

# Assessing Comprehensive Performance Assessment

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## **Abstract**

The use of Comprehensive Performance Assessment (CPA) to monitor the performance of 148 English local authorities (unitary and two-tier) between 2002 and 2008, and reward good performers with lower central intervention was a unique policy experiment. This paper investigates whether this experiment had any impact on the efficiency with which local authorities deliver services. To that end, we proceed in two steps. First, we use Data Envelopment Analysis (DEA) to calculate an index of local government efficiency for both English and Welsh local authorities, using as outputs, up to five key Best Value Practice Indicators, and as inputs, per capita budget expenditure in each of the four assessed sectors (education, social services, environment and central services). The efficiency measure is only moderately correlated with CPA scores (a Spearman correlation not greater than 0.30). Then, we exploit the fact that local authorities in Wales were not subject to the same CPA regime. Specifically, using Welsh local authorities as a control group, we use difference in difference methods to estimate the effect of CPA on the efficiency scores of English local authorities. We find that the impact of CPA on efficiency is not statistically different from zero.

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## 1 Introduction

In 2001, the UK government, via the Audit Commission, embarked on an elaborate evaluation exercise - comprehensive performance assessment (CPA) - to gauge how effectively its money was being spent to provide local services. From 2002 CPA has been used to scrutinise service delivery in English local authorities across six service blocks: benefits; social care; environment; libraries and leisure; use of resources; education and housing. Hundreds of performance indicators and a plethora of audit and inspection reports have been collected, summarised, weighted, and categorised so as to arrive at final category ratings of "excellent", "good", "fair", "weak", and "poor". During the first three annual rounds, the CPA exercise was applied to the 148 English unitary and upper-tier authorities only; it was extended in 2005 to include also the 238 District authorities.

The stated objective of the CPA was to target support at those councils that need it most, and to offer a number of benefits for better-performing councils, including exemptions from caps on council tax, elimination of "ring-fencing" grants, and a three-year exemption from subsequent audit inspections. So, first and foremost, it was an incentive scheme: councils that perform well are rewarded with greater autonomy. However, because the results of the CPA are widely disseminated in the media (for example, more than 30 articles published on-line on the BBC web site), it was also an exercise in providing voters with more information about the performance of their local council, both absolutely, and relative to other councils. In turn, this, in principle, provides indirect incentives for good performance; councils which perform poorly on CPA may be punished by the voters at subsequent elections. Some evidence of this occurring is in Boyne et al. [2009]: they find that poor performance on the CPA significantly lowers the vote share of the incumbent party at the following election.

The CPA is particular interest for a number of reasons. First, (as far as we know) it is the only incentive scheme for sub-national government based on quantitative indicators of performance. It is also very costly: for example, Haubrich and McLean [2006] that the cost of auditing local government is around 2.1% of total local government expenditure. The obvious question is then whether this costly exercise has brought any tangible benefits. Finally, the CPA scheme, was brought to an end in 2008, partly because it was viewed as having achieved its objectives: "In its last years, there grew a sense that CPA had run its course. Councils had clearly improved. A new level of challenge was needed that asked more fundamental questions about performance from the citizen's perspective" [Audit Commission, 2009].

The question then arises as to whether the CPA has succeeded in its aims i.e. has it really made councils more effective in delivering services? One way to look at this is simply to ask whether the CPA scores of poorly performing councils has improved over the period from 2002. It seems that there has been a general upward trend in the scores of all councils [Audit Commission, 2009]. For example, the number of councils that received a poor evaluation (a score of zero or 1) decreased dramatically, from 35 in 2002 to just 3 in 2008, while the number of local authorities who were assessed in the highest category increased from 21 in 2002 to 61 in 2008.

This simple test, however, is open to two objections. First, it is not clear that the CPA is really measuring the efficiency with which services are delivered. Rather, they are output indicators<sup>1</sup>. So, an increasing score on these indicators could indicate a very efficient service, or it could just indicate that the LA has had an increase in its budget. Over the period 2002-08, the real spending of English LAs increased by 42%. Second, and

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<sup>1</sup>For example, the score for the environment service block is based on about 30 performance indicators, which clearly measure outputs, rather than the efficiency with which inputs are combined to produce outputs. To give an example, the performance indicators relating to cleanliness and waste disposal are: cleanliness of public places, satisfaction with waste collection, satisfaction with recycling, and satisfaction with waste disposal.

equally importantly, we do not observe the counterfactual; it may be that service delivery would have improved anyway, even in the absence of the CPA.

This paper deals directly with both these problems. First, we treat the CPA as a natural experiment by exploiting the fact that it was only introduced in England, whereas in Wales, where the structure of local government is the same, a much weaker performance management scheme was introduced. As reported by Haubrich and McLean [2006] Welsh assessment regime was much less prescriptive and much less elaborate than its English counterpart. In particular, there were no quantitative rankings, much less information published, and authorities have also a say with regard to the type of inspections they would like to see for specific areas. So, we use local authorities in Wales as a control group when assessing the impact of CAP on the treatment group, the English councils. Second, we need a metric to measure the real efficiency of the service delivery in a consistent way across both English and Welsh councils. Clearly, CPA itself is an inappropriate metric, for two reasons. First, no CPA scores were calculated for Wales, and second, as remarked above, CPA generally measures the quality of output, rather than the efficiency with which outputs are produced from inputs. The approach we take here is to calculate an efficiency index for each council in each year of our study, which is based on data envelopment analysis. Specifically, in the main empirical model we identify five quantitative outputs of the council (in secondary education, elderly assistance, waste disposal, and children social services - see Section 3 below for details) and four inputs (per pupil expenditure in case of education, and per capita spending in each of other three services). We then apply data envelopment analysis to calculate an efficiency index for each council in each year. This index for any council  $i$  in year  $t$ , is a measure of the distance of that council's output index from the production possibility frontier, conditional on its inputs (see Section 3 below). The

index is only moderately correlated with the CPA scores, with a Spearman correlation coefficient of between 20% and 30%. Moreover, interestingly, the efficiency index is generally less correlated with the socio-economic and political characteristics of the council than is the CPA. In particular, the efficiency index is not significantly correlated with the the Index of Deprivation 2004 created by the British Department for Communities and Local Government using 2001 census data.

