Charles University in Prague

Faculty of Social Sciences
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MASTER THESIS

Changes in Hospital Financial Performance after Legal Form Conversion

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Declaration of Authorship

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Prague, 23rd July 2013

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Signature

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Abstract

This thesis examines the effect of corporatization, i.e. pure legal form conversion of contributory organizations into joint-stock companies, on financial performance of 77 Czech non-privatized general hospitals during 2001-2011. Using differences-in-differences estimation the effect on overall financial performance was not confirmed. Regarding individual performance components different changes in revenues and costs per inpatient day (relative to non-corporatized hospitals) were recognized after different corporatizations periods. Both revenues and costs measures either increased or decreased after 2003 & 2004 and 2005 corporatization respectively; and were maintained after 2006 & 2007 period. Ambiguous effect of corporatization on financial performance is consistent with the principal-agent theory developed in this thesis.

Abstrakt

Diplomová práca skúma vplyv korporatizácie, tj. zmeny právnej formy nemocníc príspevkových organizácií na akciové spoločnosti, na finančnú výkonnosť 77 českých verejných nemocníc v období 2001-2011. Aplikovaním ekonometrickej metódy differences-in-differences sa vplyv na celkovú finančnú výkonnosť nemocníc nepotvrdil. Práca však odhalila výrazné rozdiely v zmene výkonnosti na strane príjmov a nákladov v závislosti na perióde, kedy bola nemocnica korporatizovaná. Rôzne zmeny v príjmoch a nákladoch na lôžkodeň (po korporatizácii) boli rozpoznané v obdobiach 2003 & 2004, 2005, 2006 & 2007. Neistý vplyv korporatizácie na finančnú výkonnosť je konzistentný s teóriou principála a agenta rozvinutou v tejto práci.

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Acronyms

CO   Contributory Organization

EU   European Union

JSC   Joint-Stock Company

PCA   Principal Component Analysis

VIF   Variance Inflation Factor

a.s.   Akciová Společnost

p.o.   Příspěvková Organizace

s.r.o. Společnost s Ručením Omezeným

Master Thesis Proposal

Author	Bc. Adam Jankura
Supervisor	PhDr. Jana Votápková
Proposed topic	Changes in Hospital Financial Performance after Legal Form Conversion

Topic characteristics   There is an ongoing debate about unsustainable health expenditures, for which hospitals are substantially accountable for. Governments have thus been reassessing their role in the sector and trying to address poor performance of public hospitals: either by ownership or by purely legal form conversion, where public hospitals were privatized but with majority of shares staying in the hands of regions, districts, municipalities or the state. The latter approach has been employed by policymakers in order to apply private sector incentives structures to state owned organizations. This question has not been of much interest neither in domestic nor in foreign literature, which has been exclusively dealing with hospital performance after ownership conversion into private hands (i.e. privatization) since the conversion of legal form (i.e. corporatization) with newly created joint-stock companies in state hands represent rather rare market arrangements. The lack of research in this field gives a powerful impetus for my master thesis, in which I would like to analyze changes in financial performance of those Czech hospitals which formally became private corporations but with majority of shares of which, in fact, remained in public hands, i.e. I will assess the effect of corporatization employing appropriate statistical and econometric methods.

Hypotheses   Firstly, this thesis will test the hypothesis that hospital financial performance improves after corporatization. Secondly, the permanency of the corporatization effect in subsequent periods will be examined. Finally, I would like to detect whether there are differences in conversion periods, specifically whether the period when the hospital was transformed does matter as

far as financial performance is concerned, keeping in mind the fact that major conversion waves took place in 2006 and 2008.

Methodology When assessing the changes resulting from corporatization, profit margin, defined as total revenues minus total costs divided by total revenues, will be used as our main measure of financial performance. The population of interest will be composed of general acute care hospitals observed in the period between 2003 and 2010. Only corporatized and noncorporatized hospitals will be taken into account. Privatized entities are thus left aside, since besides pure legal form they went through ownership conversion too, and thereby altered their objective function and consequently they are no more comparable with state owned hospitals in terms of financial performance measures. Most of the corporatized hospitals from the sample were converted in 2006, therefore at least two years prior to the conversion and two years after it will be available for majority of hospitals.

First of all, our sample adjusted for noncorporatized entities enables us to test whether performance changes after corporatization. Hence I will apply Wilcoxon rank sum test and subsequently also a proportion test, following Megginson et al. (1994). The former one is a nonparametric test comparing changes in financial performance before and after corporatization. Firstly, we will compute profit margin for each corporatized hospital and for each year of observation, with at least two years for both pre- and post-corporatization period necessary for each entity, excluding the conversion year. Then we will calculate means of profit margin for each hospital for the period prior to and after the conversion year. The null hypotheses that the median difference in pre- and post-conversion samples is zero could be then verified. Standardized Z test statistic following standard normal distribution for samples of at least ten observations will be used. The latter test determines whether the proportion π of hospitals undergoing performance changes in a given direction is greater than it would be expected, i.e. testing whether $\pi = 50\%$ in our case.

Further, according to Tiemann and Schreyogg (2011), difference-in-difference methodology will be applied to the entire population – treatment group of converted and control group of non-converted hospitals. All non-converted hospitals are budgetary organizations and take up approximately half of the entire hospital market in the Czech Republic. On the other hand, the number of converted hospitals is not significantly lower, because only about 5 percent of hospitals were privatized, i.e. changed their ownership besides the legal form. Therefore,

treatment and control group will be of comparable size. The model works as follows:

$$PM_{it} = \alpha + \beta CONV_i + \gamma POST_{it} + \delta CONV_i POST_{it} + \theta X_{it} + \varepsilon_{it}$$

where PM_{it} is the profit margin of hospital i at year t ; $CONV_i$ is an indicator variable taking a value of 1 if the hospital was corporatized in the given period and a value of zero otherwise; $POST_{it}$ is assigned a value of 1 in the years after corporatization and a value of zero otherwise; X_{it} controls for other external and internal hospital characteristics, including a variable accounting for the effect of the business cycle. The effect we are particularly interested in will be observed from the coefficient of the interaction term $CONV_i POST_{it}$, which indicates how financial performance of hospitals in the treatment group changed after corporatization relative to hospitals in the control group.

To verify our next hypothesis of permanency of the effect of conversion of legal form, following Shen (2003), the estimation of the previous model will be repeated, including a new dummy variable representing the difference between the changes in the first two years and the next years, in other words whether the changes in performance are of temporary or permanent nature. This variable will get a value of 1 if the year will coincide with the first two years after conversion and zero otherwise. When testing this hypothesis, only the hospitals being converted in the same year (specifically 2006) will be involved.

Lastly, according to Shen (2003), the prediction of the dependency of performance changes on conversion period in question will be explored, namely by adapting the previous model by incorporating other period binary variable for hospitals that changed their legal form in period 2008-2010, i.e. this variable will take on a value of 1 if the hospital was converted in 2008-2010 period or zero otherwise. This indicator will cover the differences in financial performance between hospitals that underwent conversion in that period and hospitals that converted their legal form earlier.

Outline

1. Introduction
2. Theoretical Background
3. Methodology and Data
4. The Model

5. Empirical Verification

6. Conclusion

Core bibliography

ELDENBURG, L.G., B.E. HERMALIN, M.S. WEISBACH & M. WOSIN-SKA (2001): "Hospital Governance, Performance Objectives, and Organizational Form." NBER Working Paper 8201.

HILL, R.C., GRIFFITHS, W.E., LIM, G.C. (2011). Principles of Econometrics. John Wiley and Sons, Inc., 4th edition.

JAKAB, M., A.S. PREKER, A. HARDING & L. HAWKINS (2002): "The Introduction of Market Forces in the Public Hospital Sector: From New Public Sector Management to Organizational Reform." Health, nutrition and Population (HNP) Discussion Paper. Washington, D.C., World Bank.

MEGGINSON, W., R. NASH & M. RANDENBORGH (1994): "The financial and operating performance of newly privatized firms." Journal of Finance 49, pp. 403-452.

PREKER, A.S. & HARDING, A.L., edit. (2003): "Innovations in Health Service Delivery: The Corporatization of Public Hospitals." Washington, DC: World Bank Publications. 640 p. ISBN 978-0-8213-4494-1.

SHEN, Y., K. EGGLESTON, J. LAU & C. SCHMID (2005): "Hospital Ownership and Financial Performance: A Quantitative Research Review." NBER Working Paper 11662.

SHEN, Y. (2003): "Changes in Hospital Performance After Ownership Conversions." Inquiry, 40(3), pp. 217-234.

TIEMANN, O. & T. SCHREYÖGG (2011): "Changes in Hospital Efficiency after Privatization". Hamburg Center for Health Economics.

VILLALONGA, B. (2000): "Privatization and efficiency: differentiating ownership effects from political, organizational, and dynamic effects." Journal of Economic Behavior & Organization 42, pp. 43-74.

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        Author   Supervisor

Chapter 1
Introduction

Hospitals constitute a crucial part of the health care system. Besides the significant impact on the overall health of the population, they receive a vast majority of funds going to health care (Hava and Hanusova, 2007). The indispensable role of hospitals is well recognized and thus they have been target of many reforms aimed at efficiency and quality improvements.

Over the last two decades, the organizational and legal position of hospitals in the Czech Republic has been changing as a result of the overall health sector reform. Policymakers have been mainly trying to address the problems of publicly run hospitals which are primarily grounded in the rigidity of hierarchical bureaucracies, managers lacking control over day-to-day operations and there is also an absence of performance based objectives (Preker and Harding, 2000). The principle of decentralization has become the main driving force of reforms after 1989. In 1993, hospitals became independent legal entities in contractual relationships with health insurance funds. A quarter of hospitals were privatized between the years 1992 and 1995 into limited liability companies (s.r.o. in the Czech terminology). Further changes in the organization of hospital market were introduced within the territorial reform of public administration in 2000-2003. Community-level state hospitals became accountable to the newly established self-governing regions and were set up as organizations receiving contributions from their budgets (p.o.). Due to tax regulation putting contributory organizations of regions into disadvantage, almost half of the hospitals were corporatized into joint-stock companies (a.s.) in the period of 2003 to 2007. However, they all remained fully owned by the regional self-governing authorities.

Besides the specifics of the ambiguous Czech legal framework, the reasons for such a legal form conversion relate to enhancing the autonomy of health care facilities by transforming the hierarchical bureaucracy into parastatal corpora-

tions exposed to market-like pressures (Hava and Hanusova, 2007, Preker and Harding, 2000).

Hospital corporatization is an institutional design transformation of public hospitals which seeks to mimic the structure and efficiency of private enterprises, while ensuring that social objectives are still emphasized through public owner. In other words, both the strategic direction and everyday decisions of a corporatized entity are assigned to managers rather than civil servants, while politician still retain ultimate hierarchical control. They are able to intervene by providing broad direction in key performance targets and community service obligations. Undergoing this change, public hospitals become subject to regulations applicable to private sector companies which contains more independence and less financial assistance from state, with the hard budget constraint or financial "bottom-line" which makes the corporation fully accountable for its financial performance formally entailing the possibility of bankruptcy (Teo, 2000; Eid, 2001; Preker and Harding, 2003; Kahancová and Szabó, 2012). Among the main steps accompanying corporatization Bilodeau et al. (2007) include narrower task domains, explicit performance measures and goals, larger focus on the responsibility of the chief executive to meet these goals, and more discretion of chief executives to manage budgets and employees.

Despite the widespread adoption of corporatization worldwide, there is a relatively narrow empirical research on the effect of corporatization on behaviour change or performance improvement (Bilodeau, 2007). Moreover, the existing theories that can be applied to corporatization are either contradictory or ambiguous with respect to performance impacts and critics often pointed to its shallow foundations. Recently, there have been calls for much larger rigor in the evaluation of public management practice in general and organizational innovation in particular (Boyne, 2003; Heinrich and Lynn, 2001). As a result corporatization and its performance effects represents an important, emerging and complex research agenda (Laurin and Vining, 2012).

Employing differences-in-differences estimation within a panel regression framework, this thesis contributes to this stream of research and formulates three central questions:

1. Does the hospital financial performance improve after corporatization?

2. Is there a permanent corporatization effect in the subsequent periods?

3. Does the period when the hospital was transformed matter as far as financial performance is concerned?

The thesis analyzes 77 hospitals in the period 2001-2011. Only general hospitals were included. Furthermore, we left privatized entities aside concentrating only on: (1) the corporatized entities which changed their legal form into joint-stock companies in the given period and (2) the non-corporatized hospitals, owned by the region, state or municipality, preserving their legal form of contributory organizations for the entire period. The majority of data on individual hospitals were collected from two main sources: annual regional publications of the Institute of Health Information and Statistics of the Czech Republic and financial statements of the Business Register of the Czech Republic. Additional information concerning hospitals´ external environment characteristics was gained from the Czech Statistical Office.

As dependent variables, four financial performance measures were employed in the analysis: average revenues per inpatient day, average revenue per inpatient, average cost per inpatient day and average cost per inpatient. Besides the variables on corporatization effect, we considered nine control variables with potential impact on financial performance: average number of doctors per bed and day, average number of nurses per bed and day, utilization of beds, size of the hospital in terms of the total number of inpatients, teaching status, unemployment rates in the municipalities with extended powers, average monthly wage of districts, number of hospitals operating in the region in a given year, and the population size. Examining three corporatization periods 2003 & 2004, 2005 and 2006 & 2007, we found no significant effect of corporatization on financial performance of hospitals. However, regarding revenues and costs per inpatient day, substantially different corporatization effects among different periods were identified. Lastly, gradual performance change in revenues and temporary change in costs per inpatient day were revealed for hospitals corporatized in 2003 & 2004.

This thesis is structured as follows. Chapter 2 describes major differences in the legal position of hospitals as contributory organizations and joint-stock companies in the Czech Republic. Chapter 3 covers theoretical underpinnings of corporatization discussed in the literature, focusing mainly on the principal-agent theory. Chapter 4 summarizes the empirical research on corporatization in various sectors including hospitals. Chapter 5 explains our methodological approach and econometric specification using differences-in-differences estimation. Chapter 6 presents the dataset and variables employed. Chapter 7 provides empirical findings about the effect of corporatization on financial performance of hospitals in the Czech Republic. Chapter 8 discusses the consistency of results with the theory. Chapter 9 shortly concludes and gives impetus for further research.

Chapter 2
Hospital Sector
in the Czech Republic

As a consequence of a territorial reform of public administration as of 2000-2003, the former community-level hospitals on community or district level were transferred into the hands of self-governing authorities of newly established regions and municipalities. However, due to existing tax law regulation, operating of such contributory organizations (p.o.) was disadvantaged to a large extent. Consequently, nearly half of the hospitals was transformed into the legal form of business companies (a.s.), while preserving their public ownership, in the period of 2003 to 2007. This development has lead to a discussion over the alternatives of organizational arrangements and questions of possible risks of different legal forms in the hospital industry. This chapter will explain the major differences in the legal position and economic consequences of two prevailing organizational forms on the Czech hospital market – contributory organizations and joint-stock companies.

