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Does Mixed Reimbursement Schemes Affect Hospital Activity and Productivity?

An Analysis of the Case of Denmark

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Does Mixed Reimbursement Schemes Affect Hospital Activity and Productivity?

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Abstract

The majority of public hospitals in Scandinavia are reimbursed through a mixture of two prospective reimbursement schemes, block grants (a fixed amount independent of the number of patients treated) and activity-based financing (ABF). This article contributes theoretically to the existing literature with a deeper understanding of such mixed reimbursement systems as well as empirically by identifying key design factors that determines the incentives embedded in such a mixed model. Furthermore, we describe how incentives vary in different designs of the mixed reimbursement scheme and assess whether different incentives affects the performance of hospitals regarding activity and productivity differently.

Information on Danish reimbursement schemes has been collected from documents provided by the regional governments and through interviews with regional administrations. The data cover the period from 2007-2010.

A theoretical framework identified the key factors in an ABF/block grant model to be the proportion of the national Diagnosis-Related Group (DRG) tariff above and below a predefined production target (i.e. the baseline); baseline calculations; the presence of kinks/ceilings; and productivity requirements. A comparative case study across the five regions in Denmark demonstrated presence of inter-regional variation in the design of reimbursement schemes. This variation creates different incentives regarding activity and productivity. Using gender-age standardized rates across year and region we show that there have not been any significant changes in the number of hospital discharges for any of the regions from 2007 to 2010 within any of the treatment groups.

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JEL classifications: H; H1; H51; H72; I18

1. Introduction

In the 1980s, activity-based financing (ABF) using Diagnosis-Related Groups (DRGs) as basis for hospital reimbursement was introduced in US Medicare. During the 1990s, ABF and DRGs found their way into the Scandinavian hospital sector, which had previously been dominated by global budgets. By now several OECD countries has adopted the DRG-based hospital payment system, e.g. Australia, Italy and Portugal (Busse et al., 2011).

Several papers have discussed the underlying incentives of different types of reimbursement systems (Aas, 1995; Jegers et al., 2002; Kutzin, 2001). Frequently, theoretical models were used to analyze a composition of a linear cost-sharing scheme with prospective ABF and retrospective cost reimbursement (Chalkley and Malcomson, 1996; 2000; Ellis and McGuire, 1986; 1990). The cost reimbursement scheme creates strong incentives to increase the number of cases treated and the number of services provided, while the global budget neither incentivized increased activity nor the number of services provided. However, the latter system might create incentives for cost containment. The ABF system using DRGs has the theoretical advantage of increasing activity, decreasing number of services and increasing cost containment. A potential disadvantage is the risks of patient selection and unwarranted increase in the number of admissions.

Today, the most common reimbursement model for public hospitals in Scandinavian countries is a combination of ABF using DRG tariffs and block grants (Ankjær-Jensen, 2006; Bilde, 2010; Bjørn et al., 2003; Jakobsen, 2009; Kastberg and Siverbo, 2007; Kjerstad, 2003; Mikkola, 2002; Pedersen, 2006; Street et al., 2007). Other countries like Australia, Portugal and Italy also use the mix of ABF and a block grant. The rationale behind combining different schemes is that compensation for potential weaknesses of each single payment scheme is facilitated. However, even though the implementation of mixed schemes is widespread, there is still a need to supplement the existing theoretical analyses and literature on these models (Bech, 2004; Busse, 2006; Kjerstad, 2003). Specifically, policy makers need to be aware of the incentives embedded in different designs of hospital reimbursement schemes combining ABF and block grants in order to understand hospital behaviour and performance. Thus, the present study contributes to existing literature by 1) identifying key design factors that determine the incentives

of the mixed reimbursement schemes; 2) describing how these factors are at play and can vary in different designs of the ABF/block grant model and 3) assess whether these different models have influenced the hospital performance with respect to activity and productivity. The composition and the level of activity will be analyzed to examine whether hospitals behave according to the incentives embedded in the implemented schemes. The variation in design and implementation of the ABF/block grant model in the five Danish regions provides an excellent case for analyzing the variations and incentives embedded in different designs of reimbursement schemes and may well generalize to other countries where ABF/block grant models are implemented.

The main findings of the present study are the identification of key elements of the ABF/block grant model together with evidence demonstrating that inter-regional variation does exist in the way that Danish regions have designed their reimbursement schemes. The discussion of the importance of the productivity requirements and the methods for determining target activity for the block grant (denoted the baseline) are especially important contributions to the literature. These are specific design factors that are often neglected or not explicitly discussed in the general discussion about the degree of block grants versus activity based financing. Finally, the study provides a quantitative analysis of activity variation across years and regions. To facilitate comparability of activity rates, gender-age stratified population data was utilized to standardize these. Specifically, this analysis shows that there has not been a significant change in the number of hospital discharges within the four treatment groups for any of the regions from 2007 to 2010.

The remaining part of the paper is organized as follows: Section 2 frames the theoretical mixed reimbursement scheme employed in Denmark and section 3 describes the data and method used. Next, Section 4 focuses on the inter-regional variations among the mixed reimbursement schemes while Section 5 presents an analysis of activity and productivity and the incentives for these aspects embedded in the different models. Finally, Sections 6 and 7 end up the paper with discussion and conclusion.

