Quality of Governance and Its Impact on Interjurisdictional Competition

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Abstract

The main object of the dissertation's research is governance, and its role in public finance, in particular in interjurisdictional competition. Three essays on this topic are included in the work as separate chapters (Chapter 2, Chapter 3, Chapter 4). First two of the essays analyze several public finance outcomes when governments - the main actors in the analysis - are different in their efficiency (quality), i.e. they transform tax revenues into public interest at a different rate. This includes both their expertise, integrity (absence of corruption), and exogenous circumstances they face in jurisdictions, they are chosen (or appointed) to administer. The third essay takes purely empirical approach to actually measuring and monitoring the quality of governance in different countries.

The main result in the first chapter (essay) is that if the governments of two countries are different in their efficiency (i.e. one of them is able to produce more public good out of the same revenue) then the more efficient government charges the higher corporate income tax rate. It can do so, because besides the high tax rate it offers to the potential investors a qualitative public infrastructure, which reduces the cost of their production. At the same time, less efficient government is not able to compete in the level of public good provision, so it chooses to attract the firms with low taxes. The main result of the paper is, however, contingent on two major assumptions. First is that the profit function of an investor is concave enough in public good. Second is that the countries should be sufficiently different in their efficiency. If at least one of the conditions does not hold then both governments have incentives to deviate, and there are no equilibria in pure strategies. At best, governments are involved in the mixed strategies, and set tax rates in a random manner. The theoretical conclusions of the chapter are in general supported by anecdotal empirical evidence, which I present in the end of it. However, further investigations in this field are needed in order to make robust conclusions.

In the Chapter 3 I present new theoretical argument in favor of intergovernmental transfers from a rich (advantaged) jurisdiction to a poor (disadvantaged) one. Namely, if local governments are (at least, partly) malevolent, and the factor productivities in the jurisdictions are different, then subsidizing the jurisdiction with lower productivity intensifies competition for mobile factor between self-interested governments, and leads to an overall higher level of public goods production, thus lower level of corruption. This happens though only in the case of regional subsidies, when budgets of the governments are not affected directly. It is shown in the chapter, that if the difference between jurisdictions is large enough, intergovernmental grant may be beneficial even for the residents of the net-paying jurisdiction.

Chapter 4 deals with the empirical measurement of quality of governance on the level of countries. Governance indicators are now widely used as tools for conducting development dialogue, allocating external assistance and influencing foreign direct investment. The chapter argues that available governance indicators are not suitable for these purposes as they do not conceptualize governance and fail to capture how citizens perceive the governance environment and outcomes in their countries. With my co-author A. Shah, I attempt to fill this void by conceptualizing governance and implementing a uniform and consistent framework for measuring governance quality across countries and over time based upon citizens' evaluations. Citizen-centric governance indicators are constructed for 125 countries (over 1994-2005), their comparative analysis is provided as well as some robustness checks.

List of Abbreviations

AFR	African Barometer
ASB	Asian Barometer
AGRI	African Governance Report Indicators
CEE	Central and Eastern European Countries
CGI	Citizen-centric Governance Indicators
CPI	Corruption Perception Index
DB	Doing Business
EATR	Effective Average Tax Rate
EU	European Union
FDI	Foreign Direct Investment
GAC	Governance and Anti-corruption
GDP	Gross Domestic Product
GNI	Gross National Income
GQI	Governance Quality Indicators
GWP	Gallup World Poll
HDI	Human Development Index
HF	Heritage Foundation
IDA	International Development Association
IIAG	Mo Ibrahim Foundation's Index of African Governance
IEF	Index of Economic Freedom
IMF	International Monetary Fund
OECD	Organization of Economic Cooperation and Development
OLS	Ordinary Least Squares
TI_GCB	Transparency International Global Corruption Barometer
UK	United Kingdom
UNCTAD	United Nations Conference on Trade and Development
US	United States
USD	US Dollar
WB	World Bank
WBI	World Bank Institute
WGA	World Governments Assessment
WGI	Worldwide Governance Indicators
WVS	Worldwide Values Survey

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Chapter 1

Introduction

The main object of this dissertation's research is governance, and its role in public finance, in particular in interjurisdictional competition. The main body of the dissertation consists of three chapters, which are relatively independent of each other. Their names are "Tax competition and governmental efficiency", "Theory of efficiency-enhancing intergovernmental grants", and "Citizen-centric governance indicators: Measuring and monitoring governance by listening to the people and not interest groups". First two of the essays analyze several public finance outcomes when governments - the main actors in the analysis - are different in their efficiency (quality), i.e. they transform tax revenues into public interest at a different rate. This includes both their expertise, integrity (absence of corruption), and exogenous circumstances they face in jurisdictions, they are chosen (or appointed) to administer. The third essay takes purely empirical approach to actually measuring and monitoring the quality of governance in different countries.

The literature on governance has exploded in recent years. Following Dixit (2008) there were only 4 citations of the word "governance" in Econlit during 1970-1979, while in 2000-2007 the number of citations rose to 15455. The research on governance is baked by media, international organizations (with World Bank and International Monetary Fund being in the first raw), and governments themselves, which dominantly perceive quality of governance as the main factor of growth and development (see North, 1990; Keefer and Knack, 97). Yet there are quite a few gaps in the research on governance: neither there is a common framework for its definition and measurement, nor there is empirical and theoretical research on the effect of governmental efficiency on many policy issues.

One of the policy issues, which has not been analyzed from the point of view of governance, - and it is in the first chapter of the dissertation - is international tax

competition. There is no place for asymmetric equilibrium in the standard interregional tax competition literature (see Wilson, 1986; Zodrow and Mieszkowski, 1986). Yet it seems to be the case in the European Union and USA - the economic areas, which are the most exposed to intergovernmental competition for mobile factors (for evidence, see Devereux et al., 2008; OECD, 1998). Asymmetric capital or population endowments in countries were used (in Bucovetsky, 1991; Wilson, 1991; Haufler and Wooton, 1999) as the explanations for their governments to adopt different corporate income taxes, but it does not cover the whole picture (take high-tax small Belgium vs. low-tax big Poland). An alternative explanation, which is explored in the Chapter 2 of the dissertation, is that taxes can be higher in the countries, which are governed better. The idea is that investors trust their tax money to the governments, which make better use of them.

Intergovernmental transfers and subsidies, when jurisdictions are governed with a different quality, is analyzed in the second chapter (Chapter 3) of the dissertation. The main argument among researchers and policymakers for advantaged jurisdictions sharing with disadvantaged ones is equity (see Constitutions of Canada, Australia, also Boadway, 1996; Oates, 1999; Shah, 2006). Still, transfers between governments may also promote the welfare of the whole country: eliminate fiscally induced migration (Boadway and Flatters, 1982; Dahlby and Wilson, 1994), mitigate harmful tax competition (Köthenbürger, 2002; Bucovetsky and Smart, 2006; Buettner, 2006), provide insurance from macroeconomic shocks (Persson and Tabellini, 1996; Lockwood, 1999), reduce fiscal barriers to factor mobility (Fuest and Huber, 2006). I argue in the Chapter 3 of the dissertation that transfers between governments may promote the efficiency of their service, if the governments are (at least partly) corrupt and self-interested. Namely, intergovernmental sharing equalizes fiscal capacities of the self-interested governments, which intensifies the intergovernmental competition for mobile factors, leading to a more efficient provision of the public goods.

The third essay of the dissertation, Chapter 4 is concerned with the assessment on practice of the quality of governance. The quantification of quite a vague concept of "governance" has almost infinite demand from mass media, researchers, governments, and international organizations. Meeting this demand, there is plenty of indexes of governance, endorsing certain ideological views, aggregation techniques and sets of chosen variables (HF, 2006; Kaufmann et al., 1999; Kaufmann and Kraay, 2008). The voids of these indexes are lack of conceptualization of governance (its definition) and over reliance on the opinion of different interest groups and country experts, whereas opinion of the main stakeholders of a country - the country's population - is left aside. Both of these gaps are addressed in the Chapter 4 of the dissertation: the quality of governance in a country is assessed based on the public opinion about

the government in this country.

Next I introduce each chapter - their motivation, related literature, and results - separately.

1.1 Chapter 2: quality of governance and international tax competition

Despite ever increasing mobility of capital in the globalized world the variation of capital income tax rates set by different countries does not seem to get smaller. In European Union there are basically no restrictions for capital movement, and many studies find the evidence of strategic interaction between European governments.[1] Yet, the variation of capital income tax rates in member-countries remains high: effective average tax rate (EATR), developed by Devereux and Griffith (2003), ranged in 2005 from 11% in Latvia and Ireland to 32% in Germany. Despite competition pressure countries like Germany, France or Netherlands managed to tax capital heavier than the countries like Ireland, Portugal or Greece. The data on EATR suggest that the gap between the tax rates in these countries is about 4-5 percentage points and persists through years, even though the tax rates have been declining in almost all countries.

The classical tax competition literature[2] does not provide an explanation for asymmetric equilibria apparently emerging in the European Union and other regions.[3] Some papers modify the classical model to allow for exogenous asymmetries between competing jurisdictions. Usually, the asymmetry concerns the size of the jurisdictions, be it either capital endowment or population (labor). Wilson (1987) shows that under free trade and free capital movement the country endowed initially with more capital sets higher capital income tax rate. Wilson (1991), Bucovetsky (1991), Kanbur and Keen (1993), Haufler and Wooton (1999), Bucovetsky and Haufler (2007) consider jurisdictions with different population and show that the bigger one taxes capital income heavier. Yet, these models do not seem to capture the whole story in the European Union: take capital and labor rich Poland with the effective tax rate of 19% in 2005 versus much smaller Belgium with the tax rate of 26%.

Chapter 2 provides an alternative explanation for an asymmetric outcome in a fiscal competition game. It is based on two principal assumptions. First, I claim

[1] See, for example, Devereux et al. (2008), Griffith and Klemm (2004), Nicodéme (2006)

[2] Starting from Oates (1972), Wilson (1986), and Zodrow and Mieszkowski (1986)

[3] The general conclusion of the theory is that the countries end up charging the same tax rate, which is inefficiently low

that governments of the competing countries are exogenously endowed with different degree of efficiency. Namely, it is assumed that in the framework of two countries government of one of them can produce more public good out of the same revenue. Second, as in Zissimos and Wooders (2008), the potential investors are assumed to have different needs for public inputs provided by the governments. The result of this asymmetric tax competition setting is that the capital tax rates may be different in equilibrium: if the difference between countries is big enough and a firm's profit function is sufficiently concave in public good then more efficient country attracts investments even with the higher tax, while the less efficient one is forced to use lower fiscal pressure as its only instrument of inducing firms to stay. It happens because even with high tax the efficient government offers more-than-proportional increase in the level of public good production. This in turn reduces the production costs of the firms, making it optimal for some of them to pay higher tax. Therefore, the government can run a balanced budget, and maintain higher level of tax burden.

The assumption that I make in this chapter, and the results that I get seem to be supported by an empirical evidence - governments in real world are different in their efficiency, and more efficient governments tax capital heavier. Coming back to the European Union, the Index of Economic Freedom (IEF), which arguably proxies governmental efficiency quite well,[4] follows the same pattern as the capital income tax rates: it is on average 30-40 points out of 500 higher for low-tax Greece and Portugal than for high-tax France, Germany or Netherlands.[5] The negative correlation between effective average tax rate and IEF in EU is clearly seen on the Figure 1.1.