Contributory Organizations versus Joint-Stock Companies

Hospitals as contributory organizations (CO) are funded by organizational units of the state (ministries) or by self-governing authorities (regions, municipalities) and operate pursuant to the Act on Budgetary Rules. The statutory body is the director appointed by the ministry, region or municipality which retains a space for interventions into the hospital operation. The liability of the director is limited. The scope of hospital´s activities is specified by the certificate of incorporation and is divided into the main (provision of health care) and complementary (economic) activities. The latter one cannot interfere with the goals

of the main activity and is monitored separately applying dual circuit accounting of costs and revenues. Financial results (profit or loss) are then computed as a sum of both activities.

Hospitals as joint-stock companies (JSC) are funded and operate according to the rules of the Commercial Code. In our case the only shareholder is the region or municipality which, unlike in case of CO, gives up a part of their managing powers allowing for company´s more independence. Management and control of the company is executed by the board of directors, which is a statutory body acting on behalf of the JSC, appointed by the Shareholders' Meeting or regional assembly itself. The performance of the management and business operations is overseen by the supervisory board. Members of the boards bear personal responsibility with unlimited liability for their actions. Besides the healthcare provision, hospitals can also engage in another line of business, which should utilizes the tangible and intangible assets of the company in an efficient way. Financial management is more transparent and financial statements are subject to audit.

Financial Management

CO operates with the funds earned through its activity and with the financial resources received from the budget of its founder, or gifts. They are not able to use resources from the EU funds. The potential profit from its economic activity can be used only in favor of its main activity, unless the founder decides otherwise.

JSC are independent legal entities not restricted in their financial management. Their are financed mainly by the resources generated by their main activity. The business company may use both internal and external sources for its financing, above all the contributed capital, profit and leasing financing. Unlike the contributory organization, it has to optimize the capital structure to avoid the threat of excessive indebtedness.

Property Management and Accounting Rules

CO manages the entrusted property of its founder, which remains in his ownership as well as the property gathered by the CO using the funds of the founder. The property handling of CO is restricted since it is dependent on the approval of its founder. On the other hand, hospital´s own property consists only of

some receivable and payables transferred to the ownership directly by law, then the property acquired from third parties as gifts, legacy and property obtained through own resources and official economic activity. However, COs founded by ministries cannot own or become owners of the property at all.

JSC manages the property it owns. The founder can transfer its tangible and intangible assets into the company by enhancing the contributed capital, or by using the sales or gift contracts. Part of the property might retain in the ownership of the the self-governing region and might be leased to the hospital.

The crucial difference between the two legal forms lies in how they depreciate property. Unlike JSC, CO uses only the book depreciation for the entrusted property, which is not tax deductible, while the tax depreciation is applied solely to the own property used for achieving taxable income. There is a clear disproportion between book and tax depreciation where the former one increases costs which burden the net income and simultaneously do not decrease the tax base from which the tax is computed. Hence, a tax discrimination of CO founded by regions and municipalities is present, whereas contributory organizations cannot depreciate for tax purposes to the same extent.

Moreover, the ambiguity of the system is reinforced by the practice of the CO to depreciate only when it ends up in the black numbers. The book depreciation of the CO is stored into the fund of reproduction of the property or the investment fund whereas lowering the contributed capital and hence creating own sources which could be spent in accordance with founder´s instructions. However, since 2004 CO has depreciated against these funds only contingent upon their financial coverage. In other words, unless the CO provides enough financial backing of the reproduction fund of the property or the investment fund in terms of net income, it decreases the funds by that difference. Thus the accounting net income may be biased by this accounting intervention, the accounting data may fail to provide true and fair view of the financial position and the comparability with the JSC is threatened.

Reward Mechanisms

The renumeration system of CO is based on the law specifying civil servants salaries which prefers formal principles of age and education rather than performance. These legal restrictions do not allow the management to employ efficient tools for creating incentive reward system along with performance dif-

ferentiation. Apart from the nominal values of salaries and bonuses, the problem predominantly lies in the low flexibility of employing such new incentives and a lack of motivation of the management.

The renumeration of JSC is less formal allowing for the use of larger scale of motivation stimulus and differentiation of management and other hospital employees. Financial motivation can be linked to performance by balancing the positive incentives by performance differentiation and proper restraints in case of adverse results. The JSC legal form also enables to enter into contracts with the members of the board of directors or equity participation. Last but not least, JSC can manage their costs more efficiently since the salaries represent a significant cost component.

Table 2.1 summarizes the main differences between contributory organizations and joint-stock companies.

Table 2.1: Contributory Organizations versus Joint-Stock Companies

Contributory Organization	vs.	Joint-Stock Company

Operates according to

- Act on Budgetary Rules   - Commercial Code

Statutory body

- director (appointed by ministry,   - board of directors (appointed by
  region or municipality)   shareholder´s meeting)

Responsibility

- limited (up to 3 monthly salaries)   - unlimited
                                                 + audit requirement

Financing through

- own activity, founder´s budget   - own activity, profit, contributed
  and gifts   capital and leasing
  (profit can be used only in favor
  of main activity)

Property management

- entrusted property vastly prevails   - own property prevails (part of
  (restricted management contingent   contributed capital or leased
  on owner´s approval)   from founder)

Property depreciation

  2 counteracting forces:

a) tax discrimination
- tax deprec. of own property only   - tax deprec. of own property
  => lower tax depreciation than JSC

b) contingent depreciation
- depreciate only if it ends up   - depreciates always
  in profit

Reward system

- formal principles (age, education),   - performance differentiation
  i.e. less performance incentives   (financial motivation)

Chapter 3
Theoretical Underpinnings
of Corporatization

An answer to the question of what difference the public sector organizational form makes requires a theory specifically considering the relative advantages and disadvantages of different organizational arrangements (Bilodeau et al., 2007).

3.1 Principal-Agent Theory

Principal-agent theory provides such an organizational theory emphasizing the need to reconcile divergent interests among individuals by means of incentives under uncertainty and informational asymmetry (Bilodeau et al., 2007). "We will say that the agency relationship arises between two parties when one, designated as agent, acts for, on behalf of, or as representative for the other, designated as the principal, in a particular domain of decisions problems" (Ross, 1973, p. 134). In our case, hierarchical principal-agent relationships between the government owner and the hospital management at a higher tier, and between the management and employees at a lower tier, are central to the organizational change being discussed. The key issue here is how asymmetric information between these hierarchical levels can be reduced (Bilodeau et al., 2007). Dixit (2002) classifies the economic relationship between the two parties into two main categories according to the nature of information flows between them. Firstly, under the moral hazard, the agent´s action has influence on principal´s payoff, nevertheless the action is not directly observable to the principal. Some outcomes are observable, but besides the action they depend on some other random variable, so the actions cannot be completely inferred from outcomes.

Secondly, in case of adverse selection, the agent has some private information willing to reveal to the principal and share the economic surplus in the relationship only when the suitable reward is offered in the contract. Of these two asymmetric information forms, moral hazard is the one most used concerning public sector incentives, but in practice both may arise simultaneously.

Principal-Agent Theory and Corporatization

There is not a straightforward explanation of whether principal-agent theory is compatible with the specifics of corporatization. According to Bilodeau et al. (2007) we should first compare it to privatization, since the principal-agent rationale has been clearly documented there. While the managers in both public and private firms are assumed to seek maximization of their own utility rather than that of organization or its owners, in private firms this divergence is reduced by competitive markets constraining agents to act opportunistically through: the market of ownership rights where the owners are able to sell if they are not satisfied with the management performance, the threat of takeover, potential bankruptcy and a presence of a competitive managerial labor market (Villalonga, 2000; Bilodeau et al., 2007). Thus the principal-agent theory provides a strong rationale for privatization to increase economic efficiency (Parker and Saal, 2003).

However, corporatization in the Czech Republic is considered to be a permanent organizational form and as in state-owned firms all mentioned correction channels are incomplete to a certain extent. Therefore neither competitive markets nor the threat of them is likely to be the impetus for behavioural change and subsequent performance improvement. Furthermore, the agency problem is fragmented into two tiers as explained earlier. As a consequence, we must adopt different channels for identifying how corporatization may effectively constrain agent´s behaviour (Bilodeau, 2007).

The principal agent-model applied to corporatization developed by Bilodeau et al. (2007) will be further discussed. The authors suggest that essential relationships and behaviours may be modified at two levels: between government owner[1] and agency managers and between the managers and agency employees.

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[1]In the Czech Republic the owner on the level of region, municipality or ministry.

Owner-Managers Tier

The change of the legal form is accompanied by other important organizational changes. For instance, narrower mandates and thus applicable explicit performance measures enable more transparent relationship. These factors are likely to reduce information asymmetry between the government owner and agency management. Consequently, there will be a higher personal responsibility of the board of directors to meet the stipulated goals. Furthermore, as a result of corporatization some degree of formal insulation from political actors concerning the budget, employees or inputs choice arise, and thus the increase of the managerial autonomy may lead to improved performance (Laurin and Vining, 2012).

Managers-Employees Tier

On the other hand, the processes of corporatization attempts to reduce the agency problem at the second level, i.e. within the organization, too. Firstly, the information asymmetry between the management and employees is decreased due to management supervising agencies with narrower task domains allowing for more feasible performance measures and targets. Secondly, managers may introduce more high-powered incentives through less restrictions in hiring, dismissing and flexibility in designing evaluation and reward mechanism. The renumeration of corporatized organization is less formal, in contrast with traditional government-owned organizations, allowing for the use of larger scale of motivation stimulus and differentiation of employees. Hence with more corporate-like organizational form, where civil servants are turned into more like private sector managers, there is more freedom to reduce the agency loss by placing more emphasis on ex post rewards rather than on ex ante controls.

In the Czech Republic, for instance, the renumeration system of contributory organizations is based on the law specifying civil servants salaries which prefers formal principles of age and education rather than performance. These legal restrictions do not allow the management to employ efficient tools for creating incentive reward system along with performance differentiation. On the other hand, the financial motivation in corporatized hospitals can be linked to performance by balancing the positive incentives by performance differentiation and proper restraints in case of adverse results.

The Net Effect on Performance

In sum, performance improvements might fundamentally flow from reduced asymmetric information, namely either from reduced moral hazard or reduced adverse selection, at both government-managers and managers-employees levels. The reasons reside with clearer incentives and targets for the manager and employees, increased transparency around managerial behaviour and stronger pressure on chief executive to deliver on results (Laurin and Vining, 2012). Bilodeau et al. (2007) conclude that corporatization comprising a portfolio of changes may represent a signal to agents at both levels, managers and employees, that essentially different behaviours and outcomes will be valued.

However, corporatization is not likely to generate as high-powered incentives as are competitive environments. As mentioned earlier, it is characterized by some degree of insulation from political interference, where manager´s autonomy is likely to increase. Especially the role of chief executive officer resembles the one from a private sector. But larger autonomy also affords managers larger freedom to focus on self-interested behaviour rather than on improving performance. The net effect of the above-mentioned potentially opposing forces on performance is then theoretically ambiguous and depends on the prevalence of one of the effects (Laurin and Vining, 2012). Figure 3.1 summarizes the principal-agent model of Bilodeau et al. (2007) applied to corporatization, and further extended by Laurin and Vinning (2012). In the case of positive net effect, the rest of the steps are expected to progress as displayed in the Figure 3.1.