2. Mixed Reimbursement Schemes

Politicians and hospital managers generally agree that the most important objective of a hospital reimbursement scheme is to provide the activity that will meet the demand for treatment. For politicians, the second most important objective is budget safety, followed by increased quality. On the other hand, hospital management gives priority to quality followed by budget safety

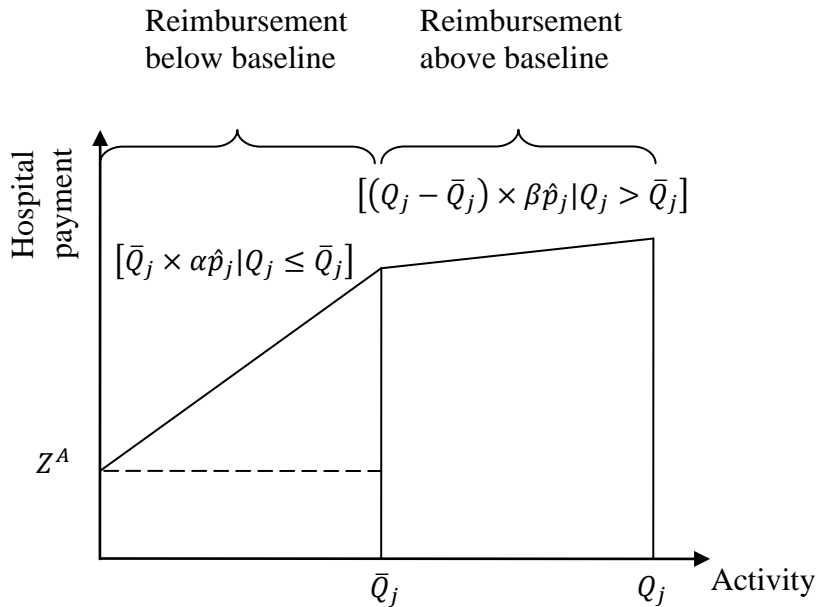
(Bech, 2003). The hospital payment scheme is one way of aligning these incentives of hospital managers with the objectives of the regional politicians.

The composition of hospital payment can be written as follows

$$\text{Hospital payment} = \begin{cases} Z^A + \bar{Q}_j \times \alpha \hat{p}_j, & Q_j \leq \bar{Q}_j \\ Z^A + \bar{Q}_j \times \alpha \hat{p}_j + (Q_j - \bar{Q}_j) \times \beta \hat{p}_j, & Q_j > \bar{Q}_j \end{cases} \quad (1)$$

where Z^A is the block grant, $[Q_j \times \alpha \hat{p}_j | Q_j \leq \bar{Q}_j]$ denotes the payment for the amount of activity delivered (Q_j) which is below the baseline \bar{Q}_j , and $[(Q_j - \bar{Q}_j) \times \beta \hat{p}_j | Q_j > \bar{Q}_j]$ the payment for the amount of activity which is above baseline. Furthermore, the term \bar{Q}_j denotes baseline activity for the activity j , \hat{p}_j the national DRG tariff, and α the proportion of this tariff which is below baseline for the activity in question. Finally, β is the proportion of the national DRG tariff which is above the baseline. Figure 1 illustrates the hospital payment under a mixed reimbursement system combining ABF and block grant as described above.

Figure 1: Hospital payment under a mixed reimbursement system



The combination of block grants and ABF requires that policy makers decide about two key elements: 1) the proportion of the national DRG tariff that the hospital receives as reimbursement for different levels and types of activities and 2) the target levels of activities for baseline and eventually further kinks with changes in β .

2.1 *The rate and structure of reimbursement*

The proportion of the DRG tariff, α and β in Figure 1, determines the incentive of the hospital to sustain and increase activity. Ceiling or kinks with lower β reduce the incentives to increase activity beyond a certain activity level (Street et al., 2007). A larger β gives stronger incentives for the hospitals to increase activity while lowering the region's expenditure control.

Not reimbursing above baseline ($\beta = 0\%$) is equivalent to having a ceiling in the model at the level of the baseline. Introducing such a ceiling incurs a risk of limiting activity increase, whereby waiting lists may increase so that hospitals are forced to send patients to hospitals in other regions or to private hospitals.

2.2 *Baseline calculation*

In the mixed model, a target level of activity (the baseline \bar{Q}_j in Figure 1) should be defined for each hospital. The existing literature should be enriched with knowledge about this key element, as it is important for understanding the incentive effects of combined ABF/block grant models. In its simplest version, the baseline is calculated on the basis of either the previous year's activity or the previous year's baseline, to which a productivity increase requirement of at least 2% is added as requested by the Danish state regulations. Alternatively, the baseline can be based on negotiations (e.g., adding planned permanent expansions as a result of reorganisations or subtracting activity produced as a result of extraordinary initiatives). Furthermore, activity that is not expected to be relevant in the following year's production can be subtracted from the calculation of the baseline and from the hospital's budget.

The way the level of production from the previous year is included in the baseline of the subsequent year can be expected to affect productivity. If the baseline activity is based on the previous year's activity level, then there is an automatic productivity requirement if the activity above the previous year's baseline has been reimbursed below 100% of the national DRG tariff. Baseline activity is increased to previous year's activity level and the following year's budget will increase with previous year's reimbursement rate above baseline (most often at a rate below 100% of the DRG tariff). The previous year's extra production is thus expected to be provided again for the same rate of reimbursement as the previous year.

Hospitals are subjected to a minimum of 2% productivity requirement which involves that hospitals baseline increase with 2% annually. If the baseline is not reached, the tariff for activity below baseline will be deducted from the hospital's revenue.

Depending on the severity of the budget constraint exercised by the regions, surpluses and deficits may be carried forward to the following year's budget (Kornai, 1986; 2003). A 'soft' budget constraint limits the incentive to increase productivity and contain costs, as hospitals might work under the philosophy that "*it is better to ask for forgiveness...*" and potentially create a vicious cycle of deficits. Even if the hospitals try to minimize deficits, subjected to a 'hard' budget constraint, it will not be tolerated to be carried forward to next year's budget. Hence, the hospitals have little incentive to minimise costs. The more the hospitals are spared from the consequences of their deficits, the softer the budget constraint.

3. Data and Method

A comparative qualitative case study across the five regions of Denmark provided data about differences in hospital reimbursement schemes and information about the objectives of the regions in the period 2007 to 2010. Information was provided by the regional governments through a variety of documents and through semi-structured interviews with the Directors of Health and the Directors of Finance and Planning in the regions. A total of 13 individuals participated in the interviews. Furthermore, similar semi-structured interviews were used to interview 9 hospitals Directors of Finance across the five regions, so that essential information about the hospitals perception and use of ABF was obtained.

Quantitative activity data was extracted from the Danish database eSundhed, which contains information on the financing, reimbursement and underlying activity, based on the Danish DRG-system. Data used in the present study is somatic activity data from 2007 to 2010 in public hospitals. The number of inpatient discharges includes observations where a national DRG-tariff was observed. Observations where the region of residence of the patients was not available was excluded from the dataset. Somatic outpatient data excludes data for emergency room visits, phone consultations, MG90 groups and observations with no visits.