Our main results are the following. Using a difference-in-difference analysis, we estimate the effect of the introduction of CPA in the English councils on our index of efficiency. After 2001 we observe a general increase of efficiency both in Wales and England whereas the "treatment" effect of the CPA on English local authorities never results statistically different from zero. Therefore we can conclude that the specific features that distinguished CPA from Welsh performance assessment, like for example the publication of league tables, did not boost efficiency. This is in stark contrast to the view of the Audit Commission [2009] that CPA has "done its job" effectively.

## **2 The CPA - A Brief Overview**

Although the CPA started in 2002 with the assessment of the 2001/02 financial year, the methodology for the CPA changed in 2005 in relation to the assessment of the 2004/05 financial year. In the first three rounds, the method for assessing the current performance of the LA was the following. Current performance of authorities was assessed in seven categories (benefits; social care; environment; libraries and leisure; use of resources; education and housing). Where available, performance was assessed through already existing judgments from inspectorates and auditors, such as those by Office for Standards in Education (Ofsted) and Department for Education and Skills (DfES) for education. Numerous categorizations and conversions were

applied in order to summarize more than 1,000 performance indicators and auditor judgments. Eventually, authorities obtained a score between 1 and 4 for each of the service blocks (with 1 being the lowest and 4 the highest). The scores were then weighted so that the scores for education and social services count four times, housing and environmental services twice, with the remaining blocks counting only once. These were then added up to produce a performance score of between 15 and 60 points, or 12 and 48 points for shire county councils (because they do not provide, and are therefore not assessed on, housing or benefits services). The performance scores were then categorized to produce a performance rating of between 1 and 4 for each authority using the following rule.

Performance score	Category Score	Performance score	Category Score
Counties		London, Metropolitan Districts and Unitary Authorities	
Less than 24 points	1	Less than 30 points	1
24 to 29 points	2	30 to 37 points	2
30 to 36 points	3	38 to 45 points	3
More than 36 points	4	More than 45 points	4

In the end the final CPA score (poor, weak, fair, good, excellent) was obtained combining the above 1 to 4 councils’ performance score on core service with the 1 to 4 councils’ ability to improve (a second assessment of the council’s plan to improve services in the future) as reported in the following table.

Councils’ ability to improve	Councils’ performance score on core services			
	1	2	3	4
1	poor	poor	weak	n/a
2	poor	weak	fair	good
3	weak	fair	good	excellent
4	n/a	good	excellent	excellent

In 2005, a new methodology, the harder test [Audit Commission, 2009] was introduced. The current performance of the LA was now assessed in the same categories with the exclusion of education, that after 2004 assessment has been taken out the CPA. The main innovation, however, involved

the aggregation procedure where the ability to improve was replaced by the corporate assessment, a three year period assessment of the council’s ability to lead its local community having clearly identified its needs and set clear ambitions and priorities. Among the services categories social care and use of resources received effectively a higher weighting than the other five through the following aggregation rule.

Corporate assessment	Level 1 assessments (children and young people adults’ social care and use of resources)	Level 2 assessment (housing, environment, culture, benefits)	Category
4	None less than 3	None less than 2	4 star
4	None less than 2	No more than one less than 2	3 star
4	No more than one less than 2	No more than one less than 2	2 star
4	Any other combination	Any other combination	1 star
3	None less than 3	None less than 3	4 star
3	None less than 2	None less than 2	3 star
3	None less than 2	No more than one less than 2	2 star
3	Any other combination	Any other combination	1 star
2	None less than 3	None less than 3	3 star
2	None less than 2	None less than 2	2 star
2	No more than one less than 2	No more than one less than 2	1 star
2	Any other combination	Any other combination	0 star
1	None less than 3	None less than 2	2 star
1	None less than 2	None less than 2	1 star
1	Any other combination	Any other combination	0 star

Finally, as reported in the table above, differently from the first three rounds the new final CPA score varied between zero and four stars.

### 3 The Construction of the Efficiency Index

We will measure efficiency by data envelopment analysis (DEA hereafter). To that end, each LA will be treated as a decision-making unit that provides local services under the behavioural assumption that each of them operates in order to minimise the level of inputs given the level of output (input approach), or alternatively, that operates in order to maximise the output given the inputs (output approach). According to these simplified assumptions, therefore, we assume that the aggregated output of the local authorities is

the result of the following production function:

$$y_{it} = f(\mathbf{x}_{it}; \beta)h(\mathbf{z}_{it}; \gamma)\exp(v_{it} - u_i) \quad i = 1, 2, \dots, N \quad \text{and} \quad t = 1, 2, \dots, T. \quad (1)$$

where  $N$  is the number of local authorities,  $T$  the number of years,  $y_{it}$  is the aggregated output,  $\mathbf{x}_{it}$  is a  $(L \times 1)$  vector of inputs,  $\mathbf{z}_{it}$  is a  $(M \times 1)$  vector of environmental variables,  $\beta$  a vector of technology parameters,  $\gamma$  is the vector of coefficients on the environmental variables. For simplicity, and with little loss of generality, we assume separability between  $f(\cdot)$ , which describes the technology, and  $h(\cdot)$  which represents the way in which the environment affect the output. Since we are estimating a "frontier" production function, the error term has two components: the idiosyncratic error  $v_{it} \sim i.i.d.(0, \sigma_v^2)$ , which accounts for the statistical noise in the production function, and the inefficiency error component  $u_i$ , which is assumed to satisfy the restriction  $u_i > 0$  and provides a measure of "net" or "residual" inefficiency since it captures the distance of the actual level of output from the frontier once we take into account the influence of exogenous environmental factors. It is important to stress that  $u_i$  can be associated to the managerial inefficiency specific to each local authority, that can not be observed directly but only inferred as a residual. In this case, since we are conducting a short term analysis, it is possible to assume that  $u_i$  is time invariant.

