteroscedasticity in the data since the Hausman test statistic is not appropriate in that case (Wooldridge 2010; Baltagi 2013), and which may lead to an erroneous choice of the estimation method. To overcome this potential problem we compute the robust version of the Hausman test proposed by Schaffer and Stillman (2011).

Finally, it is important to address the issue of potential endogeneity occurring through the error terms, i.e. the correlation between the explanatory variable of interest and the disturbances. This could arise if some of the observed and unobserved factors that influence quality outcomes also influence selection into public or private management. In our context, this endogeneity issue would be ideally addressed using dynamic Arellano and Bond's (1991) estimators, which instrument for selection effects using suitable lags of the potential endogenous variables in differenced form. However, the lack of variation in private management during the study period limits our ability to adopt this approach. Nonetheless, we tested whether the potentially endogenous regressors (i.e., the type of management) can be actually treated as exogenous. To do so,

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we ran the endogeneity tests described in Baum et al. (2007) after a two-stage least squares specification, using the first and second lags of the management model as instruments. For all cases, we could not reject the null hypothesis that a non-instrumental estimator of the same equation would yield consistent estimates. Hence, we feel confident that, within the constraints posed by our dataset, the estimates that we present below are not unduly affected by endogeneity.

RESULTS

Tables 3 and 4 present Hausman-Taylor (HT) and random effects (RE) estimates for the proposed regression models, starting with prison conditions, activities and order in Table 3, before moving on to prison safety and security in Table 4. The conventional Hausman test and the robust version, point to the HT estimator when predicting prison overcrowding and drugs misuse. As regards the regression model predicting serious assaults, the estimator choice is unclear: though both tests point to the RE estimator at a 5 per cent significance level, the robust version points to the HT estimator if we set the significance level up to a 10 percent (p-value=0.066). On the other hand, both tests point to the RE estimator when predicting the number of escapes (see Tables 3 and 4). Hence, although we present estimation results for both the RE and HT estimators, we discuss only those results related to the preferred estimator for each regression model, excepting the serious assaults model where we compare the RE and HT results.

Diagnostic tests revealed that the data may suffer from heteroscedasticity. To overcome this problem we compute heteroscedasticity robust standard errors.[1] By contrast, multicollinearity does not seem to be a concern for our analysis since the individual Variance Inflation Factor is well below 2.5 for all explanatory variables

(Belsley et al. 1980), and, furthermore, the correlations between all of the variables included in our analysis are all below 0.4 (see Table 2A in the Appendix).

[Table 3 about here]

Starting with the analysis of the conditions variable, it appears that privately managed prisons seem to experience less overcrowding than public ones: the coefficient for the private management dummy variable is negative and statistically significant. This mirrors the results of previous studies showing that prison conditions may be better in privately-managed establishments. Among the control variables, establishment size and some categories of prisons are significantly related to the level of overcrowding. As expected, prison population is positively related to overcrowding, while it seems that dispersals and female training prisons are significantly less overcrowded than male training and local prisons. The time trend has a positive and significant coefficient, suggesting that the level of overcrowding has risen among English and Welsh prisons over the last decade.

Turning our attention to the activity dimension, the results suggest that inmates held in privately managed prisons enjoy more weekly hours of purposeful activity than those confined in public facilities. Among the control variables, prison population and, especially, dispersal prisons, are negatively related to hours of activity. The latter result is quite interesting, since it suggests that a trade-off between security and hours of activity may exist in high security prisons, a concern recently expressed by the HM Inspectorate of Prisons (https://www.justice.gov.uk/news/press-releases/hmi-prisons/hmp-belmarsh-too-much-security,-too-little-purposeful-activity). The time trend

coefficient is positive (and significant) suggesting that the weekly number of hours dedicated to purposeful activity has risen, on average, during the period under study.

The regression models indicate that the private management dummy variable is not an important determinant of prison security, implying that publicly and privately managed prisons report similar levels of prisoner escapes. Hence, our analysis suggests that there may be something common to how public and private prisons deal with security that generates similar levels of escaping. Dispersals and female training prisons appear to report fewer escapes, and whilst prison size and overcrowding rates show significant z-statistics, their coefficients are close to zero. The results also show a negative time trend, suggesting a security improvement in English and Welsh prisons over the last decade.