In order to identify the key design parameters and the incentives embedded in mixed hospital reimbursement schemes, a theoretical understanding is necessary (section 2). The knowledge gained from the theoretical section contributes to the comparative case study of the five regions, which further describes the differences and similarities characterizing the incentives across the

regions (section 4). Using gender-age adjusted data, the development in activity and productivity can be assessed to evaluate whether the different schemes do influence hospital performance (section 5). Different treatment groups are analyzed for inpatient admissions in addition to outpatient treatments. Gender-age stratified population data for each region across the years were used to standardize the rates. Admission rates were compared using Z-tests to compare the average number of admissions between two independent samples. The Capital Region of Denmark in year 2007 is used as reference group.

4. The Inter-Regional Variation in Mixed Reimbursement Schemes

The Danish health care system is decentralised politically, financially as well as operationally and provides universal access to health care. The financial budget which the regions have to finance the health care sector is negotiated annually between the association Danish Region and the government. In 2007, a structural reform replaced 14 counties with five regions which were given the primary responsibility of managing the public health care sector in each region. Each region has a council of elected representatives. This decentralisation allows local preferences to affect decision-making, as the regions are responsible not only for financing the hospitals but also for running the hospitals within a national regulatory framework. Hence, decentralisation creates opportunities for inter-regional variation in hospital reimbursement.

Hospital financing combining block grant and ABF was gradually introduced in Denmark in 2000 with a so-called 90/10 model. Specifically, 90% of a hospital's budget was provided as a block grant while 10% was based on activity, thus replacing a system that relied exclusively on block grants. In 2002, the model was adjusted to an 80/20 model, and it was extended to a 50/50 model in 2007 (Pedersen et al., 2006). National regulations established in 2007 require that at least 50% of the hospitals budget should be activity-based. The introduction of ABF to the block grants was motivated by the aim of introducing incentives for increasing hospital activity to meet patient demand, decreasing waiting lists and increasing productivity (Indenrigs- og Sundhedsministeriet, Økonomi- og Erhvervsministeriet, & Finansministeriet, 2003). At the same time, elements of the block grant have been preserved to ensure cost containment and overall budget control.

The five Danish regions are used as a case to study whether different designs of combined ABF and block grant models may create different incentives and subsequent variations in the delivered activity and productivity. The present section is devoted to a systematic overview of the official models to identify differences and similarities. The designs of reimbursement schemes

have in common that a constant and sufficient demand for health care is present (Bilde et al., 2010). From the governmental reports and interviews key design elements has been identified. These turned out to be the reimbursement rate below and above baseline; whether the models has implemented ceilings or kinks; the productivity requirement; how the baseline is calculated; and whether it is possible to forward a deficit/surplus to the following year's budget. Hence, focus will be on these parameters while comparing the schemes implemented across the five regions.

4.1 The Capital Region of Denmark

The scheme of The Capital Region of Denmark has had the intention of creating a “*relationship between the delivered activity and financing*”. The system does not differentiate between reimbursements for different types of activity or treatment groups. Below and above the baseline, activity has been reimbursed at 50% of the national DRG tariff in compliance with the minimum rate of activity-based financing set by the state government.

The model has no ceiling or kinks. However, since 2010, activity above baseline must be approved by the central administration of the region to ensure budget security.

Table 1: Characteristics of the hospital reimbursement system in The Capital Region of Denmark 2007-2010

Year	Reimbursement below baseline (% of DRG, α)	Kink/ ceiling	Reimbursement above baseline (% of DRG, β)	Productivity requirement (average)	Baseline setting	Transfer of surpluses and deficits
2007	50%	No/no	50%	2.00%	2006 activity	(No)
2008	50%	No/no	50%	2.00%	2007 activity	(No)
2009	50%	No/no	50%	2.40%	2007 activity	Yes
2010	50%	No/no	50%	3.60%	2008 activity	Yes
			0%*			

Note: * Activity above baseline requires central administrative approval.

The baseline is calculated on basis of previous year's activity level, including activity above baseline, and a productivity requirement is added. As a consequence of the strike in 2008, the 2009 baseline was calculated based on the activity level of 2007. To push through savings, a higher productivity requirement was introduced in 2009 and 2010. A higher productivity

requirement affects the baseline calculations upwards; hence, the total reimbursement of the hospitals will decrease as more activity is expected within the same budget.

The Capital Region does not permit hospitals to carry forward a deficit to the following year as the hospitals should not be given the opportunity to take up loans from the following year's budget. On the other hand, a surplus can be carried forward in selected areas. These areas include delayed projects in the operating account, which are financed through external funding and other areas that can be negotiated with the region. In 2009, these rules were changed when it came to the attention of the region that several hospitals within the region ended the year with large deficits. From the end of 2009, hospitals that could not operate within their budgets had to pay back the deficit in the following year(s).

4.2 Central Denmark Region

Central Denmark Region has changed its reimbursement system several times from 2007 to 2010. In the beginning of the period, there were a strong relationship between activity and financing.

Table 2: Characteristics of the hospital reimbursement system in Central Denmark Region 2007-2010

Year	Reimbursement below baseline (% of DRG, α)	Kink/ceiling	Reimbursement above baseline (% of DRG, β)	Productivity requirement (average)	Baseline setting	Transfer of surpluses and deficits
2007						
1 st half	55%	No/no	55%	2.00%	2006 activity	Yes
2 nd half	50%	No/yes	50% 0%*	2.50%	2006 baseline	
2008						
1 st half	50%**	-/-	50%** 0%*	2.50%	2007 baseline	Yes
2 nd half	50%	No/yes	0%	2.50%		
2009	50%	No/yes	0%	2.50%	2008 baseline	Yes
2010	50%	No/yes	0% 50%***	2.50%	2009 baseline	Yes

Note *: Elective medical activity is not reimbursed

***: The hospital reimbursement system was suspended during the strike.

***: Selected areas

In the first half of 2007, activities above baseline were reimbursed at 55% of the DRG tariff. In the second half of the year, elective medical activity above the baseline was no longer reimbursed, thus incentivizing hospitals to keep activity low in these areas.

