

**CHARLES UNIVERSITY IN PRAGUE**

FACULTY OF SOCIAL SCIENCES

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Bachelor thesis

**Determination of firm boundaries:  
Influence of regulations and rule of law  
on firm size**

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Prague, May 7, 2015

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Signature

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## Abstract

Study of determinants of firm size is important for policy making and economic theory, because much of economic growth takes place within firms and firms are prevailing form of organisation of production units in modern economies. Theory offers contradictory views on effect of quality of regulations and rule of law on firm size. Better regulatory quality in the environment of post-soviet countries enables firms to become larger. In the case of rule of law, the relationship seems to be rather fragile and of a more complex nature with ambiguous effects, hence the matter remains subject of future research. Regulatory quality and rule of law explain only very little part of variations in growth rates of firms.

**Keywords:** firm size determination, quality of regulations, rule of law, industrial organisation

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## Abstrakt

Studium determinantů velikosti firem je důležité pro vytváření politik i ekonomickou teorii, protože velká část ekonomického růstu je způsobena růstem existujících firem a firmy jsou převažující formou organizace produkčních jednotek v moderních ekonomikách. Teorie přináší protichůdné pohledy na vliv kvality regulace a právního státu na velikost firem. V prostředí postsovětských zemí je růst kvality regulace spojený s růstem velikosti firem. Vztah kvality právního státu a velikosti firem v tomto prostředí se jeví jako slabý a má komplexnější podstatu, tudíž tato záležitost zůstává otevřená pro další výzkum. Kvalita regulace a právního státu vysvětluje jen velmi malou část rozdílů v rychlosti růstu firem.

**Keywords:** determinace velikosti firem, kvalita regulace, kvalita právního státu, průmyslová organizace

# Bachelor Thesis Proposal

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<b>Proposed topic</b>	Determination of firm boundaries: Influence of regulations and rule of law on firm size

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**Topic characteristics** The aim of the thesis is to find out the nature of relations between firm size and conditions in which the firm operates, namely characteristics of the institutional framework.

If the results turn out to be interesting, it could help policymakers to establish rules and policies in a way which would promote economic growth, design corporate law in a manner which would not interfere with natural development of the organizational structure of the economy. Also, in broader sense, the implications could help entrepreneurs in designing optimal business model for specific conditions.

I will work with data on size distributions of firms in different post-soviet countries and time periods and information on the nature of business environment in the specific countries and time periods, because the specific environment of post-soviet countries may alter the results of similar analysis which had been already performed on samples of different countries in both developed and developing world. I will project relevant characteristics of different institutional frameworks in those countries and changes of those over time and in the end look into the relations of all of these through various regressions of the obtained data.

## Hypotheses

- Rule of law and better quality of regulations enables growth in size of firms

- Institutional characteristics such as rule of law or quality of regulations are a good starting point for determination of optimal firm size
- The specifics of the culture in post-soviet countries may have an influence on the way institutional factors determine optimal firm size

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# Chapter 1

## Introduction

Size of firms is a fascinating field of study, because the mechanics behind it influence a great deal of organisation of economic activities.

Firstly, the study of determination of boundaries between firms has many practical implications. The boundaries between firms are crucial for financing decisions, the insight may be really helpful for the actors on financial markets. Research in the optimal firm size and factors determining it may also bring highly practical suggestions for planning of mergers and acquisitions. What is more, research on the best managerial techniques and organisational hierarchies within firms, which may improve the day-to-day efficiency of firms can utilize insights of the mechanisms of determination of boundaries of firms as well. Also, a big part of economic growth takes place within organisational structures with growth of their size (Rajan & Zingales, 1998). Because of that, it is extremely useful to know what the incentives of growth of firms when thinking about factors behind economic growth in general are.

Secondly, the study of firm size contributes to the overall framework of economics. It is necessary to think about the organisational structure of economy in order to apply the implications of both microeconomics and macroeconomics at convenient organisational levels and within the organisational boundaries. If microeconomics offers insights into behaviour of individual actors in the marketplace and macroeconomics into the phenomena in economy as a whole, third view on how the individual

actors (and on what levels) are formed is needed. When looking at the real world economy of 21<sup>st</sup> century, it is clear firms play crucial role in its organisational structure and in the way production factors are channeled into the production process. If we understood the process of determination of boundaries between firms, it would greatly contribute to understanding of firms itself, which is crucial for understanding of the workings of the whole economy with implications for both analysis and policymaking.

Most of comprehensive theory of a firm builds on the classic paper by Coase (1937), who identified a key role of transaction costs in the process of creation of firms, because some transaction costs may be diminished by internal firm organisational structure rather than by market mechanisms based on price signals (Cheung 1983; Powell 1990). The factors determining firm size can be viewed from different perspectives, ranging from neoclassical view based on technological factors (Kremer, 1993), elaboration on Coase's organisational view of transaction costs (e.g. Cordes et al., 2008) to rather recent studies based on the theory of networks (Beinhocker, 2007). Unfortunately, the most recent findings in the field have not yet been fully incorporated in a really broad theoretical framework, as most of the research concentrates more or less on particular issues. Vast variety of the general implications of those theories has been successfully empirically tested, e.g. Kumar, Rajan & Zingales (2001) show that firms in capital-intensive industries tend to be larger.

Better rule of law is needed for effective managerial control within a larger firm on one side (Yi Man Li, 2008), while on the other improves efficiency of market contracts, and thus lessens the incentive to organise more activities within firms without efficiency-driving price signals (Khanna & Palepu, 2000; Pascali, 2009). The theory does not give any definite answer on which of these forces is stronger in what circumstances.

Similarly, low quality of regulations is seen as a fixed cost for firms on one side and as such drive them to become larger (Klapper, Laeven & Rajan, 2006; Brad-

ford, 2004). On the other side, distortive regulations often favour smaller firms and discourage organisation of production within larger firms in general (Ardagna & Lusardi, 2008; Nystrom, 2008). Once again, the theory has no predictive power on which of these forces is stronger and similarly, as for the quality of legal framework, the definite answer remains to be an empirical question and, as both of these institutional factors are important in firm size determination, the whole problem deserves careful consideration.

The objective of this thesis is to synthesise factors of firm determination from various parts of economic theory and to enrich empirical findings in one particular field where the theory gives contradictory implications - overall effects of changes in the quality of regulations and legal framework on firm size. This is done on a sample of the post-soviet countries. Theoretical conclusions have not been tested on these before and the post-soviet specifics may alter the results of the analysis compared to other regions where similar empirical studies have been carried (e.g. on the case of US Calcagno & Sobel, 2013). The organisational structure within economy is a result of broad behavioural patterns deeply rooted in the society, the cultural differences specific for post-soviet countries may have strong effect on the workings of the mechanisms determining firm size.

The thesis is structured as follows: section 2 builds a broad theoretical framework for determination of size of firms and its implications for the regulations and rule of law. Section 3 utilizes the theory in empirical application on post-soviet countries - where section 3.1 describes the methodology, section 3.2 used data and section 3.3 presents the results. Finally, section 4 presents conclusions based on the analysis and recommendations for future research.

# Chapter 2

## Theoretical framework

### 2.1 Definition of firm

There is some common understanding of what a firm is. If one says Apple or the local bakery, it pretty easily creates an image of legal entity guiding an institution, where managers organise workforce and capital in production of goods or services. However, when looking at how businesses operate in detail, the image of a firm becomes somehow blurred.

Definition of a firm based on the legal entity is straightforward, but it turns out to be too meretricious concept for economic analysis, because the boundaries drawn by law are rather artificial and do not necessarily correspond to the division of real power and hierarchical control, decision-making and economic activities guiding the production of goods and services. Even such technocratic body as eurostat recognises this phenomenon in its definition of enterprise:

An enterprise is defined as the smallest combination of legal units that is an organisational unit producing goods or services, which benefits from a certain degree of autonomy in decision-making, especially for the allocation of its current resources. An enterprise carries out one or more activities at one or more locations. (OECD 2001, p.1)

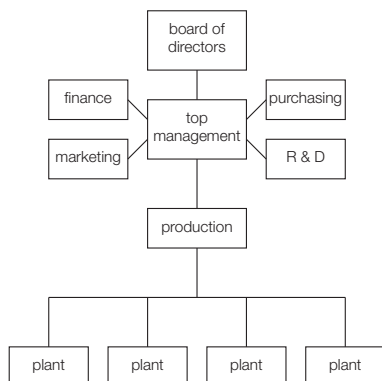
What is a certain degree of autonomy? Is it connected with the legal boundaries between firms? The Property Rights view suggests (Grossman & Hart, 1986) that the common ownership of assets is what matters and makes clear-cut distinction between control exercised via property rights and contracts with other entities (e.g. because of the residual rights not covered by contracts). However, when confronted with real-world examples, it seems this practical distinction cannot cover the complexity of differences between organisational structures of different firms. Some uniquely owned unique legal entities give an unprecedented autonomy to its different plants. On the other side, some production processes and patterns performed by distinct legal entities owned by many different owners may be thought of as a firm in the economic sense as e.g. the control of Toyota over its suppliers may be of great strength because of the limited use of their products (Kumar, Rajan & Zingales, 2001).