[Table 4 about here]

In contrast, when looking at the prison order and safety, we clearly see that confinement quality appears to be worse in private than publicly-run prisons. Privately managed prisons experience higher rates of drugs misuse and a higher number of serious assaults: the coefficient for private management is positive and statistically significant in both models.[2] Among the control variables, prison size and prison category again seem to be relevant factors when explaining quality. Prison population is positively related to both rate of drugs misuse and number of serious assaults. Nevertheless, the results suggest that prison category is not a significant factor when explaining drugs misuse. On the other hand, male and female training prisons and local female prisons appear less likely to experience violence than dispersals and male local prisons when analysing the RE estimator results, but not with the HT model, where

prison category is not significant. As pointed out previously, the estimator choice in the model explaining assaults is unclear, so results regarding the influence of prison category on violence should be interpreted with caution. The time trend coefficient is only statistically significant (and negative) in the model explaining drugs misuse, suggesting that this dimension of service quality improved, on average, during the study period.

DISCUSSION

In general, our results support our hypotheses that privatization will be positively related to easy-to-measure dimensions of public service quality, and vice versa. Privatization appears to be associated with better prison conditions and activities, but worse prison order and safety. In particular, the findings for prison overcrowding suggest that private prisons may offer better quality confinement in some important respects than their publicly-managed counterparts. The theory of incomplete contracts provides a fruitful lens for understanding why standards for some dimensions of quality may be more easily specified than others. This may be especially important in the case of English and Welsh prisons where the nature of the contracts between the UK government and private prison contractors can illustrate why privatization may have varying results for the different dimensions of confinement quality. At the same time, the differential (and shared) capabilities of private and public organizations may also provide further insight into the findings that we uncover.

Although UK prison contracts are not made publicly available, how the contracts are drafted is discussed in audit reports and qualitative research on prison management (Bastow 2013; NAO 2003). There are two common characteristics of the contracts, which may influence prison service quality: firstly, the payment mechanism; and,

secondly, the payment deduction system. Private contractors are paid in terms of the number of prisoner places available, not by the allocated number of prisoners. Contracts also specify the number of prisoners to accommodate and/or "acceptable" overcrowding rates.[3] Critically, due to the contract specification, private contractors may refuse point blank to take in additional prisoners, unlike public prison managers who have to negotiate with central government over the allocation of further prisoners. As a result, private contractors have a strong profit-maximization incentive to reduce overcrowding rates, especially as they may get financial deductions for unauthorized overcrowding (Bastow 2013, 214). A similar explanation may hold in the case of prisoner activity, with contracts for private prisons specifying higher targets for activity compared with the targets for public prisons (NAO 2003). At the same time, private firms are typically able to access and utilise new technological developments more quickly than their public sector counterparts (Osborne and Gaebler 1992), and so have stronger capability in those areas where technological innovation matters more. In fact, private prisons in England and Wales have been shown to innovate in the design and management of prison facilities and prisoner activities in just this way; case-based studies have shown that in privately operated prisons, innovative solutions in prison design and operation have been incorporated that had not been implemented previously (NAO 1997; 2003).

A further potential reason for private prisons to focus attention on conditions and activity is the reputational benefits that might accrue as a result of doing so. Stewardship theory suggests that relational reciprocity is a more important influence on the behaviour of contractors than profit-maximization (Davis et al. 1997). By demonstrating that they are trustworthy to government, private firms providing public services can enhance their reputation as "stewards" that share the same goals as their principals. This, in turn, may help with future contract negotiations. Hence, private

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firms are likely to regard good performance on easier-to-measure dimensions of service quality as a valuable and inexpensive means for gaining reputational benefits that can reduce the transaction costs associated with meeting monitoring requirements. This is something that may be especially likely for levels of overcrowding in private prisons, because the main stakeholders in the UK prison system continue to regard overcrowding as the key performance indicator by which prisons' achievements should be judged.