Given the previous assumptions about the behaviour of the local authorities, the first step is the estimation of the "gross" level of efficiency  $e_{it} = \frac{y_{it}}{f(\mathbf{x}_{it}, \beta)}$  that corresponds to the distance between the actual level of output attained by the local authority  $i$  in the year  $t$  and the maximum output attainable given the inputs employed in the production. DEA is a non-parametric estimator of  $e_{it}$ , no assumptions about the shape of  $f(\cdot)$  are necessary, and the convexity of the production set is the only restriction that needs to be imposed. Moreover DEA is a powerful estimator in case of mul-

tidimensional production frontier since allows us to avoid contrived forms of output aggregation. On the other hand, a large number of observations is an important prerequisite for a meaningful analysis in case of a multidimensional production frontier. This problem will be discussed again later on.

In the case of the input approach, let  $\tilde{e}_{it}^{DEA}$  be the solution of the following linear program:<sup>2</sup>

$$\min_{\phi, \lambda} \phi \quad s.t. \quad \phi \mathbf{x}_{it} \geq \mathbf{X}_t \lambda; \quad \mathbf{Y}_t \lambda \geq \mathbf{y}_{it}; \quad \lambda \geq 0; \quad \iota' \lambda = 1 \quad (2)$$

Then  $\tilde{e}_{it}^{DEA}$  is the efficiency score for the council  $i$  in period  $t$ . It satisfies:  $\tilde{e}_{it}^{DEA} \in (0, 1]$ , with a value of 1 indicating a point on the frontier and hence a technically efficient council, according to Debreu [1951], Farrell [1957] definition. The linear program in (2) is usually solved by using a pooled approach where only one production frontier is estimated and each region is compared also with itself in another year. In this way it is possible to use all the  $N \times T$  observations.

Consistency is the most important property of an estimator, that is an estimator of an unknown parameter is consistent when it converges to the true value of that parameter as the sample size increases. There is no reason to use an inconsistent estimator since in that case increasing the amount of data would not allow of getting close to the true value that one wants to estimate. In nonparametric statistics, it is quite difficult to prove convergence of an estimator as well as to obtain its rate of convergence. Recently, however, it has been found that  $\tilde{e}_{it}^{DEA}$ , as a non-parametric estimator of Debreu-Farrell measure of technical efficiency, is biased upwards since it does not converge

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<sup>2</sup>In (2)  $\mathbf{x}_{it}$  is the matrix of input of council  $i$  at time  $t$ ,  $\mathbf{X}_t$  is the matrix of inputs of all councils,  $\mathbf{Y}_t$  is the matrix of outputs of all councils,  $\lambda$  is a vector of optimal weights attached to the peers of local government  $i$ ;  $\iota$  is a vector of ones, the last constraint is important for imposing variable returns to scale.

toward  $e_{it}$ . In particular, Kneip et al. [1998] showed that:

$$\tilde{e}_{it}^{DEA} = e_{it} + O_p(n^{-\frac{2}{l+q+1}}) \quad (3)$$

where  $n$  is the number of observed production plans,  $l$  is the number of inputs, and  $q$  is the number of outputs in DEA. Which means, with some abuse of language, that as we increase the sample size DEA converges toward the true value of efficiency plus something that corresponds to the bias, and that the rate of convergence is  $n^{\frac{2}{l+q+1}}$ . Hence it appears that the higher the number of the inputs and/or the outputs, the slower the convergence rate, this means that when  $l + q$  is greater than three, like in this case, our estimates can be very imprecise unless a very large quantity of data is also available since the rate of convergence is slower than the standard  $\sqrt{n}$ .

In this study, although more than 1500 observations are available considering both English and Welsh councils in the production function, the bootstrap procedure developed by Simar and Wilson [2007] will be used to estimate a "bias corrected" measure of efficiency ( $\hat{e}_{it}^{DEA}$ ) along with its interval of confidence at the 95% level of significance. In the second stage the impact of CPA and other exogenous environmental variables on local government's efficiency is evaluated through the estimation of the following empirical model derived directly from the base model in (1):

$$\frac{y_{it}}{f(\mathbf{x}_{it}, \beta)} = h(\mathbf{z}_{it}; \gamma) \exp(v_{it} - u_i) \quad (4)$$

After replacing  $\frac{y_{it}}{f(\mathbf{x}_{it}, \beta)}$  with the bias corrected DEA measure of efficiency  $\hat{e}_{it}^{DEA}$ , and assuming for simplicity a Cobb-Douglas functional form for  $h(\cdot)$  the final empirical model to estimate the impact of CPA and other environ-

mental variables becomes:

$$\hat{e}_{it}^{DEA} = \prod_{m=1}^M z_{itm}^{\lambda_m} \times \exp(v_{it} - u_{it}) \tag{5}$$

where  $M$  is the number of environmental variables.

## 4 The Data

The Data used in the construction of the efficiency index is the following.

We use five output variables, and four input variables.

Table 1: Output and Input Variables.

Variable	Observation		Mean		Std.Dev.		Min.		Max.	
	E	W	E	W	E	W	E	W	E	W
Output variables (best value practice indicators)										
Secondary Education (bvpi38)	1373	179	51.10	51.04	9.51	6.49	23.00	31.40	77.52	64.23
Children social service (bvpi49)	1373	179	11.92	9.36	4.21	4.67	0.62	0.41	33.33	25.41
Elderly social services (bvpi54)	1373	179	85.51	100.29	26.97	36.83	29.14	18.38	215	244
Waste disposal (bvpi82a)	1373	179	11.66	14.35	5.67	8.75	0.85	1.50	37.00	42.80
Central services (bvpi8)	1373	179	82.80	82.77	10.99	9.62	23.00	52.20	99.49	98.93
Input variables (expenditure)										
Secondary Education (real £ per pupil)	1373	179	3,503	3,203	728	392	1,822	2411,63	6,619	4,124
Elderly and Children (real £ per capita)	1373	179	205	209	76	56	81	107	563	342
Waste disposal (real £ per capita)	1373	179	21	22	7	9	0.01	5.18	43	63
Central services (real £ per capita)	1373	179	19	31	11	14	0.16	2	89	87

Note: 1) E = England, W = Wales.