Figure 3.1: Principal-Agent Model Applied to Corporatization

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                    ┌─────────────────────────┐
                    │   Change of legal status │
                    │  (+ accompanying changes)│
                    └─────────────────────────┘
                                  │
                                  ↓
                      ┌─────────────────────┐
                      │    Corporatization   │
                      └─────────────────────┘
             ↙                    │                    ↘
                                  ↓
  ┌──────────────────┐  ┌──────────────────┐  ┌──────────────────────┐
  │ Narrower mandates│  │   More autonomy  │  │High-powered incentives│
  └──────────────────┘  └──────────────────┘  └──────────────────────┘
           │                      │                       │
           ↓                      ↓                       ↓
  ┌──────────────────┐  ┌──────────────────┐  ┌──────────────────────┐
  │ Reduced adverse  │  │  Net effect (+/-)│  │ Reduced moral hazard │
  │    selection     │  │                  │  │                      │
  └──────────────────┘  └──────────────────┘  └──────────────────────┘
              ↘                   ↓                   ↙
               ┌──────────────────────────────────┐
               │ Performance measures and targets │
               │          more feasible           │
               │  CE performance more transparent │
               └──────────────────────────────────┘
                                  │
                                  ↓
                 ┌──────────────────────────────┐
                 │ Reduced information asymmetry │
                 └──────────────────────────────┘
                                  │
                                  ↓
                 ┌──────────────────────────────┐
                 │ Greater pressure on CE to     │
                 │     deliver on results        │
                 └──────────────────────────────┘
             ↙                                        ↘
  ┌──────────────────┐                      ┌──────────────────────┐
  │ Increased CE     │                      │  Greater CE ability  │
  │ incentive to     │        ⟷             │   to implement higher│
  │ monitor and      │                      │   -powered incentives│
  │ incentivize      │                      │                      │
  │ employees        │                      │                      │
  └──────────────────┘                      └──────────────────────┘
               ↘                           ↙
                 ┌──────────────────────────┐
                 │    Changed behaviour     │
                 │ (Improved performance)   │
                 └──────────────────────────┘
```

Note: Based on Bilodeau (2007) and Laurin and Vinning (2012).

3.2 Alternative Theories on Corporatization

Besides the principal-agent theory, the rest of the existing research on the performance effects of corporatization mostly builds upon two streams of thought: *public choice theory* and *property rights theory*, each of which provide different explanation for the same outcome – the performance effect of corporatization (Preker and Harding, 2003).

3.2.1 Public Choice Theory

The *public choice theory* established by Buchanan and Tullock (1962) is based on the idea that politicians and civil servants are rationale utility maximizers acting in their self-interest, rather than in the public interest (Borcherding, 1977, Mueller, 1997; Preker and Harding, 2003). It is partly consistent with the agency problem due to greater autonomy of managers and employees and hence more leeway to pursuit their self-interest. Hence this theory predicts at most only transient performance improvement or even worsening after corporatization (Laurin and Vining, 2012). The public choice school´s explanation resides with the principal (politician) rather than the agent (management), since the politicians impose such goals on state-owned firms that can gain votes but can counteract efficiency. However, the costs of monitoring the public sector behaviour by the general public are mostly prohibitive and likely offset the benefits (Villalonga, 2000). On the other hand, agents (managers) subject to high-power financial incentives in the public sector represents a certain threat, too. In the environment of multiple principals, difficulty of measuring output and the issue on intrinsic motivation of workers the theory predicts that task assignment and work organization may even sometimes be substitutes for financial incentives in promoting better performance (Burgess and Ratto, 2003).

3.2.2 Property Rights Theory

The *property rights theory* developed by Demsetz (1967) deals with the incentives embedded within the private ownership. Specifically, it is concerned with residual decision rights and allocation of residual returns. Residuals rights of control are the rights to make any decision related to an asset´s use not explicitly given by law or assigned to someone else by contract. These rights usually held by the owner may be allocated to others, particularly in large organizations.

Additionally, an owner possesses the rights to residual revenue, i.e. net income of the organization. However, there can be other residual claimants sharing the firm´s residual returns such as managers or employees when implementing policies of paying bonuses, increasing salaries or promoting workers or management into higher ranking in case of favorable performance. It is then the combination of residual control and residual claims that is the key driving force to high-powered incentive effect on performance. On the contrary, improper setting of residual control and residual returns in state-owned organizations causes serious performance problems. In such a case, the residual claimant is the public purse and the residual decision rights are held by the manager, workers and the bureaucrats in the supervisory agency, of whom none has any relevant residual stake in the value of the enterprise. And thus the corporatization may improve performance by addressing the problem of pairing of residuals rights and returns by attempting to strengthen the incentive regime of state-owned hospitals without privatizing them. Critical decision rights are shifted from the hierarchy to the hospital management, giving it virtually complete control over all inputs and issues related to the production of services, and financial and strategic management, too. This is due to of overcoming the high costs of public ownership when including public into control processes by abandoning any benefits of full ownership in favor of stricter fiduciary constraints on managers (Hansmann, 1996). And thus public purse ceases to be a sole residual claimant, being replaced by the hospital itself, which entitles it to excess revenues but also makes it responsible for losses (Preker and Harding, 2003; Milgrom and Roberts, 1992).

All in all, the existing theories on corporatization being discussed in this chapter are either conflicting or ambiguous regarding their predictions about performance impacts. Hence, the corporatization and its performance effects still present an important and complex research agenda (Laurin and Vining, 2011). Table 3.1 summarizes the anticipated effect of corporatization according to theories discussed above.

Table 3.1: Theoretical Effect of Corporatization

Corporatization brings:	*Effect on Financial Performance:*
Principal-Agent Theory	
- reduced information asymmetry:	- ambiguous
- narrower mandates (reduced adverse selection)	
- high-powered incentives (reduced moral hazard)	
- (but) more autonomy (more focus on self-interest behaviour)	
Public Choice Theory	
- greater autonomy of managers and employees, i.e. more leeway for self-interest and focus on gaining votes rather than on efficiency	- transient improvement
Property Rights Theory	
- pairing of residuals rights and returns (strengthening incentive regime)	- positive
- critical decision rights shifted from hierarchy (bureaucracy) to hospital management	
- public purse (as residual claimant) replaced by hospital itself	

Chapter 4

Previous Literature

Currently, the empirical evidence on corporatization and its effect on financial performance is quite limited as directly pointed out by Boyne (2003), Bilodeau et al. (2007) or Laurin and Vinning (2011). In the case of hospitals, the majority of studies has been primarily focusing on changes in performance after privatization and comparing financial performance of hospitals of different ownership types rather than concentrating solely on the effect of corporatization.

4.1 Empirical Evidence in the Literature

Shen et al. (2005) carried out an extensive quantitative review of empirical literature including 141 studies since 1990 comparing financial performance of US for-profit, not-for-profit and government general acute hospitals. Applying meta-analytic methods, the authors found out that the diverse results in the literature investigating the effect of ownership on hospital financial performance can be explained largely by differences in author´s theoretical frameworks, assumptions about the functional form of the dependent variables and model specifications. Braithwaite and Travaglia (2007) provided a comprehensive review of the literature on privatization and corporatization related to hospitals from the period 1950-2007. The total number of 2334 references on privatization of health care services were found. Braithwaite et al. (2011) followed up on the aforementioned systematic analysis examining the effect of privatization and corporatization on public hospitals with the aim of uncovering the key themes in the literature and considering implementation issues. The authors argue that the evidence of privatization and corporatization impacts is often weak and sometimes conflicting. Further they claim that much of the underlying argument is ideological rather

than evidence based. The impact of privatization and corporatization seems to depend more on the motivation of the evaluator rather than on the outcome of the results.

We were able to identify eleven empirical studies related exclusively to the effect of corporatization. However, when applying jointly two restrictive conditions of *i*) solely hospital corporatization and *ii*) effect on financial performance, only three studies remain (category 3). The rest of the research deals with non-performance effect of corporatization on hospitals (category 1) and performance of non-hospitals after corporatization (category 2). Table B.1 summarizes the literature according to the two criteria defined.

4.1.1 Non-Performance Effect of Corporatization on Hospitals

Concerning the category of works on non-performance effect of corporatization on hospitals (category 1), Kahancova and Szabo (2012) explored the effect of hospital corporatization on employment relations in Hungary and Slovakia. The case study used coordinated qualitative comparative research methods aimed at hospital sector and hospital personnel covering the period of 2001 to 2011. The authors concluded that despite market-oriented reform of the institutional environment of the public sector, actors in the hospital sector did not immediately begin behaving in line with private sector rules. Eid (2001) studied the design of public hospitals´ corporate boards in Lebanon in order to better understand the role of governance and incentives in corporatized hospitals. The proposed common agency multitasking approach confirmed the problem of principal coordination in hospital boards.

4.1.2 Performance of Non-Hospitals after Corporatization

When taking the category of studies considering the performance of non-hospitals after corporatization into account (category 2), there is rather a high degree of consistency in the literature. Bradbury (1999) provided evidence of improved financial performance, supporting the view that managerial accountability is more important than the form of ownership according to the short-term evidence presented. Aivazian et al. (2005) and Queneville et al. (2008) found out that corporatization has had a positive impact on performance, too. Bilodeau et al. (2007) and Laurin and Vinning (2012) showed a significant performance

improvement including output and revenues increase, the narrowed revenues-to-expenditures coverage gap and improved cost-efficiency and employee productivity after corporatization. The results of Cambini et al. (2011) demonstrated that corporatization had a reducing effect on production costs.

4.1.3 Hospital Financial Performance after Corporatization

Three studies attracted our attention with regard to our research on hospital financial performance after corporatization (category 3). Fidler et al. (2007) provided an analysis of hospital corporatization and six performance indicators of overcapacity by contrasting the experience of Austria and Estonia over a decade. While the results are based on two case studies and not strictly on empirical methods, the paper suggested that hospital corporatization and market incentives combined with public ownership have the potential to introduce more cost-efficiency and flexibility into hospital management behaviour while offering simultaneously a politically acceptable solution to stakeholders. Namely, excess bed capacity was reduced, average length of stay was decreased and also financial sustainability was improved. Rego et al. (2010) carried out a research analyzing to what extent the adoption of business management models by hospitals can improve their performance. They employed a dataset of 59 Portuguese public hospitals observed in 2002-2004, of which 21 were state owned public enterprises, i.e. corporatized hospitals, and 38 traditional public administration sector hospitals. Data envelopment analysis was used. The first measure of efficiency used the costs associated with hospital production and the number of beds as inputs, while as the second measure the variables such as number of impatient days were considered, with the number of beds and human resources available as inputs. The authors concluded that according to the empirical evidence, the introduction of corporatization has had a positive effect on Portuguese public hospitals. However, as noted by the authors, these results must be treated with caution because of the small sample size and also because of the possibility to observe some sensitivity of results to changes in variables selected as measures of hospital efficiency. Carneiro (2011) analyzed the impact of corporatized management on 12 selected indicators of cost, quality and access to inpatient care in 58 Portuguese public hospitals from 1998 to 2006. Both transformed hospitals and hospitals that at the end of the period were still under direct government administration were included. The econometric methodology relied on the relationship between the particular performance indicator and the 3 binary variables

capturing the shift to corporatized management assuming the value of 1 if the hospital was in its first, second or third year under the corporatized management. By exploring panel data employing random effects estimator the paper pointed to generally positive effect associated with management change under corporatization. Statistically significant impact on average cost per patient and resource usage was revealed. However, the author stressed a prudence in the interpretation of the results, since for most hospitals there was only a 4 year period after the implementation of changes which may be insufficient to reveal all potential impacts.

4.2 Methodological Approaches in the Literature

From a methodological perspective, we recognize two different approaches in the literature dealing with the corporatization effect on performance. The first one is the statistical procedure comparing the company performance before and after corporatization (Bilodeau et al., 2007; Queneville et al., 2008; Laurin and Vinning, 2012). This method introduced by Megginson et al. (1994) has been extensively used to examine the effect of privatization which was regarded as a structural break in a time series. It is based on i) before/after comparisons at the level of each individual hospital by computing pre- and postreform means for each performance indicator for each hospital and testing statistical significance of variable changes in means for each hospital and consequently on ii) pooled before/after comparisons at the aggregate level by statistically testing whether the median difference in variable values between the pre- and postreform sample is zero. Although widely used, the main shortcoming of this method lies in the fact that it does not control for other changes besides the corporatization or privatization that might occur in the period of interest (before and after) as pointed out by Bilodeau et al. (2007).