If we stick to a merely practical point of view, we can use the definition given by Alfred D. Chandler, who sees firm as a

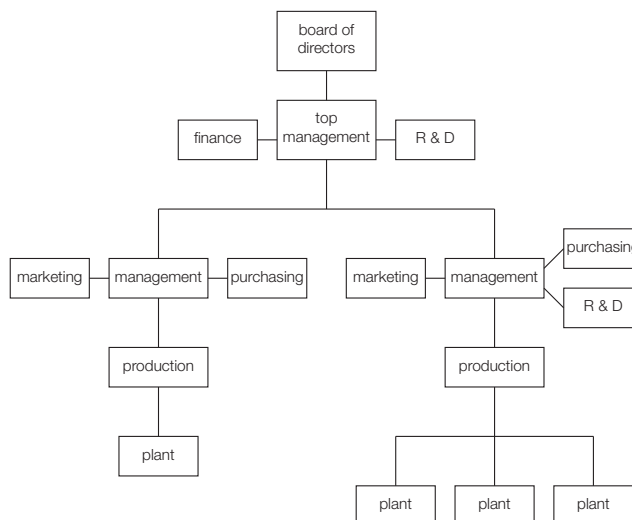
Collection of operating units, each with its own specific facilities and personnel, whose combined resources and activities are coordinated, monitored, and allocated by a hierarchy of middle and top managers. It is the existence of this hierarchy that makes the activities and operations of the whole enterprise more than the sum of its operating units (Chandler 1994, p.15)

It is clear firms may embody many different forms. The unit of production may be only one separate plant or an international institution with dozens of branches. A common feature is some kind of organisation of the production procedure, where inputs are transformed into goods, services or other outputs and sold in a profit maximising way. Typically, these activities are under control of top management, which is supervised by a body such as board of directors which, to some extent, represents the owners of the firm. Managers also take care of assets of the firm. The functional structures may vary greatly in both the degree of centralisation and autonomy of different branches (Shepherd & Shepherd, 2004).

Figure 2.1: Different functional structures of a firm  
 FIRM 1



FIRM 2



Firm with such a managerial hierarchy where management is separated from the owners of the firm is historically relatively new phenomenon and emerged only with development of technologies which are connected to large economies of scale. The hierarchies were usually created along the functional lines. Of course, it is extremely difficult to generalise in how the modern corporations of today evolved from the simple entrepreneurship, Alfred Chandler described the typical process as follows:

Each function was administered by a department. The largest and first to be formed were those for production and sales, with a smaller one for purchasing. At the headquarters of these functional departments middle managers coordinated and monitored the activities of the lower-level managers who administered the enterprise's operating units - its several factories, its sales and purchasing offices, and its research laboratories. (Chandler 1994, p.32)

All the definitions given so far were more or less results of practical perception of a firm, but it is necessary to be aware of the underlying theoretical assumptions.

Most of the neoclassical microeconomics was built upon a firm as a black-box and, to some extent, exogenous entity (Spulber, 2009). It is a building bloc of the the-

ory, basic unit following the predicted behavioural patterns in the marketplace, but studied merely from outside. As firms and their structure have great influence on day-to-day workings of the economy, comprehensive theory explaining the internal mechanisms behind existence of firms was needed.

On one side, in the neoclassical view of complete contracts, fully informed and rational agents leave the firm to be fully described by its production function. Firm is seen as

a production set that transforms one set of commodities into another, and a market as a coming together of firms and consumers to exchange commodities (Milgrom & Roberts 1988, p.456)

But as the role of information asymmetry is crucial for the organisation of firms, the neoclassical view offers only very limited insights.

On the other side, view of incomplete contracts elaborates on the transaction costs and offers much more valuable implications for real world problems. This piece of theory builds upon the work of R. H. Coase and his groundbreaking paper "The Nature of the Firm" from 1937. Coase was well aware of the importance of precise definition of firm. In his work, the central distinguishing element is that many processes in the economic activities in production patterns (such as allocation of factors of production) are not governed by the price mechanism (as neoclassical economics assumes). Quite the contrary, within firms, decision-making is based on the hierarchical power without direct tie to price signals.

If a workman moves from department Y to department X, he does not go because of a change in relative prices, but because he is ordered to do so. Those who object to economic planning on the grounds that the problem is solved by price movements can be answered by pointing out that there is planning within our economic system which is quite different from the individual planning mentioned above and which is akin to what is normally called economic planning. (Coase 1937, p.388)

From this point of view, firms can be seen as cells playing unconsciously a role in a larger organism based on price signals and market forces (only trying to maximise their profit), while the workings of the cells itself are determined by managerial control within the firms (Dobb, 1925).

It may be insightful to think about firms and structure of their boundaries within economies in a broader context. Definite boundaries between individual firms are very hard to draw, patterns within some companies (as legal entities) may act as firms within firms. The managerial structure may vary with different functional purposes, central authority may be exercised in some situations and autonomous decision-making in other. Decisions in relationships between distinct legal entities may be guided by price signals to some extent while the production process interdependencies still matter somehow. The whole structural form of ties of power, control, ownership, decision-making, production processes and so on in the economy is a rather complicated network. This new perspective on boundaries of firms may utilise implications about economies of scale or complexity problems of the theory of networks and therefore should be incorporated into the analysis of factors behind size of firms as well (Beinhocker, 2007).

## **2.2 Reasons why firms exist**

Why do firms exist? Naturally, there are many different reasons, but most of them go down to the simple fact it is efficient. Lets start with the classic transaction costs view which has a great explanatory power.

Why the price system cannot ensure guidance for production? Why is any organisation needed at all with all the market forces acting towards efficiency? The neoclassical assumptions needed for market transactions to be the best possible option are not met in the real world. While the price signals may work in theory, discovering and assigning the relevant prices is not costless. This information imperfection yields costs to every additional contract negotiated on the market. Intuitively, it may be

more efficient to make one lump-sum contract instead of dozens of similar ones, e.g. to employ a worker for a certain period of time instead of contracting every little bit of work he does, as these activities are hard to predict and bargaining costs would surely occur if separate contracts would needed to be negotiated for every new task the worker does. In this situation, when the transaction costs are high, the inefficiencies of central planning within an economic unit caused by imperfect information available to the manager may be overweighted. Similar logic as for the employed worker may be used in explaining why organisation within a firm between suppliers and receivers of commodities may be desirable. The market-based contracts are inefficient because of uncertainty about future and inability to asses the risks between the sides of the contract in a way so that unpredicted changes would incentivise behaviour which would lead to economically efficient outcomes, no matter what the unpredicted changes are. The borderline of this classic view is that the driving force in forming firms in the market is the uncertainty about future which makes it impossible to eliminate transaction costs and therefore makes authoritarian decision-making within certain hierarchy more efficient in certain cases (Coase, 1937)

Walter W. Powel summarizes in his 1990 paper "Neither market nor hierarchy: network forms of organization" the specifics of different transactions as follows:

transactions that involve uncertainty about their outcome, that recur frequently and require substantial "transactionspecific investments" of money, time or energy that cannot be easily transferred are more likely to take place within hierarchically organized firms. Exchanges that are straightforward, nonrepetitive and require no transaction specific investment will take place across a market interface. Hence transactions are moved out of markets into hierarchies as knowledge specific to the transaction (asset specificity) builds up. When this occurs, the inefficiencies of bureaucratic organization are preferred to the relatively greater costs of market transactions. (Powell 1990, p. 303)

Steven Cheung elaborates on one specific element of transaction costs - measurement costs (in form of costs of knowing the product), which had been somehow omitted by Coase, and gives more intuitive explanation of how this factor incentivises emergence of firms:

Reaching agreement on the price of a spring inside a camera incurs a proportionately higher cost than does the camera. Although the consumer has the final say in assessing the worth of the whole product, he cannot be expected to recognize the value of each component part he may not even know what some of them are or even that they exist.... ...for a component which by itself has no readily identifiable value, agreement on price is less costly between specialists and input owners than it would be between input owners and consumers or between specialists and consumers. The one who produces component parts tends to know more about them than the one who consumes (Cheung 1983, p.209)

From the institutional point of view, it is important to realise how government policies influence the nature and scope of firms. Given all the organisational reasoning above, it is highly counter-intuitive to take institutional factors as the driving force behind creation of firms in economy. However, the distorting effects imposed by the government policies may have huge consequences regarding our analysis. Two major institutional elements with impact on firms are the financing and regulatory framework.

As can be seen on many real-world examples, lots of regulations of entrepreneurship apply only to entrepreneurs of certain legal nature or size (e.g. Italian Union Laws or US health insurance in Kumar, Rajan & Zingales, 2001). Also, another regulatory element which distorts the "natural" forces behind creation of firms is that lot of the regulation takes place on the market transactions and if these are incorporated into the firm hierarchy, the entrepreneur may diminish the effect of the regulation. In a nutshell, firms may have much more freedom if they produce something for themselves and if the quality of regulations is low, this effect magnifies.

The financial aspect of institutional setting is not of such an importance to our analysis, the logic, however, is quite straightforward. More developed financial markets enable even more organisationally complex firms to obtain funding necessary for their activities.

Other reasons why individuals organise themselves into firms are of less practical importance but may yield some insight into how wide the range of motives may be. For example, Hodgson (1991) views firm not only as unit minimising transaction costs, but also protective enclave of evolutionary-emerged behavioural patterns which could be destroyed by volatile market forces if not codified into a durable organisational structure, but yield benefits to the entrepreneurs and society in the long run. R. H. Coase in his classic *Theory of the Firm* (Coase, 1937) starts his reasoning of why firms are formed with purely psychological and cultural aspects - some people may enjoy governing others and responsibility, while others prefer certainty and obeying orders. If we extend this argument, from the historical point of view we may say it is in human nature to form organised groups. Organisational patterns within society may therefore be of much more general extent than business entities only and formation of firms may be driven by those more general phenomena as well. As such reasoning may be useful to form a broader picture and set firms formation into wider context, it does not yield any differences for conclusions of our analysis.

Much work has been done by economic geographers, that often goes hand in hand with the theory. An example may be a paper by Michael Taylor and John Bryson "Guns, Firms and Contracts: The Evolution of Gun-Making in Birmingham" which examines in detail gun-making trade in Birmingham in the nineteenth century, where direct pricing became inefficient because of technological changes and mass production and therefore was gradually replaced by proxy pricing and many actors in the former group contracting system became part of paid labour. The work shows economic geographers may greatly help with understanding the processes of firm

formation, but all the institutional and contractual details have to be taken into account (Taylor & Oinas, 2006).

To conclude this section, we may note organisation of production within firms is an alternative to the market processes guided by price signals. Within firms, there is complete control, while markets are fluid and free (Shepherd & Shepherd, 2004). Because of this, firms are set up so that the processes which can be more efficiently performed internally are not subject of external market forces.