2) See Table 2 for the BVPI codification.

The choice of the variables apt to measure the output of the local government’s activity is, in general, a difficult exercise. Especially in this case,

where the goal is to evaluate the outcome observed in different sectors, it is very important to stress the simplifications that have been necessary in order to deal with the trade-off between accuracy and the curse of dimensionality that undermines the non parametric estimation of the production frontier (see next section for details).

Considering the particular nature of the decision making units, the basic idea is to measure the "quality" rather than the "quantity" of the output achieved by local authorities in each sector assessed through the CPA procedure. To that end the "Best Value Practice Indicators" (BVPIs) published by the Audit Commission for England and the Wales Audit Office for Wales are the best source of information for two main reasons: first they are broadly accepted by the local governments as measures of output quality; second we are very confident about the comparability of these measures across local authorities since BVPIs were also chosen as one of the building blocks of the CPA procedure. The first problem to solve was the absence of BVPIs for the housing and benefit sector in case of the counties, where this function is managed by districts. The only possible solution was to drop this sector from the efficiency analysis given the impossibility of using DEA without homogeneous production functions for all local authorities. A further problem worth discussing is the short life of many BVPIs. Despite the fact that we could count more than 250 indicators published on the website of the Auditing Commission, almost all of them after three or four years have been subject to some changes, and in many cases replaced with new indicators. As a result, also the sector of "culture" has been eliminated from the production function in order to obtain a consistent set of indicators fully comparable across a number of years sufficiently large to use DEA. As summarised in Table 2, in the end only five indicators could be used to measure the quality of the output consistently for England and Wales, consequently we restrict the measurement of efficiency to the following services: secondary education,

elderly and children social care, waste disposal, and central services.

Table 2: Description of output variables.

Service	BVPI code	Description	Measurement period
Secondary Education	BVPI38	Percentage of 15 year old pupils in schools maintained by the local education authority achieving five or more GCSEs at grades A* - C or equivalent	average over the current and the three following academic years
Social services (children)	BVPI49	The percentage of Looked After Children at 31 March with no more than three placements during the last financial year.	Current financial year
Social services (elderly)	BVPI54	Older people helped to live at home per 1,000 population aged 65 or over	Current financial year: snapshot at 31st March
Waste disposal	BVPI82a	Percentage of household waste arising which have been sent by the Authority for recycling	Current financial year
Central services	BVPI8	Percentage of invoices for commercial goods & services paid by the Authority within 30 days of receipt or within the agreed payment terms	Current Financial Year (Calendar days)

Source: Audit Commission Best Value Performance Indicators Guidance 2007/08

As far as the input side is concerned, data from the Finance and General Statistics (FGS) and Local Government Comparative Statistics (LGCS), available on the website of the Chartered Institute of Public Finance and Accountancy (CIPFA) from the 1997/98 to the 2007/08 financial years, can be used to define the inputs in terms of per pupil cost in case of secondary education, and in terms of per-capita cost for the other services. Since our analysis aims at estimating a short-term frontier production function we assume a constant level of capital employed in the production. In the end, up to 57% of the total local government's budget expenditure will be taken into account since education and social services are the sectors that absorb most of the budget expenditure.

Finally a set of environmental variables has been collected in order to control for the impact of exogenous local social-economic characteristic on local government's efficiency. This last group of variables is described in full in Table A1 in the Appendix and can be subdivided in the following sub-categories: 1) the first category related to the characteristics of the local population and its concentration in the local authority territory, like the

percentage of the total population below the age of 16 and above the age of 75, the percentage of population that declare themselves religious, the percentage of white people, the population density, and finally the percentage of households who own their house, the number of Band D equivalent dwellings per capita that correspond to the tax base of the council tax and has been included as a proxy of the demand for local public services; 2) the second category includes a set of dummy variables to capture the impact of the ruling party and the feature of the electoral system ("all out" election every four years, or "by thirds" system which involve more frequent elections); 3) the third group of variables is related to the structure of the local economy and includes: the average gross hourly pay, the percentage of the workforce claiming unemployment-related benefits, the percentage of people above the of 65 claiming attendance allowance, the percentage of people below 65 claiming disability living allowance, the percentage of VAT tax payers in the financial and real estate sector, the percentage of VAT taxpayers in the social services sector, the percentage of high qualified workforce, and the percentage of workforce self employed; 4) finally we include the Indices of Deprivation 2004 (based of 2001 census data) in terms of the average council rank. This is a deprivation index created by the British Department for Communities and Local Government taking into account the following domains at the small area level: income, employment, health and disability, education, barriers to housing and services, environment, crime.