Besides the papers mentioned above, which assume exogenous asymmetry between countries, there is another branch of the literature, which is related to the topic of the chapter, and which explores how interaction between symmetric jurisdictions may lead to the asymmetric outcome. Most of such studies assume the presence of a scale or agglomeration economies, which eventually, following the terminology of Baldwin and Krugman (2004), turns one jurisdiction into a high-tax core, and other into a low-tax periphery.[6] At the same time, Zissimos and Wooders (2008), Bènassy-Quèrè et al. (2007) show that even without agglomeration economies symmetric jurisdictions may turn into asymmetric core and periphery if governments

[4]IEF is issued annually by Heritage Foundation. In general, the proxies for governmental efficiency are discussed in the Section 2.3

[5]Which should mean that the latter countries are more efficient, since by definition the bigger IEF means lower ranking of a country

[6]See Baldwin and Krugman (2004), Kind et al. (2000), Ludema and Wooton (2000), Borck and Pflüger (2006), Bucovetsky (2005)

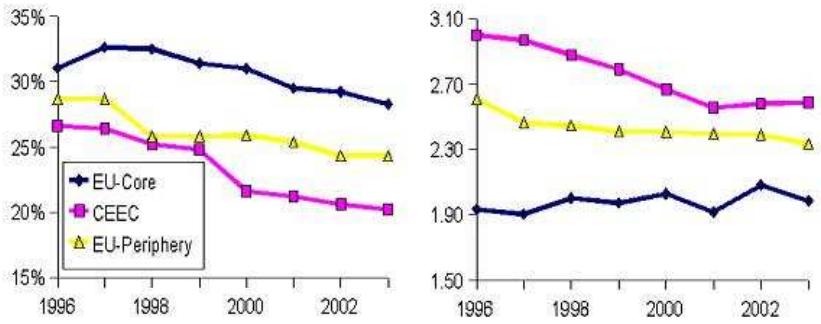


Figure 1.1: Tax burden vs. governmental efficiency in EU

Unweighted average in 3 groups: EU-Core - France, Germany, Belgium, Netherlands; CEEC - Poland, Czech Republic, Slovakia, Slovenia, Hungary; EU-Periphery - Spain, Portugal, Greece
Y-axis: on the left - effective average tax rate (EATR), on the right - Index of Economic Freedom (IEF) without tax burden, divided by 100
Source: EATR - Devereux and Griffith (2003), Kotans (2005); IEF - http://www.heritage.org

compete in both tax rates and public expenditures: the core would set higher tax rate and provide higher level of public inputs than periphery. While the setup of my model is very similar to that of Zissimos and Wooders (2008), I assume initial asymmetry between jurisdictions, and thus get a clear direction of asymmetry in equilibrium tax rates. Therefore, I assert that there are other factors but a chance (as in all papers mentioned above) that create high-tax/low-tax distribution. Besides, the specific purpose of the Chapter 2 is to explore the effect of governmental efficiency on the tax competition outcome.

Chapter 2 contributes to the literature in two ways. First, to the best of my knowledge, it is the first work that accounts for the efficiency of governments involved in tax competition. All of the earlier studies assume that each jurisdiction can produce the same amount of public good out of one unit of the private good. The varying governmental efficiency can be used to explain the fact, that the economically integrated areas in the real world still produce significant variation in capital income tax rates. The second contribution is that the combination of specific model (based on Zissimos and Wooders, 2008) and the assumption of varying governmental efficiency helps to explain several other empirical facts from the corporate income tax history of Europe. First of such facts is that despite high taxes in old EU countries (EU-Core) level of foreign direct investments in these countries is still much higher that in low-tax CEE countries. The second fact is that despite significant differences

in labor and capital endowments inside EU-Core countries from this part of Europe tax capital virtually at the same rate (25-26% except for Germany). The third fact is that the clear division on high-tax and low-tax groups of countries happened in Europe only after competition for the mobile tax base got more intense - after Maastricht Treaty of 1993, and after some CEE countries were officially recognized as candidates for EU membership. See Section 2.2 for the detailed discussion of these facts.

1.2 Chapter 3: Intergovernmental transfers as a tool to increase quality of governance

Intergovernmental sharing in the form of direct transfers or regional subsidies - both inside countries and on the international level - is a widely spread economic phenomenon. According to the IMF's Government Finance Statistics, in 1996-2000 36% of the local and provincial public spending in the world - over the sample of 109 countries, most biggest economies included - was financed by the transfers from same- or upper-tier governments. This number is significant both in developed countries (38%) and in developing ones (44%), both in federations (USA - 29%, Canada - 21%, Germany - 24%, India - 41%) and in unitary states (usualy more than 40%), and it does not seem to decrease with time (37% in 1991-1995, 35% in 1986-1990). Practically all countries in the world adopted some kind of fiscal equalization or regional subsidies schemes to help disadvantaged jurisdictions. According to Blöchliger, Merk, Charbit, and Mizell (2007), in OECD countries fiscal equalization made up on average about 2.3% of GDP in 2004. On the international level, about a third of the European Union's budget is being allocated each year to Structural Funds with the aim to strengthen economic and social cohesion among regions, EUR 340 billion is planned to be spent in 2007-2013. In 2007, USD 115 billion (0.34% of GNI) were transfered by bilateral donors to developing countries in the form of foreign aid - a form of international intergovernmental sharing.

While most scientists and especially politicians think of intergovernmental sharing, first of all, as of equity promoting instrument,[7] there are few studies, which explain this phenomenon from an efficiency point of view. One strand of the literature sees intergovernmental sharing as a way to suppress or diminish negative externalities arising from decentralized decision-making: inefficiently high migration, when congestion in public services is not taken into account by individual decision-

[7]Equity is prescribed in the Constitution of Canada, legislation of Australia, etc. See also Boadway (1996); Oates (1999); Shah (2004, 2006), etc.

makers (see Flatters et al., 1974; Boadway and Flatters, 1982; Dahlby and Wilson, 1994); inefficiently low tax rates, when jurisdiction engage in tax competition for mobile factors (see Köthenbürger, 2002; Bucovetsky and Smart, 2006; Buettner et al., 2006; Hindriks et al., 2008; Gaigné and Riou, 2007). Following another strand of the literature, intergovernmental transfers may also be used as an insurance mechanism against macroeconomic shocks on jurisdictions (Persson and Tabellini, 1996; Bucovetsky, 1997; Lockwood, 1999). Fuest and Huber (2006) argue that subsidies to disadvantaged region are necessary to achieve efficient location of businesses in a country, since welfare of the region's residents is not taken into account, when firms choose where to locate. The common feature of the papers above is that they concentrate on failures of competitive market to achieve efficient outcomes, while leaving aside the objectives of the governments involved - the bureaucrats in these papers are assumed to be benevolent social welfare maximizers.

As it is argued by the advocates of the Second Generation of Fiscal Federalism (see Brennan and Buchanan, 1980; Oates, 2005; Weingast, 2009) this idealistic view on the government is too optimistic - the bureaucrats are not perfect and in general they make decisions, which are favorable to them rather than to society. Inefficiencies on a governmental side are explored in the Chapter 3. Similarly to the papers above, it provides an economic rationale for why introduction of intergovernmental revenue sharing system in a country with two or more regions may lead to more efficient usage of tax revenue and consequently higher welfare of the country's residents. However, on a contrary to the previously mentioned papers, my argument builds on assumption that the local governments involved are (partly) malevolent, i.e. they are not merely transformers of tax revenue into public goods, but their objective is - at least to a certain degree - to maximize tax revenue less public spending, or in other words extract rents to the office. In addition, governments face different factor productivities in the jurisdictions they administer, or - to put it in the words of Equality of Opportunity theory[8] - jurisdictions have different "circumstances", so that even when the governments put the same "effort" the output in an advantaged jurisdiction is higher than the output in a disadvantaged one. Without intergovernmental sharing, the advantaged government is able to outcompete the disadvantaged one without using all of its potential, and thus extract additional rents from holding the office. The natural solution for the country in this case is to take away some share of revenue from the advantaged government and grant it to the disadvantaged one, i.e. to (partially) equalize circumstances that the governments face. It will enhance the competition between them and force both to produce public goods at a higher rate, i.e. put more effort.

[8]See Roemer (1998)

With the help of a simple model, which incorporates the assumptions described above, I am showing that intergovernmental sharing may indeed increase aggregate welfare of a country. This happens, however, only in the case when the transfer from the advantaged jurisdiction to the disadvantaged one comes in the form of regional subsidy - when marginal returns on capital, and not the budgets of the governments directly are affected. This helps to avoid moral hazard problem, when disadvantaged government has an incentive to increase tax base of the advantaged government in order to receive higher transfer. Another necessary condition for intergovernmental sharing to be welfare-improving is that the governments at least partly realize, that they are competing with the other governments, i.e. that their decisions influence the rate of return on mobile factor in the whole country. If all assumptions above are true, and the differences between jurisdictions are sufficiently large, the transfer from advantaged jurisdiction to the disadvantaged one benefits residents of both jurisdictions, i.e. it is a Pareto improvement from the no-subsidies case.

To the best of my knowledge, there is only one paper so far, which analyzes intergovernmental transfers (in their case - fiscal equalization) as an instrument to restrain malevolent behavior of bureaucrats. Kotsogiannis and Schwager (2008) use a model of yardstick competition, where governments are incidentally assigned the size of their tax base, and maximize their rents to office with account of probability to be elected for a next term. Authors argue that fiscal equalization of the governments reveals hidden information about their types to voters, which makes them put more efforts in the public good production. While the conclusions that this paper draws are somewhat similar to that of presented in the Chapter 3, the papers are different in the modeling techniques as well as in the aspects of inefficiencies on a governmental side analyzed. There is no political competition as well as no private information in my model: governments do not compete for voters, but trying to attract mobile factor (capital) to their jurisdiction, and their "circumstances" (initial advantages/disadvantage they face) are known to everyone in economy. In that sense equalizing governments (with the help of regional subsidies) may bring dividends to society's welfare in a wider range of situations than what is allowed in Kotsogiannis and Schwager (2008) - it works even when the local governments are not elected (which is rare though in a modern world) or when there are obstacles to free and honest political competition during elections (which is more commonly spread).[9]

In a sense, Chapter 3 is a natural continuation of the story portrayed in Cai and Treisman (2005). There the authors argue that opening borders for a free flow

[9] At the same time, fiscal equalization in the sense described in Kotsogiannis and Schwager (2008) would not work in my model, since it affects budget of local governments directly thus leading to the moral hazard problem

of capital may actually make governments less disciplined if there are differences in factor productivities between jurisdictions - foreseeing their loss in attraction of mobile capital disadvantaged governments simply give up competing and divert more revenue into unproductive consumption (rents to the office). This result resembles the more general one from the game theory that when the players are rewarded based on a relative performance the underdog of the competition supplies less effort than it would had it been rewarded on an absolute basis (or had it been competing with an equal one) (see Nalebuff and Stiglitz, 1983; Dixit, 1987). For example in sports, this theory tells us that a football (and I mean European football here) team of Economics graduate class would put less effort when it were playing with the national team of Brazil (5 times world champion) then when it were playing with, say, a team of Chemistry graduate class. What I suggest in the Chapter 3[10] is that equalizing an underdog and a favorite (disadvantaged and advantaged government, Economics graduate class and Brazilian national teams) would induce underdog to put more efforts in a competition, which is beneficial for society in this case. What is more, the favorite's advantage gets smaller with equalization, which induces it to put more effort in a competition too: Brazilian national football team tries much harder when it plays with an Italian national team (4 times world champion) then when it plays with the Economics graduate class team.