## **2.3 Firm size determination**

When looking at real world examples of firms, it is staggering how much they differ in their size and scope. Why does Microsoft operate in so many countries and employs 128 000 people while the local baker never extends his operations beyond local community? The answer lies in the balance of economies and diseconomies of scale of various types and in various dimensions.

The relation between efficiency and size is one of the most serious problems of theory, being in contrast with the relation for a plant, largely a matter of personality and historical accident rather than of intelligible general principles...the possibility of monopoly gain offers a powerful incentive to continuous and unlimited expansion of the firm, which force must be offset by some equally powerful one making for decreased efficiency (in the production of money income) with growth in size, if even boundary competition is to exist (Knight 2002, p.2)

It is important to realise the current state of firms is a result of the underlying firm growth processes and needs to be treated accordingly. In some cases, it may have not been driven by efficiency, but more likely by historical circumstances. Some authors even view growth of firms as stochastic processes. The famous Gibrats Law states that there is no relationship between the size of a firm and its growth (Gibrat, 1931), which means the firm sizes will not converge to any kind of optimum and are

more or less random. However, such a sharp formulation of the Gibrats Law has been fairly strongly empirically rejected (Santarelli, Klomp & Thurik, 2006). Still, it is crucial to be aware that in some special circumstances the Gibrats Law may more or less work. Therefore, the actual size of firms may tell us very little about what is optimal and real world imperfect markets may be very slow to correct for inefficiencies. This is why it is necessary to study the actual state of firms confronted with their performance in order to identify the real determinants of efficient boundaries between market organisation and organisation within firms and their hierarchies.

We will go through views on size determination of firms of different approaches. It is crucial to note those often do not contradict each other and are rather complementary points of view on a more complex issue and in some cases even only different ways of describing the same phenomena.

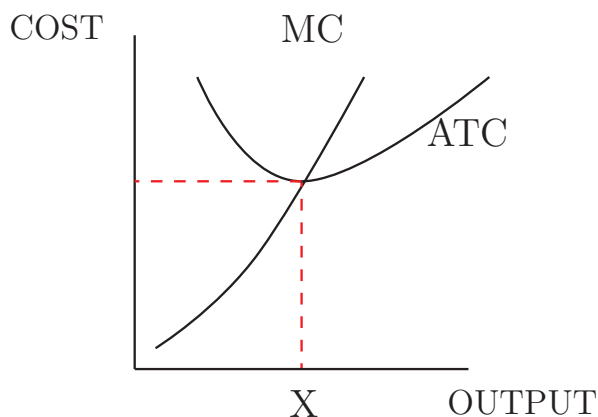
### **2.3.1 Classical framework**

In the classical framework, firm size is a result of markets moving towards equilibrium. Because of competition, the profit maximising behaviour drives every firm to most efficient size - where its average total costs (ATC) are the lowest (Martin, 2010). The ATC, when graphed with firm size, is thought to be U-shaped. At first, economies of scale take place, and unitary costs diminish because the proportion of fixed costs is lowered with more units produced. However, at some point, the unit costs start to rise again (Scherer, 1972), e.g. because a bigger firm needs better paid managers to run it or because the transportation costs occur (higher production cannot be sold only locally because local demand is limited).

One underlying implication of this model is that the size of a market bounds the effective size of firms through the channel of possible degree of specialisation.

Another constraint is imposed on the ATC curve through the limits of human capital. One point of view on this effect of human capital is that bigger firms using more complex technologies and procedures need more skilled workers not only because of the nature of their business, but also because mistakes are more costly for them

Figure 2.2: determination of firm size in classical setting



(Kremer, 1993). Another aspect may be that more skilled managers are needed to run large organisations and only as big organisations as are manageable for the management can exist (Rosen, 1982).

### 2.3.2 Transaction costs

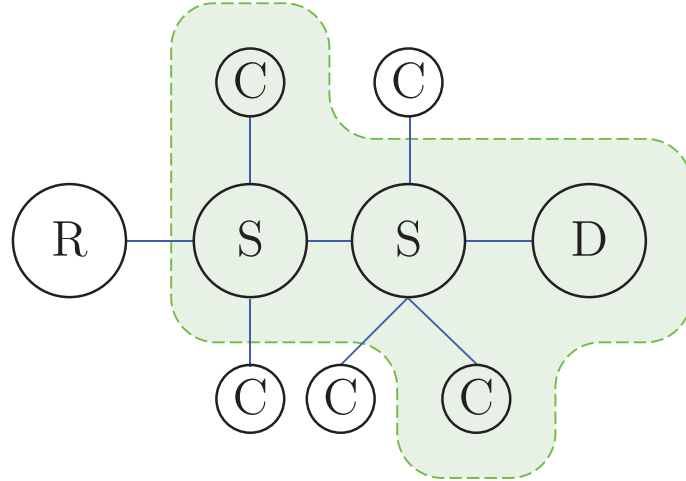
Why there are two separate firms? Two reasons 1. Increasing cost for each additional market transaction until cost of organizing marginal market transaction was equal to marketing cost that of organization. 2. That as transaction increased, might not carry out its object of reproducing market conditions (Coase 1988, p.35)

The logic of determination of boundaries between firms from the point of view of transaction costs is quite straightforward - whenever it is more efficient to carry market transaction internally, the profit maximising behavior of a firm pushes for this transaction to be performed within the firm. The scope of the firm broadens until no such transactions remain.

This determination of boundaries may be easily demonstrated on a diagram. Imagine that firms have only two organisational options - perform tasks internally or use the market. Of course, some kind of mix of these options exists in the real world, but such categorical distinction does not hurt the illustrativeness of this setting. The production process within the firm can be described by the purchase of raw

materials, different stages of productions where various componets are used and, finally, distribution of the product.

Figure 2.3: transaction costs size determination



Now if we take a look at the graph, it is clear every node can be easily included or left out of the boundary of the firm, based on which option is profit-maximising, e.g. the firm has two options about the first component needed in the first stage of production - it may either produce it, or it may obtain it on the market. It may be the case that it is really hard to determine the quality of the component when it is already made, so the transaction costs of the market transaction are high and the firm decides to produce it by itself. Another option is that the management of the firm simply does not have the capacity to supervise production of the component in a way so that it is produced in the most efficient manner, so the firm decides to buy it on the market. If similar analysis is performed for every node of the graph, a boundary of the firm is drawn and therefore even the size and scope of the firm is determined.

One more transaction costs factor worth mentioning, which results in diseconomies of scale, is the opportunistic behaviour. The incentives to shirk of employees are one of the greatest challenges for management and monitoring costs are likely to increase with increasing firm size and complexity (Cordes et al., 2008). Also, moving further towards behavioural economics, it may be useful to take into account conflicting interests of owners and managers of a firm. Some authors (Baumol, 1962; Marris,

1965) explain why managers may expand the firms beyond what is efficient in terms of profit maximisation in pursuing their own satisfaction and interests.

The implications of the transaction costs view are that well-functioning market with little information asymmetry makes small businesses more effective, while any technology which makes internal transactions more effective (such as telephone, e-mail or any other information technologies) should enable firms to become larger. Unfortunately, the implications of the transaction costs view are quite hard to verify empirically, as many of the variables (such as information asymmetry) are hard to measure or proxy (Kumar, Rajan & Zingales, 2001).

### **2.3.3 Networks**

When thinking about the determinants of firm size, it may once again yield great insight to think about firms in economy as networks and networks within networks. No matter whether we take as the starting point for the network analysis individuals or departments within a firm, the theory of networks provides some general implications which may be able to help to describe the forces driving firms to become larger (or why they do not become larger).

First, implications of the theory of networks shed some new light on the traditional view of economies of scale. It can be shown mathematically (Crama & Hammer, 2010) that possible stances in Boolean networks increase exponentially with more nodes. This means that information value of any information processing network increases exponentially as well. Also, this may mean exponential growth in complexity of performed tasks as well as exponential growth in potential for novelty with growing size which may be utilised e.g. in innovation. Therefore, economies of scale may be much greater than those we know as a consequence of mass production or specialisation, because larger interconnected units of human organisation are capable of much (exponentially) more complex tasks.

On the other side, the properties of Boolean networks give us some kind of guidance

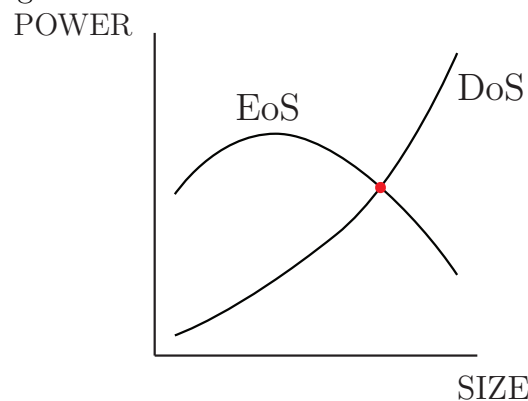
why growth in size and complexity of firms may fail to deliver efficiency. Complex interconnected networks are prone to instability because changes in one part of the network have strong influence on other parts of the network. This may lead to complexity catastrophes, term used by Kauffman (1993), when a positive change in one place causes movements in the network resulting in a bad change somewhere else. Beinhocker (2007) illustrates how these theoretical phenomena may translate into practice on examples of decision-making processes between various departments of a firm. If approval of other departments is needed for a move to be implemented and this move influences other departments, which need to adjust accordingly to wants of other departments, the decision-making becomes somehow engulfed in bureaucracy. Because of the properties of Boolean networks, the complexity of this decision-making process increases with the number of actors exponentially and in the end, the big firm may not be able to adopt efficient decisions at all because of the bureaucratic boundaries. Beinhocker uses example of the computer division of IBM, which was not able to keep up with the trend of selling computers through mail. Because of internal processes in IBM and its exclusive retail channels, even though IBM most likely had superior staff and experts to its rival Dell, it became somehow cumbersome and did not keep up with the trends and eventually had to sell its computer division.