Despite the appearance of a positive privatization performance pay-off for prison conditions and activity, it seems that there is a performance penalty for the less easily-measured and managed dimensions of prison order and safety. The contracts signed by private prisons can again illustrate why this may be so. UK prison contracts aim to circumvent performance erosion, and payment deductions can be made if a contractor fails to achieve certain quality standards. In particular, fixed-penalty deductions can be made for very serious incidents, such as an escape. This can also occur when a contractor exceeds an agreed number of penalty points for poor performance on a range of other key performance measures relating to prison order and safety (NAO 2003, 13). However, if the penalty points accrued do not exceed the baseline number there is no deduction made, indicating that there is little incentive to provide more than the minimum standard on some dimensions of service quality. Or put differently, there is presently no reward for providing excellent levels of prison order and safety. At the same time, it is quite conceivable that public prisons have longer experience of, and better qualified staff able to deal with, the complex social relationships that underly the development of a well-ordered prison. In this sense, better performance on hard-to-measure dimensions of service may reflect the distinctive capabilities or comparative sectoral advantage of public organizations.

In terms of escapes, the use of a fixed penalty provides the strong incentive required to ensure that private contractors work as hard as public prisons to prevent inmates escaping. By contrast, less grievous incidents, such as drugs misuse or violent assaults, play a relatively small part in the performance point system, and so private managers may have little incentive to go beyond the bare minimum for these quality dimensions. In fact, it has been found that "under certain circumstances, these charges (penalty payment deductions) may be waived"[4] through negotiations between the Prison Service and the private contractors. Nevertheless, the results for prison escapes may also indicate that the seriousness of this organizational goal means that both public and private prison service providers must develop some core capabilities or competences in order to meet the bare minimum standards of confinement quality.

In sum, our findings illustrate that not only are there few incentives for private contractors to perform well on harder-to-measure quality dimensions, and that government may be content to accept that there are difficulties in monitoring the capabilities of private organizations in such areas. Hence, it seems that profit maximization incentives, organizational capabilities, reputational benefits and output measurability might help to explain our findings regarding prison service quality in England and Wales.

CONCLUSIONS

In this paper, we have analysed variations in public service quality attributable to the private management of prisons and assessed whether output measurability, incentives and capabilities are important factors in shaping the effects of privatization. Overall, our results seem to support our hypothesis that the privatization of prison services may lead to service improvement for easy-to-measure dimensions of service quality. On those

dimensions where the contracts give very little incentive to private contractors to reduce costs and that may even represent an area of comparative sectoral advantage for them, i.e., conditions and activities, we find no quality deterioration issues as a result of privatization. On the other hand, the findings for prison order and safety imply that it has not been possible to specify the contractually-agreed performance point system in such a way as to circumvent the incentive for private contractors to allow service quality to deteriorate. They also suggest that the capabilities of public organizations may be superior for delivering good performance on such hard-to-measure and manage dimensions of service quality. Despite these apparent sectoral differences, the results for prison escapes are suggestive of the possibility that for the most critical dimensions of service quality, public and private organizations may share some core capabilities and competences. These findings have important theoretical and practical implications.

Previous studies of prison privatization have provided mixed evidence of its effects on service quality. However, these studies have been almost exclusively concerned with the US penal system, and have largely relied on bivariate or descriptive statistics or under-specified multivariate regression models. In this paper, we have presented an analysis of private versus public-managed prisons in England and Wales that utilises a longitudinal data set, permitting the application of panel regression techniques, which can deal with omitted variable bias and unobserved heterogeneity. Our findings point towards the variability of private prison performance, which some prior research has also identified. In particular, the results suggest that contract specification and organizational capabilities may have a critical role to play in determining the quality of confinement offered in privately-run prisons, with harder to specify dimensions of service quality appearing to suffer most when prisons are privatized. As such, the study offers support for the theory of incomplete contracts

advanced by Hart et al. (1997), and tends to confirm the argument advanced in that paper that output measurability matters for the performance of privatised public services. In the case of English and Welsh prisons, the development of a sophisticated and complex penalty point system for hard-to-specify dimensions of service quality does not appear to have resulted in quality improvements. Given the apparent persistence of distinctive sectoral capabilities, it may not be efficient or effective to devote considerable effort to redesigning contracting frameworks to improve performance on hard-to-measure dimensions of service quality.