The Central Denmark Region has designed a reimbursement scheme with a ceiling and negotiated an activity levels above baseline. If production is higher than the agreed level, the hospital is not reimbursed for the extra activity.

During the nationwide strike in the health sector in 2008, the reimbursement scheme was suspended but was re-implemented after the strike, and activity below the baseline was hereafter reimbursed at 50% of the DRG tariff. This design continued in 2009. In 2010, only activity above baseline within selected areas was reimbursed, including breast cancer screening, heart focus areas, cancer focus areas and areas where the region tried to limit patient flow out of the region.

Two different methods of calculating baseline have been used, depending on whether a ceiling has been implemented in the design or not. In the first half of 2007, when activity above baseline was reimbursed, the baseline was calculated on the basis of previous year's activity at the present year's DRG tariffs with an added productivity requirement of 2.00%. From the second half of 2007 and onward, the baseline was calculated on the basis of previous year's baseline at the present year's DRG tariffs added the productivity requirement. In 2007, the productivity requirement was 1.80% for the productive hospitals and 2.30% for the less productive hospitals. In the second half of the year, the average productivity requirement was increased to an average of 2.50% (2.30% for the productive hospitals and 2.70% for the less productive hospitals) in an attempt to create savings. The increase in productivity requirement puts a pressure on the hospitals to produce more for less.

Deficits and surpluses are fully forwarded to the following year's budget to ensure cost consciousness at the hospitals.

4.3 *The North Denmark Region*

The reimbursement scheme in The North Denmark Region is designed to *“support a general mind of incentives, where an extra effort and activity is being paid for”*.

The design implemented reimburses activity below baseline at a rate of 70% of the national DRG tariff. Above the baseline, reimbursement is differentiated among three areas: general activity (reimbursed at 20% of DRG tariff); special focus areas that are decided according to the political agenda (reimbursed at 70% of DRG tariff); and finally, areas where there are attempts to alter patient flow by bringing in patients from the rest of the Northern part of Jutland who would have received treatment at hospitals outside the region, thus ensuring that they are being treated

within North Denmark Region. The special focus areas are areas where the public hospital has the resources and competencies to compete with private hospitals and where there is a high volume. The reimbursement rate for the areas attempting to alter patient flow was 80% of the DRG tariff in 2007, 70% in 2008, 60% in 2009 and 70% in 2010. The high reimbursement rate above baseline within special focus areas creates incentives for the hospitals to increase activity within these areas.

Table 3: Characteristics of the hospital reimbursement system in The North Denmark Region from 2007-2010

Year	Reimbursement below baseline (% of DRG, α)	Kink/ceiling	Reimbursement above baseline (% of DRG, β)	Productivity requirement (average)	Baseline setting	Transfer of deficits and surpluses
2007	70%	Yes/no	20%	2.00%	2006 activity	Partly
2008	70%	Yes/no	20%	2.00%	2007 activity	Partly
2009	70%	Yes/no	20%	2.00%	2008 activity	Partly
2010	70%	Yes/no	20%	2.00%	2009 activity	Partly

Note: Selected areas have been reimbursed with between 60-80% for activity above baseline.

The baseline is calculated on the basis of previous year’s activity (not including the activity within the two special focus areas) adding a productivity requirement. The productivity requirement has been stable through the period following the state regulated requirement of a 2.00% productivity requirement.

Hospital deficits are fully carried forward, while in situations with a surplus a maximum of 1% of the hospital’s total budget can be carried forward to the following year’s budget. Forwarding a full deficit limits the incentives for increasing activity infinitely, but does create incentives for cost awareness and productivity increase.

4.4 *The Region of Southern Denmark*

The region has had a stable model throughout the period. The design includes differentiated reimbursement rates between acute, elective, inpatient, outpatient, surgical and medical treatments.

Activity below the baseline was reimbursed at 55% of the DRG tariff for all outpatient treatments and elective inpatient activity (not including medical activity) and at 14% of the DRG

tariff for all acute activity and elective medical inpatient activity in 2007 and 2008. Since 2009, acute activity and elective medical inpatient activity has been reimbursed at 0% above baseline. The level of acute activity is expected to increase 1% annually and the scheme should not incentivize increasing acute activity.

Table 4: Characteristics of the hospital reimbursement system in The Region of Southern Denmark from 2007-2010

Year	Reimbursement below baseline (% of DRG, α)	Kink/ceiling	Reimbursement above baseline (% of DRG, β)	Productivity requirement (average)	Baseline setting	Transfer of deficits and surpluses
2007	55%	No/no	55% (elective) 14% (acute)	2.83%	2006 activity	Yes
2008	55%	No/no	55% (elective) 14% (acute)	2.83%	2007 activity	Yes
2009	55%	No/no*	55% (elective) 0% (acute)	2.75%	2008 activity	Yes
2010	55%	No/no*	55% (elective) 0% (acute)	2.75%	2009 activity	Yes

Note *: A ceiling was implemented for acute and elective inpatient medical treatments.

Medical inpatient treatments are reimbursed at 0% of the DRG tariff, while outpatient treatments are reimbursed at 55%, thus creating strong incentives to redistribute patients from inpatient to outpatient care. Because some activities are reimbursed at only 14% or 0% of the DRG tariff, a higher reimbursement rate of 55% is used for other activities to ensure that at least 50% of the budget is based on activity. The Region of Southern Denmark has designed a model with no ceiling and no kink.

The baseline is based on the previous year's activity at the present year's DRG tariffs with an added productivity requirement. The region uses a different productivity requirement for each hospital, depending on the hospital's productivity in the previous year. Less productive hospitals are required to deliver a productivity increase of 4%, highly productive hospitals a 2% requirement and average hospitals a 3% requirement. Assigning a higher productivity requirement to the less productive hospitals is intended to motivate these hospitals to reach the levels of the most productive hospitals.

If budgets are not met, deficits or surpluses are fully forwarded to next year's budget, enforcing a 'hard' budget constraint. Hospitals with deficits can negotiate a multi-annual instalment agreement.