Another implication of the theory of networks is that the organisational structure matters. A lot of the above mentioned phenomena depend on how densely and randomly the network is interconnected. Therefore, hierarchical structure may diminish complexity catastrophes while threatening the potential of joint forces of different employers/branches as well. Recognition of this fact may change the organisational decisions of managers - e.g. General Eletrics gives its employees possibilities of training programs in vastly different departments, and, on the other hand, in the 80s and 90s many corporations enabled more autonomy to different business units with growth in size in order to lower the risks of complexity.

### 2.3.4 Synthesis of the theories: multidimensional contradictory forces

What is one key element that permeates through all of the above mentioned theories? It is that two opposing forces determine the size - one of efficiency of economies of scale and the other one of problems connected with larger size and complexity. These two forces can be easily graphed on a two axis diagram where Y axis stands for the power of this force and X axis stands for firm size. Starting with the diseconomies of scale, these start rather modestly, but increase with size as problems with management, transportation costs etc. occur. Therefore, the curve representing these forces (DoS) will be upward sloping in firm size. A bit more complicated case are the economies of scale as the network logic suggests it is not clear whether these are upward or downward sloping. If we follow the logic of decreasing marginal returns, this curve (EoS) will be downward sloping and our simple model will eventually reach equilibrium where the two curves intersect (if the economies of scale curve is above the diseconomies of scale curve, the forces of economies of scale are stronger and therefore drive the firm to grow. Similar logic applies for the opposite case).

Figure 2.4: economies and diseconomies of scale



However, if the economies of scale curve is upward sloping, it may happen that the two curves never intersect and the growth of the firm never stops. Nevertheless, this is obviously purely theoretical example. In real world, the market is never infinite and therefore, if nothing else, at some point the economies of scale start to diminish

because there is no one to consume the additional production and the curves will intersect at some point.

It is important to realise dozens of dimensions of organisational complexity are flattened to one axis only and so are the various factors of (dis)economies of scale. This, however, does not interfere with the basic implications of this schematic setting.

## **2.4 Implications for regulatory and legal framework**

Now that we have the broader theoretical background, we can move on to what is central to our analysis - the institutional setting of government policies in the form of legal and regulatory framework, which can be thought of as a little distinct element of the problematic of transaction costs and is actually of great importance in the real world.

If we move from a regime of zero transaction costs to one of positive transaction costs, what becomes immediately clear is the crucial importance of the legal system in this new world. I explained in *The Problem of Social Cost* that what are traded on the market are not, as is often supposed by economists, physical entities, but the rights to perform certain actions, and the rights which individuals possess are established by the legal system (Coase 2008, p.37)

### **2.4.1 Regulations**

First aspect are the practical distortions imposed on firm boundaries by government policies in the form of regulations. Any government subsidy deforms the marketplace in favour of those receiving it and deformed marketplace deforms what kind of firms can cope with the competition (Carrizosa, 2006).

As lots of the distortive regulations have exemptions for small firms, firms are incentivised to break up their activities and outsource what would otherwise be carried internally. Bad regulations of entrepreneurship increase the overall costs of the organisation of production within firms, therefore, following the basic logic of Coase (1937), it discourages growth of firms. There is a vast amount of literature which describes this effect and even tests it empirically in various circumstances (see e.g. Thomas, 1990, Colbert & Murray, 1999, Laeven & Woodruff, 2007, Ardagna & Lusardi, 2008; Nyström, 2008).

On the other side, bad regulations can be seen as fixed costs. If we take a look at the neo-classical framework from graph 2.2, we can see that this increases the optimal size of a firm, because larger firms can better cope with the fixed cost which is distributed along larger volume of production (Bradford, 2004). Once again, even this effect has been empirically tested for and proved to exist in various circumstances (Klapper, Laeven & Rajan, 2006; Calcagno & Sobel, 2014).

## **2.4.2 Rule of Law**

Overall quality of the legal framework has somehow conceptually similar effects on the transaction costs as regulations.

The quality of legal institutions is crucial for efficiency of contracting (mostly enforcement of the contracts). The practical implications of this are that with basic respect to property rights, physical assets are protected, and therefore physical assets intensive industries make it possible for firms to become larger. With further improvement of legal institutions even intangible assets such as property rights become well-protected and firms that are more sensitive to intangible assets utilise economies of scale as well (Kumar, Rajan & Zingales, 2001). Also, overall improvement of the legal framework should enable firms to become more complex and broaden the scope of their activities. Hand in hand with the classic transaction costs logic of Coase (1937), better quality of legal institutions enables the central power to function in more complex hierarchies.

What is more, if the legal framework is subject to harsh and unpredictable changes, it yields additional costs in predicting and interpreting the rules, which may discourage firms from making more transactions and growth in complexity. Yi Man Li (2008) illustrates this empirically on construction firms in Hong Kong and China. In Hong Kong, construction firms provide many additional services to the core construction business as a marketing strategy to attract potential buyers. This is possible because of rule of law which makes relationships with contractors and suppliers smooth. On the other hand, in China, construction firms reduce the scope of their activities as much as possible, as any additional contract yields risks of losses with low enforceability and predictability of changes in law (Yi Man Li, 2008).

On the other side, low enforceability of contracts may have also the opposite effect on size of the firms, as the institutional view advocates. As market transactions become more expensive because of higher monitoring and bargaining costs, the transaction cost logic motivates firms to carry these transactions internally. This may simulate especially vertical integration and with diminishing the benefits of market efficiency lead to larger firms. Once again, this effect has been demonstrated both theoretically and empirically (Pascali, 2009), for example on the emerging market of India compared to the US (Khanna & Palepu, 2000).

### **2.4.3 Predictive implications of the theory**

When looking back at the diagram from section 2.3.4, the theory does not give a definite answer to the question to what extent (or whether at all) the quality of regulations and rule of law will be included in the economies of scale curve and to what extent in the diseconomies of scale one. Both for the regulations and rule of law the theory predicts qualitatively contradictory effects, and the quantitative aggregate is hard to be predicted. Therefore, the implications of the theoretical framework for forming real world policies in this area remain very limited and the matter remains to be rather an empirical issue. Much of the work previously mentioned yields quantitative empirical answers, but these are subject to conditions of these studies and

may not apply to the specifics of the post-soviet countries.

# Chapter 3

## Empirical application

### 3.1 Methodology

The framework from section 2 proposes an economic model which can be easily formalised.

$$firm\ size = f(rule\ of\ law, quality\ of\ regulations, ...) \quad (3.1)$$

Firm size can be thought of as a function of level of rule of law, quality of regulatory framework and other variables, but the exact functional relationship is unknown. What is central to our analysis is whether this function is decreasing or increasing in these two variables.

$$\frac{\partial f(rule\ of\ law, quality\ of\ regulations, ...)}{\partial rule\ of\ law} \begin{matrix} \leq \\ \geq \end{matrix} 0 \quad (3.2)$$

$$\frac{\partial f(rule\ of\ law, quality\ of\ regulations, ...)}{\partial quality\ of\ regulations} \begin{matrix} \leq \\ \geq \end{matrix} 0 \quad (3.3)$$

Lets proceed to converting this economic model into econometric model.

### 3.1.1 Finding the best econometric model

Now is the time to utilise the broad framework from previous chapters on determinants of firm size. The borderline is there are many different factors which have to be taken into account and, as noted in section 2.3.2, some of them may be extremely hard to measure or proxy. These may include e.g. information asymmetry in negotiations for contracts, smoothing of internal communication within a firm with development of information technologies, or the psychological and behavioural aspects. However, many of the factors mentioned in the preceding chapters which are nearly impossible to measure, are likely to be correlated with rule of law and quality of regulations. This means that if simple linear regression model was used, omitted variable bias would arise, and we would face substantial endogeneity. Of course, it is hard to predict whether this endogeneity would lead to false conclusions of our analysis, and how much it would alter the results, but based on the theory, this problem is likely to be of a great importance and cannot be ignored.

What do all these unmeasurable factors have in common? They are often results of cultural factors and behavioural patterns deeply rooted within the society. Because of that, we assume these factors evolve slowly and can be thought of as fixed for the purpose of our analysis. This naturally brings us to the fixed effects model which can treat for our unobserved heterogeneity.

In fixed effects model it is crucial to identify the factors which cannot be treated as fixed and these are mainly macroeconomic variables which change on annual basis and obviously influence decisions about firm size. When looking into other empirical literature (see e.g. Calcagno & Sobel, 2013), it seems that unemployment rate and real per capita income could be sufficient. Other important factors such as proportion of people living in urban areas, size of population, age distribution in population, education distribution in population or structure of the economy evolve rather slowly over time and therefore may be included in the (country, industry, society, firm) fixed effect.

This reasoning leads to model in the form of

$$y_{it} = \mathbf{x}'_{it}\boldsymbol{\beta} + a_i + u_{it} \quad (3.4)$$

where  $a_i$  is the unobserved heterogeneity fixed over time (composed of elements on different levels - country, society, industry and firm),  $y_{it}$  is size of firm  $i$  in time  $t$ ,  $u_{it}$  is the idiosyncratic error, and  $\mathbf{x}_{it}$  is the vector of explanatory variables including rule of law, quality of regulations, and other factors which change over time.

Also, because of the conflicting predictions of the theory it seems that functional relationship between rule of law, or quality of regulations and firm size may be rather complicated, and simple linear relationship could not be sufficient if dynamic relationships were actually of a very nonlinear nature, because the worse fit of the model could cover some less significant relationships. On the other side, as we are interested in general nature of the phenomena, it seems that quadratic functional form should be sufficient as the starting point.

We include the log form of the firm size, the model has better interpretative value as the proportional change in size is more natural measure of the effect, so our proposed model (for two-period panel data) is

$$\begin{aligned} \log(y_{it}) = & \beta_0 + \delta_0 dP_t + \beta_1 RL_{it} + \beta_2 RL_{it}^2 + \beta_3 RQ_{it} + \beta_4 RQ_{it}^2 \\ & + \beta_5 GDP_{it} + \beta_6 UN_{it} + a_i + u_{it}, \quad t = 1, 2. \end{aligned} \quad (3.5)$$

where RL is rule of law, RQ quality of regulations, GDP real per capita income, UN unemployment rate,  $a_i$  is the unobserved heterogeneity fixed over time,  $y_{it}$  is size of firm  $i$  in time  $t$ ,  $dP$  stands for dummy variable for the initial time period and  $u_{it}$  is the idiosyncratic error.