By contrast the second approach has allowed for other factors affecting performance and also included a control group of non-converted organizations when employing some kind of panel data model (Aivazian et al., 2005; Cambini et al. 2011; Carneiro, 2011) or efficiency measuring method (Rego et al., 2010). Since only two of these studies dealt directly with hospitals, analogously as with the first approach, the studies evaluating the effects of privatization in terms of hospitals should be taken into account when considering the appropriate methodology. In majority of these studies a sort of differences-in-differences

estimation is primarily used (Shen, 2002, 2003; Tiemann and Schreyögg, 2011). Such a quasi-experiment approach provides one of the simplest and most powerful techniques for estimating treatment effects with observational data. It builds on identifying the intervention or treatment, often a passage of a law, and then comparing the difference in outcomes before and after the treatment for group affected by the intervention to the same difference for unaffected group (Buckley and Shang, 2003; Bertrand et al., 2003).

4.3 Research in the Czech Republic

Literature on corporatization in the Czech Republic is limited. As a part of the explanatory statement for the Liberec Regional Assembly, Benedikt (2005) provided an analysis on operating of hospitals in different legal forms. He described the main differences between hospitals as contributory organizations and joint-stock companies and the pros and cons of possible transformation. Although not providing empirical evidence, Hava and Maskova (2007) analyzed the discussion on the alternatives of organizational arrangements of hospital care and their social consequences in the Czech Republic, in particular. They focused on the conceptualization of various types of hospital corporatization and compared the main differences between public and private corporations and their mixed form, based primarily on the nature of the legal entities, their relations to the systems of public and private law, and to human rights. According to authors, independent research is suppressed by excessive politization and deficiencies in law application. Janecek (2007) analyzed the transformation of contributory organizations of regions. He focused on their legal position and its deficiencies resulting in deviation from this form. Vavrova (2007) dealt with main differences between contributory organizations and joint-stock companies in health care (hospitals). Finally, Rehak (2008) analyzed the differences between the legal forms from the accounting perspective.

Given the lack of empirical evidence on the field of hospital corporatization either globally or in the Czech Republic, there is apparently a room for such a quantitative research. Moreover, the above-mentioned appropriate differences-in-differences methodological approach has not been developed in terms of corporatization impact on hospital performance yet. Therefore this thesis will build upon this estimation technique employing panel data and also controlling for other factors to account for the dynamics in the model.

Chapter 5

Methodology

In order to investigate the corporatization effect on Czech hospitals, we employ differences-in-differences estimation (further "diff-in-diff"). In the simplest set up we observe two groups before and after the policy reform (treatment). The first one is the treatment group affected by the reform in the second period, while the second one is the control group unaffected by the reform in either period.
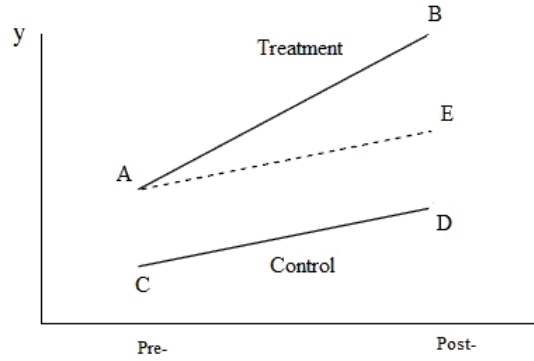
5.1 Differences-in-Differences

Assume that before the reform, the treatment group value is $y = A$, after the reform it is $y = B$ (see Figure 5.1). However, relying solely on the data on the treatment group, we cannot isolate the portion of the change from $y = A$ to $y = B$ that is due to other factors than the reform. Hence the incorporation of the control group with $y = C$ before the reform and $y = D$ after the reform is necessary. We assume that the underlying trend in y is the same for both treatment and control group as depicted in Figure 5.1, where the dashed line AE shows what the treatment group growth would have been without the reform.

When assuming a common trend of both groups, we can estimate the treatment effect to be the distance BE, which is the difference between the treatment and control values of y in the pre-reform and post-reform period, after subtracting ED which would have been the difference between the two groups in the absence of the reform.

To be more specific suppose that y is the outcome variable. Let´s define $\overline{y}_{it}$ to be the average of the outcome y in group i at period t, where $i = 1$ for the treatment group, and $i = 0$ for the control group, and $t = 0$ for the pre-reform

Figure 5.1: The Diff-in-Diff Estimator

period and $t = 1$ for the post-reform period.

Thus the difference in the change in means between the treatment and control groups is

$$\hat{\delta} = (\bar{y}_{11} - \bar{y}_{01}) - (\bar{y}_{10} - \bar{y}_{00}) \tag{5.1}$$

which is an estimate of the treatment effect called the diff-in-diff estimator. It is an unbiased estimator as can be seen in Appendix A.

The diff-in-diff estimator can be then computed using a simple regression. Let y_{it} denote the outcome variable for individual i in period t and consider that the outcome is modeled by the following regression model

$$y_{it} = \alpha + \beta TREAT_i + \gamma POST_t + \delta TREAT_i POST_{it} + e_{it} \tag{5.2}$$

where $TREAT_i$ is a dummy variable being assigned the value 1 if the individual is in the treatment group (i.e. corporatized hospital in given period) and 0 if it is in the control group (i.e. preserved original legal form), and $POST_t$ is a dummy variable being assigned the value 1 in the post-reform period and 0 in pre-reform period. The diff-in-diff estimator is the least squares estimate of δ, i.e. the coefficient of the interaction term $TREAT_i POST_{it}$ which is effectively a binary variable taking the value 1 for the treatment group in the post-reform period.

For further details on methodology see Hill (2011), Woolridge (2007), Manning (2006), Albouy (2004) or Buckley and Shang (2003).

5.2 The Model for Corporatization Effect

Given our setting, the diff-in-diff regression is described by the equation

$$FM_{it} = \alpha + \beta CORP_i + \gamma POST_t + \delta CORP_i POST_{it} + v_{it} \qquad (5.3)$$

where FM_{it} is the measure of financial performance of hospital i ($i = 1, \ldots, N$) in period t ($t = 1, \ldots, T$), $CORP_i$ is a dummy variable being assigned the value 1 if the hospital is in the treatment group (i.e. corporatized in given period) and 0 if it is in the control group, and $POST_t$ is a dummy variable being assigned the value 1 in the post-reform period and 0 in pre-reform period. The error term $v_{it} = u_i + e_{it}$ is composed of the random individual effect u_i and the usual regression random error e_{it}.

Diff-in-diff requires a strong assumption of common trend, so we have to choose a comparable control group of non-corporatized hospitals and include more time periods before and after the reform. The Czech hospital market fulfills both attributes since the treatment and control groups are both composed of comparable general acute care hospitals and the majority of conversions took place from 2003 to 2007 which provides enough pre- and post-reform annual observations.

Equation 5.3 is applied to three unbalanced panels specified by the three transformation periods of 2003 & 2004, 2005 and 2006 & 2007. Hospitals were transformed throughout the particular years, so the transformation years are omitted in each case. The aim is to gain a pure transformation effect unaffected by the overlapping of both pre- and post-transformation legal form specifics in the reform years.

Hausman-Taylor Estimator

The convenient way to proceed is to apply random effects model, which allows to generalize the inferences beyond the sample used in the model (Torres-Reyna, 2009). This estimator takes into account the random sampling process of obtaining data, permits us to estimate effects of individual time-invariant variables and also it is a generalized least squares estimation procedure with smaller variance than least squares estimator in large samples. Compared with fixed effects, to estimate the effects of the explanatory variables, the random effects estimator uses not only the information from variation in the the explanatory variables

and the response variable over time, for each individual, but also the information on how changes in the response variable across different individuals could be attributable to the different explanatory variables´ values for those individuals.

However, when the individual specific error component u_i is correlated with some of the explanatory variables which is often a problem in random effects model, the estimator is inconsistent. And thus before moving on to actual analysis, we always perform Hausman test to detect potential correlation. Fail to reject the null hypothesis of no correlation between the explanatory variables and the random effects means that the estimator is inconsistent. This so called endogeneity problem can be coped with either by using a less precise fixed effects estimator or by preferred instrumental variables estimator applied to the random effects model that has the desirable property of consistency and allows for time-invariant regressors – Hausman-Taylor estimator.

This estimator, originally proposed by Hausman and Taylor (1981), assumes that some of the regressors are correlated with u_i and all of them uncorrelated with e_{it}. To carry out an instrumental variables estimation, we need instruments for the endogenous regressors. However, no external instruments are required by this method. Instead:

1. transformation by demeaning (value in deviation from the individual specific means) the endogenous variables that vary over time and individuals for each individual yields suitable instruments,

2. the time means of the exogenous time-varying regressors serve as suitable instruments for time-invariant endogenous variables and

3. the exogenous variables serve as their own instruments.

Hausman-Taylor estimation is then applied to the transformed generalized least squares model, which takes the following form:

$$y_{it}^* = \beta_1 + \beta_2 x_{it,exog}^* + \beta_3 x_{it,endog}^* + \beta_4 w_{i,exog}^* + \beta_5 w_{i,endog}^* + v_{it}^* \qquad (5.4)$$

where, for instance $y_{it}^* = y_{it} - \hat{\alpha}\bar{y}_i$, $\hat{\alpha} = 1 - \hat{\sigma}_e/\sqrt{T\hat{\sigma}_u^2 + \hat{\sigma}_e^2}$ and $v_{it} = u_i + e_{it}$. Parameters $\hat{\sigma}_u^2$ and $\hat{\sigma}_e^2$ need to be estimated[1] before 5.4.

Since the stronger assumption that the subset of the regressors (instrumental variables) is uncorrelated with the random individual effect tems u_i, in addition to all regressors uncorrelated with the regression error terms e_{it} is needed, we

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[1]Some details on how to find these estimates can be found in Hill et al. (2008) or Wooldridge (2010).

always test overidentifying restrictions which can be also seen as a testing of fixed vs. random effects. By not rejecting the null hypothesis of the consistency of selected Hausman-Taylor random effects estimation process, this estimator is considered to be a suitable choice. By carrying out this testing procedure we substitute for goodness of fit measures[2], which are rather uncommon in panel data applications (Verbeek, 2004). Furthermore, we test for the overall significance of the regression model by applying F test (or alternatively Wald chi square test) with the joint hypothesis that each of the parameters (except for the intercept) are simultaneously zero.

One of the assumption underlying the Hausman-Taylor estimator is homoscedasticity of the residuals[3]. When applying cluster-robust standard errors, by clustering on hospital level, we allow for possible existence of heteroscedasticity. Under this less restrictive structure, the random effects estimator will no longer be minimum variance, but the cluster-robust standard errors and consequently hypothesis tests and interval estimates will be valid.

However, the assumption of homoscedasticity is often inappropriate when estimating panel data models. Economic variables often exhibit distributions of varying spread at different levels of one or several covariates (Fe, 2011). One of the alternative approach to obtain more robust cluster standard errors is the method of bootstrapping which does not rely upon strong assumption regarding the distribution of the statistic (Guan, 2003). Thus by using bootstrapped clustered standard errors the restrictive error components structure assumed by the Hausman-Taylor can be avoided (Abbott and Klaiber, 2009).

Bootstrap method is a nonparametric approach for evaluating the distribution of a statistic based on random resampling, which takes a number of pseudo-samples from the original sample, for each pseudosample calculate the statistic of interest represented here by regression coefficient and use the distribution of this coefficient across pseudo-samples to infer the distribution of the original sample standard error for each coefficient (Guan, 2003; Cameron et al., 2006). It only assumes that the sample is representative of the population, no other assumptions about the distributions nor about the true values of the parameters are needed (Schmidheiny, 2012).

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[2]Usual R-squared or adjusted R-squared are only appropriate if the model is estimated by OLS.

[3]The assumption of autocorrelation is taken care of by the Hausman-Taylor estimator itself, since it is a generalized instrumental variables estimator, which is consistent even in the presence of autocorrelation.

Cluster-robust and bootstrapped standard errors yield slightly different results. Hence, we decided to employ a conservative approach of reporting and interpreting the results of the method with the largest standard errors in each case.

5.3 Hypotheses

We will tests three hypothesis:

Hypothesis 1 Financial performance of hospital does not improve after corporatization.

The analysis of corporatization effect on hospital performance begins with the basic diff-in-diff model in 5.3. Applying the log-log function, the slopes now exhibit constant relative change in contrast to constant absolute change in the linear function. Hospital characteristics are included to control for other factors affecting performance. The model is represented by the equation

$$ln(FM_{it}) = \alpha + \beta CORP_i + \gamma POST_t + \delta CORP_i POST_{it} + \theta \sum_{i=1}^{n} ln(X_{it}) + v_{it} \quad (5.5)$$

where FM_{it} is the measure of financial performance of hospital i at year t, $CORP_i$ is a binary variable for corporatization being assigned a value 1 if the hospital was corporatized in the given period and a value 0 otherwise; $POST_{it}$ takes a value 1 in the years after corporatization and a value 0 otherwise; and X_{it} are hospital characteristics of hospital i at year t.

The effect we are particularly interested in will be observed from the coefficient of the interaction term $CORP_i POST_{it}$, which identifies how financial performance of hospitals in the treatment group changed after corporatization relative to performance in the control group (i.e. diff-in-diff estimator). However, in line with ambiguous theories discussed in Chapter 3, rather an insignificant effect is expected. We will then conclude that corporatization has no effect on financial performance.

Hypothesis 2 The corporatization effect is transient.

In order to test the permanency of the corporatization effect, we add a new dummy variable $TEMP_{it}$ representing the difference between the changes in performance in the first two years after corporatization and the subsequent years. For corporatized hospital i at year t this variable will take a value 1 if the year

will coincide with the first two years after conversion and 0 otherwise. The log-log function modification of the basic model follows the equation

$$
\begin{aligned}
ln(FM_{it}) &= \alpha + \beta CORP_i + \gamma POST_{it} + \delta CORP_i POST_{it} + \theta \sum_{i=1}^{n} ln(X_{it}) \\
&\quad + \eta TEMP_{it} + v_{it}
\end{aligned} \tag{5.6}
$$

The rationale behind $TEMP_{it}$ is that converted hospitals may tend to return to its old behavioural patterns after the transitional period and hence the changes of performance can be only temporary. Such a finding may subvert further corporatization efforts in favor for permanent improvements of performance. So, if the potential corporatization effect is not permanent, the coefficient should turn out to be statistically significant.