4.5 Region Zealand

The motivation behind the design of reimbursement scheme in Region Zealand is to “*support a development with focus on unit costs and productivity, and political goals of treating 95% of the residents at hospitals within the region*”.

Reimbursement below baseline has been stable with a reimbursement rate at 70% of the national DRG tariff. In 2007, activity above baseline was reimbursed at 70% of the DRG up to a primary kink and then 55% afterwards. The reason behind the high reimbursement rate was to create incentives to ensure a high activity level and, if possible, to attract patients from other regions.

Table 5: Characteristics of the hospital reimbursement system in Region Zealand from 2007-2010

Year	Reimbursement below baseline (% of DRG, α)	Kink/ceiling	Reimbursement above baseline (% of DRG, β)	Productivity requirement (average)	Baseline setting	Transfer of deficits and surpluses
2007						
1 st half	70%	Yes/no	70%			
2 nd half	70%	Yes/no	70%	2.00%	2006 baseline	Partly
			55%			
2008						
1 st half	70%	Yes/no	70%			
2 nd half	70%	Yes/no	70%	2.65%	2007 baseline	Partly
			10%			
2009						
1 st half	70%	Yes/no	70%			
2 nd half	70%	Yes/no	70%	2.65%	2008 baseline	Partly
			55%			
			10%			
2010	70%	Yes/yes	70%	3.50%	2009 baseline	Partly
			55%			
			0%			

In the second half of 2008, after the strike in the health sector, reimbursement above the primary kink was reduced to 10% of the DRG tariff to maintain the budget. In the second half of 2009, the 55% reimbursement rate was reinstated, and a 10% reimbursement level above a secondary kink was included. The implementation of the 55% reimbursement rate was influenced by the region’s objective of decreasing waiting lists within the region after the strike in 2008.

The model implemented by Region Zealand from 2007-2010 is kinked and with no ceiling until the second half of 2010, where a ceiling at the secondary kink was implemented.

Baseline calculations are based on the previous year's baseline valued by previous year's national DRG tariffs. In addition, the productivity requirement is added and corrections are made for permanent expansions, such as focus areas in surgery for obesity and back surgery.

The reduced reimbursement rate at the second kink was implemented with the purpose of expenditure control. A maximum of 1% of the hospital's total budget, either as a deficit or surplus, can be carried forward to next year's budget. Limiting the amount being forwarded provides incentives to the hospitals to increase production and balance the budget. If a deficit has been created that is larger than 1% of the total budget and there is no chance of reducing this deficit, there are no incentives to limit the deficit, as the hospitals will only have to pay back 1%.

4.6 Summary

Table 6: Comparison of relative incentives in the implemented mixed reimbursement schemes across regions in 2010

Region	Capital	Central	North	South	Zealand
<i>Key parameters</i>					
α (%)	50	50	70	55	70
β (%)	50	0	20	55 (elective)	70
	0	50 (selected areas)		0 (acute)	55
Baseline calculation	Activity 2008	Baseline 2009	Activity 2009	Activity 2009	Baseline 2009
Productivity requirement (%)	3.60	2.50	2.00	2.75	3.50
<i>Incentives</i>					
Activity increase	Weak incentive	Weak incentive	Limited incentive	Strong incentive in elective care	Limited incentive
				Decrease in acute activity.	
Productivity increase	Strongest incentive	Lowest incentive			

Section 2 framed the theoretical mixed reimbursement system combining ABF and block grant. Parameters of especially importance to the model were identified to be the rate and structure of the reimbursement rate, baseline calculations and productivity requirements. Baselines calculated from previous year's activity implies a relatively stronger incentive for activity and productivity increases than baseline calculated from previous year's baseline. A higher rate of reimbursement

further strengthens the incentive for activity and productivity increase; this is also the consequence of a higher productivity requirement in the baseline calculation.

In the present section, an assessment of the relative incentives in the different models implemented across Denmark is provided. Table 6 presents a comparison of the reimbursement schemes and incentives applied in 2010 across the five regions of Denmark.

The rate and structure of reimbursement

The Capital Region has designed a scheme that created incentives to increase activity until 2010 where an administrative approval for activity above baseline was implemented. This design has the function of implementing a ceiling at baseline level thus creating the expectation that the development in activity will slow down.

In 2010, the Central Denmark Region changed the structure of reimbursement by an implemented ceiling at baseline level by implementing reimbursement of special areas, which created incentive to increase activity within these areas.

North Denmark Region had a stable model through 2007 to 2010 thus creating an expectation of increased activity throughout the period. Only distinctive areas with high competition from private hospitals and outer region hospitals have changed the reimbursement rate of the national DRG tariff. In 2010, activity above baseline was reimbursed with 20% of the national DRG tariff.

The Region of Southern Denmark designed a model that differentiated between treatment groups. Elective and acute activity is reimbursed at different rates, 55% and 14% respectively. From 2009, acute activity has no longer been reimbursed based on activity; hence a decrease in acute activity must be expected from 2008 to 2009 and 2009 to 2010, and redistribution from acute to elective activity can be expected. Thus, when a decrease in acute activity is expected an increase in elective activity is expected.

Region Zealand is the only region who has implemented several kinks in their model. At first glance the model has a high reimbursement rate. However, through the interviews it was revealed that due to the method of baseline calculations the actual activity level of the hospitals are far above baseline. Hence the reimbursement of extra activity is low, thus limiting the incentives to increase activity further.

Baseline calculations and productivity requirement

As mentioned before the hospitals should be subjected to a productivity requirement of at least 2% according to Danish state regulations. The five regions all fulfill this requirement.

Baseline calculations in The Capital Region were in 2010 based on the activity level of 2008 adding a productivity requirement of 3.6%. The high productivity requirement can counterbalance the incentive of limiting activity increase by the implemented ceiling.

Central Denmark Region calculated the baseline for 2010 based on the baseline from 2009 with the addition of a productivity requirement of 2.50%.

North Region Denmark calculated the baseline based on previous year's activity while adding a productivity requirement of 2.00% which is the lowest productivity requirement implemented across the five Danish regions in 2010.