### 3.1.2 Estimation method

If we used standard OLS with pooled cross sections, the estimates would suffer from the omitted variable bias described above. Will first-difference estimator yield satisfactory results? The drawback of first-differencing is the reduced variation in

explanatory variables. But as both rule of law and quality of regulation somehow dynamically evolve and our other explanatory variables were chosen because of the time dynamics they contain (otherwise would be left in the fixed effect), it seems that with large enough sample the variation in the data should not be a big issue. Even though it may diminish the statistical significance of the results, it seems the benefits outweigh the risk of bias of standard OLS.

Are all the assumptions for valid statistical inference under first differences fulfilled? We may assume the functional form fits and same sample with variance and no perfect collinearity will be assured if the dataset is chosen properly.

Also, if the logic from section 3.1.1 stands, the expected value of the idiosyncratic error is not influenced by the explanatory variables as the problematic factors were left out in the fixed effect term, and the explanatory variables are intuitively generated outside of our model, so simultaneity shall not be an issue either. However, we need to be careful about sample selection issues when operating with the data.

Therefore, the assumptions for first-difference estimator to yield unbiased results are likely to be met. We still need to remain suspicious about possible heteroscedasticity and serial correlation, as these could invalidate our statistical inference if not tested for (and eventually corrected for).

### **3.1.3 How to measure firm size**

Looking back at section 2.1 where we showed how complex phenomenon firm is, it raises natural concerns about the measurement of its size. As the size of a firm is central to our analysis, the problem of the measurement deserves careful consideration.

Very little could be achieved empirically without the assumption that legal entity is a good proxy for a firm as a production unit from the point of view of economics

and the length of its production process. It is intuitively natural that more complex production process is connected with larger legal entity. Authors in the field usually follow this logic (see e.g. Kumar, Rajan & Zingales, 2001). However, we need to be careful in interpreting the results if legal entity is used as a proxy for firm in the economic sense because it is obvious the legal entity is directly influenced by changes in the legal framework, and it is questionable whether these changes necessarily smoothly translate into the real nature and scope of the firm itself. All such concerns need to be reflected on case by case basis, and all the findings need to be treated accordingly.

Still, even as the legal entity is taken as a good representation of a firm, it remains to be decided what kind of indicator of the size to use. Davidsson, Delmar & Wiklund (2006) summarised some of the most often used indicators of firm size and growth in firm size. These include number of employees, market value of a firm and indicators connected with production (revenues, value of production, sales, added value of production, etc). It may be argued each of them may be optimal in different research circumstances and purposes, however, as Correa (1999) notes, the authors often choose the indicator according to the kind of data they have. This is possible because these indicators are highly correlated, as various research has shown (see e.g. Kirchhoff & Norton, 1994 or Carrizosa, 2006). It does not mean the choice of the indicator should be random, because interpretation of what all of these indicators measure differs slightly.

We need to have on our mind our goal is to measure internal economic activity in the firm. This is why it may be a good idea to omit indicators which may be directly influenced by monetary changes (such as exchange rate adjustment or inflation) even if those do not translate in the real workings of the economy. Because of this, indicators connected with both sales and revenues may not provide accurate information about the nature and scope of the activities within a firm (Delmar, Davidsson & Gartner, 2003).

On the other side, Penrose (2009) identifies number of employees as a suitable indicator of firm size if the managerial implications of the size matter. Number of employees is not subject to the problems mentioned earlier and arguably directly shows the organisational complexity. Also, it is widely and most commonly used in papers dealing with the firm size (Kimberly, 1976).

Even though number of employees seems to be a good proxy for firm size, it is important to be careful of its limitations. As Delmar, Davidsson & Gartner (2003) mention, the drawbacks of number of employees as firm size indicator may be that it does not reflect increases in labour productivity and the substitution of workforce by machines. Also, it does not provide information about the degree of integration. This does not mean it is not a good proxy for firm size, but results of analysis with number of employees as a firm size indicator need to be treated accordingly with these limitations. What is more, the high correlation with other possible indicators remains, so the explanatory power of the analysis is likely to be similar as if more indicators were used (see Hart, 2000).

### **3.1.4 Measuring rule of law and quality of regulations**

There are two general ways in which to assess quality of legal framework and regulations - some authors prefer to use easily measurable distinct variables as proxies while others use indices which are often a result of a complex and complicated methodology, which aggregates various indicators and data sources.

As an example of some of the simple indicators (even though for a little bit different kind of indicator than we need), Campbell, Heriot & Jauregui (2010) use expenditures on regulatory inspections as a proxy for regulation burden, because these should reflex both new legislative and harder pressure on compliance. Mulligan & Shleifer (2005) proxy state regulation with volume of all statutes. Surveys between managers have been used as a measure of regulatory quality, and similar examples can be found in empirical literature for proxies of rule of law as well.

These indicators are conceptually clear and somehow easy to interpret, however, they may not be able to capture the whole scope of various regulatory and legal influences (Falkenhall & Eklund, 2010). Because of this, complex indices assessing many different categories and combining various data sources may be more successful in comparison of different countries (Botero & Ponce, 2010). Obvious drawback is connected with the complexity - the methodology of construction of an index must be taken into account while interpreting the results.

As we are interested in showing quite general phenomena, it could harm the results if we used very specific indicator which may not cover all the factors about both rule of law and regulatory framework, and therefore using indices constructed by international organisations such as World Bank or OECD seems to be more convenient.

## **3.2 Data**

In this section, we start with describing individual data sources used in our analysis and conclude with description of the resulting dataset.

### **3.2.1 BEEPS**

The Business Environment and Enterprise Performance Survey (BEEPS) is a result of joint effort of the World Bank and European Bank for Reconstruction and Development (EBRD) in collecting panel firm-level data of firms in former soviet countries. The main goal is to gather information about business development and environment for private enterprise.

The idea of the survey is to use fixed representative sample of economys private sector. So far, the firms were surveyed 5 times (1999-2000, 2002, 2004-2005, 2008-2009, 2011-2014). Private contractors gather the information about the statistically chosen firms in face-to-face interviews with business owners or top managers with

the promise of confidentiality in order to assure as high participation (and therefore low selection sample bias) as possible. The questionnaire is rather complex, for the 5<sup>th</sup> round, it included around 400 questions.

The panel data nature of BEEPS is problematic because of two reasons - only a fraction of firms has been actually surveyed in all 5 rounds, and the methodology of the survey has been improved after each of the rounds. Therefore, the results from individual rounds are to be directly compared only with a great caution. Because of this fact, we use only the V round of BEEPS. It does not mean we lose the panel-data nature of our dataset. For some of the questions, managers and owners are not surveyed only for the current state but also for the state 3 years ago. Therefore, we may construct two-period panel dataset, using the most recent round of the survey only.

In BEEPS V, total number of 15 883 establishments of firms had been surveyed. The information about number of full-time employees (which we use as a proxy for firm size) is missing for 105 observations, and the information about number of full-time employees 3 years ago is missing for 1910 observations. At this point, we need to address concerns about sample selection bias. There are two major reasons why the information on number of employees 3 years ago is missing.

First, in some cases, BEEPS simply failed to obtain this information probably because managers and owners did not know it or did not want to provide it. When looking into other characteristics of these firms, there does not seem to be any significant systematic difference compared to the rest of the sample (speaking of means and standard errors of other variables), and even intuitively the ability of managers and owners to provide this information should not be correlated with the firm size.

Second, some of the firms simply did not exist 3 years ago. Judging from the information about the year when the establishments started its operations, this is the case for 917 observations which is 5.77% of our sample size. Now the situation is quite

different than in the first case, but the problems of the possible sample selection bias may be overcome by careful interpretation of the results. We do not have random sample on all firms, but we may have a random sample from different population - that is established firms farther from the boundary of timeframe of their existence. If we assume the creation and destruction of firms is not consequence of the forces determining firm size only (which is surely to hold in the real world), focus on firms that are not newly established or in the process of destruction will actually yield more insight on the forces which determine size of firms in non-extreme existential conditions. Other side of this coin is the non-randomness in the "selection" of firms for the initial time period (3 years ago), because some of the firms may have gone out of the business and therefore were not selected, even though they would have been selected into the sample otherwise. Same logic as before follows for this case as well. The borderline is we need to be careful while interpreting the results, as the estimates will be valid for population of firms far away from establishment and extinction, and some special circumstances not covered by our sample may arise in these special time periods.

The original BEEPS V dataset includes 30 countries, however, in our analysis, we exclude Kosovo. Kosovo declared its independence from Serbia as recently as in 2008, therefore its institutional climate is hardly revealing speaking of typical post-soviet countries, and many institutions are still being established. Because of these geopolitical differences, there is a chance inclusion of Kosovo in the dataset would rather contaminate it for the purpose of our analysis.

### **3.2.2 Worldwide Governance Indicators**

The Worldwide Governance Indicators (WGI) is a set of indices on perception of governance constructed by World Bank from 31 various underlying data sources, ranging from various surveys to expert assessments (Kaufmann, Kraay & Mastruzzi, 2010). We use 2 of the total 6 indices included in WGI - Rule of Law and Regulatory Quality.

The Rule of Law index measures perceptions of contracts enforcement efficiency, workings of courts, level of protection of property rights, but also probability of violence and crime. These particular indicators show overall confidence in the rules and their enforcement in the given country. Regulatory quality index measures perception of the ability of government to formulate and implement regulations which promote private sector development.

It is important to note that the WGI indices reflect the perception of the variables we are interested in more than measure them directly, therefore, in our analysis, these indices need to be treated as proxies of real rule of law and regulatory quality.

### **3.2.3 World Bank macroeconomic indicators**

Set of macroeconomic variables used in our analysis is based on indicators available in the World Bank database (<http://data.worldbank.org/>). The source of the indicators used are World Bank national accounts, OECD National Accounts and International Labour Organisation. For codes of the individual indicators and more information, please see Appendix a.