## 5 Properties of the Efficiency Index

Using a sample made up of 1552 production plans including English and Welsh councils over the 1997/98-2006/07 financial years, DEA bias-corrected efficiency indices along with their 95% interval of confidence have been computed following the bootstrap methodology discussed above. Subsequently

bias-corrected scores of efficiency have been used to rank English and Welsh local authorities in accordance with the quartile they belong to in the distribution of DEA indices of efficiency as shown below.

$$\text{Efficiency categories} = \begin{cases} 1 & \text{if } e_{it}^{DEA} \text{ is in the first quartile} \\ 2 & \text{if } e_{it}^{DEA} \text{ is in the second quartile} \\ 3 & \text{if } e_{it}^{DEA} \text{ is in the third quartile} \\ 4 & \text{if } e_{it}^{DEA} \text{ is in the fourth quartile} \end{cases} \quad (6)$$

This procedure, other than making DEA comparable with CPA in case of English councils, allows to detect those statistically "unstable" production plans that exhibit different placements when comparing their placements in the upper and lower boundary of the 95% interval of confidence. For example if York 2005 is ranked in the highest quartile according to the right boundary of the 95% interval of confidence but in a lower quartile when considering the left boundary of the interval of confidence, then its DEA efficiency evaluation can not be considered statistically reliable and so York 2005 will be dropped from the dataset. As a result only a subset of statistically "stable" indices of efficiency will be used discarding those authorities with an ambiguous evaluation. As shown in Table 3 is possible to keep 64% of the DEA bias-corrected efficiency indices in case of input approach, and 60% in case of output approach.

Table 3: Stable and unstable efficiency evaluations, 1997/98-2006/07 financial years.

Type of local authorities	Total observations	Input Approach		Output Approach	
		Stable	%	Stable	%
English Counties.	329	203	61%	202	61%
London Boroughs	304	228	75%	190	62%
English Metr. Districts	333	192	57%	196	59%
English Unitary Authorities	407	264	64%	253	62%
Welsh local authorities	179	102	56%	94	53%
TOTAL	1552	989	64%	935	60%

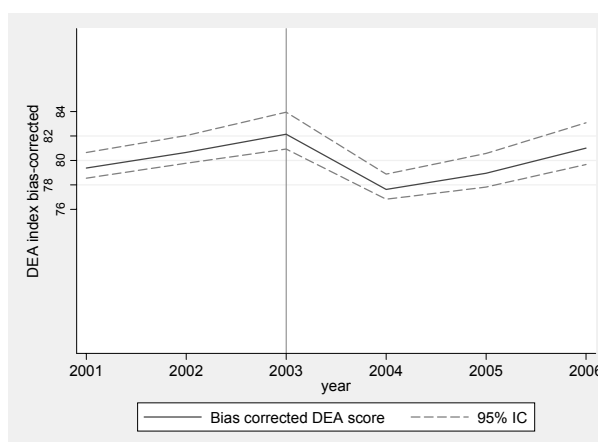


Figure 1: Average DEA scores (average between input and output approach) across years, only stable English production plans, year 2001-2007. Note: Efficiency scores on the Y-axis are in percentage.

Figure 1 and 2 report the DEA score (average between input and output approach) considering only the statistically "stable" DEA indices of the English councils from the 2001/02 to 2006/07 financial years. Because of missing input and output data we could not compute DEA for the financial year 2007/08, the last period assessed by the CPA. In Figure 1 a clear increase in efficiency can be observed in all years but 2004. Then, looking at the average efficiency level achieved between 2001 and 2006 by each local authorities it is possible to note that Counties, the third block of codes in Figure 2, performed better than the other types of local governments. Instead London Boroughs, the first block of codes in the picture, exhibit on average the worst performance.

We now turn to study the correlation between CPA and DEA rankings in case of English councils. CPA categories have been reduced from 5 to 4 bringing together local authorities in the first two lower brackets where we could count fewer observations, and DEA ranking has been considered in terms of quartiles of the original distribution. As a result with both methodolo-

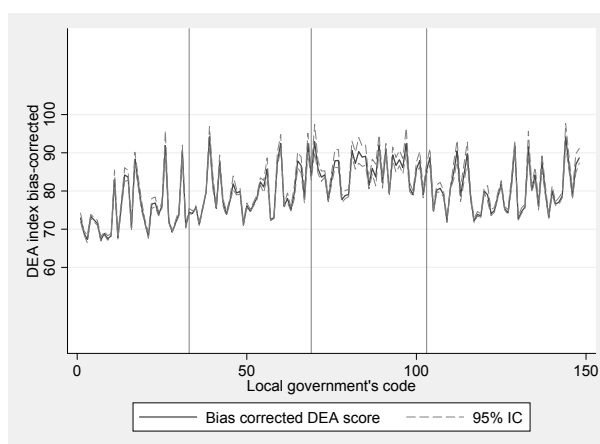


Figure 2: Average DEA scores (average between input and output approach) across local authorities, only stable English production plans, year 2001-2007. Note: Efficiency scores on the Y-axis are in percentage; first block of codes = London Borough, second block of codes = Metropolitan Districts, third block of codes = Counties, fourth block of codes = Unitary Authorities.

gies local authorities are ranked in an homogeneous way using four discrete categories. Moreover, in order to be sure that the correlation between the two rankings is not biased because of the exclusion of housing and cultural services from the production function used for the efficiency evaluation, a "modified" CPA categorization has been computed applying the CPA aggregation rules reported in Section 2, to the same sub-set of services included in the production function. The Spearman correlations between the original CPA ranking and our efficiency ranking is equal to 0.22 in case of input approach and 0.29 in case of output approach, the correlation becomes respectively 0.24 and 0.31 using the modified CPA, and the null hypothesis of independence is always rejected at 1% significance level. Figure 3 can help to visualize the similar path followed by efficiency and CPA. We can observe an high degree of correlation across time, 2004 plunge in DEA efficiency indices corresponds to a decrease in CPA scores as well. In the other periods both efficiency and CPA follow the same upward trend.