Despite the strengths of the findings and our study design, there are several limitations of our analysis that offer opportunities for further research. Firstly, the dependent variables used in our analysis capture only five of the eight dimensions of prison service quality identified by Logan (2002). Subsequent studies could analyse the relationship between privatization and care, justice, and management within prisons. The development of reliable indicators of each of these dimensions of confinement quality would therefore be of immense value, as would the construction of additional indicators of those dimensions we already capture. Secondly, we discuss the role of incomplete contracts as an explanatory factor in some detail. Yet, there are other aspects of private versus public management of prisons that we are unable to garner reliable information, such as the number and quality of prison officers in different institutions. Moreover, data capturing the distinctive (and shared) capabilities of private and public organizations would enable the role of comparative sectoral advantage to be explored in full. In particular, it is conceivable that the positive relationship between public management and prison order and safety is attributable to the public service motivation and ethos of publicly employed prison officers (see Koumenta 2011). The use of panel regression models provides some reassurance that we have accounted for individual

institution effects, but longitudinal research that could draw upon measures of non-contractible factors and capabilities would undoubtedly cast considerable further light on the relationships we identify here. As indeed would detailed qualitative research and case study work comparing the ways in which public and private prisons are managed in England and Wales.

Finally, our research is restricted to publicly and privately-managed prisons in a single national context. Evidence on prison service quality from settings other than the UK, the US and Brazil, and from systematic comparative studies, would prove invaluable in moving theoretical and empirical understanding of privatization forward. In particular, it is quite possible that the results would be quite different in contexts in which the service delivery contracts did not incorporate such a diverse range of potentially conflicting dimensions of service quality. For now, though, we can conclude that our study highlights that the theory of incomplete contracts allied to the concepts of output measurability and offers an especially useful framework for analysing the effects of privatization. Our findings also suggest that policy-makers should think very carefully about the limits of contract specification and organizational capabilities when considering the involvement of the private sector in the provision of public services.

NOTES

1. To compute the robust standard errors for the HT estimator, we have modified the STATA command *xthtaylor* to allow for heteroscedasticity robust standard errors. The .ado file can be provided on request. Identical results can be obtained by using the STATA user written command *xtoverid* (Schaffer and Stillman 2011) with the option *robust,* after *xthtaylor.*

2. In the case of the serious assaults model, the pretest estimator points to the discussed RE model only at a 5 percent significance level, thus the estimator choice is not clear. However, both estimators, namely RE and HT, report almost the same results for our main variable of interest.

3. Early contracts included the number of prisoners to accommodate, while more recent contracts include thresholds of crowding rates from the outset and capacity increments can be activated from the existing contracts at pre-specified prices and, unlike earlier contracts, with no additional contract renegotiations.

4. Hansard (Commons), 19 October 2012, column 496W.

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TABLE 1

Studies of privatization and public service quality in prisons

Study	Country /Sample	Security	Safety	Order	Care	Activity	Justice	Conditions	Management
Brakel 1989	USA/1	Inconclusive	Inconclusive	-	No differences	Mixed	Mixed	Private	Private
Urban Institute 1989	USA/6	Private	Private	-	-	Public	-	Private	No difference
Logan 1992	USA/3	Private	Private	Private	Public	Private	No difference	Private	Private
Archambeault and Deis 1996	USA/3	Public	Private	Private	-	Private	Private	-	Inconclusive
Thomas 1997	USA/16	Private	Private	Private	-	Inconclusive	Private	-	-
Austin and Coventry 2001	USA/1565	-	Public	-	-	Equal/Private	-	-	-
Camp and Gaes 2002	USA/91	Public	Inconclusive	Public	-	-	-	-	Public
Armstrong and MacKenzie 2003	USA/48	-	No difference	-	-	No difference	No difference	No difference	-
Perrone and Prat 2003	USA/9*	Inconclusive	Equal/Public	Equal/Private	Equal/Private	Inconclusive	-	Inconclusive	Inconclusive
Lukemeyer and McCorkle 2003	USA/873	-	Private	-	-	Private	-	-	-
Lundahl et al. 2009	USA/12*	Public	Private	-	No difference	No difference	Public	Private	Private
Cabral et al. 2010	Brazil/13	Private (hybrid)	No difference	-	Private (hybrid)	-	No difference	-	-
Makarios and Maahs 2012	USA/1129	No difference	No difference	No differences	No difference	Public	-	Private	No difference
Cabral et al. 2013	Brazil/19	Private (hybrid)	Private (hybrid)	-	No difference	-	No difference	-	-

Notes: Quality domains adapted by the authors to fit Logan's (1992) quality of confinement model. *Number of studies included in the meta-analysis. - = not analyzed.