Hypothesis 3 Period when the hospital was transformed does matter as far as financial performance is concerned.

When testing for Hypothesis 1 and Hypothesis 2, estimation of equations 5.5 and 5.6 were estimated three times for each subsample specified according to three transformation periods of 2003 & 2004, 2005 and 2006 & 2007. Hospitals corporatized in different periods might have experienced different conversion paths, and therefore we will compare the estimation results of $CORP_i POST_{it}$ and $TEMP_{it}$ among the periods. If the coefficient estimates display different values for different periods, we conclude that the transformation periods themselves have an influence on financial performance changes after corporatization.

For the sake of completeness, the composition of vector $X \epsilon (T \times N)$ which is included in both specifications shall be discussed in the next chapter. By adding X, our model is extended for variables controlling for heterogeneous dynamics at the hospital level. Both *internal* and *external* variables are included as described later.

Chapter 6

Data

The general problem of empirical analysis of Czech hospitals is a data availability. If available, the data are spread through various databases. Moreover, we cannot rely on the whole sample available since some of the hospitals regularly fail to disclose their annual characteristics and financial results. Out of 77 hospitals analyzed over 11 years period, there is more than 28 % of (mainly financial) information missing in our dataset. This lack of transparency and comprehensiveness induces that one should be cautious when analyzing a segment of such an incomplete nature and be reasonably suspicious of possible skewness of the data.

When evaluating the financial performance of Czech hospitals after legal form conversion, we considered the period 2001-2011. Transformations took place between 2003 and 2007, which provides us with enough pre- and post-reform evidence. The majority of data on individual hospitals were collected from two main sources: annual regional publications of the Institute of Health Information and Statistics of the Czech Republic[1] and financial statements of the Business Register of the Czech Republic[2]. Additional information concerning hospitals´ external environment characteristics was gained from the Czech Statistical Office.

Most hospitals of both forms, joint-stock companies and contributory organizations except for hospitals founded by the state organizational units, submit their financial statements into the Business Register and Collection of Deeds which is available online[3]. However, no aggregate database with all information gathered at one place is available. Instead, only individual annual files for each hospital

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[1]www.uzis.cz
[2]www.justice.cz
[3]www.justice.cz

are reported. Financial data for some hospitals from the period 2006-2009 was then completed with the help of a complex database of the CRIF - CCB Czech Credit Bureau, a.s.[4] Although, the data on some years are often absent. The rest of hospitals, not included in the previous two sources, either have all or a part of their annual financial statements on their web sites or do not report their financial results at all. In the case of contributory organizations, which track their revenues and costs separately from the perspective of the main and economic activity, we take the total numbers into account in order to keep the sample homogenous, since the hospitals joint-stock companies do not distinguish between those two activities. Lastly, data on some nonfinancial variables[5] from the period 2001-2008 were kindly provided by PhDr. Jana Votápková, Institute of Economic Studies, Prague.

Only general hospitals, except for privatized entities, were included in the analysis[6]. Out of 166 hospitals operating in the market as of 2011, hospitals of subsequent care, institutes for long-term patients, psychiatric institutes, etc. were excluded. We also left out hospitals which were both corporatized and thereafter privatized in the observed period (3 hospitals), then hospitals in the legal form of public service company[7] (1 hospital) and hospitals with missing financial data for the whole period (1 hospital). Applying the aforementioned restrictive criteria, we arrived at the number of 77 hospitals; out of which 36 hospitals were corporatized in the given period and 41 have remained non-corporatized organizations. The complete list of hospitals divided into joint-stock companies (corporatized) and contributory organizations (non-corporatized) as of 2011 included in our unbalanced panel is in Table B.2. Figure 6.1 shows the distribution of hospitals according to the average number of inpatients per year over 2001-2011 period depending on the legal form. Distribution of hospitals contributory organizations is biased by 11 teaching hospitals with more than 48 000 inpatients per year on average. However, when omitting the teaching hospitals, contributory organizations treat only 15 144 inpatients on average, which is roughly comparable with 17 818 inpatients for joint-stock companies. We decided to keep these observations in the regression analysis, because they can provide important in-

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[4]All financial data for 2006-2009 transparently collected in the excel spreadsheet.

[5]Variables *doctors_bed*, *nurses_bed*, *size_1*, *size_3*, *unemployment*, *competition* and *salary*. Definitions provided in section 6.2.

[6]i.e. the corporatized entities which changed their legal form into joint-stock companies in the given period and the non-corporatized hospitals preserving their legal form of contributory organizations for the entire period. For the first group we considered only the hospitals in the ownership of state, region or municipality.

[7]"Obecne prospesne spolecnost" (o.p.s.) in the Czech terminology.

formation by increasing the variation in explanatory variables (Woolridge, 2002)
. Furthermore, their influence is reduced by applying the log-log function in our
regression analysis.

Figure 6.1: Hospitals Distribution according to Inpatients
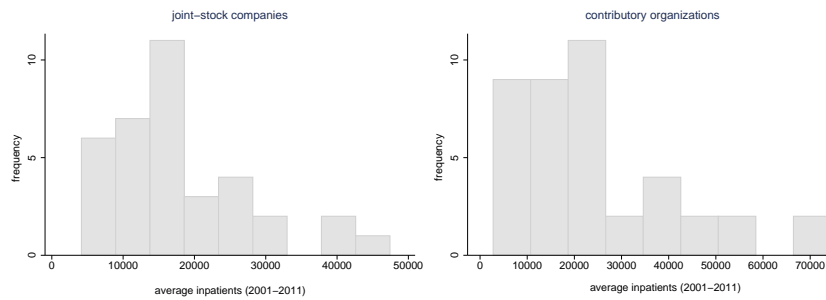
The dataset was adjusted to account for three main transformation periods:
2003 & 2004, 2005, 2006 & 2007, thus arriving at three unbalanced panels of a
comparable size. There are 11 hospitals which underwent a legal form change
in the first period, i.e. 2003 & 2004 (of which 1 in 2004), 15 hospitals were
transformed in the second period, i.e. 2005, and finally 10 hospitals were corpo-
ratized in the third period, i.e. 2006 & 2007 (of which 1 in 2006). The strategy
of grouping the consecutive years together regarding the first (2003 & 2004) and
third period (2006 & 2007) pursuits the aim of measuring the corporatization
effect for each of these longer periods rather than individual years, which cover
only a low number of transformations.

We left the transformation years in each period aside in order for the previous
and newly implemented legal form specifics not to overlap in the year of the
change. The same control group of contributory organizations is used for each
transformation period. Table 6.1 depicts the size of each sample in terms of
the number of corporatized hospitals and identifies hospitals converted in that
period.

We divided the data used into two groups: financial and nonfinancial variables.
The former covers the explanatory variables of hospital´s financial performance,
while the latter consists of the variables capturing corporatization variables and
hospital characteristics in the given years.

Table 6.1: Transformation Periods

	Corporatized hospitals	No.
2003 & 2004	11	1, 9, 10, 11, 12, 39, 49, 50, 52, 53, 64
2005	15	2, 3, 4, 5, 6, 7, 40, 59, 60, 62, 63, 73, 74, 75, 76
2006 & 2007	10	13, 15, 31, 32, 33, 54, 55, 56, 57, 58 57, 58

No. denotes the identification number of the hospital as of Table B.2.

6.1 Financial Variables

The evolution on both revenues and cost sides was taken into account. Specifically, we employed four financial measures: average revenues per inpatient day, average revenue per inpatient, average cost per inpatient day and average cost per inpatient, which serve as dependent variables in the regression analysis.

- *Revenues per inpatient day*: average revenues per one inpatient day

$$rev\_days = \frac{total\,revenues}{inpatient\_days},$$

where variable *inpatient_days* is the sum of all patient overnight stays over the year, computed as the multiple of total number of inpatients and average length of stay.

- *Revenues per inpatient*: average revenues per one inpatient

$$rev\_inpat = \frac{total\,revenues}{inpatients},$$

where variable *inpatients* denotes the total number of patients provided with inpatients care.

- *Costs per inpatient day*: average costs per one inpatient day

$$cost\_days = \frac{total\,costs}{inpatient\_days}.$$

- *Costs per inpatient*: average revenues per one inpatient

$$costs\_inpat = \frac{total\,costs}{inpatients}.$$

6.2 Nonfinancial Variables

Since we apply the diff-in-diff methodology to analyze effect of corporatization on financial performance (Hypothesis 1), the binary variables $CORP$ and $POST$ and their interaction term $CORP \times POST$ are incorporated in our model.

- *CORP*

  Binary variable taking the value of 1 if the hospital was corporatized in the given period.

- *POST*

  Binary variable being assigned a value of 1 for all hospitals in all years after corporatization. In our analysis we use three variables: POST_3_4, POST_5 and POST_6_7 for three main transformation periods: 2003 & 2004, 2005 and 2006 & 2007, as explained in Section 5.2.

- *CORP×POST*

  Binary variable equal to 1 for the treatment group ($CORP = 1$) in the post-reform period ($POST = 1$). The coefficinet of $CORP \times POST$ is the diff-in-diff estimator as explained in Section 5.1. According to conflicting or ambiguous theories discussed in Chapter 3, we expect no significant improvement in financial performance after corporatization.

To test the permanency of the corporatization effect (Hypothesis 2), we add a variable $TEMP$.

- *TEMP*

  Binary variable which is 1 if the year will coincide with the first two years after corporatization. If some corporatization effect is revealed though (at least in revenues and costs measures), we would expect it to be only temporary. Hence a significantly positive coefficient of $TEMP$ would be anticipated for revenues and a negative coefficient for costs.

Besides the variables on the corporatization effect, we use several control variables capturing hospital characteristics with a potential impact on financial performance. These are divided into two groups – *internal* and *external* variables depending on the extent to which hospitals can control them.

Internal characteristics:

- *doctors_bed*
  Average number of doctors per one bed per day derived as the reciprocal of the average bed occupancy per one doctor. A higher number of doctors per one bed is assumed to increase inefficiency, thus a negative effect on financial performance is anticipated.

- *nurses_bed*
  Average number of nurses per one bed per day derived as the reciprocal of the average bed occupancy per one nurse. Applying the same logic as for variable *doctors_bed,* we expect a negative effect on financial performance.

- *size_1, size_3*
  *S*ize of the hospital in terms of the total number inpatients with respect to the period in question. We divided the sample into three size categories captured by time invariant binary variables. Hospital belongs to: small hospitals (Size_1) if the average number of inpatients over the period 2001-2011 is less than or equal to 10 000, and big hospitals (Size_3) if it is greater than 20 000. Only the effect of small and big hospitals is taken care of[8]. We assume that bigger hospitals could benefit from economies of scale, but on the other hand a lot of inefficiencies could arise, especially in big state-owned organizations which we analyze. We anticipate, that the second effect prevails and thus a negative effect of hospital´s size on financial performance is expected.

- *beds_utilization*
  The percentage of annual bed occupancy rate computed as $(\frac{inpatient\_days}{beds}/365) \times 100$, where *beds* stands for the number of beds in a hospital in the given year and *inpatient_days* is the sum of all patient overnight stays over the year. In line with the parsimonious principle, we prefer this variable to using both *inpatient_days* and *beds* which are highly correlated. Moreover, unlike *inpatient_days* and *beds*, this measure indicates the efficiency level of bed fund utilization in each hospital and thus better captures hospital´s economic behaviour. Hospitals with higher beds utilization use their resources more effectively and therefore a positive effect on financial performance is anticipated.

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[8]This variable defined according to the methodology of Prochazkova and Stastna (2011).

External characteristics:

- *teaching_status*
  Hospitals founded by the Ministry of Health that provide training for doctors and medical staff besides offering health care services are assigned a value of 1. Until 2011, there were 11 teaching hospitals operating in the Czech hospital market, all of which are included in our analysis. We assume, that maintaining sound financial performance of these state-owned hospitals may collide with costly doctor training and research involvement. Teaching status is thus anticipated to have a negative effect on financial performance.

- *unemployment*
  The annual unemployment rates in the municipalities with extended powers where the given hospital is situated. It is assumed that health status of individuals is decreased with rising unemployment and consequently rising hospitals treatment costs are expected to deteriorate financial performance of hospitals. On the contrary, unemployment may also increase competition in labor market, and thus boost efficiency of hospital personnel. Resulting effect then depends on which effect will prevail.

- *salary*
  Average monthly wage of districts where the hospital operates. We adjusted the nominal prices for inflation to the base year of 2001. The data on monthly wage of districts were reported by the Czech Statistical office only until 2005, for the remaining years we used the adjustment for year-to-year increase in the corresponding regions. Higher salaries are assumed to increase the interest of people in their own health and thus decrease the ratio of demand for unprofitable to profitable services. Therefore, a positive effect of salaries on financial performance is anticipated.

- *competition*
  The number of hospitals operating in the region in a given year. Higher competition is in general assumed to increase the financial performance, since hospitals are forced to improve their efficiency to be able to compete for available funds. A positive coefficient is anticipated then.

- *city*
  Population of municipalities where the hospital operates. Regarding hospitals located in Prague, we adjusted the entire population according to

Table 6.2: Descriptive Statistics of Financial and Nonfinancial Variables

Variable	Obs	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
CORP	847	.4675325	.4992395	0	0	.1301448	1.016938
POST_3_4	847	.6363636	.4813299	0	1	-.5669467	1.321429
POST_5	847	.5454545	.4982238	0	1	-.1825742	1.033333
POST_6_7	847	.3636364	.4813299	0	1	.5669467	1.321429
TEMP	847	.042503	.2018528	0	1	4.535655	21.57217
revenues_days	607	6.22263	4.341297	1.452185	35.6067	3.199873	17.16877
revenues_inpatients	609	45.61388	28.57903	15.46139	192.2762	2.292884	8.961659
costs_days	608	6.296286	4.605999	1.450046	46.83603	3.662072	22.59461
costs_inpatients	610	46.21547	31.55883	15.75879	388.7391	3.704467	28.44276
doctors_bed	811	.1572489	.0427499	.0436953	.376056	1.259338	6.076291
nurses_bed	811	.5588706	.1193017	.263287	1.377566	2.256789	14.15271
size_1	847	.2077922	.405967	0	1	2.085634	6.339855
size_3	847	.4155844	.4931137	0	1	.3425801	1.117361
beds_utilization	815	71.75594	7.584219	45.70732	95.15791	.0512469	3.049316
teaching_status	847	.1428571	.3501339	0	1	2.041241	5.166667
unemployment	843	9.019632	4.091233	2.14	24.21	.7073681	3.327244
salary	847	16457.55	2739.019	11469	24805.89	1.070373	4.069868
competition	847	16.39315	6.859971	6	28	.0552152	1.502988
city	847	75199.85	95583.38	3503	384277	2.085634	6.339855