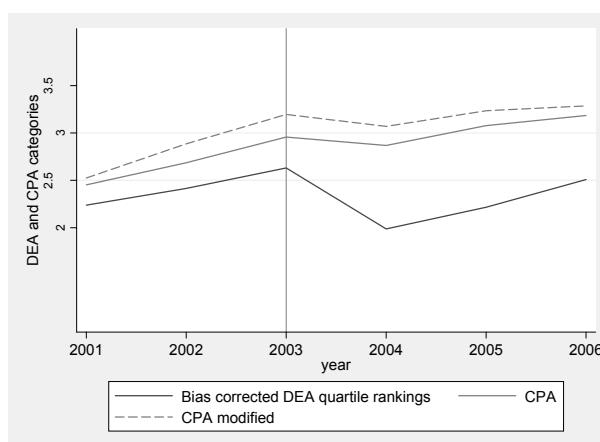


Figure 3: Comparison between average DEA quartile rankings (input approach) and CPA across years and local authorities, only statistically stable production plans, year 2001-2007. Note: Efficiency scores on the Y-axis are in discrete levels from 1 to 4

A final issue is the degree to which the external environment of the LA affects its efficiency score, or indeed its CPA ranking. This is important because a council may be efficient, but the external environment in which it operates, in particular levels of deprivation in community it serves, may be such as to make "demand" for its services more difficult to meet, and may thus cause such a council to score relatively poorly on CPA [Andrews, 2004, Andrews et al., 83, McLean et al., 2009]. For example, in a well-known paper, Andrews [2004] showed that for 108 individual performance indicators used to calculate the CPA, 61% were significantly correlated with the Index of Multiple Deprivation, a deprivation index created by the Department for Communities and Local Government. Of these, the majority, 61%, were affected negatively.

This issue is investigated thoroughly in Porcelli [2010]. Here, we just give the main regression with efficiency variables, which also serves as the baseline specification for the difference-in-difference estimation in the next Section.

Taking logs of equation (5), we get:

$$\log(\hat{e}_{it}^{DEA} \times 100) = \sum_{m=1}^M \gamma_m \log z_{itm} + \eta_t - u_i + v_{it} \quad (7)$$

where  $\eta_t$  correspond to a set of year dummies. Here are a large number of environmental variables, and so this regression is reported in Table 7 in the Appendix.<sup>3</sup> The results in that paper shows that the effect of various environmental variables on the DEA index is quite different from its impact on the CPA index. Here, we just report the effects of environmental variables on the DEA index. In particular, the percentage of people below the age of 16 and above the age of 75 (that is, those outside the workforce) has a positive effect on councils' efficiency. The population density and the tax base of the council tax exhibit a negative and statistically significant impact both on CPA performance and DEA efficiency, this result can be interpreted as the empirical evidence of congestion in the provision of local services. The percentage of households who own their house exhibits a positive impact only on DEA efficiency. The Index of Multiple Deprivation, or other related measures, such as the percentage of the population claiming unemployment benefit, seems to have no effect, in contrast to the case of CPA. The identity of the ruling party (Labour, Conservative, Liberal Democrat) has no significant effect on the DEA index. By contrast, the type of local authority does matter for efficiency: London Boroughs exhibit the worst performance while the Counties the best, with metropolitan districts being intermediate.

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<sup>3</sup>It is important to stress that the point estimates taken from Porcelli [2010] and reported in the Appendix are related to an empirical model where the dependent variable  $\log(\hat{e}_{it}^{DEA} \times 100)$  in (7) is replaced by  $w = \{1, 2, 3, 4\}$  related to the efficiency categories in order to compare the results with the those obtained using CPA as a dependent variable of the model in (7).

## 6 Main Results

Figure 4 plots the bias corrected DEA efficiency indices (average between input and output approach) in England and Wales from the financial year 1997/98 to the financial year 2006/07. Although Welsh councils appear in general more efficient than English councils, the gap is completely closed in the last assessed financial year. Before the introduction of CPA both countries seems to follow a similar path, and it is only after 2001 that we can observe a clear divergence. As a results Welsh councils can function very well as a control group to address the counterfactual question of what would have been the efficiency path of English councils after 2001 if their assessment was similar to that implemented in Wales, that is to say a system where no rankings of local authorities were published. Both English and Welsh councils' efficiency indices follow a decreasing trend as a result of the New Labour strategy that since 1997 combined large real terms increases in public spending directed to modernise local government with strong emphasis on top-down performance management centred, in England, on the CPA exercise [Martin et al., 2010]. In fact after the introduction of CPA and local government's performance assessment in Wales the decreasing trend seemed to reverse its course, especially in English councils we observe a clear quadratic trend. Therefore the injection of new resources initially reduced local government efficiency and only after the introduction of councils' performance assessment it has been possible to observe some rise in efficiency.

However in order to evaluate if CPA boosted local government efficiency in English councils we need to address this issue more formally. To that end, we take advantage of the fact that Welsh councils can function as a control group in order to estimate the impact of CPA on efficiency in a quasi-experimental setting through a difference-in-difference estimator (DID). We proceed by adding dummy variables to the baseline specification in 7 as follows:<sup>4</sup>

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<sup>4</sup>It is important to stress that in the model in (8), differently from the model in (7), we

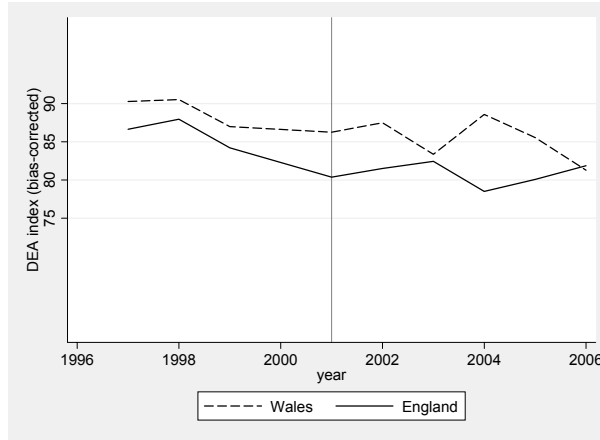


Figure 4: DEA indices of efficiency (bias-corrected), average between input and output approach. Note: Only statistically stable efficiency indices.