1.3 Chapter 4: Measuring quality of governance

Chapter 4 of this dissertation was co-authored by Dr. Anwar Shah from the World Bank. My part of the job was - based on the conceptual framework of governance, laid out by Dr. Shah - to find relevant data, process them, produce the actual indicators, and check their robustness. In the parts of this dissertation, which are related to the Chapter 4 term "we" refers to me and Dr. Shah.[11]

Over the last decade, there has been a proliferation of composite worldwide governance indicators purporting to measure various aspects of governance quality. The growth of these indicators have been spurned by generous support by the development assistance community especially multilateral development finance agencies and infinite appetite of media and the academic community for governance assessments and country rankings. Governance indicators are now being used as tools for conducting development dialog, allocating external assistance and influencing foreign

[10] A similar idea was expressed in Cai and Treisman (2005)

[11] At the same time, the views expressed in the Chapter 4 are those of the authors alone and should not be attributed to World Bank and its Executive Directors

direct investment. Each new indicator series are now released with great fanfare from major industrial country capitals and the popular press uses these indicators to name and shame individual countries for any adverse change in rank order over time or across countries. The development assistance community is increasingly using these indicators in making critical judgments on development assistance. The World Bank's International Development Association (IDA) allocation - a window of subsidized lending to the developing world and the United States Agency for International Development's Millennium Challenge Account uses various governance indicators as criteria for allocating external assistance. At the same time, some of the recent findings of these indicators have also led to much controversy and acrimony and thereby contributing to complicating the dialog on development effectiveness.[12] In view of the influential nature of these indicators and potential to do harm if judgments embodied in these indicators are biased and erroneous, it is imperative that they capture critical dimensions of the quality of governance and all countries are evaluated using uniform and reasonably objective assessment criteria.

Do the existing indicators meet this test? While the literature on this subject is woefully inadequate and thin, four widely used indicators namely the World Bank's Worldwide Governance Indicators (WGIs), Overseas Development Institute's World Governance Assessments (WGAs), Mo Ibrahim Foundation's Indexes of African Governnace (IIAGs) and the United Nations Economic Commission for Africa's African Governance Report Indicators (AGRIs) - all lack a conceptual framework on governance, lack of citizen-based evaluations and time and country assessment inconsistencies to make their rankings suspect. A number of recent papers have been especially critical of WGIs for lacking "concept" (implying lack of clarity in conceptualization) and "construct" (implying lack of clarity in measurement) validity, sample bias (mostly interest group views), lack of transparency and time inconsistency of definitions and measurements (see Arndt, 2008; Arndt and Oman, 2006; Kurtz and Schrank, 2007; Iqbal and Shah, 2008; Langbein and Knack, 2008; Schrank and Kurtz, 2008; Thomas, 2006). One of the most important limitation common to all available composite indexes of governance is that they fail to capture how citizens perceive the governance environment and outcomes in their own countries.

For governance assessments to be useful for policy purposes, they must conceptualize governance and provide uniform and consistent criteria for measuring governance across countries and over time. Foremost concerns for such measurement should be citizens' evaluation of governance environment and outcomes in their own countries supplemented of course by objective indicators of the same. For develop-

[12]See Iqbal and Shah (2008) for examples of indefensible country ranking by one of the more widely used indicators

ment assistance purposes, these indicators could be supplemented by experts-based evaluations. There is some work available on objective indicators as done by the Doing Business indicators of the World Bank and on experts-based evaluations as done for the Global Integrity Index. The most important void in our knowledge is how citizens view governance environment and outcomes in their countries.

Chapter 4 takes a first step to fill the above-mentioned void. First, we specify a citizen-centric conceptual framework on measuring governance quality, where citizens - the main stakeholders of a country - are asked to evaluate the quality, with which their country is being governed. Then we provide the framework for general empirical implementation of our conceptual framework. Using the data from World Values Survey project, we actually implement this framework, and build citizen-centric governance indicators for 125 countries in different years from 1994 to 2005.

Chapter 2

Tax competition and governmental efficiency

This chapter is organized the following way. The model is set up in Section 2.1. The solution to it is analyzed in Section 2.2. Finally, Section 2.3 presents some anecdotal empirical evidence.

2.1 Setup of the model

The basic features of the model are borrowed from Zissimos and Wooders (2008). However, I adjust their model to account for differences in governmental efficiency, and this brings quite a significant departure from their results.

The model consists of 2 countries, A and B, and multinational absentee firms, willing to invest in either of these countries. Governments of both countries levy tax on every firm entering the market, and produce public goods out of the collected revenue. Firms make their investment choices taking into account the tax rates and levels of public good production, offered by the governments, τ_A, τ_B, g_A, g_B correspondingly. After locating the production in one of the countries each firm produces one unit of some good and sells it on the world market.

We concentrate first on the behavior of the firms, then go back to the governments.

2.1.1 Firms

There is continuum of firms in the economy. All of them are owned by absentees, i.e. governments do not take their profits into account when designing their fiscal policy. Public goods, provided by the government, are assumed to affect positively

the production technology of each firm. With regard to this firms are characterized by parameter s, which is distributed uniformly on $[0, 1]$. The profit function of the firm s (firm of type s) looks the following way:

$$\Pi_i = p - c - \tau_i + sg_i^\theta,\ i \in \{A, B\},\ 0 < \theta < 1 \tag{2.1}$$

Here p is the price of the good on the world market, and c is some cost of producing this good. Both p and c are exogenously given in the model. Neither of them depends on the fiscal policy of a particular government, i.e. they do not change with τ_i and g_i. As it was assumed earlier the output is also set to 1, and cannot be changed by the fiscal policy. This way we can ignore any distortive effects of taxation. This assumption may seem more realistic when one thinks of big multinational firm choosing location for small investment, which will have close-to-nothing effect on the firm's global pricing and output policy. In general, p and c are not important for our further analysis, and the only thing we demand is that the difference between them is big enough to assure non-negative profits of the firm.

τ_i is the tax a firm has to pay if it invests in the country i, and g_i is the amount of public good produced by government i. $sg_i^\theta,\ 0 < \theta < 1$ is the firm's s cost reduction of producing one unit of the good due to public input. It exerts decreasing returns to scale with regard to g_i, which we would naturally expect, and it is increasing with type of firm s. This way I differentiate between firms, and claim that some of them benefit from public infrastructure present in a country more than the others. For instance, if one thinks of different industries, then, say, a producer of microprocessors or generic drugs will benefit a lot from highly-educated labor, high level of public R&D spending and qualitative copyright laws. Such firms are of high s type. At the same time, a producer of some crop or cheap clothes will not need much public infrastructure and care more about the taxes it pays. Therefore, it has low s type.

Each firm faces the tax rates in counties A and B - τ_A and τ_B respectively, and the levels of public good provision - g_A and g_B. For every s if $-\tau_A + sg_A^\theta > -\tau_B + sg_B^\theta$ then firm s invests in the country A, if $-\tau_A + sg_A^\theta < -\tau_B + sg_B\theta$ then it goes to the country B. Otherwise, firm s is indifferent. As a result, share of the firms $\hat{s}_B$ will go to country B, the others $\hat{s}_A = 1 - \hat{s}_B$ will go to A. Obviously, both $\hat{s}_A$ and $\hat{s}_B$ are between 0 and 1, and both depend on strategic interaction between governments.

Finding the expression for $\hat{s}_B = \hat{s}_B(\tau_A, \tau_B, g_A, g_B)$ is crucial for further analysis. We proceed with the following lemma:

Lemma 2.1.1 *Depending on $\tau_A,\ \tau_B,\ g_A$, and g_B $\hat{s}_B$ can only take values 0, 1, $\hat{s}$, or $1 - \hat{s}$ where*

$$\hat{s} = \frac{\tau_A - \tau_B}{g_A^\theta - g_B^\theta}. \tag{2.2}$$

In particular, when $\tau_A > \tau_B$, $g_A > g_B$, and the difference between tax rates is sufficiently small:

$$0 < \hat{s}_B = \hat{s} < 1 \tag{2.3}$$

and $\hat{s}$ is the type of firm, which is indifferent between investing in either of countries.

Proof See the Appendix A.1.1

Lemma 2.1.1 tells that if there exists a firm of type $\hat{s}$, the after-tax profits of which will be equal in both countries, firms of higher type will be willing to invest in the country with higher tax rate, but also with higher level of public good provision. On a contrary, firms of lower type will invest in low-tax-low-public-good-provision country.

Another point to make is that $\hat{s}_B$ is not continuous everywhere. In particular, it is discontinuous in points of type $(\tau_A, \tau_A, g_A, g_A),\ \forall\ \tau_A,\ g_A$, where it takes value $1/2$, but can jump to 0 or 1 for any infinitesimally small change in arguments.

We continue with the governments in the model.

2.1.2 Governments

Each government sets the tax rate and chooses the level of public good provision in a jurisdiction. Its objective is to maximize the difference between the revenue it collects from investors and the amount it spends to produce public goods.

The objective functions of the governments A and B look the following way:

- government A, given τ_B and g_B, -

$$\max_{\tau_A, g_A} \tau_A * (1 - \hat{s}_B) - g_A/b,\ b > 1 \tag{2.4}$$

- government B, given τ_A and g_A, -

$$\max_{\tau_B, g_B} \tau_B * \hat{s}_B - g_B, \tag{2.5}$$

  where $\hat{s}_B = \hat{s}_B(\tau_A, \tau_B, g_A, g_B)$ is determined jointly by the decisions of government A and government B.

$\tau_A * (1 - \hat{s}_B)$ in the objective function (2.4) is the total revenue of government A - tax rate τ_A multiplied by a tax base of the government A, which is equal to the share of firms $\hat{s}_A = 1 - \hat{s}_B$ investing in the country A. Analogously in the objective

function (2.5), $\tau_B * \hat{s}_B$ is the revenue of government B. g_A/b and g_B are the amounts of public spending by governments A and B correspondingly.

As it can be seen from (2.4), the transformation from private good into public one is not one-to-one as it is assumed in most of the similar models:[1] to produce one unit of the public good the government A has to use only $1/b$, $b > 1$ units of the private good, while for the government B the transformation is one-to-one. In this way I assume that the government of the country A is more efficient in producing the public good then the government of the country B, i.e. it is able to produce more units of the public good out of the same amount of the private good. b is referred to as an efficiency parameter.

The objective functions (2.4)-(2.5) are consistent with two different views on the nature of a government. First view, firstly developed by Brennan and Buchanan (1980),[2] considers government as an ever-growing Leviathan, interested only in increasing its size and extracting as much rents from holding the office as possible. If we assume malevolent government in our case, and no way households can control it, then maximizing the difference between revenue and spending means exactly maximizing the rents from holding the office.