### **3.2.4 Dataset**

The WGI and WB data were matched with the original BEEPS V dataset along countries and years. The result is a two-period panel data dataset with information on 13781 establishments in 29 countries. These include Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Macedonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Mongolia, Montenegro, Poland, Romania, Russia, Serbia, Slovak Republic, Slovenia, Tajikistan, Turkey, Ukraine and Uzbekistan. The description and summary statistics of the most important characteristics of the variables used can be found in the following table:

Table 3.1: description of variables and summary statistics of the dataset

<u>Variables description:</u>		<u>Summary statistics:</u>				
Variable	Description	Variable	Mean	Std. Dev.	Min	Max
EMP	number of employees	EMPt	65,397	267,182	1,000	1100,000
RL	rule of law index estimate	EMPt3	62,039	253,243	0,000	1150,000
RQ	regulatory quality index estimate	dEMP	3,029	53,554	-1242,000	215,000
GDP	GDP per capita (in 2005 US \$)	RLt	-0,332	0,632	-1,414	1,160
UN	unemployment rate (in %)	RLt3	-0,381	0,649	-1,317	1,091
		dRL	0,049	0,092	-0,143	0,165
		RQt	0,016	0,635	-1,584	1,390
		RQt3	0,001	0,645	-1,492	1,407
		dRQ	0,015	0,073	-0,243	0,144
<u>Variables variations:</u>		GDPt	6014,604	3782,946	437,222	19404,000
Variation	Explanation	dGDP	5,165	7,059	-3,960	21,273
dVAR	(VAR today) - (VAR 3 years ago)*	UNt	10,518	5,664	4,800	31,000
VARt	VAR today	dUN	0,292	2,016	-4,200	6,000
VARt3	VAR 3 years ago					
IVAR	log(VAR)					
VARsq	VAR squared					

\*only for GDP we use dGDP as a cumulative % change in GDP per capita in the 3 years insted of the absolute change

More detailed description of some of the variables and their sources is included in the Appendix a.

### 3.2.5 Possible problems of our dataset

The biggest threat to our analysis seems to be relatively high correlation between our 2 key explanatory variables. The correlation between RL and RQ in both of the time periods is 0.93. This actually is not a surprise as both are likely to be determined by similar phenomena. However, the usage of first differencing and therefore focus on dynamics should help to solve this issue. The correlation between dRL and dRQ is only 0.26, which should not be an issue in such a large dataset.

Another thing is the relatively low variation some of our variables show over the two time periods. Because of this fact we need to be aware it is possible the significance levels of our findings will not be high. On the other side, the large amount of observations in our dataset should help, and therefore it still seems the lower variance is a bearable cost of first differencing compared to the possible endogeneity and multicollinearity if first differencing were not used.

The global financial crisis may have had influence on our data as the final dataset reflects the period 2007-2012 and many of the countries of our focus had gone through recessions at some point during this period. This is something that probably increases volatility and diversity of economic conditions in our data, which should help us study the dynamic effects (it is possible the variance in the data would be lower for other time periods). On the other side, we should be aware of the fact the economic conditions during those years may have been somehow specific.

### 3.3 Results and discussion

The following table summarizes results of fixed effects estimate of the model proposed in section 3.1.1. As homoscedasticity was soundly rejected by the Breusch-Pagan test, the reported results use robust standard errors.

As can be seen in the table, all the variables of our interest turned out to be statis-

Table 3.2: Regression of dIEMP on dRQ, dRQsq, dRL, dRLsq, dGDP, dUN

	Coef.	Robust Std. Err.	t	P>t
dRQ	0,470	0,058	8,140	0,000
dRQsq	0,787	0,368	2,140	0,033
dRL	-0,062	0,074	-0,850	0,397
dRLsq	2,121	0,564	3,760	0,000
dGDP	-0,003	0,001	-3,970	0,000
dUN	-0,017	0,002	-8,500	0,000
__cons	0,062	0,009	7,100	0,000

Observations: 13769

R-squared: 0,02

tically significant in the regression even at the 5% significance level (the P value of the linear change in rule of law indicator is 0.397, but it is jointly significant at the 5% significance level with the variable in the squared form). This may suggest that the variance in the sample we have is sufficient for statistical inference and that our logic of the construction of the model was correct.

Starting with the control variables, the sign on differenced unemployment rate suggests that decreasing unemployment rate is connected with increasing number of employees of firms which is what would be intuitively expected and in accordance with other empirical studies. As a bit of a surprise may come the sign on differenced GDP per capita. However, interpretation of GDP growth with other factors equal (including unemployment) may be contra-intuitive, as GDP growth is (in the real world) connected with overly improving economic conditions (because these are, for a big part, jointly determined with GDP growth). Also, the financial crisis connected with recessions may have had an effect on the influence of GDP growth on firm size. Possible explanation may be in the creative destruction process connected with mergers and acquisitions in recessions. This hypotheses, however, would need more investigation and remains open for future research. The important thing for our analysis is that these factors are controlled for and therefore do not contaminate the results on the two variables of our focus.

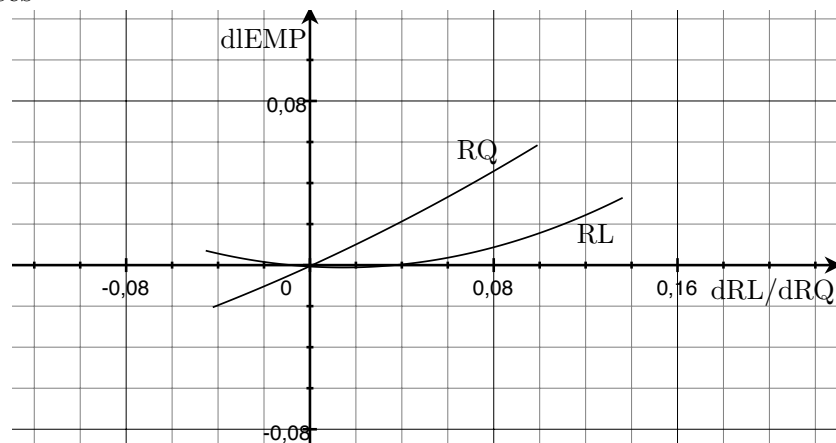
Another thing that deserves commentary is low value of the R-squared statistic. If we take a look at the micro perspective of the determination of growth of size of a firm, we see that many everyday situations and hardly predictable factors come into the decision-making of the managers. From the viewpoint of the manager, the decision to hire one more worker is a result of rather organic observation of surrounding environment of the firm and very bounded-rationality lead predictions about its future development. Therefore, it is no surprise our model is not able to explain major part of the variation in the changes of number of employees. But that is actually not something we are trying to do in this empiricall setting - the goal of our analysis is to capture the effects (and their magnitude) of rule of law and regulations, not to explain the size of firms. Such a very low value of R-squared yields an important insight - even though we can statistically prove there is an effect of level of rule of law, quality of regulations and our controls, we can see these explain very little part of the variation in changes in the number of employees, so the economic significance of these factors for firm sizes is not likely to be high (even though this is, of course, relative). Also, it is important to realise we use the fixed effect estimation, and

we difference out many of the important factors, therefore the interpretation of the R-squared statistic is limited, and the original model, where the fixed effects are included, is likely to explain much greater part of the variation, even though the fixed effects were not subject of our estimation.

### 3.3.1 Effect of rule of law and quality of regulations

Moving on to the two variables of our interest, the following graph summarizes the estimated effect of changes in the logs of rule of law and regulations quality indicators on change in number of employees of a firm.

Figure 3.1: Estimated effects of changes in RQ and RQ on change in logs of number of employees



The vertical axis represents change in the number of employees (in tens), while the horizontal one change in the value of the given index. The curves “RQ” and “RL” are the estimated functional relationships between dEMP and dRQ (respectively dRL). The functions are graphed only in the range of standard deviation from mean in the distributions of dRL (dRQ), because the estimated functions are not likely to be good representation of the population relationships outside of these boundaries, as we do not have many observations with corresponding values. It seems that dEMPL is increasing in dRQ. On the other side, the effect of dRL seems to be of more complex nature. However, it is not possible to provide valid statistical inference about the exact shape of the curves as the functional relations are estimates

only, and estimates of both the linear and quadratic componets have substantial standard errors. But if we reestimate the model with exclusion of the quadratics, we obtain somehow conclusive results for the general direction of the effect of RQ.

Table 3.3: Regression of dIEMP on dRQ, dRL, dGDP, dUN

	Coef.	Robust Std. Err.	t	P>t
dRQ	0,403	0,050	8,000	0,000
dRL	0,092	0,056	1,660	0,098
dGDP	-0,004	0,001	-5,450	0,000
dUN	-0,018	0,002	-9,000	0,000
_cons	0,088	0,007	12,450	0,000

Observations: 13769

R-squared: 0,01

As can be seen in the table, the results of this auxiliary regression correspond to those of the first one for RQ. We have strong evidence of positive effect of positive changes in RQ, while the original model is inconclusive about the exact nature of the influence of RL. The shape of the curve suggests that changes in RL, no matter whether positive or negative, incentivise firm growth, or, because of the distribution of our observation, it may seem that there is no or very little effect unless there is sufficient positive increase in RL, when dIEMP starts to increase in dRL. However, the effect is less significant in both statistical and economic terms, and we should wait for the sensitivity analysis for interpretation.

Because of the nature of our model and our data, it would not make much sense to look for quantitative interpretation of the estimation. This is because the values of the indices on rule of law and regulatory quality do not have a good quantitative interpretation either. They are constructed in such a manner so that it is possible to make comparisons between different time periods and between different countries. Therefore, it is the sign of the coefficients rather than the absolute size what matters. For an idea about the magnitude of the effect, we can take look at it in the terms of standard deviation. One standard deviation increase in RQ is connected

with predicted growth in firm size of nearly 5 %, which can be considered as highly economically significant effect.