TABLE 2

Variable definitions and descriptive statistics

Variable	Definition	Mean	SD	VIF
Overcrowding	Percentage of prisoners who are held in a cell, where the number of occupants exceeds the uncrowded capacity of the cell.	23.63	26.82	1.86
Activity	Number of hours per week per prisoner spent engaged in activities, such as educational classes, offender behaviour programmes, vocational training, and production workshops	23.97	6.16	
Escapes	Total number of escapes	0.11	0.44	
Positive MDT	Rate of positive drug tests under the random MDT programme	10.54	7.08	
Serious assaults	Number of incidents in which at least one victim sustained a serious injury as a result of offences against the person.	10.04	8.75	
Private	Dummy variable which takes value 1 if the prison if privately managed.	0.09	0.28	1.05
Size	Average annual prison population	624.93	308.42	1.39
Dispersals	See table 1A	0.05	0.21	1.44
Male Training	See table 1A	0.51	0.50	2.31
Female Training	See table 1A	0.03	0.18	1.49
Female local	See table 1A	0.07	0.25	1.65

Notes: Some variables' definitions are based on, National Offender Management Service (2010). SD refers to the standard deviation. VIF refers to the variance inflation factor

TABLE 3

Determinants of prison conditions, activity and security in England and Wales (1998-2012)

	Overcrowding rate				Purposeful Activity				Escapes			
	HT[&a]		RE		HT[&b]		RE		HT[a]		RE[&]	
	Coef.	SE.	Coef.	SE	Coef.	SE.	Coef.	SE	Coef.	SE	Coef.	SE
Private	-6.066**	2.423	-6.553**	2.833	2.052*	1.115	2.807***	1.036	-0.006	0.053	-0.009	0.038
Size	0.016***	0.004	0.013**	0.006	-0.003***	0.001	-0.003**	0.001	0.000*	0.000	0.000***	0.000
Overcrowding					0.005	0.010	-0.003	0.015	0.000	0.001	-0.001**	0.000
Dispersals	-27.806***	5.012	-35.237***	4.346	-4.516***	1.615	-2.97**	1.207	0.099	0.249	-0.097***	0.031
Male training	-4.925	3.096	-16.247***	5.683	0.168	0.783	2.910**	1.281	0.072	0.061	0.005	0.032
Female training	-6.880**	3.341	-19.352***	6.268	0.357	1.153	3.246**	1.508	0.019	0.069	-0.073**	0.034
Female local	-15.088	9.212	-23.494***	5.894	-1.529	2.113	-0.161	1.404	0.154	0.110	0.070	0.064
Time trend	0.300***	0.073	0.370***	0.122	0.147***	0.025	0.153***	0.045	-0.021***	0.003	-0.020***	0.004
Observations	1524		1524		1314		1314		1524		1524	
Groups	114		114		109		109		114		114	
Wald-Chi2	170.88		150.47		55.75		76.79		64.16		70.23	
Hausman stat.	0.19		65.23***		4.51		29.09***		2.12		3.79	
Sargan-Hansen stat.	0.32		61.79***		5.45		40.37***		5.72		10.45	

Notes: & Preferred estimator. (a) Endogenous covariates: Size, Private, Dispersal and Female training. (b) Endogenous covariates: Size, Overcrowding, Male training. (c) Endogenous covariates: Size, Private, Male and Female training. The selection is based on Hausman and overidentification tests (Sargan-J-Hansen statistic). The asterisks ***,**, and * denote significance at the 1%, 5%, and 10% levels, respectively

TABLE 4

Determinants of prison order and safety in England and Wales (1998-2012)