From the other side, under our initial assumptions, the government can also be considered as the one maximizing country's welfare. Indeed, as all firms are owned by absentees, the government is not taking into account the firms' profits. Additionally, I ignore all the price effects, which may be caused by fiscal policy, and abstract from all the possible good and bad sides of FDI.[3] As a result, the only way the firms affect the welfare of the country is by paying the tax to the government. The revenue less public expenditures then may be distributed among households or used for production of public goods, which benefit households. Therefore, benevolent government will have the objective function like (2.4) or (2.5).[4]

It is left to note that the tax base of each government ($(1-\hat{s}_B)$ for the government A, $\hat{s}_B$ for the government B) depends on the choices of both of them. Therefore they set their tax rates and levels of public good production strategically. At the same time, there is no need to worry about the budget constraint of each government, since the tax rate and the level of public good provision are set simultaneously and independently of each other. Therefore, each government always has an option to

[1] See Introduction for the discussion

[2] See also Edwards and Keen (1996), Zissimos and Wooders (2008)

[3] See, for example, Rama (2001), Javorcik (2004), Chor (2006)

[4] There would be some trade off if we assume that the households receive also utility from public inputs produced by the government, as it is argued, for example, by Bènassy-Quèrè et al. (2007). For simplicity, we do not touch this issue here

set 0 tax rate, produce no public goods and get 0 rents.

2.2 Solution of the model

Competing for foreign investments, governments are engaged in a tax competition game, where the objective functions are given by (2.4) and (2.5). The equilibrium of this game is the intersection of corresponding governmental reaction functions. However, finding of those gets complicated by the fact that the function $\hat{s}_B$ is not differentiable, and even not continuous everywhere (as we can see from the Lemma 2.1.1). As a result, the objective functions of both governments are not differentiable and discontinuous in certain points, so we cannot use standard methods of calculus to maximize them.

Intuitively, however, it should be clear that in equilibrium both governments are willing to attract strictly positive share of investments to their countries. Country A, being relatively more efficient, has better chances of doing that by offering to firms high level of public good provision. Consequently, it can also charge high income tax, as a trade-off between higher revenue per firm and smaller share of firms willing to invest in high-tax-high-public-good-provision country. At the same time, country B can attract low-s firms by offering low tax rate. Intuitively, we conjecture then that in equilibrium tax rate, as well as level of public good provision in country A are higher than in country B, and $0 < \hat{s}_B < 1$ - there exist a firm, which is indifferent between investing in either of two countries.

However, the above-mentioned intuitive result apparently is not valid for all values of our parameters in the model: efficiency parameter b (from (2.4)) and a firm's profit function parameter θ (from (2.1)), which basically measures the concavity of the profit function with regard to public good. Indeed, if b is close to 1 - so that governments A and B are relatively equally efficient - the government B may find it optimal to deviate from a low-tax strategy. Instead it may mimic the strategy of the government A - set the same tax rate and produce slightly more of the public good. This way it will attract all the firms in the economy. From the other side, if the tax competition between the governments is not very intense - θ is high - then the government A may find it optimal to mimic B, i.e. set lower tax, but produce much less of the public good.

My further objective in this chapter is to show the math behind the intuition. In the Proposition 2.2.1 I find the explicit equilibrium values of the tax rates and the levels of public good provision if the efficient government A does set the higher tax rate and produces more of the public good than the government B (in line with our intuitive arguments). In the Proposition 2.2.3 I derive the set of parameter values

of b and θ, for which the governments do not deviate from the strategies assumed in the Proposition 2.2.1.

In general, suppose the strategy of the government B is to play (τ_B, g_B). Government A has then several options:

I. $\tau_A = \tau_B,\ g_A = g_B+$ - "mimicking" strategy. Government A can set the tax rate to τ_B and produce slightly more public good. This way all the firms prefer to invest in the country A ($\hat{s}_B = 0$), so the revenue of A is:

$$Rev_A^M = \tau_B - \frac{g_B}{b} \tag{2.6}$$

- the government collects τ_B in taxes and, being more efficient than the government B, spends only $\frac{g_B}{b}$ to produce g_B.

II. $\tau_A > \tau_B,\ g_A \leq g_B$ - set higher tax rate, but lower level of the public good provision. This is clearly not an optimal strategy for the government A, since all firms prefer to invest in country B in this case ($\hat{s}_B = 1$) ;

III. $\tau_A < \tau_B,\ g_A > g_B$ - set lower tax, but higher level of public good provision. A does not play this strategy either - even though all firms invest in A in this case ($\hat{s}_B = 0$), the strategy is strictly dominated by the "mimicking" one;

IV. $\tau_A < \tau_B,\ g_A < g_B$ - "decrease" strategy. Government A sets tax rate and level of public good provision lower than its competitor;

V. $\tau_A > \tau_B,\ g_A > g_B$ - "increase" strategy. Both tax rate and level of public good provision are chosen to be higher than in country B.

Government B, facing (τ_A, g_A) strategy from the government A, has similar options. The only difference is that the payoff from playing the "mimicking" strategy is:

$$Rev_B^M = \tau_A - g_A. \tag{2.7}$$

As a result, there are 3 different kinds of responses for both governments: they can either mimic each other's strategies, play "decrease", or play "increase" strategies. In either case the functional form of $\hat{s}_B$ changes, so are the objective functions of the governments (2.4)-(2.5).

We proceed with the following proposition:

Proposition 2.2.1 *Assume in the equilibrium of the game (2.4)-(2.5) $\tau_A > \tau_B$ and $g_A > g_B$ - government A plays the "increase" strategy, and government B plays the "decrease" strategy. Then in equilibrium:*

$$\hat{s}_B^I = \frac{1}{3}, \tag{2.8}$$

$$\tau_A^I = \frac{2}{3}\left(\frac{\theta}{9}\right)^{\frac{\theta}{1-\theta}}\left((2b)^{\frac{\theta}{1-\theta}} - 1\right), \quad g_A^I = \left(\frac{2\theta b}{9}\right)^{\frac{1}{1-\theta}}, \tag{2.9}$$

$$\tau_B^I = \frac{1}{3}\left(\frac{\theta}{9}\right)^{\frac{\theta}{1-\theta}}\left((2b)^{\frac{\theta}{1-\theta}} - 1\right), \quad g_B^I = \left(\frac{\theta}{9}\right)^{\frac{1}{1-\theta}}, \tag{2.10}$$

where I stands for "increase".

Proof It follows from the Lemma 2.1.1 that when $\tau_A > \tau_B$ and $g_A > g_B$:

$$0 \leq \hat{s}_B = \frac{\tau_A - \tau_B}{g_A^\theta - g_B^\theta} \leq 1, \tag{2.11}$$

if the difference between the tax rates is not too big. Assuming this is the case - later we will check this assumption - we can rewrite (2.4)-(2.5) in the following way:

$$\max_{\tau_A, g_A} \ \tau_A\left(1 - \frac{\tau_A - \tau_B}{g_A^\theta - g_B^\theta}\right) - \frac{g_A}{b}, \tag{2.12}$$

$$\max_{\tau_B, g_B} \ \tau_B \frac{\tau_A - \tau_B}{g_A^\theta - g_B^\theta} - g_B, \tag{2.13}$$

To solve (2.12)-(2.13) we can use standard calculus technique. First-order conditions for the objective function (2.12):

$$1 - \frac{\tau_A - \tau_B}{\Delta} - \frac{\tau_A}{\Delta} = 0, \tag{2.14}$$

$$\tau_A \frac{\tau_A - \tau_B}{\Delta^2}\theta g_A^{\theta-1} = \frac{1}{b}, \tag{2.15}$$

where

$$\Delta = g_A^\theta - g_B^\theta. \tag{2.16}$$

First-order conditions for the objective function (2.13):

$$\frac{\tau_A - \tau_B}{\Delta} - \frac{\tau_B}{\Delta} = 0, \tag{2.17}$$

$$\tau_B \frac{\tau_A - \tau_B}{\Delta^2}\theta g_B^{\theta-1} = 1, \tag{2.18}$$

The system of equations (2.14)-(2.18) implies the solutions to (2.12)-(2.13) - 4 unknown variables in 4 equations. We proceed with finding its solution. From the equation (2.18):

$$\tau_B = \frac{\tau_A}{2} \tag{2.19}$$

Then from (2.14):

$$\tau_A = \frac{2}{3}\Delta \;\Rightarrow\; \tau_B = \frac{1}{3}\Delta \tag{2.20}$$

Then

$$\hat{s}_B = \frac{\tau_A - \tau_B}{\Delta} = \frac{1}{3} \tag{2.21}$$

- $\hat{s}_B$ is indeed between 0 and 1 in equilibrium, as it was assumed earlier.

Substituting τ_A and τ_B in (2.15)-(2.18) we get:

$$g_A^I = \left(\frac{2\theta b}{9}\right)^{\frac{1}{1-\theta}}, \quad g_B^I = \left(\frac{\theta}{9}\right)^{\frac{1}{1-\theta}} \tag{2.22}$$

Then:

$$\Delta = \left(\frac{2\theta b}{9}\right)^{\frac{\theta}{1-\theta}} - \left(\frac{\theta}{9}\right)^{\frac{\theta}{1-\theta}}, \tag{2.23}$$

so we can get the expressions (2.9)-(2.10) for τ_A^I and τ_B^I.

Finally, to prove that the solutions (2.9)-(2.10) are the points of maximum for (2.12)-(2.13)respectively we need to look at the second order conditions. With some restrictions on b and θ these conditions are fulfilled. This is demonstrated in the following lemma:

Lemma 2.2.2 *The second order conditions for both objective functions (2.12)-(2.13) are satisfied if*

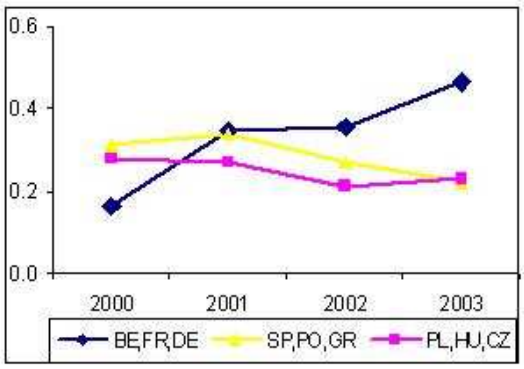
$$b < \frac{9}{2\theta}\left(\frac{3-3\theta}{\theta}\right)^{\frac{1-\theta}{\theta}}. \tag{2.24}$$

For instance, if θ is 0.7 than b should be less than 7.15, for $\theta = 0.5$ b should be less than 27, and for 0.2 - less than 460000.

Proof See Appendix A.1. ∎

Several points should be noted about what we have just proved. First, Proposition 2.2.1 tells us that $\hat{s}_B$ is 1/3 in the equilibrium. It means that two thirds of all firms in the economy prefer to invest in the high-tax country, i.e. they are willing

Figure 2.1: FDI flows from US to EU



Note Unweighted 3 last years average in 3 groups: BE,FR,DE - Belgium, France, Germany; SP,PO,GR - Spain, Portugal, Greece; PL,HU,CZ - Poland, Hungary,Czech Republic;
Y-axis: US FDI flows in the country group, % of GDP (datapoint of Hungary in 2000, -3.8% of GDP, is excluded)
Source: UNCTAD

to pay more taxes in exchange for qualitative public infrastructure. This is rather surprising result in the light of popular view that the tax competition distorts the tax base of traditionally high-tax countries and directs foreign firms to "tax havens".[5] However, this result is consistent with the empirical evidence from EU. For instance, in Belgium on average 51 US dollar in every thousand of country's GDP was invested by US firms in 1995-2003. In Portugal this number was 25, and in Poland - 20. The annual data on FDI flows are quite volatile, but if averaged over several years the picture becomes clear (see Figure 2.1). The discrepancy between country groups gets even bigger if we look at the per capita or just level data - despite low taxes, openness and promising opportunities of newly emerged markets international capital does not seem to migrate from the countries with the efficient provision of public infrastructure.