$$\log(\hat{e}_{it}^{DEA} \times 100) = \beta_1 cpa + \beta_2 (cpa \times England) + \sum_{m=1}^M \gamma_m \log z_{itm} + \eta_1 trend + \eta_2 trend^2 - u_i + v_{it} \quad (8)$$

where  $cpa$  is a dummy that takes value one after 2001 and  $England$  is a dummy that takes value one for English councils. The main parameters of interest here is  $\beta_2$  which capture the treatment effect of the CPA. The simplest consistent estimator for  $\beta_2$  is within-group in order to get rid of  $u_i$ . Point estimates for  $\beta_1$ ,  $\beta_2$ ,  $\eta_1$ , and  $\eta_2$  are reported in Table 4. Clearly it is possible to observe an increase in efficiency after the introduction of CPA between 3.4% and 4%. The input approach allows a very straightforward interpretation: after the introduction of local government assessment, in England and Wales, the same output quality has been achieved spending 4% less. However we are not able to find any causal effect of CPA on efficiency of English coun-

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have to replace the years dummies with a quadratic trend in order to estimate the impact of CPA.

cil since  $\beta_2$ , the coefficient of the treatment effect exhibits a point estimate that is not statistically different from zero. Moreover our estimates confirm the presence of a generalised quadratic trend.

Table 4: Point estimates of the treatment effect of CPA.

	Dependent variable = $\log(\hat{e}_{it}^{DEA} \times 100)$		
	Average input-output approach	Input approach	Output approach
dummyCPA	3.425 (2.006)*	4.065 (2.147)*	0.026 (0.987)
dummyCPA $\times$ England	-2.089 (2.124)	-2.344 (2.339)	1.223 (1.034)
Trend	-4.890 (0.982)***	-7.925 (1.458)***	-1.190 (0.760)
Trend square	0.364 (0.052)***	0.551 (0.080)***	0.130 (0.038)***
Other Environmental var.	Yes	Yes	Yes
Observations	512	825	774
Number of code	155	158	157
R-squared	0.4	0.56	0.15

Robust standard errors in brackets \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%  
Point estimates are in %.

## 7 Robustness Checks

The first concern is to what extent our indices of efficiency depend on the choice of particular outputs. In order to estimate a more general production frontier the previous measures of the quality of output in the social service and environmental sectors has been replaced by the correspondent CPA scores achieved by each council in those sectors. Moreover the percentage of proposed statements of special educational need prepared within 18 weeks (excluding exceptions) has been included as a further measure of the output quality in the education sector, and per-pupil cost for secondary education has been replaced with the total per capita cost in order to cover almost 80% of the total local government's expenditure. Obviously, this new produc-

tion frontier could be estimated only for English councils across the financial years from 2001/02 to 2006/07. Nine hundred production plans could be used to estimate a new production frontier using the "bias-corrected" version of DEA. After dropping the efficiency indices which are statistically "unstable" only 400 observations survived in case of input approach and 108 in case of output approach, consequently the rest of the analysis will be based on the estimates of efficiency obtained using only the input approach. The following table reports the spearman correlation among our new DEA indices, the previous DEA indices, and CPA categories. The high degree of Spearman correlation with the old DEA indices, especially in case of input approach, corroborates the robustness of our efficiency measures with respect to the choice of the input and output variables.

	Old DEA (input approach)	Old DEA (output approach)	CPA	CPA modified
New DEA indices (input approach)	0.67	0.56	0.20	0.24
No. of observations	321	240	400	388

Note: only statistically stable efficiency evaluation

The second concern is the linearity assumption in the estimation of the second stage panel data model reported in (8). The linearity assumption may not be appropriate here because the dependent variable can vary only between zero and one. A possible solution would be to estimate the following non-linear panel data model:

$$\hat{e}_{it}^{DEA} = \Phi \left( \beta_1 cpa + \beta_2 (cpa \times England) + \sum_{m=1}^M \gamma_m \log z_{itm} + \eta_1 trend + \eta_2 trend^2 - u_i \right) + v_{it} \quad (9)$$

where  $\Phi(\cdot)$  is the standard normal cumulative distribution function, so that the fitted values of the efficiency scores will neither exceed 1 nor be less than

0. In this framework, the impact of the policy variables can be consistently estimated by a pooled Bernoulli quasi-MLE (QMLE) as proposed by Papke and Wooldridge [2008]. Coefficients' point estimates for the treatment effect and the trend are presented in the following Table 5. The magnitude of the policy variables expressed in terms of average partial effects is in line with those obtained in the case of linear models.

Table 5: Point estimates of the treatment effect of CPA, non-linear model.

	Dependent variable = $\hat{e}_{it}^{DEA}$		
	Average input-output approach	Input approach	Output approach
dummyCPA	3.18 (1.54)**	3.40 (1.59)**	0.28 (0.87)
dummyCPA $\times$ England	-2.06 (1.51)	-2.03 (1.60)	0.54 (0.88)
Trend	-4.28 (0.65)***	-7.10 (0.81)***	-1.19 (0.49)**
Trend square	0.29 (0.034)***	0.46 (0.045)***	0.12 (0.024)***
Other Environmental var.	Yes	Yes	Yes
Observations	512	825	774

Robust standard errors in brackets \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%  
Point estimates in terms of average partial effects, and in %.

The fundamental identifying assumption underlying the validity of the quasi-experimental setting implemented in this paper is that, in the absence of CPA, the time path of our efficiency measure would be the same in England and Wales. As suggested by Stewart [2004], a formal test for this assumption is provided by the absence of significant interactions in the pre-CPA period between the groups of councils and the time effects in relation to efficiency. Under the null hypothesis that the two groups are following the same efficiency path before the introduction of CPA. This test has been performed by estimating the following model:

$$\log(\hat{e}_{it}^{DEA} \times 100) = \eta_t + \theta_t(\eta_t \times D) + \sum_{m=1}^M \gamma_m \log z_{itm} - u_i + v_{it} \quad (10)$$

where  $\hat{e}_{it}^{DEA}$  is replaced by the DEA indices used as dependent variables in Table 4,  $\eta_t$  is the set of year dummies,  $D$  is a dummy for English councils, and  $\theta_t$  is the parameter of interest. Strong evidence in favour of the underlying identifying assumption of no interactions in the pre-reform period has been obtained by the impossibility to reject the following null hypothesis  $H_0 : \theta_{97}, \theta_{98}, \theta_{99}, \theta_{00} = 0$  in relation to the input approach and the average between input and output approach efficiency indices.