the proportion of inpatients of a given hospital to the overall number of inpatients in a given year in the catchment area. Hospitals in more populated municipalities are assumed to use more modern technologies. On the other hand, hospitals in less populated municipalities often transfer more complicated, and thus less profitable, services into hospitals in bigger cities. The effect of variable *city* then depends on which of the two effects prevails.

The Hausman-Taylor estimation used in this thesis does not require any external instruments. We only make assumption about which of the included dependent variables are correlated with u_i, i.e. endogenous. By comparing fixed and random effects estimates, variables *teaching_status, unemployment, competition* and *city* report significant differences and thus are hypothesized to be endogenous.

Table 6.2 shows descriptive statistics for both financial and nonfinancial variables described above. Correlation matrix for independent variables is available

in Table B.3. Variance Inflation Factor (VIF) test and Principal Component Analysis (PCA) were used as indicators of potential multicollinearity among the variables. Presence of multicollinearity was not detected, as proved by the test results provided in Tables B.4, B.5 and B.6.

Chapter 7

Results

In this chapter we present the results of the empirical analysis. We concentrate on the effect of corporatization on the financial performance of hospitals, applying the methodology described in Chapter 5.

We divided this chapter into three sections. Section 7.1 interprets the results of the effect of corporatization on financial performance (Hypothesis 1), while section 7.2 provides evidence of a permanent nature of such an effect (Hypothesis 2). Both sections comprise 3 analyses regarding 3 transformation period subsamples as described in Chapter 6 and comments on differences between the transformation periods (Hypothesis 3). In order to control for the risk of hidden endogeneity in the dependent variable, alternative measures of financial performance are employed and subsequently the results are compared. Finally, in Section 7.3, we summarize the main findings, we also take into account control variables and draw inferences about their effects (consistency across all subsamples is discussed).

Stata software version 11.0[1] was used for all econometric estimations.

7.1 Corporatization Effect

Regarding the corporatization effect on financial performance, i.e. Hypothesis 1, equation 5.5 was estimated four times, once for each dependent variable – revenues per inpatient day, revenues per inpatient, costs per inpatient day and costs per inpatient – for all 3 transformation periods (further subsamples). Revenues and costs per inpatient, which serve as a robustness check, are employed

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[1]StataCorp. 2009. Stata Statistical Software: Release 11. College Station, TX: StataCorp LP.

as an alternative measure of financial performance controlling for a certain level of discretion of hospitals in affecting the inpatient days.

Our primary interest resides in the significance and sign of the coefficient of $CORP \times POST$ capturing the differences of the average financial performance of hospitals in the treatment group relative to average performance in the control group after corporatization. Because the dependent variable is logged, the interpretation of this coefficient is such that: if $CORP \times POST$ switches from 0 to 1, the percentage effect of $CORP \times POST$ on the dependent variable is $100 \times [exp(CORP \times POST) - 1]$. As a conservative criterion for diagnosing a presence of corporatization effect, we require the estimates for both sets of dependent variables (i.e. the one normalized by inpatient days and the other one by inpatients) to be significant and with a common sign.

When interpreting the corporatization effect, we always consider only the net effect, i.e. the effect on the overall financial performance. It is defined as

net effect = effect on revenues – effect on costs.

Even though these effects on individual performance components (revenues and costs) could be economically significant[2], the net effect needs not, since the two effects may cancel out.

The regression results concerning Hypothesis 1 are summarized in Table 7.1.

Table 7.1: CORP×POST Coefficient Estimates

Dependent variables:	*rev_days*	*cost_days*	*(net effect)*	*rev_inpat*	*cost_inpat*	*(net effect)*
2003 & 2004	**0.160*****	**0.189*****	**-0.035**	0.048	0.076	-2.98
	(0.044)	(0.043)		(0.044)	(0.048)	
2005	**-0.109****	**-0.060***	**-0.053**	-0.075	-0.026	-5.15
	(0.053)	(0.033)		(0.068)	(0.047)	
2006 & 2007	0.036	0.071	-0.037	0.097	0.133	-4.04
	(0.165)	(0.161)		(0.130)	(0.179)	

Notes: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

net effect is the difference between the effects on revenues and costs, where each of the 2 effects

is interpreted as: *(exp(CORPxPOST)-1)*

The results support Hypothesis 1 and hence no significant performance effect

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[2]Compared to statistical significance, the concept of economic (or substantive) significance requires the numerical result to be of economically important magnitude (i.e. interpretable).

of corporatization which took place in 2003 & 2004 subsample. While revenues per inpatient day of corporatized hospitals increased by 17%[3] relative to non-transformed hospitals after corporatization, the costs per inpatient day increased by 21% in comparison with the control group, holding all other variables constant. The positive change in revenues is overwhelmed by the costs expansion, thus a slightly negative resulting impact (net effect) of corporatization on overall financial performance is identified for 2003 & 2004 subsample. However, when controlling for possible endogeneity and using a different specifications of the dependent variables – revenues per inpatient and costs per inpatient, corporatization effect on both revenues and costs turned out to be statistically insignificant. We thus conclude that that there is no evidence of significant corporatization effect.

Similarly neither did we found any significant effect of corporatization carried out in 2005, as can be seen in Table 7.1 For hospitals corporatized in 2005, revenues per inpatient days decreased by 11% relative to the non-transformed hospitals, however they exhibited only 6% decrease of costs. The net effect is significantly negative in contrast with the anticipated results of Hypothesis 1. However, once again, the specifications with revenues and costs weighted by inpatients instead of inpatient days yield insignificant estimates. To conclude, insignificant effect of corporatizaton is identified.

As far as the last 2006 & 2007 subsample is concerned (last row of Table 7.1) for all dependent variables, the estimated coefficient of $CORP \times POST$ is statistically insignificant revealing no change in financial performance of hospitals corporatized in 2006 & 2007 relative to the control group.

As Table 7.1 shows, even though no overall performance changes were observed as discussed earlier, there were substantial differences in terms of revenues and costs after corporatization (relative to non-corporatized hospitals) among the three corporatizations periods (Hypothesis 3). Among the hospitals corporatized in 2003 & 2004, the revenues per inpatient day increased by 17%, but decreased by 12% among 2005 corporatized hospitals and were maintained by hospitals converting legal status in 2006 & 2007. On the other hand, hospitals converted in 2003 & 2004 were not doing as well as those being converted in later periods. They experienced 21% increase in costs per inpatient day, while hospital that changed their legal form in 2005 reduced their costs by 6% and there was no costs change among hospitals transformed in 2006 & 2007.

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[3]Interpretation of *CORPxPOST* coefficient for 2003 & 2004: 100*(exp(0.16)-1) = 17%.

Finally, according to the test of overidentifying restrictions for panel data, which is effectively a test of fixed versus random effects, our choice of Hausman-Taylor estimation procedure in each of the estimated models is confirmed. On the grounds of Sargan-Hansen´s statistics and corresponding P-values do not exceeding the critical values as can be seen in the Tables B.7, B.8 and B.9, we cannot reject the null hypothesis of random effects consistency and thus prefer Hausman-Taylor. Further, reported F statistics in the test for the overall significance of the regression are sufficiently large to reject the joint hypothesis of all coefficient equal to zero at 1% level of significance.

7.2 Permanency of the Corporatization Effect

Regarding permanency of the performance change after corporatization, i.e. Hypothesis 2, the regression equation 5.6 has been estimated four times for each dependent variable – revenues per inpatient day, revenues per inpatient, costs per inpatient day and costs per inpatient – for all 3 subsamples. Here, we are particularly interested in the significance and sign of the estimated coefficient of the variable $TEMP$ representing the difference between the changes in performance in the first two years after corporatization and the next years. The interpretation of this binary coefficient in the model with the log-transformed dependent variable follows the same rule as in case of $CORP \times POST$. Due to insignificant corporatization effect on overall performance recognized in Section 7.1, we now consider only permanency of the significant effects on individual performance components (revenues and costs per inpatient day) in the first two subsamples 2003 & 2004 and 2005.

The estimation results can be found in Table 7.2.

The results for hospitals corporatized in 2003 & 2004 show significantly decreasing effect as time passes. Both revenues per inpatient day and costs per inpatient were by 13% lower in the first two years after the corporatization than in the subsequent years. This may imply a gradual performance change in terms of revenues and it suggests that some changes need some time to be realized. Regarding costs per inpatient day, the effect is exactly the opposite, indicating only temporary improvement in costs.

With respect to the second subsample, i.e. 2005, the effect of variable $TEMP$ on revenues and cost per inpatient day turned out to be statistically insignificant. This indicates no difference in revenues and costs measures between the first two

Table 7.2: TEMP Coefficient Estimates

Dependent variables:	rev_days	cost_days
2003 & 2004	**-0.124****	**-0.124****
	(0.058)	(0.053)
2005	0.026	0.019
	(0.619)	(0.054)

Notes: Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

years and in the following years after corporatization, and hence a permanent effect for 2005 corporatization.

Thus, we identified a different pace of performance (revenues and costs) changes among periods (Hypothesis 3), as shown in Table 7.2 and explained above.

In each of the estimated models, the test of overidentifying restrictions cannot be rejected, while the Wald test for the overall significance of the regression is rejected at 1% level of significance in each case, as can be seen on test statistics in tables B.10, B.11 and B.12. Moreover, as can be seen in these tables the estimates of $CORP \times POST$ roughly maintain the values from previous models without $TEMP$, thus supporting results for Hypothesis 1. Including $TEMP$ into the model for 2003 & 2004 subsample creates a statistically significant improvement in the fit of the model, where the p-values in the Wald test are associated with chi-squared of 13.52 and 13.40 for revenues and costs respectively[4]. For 2005 subsample, we arrived at chi-squared of 0.71 and 0.23, suggesting that removing the variables from the model will not significantly harm the fit of the model. Although, it is always important to include this variable into our models, since hereby the permanency of the corporatization effect can be analyzed.

7.3 Overall Model Results

Besides the variables capturing the corporatization effect, control variables covering hospital internal and external characteristics are also included in all model specifications. Across all three subsamples, we identified statistically significant impact on all four performance measures in case of the average number of nurses

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[4]Null hypothesis of $TEMP = 0$.

per one bed (*nurses_bed*), average monthly wage of district where the hospital operates (*salary*) and the annual unemployment rate in the municipality with extended powers where the hospital is situated (*unemployment*), as can be seen in tables B.7, B.8 and B.9. Moreover, in 2003 & 2004 and 2005 periods the utilization of the bed fund (*beds_utilization*) and average number of doctors per on bed (*doctors_bed*) yield statistically significant estimates as well.

For instance, 1 percent increase in number of nurses per one bed in a hospital (*nurses_bed*) would cause a 0.59 percent increase in the revenues per inpatient day and simultaneously a 0.52 percent increase in the costs per inpatient day for hospitals corporatized in 2005. Similarly, a percentage rise in the unemployment rate of the corresponding municipality *(unemployment)* would cause a 0.15 percent increase in the revenues per inpatient day and simultaneously a 0.16 percent increase in the costs for 2006 & 2007 subsample. However, these effects on revenues and costs roughly cancel out for all three subsamples and ultimately yield economically insignificant effects on the overall financial performance of hospitals. In case of the *nurses_bed*, rather a negative sign was expected, since a higher number of nurses per bed increases inefficiency. However, due to teaching hospitals being subsidized for medical staff training, this effect may be suppressed in our sample. Regarding *unemployment*, an ambiguous effects was anticipated, since there are two counterbalancing effects present as described in Section 6.2.

The only variable with economically significant net effect in two periods (2005 and 2006 & 2007) is the average monthly wage in the districts *(salary)* with 0.51 and 0.28 percent increases, and 0.54 and 0.25 percent increases in revenues and costs respectively (i.e. net effects of 0.23 % and 0.29 %) after 1 percent *salary* increase. This effect was anticipated, since the ratio of demand for unprofitable to profitable services increases in districts with higher salaries, because they likely imply higher interest of people in their own health.

To sum up the results of this chapter, we found no significant evidence on the effect of corporatization on overall financial performance. However, significant effects on revenues and costs per inpatient day were identified. After corporatization, both revenues and costs measures either increased or decreased for the first and the second subsample respectively. These changes were gradual for revenues and temporary for costs in the former case and permanent in the latter one. Likewise, some control variables proved to have influence on the revenues and costs. Although, except for *salary*, these effects cancel out and no significant

impact on the overall financial performance was recognized.

Chapter 8

Discussion

8.1 Consistency with Principal-Agent Theory

We clearly found out that corporatization hasn´t generated sufficient high-powered incentives as competitive markets and consequently the agency problem has not been effectively reduced. Firstly, at the government owner-managers level, the narrower mandates and applicable explicit performance measures enabling more transparent relationship should bring more personal responsibility of the management to meet the stipulated goals and hence to reduce information asymmetry. Secondly, the information asymmetry at the managers-employees level should be lowered by narrower mandates of the hospitals allowing for more feasible performance measures, less restrictions in employees management and more flexibility in designing reward and evaluation mechanism.

However, regarding the first level agency relationship, the corporation fully accountable for its financial performance, even including the possibility of bankruptcy, is rather a theoretical option. This is strengthened by the rigidity of the appointment process of the board of directors as the managing body of the corporatized hospital which still remains within the competence of the goverment-owner on different level of state administration hierarchy. Then the competitive market of ownership rights allowing for management change, characteristic for private firms, is impaired to a large extent and thus imposing lower threat on management turnover which depends on political cycles rather than on performance. The increase of the management´s autonomy in corporatized hospital may then be accompanied by more freedom in self-interest seeking behaviour likely stimulating corruption practices in a hospital sector. These trends possibly balance out the above-metioned positive effects of corporatization.