From (2.9) we can see that the provision of the public good in the country A increases with b - government A uses its efficiency advantage to attract investment. At the same time, provision of the public good in the country B does not depend on the relative efficiency of its competitor - only θ enters (2.10). Government B provides only a minimal public infrastructure and attracts the firms with its low taxes.

The tax rates τ_A and τ_B set by governments A and B in the equilibrium are proportional to Δ - a difference between two countries in the production cost reduction

[5]See, for example, OECD (1998)

they offer to each investor (without accounting for s - type of a firm). The bigger is the difference between the countries the higher are the rates in both of them, hence the less harsh is the tax competition between the countries. At the same time, both tax rates and levels of public good provision (2.9)-(2.10) decrease when θ gets smaller. This is because smaller θ for each firm means higher elasticity of the public good offered by a country to the tax paid in that country - public good gets less valuable for the firms, so they value lower taxes more.

The Proposition 2.2.1 reports equilibrium τ_A, τ_B, g_A and g_B if government A plays the "increase" strategy, and government B plays the "decrease" strategy. It is still needed to be proved, though, that the governments do not want to deviate from these strategies. The conditions, for which it is the case, are given in the following proposition:

Proposition 2.2.3 *Let the game be given by the equations (2.4)-(2.5). Then (2.9)-(2.10) is the equilibrium of this game if:*

I. θ is small enough - the profit function of a firm (2.1) is sufficiently concave in the level of public good provision. In particular, if $\theta \geq \frac{1}{2}$ than regardless of its efficiency advantage b government A always chooses to deviate from the "increase" strategy;

II. b is big enough - the countries are sufficiently different in the efficiencies of their governments. For every θ the smallest b compatible with the equilibrium (2.9)-(2.10) is the maximum of the solutions to the following equations (in case it does not contradict condition (2.24) for the SOC's to hold):

$$b^{\frac{\theta}{1-\theta}} \left(\frac{1}{\theta} 2^{\frac{\theta}{1-\theta}} - 2^{\frac{1}{1-\theta}} \right) - \frac{1}{\theta} + \frac{1}{b} = 0, \tag{2.25}$$

$$-\frac{5}{\theta} \left((2b)^{\frac{\theta}{1-\theta}} - 1 \right) + 2b - 1 = 0 \tag{2.26}$$

If at least one of the conditions (I)-(II) does not hold than the game (2.4)-(2.5) does not have an equilibrium in pure strategies.

Proof (2.9)-(2.10) is the equilibrium of (2.4)-(2.5) if:

I. facing (τ_B, g_B) as in (2.10) government A does not have an incentive to play "mimicking" or "decrease" strategies;

II. facing (τ_A, g_A) as in (2.9) government B does not have an incentive to play "mimicking" or "increase" strategies.

Thus to prove the proposition we first need to see for which values of θ and b these conditions hold. Then we need to show that the other combination of the strategies, which may lead to the equilibrium in the pure strategies, - when government A plays the "decrease" strategy, and government B plays the "increase" strategy - does not lead us to the equilibrium.

I break the proof into several lemmas.

Lemma 2.2.4 *Facing (τ_B^I, g_B^I) as in (2.10) government A has an incentive to "mimic" the strategy of the government B if and only if:*

$$b^{\frac{\theta}{1-\theta}}\left(\frac{1}{\theta}2^{\frac{\theta}{1-\theta}} - 2^{\frac{1}{1-\theta}}\right) - \frac{1}{\theta} + \frac{1}{b} < 0 \tag{2.27}$$

Proof By mimicking the government B's strategy - to set τ_A to τ_B^I and g_A to g_A^I - the government A attracts all firms to its country ($\hat{s}_B = 0$). The difference in revenues from playing two strategies ("increase" vs. "mimicking") is the following:

$$Rev_A^I - Rev_A^M = (1 - \hat{s}_B^I)\tau_A^I - \frac{g_A^I}{b} - \tau_B^I + \frac{g_B^I}{b} \quad - \tag{2.28}$$

the government A uses its efficiency advantage in both cases. Substituting (2.9)-(2.10) into (2.28) and doing some basic calculations we obtain:

$$Rev_A^I - Rev_A^M = \left(\frac{\theta}{9}\right)^{\frac{1}{1-\theta}}\left(b^{\frac{\theta}{1-\theta}}\left(\frac{1}{\theta}2^{\frac{\theta}{1-\theta}} - 2^{\frac{1}{1-\theta}}\right) - \frac{1}{\theta} + \frac{1}{b}\right) \tag{2.29}$$

The government chooses the strategy, which results in the higher revenues. Hence the condition (2.27). ∎

Now we proceed with the analysis of (2.27). First, one auxiliary result is shown:

Lemma 2.2.5 *The function*

$$f(\theta) = \frac{1}{\theta}2^{\frac{\theta}{1-\theta}} - 2^{\frac{1}{1-\theta}} \tag{2.30}$$

is decreasing for all θ's between 0 and 1. In addition, $f(\frac{1}{2}) = 0$.

Proof See Appendix A.1.

The condition I of the Proposition is proved below:

Lemma 2.2.6 *The following statements hold:*

I. If $\theta \geq \frac{1}{2}$ then for any b $Rev_A^I - Rev_A^M < 0$ - if θ is too high then the government A always chooses the "mimicking" strategy.

II. If $\theta < \frac{1}{2}$ then there always exists efficiency parameter b^*, for which $Rev_A^I - Rev_A^M \geq 0$, and for all $b > b^*$ $Rev_A^I - Rev_A^M > 0$ - if the profit function of a firm is sufficiently concave (θ is small enough) and the countries are sufficiently different in their efficiency then the "increase" strategy becomes optimal for the government A.

Proof From the Lemma 2.2.2 it follows that:

$$Rev_A^I - Rev_A^M < 0 \;\Leftrightarrow\; b^{\frac{\theta}{1-\theta}} f(\theta) - \frac{1}{\theta} + \frac{1}{b} < 0, \tag{2.31}$$

where $f(\theta)$ is defined by (2.30).

For $\theta \geq \frac{1}{2}$ $f(\theta) \leq 0$. At the same time, $\frac{1}{\theta}$ is always greater than $\frac{1}{b}$. Hence the first part of the lemma.

To prove the second part, it is enough to note that for any θ between 0 and 1:

$$\lim_{b\to\infty} b^{\frac{\theta}{1-\theta}} = \infty. \tag{2.32}$$

Therefore, if $f(\theta) > 0$ (or equivalently $\theta < \frac{1}{2}$) then for each θ there exists b^*, for which $Rev_A^I - Rev_A^M = 0$ - solution to the equation (2.25).

It is left to show that for any $b > b^*$ $Rev_A^I - Rev_A^M > 0$- "increase" strategy is optimal. From (2.25):

$$\left(b^{\frac{\theta}{1-\theta}}\left(\frac{1}{\theta}2^{\frac{\theta}{1-\theta}} - 2^{\frac{1}{1-\theta}}\right) - \frac{1}{\theta} + \frac{1}{b}\right)'_b = b^{-2}\left(\frac{\theta}{1-\theta} f(\theta) b^{\frac{1}{1-\theta}} - 1\right). \tag{2.33}$$

(2.33) changes sign only once, in the point $\hat{b} = \left(\frac{1-\theta}{\theta f(\theta)}\right)^{1-\theta}$, and for all $b > \hat{b}$ it is positive (therefore, $Rev_A^I - Rev_A^M$ is increasing in these points). Now, as our b^* is the solution of (2.25), we have:

$$b^{*\frac{\theta}{1-\theta}}\left(\frac{1}{\theta}2^{\frac{\theta}{1-\theta}} - 2^{\frac{1}{1-\theta}}\right) - \frac{1}{\theta} + \frac{1}{b^*} = 0 \;\Rightarrow\; \frac{\theta}{1-\theta} f(\theta) b^{*\frac{1}{1-\theta}} - 1 = \frac{b^* - 1}{1-\theta} > 0. \tag{2.34}$$

Therefore for all points $b > b^*$ $Rev_A^I - Rev_A^M$ is increasing, and consequently, is greater than 0. ∎

While for every $\theta < \frac{1}{2}$ there exist b, which makes "increase" strategy dominating the "mimicking" strategy, this is not true in general in the reverse order - there are b's greater than 1, for which $Rev_A^I - Rev_A^M$ is always smaller than 0 (regardless of θ). This result is proved in the following lemma:

Lemma 2.2.7 *Let θ be between 0 and $\frac{1}{2}$. Then:*

$$\min_{\theta} \left\{ b : \ Rev_A^I - Rev_A^M > 0 \right\} > 1 \ - \tag{2.35}$$

the lowest efficiency parameter of the government A b should be strictly greater than 1. Therefore, the countries should be sufficiently different in their efficiency in order for the "increase" strategy of the government A to dominate the "mimicking" strategy.

Proof If $b = 1$ then the left-hand side of (2.25) is:

$$\left(b^{\frac{\theta}{1-\theta}} \left(\frac{1}{\theta} 2^{\frac{\theta}{1-\theta}} - 2^{\frac{1}{1-\theta}} \right) - \frac{1}{\theta} + \frac{1}{b} \right) \Bigg|_{b=1} = \left(\frac{1}{\theta} 2^{\frac{\theta}{1-\theta}} - 2^{\frac{1}{1-\theta}} \right) - \frac{1}{\theta} + 1 \tag{2.36}$$

To prove the lemma we need to show that the expression (2.36) is smaller than 0 for all θ between 0 and $\frac{1}{2}$. This is so if and only if:

$$\frac{2^{\frac{\theta}{1-\theta}} - 1}{2^{\frac{1}{1-\theta}} - 1} < \theta. \tag{2.37}$$

It is easy to check that for all θ's in our range left-hand side of the equality above is strictly monotone (increasing). At the same time, it changes from 0 (when θ is 0) to $\frac{1}{4}$ when θ is $\frac{1}{2}$. Therefore, for any θ between 0 and $\frac{1}{2}$ this inequality is true. ∎

In the Lemmas 2.2.6 and 2.2.7 we stated the conditions needed for the government A's "increase" strategy to dominate the "mimicking" strategy. Now we need to check if the government A has an incentive to deviate to the "decrease" strategy. The result is formulated in the following lemma:

Lemma 2.2.8 *Suppose government A faces (τ_B^I, g_B^I)-strategy of the government B. Then for any θ between 0 and 1, and for any $b > 1$ the "increase" strategy of A dominates the "decrease" strategy.*

Proof See Appendix A.1.