	Positive MDTs				Serious assaults			
	HT[&c]		RE		HT[a]		RE[&]	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Private	7.975***	2.469	1.938	1.350	9.571**	2.468	8.188***	2.157
Size	0.003*	0.002	0.003**	0.001	0.007**	0.003	0.012***	0.002
Overcrowding	0.012	0.020	0.013	0.021	0.010	0.032	-0.004	0.023
Dispersals	-9.455	6.562	-6.877***	1.561	5.511	9.858	-0.511	2.455
Male Training	-1.576	1.401	-2.354***	1.205	-3.626	2.533	-3.715***	1.447
Female Training	-1.050	2.457	-3.303**	2.952	-5.671	3.188	-5.482***	1.779
Female local	-1.677	2.530	-2.061	1.716	-4.800	3.630	-3.664**	1.839
Time trend	-0.771***	0.041	-0.772***	0.062	0.069	0.080	-0.010	0.107
Observations	1523		1523		824		824	
Groups	114		114		107		107	
Wald-Chi2	529.26		224.51		82.66		190.06	
Hausman stat.	2.91		19.68***		-0.16		-2.49.	
Sargan-Hansen stat.	2.37		15.88***		2.31		8.80*	

Notes: & Preferred estimator. (a) Endogenous covariates: Size and Dispersals. The selection is based on Hausman and overidentification tests (Sargan-J-Hansen statistic). The asterisks ***,**, and * denote significance at the 1%, 5%, and 10% levels, respectively

TABLE 1A

Definitions of prison functions

Type of prison	Prison function
Dispersal	These prisons hold the most difficult and dangerous prisoners in England and Wales including those assessed as Category A. They serve to spread the Category A population, ensuring that the most dangerous prisoners are not concentrated in a single establishment, thereby reducing the risks involved in holding them.
Male training Female training	Closed training prisons provide a range of facilities for Category B and Category C adult male prisoners and closed condition adult females who are serving medium to long-term sentences. Prisoners tend to be employed in a variety of activities such as prison workshops, gardens and education and in offending behaviour programmes.
Female local Male local	Local prisons serve the courts and receive remand and post conviction prisoners, prior to their allocation to other establishments.
Female open Male open	Open prisons house Category D adult male prisoners and Open condition adult females whose risk of absconding is considered to be low, or who are of little risk to the public because of the nature of their offence. Open prisons also house long-term prisoners who are coming towards the end of their sentence and who have gradually worked their way down the categories. Open prisons are part of the resettlement programme to reintegrate prisoners back into society. Whilst Open prisons may have some workshop facilities, some of the prisoners will work in the community, returning to the prison in the evening.
Male closed YOI (ages 15-21)	Young Offender Institutions (YOIs) holding Young Adults (18 to 21 years old). May also include young people (aged 15 to 17) who are held separately from adults within the establishment.
Male YOI young people (ages 15-17)	Young Offender Institutions (YOIs) holding Young People (15 to 17 years old).
Male open YOI	Open YOI prisons house young adult prisoners whose risk of absconding is considered to be low, or who are of little risk to the public because of the nature of their offence.
Cluster	Cluster prisons may contain a number of prisons with different functions.

Source: National Offender Management Service (2013) *Costs per place and costs per prisoner Annual Report and Accounts 2012-13 Management Information Addendum*, London: Ministry of Justice.

TABLE 2A

Pairwise correlation matrix of independent variables

	Private	Size	Overcrowding	Dispersals	Male training	Female training	Female local
Private	1.000						
Size	0.185	1.000					
	(0.000)						
Overcrowding	0.026	0.179	1.000				
	(0.316)	(0.000)					
Dispersals	-0.068	-0.044	-0.200	1.000			
	(0.006)	(0.084)	(0.000)				
Male training	-0.082	-0.159	-0.399	-0.222	1.000		
	(0.001)	(0.000)	(0.000)	(0.000)			
Female training	-0.058	-0.243	-0.165	-0.041	-0.191	1.000	
	(0.019)	(0.000)	(0.000)	(0.095)	(0.000)		
Female local	-0.007	-0.259	-0.151	-0.060	-0.276	-0.051	1.000
	(0.783)	(0.000)	(0.000)	(0.016)	(0.000)	(0.038)	

Notes: P-values reported in parentheses.