Region of Southern Denmark also calculated the baseline for 2010 based on the delivered activity level in 2009 while adding an average productivity requirement of 2.75%. The region implemented differentiated productivity requirements across hospitals.

Danish hospitals are assumed to be subjected to a 'hard' budget constraint as there are consequences if they do not keep within the budget for global expenses or if baseline is not met (Bilde et al., 2010). Hence, it becomes a fine balance to produce as close as possible to baseline in order to avoid punishment in the following year either by a decreased budget or increased activity and productivity pressure.

Incentives

Studying the key parameters jointly, it is seen that Region of Southern Denmark has the relatively strongest incentive to increase activity within elective activity while at the same time having the weakest incentive to increase acute care. The reason is found in the high rate of reimbursement, baseline calculation based on previous year's activity and a relatively high productivity requirement.

The Capital Region and Central Denmark Region have the relatively weakest incentives to increase activity, as they have implemented models with ceilings at baseline level. Furthermore, having baseline calculations based on the activity level in a year with a national health care strike

(in 2008) or on previous year's baseline limited the incentive for increased activity. The strong productivity requirement in The Capital Region creates the strongest incentive to increase productivity. Central Denmark Region has the weakest incentive for productivity increase as they have a relative low productivity requirement combined with baseline calculations based on previous year's baseline.

5. Analysis of activity and productivity

Each of the five Danish regions has designed a model that creates different incentives to the hospitals regarding their delivered activity and productivity level. To provide a quantitative examination, activity data has been drawn from the database eSundhed aiming at illustrating whether there has been a trend in the data in support of the argument that the hospitals behave according to the incentives outlined. The theoretical framework in section 2 provides support to the expected development and incentives regarding the development in activity and productivity level. As discussed in details, different elements of the reimbursement system incentivize differently. E.g. high rate of reimbursement creates incentives to increase activity while ceilings and kinks limit these incentives. Baselines calculated from previous year's activity level rather than previous year's baselines create an implicit productivity pressure. The budget constraint also affects the incentives. Thus, a 'hard' budget constraint creates incentives for productivity and cost awareness and limits the incentive for increased activity.

The tests to be conducted are for differences in rates of admission across regions and years. To ensure comparability, activity data has been gender-age standardized. The Capital Region in the year 2007 was used as reference in these tests. For details regarding computation of the standardized figures, see the Appendix.

5.1 Analysis of activity

Nationwide, the number of inpatient discharges increased by 9.7% from 2007 to 2010. Equivalently, the number of outpatient treatments increased by 10.9% nationwide from 2007 to 2010. Across regions, the percent change from 2007 to 2010 ranges from 2.7% to 24.0% for inpatient and 8.0% to 18.3% for outpatient treatments.

Table 7 presents the number of inpatient activity per 10,000 inhabitants across the five regions from 2007 to 2010. As the only region, Region Zealand had a weakly statistically significant change in the total number of inpatient admissions from 2007 to 2010 ($p < 0.10$) with an increase

of 23.98%. All of the regions in all years, except Region Zealand in 2010, had an admission rate significantly different from The Capital Region.

Table 7: Total inpatient activity per 10,000 inhabitants across region 2007 - 2010

Region	2007	2008	2009	2010	2007 – 2010 (change in %)
Capital	2,350	2,317	2,486	2,546	8.37%
Central	2,029*	1,984**	2,036**	2,107**	3.83%
North	1,898***	1,897***	1,976***	1,942***	2.35%
Southern	1,968**	1,974**	2,044***	2,051***	4.20%
Zealand	2,006**	2,013**	2,257*	2,486	23.98%*

Note: Inpatient observations only include observations with a DRG tariff larger than zero.

Change in gender-age adjusted rates, * p<0.10 ** p<0.05 *** p<0.01

The number of outpatient activity per 10,000 inhabitants across region and year is shown in Table 8. North Denmark Region and Region Zealand had admission rates which were statistically significantly different from The Capital Region across all four years. In the same period, neither of the regions had statistically significant changes in the level of outpatient activity delivered from 2007 to 2010.

Table 8: Total outpatient activity per 10,000 inhabitants across region 2007 – 2010

Region	2007	2008	2009	2010	2007 – 2010 (change in %)
Capital	12,765	12,773	13,380	13,872	8.66%
Central	10,631	10,200	11,217	11,457	7.77%
North	8,381***	8,413***	9,449**	9,792**	16.84%
Southern	11,573	11,640	12,947	13,743	18.75%
Zealand	8,846**	8,696**	9,463**	9,507***	7.47%

Note: Outpatient activity does not include emergency room visits, phone consultations, MG90 groups or observations with no visit.

Change in gender-age adjusted rates, * p<0.10 ** p<0.05 *** p<0.01

Region of Southern Denmark distinguished reimbursement between acute and elective treatments of inpatient activity. Hence, their model created incentives to increase elective activity while limiting acute activity by implementing a higher reimbursement rate for elective and no reimbursement for acute activity.

Table 9: Elective inpatient activity per 10,000 inhabitants across region 2007 - 2010

Region	2007	2008	2009	2010	2007 – 2010 (change in %)
Capital	1,693	1,733	1,827	1,871	10.52%
Central	1,359	1,376	1,396	1,471	8.19%
North	1,289*	1,306	1,317	1,329**	3.10%
Southern	1,444***	1,472***	1,470***	1,461***	1.20%
Zealand	1,541***	1,565***	1,825***	2,069***	34.26%

Note: Change in gender-age adjusted rates, * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$

In elective inpatient admission, there has been no statistically significant change in the delivered level of activity from 2007 to 2010 across all the regions. Region of Southern Denmark and Region Zealand has delivered statistically significantly different amount of elective inpatient activity as compared to The Capital Region across all the years ($p < 0.01$), cf. Table 9. In section 4.6 it was expected that Region of Southern Denmark would have a relative stronger incentive to increase elective activity. However, it has not been possible to support this conclusion statistically. The region only had a change in number of elective admissions from 2007 to 2010 of 1.20% per 10,000 inhabitants.