While we have shown that the "increase" strategy is indeed optimal for the government A if conditions (I)-(II) of the proposition hold, we still need to check if the government B has no incentives to deviate from the "decrease" strategy. The conditions which are necessary for that are given in the following lemma:

Lemma 2.2.9 *Suppose the government B faces* (τ_A^I, g_A^I)*. Then for every* θ *between* 0 *and* $\frac{1}{2}$ *there exist* b^* *for which (and for all* $b > b^*$*) the "decrease" strategy of B dominates the "mimicking" strategy.* b^* *is derived from the following equation:*

$$-\frac{5}{\theta}\left((2b^*)^{\frac{\theta}{1-\theta}} - 1\right) + 2b^* - 1 = 0 \tag{2.38}$$

Moreover, b^* *as a function of* θ *is decreasing with* θ*, and* $b^*(\frac{1}{2}) = 4.5$ *- the smallest relative efficiency parameter consistent with playing the "decrease" strategy in optimum.*

Proof By mimicking the strategy of the government A B attracts all firms to the economy but it has to produce the government A's amount of public goods. The difference in revenues between the "decrease" and the "mimicking" strategies is the following:

$$Rev_B^I - Rev_B^M = \hat{s}_B^I \tau_B^I - g_B^I - \tau_A^I + g_A^I = -\frac{5}{9}\Delta + \Delta_g, \tag{2.39}$$

where $\Delta_g = g_A^I - g_B^I$. After some calculations we obtain:

$$Rev_B^I - Rev_B^M = (\frac{\theta}{9})^{\frac{1}{1-\theta}}\left(-\frac{5}{\theta}((2b)^{\frac{\theta}{1-\theta}} - 1\right) + 2b - 1). \tag{2.40}$$

Therefore, the sign of $Rev_B^I - Rev_B^M$ is the same as the sign of the left-hand side of the identity (2.38). It is easy to verify that this left-hand side reaches its minimum at $b = 2.5$ for every feasible θ. Moreover, for every feasible θ it is smaller than 0 at $b = 1$, and goes to infinity when b goes to infinity. Hence, the equation (2.38) has the unique solution in terms of b for every θ between 0 and $\frac{1}{2}$. We call it b^*.

b^* decreases with θ and for $\theta = \frac{1}{2}$ $b^* = 4.5$ - the smallest relative efficiency parameter consistent with playing the "decrease" strategy in optimum. The proof of this fact is rather technical and is given in the Appendix A.1. ∎

Besides the "mimicking" strategy the government B can deviate by playing the "increase" strategy. However, it is not optimal:

Lemma 2.2.10 *Suppose the government B faces* (τ_A^I, g_A^I)*. Then for every* θ *between* 0 *and* 1*, and for every* $b > \frac{9}{8}$ *the "decrease" strategy dominates the "increase" one.*

Proof See Appendix A.1.

The range of b's $[1, \frac{9}{8}]$, where the "increase" strategy is optimal for the government B, has been already ruled out by another lemmas (in particular, by the Lemma 2.2.9). Therefore, the Lemma 2.2.10 poses no additional restrictions on θ and b.

It follows from the Lemmas 2.2.6, 2.2.7 and 2.2.9 that when conditions (I)-(II) of our proposition hold both governments A and B do not deviate from the "increase"-"decrease" strategy, which in turn means that (2.9)-(2.10) is indeed the equilibrium of our game (2.4)-(2.5).

Now let us check if there are other equilibria in pure strategies. Namely, the only possibility left is when the government B plays the "increase" strategy, and government A plays the "decrease" strategy. In the following lemma I show that such equilibrium does not exist:

Lemma 2.2.11 *Suppose, the game is given by (2.4)-(2.5), governments A and B play the "decrease" and "increase" strategies correspondingly. Then for any θ between 0 and 1, and for any b between 1 and 2 the "increase" strategy of the government B is dominated by the "mimicking" one. For $b > 2$ the equilibrium does not exist.*

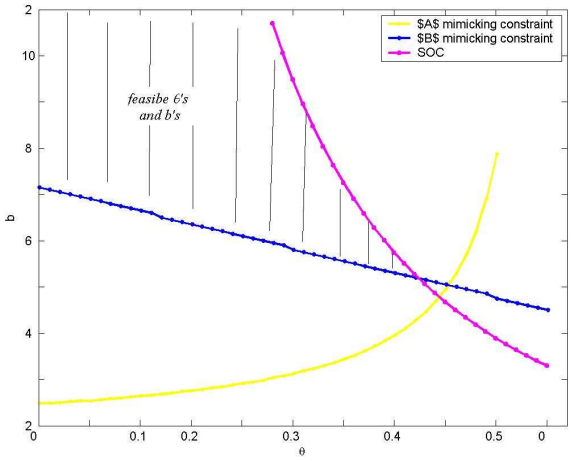
Proof See Appendix A.1.

Lemma 2.2.11 completes the proof of the proposition. The equilibrium in pure strategies does not exist unless conditions (I)-(II) hold. ∎

The Proposition 2.2.3 puts 2 conditions on the firms and governments in our economy in order for "intuitively comprehensible" outcome - when more efficient government charges higher tax rate - to take place. The first condition is that a firm's profit function (2.1) should be concave enough in public good - in other words, firms should care more about taxes they pay than about public infrastructure they receive. The second condition is that the relative advantage of one country over another should be sufficiently big. The set of feasible b's and θ's is shown on the Figure 2.2. It is shaded with the vertical lines. If conditions mentioned above do not hold then both governments have incentives to deviate from their strategies, namely they mimic each other's strategies.

Sufficiently concave profit function of a firm, the first condition needed, is necessary for the more efficient government not to deviate. Indeed, even though increase in θ means that both equilibrium tax rates and levels of public good provision in two countries increase, so does the payoff from the deviation for the government A. This is happening because the government B sets g_B to $(\frac{\theta}{9})^{\frac{1}{1-\theta}}$ regardless of efficiency advantage of the government A. At the same time, tax rates increase with b in both countries - they are proportional to the difference in cost reduction the governments

Figure 2.2: Constraints for b and θ



Note The set of b's and θ's is depicted (shadowed with the vertical lines), which is necessary for the existence of the equilibrium in pure strategies. A mimicking constraint is represented by the equation (2.25). B mimicking constraint is represented by the equation (2.26). SOC is represented by the equation (2.24).

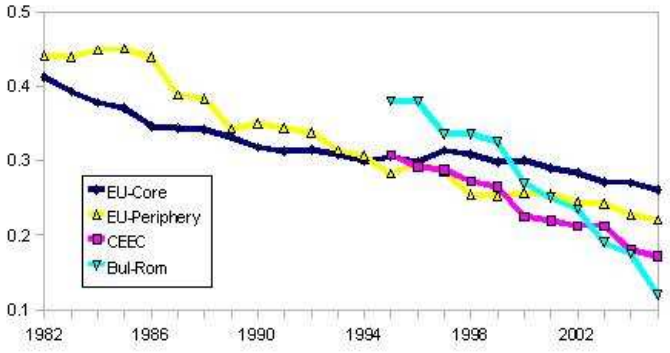
offer to the firms, which increases with b. Therefore, the difference between tax rates in two countries grow slower with θ than the difference between public spendings. Eventually, when θ is sufficiently big, the government A finds it optimal to switch to low-tax-low-public-good-provision policy.

The above mentioned condition seems rather unexpected - the government, which is more efficient in producing the public good, uses its advantage on full (by producing more public good than its competitor) only when firms value the public good less. However, what this condition really means is that governments are forced to compete with each other only when the firms are sufficiently greedy in paying their taxes - when the tax competition between the countries is intense enough, and the marginal impact of an additional unit of the public good is high. Otherwise, the government A prefers to do what the government B does - charge sufficiently high tax, which the firms agree to pay, and produce close-to-nothing amount of public good.

In practice, the intensity of the tax competition between countries - a direct outcome of the lower θ - does affect the pattern of governmental fiscal policies in a way my model predicts. The Figure 2.3 shows the average effective tax rates in different groups of European countries. One can easily see from the figure, that in 80s the taxation pattern was quite blurred in Europe: then young and apparently inefficient democracies Spain, Portugal and Greece taxed capital heavier than the oldest EU members France, Germany, Belgium and Netherlands. The similar pattern emerged in the early post-communist transition periods of CEE countries, especially of Bulgaria and Romania. However, the situation was getting clearer when the countries were becoming more and more integrated into a single European market. Spain, Portugal and Greece significantly decreased their effective taxes on capital after signing the Maastricht agreement in 1993 and basically abandoning any restrictions on international movement of capital. CEE countries started to play the "decrease" strategy after becoming the candidates for the EU membership. As it is predicted by the model, the increasing intensity of the tax competition eventually lead European countries to separate out into high-tax-high-public-good-provision and low-tax-low-public-good-provision groups.

Another condition is that sufficiently high b is needed for both governments to sustain the equilibrium. If $\theta < \frac{1}{2}$ then with arbitrarily high b government A can infinitely increase difference between the cost reduction it offers to the firms and its public spending. Therefore, at some level of relative efficiency the incentive to mimic government B will be offset. From the other side, when b is small government B also has an incentive to mimic the government A. However, apart from charging high tax τ_A B also has to produce high level of public good g_A, and when the b is high it becomes prohibitively expensive without the efficiency advantage. Therefore,

Figure 2.3: Tax rate differentials in European countries



Note Unweighted average in 4 groups: EU-Core - Belgium, Netherlands, France, Germany; EU-Periphery - Spain, Portugal, Greece; CEEC - Poland, Czech Republic, Slovenia, Slovakia; Bul-Rom - Bulgaria and Romania;
Y-axis: effective average tax rate (EATR)
Source: EATR - Devereux and Griffith (2003), Kotans (2005)

eventually the government B sticks to the low-tax-low-public-good-provision policy.

2.3 Empirical evidence

In this section I present some anecdotal empirical evidence in support of the theoretical part of the work. The main prediction of the model is that of 2 countries, which are different only in the efficiency of their governments, the more efficient one should charge higher corporate income tax rate. Extending the analysis to many countries we should get positive coefficient in a regression of the tax rate on governmental efficiency. At the same time, one more prediction of the model is that if countries are too close in their efficiency then there should not be any clear relation between the variables.

In what follows I am running the corresponding regressions so far as available data permits. I use a sample of 28 countries, years from 1995 till 2005. Countries include EU-15 (except Denmark and Luxembourg), Switzerland, Norway, USA, Canada, Japan, finally Poland, Hungary, Czech Republic, Slovakia, Slovenia, Estonia, Latvia, Lithuania, Bulgaria and Romania. As a result, there are 308 observations. To demonstrate the second prediction of the model, I also use a restricted sample, in which only countries from EU-15 are included.

As a dependent variable I take widely used nowadays effective average tax rate (EATR).[6] It is defined as a proportion of the pre-tax profit from previously invested in the country assets, taken by the state as a tax levy, and is claimed to be the main measure of the tax burden for multinationals choosing the country to invest in - precisely what we need for our analysis. EATR's for 'old'-OECD(i.e. all except CEE countries) countries were calculated by Devereux and Griffith (2003). For the rest of the countries EATR's were calculated by Kotans (2005).

While the choice of the tax burden measure is more or less obvious, it is much more challenging to come up with the appropriate proxy for governmental efficiency. Theoretical model solves this issue in a simple way: more efficient government produces more public goods out of the same revenue. However, real life is more complicated, and there are several problems with implementation of this measure into an empirical estimation. First is that governments produce more than one public good. Moreover, many of them are hardly measurable in quantity (such as defense or law-making) and, especially, quality. Secondly, even if we succeed in measuring these it will be hard to come up with a unified indicator combining all factors and sorting all countries in terms of their efficiency.[7] To a certain extent, governmental efficiency may be proxied by the less direct indicators, both on the production side (such as level of corruption, which eventually influences level of public good production) and on the side of final outcomes (for instance, macroeconomic indicators of the country - the better they are the more efficient is, apparently, government). This is the approach I am taking in this Section.