### 3.3.2 Sensitivity analysis

We now provide some alternations in our original model to see whether any of the important conclusions will change. Namely, we use change in the levels as the dependent variable instead of log form and also different polynomial forms of the dRL and dRQ - polynomials of degree 3, 2 and 1.

Figure 3.2: Estimated effects of RQ and RL with various functional forms

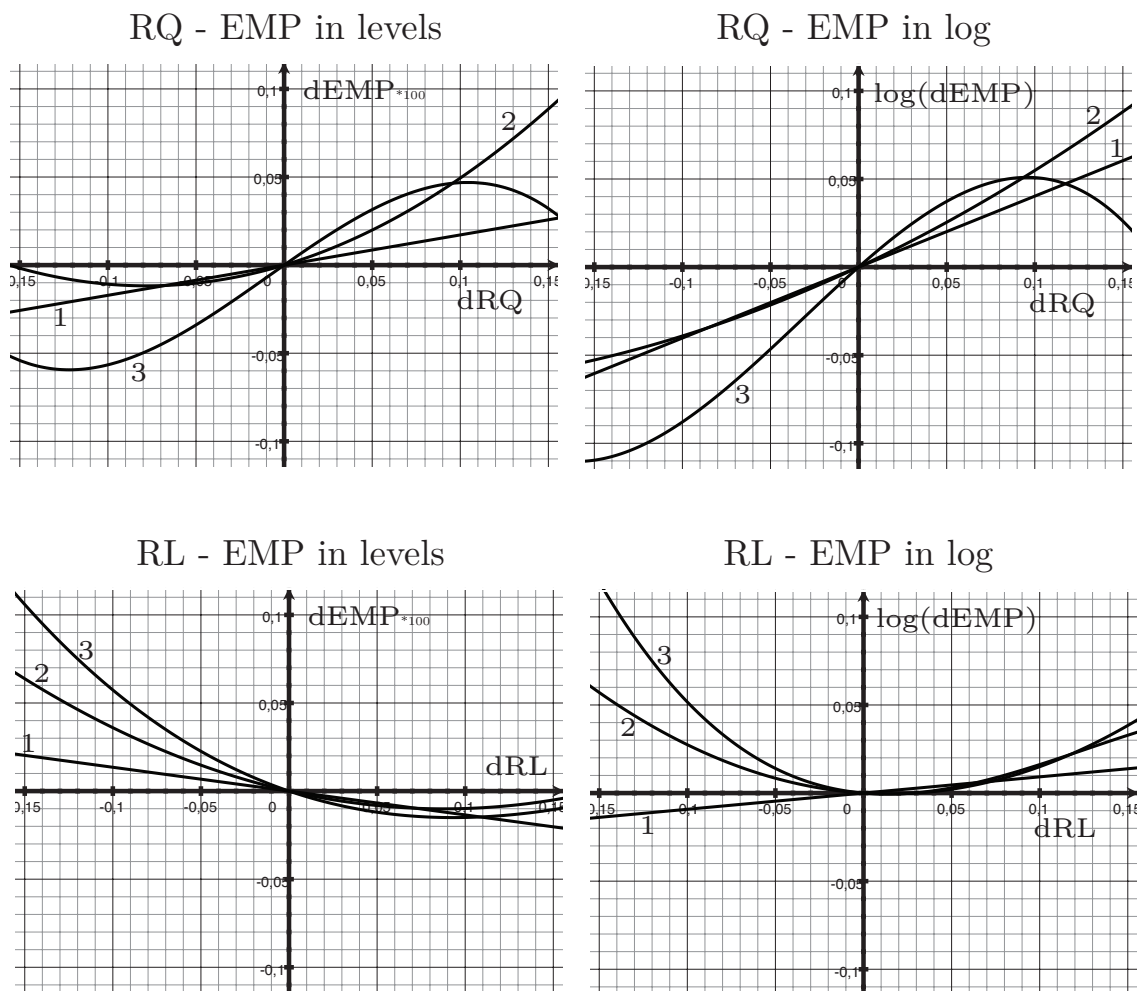


Figure 3.2 presents graphed estimates of the 6 resulting models. For each of the graph, one form of the dependent variable and one of the explanatory variables are chosen, and curves representing the functional relationships for all of the 3 func-

tional forms of the explanatory variable are graphed in one graph. For clarity, we note that all the axes still refer to differences. The distinction is in whether those are differences in levels or differences in logs. The curves labelled “1” represent linear relationship, those labeled “2” polynomial of degree 2 and these labeled “3” polynomial of degree 3. Detailed tables of parameters and statistics from the 6 regressions are to be found in Appendix b.

Because we estimate the relations of the differences, rather than relations between specific levels of the variables, experiments with various functional form of the explanatory variables have very limited interpretation as well, and may be useful only because some of the qualitative information may become statistically significant with functional form more suitable for the actual data. Only if the functional relationship in the range, where most of the observations are located, was of rapidly nonlinear nature, could polynomial functional relationship of higher degree unveil qualitative mismatch of the direction of the effect, but this is obviously not the case for our data; it can be seen in the graphs that different functional forms of explanatory variables do not bring any qualitative differences into the analysis.

Using number of employees instead of log does not alter any qualitative results of the analysis for RQ. Quite the contrary, the results look rather similar and what is more, all the functional forms of RQ are still highly statistically significant, therefore, the sensitivity analysis only strengthens the implications made in section 3.3.1.

On the other side, when looking at the results of rule of law, there is something to worry about. There is qualitative difference between the direction of the effect changes in rule of law have on size of firms. Moreover, the significance of the effect of rule of law is not that high - in regression with the linear term only, P value for dRL is 0.06, joint significance in the other two regressions of terms including dRL is high, but the individual components are sometimes not that clear, see Appendix b). There are two possible reasons why the results of the estimations are uncovering about the effect of rule of law. Firstly, it may be that the variance in the data connected with

correlation between explanatory variables turns out to be insufficient to prove the exact nature of the relation, which is not strong enough to emerge in this setting. However, there is one more possibility - the functional relation between rule of law and firm size may be of such a nature that our model is not capable of uncovering it. If the relationship is vastly different for different levels of both firm size and rule of law, the focus on differences may not be able to detect it properly. Our estimates actually provide some kind of evidence that the functional relationship may be of a more complicated nature. The correct explanation will probably be somewhere in between of those two. Therefore, our analysis does not bring definite conclusion on the relation between rule of law and firm size in the post-soviet countries. However, it provides some leads for future research.

# Chapter 4

## Conclusions

Firm size determination is extremely complex phenomenon with many different factors involved, and its study may yield important implications for policy-making and understanding of the economy. Throughout the theoretical part, we build broad framework of different views on the different factors involved in this process, focusing on the institutional factors of regulatory quality and rule of law. For both quality of regulations and rule of law, the theory provides contradictory arguments on what kind of effect should these have on changes of boundaries of firms.

The main arguments are that bad institutional quality makes on one side the internal transactions more costly and therefore incentivizes firms to perform these on markets, but on the other worsens the functioning of markets as well, and therefore there is also contradictory incentive to use market transactions less and extend the boundary of the firm. The theory cannot provide definite answer on where this effect is stronger and what the overall relationship between regulatory quality and rule of law and firm size is.

In the empirical part, we examine the effect of regulatory quality and rule of law on two-period panel data on post-soviet countries from eastern Europe and Asia from years 2007 to 2012. Because of the complex nature of the problem, we examine the dynamics in fixed effect model - the factors which would be hard to control for are usually of a long-term nature, and therefore can be differenced out. This approach

also provides better image of the current situation of the post-soviet countries, as the actual state may be more of a result of historic circumstances than actual current determinants of firm size.

We find out that improvements in the quality of regulations are connected with growth of firms. The most novel aspect of our study is the focus on post-soviet countries where the firms face specific economic conditions, and therefore it is hard to predict (from the theoretical point of view) whether the relations uncovered on data from western Europe and US will hold. The same qualitative effect of regulatory effectiveness as found in our study has been described in countries of the developed world or upper-middle income developing countries. The quantitative effect is hardly comparable because the methodologies and focus of different studies differ significantly. Therefore, it seems that the special conditions of post-soviet countries do not affect this element in determination of firm size and firm growth.

On the other side, our analysis is inconclusive on the effects of quality of legal framework in the form of rule of law. It seems the effect is of somehow more complex nature and not as much significant as the effect of quality of regulations. Due to this, the examination of differences over time may not yield sufficient insight. Further research using different methodology and data is therefore needed to uncover whether in this case the specifics of post-soviet countries make any difference.

Also, as regulatory quality and firm size explain only little part of the determination of firm size and its growth, the field of study of firm size yields many other opportunities for future research. For example, the effect of development of information technologies on the effectiveness of internal transactions and monitoring processes is yet to be empirically examined. All the information on firm size determination is crucial for policy makers, because big part of the economic growth takes place within firms.

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# Appendix a

More information on the used dataset is to be found in this appendix.

## BEEPS questions

Firstly, we provide exact wording from the BEEPS questionnaires on number of employees used to construct variable EMPt and EMPt3.

### Question L.1

“At the end of fiscal year [insert last complete fiscal year], how many permanent, full-time individuals worked in this establishment? Please include all employees and managers (INTERVIEWER: INCLUDE INTERVIEWEE IF APPLICABLE).

(Permanent, full-time employees are defined as all paid employees that are contracted for a term of one or more fiscal years and/or have a guaranteed renewal of their employment contract and that work full-time)”

### Question L.2

“Three fiscal years ago, at the end of fiscal year [insert three complete fiscal years ago], how many permanent, full-time individuals worked in this establishment? Please include all employees and managers. (INTERVIEWER: INCLUDE INTERVIEWEE IF APPLICABLE).”

(European Bank for Reconstruction and Development & World Bank, 2012)

## WGI indicators

The exact definitions of the WGI indicators we use are following:

Regulatory Quality (RQ) capturing perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development...

... Rule of Law (RL) capturing perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.