8.2 Consistency with Public Choice Theory

The ambiguous results of corporatization on hospital financial performance observed in this thesis are also also partly compatible with *the public choice theory* which predicts only transient performance improvement or even decline after the legal form conversion towards the joint-stock company. This theory is based on the assumption of politicians imposing such goals on corporatized, and thus state-owned, hospitals that can gain votes but counteract performance. Hospitals usually cover a large variety of objectives to satisfy their patients and electorate in one person. Thus instead of focusing on certain specific areas of health care and cooperation in terms of geographical tasks distribution, they provide a broad scope of services at the expense of efficiency. Profitable operation of corporatized hospitals is further disrupted by inefficient treatment predominantly focused on attracting potential voters.

8.3 Consistency with Property Rights Theory

Lastly, in order to explain the achieved results we take *the property rights theory* into account. Pursuant to this theory, corporatization may improve performance by addressing the problem of pairing of residuals rights and returns by attempting to strengthen the incentive regime of state-owned hospitals without privatizing them. Critical decision rights should be then shifted from the state administration to the hospital management, giving it virtually complete control over all inputs and issues related to the production of services, hereafter also financial and strategic management. Theoretically, public purse should cease to be a sole residual claimant. Instead, it should be replaced by hospital entitled to excess revenues and responsible for losses. Under these conditions, corporatization is assumed to bring positive financial performance change. However, under persisting state ownership none of these assumptions is fulfilled perfectly, as was discussed earlier. Above all, management in the corporatized hospital has formally control over the company, but there are persisting links to hierarchy due to appointment process tied to political cycles restricting its decision rights. Moreover, public purse still remains the lender of last resort in case of difficulties. Moral hazard in the behaviour of the managers and employees may likely arise in such circumstances.

Chapter 9
Conclusion

This thesis analyzed the effect of corporatization on financial performance of 77 Czech general hospitals during 2001-2011. We left privatized entities aside concentrating only on the corporatized hospitals which changed their legal form into joint-stock companies and the non-corporatized hospitals preserving their legal form of contributory organizations in the given period. Average revenues per inpatient day and average costs per inpatient day were used as dependent variables in the analysis. As a robustness check, revenues and costs per inpatient were additionally employed as an alternative measure of financial performance controlling for a certain level of discretion of hospitals in affecting the inpatient days.

Employing differences-in-differences estimation, the effect of corporatization on financial performance was not confirmed. Even though no overall performance changes were observed, we identified substantial differences in revenues and costs measures (relative to non-corporatized hospitals) among the three corporatizations periods. After corporatization, both revenues and costs either increased or decreased for the first and the second period respectively. Hospitals corporatized in 2003 & 2004 experienced 17% decrease in the revenues per inpatient day, while there was only 12 % decrease among hospitals corporatized in 2005 and revenues per inpatient day were maintained by hospitals converting their legal form in 2006 & 2007 period. On the other hand, hospitals converted in 2003 & 2004 were not doing as well as those being converted in later periods. They reported 21% increase in costs per inpatient day, while hospital that changed their legal form in 2005 reduced their costs by 6% and there was no costs change among hospitals transformed in 2006 & 2007. However, when controlling for possible endogeneity and using a different specifications of the dependent variables – revenues per inpatient and costs per inpatient – corporatization effect turned out to

be statistically insignificant. Lastly, there was a transient performance change revealed for hospitals corporatized in 2003 & 2004. Revenues per inpatient day were by 13% lower in the first two years after the corporatization than in the subsequent years, suggesting that some changes on the revenues side need some time to be realized, while on the costs side only temporary transition with costs per inpatient day by 13 % lower in the first two years occurred. Nevertheless, for 2005 subsample, we recognized no significantly different revenues and costs measures in the first two years and in the following years after corporatization, and hence a permanent effect was identified.

The ambiguous results of the legal form change on hospital financial performance are no surprising given the assumptions of the principal-agent theory. Corporatization hasn´t generated sufficient highpowered incentives as competitive markets and consequently the agency problem has not been effectively reduced. Bankruptcy only as a theoretical option, the appointment process of the board of directors remaining within the competence of the goverment-owner and a low threat on management turnover has not allowed for sufficient information asymmetry reduction. Moreover, the increase of the management´s autonomy in corporatized hospital may be accompanied by more freedom in self-interest seeking behaviour likely stimulating corruption practices in a hospital sector.

However, it must be recognized that there are some limitations of the study and the results must be interpreted with some prudence. Not only because a part of data are not available, but also because the available data can be biased to a certain extent due to different accounting rules followed by hospitals as contributory organizations and joint-stock companies. In further research, it is necessary to analyze the discrepancies in accounting figures and extract comparable information on hospitals of both legal forms. This shall be achieved only with improved practice of information disclosing, which is essentially the main policy recommendation of this thesis.

Lastly, we fully acknowledge that analyzing the relationship between corporatization and financial performance is only part of the problem. Quality of health care provision should also be considered in accomplishing our results.

Bibliography

AIVAZIAN, V., Y. GE & J. QIU (2005): "Can Corporatization Improve the Performance of SOEs even without Privatization?" Journal of Corporate Finance 11, 747-946.

ALBOUY, D. (2004): "Program Evaluation and the Difference in Difference Estimator." Department of Economics, University of California, Berkeley.

BENEDIKT, J. (2005): "Analýza Fungování Zdravotnických Zařízení v Různých Hospodářsko-Právních Formách." Důvodová Zpráva. Zasedáni Zastupitelstva Libereckého Kraje, 28.6.2005.

BILODEAU, N., C. LAURIN & A. R. VINING (2007): "Choice of Organizational Form Makes a Real Difference: The Impact of Corporatization on Government Agencies in Canada." Journal of Public Administration Research and Theory 17 (1): 119-147.

BORCHERDING, T. E. (1977): "Budgets and Bureaucrats: The Sources of Government Growth." Durham, NC: Duke University Press.

BOYNE, G. A. (2003): "Sources of Public Service Improvement: A Critical Review and Research Agenda." Journal of Public Administration Research and Theory 13 (3): 367-94.

BRAITHWAITE, J., J. F. TRAVAGLIA & A. CORBETT (2011): "Can Questions of the Privatization and Corporatization, and the Autonomy and Accountability of Public Hospitals, Ever be Resolved?" Health Care Analysis 19(2): 133-153.

BUCKLEY, J. & Y. SHANG (2003): "Estimating Policy and Program Effects with Observational Data: The "Differences-in-Differences" Estimator." Practical Assessment, Research & Evaluation, 8(24).

BURGESS, S. & M. RATTO (2003): "The Role of Incentives in the Public Sector: Issues and Evidence." Oxford Review of Economic Policy 19 (2): 285-300.

CAMBINI C., M. FILIPPINI, M. PIACENZA & D. VANNONI (2011): "Corporati-

zation and Firm Performance: Evidence from Publicly-Provided Local Utilities." Review of Law and Economics, 7, 1, 196-217.

CARNEIRO, C. A. DOS SANTOS (2011): "Essays on Health Economics: Equity and Access to Health Care and Public Hospital Performance under Corporatized Management." Faculty of Economics, University of Porto. Repositório Aberto da Universidade do Porto.

EECKLOO, K., K. DELESIE & A. VLEUGELS (2007): "Where is the Pilot? The Changing Shapes of Governance in the European Hospital Sector." The Journal of the Royal Society for the Promotion of Health, 127(2), 78-86.

EID, F. (2001): "Hospital Governance and Incentive Design: The Case of Corporatized Public Hospitals in Lebanon." World Bank Policy Research Working Paper No. 2727.

FIDLER, A. H., R. R. HASLINGER, M. M. HOFMARCHER, M. JESSE & T. PALU (2007): "Incorporation of Public Hospitals: A "Silver Bullet" against Overcapacity, Managerial Bottlenecks and Resource Constraints?" Case Studies from Austria and Estonia. Health Policy, 81, 328-338.

HANSMANN, H. (1996): "The Ownership of Enterprise." Cambridge, Mass: Harvard University Press. in HOWELL (1999).

HÁVA, P. & P. MAŠKOVÁ (2007): "The Corporatization of Hospitals." Proceedings of the Conference, 20.-21.9.2007. Faculty of Social Sciences, Charles University, Prague.

HEINRICH, C. J. & L. LYNN JR. (2001): "Means and Ends: A Comparative Study of Empirical Methods for Investigating Governance and Performance." Journal of Public Administration Research and Theory 11 (1): 109-38.

HILL, R. C., W. E. GRIFFITHS & G. C LIM (2008): "Principles of Econometrics." 4th edition. John Wiley and Sons, New Jersey.

HOWELL, B. (2000): "Ownership-Based Analysis of Public Hospital Corporatisation in New Zealand." Agenda, 7(3), 237-250.

HOWELL, B. (1999): "A Response to Vaithianathan´s The Failure of Corporatisation: Public Hospitals in New Zealand." New Zealand Institute for the Study of Competition and Regulation (ISCR).

JANEČEK, J. (2007): "Několik Poznámek k „Transformaci" Příspevkových Organizací Krajů." Dny veřejného práva. Masarykova univerzita, 2007. ISBN 978-80-210-4430-2.

Kahancová, M. & I. G. Szabó (2012): "Acting on the Edge of Public Sector: Hospital Corporatization and Collective Bargaining in Hungary and Slovakia." CELSI discussion paper No.1, 2012.

Laurin, C. & A. Vining (2012): "The Longer-Run Performance Effects of Corporatization: Theory and Evidence from Québec Agencies". European Institute for Advanced Studies in Management (EIASM).

Maning, A. (2006): "Differences-in-Differences and A Brief Introduction to Panel Data". Department of Economics, London School of Economics and Political Science.

Milgrom, P. & J. Roberts (1992): "Economics, Organization and Management." New York: Prentice-Hall.

Mueller, D. C. (1997): "Public Choice in Perspective." In Perspectives on Public Choice: A Handbook, ed. D.C. Mueller. Cambridge University Press: Cambridge.

Parker, D. & D. Saal (2003): "Introduction. In International handbook on privatization." ed. D. Parker and D. Saal, 1-21. Northampton, MA: Edward Elgar.

Preker A. S. & A. L. harding, edit. (2003): "Innovations in Health Service Delivery: The Corporatization of Public Hospitals." Washington, DC: World Bank Publications, 2003. 640 p. ISBN 978-0-8213-4494-1.

Procházková, J., Šťastná, L. (2011): "Efficiency of Hospitals in the Czech Republic" IES Working Paper 2/2011. IES FSV. Charles University.

Quenneville, M.-È., C. Laurin & N. Thibodeau (2010): "The Long Run Performance of Decentralized Agencies in Québec." In Governance of Public Sector Organizations: Autonomy, Control and Performance, eds. P. Lægreid and K. Verhoest. Basingstoke, UK: Palgrave Macmillan.

G. Rego, R. Nunes & J. Costa (2010): "The Challenge of Corporatisation: The Experience of Portuguese Public Hospitals." The European Journal of Health Economics, Vol. 1, No. 4, 2010, pp. 367-381.

Řehák, J. (2008): "Transformace Příspevkových Organizací na Obchodné Společnosti: Účetní Pojetí. Poradce Veřejné Správy [PVS], roč. 1, č.5, s. 30-36.

Shen, Y. (2003): "Changes in Hospital Performance After Ownership Conversions." Inquiry, 40(3), pp. 217-234.

Shen Y. (2002): "The Effect of Hospital Ownership Choice on Patient Out-

comes after Treatment for Acute Myocardial Infarction." Journal of Health Economics 21: 901-922.

SHEN, Y., K. EGGLESTON, J. LAU & C. SCHMID (2005): "Hospital Ownership and Financial Performance: A Quantitative Research Review." NBER Working Paper 11662.

TEO, S. (2000): "Evidence of Strategic HRM Linkages in Eleven Australian Corporatized Public Sector Organizations." Public Personnel Management 29 (4): 557-75.

TIEMANN, O. & T. SCHREYÖGG (2011): "Changes in Hospital Efficiency after Privatization." Hamburg Center for Health Economics.

TORRES-REYNA, O. (2009): "Panel Data Analysis: Fixed & Random Effects: Version 3.0." Princeton University. Princeton University Press, 2009.

VAITHIANATHAN, R. (1999): "The Failure of Corporatisation: Public Hospitals in New Zealand." Agenda 6(4):325-338.

Vávrová, H. (2007): "Akciové Společnosti a Příspevkové Organizace ve Zdravotnictví." Nová teorie správy společnosti CG pro neziskový sektor a její aplikace na vybrané instituce v ČR, 402/07/0563.

VILLALONGA, B. (2000): "Privatization and Efficiency: Differentiating Ownership Effects from Political, Organizational, and Dynamic Effects." Journal of Economic Behaviour & Organization, 42, 43-74.

WOOLDRIDGE, J. M. (2010): "Econometric Analysis of Cross Section and Panel Data." Second Edition, MIT Press, pp. 358-361.

WOOLDRIDGE, J. M. (2007): "What's New in Econometrics?." Imbens/Wooldridge Lecture Notes; Summer Institute 2007, Lecture 10: Differences-in-Differences Estimation, NBER.

WOOLDRIDGE, J. M. (2002): "Introductory Econometrics: A Modern Approach." 2nd Edition. South-Western College Publications, 2002. 896 p. ISBN(13) 978-0-3241-1364-8.

Appendix A
Methodology Notes

Unbiased diff-in-diff estimator

The regression function takes the following form

$$
E(y_{it}) = \begin{cases}
\alpha & TREAT = 0,\ POST = 0 \\
\alpha + \beta & TREAT = 1,\ POST = 0 \\
\alpha + \gamma & TREAT = 0,\ POST = 1 \\
\alpha + \beta + \gamma + \delta & TREAT = 1,\ POST = 1.
\end{cases}
$$

Hence the diff-in-diff estimator is unbiased

$$
\begin{aligned}
E\left[\hat{\delta}\right] &= E\left[(\overline{y}_{11} - \overline{y}_{01}) - (\overline{y}_{10} - \overline{y}_{00})\right] \\
&= E(\overline{y}_{11}) - E(\overline{y}_{01}) - E(\overline{y}_{10}) + E(\overline{y}_{00}) \\
&= \alpha + \beta + \gamma + \delta - \alpha - \gamma - \alpha - \beta + \alpha \\
&= \delta
\end{aligned}
$$

since $E(y_{it}) = \overline{y}_{it}$ (Albouy, 2004).

Appendix B
Tables

Table B.1: Corporatization in the Literature

Studies	Examined effect	Methodology
category 1:		
non-performance effect / hospitals		
Kahancová and Szabó (2012)	employment relations	cross-country analysis
		(applying theoretical mechanism how corporatization affects bargaining patterns, analysing health-care reforms and employment relations over time)
Eid (2001)	corporate board design in corporatized hospitals	application of the multitasking common agency model (analysis of interviews, documents, draft and legislation)
category 2:		
performance effect / non-hospitals		
Bradbury (1997)	return on equity, return on assets, return on revenues	comparative analysis of companies (cross-sectional and time series)
Aivazian et al. (2005)	return on assets, return on sales, real output per employee, real sales per employee, Investment to sales, Investment to assets	statistical procedure (fixed effect and random effect estimators)
Queneville et al. (2008)	output, productivity, financial performance, quality	statistical procedure (Wilcoxon signed-rank test)
Bilodeau et al. (2007)	output, revenues, ratio of revenues to expenditures, unit cost, labor productivity	statistical procedure (t-test, Wilcoxon signed-rank test)
Laurin and Vinning (2012)	revenues, revenues/expenditures, primary output, average cost, labor productivity	statistical procedure (confidence intervals, binomial proportion test)
Cambini et al. (2011)	production cost	econometric analysis (random effects estimator)
category 3:		
performance effect / hospitals		