Nine different variables are used by me as proxies for governmental efficiency. Four of them - Heritage Foundation's Index of Economic Freedom, World Bank's Ease of Doing Business ranking, World Bank's Worldwide Governance Indicators, and Transparency International's Corruption Perception Index - measure the quality of governance institutions and integrity of its processes. Three others - United Nations' Human Development Index, Governance Quality Index from Huther and Shah (1998), and Citizen-centric Governance Indicators from Ivanyna and Shah (2009) - look at the governance outcomes using both objective measures, such as life expectancy, enrollment ratio, etc., and subjective measures, such as trust in government, citizens' approval of governmental policies, etc. Finally, the last two

[6] See Devereux et al. (2008), Egger et al. (2007)

[7] There are papers, which concentrate on measuring governmental efficiency in only one sector - usually education or health. See, for example, Hauner and Kyobe (2008). These papers are, however, exposed to the same set of problems: even in education or health alone there is no single outcome, which could be used as a measure of governmental output. Besides, governmental spending in these sectors may have a time lag, so comparing spending and outcomes in the same period may be misleading

variables - average cereal yield from one hectare and GDP per capita - are simple (not aggregated) quantitative measures representing governmental efficiency on the macroeconomic side.

Neither of these variables is direct or perfect measure for the governmental efficiency. The data availability represents one more problem for some of the indices. However, each of the variables characterizes some side of governance - be it governance processes (corruption, general structure of institutions, etc.) or governance outcomes (wealth of the population, average cereal yield, citizens' trust in government, etc.). Therefore, analyzing these variables together may shed some light on the empirical side of the issues discussed in this work.

The results of the OLS estimations are presented in the Table 2.1. In total, 18 regressions are run using 9 different proxies for the governmental efficiency. Each combination of variables is run both on the sample of all 28 countries, and on the restricted sample of EU-15 countries. In order to satisfy the assumptions of the theoretical model as well as to avoid endogeneity several other factors are controlled for in each estimation. As a measure of the economy's openness I use amount of foreign direct investments relative to GDP of the country (FDI flow/GDP). This way the model's assumption about perfect capital mobility is satisfied. In addition, I control for the size of economy (GDP) and its rate of growth (GDP growth). I also include the proxy for a country's expenditure needs (governmental consumption as a share of GDP). Finally, I add year and country dummies into regressions - where data availability permits - in order to control for country and time-specific effects.

As we can see from the Table 2.1, the coefficients near governmental efficiency proxies have all (except HDI) expected sign for the sample of all countries. IEF and GDP per capita are highly statistically significant (at less than 3% level), and DB, WGI and CGI are significant at less than 10% level. The coefficients are also economically significant. For instance, the magnitude of the coefficient near IEF, -0.036, means that the decrease in Index of Economic Freedom (without accounting for a fiscal burden) on 0.1 for some country, which is quite reasonable change for 1-year period,[8] should lead to increase of the effective average tax rate on 0.36 percentage points (so that EATR rises from, say, 22% to 22.36%). The coefficient near GDP per capita means that the increase in annual average population income on 1000 international dollars, which represents about 4.3% annual GDP growth with no population growth for an average country in the sample,[9] will lead the EATR to increase by about 0.8 percentage points.

[8]In fact, 0.1 is an average annual change in IEF for the countries in the sample in 2002-05

[9]In 2004-2005 on average GDP per capita increased on 670 international dollars for the countries in the sample

Table 2.1: Results of the estimation

	IEF	DB	WGI	GQI	HDI	CPI	CGI	cereal	gdp_cap
dependent variable	eatr	eatr	eatr	eatr	eatr	eatr	eatr	eatr	eatr
expected sign	-	-	+	+	-	+	+	+	+
coefficient									
all countries	-.36**	-.01*	.16*	.03	.03	.02	.03*	.00	.08***
	(.15)	(.00)	(.10)	(.03)	(.02)	(.02)	(.02)	(.00)	(.03)
only EU-15	.01	.00	-.17	.03	.03	-.03	-.02	.00	.07***
	(.19)	(.00)	(.18)	(.02)	(.02)	(.02)	(.02)	(.00)	(.02)
dummies									
all countries	yes	no	no	no	no	time	no	yes	yes
only EU-15	yes	no	no	no	no	time	no	yes	yes
$\mathbf{R}^2$									
all countries	.64	.52	.20	.74	.43	.32	.41	.63	.65
only EU-15	.86	.78	.38	.74	.43	.59	.55	.86	.87
N obs.									
all countries	300	28	196	12	39	284	51	303	308
only EU-15	140	13	91	12	39	143	20	138	143

Note * - significant at 10% level, ** - significant at 5% level, *** - significant at 1% level. 18 regressions run: 9 with the sample of all 28 countries, 9 with the sample of only EU-15 countries. Method used in all regressions- OLS. Dependent variable used in all regression - effective average tax rate (EATR) adjusted for inflation (source - Devereux and Griffith (2003), Kotans (2005)). Proxies used for governmental efficiency: *IEF* - Heritage Foundation's Index of Economic Freedom without fiscal burden index(source - *http://www.heritage.org*); *DB* - Ease of Doing Business ranking (source - *http://www.doingbusiness.org*); *WGI* - Worldwide Governance Indicators aggregate index (source - *http://www.govindicators.org*); *GQI* - Governance Quality Index (source - Huther and Shah (1998)); *HDI* - United Nation's Human Development Index, ranking(source - *http://hdr.undp.org*); *CPI* - Transparency International's Corruption Perception Index (source - *http://www.transparency.org*); *CGI* - Citizen-centric Governance Indicators (source - Ivanyna and Shah (2009)); *cereal* - average cereal yield (kg per hectare) (source - World Bank's World Development Indicators); *gdp_cap* - GDP per capita in international dollars (source - World Bank's World Development Indicators). Rows in the table: *expected sign* - expected sign of the coefficient near corresponding proxy for governmental efficiency (depending on the definition of variable); *coefficient* - coefficient near corresponding proxy for governmental efficiency (in columns), standard errors for each coefficient are indicated below in parentheses; *dummies* - indicates if country or time dummies are included in regression. Control variables used in each regression: GDP, GDP growth, share in GDP of general government consumption (source - World Bank's World Development Indicators), openness (FDI flow to GDP ratio) (source - UNCTAD)

The situation with governmental efficiency proxies becomes much less clear when the restricted sample of EU-15 countries is used. Only 3 of 9 coefficients have the expected sign in this case, and only one of them - GDP per capita - is statistically significant. These results seem to support one more prediction of the theoretical model - the efficiency of a government should not be a defining factor in the tax rate setting if the countries are not too different in their efficiencies.

The fair conclusion of this section is that there is an empirical support of the theoretical predictions of this Chapter. The obtained results, however, should be taken with care. All of the proxies for governmental efficiency are far from being perfect, and the number of observations for most of them is too small to make robust conclusions. This all leaves the space for further empirical investigations on this topic.

Chapter 3

Theory of efficiency-enhancing intergovernmental transfers

The structure of this chapter is the following. In the Section 3.1 I briefly describe the model and characterize equilibrium when there is no intergovernmental sharing. The main results are presented in the Section 3.2, where both direct transfers between governments and regional subsidies are analyzed. The last subsection of the sections explores the conditions when regional subsidy is a Pareto improvement. Section **??** concludes.

3.1 Equilibrium with no intergovernmental transfers

Consider a country with N jurisdictions, each populated by one resident. The output in the jurisdiction i is:

$$f_i(k_i, g_i) = b_i k_i^{\beta} g_i^{\gamma},\ i = 1, ..., N,\ b_i > 0,\ \beta > 0,\ \gamma > 0,\ 0 < \beta + \gamma < 1, \qquad (3.1)$$

where k_i is the private capital, and g_i is the public capital, both located in the jurisdiction i, and b_i is the jurisdiction-specific technology parameter. The production function of this type is widely used in models of growth with governmental spending (see, for example, Barro (1990); Lansing (1998); Eicher and Turnovsky (2000)). It has been quite successful in replication of countries' macroeconomic characteristics.

It follows from 3.1 that the local jurisdictions are not symmetric. If for some i and j $b_i > b_j$ than the i-th jurisdiction has an advantage over the j-th jurisdiction - both factors, private capital and public capital, are more productive there. The difference

between b_i and b_j in the model reflects the difference between circumstances that the local governments face in the jurisdictions they are to administer, and that cannot be changed. This difference may be brought about by many reasons. Among the socio-economic ones are education level and demographic structure of the population, which may influence an expertise of a government, or industry concentration, which may lead to technology spillovers and more favorable market structure. The political reasons include existing institutional arrangements of decision making, legislative restraints on a certain kinds of expenditures, or political conflict between legislative and executive bodies. Finally, jurisdictions may have different factor productivities due to their geography - location (near sea, river, main roads, etc.), climate, relief, availability of natural resources, etc.

For the simplicity of further analysis, I assume there are only two types of jurisdictions in the economy: high type b_H (advantaged ones) and low type b_L (disadvantaged ones), where $b_H > b_L$. N_1 jurisdictions are of b_H type, and N_2 are of b_L type, with $N_1 + N_2 = N$.

The residents are not allowed to migrate between jurisdictions, but the private capital is perfectly mobile. Hence it is being invested where the after-tax return is higher. In equilibrium then the after-tax returns on private capital are equal in all jurisdictions. The country's stock of private capital is fixed and is set to K: $\sum_{i=1}^{N} k_i = K$. It is owned by the residents of the country.[1]

In addition to the returns on capital, the residents retain all profits from the output produced in their jurisdiction. Assuming perfect capital markets, the income of an individual in jurisdiction i is:

$$W_i = f_i(k_i, g_i) - f_{i1}(k_i, g_i)k_i + \frac{K}{N}R = (1-\beta)b_i k_i^{\beta} g_i^{\gamma} + \frac{K}{N}R, \ i = 1, ..., N, \qquad (3.2)$$

where R denotes after-tax return on private capital, and $b_i = b_H$ for $i = 1, ..., N_1$, $b_i = b_L$ for $i = 1, ..., N_2$. Residents consume the output subject to their income, so that utility (welfare) maximization is equivalent to maximization of their income.

The public capital g_i in jurisdiction i is provided by the local government. It is financed by the tax τ to be paid for each unit of capital invested in the jurisdiction. There are no other taxes. The capital tax τ is the same for all jurisdictions. It is set by the central (upper-tier) government, but the tax revenue is fully retained by the jurisdiction, where it was generated.[2]

[1] The exact distribution of private capital ownership is not important until we get to analyze the redistributive issues of intergovernmental transfers (in the Section 3.2.4). In fact, the results before the Section 3.2.4 would not change even if all or part of private capital were owned by foreigners

[2] τ can be considered a shared tax, with the rate set by the central government, and 100% share of revenue going to local jurisdiction

That the public expenditures are done by local governments, and the tax policy is conducted from above (by a central government) is quite stylized view of a country. However, it is largely justified by the fiscal federalism and tax competition literature (see Wilson (1999); Shah (2005, 2006); Brueckner (2009) for overviews): by assumption of the model, there are no interjurisdictional spillovers in local public spending, while tax competition, if allowed, will unavoidably lead local governments to engage in beggar-thy-neighbor policies. This stylized view is also largely reflected in the current public finance practice. According to IMF's Government Finance Statistics, in 1996-2000 25% of general government expenditures in the world were spent on sub-national level. This number is significantly higher for developed countries - 30%, and it gets even bigger if calculations are done without accounting for such purely national item of spending as defense. From the other side, only 18% of general government revenues were raised by sub-national governments (22% in developed countries). Moreover, according to Blöchliger and King (2006), in OECD countries only about 60% of subnational revenues ascribe to taxes, over which there is at least some fiscal autonomy (modifications of the tax rate or tax base) of local jurisdictions. According to my own research with A. Shah (Ivanyna and Shah (2010)), from the sample of 138 countries only 22 (19 of them are members of OECD) allow local regulation of at least one major tax[3] without significant restrictions on the side of central government.[4] 58 countries in the sample do not allow local regulation of any taxes at all (except for some minor fees).