## 8 Conclusions

In this paper, the effect of CPA on English government efficiency is estimated in a quasi-experimental setting using a difference in-difference approach. The goal is to address the counterfactual question of what would have been the efficiency path after 2001 in English local governments, our treated group, if the performance assessment was similar to the one adopted in Welsh councils used as control group. Although we found robust empirical evidence that CPA and local government's efficiency (measured using DEA) are positively correlated, our estimates show no sign of causal relation between CPA and efficiency in English councils. As a result it is possible to conclude that the publication of councils' league tables, the main difference between English and Welsh local government assessment, was not able to stimulate efficiency in the provision of local services. However, the decision of the Audit Commission to abandon CPA and its "league table" system in 2009 for a new assessment procedure named Comprehensive Area Assessment (CAA), more in line with the Welsh system, can not be necessarily judged in a positive

way since we still do not know the determinants of the CPA failure, analysis left to a future extensions.

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## Appendix

Table 6: Description of environmental variables.

Variable	Observation		Mean		Std.Dev.		Min.		Max.	
	E	W	E	W	E	W	E	W	E	W
% age 0 - 16	1373	179	22.41	22.60	1.75	1.11	14.91	19.04	29.65	24.96
% age over 75	1373	179	3.21	8.47	0.65	1.18	1.50	6.50	5.39	11.92
% religious	1373	179	77.70	73.82	4.50	4.17	64.10	64.88	87.58	79.98
% white	1373	179	89.12	98.34	12.80	1.75	39.41	91.57	99.27	99.28
% tenure (house ownership)	1373	179	66.84	70.98	11.29	3.82	28.96	62.6	83.79	77.80
Population density	1373	179	24.38	4.20	26.84	4.84	0.6	0.2	153.6	23.5
Council tax base (Band D equivalent dwelling per capita)	1373	179	33.85	35.39	5.23	4.30	22.55	26.31	63.73	47.38
Conservative party dummy	1373	179	0.24	0.01	0.42	0.12	0	0	1	1
Labourist party dummy	1373	179	0.38	0.41	0.48	0.49	0	0	1	1
Lib. Dem. party dummy	1373	179	0.07	0.00	0.25	0.00	0	0	1	0
No overall control	1373	179	0.31	0.56	0.46	0.49	0	0	1	1
Election by thirds	1373	179	0.37	0	0.48	0	0	0	1	0
Gross hourly pay (real £)	1373	179	12.02	10.57	2.27	0.95	8.01	8.34	24.40	12.75
% firm in the financial sector	1373	179	29.61	17.81	8.89	6.52	12.89	8.11	58.36	38.27
% firm in the social service sector	1373	179	9.38	7.32	2.85	1.48	5.31	4.92	21.42	10.97
% of unemployment-related benefit	1373	179	3.09	2.95	1.62	0.99	0.5	1.3	12.3	6.27
% Attendance allowance below age of 65	1373	179	4.74	8.25	1.95	2.54	1.29	4.11	12.26	14.08
% attendance allowance above age of 65	1373	179	14.11	19.09	3.04	3.42	6.51	11.13	2.73	28.15
% High qualified workforce	1373	179	5.12	3.51	2.32	1.18	1.96	1.37	12.16	6.70
% of self employed workforce	1373	179	7.93	7.98	2.22	3.40	3.94	3.73	13.71	16.80
2004 deprivation index (average rank)	1373	179	17496	0	5769	0	3070	0	28775	0

Note: E = England, W = Wales.

Table 7: Impact of environmental variables on DEA efficiency.

	Input approach		Output approach	
% age 0 - 16	7.070	(4.185)*	5.730	(2.973)*
% age over 75	-1.120	(1.808)	1.930	(1.350)
Population density	-9.570	(3.424)***	1.810	(2.213)
Council tax base	-8.960	(4.074)**	-0.784	(2.548)
% religious	1.820	(5.886)	2.220	(3.528)
% white	1.260	(2.324)	1.360	(1.400)
% tenure (house ownership)	3.040	(1.750)*	-2.030	(2.021)
Conservative party dummy	-0.209	(0.207)	-0.245	(0.181)
Labourist party dummy	0.182	(0.430)	-0.326	(0.318)
Lib. Dem. party dummy	0.222	(0.211)	-0.035	(0.173)
Election by thirds	0.601	(0.489)	-0.101	(0.304)
Gross hourly pay (real £)	-1.480	(1.647)	-1.380	(1.320)
% firm in the financial sector	-3.040	(2.374)	0.581	(1.928)
% firm in the social service sector	-0.021	(1.464)	-0.615	(1.198)
% of unemployment-related benefit	-0.502	(0.599)	0.150	(0.468)
% Attendance allowance below age of 65	0.278	(1.690)	-1.960	(1.434)
% attendance allowance above age of 65	-0.279	(1.076)	-1.700	(0.891)*
% High qualified workforce	1.520	(1.489)	0.916	(0.911)
% of self employed work force	1.260	(1.446)	1.280	(0.858)
2004 deprivation index	-1.050	(1.110)	-0.189	(0.712)
Counties	2.790	(1.229)**	1.860	(0.763)**
Metropolitan Districts	1.990	(1.195)*	1.490	(0.737)**
Unitary Authorities	2.500	(1.104)**	1.570	(0.681)**
Observations	827		781	
Year dummies	Yes		Yes	
Qadrature Points	24		24	

Standard errors in brackets; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Model = Random Ordered Probit (Mundlak [1978] approach); Estimator = Maximum Likelihood