Table 10 shows that the number of acute inpatient admissions per 10,000 inhabitants across regions and years only changed significantly in Region Zealand with a decrease of 10.13% ($p < 0.10$). While the model implemented in Region of Southern Denmark had strong incentives to decrease acute activity, the observed trend was an increase by 12.44% which is in contrast to the expectations given the implemented model. However, the increase is not statistically significant. Comparing the individual regions with The Capital Region, the North Denmark Region turned out to be statistically significantly different from on the average number of acute admissions per inhabitant across all years ($p < 0.01$), while Region Zealand was not found to be statistically significantly different.

Table 10: Acute inpatient activity per 10,000 inhabitants across region 2007 – 2010

Region	2007	2008	2009	2010	2007 – 2010 (change in %)
Capital	656	585	659	675	2.94%
Central	670*	608*	640*	636*	-5.02%
North	608**	592**	660***	613***	0.76%
Southern	525	502	574*	590**	12.44%
Zealand	464	447	431	417	-10.13%*

Note: Change in gender-age adjusted rates, * p<0.10 ** p<0.05 *** p<0.01

5.2 Analysis of productivity

Historically, there has been strong variation in the productivity levels across the regions. From 2007 to 2008, Table 11 shows that all of the regions had a negative development in productivity. A major reason may be the strike in the health sector in 2008 which resulted in available capacity not being utilized as non-acute treatments were canceled.

Table 11: Productivity level across regions 2007 - 2010

Region	2007	2008	2009	2010
Capital	96	96	97	100
Central	106	103	102	100
North	97	97	97	93
South	104	105	105	104
Zealand	98	98	98	100
Nationwide	100	100	100	100

Source: Danske Regioner et al. (2010a), Danske Regioner et al. (2010b), Danske Regioner et al. (2011)

The level of reimbursement below baseline was relatively high and similar across regions, creating the same conditions for yardstick competition and thus the same incentives for productivity. Furthermore, based on the formal models of reimbursement, surpluses and deficits must be carried forward between budget years in all regions (although with some restrictions in Zealand), indicating ‘hard’ budget constraints in all regions. A ‘hard’ budget constraint is

important if the incentives for increased productivity in the ABF/block grant model are to materialise.

Focusing instead on productivity requirements and baseline setting, the region with the strongest incentives for high productivity in 2010 is The Capital Region. Of course, this is a snapshot of 2010; The Capital Region did have weaker incentives in the preceding years (see Table 1). However, in 2010, The Capital Region had a high productivity requirement, and its baseline was set based on the previous year's activity. The model with the lowest incentive for productivity increases is found in Central Denmark; in addition to their low productivity requirement of 2.5% from 2007 to 2010 they used the previous year's baseline to project the following year's baseline. There is no additional productivity requirement built into this model. The remaining models are either characterised by low productivity requirements (North Denmark Region and Region of Southern Denmark) or by setting the baseline relative to the previous year's baseline (Zealand). These variations in incentives to improve productivity across the five regions demonstrate the importance that should be placed on parameters like baseline setting and productivity requirements, as opposed to the more conventional parameters of reimbursement rate and kinks/ceilings, when analysing such models. Despite being a combination of two prospective payment schemes, the directed implementation of ABF/block models can still lead to different incentives for productivity.

6. Discussion

The mixed reimbursement model combining ABF and block grant is a complex entity that can be designed in many different ways. Policy-makers and researchers should not only contrast this model with other models but also analyze the variations within the overall ABF/block grant model.

Key factors that determine the incentives of the ABF/block grant model were identified to be the reimbursement rate below and above baseline; baseline calculations; kinks; ceiling; productivity requirements; and hardness of budget constraints. Schemes with a high reimbursement rate above baseline and baseline based on previous year's baseline creates stronger incentives for activity increase than models with ceilings, low reimbursement rate or baseline based on previous year's activity level. The schemes contain an implicit productivity pressure when baseline is based on previous year's activity.

The models have been quite unstable, even in regions like The Capital Region and Region of Southern Denmark, who tried to maintain a stable model over time. Thus, we expect that most of the effects of the models have been rather weak to date because there have been many changes over this timeframe that dilute the incentives of the models.

It is not straightforward to isolate the effect of the use of ABF in the Danish hospital sector, as there are ongoing structural changes in the industry. Further, the 8 week hospital strike in 2008 suspended the patient's free choice of hospital after a 30-day waiting period. In some regions the use of the ABF/block model was also suspended, making it difficult to establish the relationship. Though, there seems to be a tendency that regions with a high rate of reimbursement above baseline also have a higher annual percent change in activity. It is important to keep in mind that the rate of reimbursement is not the only factor influencing the activity. Baseline calculations, kinks, ceiling and productivity requirements are also important elements.

The theoretically based assessment of the incentives for productivity showed inter-regional variation as the regions differ in e.g. how baseline is calculated and the productivity requirement implemented. Similar to the activity, it is difficult to isolate the effect of the ABF/block grant model on productivity, and further research is needed to narrowing the gap in our understanding of mixed hospital reimbursement systems.

Important points do arise from the analysis of the incentives of the ABF/block grant model. First, the issue of why the regions have designed their models in their current form merits attention. While we cannot provide a systematic analysis of this issue in this article, some patterns are worth highlighting. The regions seem to have designed their models to reflect varying degrees of trade-offs between on one side a desire for treating the highest possible volume of patients in the region (for political as well as economic reasons), which calls for strong incentives for activity, and on the other side the need to stay within the budget of the region, which leads to low rates of reimbursement, kinks and ceilings. Because the regions have different challenges due to geography, hospital structure and traditional patterns of patient mobility, these challenges have probably also affected the model design. Thus, North Denmark Region experiences strong pressure from patients seeking treatment outside the region, and it has a model targeted towards the most mobile groups with a very high reimbursement rate that creates strong incentives for additional activity. Similarly, The Capital Region faces very low pressure from patients seeking treatment outside the region and has not streamlined their model towards the most mobile groups of patients. On the other hand, Central Denmark has a model that strongly emphasises

budget control. The current models thus seem to reflect some of the challenges that the regions have faced. This is also partly indicated by the many changes that have been made to the models in the regions with the most changing economic circumstances, e.g., Central Denmark. Whether these challenges are the primary explanation for the model's design is, however, a question for future research.