(Kaufmann, Kraay, & Mastruzzi, 2010)

## WB macroeconomic indicators

Table 4.1: information on the WB macroeconomic indicators used in the analysis  
(World Bank, 2015)

variable name	WB indicator code	indicator name	source note	source organization
<b>un</b>	SL.UEM.TOTL.ZS	Unemployment, total (% of total labor force) (modeled ILO estimate)	Unemployment refers to the share of the labor force that is without work but available for and seeking employment.	International Labour Organization, Key Indicators of the Labour Market database.
<b>gdp</b>	NY.GDP.MKTP.KD	GDP (constant 2005 US\$)	GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2005 U.S. dollars. Dollar figures for GDP are converted from domestic currencies using 2000 official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used.	World Bank national accounts data, and OECD National Accounts data files.
<b>gdpg</b>	NY.GDP.MKTP.KD.ZG	GDP growth (annual %)	Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2005 U.S. dollars. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.	World Bank national accounts data, and OECD National Accounts data files.
<b>gdppc</b>	NY.GDP.PCAP.KD	GDP per capita (constant 2005 US\$)	GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2005 U.S. dollars.	World Bank national accounts data, and OECD National Accounts data files.

## More dataset summary statistics

Some other characteristics of the variables in the dataset used for the final analysis, which were not carefully described in the text.

Table 4.2: dataset summary statistics

Variable	Mean	Std. Dev.	Min	Max
year*	2010.782	.522358	2010	2012

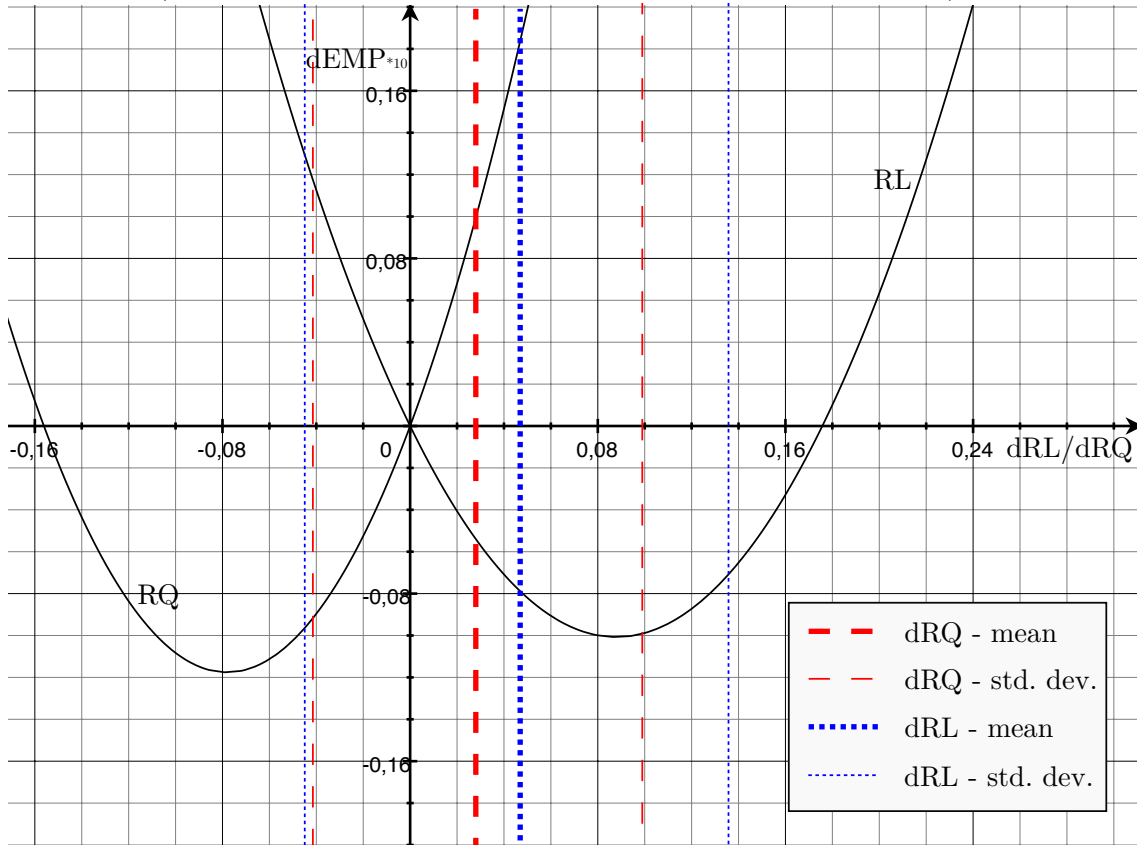
\*last completed fiscal year before the survey took place

Correlation RLt RQt .....	0.9330
Correlation RLt3 RQt3 .....	0.9271
Correlation dRQ dRL .....	0.2558

# Appendix b

Detailed information on all regressions is to be found in this appendix.

Figure 4.1: Estimated effects of changes in RQ and RQ on change in number of employees (similar as figure 3.1 but for EMP in levels instead of logs)



The vertical axis represents change in the number of employees (in tens) while the horizontal one change in the value of the given index. The curves “RQ” and “RL” are the estimated functional relationships between  $dEMP$  and  $dRQ$  (respectively  $dRL$ ). While interpreting the shape of the curves, it is important to know about the

actual distributions of the changes in indexes, therefore the dashed and dotted lines show the mean and standard deviation around it for both dRQ and dRL. As vast majority of the observations lies within those boundaries, the estimated functions are not likely to be a good representation of the relations outside of those, therefore we may ignore the exponential increases of the curves beyond those. This figure is analogous to figure 3.1, but difference in levels of number of employees is used instead of difference in logs and also the whole curves are graphed, even though the accuracy of the representation of the real functional relationship is not likely to be high outside of the boundaries of standard deviations from mean of the observations.

Regression of dlEMP on dRQ, dRQsq, dRQtr, dRL, dRLsq, dRLtr, dGDP, dUN

	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
dRQ	0,886	0,114	7,760	0,000	0,662	1,110
dRQsq	-1,856	0,821	-2,260	0,024	-3,465	-0,246
dRQtr	-19,298	4,955	-3,890	0,000	-29,010	-9,586
dRL	-0,088	0,116	-0,750	0,452	-0,316	0,141
dRLsq	3,393	0,808	4,200	0,000	1,810	4,977
dRLtr	-9,006	7,078	-1,270	0,203	-22,879	4,867
dGDP	-0,002	0,001	-3,090	0,002	-0,004	-0,001
dUN	-0,012	0,002	-5,240	0,000	-0,017	-0,008
_cons	0,061	0,009	7,100	0,000	0,044	0,078

Observations: 13769

R-squared: 0,02

Regression of dlEMP on dRQ, dRQsq, dRL, dRLsq, dGDP, dUN

	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
dRQ	0,470	0,058	8,140	0,000	0,357	0,583
dRQsq	0,787	0,368	2,140	0,033	0,065	1,509
dRL	-0,062	0,074	-0,850	0,397	-0,207	0,082
dRLsq	2,121	0,564	3,760	0,000	1,016	3,226
dGDP	-0,003	0,001	-3,970	0,000	-0,004	-0,001
dUN	-0,017	0,002	-8,500	0,000	-0,021	-0,013
_cons	0,062	0,009	7,100	0,000	0,045	0,079

Observations: 13769

R-squared: 0,02

**Regression of dIEMP on dRQ, dRL, dGDP, dUN**

	Coef.	Robust Std. Err.	t	P>t	[95% Conf. Interval]	
dRQ	0,403	0,050	8,000	0,000	0,304	0,501
dRL	0,092	0,056	1,660	0,098	-0,017	0,201
dGDP	-0,004	0,001	-5,450	0,000	-0,005	-0,003
dUN	-0,018	0,002	-9,000	0,000	-0,022	-0,014
_cons	0,088	0,007	12,450	0,000	0,074	0,102

Observations: 13769

R-squared: 0,01

**Regression of dEMP on dRQ, dRQsq, dRQtr, dRL, dRLsq, dRLtr, dGDP, dUN**

	Coef.	Robust Std. Err.	t	P>t	[95% Conf. Interval]	
dRQ	70,07	11,50	6,09	0,00	47,52	92,61
dRQsq	-48,89	85,21	-0,57	0,57	-215,91	118,13
dRQtr	-1835,85	504,57	-3,64	0,00	-2824,89	-846,82
dRL	-34,07	16,46	-2,07	0,04	-66,33	-1,81
dRLsq	212,02	95,09	2,23	0,03	25,64	398,41
dRLtr	-210,22	1207,49	-0,17	0,86	-2577,07	2156,63
dGDP	-0,09	0,10	-0,91	0,37	-0,27	0,10
dUN	-0,37	0,30	-1,21	0,23	-0,96	0,23
_cons	2,05	1,14	1,79	0,07	-0,19	4,29

Observations: 13781

R-squared: 0,003

**Regression of dEMP on dRQ, dRQsq, dRL, dRLsq, dGDP, dUN**

	Coef.	Robust Std. Err.	t	P>t	[95% Conf. Interval]	
dRQ	30,13	9,00	3,35	0,00	12,49	47,76
dRQsq	192,96	70,59	2,73	0,01	54,59	331,33
dRL	-22,93	8,91	-2,57	0,01	-40,39	-5,47
dRLsq	130,50	70,35	1,85	0,06	-7,40	268,40
dGDP	-0,18	0,09	-2,04	0,04	-0,35	-0,01
dUN	-0,86	0,30	-2,83	0,01	-1,45	-0,26
_cons	2,41	1,14	2,12	0,03	0,18	4,63

Observations: 13781

R-squared: 0,003

**Regression of dEMP on dRQ, dRL, dGDP, dUN**

	Coef.	Robust Std. Err.	t	P>t	[95% Conf. Interval]	
dRQ	17,14	6,93	2,48	0,01	3,57	30,72
dRL	-13,52	7,29	-1,86	0,06	-27,80	0,76
dGDP	-0,22	0,09	-2,56	0,01	-0,39	-0,05
dUN	-0,87	0,30	-2,90	0,00	-1,46	-0,28
_cons	4,87	0,98	4,98	0,00	2,95	6,78

Observations: 13781

R-squared: 0,002