Fidler et al. (2007)	no. of buildings, no. of beds, ALOS, bed occupancy, number of hospitalizations, annual turn-over	case study - no empirical evidence (comparisons across states)
Rego et al. (2010)	DEA efficiency measures	data envelopment analysis
Carneiro (2011)	cost per day, cost per patient, ALOS, case-mix index, social cases, caesereans, laparoscopic cholecystectomy, AMI treated intensively, surgical complications, mortality, decubitus ulcters, AMI mortality	econometric analysis (random effects estimator)

Table B.2: Analyzed Hospitals

No.	Hospitals (a.s.)	No.	Hospitals (p.o.)
1	Nemocnice České Budějovice, a.s.	8	Fakultní nemocnice Hradec Králové
2	Nemocnice Český Krumlov, a.s.	14	Nemocnice Jablonec nad Nisou, p.o.
3	Nemocnice Jindřichův Hradec, a.s.	16	Masarykova městská nemocnice Jilemnice
4	Nemocnice Písek, a.s.	17	Nemocnice s poliklinikou v Semilech
5	Nemocnice Prachatice, a.s.	18	Fakultní nemocnice u sv. Anny v Brně
6	Nemocnice Strakonice, a.s.	19	Nemocnice Milosrdných bratří Brno, p.o.
7	Nemocnice Tábor, a.s.	20	Fakultní nemocnice Brno
9	Oblastní nemocnice Jičín, a.s.	21	Vojenská nemocnice Brno
10	Oblastní nemocnice Náchod, a.s.	22	Nemocnice Ivančice, p.o.
11	Oblastní nemocnice Rychnov nad Kněžnou, a.s.	23	Nemocnice Břeclav, p.o.
12	Oblastní nemocnice Trutnov, a.s.	24	Městská nemocnice Hustopeče, p.o.
13	Nemocnice s poliklinikou Česká Lípa, a.s.	25	Nemocnice TGM Hodonín, p.o.
15	Krajská nemocnice Liberec, a.s.	26	Nemocnice Kyjov, p.o.
31	Chrudimská nemocnice, a.s.	27	Nemocnice Vyškov, p.o.
32	Pardubická krajská nemocnice, a.s.	28	Nemocnice Znojmo, p.o.
33	Svitavská nemocnice, a.s.	29	Fakultní nemocnice Olomouc
39	Bohumínská městská nemocnice, a.s.	30	Vojenská nemocnice Olomouc
40	Bílovecká nemocnice, a.s.	34	Nemocnice Krnov, p.o.
49	Domažlická nemocnice, a.s.	35	Nemocnice ve Frýdku-Místku, p.o.
50	Klatovská nemocnice, a.s.	36	Nemocnice Třinec, p.o.
52	Stodská nemocnice, a.s..	37	Nemocnice s poliklinikou Karviná-Ráj, p.o.
53	Rokycanská nemocnice, a.s.	38	Nemocnice s poliklinikou Havířov, p.o.
54	Krajská zdravotní, a.s. - Nem. Děčín	41	Slezská nemocnice v Opavě, p.o.
55	Krajská zdravotní, a.s. - Nem. Chomutov	42	Fakultní nemocnice Ostrava
56	Krajská zdravotní, a.s. - Nem. Most	43	Městská nemocnice Ostrava
57	Krajská zdravotní, a.s. - Nem. Teplice	44	Nemocnice Havlíčkův Brod, p.o.
58	Krajská zdravotní, a.s. - Masarykova nem.	45	Nemocnice Jihlava, p.o.
59	Nemocnice Rudolfa a Stefanie Benešov, a.s.	46	Nemocnice Pelhřimov, p.o.
60	Oblastní nemocnice Kladno, a.s.	47	Nemocnice Třebíč,. p.o.
62	Oblastní nemocnice Kolín, a.s.	48	Nemocnice v N. město na Moravě, p.o.
63	Oblastní nemocnice Mladá Boleslav, a.s.	51	Fakultní nemocnice Plzeň
64	Oblastní nemocnice Příbram, a.s.	61	Nemocnice Slaný, p.o.
73	Kroměřížská nemocnice, a.s.	65	Nemocnice Na Františku
74	Uherskohradišťská nemocnice, a.s.	66	Všeobecná fakultní nemocnice v Praze
75	Vsetínská nemocnice, a.s.	67	Fakultní Thomayerova nem. s poliklinikou
76	Krajská nemocnice T. Bati, a.s.	68	Nemocnice na Homolce
		69	Fakultní nemocnice v Motole
		70	Fakultní nemocnice Na Bulovce
		71	Ústřední vojenská nemocnice Praha
		72	Fakultní nemocnice Královské Vinohrady
		77	Městská nemocnice v Litoměřicích

Notes: Official names as of 2011. No. denotes the number of the hospital as used in our excel spreadsheet.

Table B.3: Correlation Matrix – Independent Variables

	doc_bed	nur_bed	size_1	size_3	beds_ut	teach	unempl	salary	compet	city
doctors_bed	1.0000									
nurses_bed	0.6711	1.0000								
size_1	-0.2093	-0.2816	1.0000							
size_3	0.2060	0.2492	-0.4467	1.0000						
beds_utilization	-0.1849	-0.1444	0.1281	-0.0692	1.0000					
teaching_status	0.3077	0.3168	-0.2190	0.4902	-0.0712	1.0000				
unemployment	-0.2511	-0.2312	-0.0085	0.0227	0.0980	-0.2523	1.0000			
salary	0.5040	0.4659	-0.1058	0.2814	-0.0447	0.4813	-0.4310	1.0000		
competition	0.1393	0.1820	-0.0769	0.1911	0.1615	0.2650	0.0447	0.4627	1.0000	
city	0.2590	0.3521	-0.1937	0.3944	-0.0068	0.6149	-0.0623	0.4424	0.3527	1.0000

($obs = 809$)

Collinearity Diagnostics

Table B.4: VIF and PCA

	VIF test		PCA	
Variable	VIF	Tolerance	Eigenval	Cond Index
doctors_bed	1.95	0.5134	1.4523	2.3565
nurses_bed	1.97	0.5076	0.6389	3.5529
size_1	1.40	0.7135	0.2872	5.2996
size_3	1.71	0.5839	0.2149	6.1256
beds_utilization	1.16	0.8606	0.1516	7.2928
teaching_status	2.34	0.4268	0.1172	8.2951
unemployment	1.61	0.6221	0.0416	13.9233
salary	2.65	0.3772	0.0181	21.0868
competition	1.76	0.5673	0.0102	28.0728
city	2.14	0.4666	0.0030	52.1188
Mean VIF	1.87		Condition number	52.1188
(obs = 809)				

Note: Only observations with available dependent variable analyzed

VIF – Variance inflation factor

PCA – Principal component analysis

Table B.5: Variance-Decomposition Proportions

	1	2	3	4	5	6	7	8	9	10	11
intercept (1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
doctors_bed (2)	0.00	0.00	0.00	0.12	0.03	0.00	0.07	0.00	0.00	0.00	0.03
nurses_bed (3)	0.00	0.00	0.00	0.43	0.03	0.00	0.14	0.01	0.00	0.00	0.04
size_1 (4)	0.00	0.00	0.00	0.23	0.65	0.00	0.02	0.00	0.00	0.01	0.22
size_3 (5)	0.00	0.01	0.00	0.07	0.11	0.00	0.32	0.08	0.00	0.00	0.51
beds_utilization (6)	0.00	0.01	0.01	0.04	0.15	0.00	0.40	0.40	0.00	0.01	0.11
teaching_status (7)	0.00	0.02	0.01	0.00	0.01	0.00	0.02	0.04	0.00	0.65	0.04
unemployment (8)	0.01	0.33	0.02	0.08	0.01	0.07	0.00	0.11	0.01	0.05	0.01
salary (9)	0.00	0.51	0.93	0.02	0.00	0.01	0.01	0.00	0.01	0.00	0.02
competition (10)	0.00	0.11	0.01	0.00	0.00	0.36	0.01	0.14	0.52	0.06	0.00
city (11)	0.98	0.00	0.02	0.00	0.00	0.56	0.00	0.23	0.45	0.22	0.02

Table B.6: Collinearity Statistics and Critical Values

Statistic:	VIF	Tolerance	Eigenval	Cond Index	Proportion of Variation
Critical values	> 10	< 0.1	< 0.01	> 50	> 0.7

Notes: Critical values only as a warning signals of multicollinearity (i.e. rule of thumb).

Table B.7: Corporatization Effect in 2003 & 2004

Hausman-Taylor Estimation Results

Variables/Model	rev_days	cost_days	rev_inpat	cost_inpat
CORP	-0.228**	-0.228**	-0.229*	-0.220**
	(0.101)	(0.096)	(0.119)	(0.103)
POST	0.138**	0.105*	0.0560	0.023
	(0.053)	(0.054)	(0.050)	(0.055)
$CORP \times POST^a$	0.160***	0.189***	0.048	0.076
	(0.044)	(0.043)	(0.044)	(0.048)
beds_utilization	-0.784***	-0.805***	-0.389**	-0.405**
	(0.186)	(0.183)	(0.156)	(0.149)
doctors_bed	0.258***	0.262***	0.180**	0.185**
	(0.067)	(0.065)	(0.073)	(0.067)
nurses_bed	0.892***	0.888***	0.611***	0.613***
	(0.130)	(0.142)	(0.111)	(0.119)
salary	0.842***	0.879***	0.837***	0.870***
	(0.206)	(0.189)	(0.200)	(0.184)
unemployment	0.110***	0.0996***	0.0975***	0.086***
	(0.025)	(0.026)	(0.024)	(0.024)
competition	-0.152	-0.0188	-0.254	-0.129
	(0.278)	(0.265)	(0.255)	(0.212)
city	0.166	0.0969	0.129	0.080
	(0.124)	(0.113)	(0.119)	(0.134)
size_1	-0.0739	-0.124	-0.034	-0.068
	(0.106)	(0.087)	(0.114)	(0.150)
size_3	-0.247	-0.224	-0.265	-0.244
	(0.187)	(0.174)	(0.212)	(0.172)
teaching_status	0.372	0.431	0.519	0.544*
	(0.311)	(0.300)	(0.314)	(0.320)
constant	-3.809**	-3.656**	-2.963	-2.978*
	(1.785)	(1.701)	(1.892)	(1.628)
No. of Hospitals	51	51	51	51
No. of Observations	362	362	362	362
F/Wald chi-sq test	231.210	208.860	1014.660	1064.370
(p-value)	0.000	0.000	0.000	0.000
Sargan_Hansen statistic	3.551	3.634	4.023	5.109
(p-value)	0.616	0.603	0.546	0.403

Notes: Standard errors in parentheses. Either cluster robust or bootstrapped standard errors reported (following the conservative principle defined in chapter 5).

$*p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[a] Coefficients represent the differences of the financial performance of hospitals in the treatment group relative to performance in the control group after corporatization.

Regression equation in log-log form.

Table B.8: Corporatization Effect in 2005

Hausman-Taylor Estimation Results

Variables/Model	rev_days	cost_days	rev_inpat	cost_inpat
CORP	0.272**	0.222**	0.0898	0.046
	(0.123)	(0.086)	(0.123)	(0.105)
POST	0.237***	0.244***	0.186***	0.195***
	(0.034)	(0.031)	(0.0312)	(0.031)
$CORP \times POST^a$	-0.109**	-0.0601*	-0.0753	-0.026
	(0.053)	(0.033)	(0.0683)	(0.047)
beds_utilization	-0.478***	-0.529***	-0.151	-0.198*
	(0.182)	(0.147)	(0.148)	(0.118)
doctors_bed	0.235***	0.293***	0.124**	0.183***
	(0.061)	(0.053)	(0.0559)	(0.058)
nurses_bed	0.586***	0.523***	0.394***	0.319***
	(0.177)	(0.166)	(0.127)	(0.106)
salary	0.514***	0.275*	0.431***	0.197
	(0.148)	(0.163)	(0.146)	(0.169)
unemployment	0.177***	0.178***	0.152***	0.154***
	(0.027)	(0.030)	(0.0227)	(0.024)
competition	0.133	0.168	-0.0652	-0.016
	(0.160)	(0.174)	(0.167)	(0.168)
city	0.205	0.174	0.236	0.212
	(0.254)	(0.147)	(0.258)	(0.209)
size_1	0.00476	-0.0313	0.182	0.149
	(0.250)	(0.135)	(0.273)	(0.195)
size_3	-0.301	-0.314	-0.214	-0.232
	(0.182)	(0.193)	(0.195)	(0.169)
teaching_status	0.649	0.768**	0.528	0.639
	(0.547)	(0.324)	(0.569)	(0.468)
constant	-3.599	-0.748	-2.196	0.457
	(2.616)	(2.067)	(2.593)	(2.466)
No. of Hospitals	409	410	409	410
No. of Observations	55	55	55	55
F/Wald chi-sq test	772.350	263.010	430.850	512.130
(p-value)	0.000	0.000	0.000	0.000
Sargan_Hansen statistic	5.312	5.526	4.791	3.988
(p-value)	0.379	0.3551	0.4419	0.5512

Notes: Standard errors in parentheses. Either cluster robust or bootstrapped standard errors reported (following the conservative principle defined in chapter 5).

$*p < 0.10$, $** \ p < 0.05$, $*** \ p < 0.01$

[a] Coefficients represent the differences of the financial performance of hospitals in the treatment group relative to performance in the control group after corporatization.

Regression equation in log-log form.

Table B.9: Corporatization Effect in 2006 & 2007

Hausman-Taylor Estimation Results

Variables/Model	rev_days	cost_days	rev_inpat	cost_inpat
CORP	-0.188	-0.182	-0.286	-0.262
	(0.233)	(0.167)	(0.246)	(0.206)
POST	0.270***	0.295***	0.257***	0.285***
	(0.047)	(0.037)	(0.033)	(0.031)
$CORP \times POST^a$	0.036	0.071	0.097	0.133
	(0.165)	(0.161)	(0.130)	(0.179)
beds_utilization	-0.356	-0.401**	-0.008	-0.050
	(0.220)	(0.184)	(0.143)	(0.158)
doctors_bed	0.117	0.169	-0.008	0.040
	(0.112)	(0.105)	(0.085)	(0.088)
nurses_bed	0.516**	0.423**	0.317**	0.215*
	(0.229)	(0.178)	(0.143)	(0.116)
salary	0.537***	0.249	0.305*	0.027
	(0.182)	(0.193)	(0.168)	(0.163)
unemployment	0.145***	0.157***	0.131***	0.143***
	(0.025)	(0.031)	(0.022)	(0.027)
competition	-0.185	-0.125	-0.329*	-0.234
	(0.195)	(0.221)	(0.185)	(0.185)
city	0.391	0.354*	0.415	0.344
	(0.323)	(0.197)	(0.356)	(0.262)
size_1	0.142	0.106	0.308	0.249
	(0.307)	(0.205)	(0.334)	(0.266)
size_3	-0.285	-0.331*	-0.216	-0.259
	(0.200)	(0.180)	(0.238)	(0.240)
teaching_status	0.305	0.522	0.345	0.619
	(0.669)	(0.427)	(0.759)	(0.541)
constant	-5.617	-2.387	-3.039	0.326
	(3.468)	(2.816)	(3.451)	(2.811)
No. of Hospitals	50	50	50	50
No. of Observations	316	317	316	317
F/Wald chi-sq test	550.450	631.380	539.020	529.260
(p-value)	0.000	0.000	0.000	0.000
Sargan_Hansen statistic	2.601	3.819	3.416	3.977
(p-value)	0.7613	0.5758	0.6362	0.5527

Notes: Standard errors in parentheses. Either cluster robust or bootstrapped standard errors reported (following the conservative principle defined in chapter 5).

$*p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[a] Coefficients represent the differences of the financial performance of hospitals in the treatment group relative to performance in the control group after corporatization.

Regression equation in log-log form.

Table B.10: Permanency of the Corporatization Effect in 2003 & 2004

Hausman-Taylor Estimation Results

Variables/Model	rev_days	cost_days	rev_inpat	cost_inpat
CORP	-0.193**	-0.190**	-0.187*	-0.177*
	0.091	0.092	0.106	0.100
POST	0.179***	0.147***	0.090**	0.057
	0.044	0.046	0.041	0.042
CORP × POST[a]	0.189***	0.218***	0.069	0.098**
	0.044	0.042	0.045	0.043
TEMP	-0.124**	-0.124**	-0.095*	-0.095*
	0.058	0.053	0.055	0.051
beds_utilization	-0.747***	-0.768***	-0.362**	-0.382**
	0.196	0.192	0.168	0.165
doctors_bed	0.236***	0.240***	0.164**	0.169**
	0.067	0.067	0.076	0.074
nurses_bed	0.868***	0.864***	0.591***	0.590***
	0.129	0.143	0.112	0.126
salary	0.714***	0.750***	0.745***	0.779***
	0.186	0.171	0.181	0.165
unemployment	0.111***	0.101***	0.099***	0.088***
	0.025	0.026	0.024	0.025
competition	-0.0185	0.112	-0.110	0.021
	0.213	0.200	0.194	0.182
city	0.143	0.082	0.115	0.069
	0.122	0.117	0.117	0.115
size_1	-0.0975	-0.141	-0.050	-0.081***
	0.101	0.093	0.107	0.102
size_3	-0.257	-0.236	-0.264	-0.243
	0.195	0.186	0.207	0.191
teaching_status	0.457	0.505	0.558*	0.579*
	0.335	0.336	0.332	0.337
constant	-2.948*	-2.863*	-2.494	-2.555
	1.706	1.630	1.766	1.621
No. of Hospitals	51	51	51	51
No. of Observations	362	362	362	362
F/Wald chi-sq test	229.260	208.860	1014.660	1064.370
(p-value)	0.000	0.000	0.000	0.000
Sargan_Hansen statistic	4.227	3.915	4.798	4.534
(p-value)	0.517	0.561	0.441	0.475

Notes: Standard errors in parentheses. Either cluster robust or bootstrapped standard errors reported (following the conservative principle defined in chapter 5). *$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. [a] Coefficients represent the differences of financial performance of hospitals in the treatment group relative to performance in the control group after corporatization. Regression equation in log-log form.

Table B.11: Permanency of the Corporatization Effect in 2005

Hausman-Taylor Estimation Results

Variables/Model	rev_days	cost_days	rev_inpat	cost_inpat
CORP	0.271***	0.221**	0.090	0.046
	0.005	0.086	0.121	0.090
POST	0.234***	0.242***	0.184***	0.194***
	0.000	0.033	0.032	0.032
$CORP \times POST^a$	-0.119**	-0.067*	-0.083	-0.031
	0.011	0.035	0.068	0.042
TEMP	0.026	0.019	0.021	0.011
	0.619	0.054	0.054	0.056
beds_utilization	-0.483***	-0.533***	-0.155	-0.200
	0.006	0.147	0.144	0.125
doctors_bed	0.244***	0.300***	0.131**	0.187***
	0.000	0.056	0.059	0.056
nurses_bed	0.593***	0.528***	0.399***	0.322***
	0.003	0.170	0.129	0.107
salary	0.515***	0.276	0.432***	0.197
	0.001	0.164	0.155	0.170
unemployment	0.182***	0.181***	0.156***	0.156***
	0.000	0.028	0.021	0.026
competition	0.110	0.152	-0.083	-0.025
	0.544	0.183	0.176	0.159
city	0.212	0.177	0.238	0.211
	0.170	0.142	0.254	0.136
size_1	0.011	-0.028	0.184	0.149
	0.941	0.131	0.248	0.127
size_3	-0.300	-0.313	-0.215	-0.233
	0.109	0.194	0.176	0.200
teaching_status	0.638*	0.762**	0.529	0.644**
	0.063	0.313	0.495	0.275
constant	-3.581*	-0.721	-2.149	0.504
	0.054	2.031	2.195	1.806
No. of Hospitals	409	410	409	410
No. of Observations	55	55	55	55
F/Wald chi-sq test	247.700	249.280	516.930	1400.950
(p-value)	0.000	0.000	0.000	0.000
Sargan_Hansen statistic	5.312	5.526	4.791	3.988
(p-value)	0.379	0.355	0.442	0.551

Notes: Standard errors in parentheses. Either cluster robust or bootstrapped standard errors reported (following the conservative principle defined in chapter 5). $*p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. ^{a} Coefficients represent the differences of financial performance of hospitals in the treatment group relative to performance in the control group after corporatization. Regression equation in log-log form.

Table B.12: Permanency of the Corporatization Effect in 2006 & 2007

Hausman-Taylor Estimation Results

Variables/Model	rev_days	cost_days	rev_inpat	cost_inpat
CORP	-0.186	-0.180	-0.285	-0.261
	0.187	(0.148)	(0.217)	(0.185)
POST	0.270***	0.295***	0.257***	0.285***
	0.045	(0.039)	(0.037)	(0.029)
$CORP \times POST^a$	0.054	0.084	0.108	0.140
	0.178	(0.177)	(0.142)	(0.156)
TEMP	-0.034	-0.026	-0.022	-0.014
	0.042	(0.039)	(0.042)	(0.042)
beds_utilization	-0.352	-0.398**	-0.005	-0.048
	0.235	(0.200)	(0.165)	(0.143)
doctors_bed	0.115	0.168*	-0.010	0.039
	0.103	(0.010)	(0.082)	(0.087)
nurses_bed	0.517**	0.424**	0.318**	0.215*
	0.228	(0.185)	(0.139)	(0.113)
salary	0.545***	0.255	0.311*	0.0302
	0.165	(0.163)	(0.168)	(0.175)
unemployment	0.144***	0.156***	0.130***	0.142***
	0.022	(0.031)	(0.019)	(0.028)
competition	-0.176	-0.118	-0.323*	-0.230
	0.193	(0.202)	(0.169)	(0.184)
city	0.382	0.347*	0.410	0.340
	0.248	(0.196)	(0.356)	(0.243)
size_1	0.135	0.101	0.304	0.247
	0.266	(0.214)	(0.331)	(0.230)
size_3	-0.280	-0.328	-0.213	-0.257
	0.181	(0.215)	(0.238)	(0.230)
teaching_status	0.310	0.525	0.347	0.622
	0.570	(0.406)	(0.762)	(0.465)
constant	-5.642**	-2.407	-3.066	0.310
	2.723	(2.731)	(3.196)	(2.611)
No. of Hospitals	50	50	50	50
No. of Observations	316	317	316	317
F/Wald chi-sq test	630.850	601.770	646.640	578.400
(p-value)	0.000	0.000	0.000	0.000
Sargan_Hansen statistic	2.780	3.934	3.510	4.005
(p-value)	0.836	0.686	0.743	0.676

Notes: Standard errors in parentheses. Either cluster robust or bootstrapped standard errors
reported (following the conservative principle defined in chapter 5). $*p < 0.10$, ** $p < 0.05$,
*** $p < 0.01$. ^{a} Coefficients represent the differences of financial performance of hospitals
in the treatment group relative to performance in the control group after corporatization.
Regression equation in log-log form.

Appendix C
Content of Enclosed CD

There is a CD enclosed to this thesis which contains:

- LaTeX source code and `.pdf` version of this thesis.

- `Stata` source code of the empirical part of this thesis.

- Sample of the dataset used in the analysis in `xls.` format.