Second, there is an issue as to whether the incentives that are inherent in the models have affected the activity and productivity levels in the Danish hospital sector. This is highly important as reimbursement schemes are one of the most clear-cut steering tools used by decision-makers in hospital management. If the schemes are effective policy tools, then the regional decision-makers in Denmark would have opportunities to achieve many of their desired objectives in the hospital sector. Knowledge on the effects of ABF/block grant models could thus increase the quality of hospital management. Unfortunately, this is also very challenging to analyze empirically. The models could be designed to mitigate specific problems in the individual regions, making self-selection a methodological challenge.

The limitations of the present analysis should be emphasised. First, we have not included factors that might moderate the effect of the incentives in the overall assessment of the regional models. In particular, the question of whether hospital managers in The Capital Region face strong incentives for activity as compared to the other regions strongly depends on how the administrative approval of activity above baseline is administered. When approval is difficult to obtain, the incentives do not have as great an impact because the behaviour rewarded by the incentives is not allowed. Future research should examine the factors moderating the incentive effects of reimbursement schemes.

Likewise, the second limitation is focused on a moderating factor, i.e. the hardness of the budget constraint. In our analysis, the formal rules regarding forwarding deficits and surpluses are assumed to reflect actual behaviour. Based on the formal reimbursement schemes, we cannot determine whether these constraints actually vary in reality across the regions rather than being just formal relationships between the region and its hospitals. There are, however, studies on hospital reimbursement indicating that the formal budget rules in Scandinavia are not always upheld, and softer budget constraints than those presented in the formal models are found (Jakobsen, 2009). Although we hope to provide measures on the strictness of the budget constraints in future research, we must at the moment accept that the incentives might differ somewhat from those assessed in the current study.

Third, an observational study such as the present does not necessarily demonstrate causality. The changes may have been caused by changes in medical practices as well as the financing system.

7. Conclusion

In order to acquire a more elaborative understanding of mixed reimbursement schemes combining ABF and block grant, the contribution of the present study to existing knowledge about ABF/block grant models has been three-fold:

First, key factors that determine the incentives of the ABF/block grant model were identified as being the reimbursement rate below and above baseline; baseline calculations; kinks; ceiling; productivity requirements; and hardness of budget constraints. In particular, the elements of baseline setting and productivity requirements deserve much more attention in future research.

Second, a comparative case study of the five regions of Denmark revealed inter-regional variation in the design of such reimbursement schemes across time as well as within and between the regions. Thus, in 2010, Region of Southern Denmark created a model with a strong incentive to increase elective activity while limiting acute activity, while The Capital Region designed a model with the strongest incentive to increase productivity.

Third, studying the development in activity using gender-age adjusted data, it was found that there has not been a significant change in number of hospital discharges within total inpatient, total outpatient, elective or acute activity for any of the regions from 2007 to 2010.

Using this knowledge, future studies should include quantitative studies of how the elements of ABF/block grant models affect activity, productivity and quality of care, where the inter-regional variation can be exploited.

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9. Appendix. Test of differences in rate of admission across regions and years

In order to control for differences across regions and changes over time in the gender-age composition of the population, the number of admissions per capita in region r in year t is calculated by transferring the actual gender-age admission rates to the group of reference (The Capital Region in year 2007).

Notation:

- $k = 1, 2$ determines gender
- $a = 1, \dots, A$ is age group. Intervals of five years are used.
- $r = 1, \dots, R$ is Region, where 1 = The Capital Region
- $t = 2007, \dots, 2010$ is year
- $j = 1, \dots, J$ is index for individuals
- $i = 1, \dots, I$ is index for number of admissions per individual
- $n_{k,a,r,t}$ is number of patients across gender, age group, region and year

- $N_{k,a,r,t}$ is number of inhabitants across gender, age group, region and year
- X is number of admissions per individual per year.

If the gender-age combination were the same for all regions as it was in The Capital Region in year 2007, the number of admissions in region r at time t per capital can be calculated as

$$X_{r,t}^0 = \left(\frac{1}{\sum_{k,a} N_{k,a,Capital,2007}} \right) \sum_{k,a} \frac{N_{k,a,Capital,2007}}{N_{k,a,r,t}} X_{k,a,r,t} \quad (1)$$

where $X_{k,a,r,t} = \sum_j X_{k,a,r,t,j}$ and $X_{k,a,r,t,j} = \sum_i X_{k,a,r,t,j,i}$.

The variance for the number of admission per patient is calculated as

$$\text{var}(X_{k,a,r,t,j}) = \frac{\sum_j (X_{k,a,r,t,j} - \bar{X}_{k,a,r,t})^2}{N_{k,a,r,t} - 1} = \frac{X_{k,a,r,t}^2 + (X_{k,a,r,t})^2}{N_{k,a,r,t} - 1} \quad (2)$$

so that

$$\text{var}(X_{k,a,r,t}) = n_{k,a,r,t} \text{var}(X_{k,a,r,t,j}) = \frac{n_{k,a,r,t}}{N_{k,a,r,t} - 1} \left(X_{k,a,r,t}^2 + (x_{k,a,r,t})^2 \right) \quad (3)$$

and

$$\begin{aligned} \text{var}(X_{r,t}^0) &= \text{var} \left[\left(\frac{1}{\sum_{k,a} N_{k,a,Capital,2007}} \right) \sum_{k,a} \frac{N_{k,a,Capital,2007}}{N_{k,a,r,t}} X_{k,a,r,t} \right] = \\ &= \left(\frac{1}{\sum_{k,a} N_{k,a,Capital,2007}} \right)^2 \left\{ \sum_{k,a} \left(\frac{N_{k,a,Capital,2007}}{N_{k,a,r,t}} \right)^2 \text{var}(X_{k,a,r,t}) \right\}. \end{aligned} \quad (4)$$

To compare region r at time t with region s at time u , the standard normal test

$$Z = \frac{X_{r,t}^0 - X_{s,u}^0}{\sqrt{\text{var}(X_{r,t}^0) + \text{var}(X_{s,u}^0)}} \quad (5)$$

is used as a test of independent means.