Given g_i's and τ the perfect mobility of capital implies the following for the after-tax return on capital:

$$R + \tau = \frac{\beta b_i g_i^{\gamma}}{k_i^{1-\beta}}, \ \forall i = 1, ..., N \tag{3.3}$$

which we can solve for k_i and obtain a capital supply in the jurisdiction i as a function of g_i's, R and τ:

$$k_i = \frac{\beta^{\frac{1}{1-\beta}} b_i^{\frac{1}{1-\beta}} g_i^{\frac{\gamma}{1-\beta}}}{(R+\tau)^{\frac{1}{1-\beta}}}. \tag{3.4}$$

The total private capital stock in economy is fixed. Therefore, given (3.4), the after-

[3] In most cases it is property tax, in Scandinavian countries it is also personal income tax

[4] By restrictions I mean here centrally imposed caps for the tax rate, methodologies to define tax base (e.g. property value), rules on how often can rate be changed, central government approval of any change, etc.

tax return on capital R plus τ can be calculated as follows:

$$k_1 + ... + k_N = K \;\Rightarrow\; (R+\tau)^{\frac{1}{1-\beta}} = \frac{1}{K}\sum_{i=1}^{N} \beta^{\frac{1}{1-\beta}} b_i^{\frac{1}{1-\beta}} g_i^{\frac{\gamma}{1-\beta}}. \tag{3.5}$$

The tax revenue in jurisdiction i is τk_i - tax rate τ multiplied by the tax base k_i.

For further analysis, define e_i - an effort of the government i - as a ratio of the public good produced in a jurisdiction i to the tax revenue obtained by the government i:

$$e_i = \frac{g_i}{\tau k_i},\ i = 1, ..., N. \tag{3.6}$$

Benevolent decision-maker would, of course, transform all available tax revenue in the jurisdiction into public goods: $g_i = \tau k_i,\ i = 1, ..., N$, i.e. $e_i = 1$. At the same time, $e_i = 0$ means that all revenue is diverted by the government to an unproductive consumption or rents to the office. In this sense, we refer to $1 - e_i$ as to the level of corruption in the jurisdiction i.

Using (3.2), (3.3), and (3.6) we can write the expression for the aggregate welfare of the country:

$$W = \sum_{i=1}^{N} W_i = \sum_{i=1}^{N} f_i - \tau K = \sum_{i=1}^{N} b_i \tau^{\gamma} e_i^{\gamma} k_i^{\beta+\gamma} - \tau K, \tag{3.7}$$

where again $b_i = b_H$ for $i = 1, ..., N_1$, and $b_i = b_L$ for $i = 1, ..., N_2$. (3.7) means that given capital tax τ the maximization of the aggregate welfare is equivalent to maximization of the aggregate output.

3.1.1 Competition of partially self-interested governments

The model goes on as follows. In the first stage the tax on capital returns τ is set by the central government. After observing τ, in the second stage, local governments decide on the levels of public capital g_i's. Then in the third stage the owners of the private capital invest where the return on capital is higher. Equilibrium levels of private capital k_i's are set so that the after-tax return on capital R, which depends on the distribution of g_i's and k_i's in the economy, is the same in all jurisdictions.

I do not analyze the first stage in this chapter, i.e. τ is assumed to be exogenous throughout this chapter. The question is, given τ, how do the local governments decide on the public capital levels g_i's, and how can the resulting equilibrium be made more efficient?

Since local governments cannot set tax rates their only instrument in attracting mobile capital to the jurisdictions is setting the level of public capital (good). One unit of the public good is assumed to cost one unit of output, so that public spending to produce g_i units of public good is g_i. Governments are assumed to be partially self-interested and their objective is:

$$\max_{g_i} \tau k_i - \lambda g_i, \tag{3.8}$$

$$\text{s.t. } \frac{\beta b_i g_i^{\gamma}}{k_i^{1-\beta}} = R + \tau, \tag{3.9}$$

$$0 \leq g_i \leq \tau k_i, \text{ or } 0 \leq e_i \leq 1, \tag{3.10}$$

Here τk_i is the tax revenue of the local government in the jurisdiction i, g_i is public spending. (3.9) is just the capital market constraint, as in (3.3): marginal return on capital in the jurisdiction i must be equal to the common market's one. (3.10) is the budget constraint of the government i - it is not allowed to spend more than the revenue it gets.

From (3.8)-(3.10) it follows that apart from b_i - technology parameter in the output production function of jurisdiction i - local governments are characterized by 1 additional exogenous parameter - λ. It is allowed to change from 0 to 1, and characterizes the degree of government's self-interest. It tells us how much do governments care about the size of public spending comparing to the maximization of the tax revenue. For any i, $\lambda = 0$ means that government i cares only about maximization of τk_i. The closer is λ to 1 the less willing is the government i to spend additional money on public capital. $\lambda = 1$ is the case of fully self-interested governments, i.e. those, which are only interested in maximization of their rents to an office - taxes they collect from firms less money they have to spend to attract these firms into the area of their jurisdiction. At the same time, $\lambda = 0$ corresponds to the case of fully benevolent government. Indeed, when $\lambda = 0$ more public spending g_i only increases government's revenues (by extending the tax base k_i) without incurring any loss as g_i is not in the government's payoff function. Therefore, the government spends as much as possible, and is only constrained by the budget constraint (3.10). Hence $g_i = \tau k_i$, or $e_i = 1$ - government i puts maximal effort into public service, and diverts no funds to unproductive consumption. λ between 0 and 1 represents a partially self-interested government - the one, which cares both about the welfare of its constituents and its own rents to the office. With $0 < \lambda < 1$ (3.8) is a simplified version of governmental objective functions usually used in political economy and, more and more often, public finance literature (in particular, in Kotsogiannis and Schwager (2008); Cai and Treisman (2005); Wilson (2005)).

λ is assumed to be the same for all governments - they are equally self-interested. It is possible to extend the model to allow λ to vary but it is not my objective in this chapter. The question asked here is, everything else equal, how would exogenous advantages/disadvantages of jurisdictions (expressed by b_i's) influence the decisions of those in charge of them to divide available resources between corruption and productive investment?

Since jurisdictions differ only by b_i, governments of the same type choose the same amount of public spending g_i in the equilibrium, and consequently attract the same share of private capital k_i.

Combining (3.4), which is equivalent to (3.9), and (3.5) we can derive k_i as a function of g_i's:

$$k_i = \frac{\beta^{\frac{1}{1-\beta}} b_i^{\frac{1}{1-\beta}} g_i^{\frac{\gamma}{1-\beta}}}{\frac{1}{K}\sum_{i=1}^{N} \beta^{\frac{1}{1-\beta}} b_i^{\frac{1}{1-\beta}} g_i^{\frac{\gamma}{1-\beta}}}. \tag{3.11}$$

Inserting (3.11) into (3.8) we can get the first-order condition for the maximization problem (3.8)-(3.10):

$$\frac{\tau\beta^{\frac{1}{1-\beta}} b_i^{\frac{1}{1-\beta}} \frac{\gamma}{1-\beta} g_i^{\frac{\gamma}{1-\beta}-1}}{(R+\tau)^{\frac{1}{1-\beta}}} - \frac{\tau\beta^{\frac{1}{1-\beta}} b_i^{\frac{1}{1-\beta}} g_i^{\frac{\gamma}{1-\beta}}}{(R+\tau)^{\frac{2}{1-\beta}}} \frac{\partial\left[(R+\tau)^{\frac{1}{1-\beta}}\right]}{\partial g_i} = \lambda \tag{3.12}$$

- marginal tax revenue from increasing public spending is equal to its marginal cost. The marginal tax revenue is composed of two effects. First, by increasing public spending government i attracts larger share of capital k_i to its jurisdiction. Second, g_i has an impact on country's return on capital R - as it can be seen from (3.5) R increases with g_i.

From the equation (3.5):

$$\frac{\partial\left[(R+\tau)^{\frac{1}{1-\beta}}\right]}{\partial g_i} = \frac{1}{K}\beta^{\frac{1}{1-\beta}} b_i^{\frac{1}{1-\beta}} \frac{\gamma}{1-\beta} g_i^{\frac{\gamma}{1-\beta}-1}. \tag{3.13}$$

Thus, taking into account (3.4), equation (3.12) can be simplified to the following:

$$\frac{\gamma}{1-\beta}\frac{\tau k_i}{g_i} - \frac{\gamma}{1-\beta}\frac{k_i}{K}\frac{\tau k_i}{g_i} = \lambda. \tag{3.14}$$

Recalling (3.6) - the definition of an effort of a government e_i - (3.14) can be

rewritten:

$$e_i = \left(1 - \frac{k_i}{K}\right) \frac{\gamma}{\lambda(1-\beta)}.^{5} \tag{3.15}$$

The first-order condition (3.12) indeed represents a maximum of (3.8)-(3.9) - the second derivative of (3.8) is always negative if g_i satisfies (3.12). This is shown in the Appendix. Equality (3.15) characterizes the strategy of a government i in the equilibrium: the level of corruption $1 - e_i$ in the jurisdiction i is proportional to the share of capital $\frac{k_i}{K}$ attracted to this jurisdiction. It means that the governments substitute the advantage b_i given to them exogenously with less efforts to attract mobile capital. This point is formally proven in the following proposition:

Proposition 3.1.1 *Suppose a government's objective is given by (3.8)-(3.10). Then in equilibrium, for any i and j:*

$$b_i > b_j \;\Rightarrow\; k_i > k_j \text{ and } e_i < e_j. \tag{3.16}$$

Proof See Appendix A.2

The overall effort of governments - the product of all e_i's - is maximized when all capital shares k_i's are the same, which would be the case, of course, only if no jurisdiction had an advantage - all b_i's were the same. Indeed, from (3.15) it follows that the maximization of the product of e_i's is equivalent to:

$$\max_{\{k_i\}_{i=1}^N} \sum_{i=1}^{N} \log(K - k_i), \tag{3.17}$$

$$\text{s.t. } \sum_{i=1}^{N} k_i = K. \tag{3.18}$$

The solution to (3.17)-(3.18) is $k_i = \frac{K}{N},\ \forall i$. Not surprisingly, equalization of b_i's, and consequently of k_i's, also maximizes the overall supply of public capital - $\sum_{i=1}^{N} g_i$. The proof of that follows the same logic as the previous one, after recalling that $g_i = e_i \tau k_i$: supply of public capital is maximized when $\sum_{i=1}^{N} k_i(K - k_i)$ is maximized, which is the case at $k_i = \frac{K}{N},\ \forall i$.

[5] To ensure no corner solutions we assume $\frac{\beta}{\lambda(1-\alpha)} < 1$. This restriction is only needed to ensure that the local governments (bureaucrats) do not pay their own money in equilibrium, which might be the case if they value the welfare of their constituents very highly (λ is close to 0). Without condition (3.10) solution to (3.8)-(3.9) exists for any $\lambda > 0$

As one would expect the effort of a government, as well as the amount of public capital it decides to supply, depend negatively on the self-interest of the government λ (see (3.15)).

Corruption of governments decreases with β and γ - elasticities of an output function with respect to private and public capital correspondingly. This result is also expected, since both β and γ increase the return on one unit of public investment (in terms of tax revenue received by a government).

Not surprisingly, equal b_i's across jurisdictions also maximize the welfare of the country - holding $\sum_{i=1}^{N} b_i = N\bar{b}$ fixed, where $\bar{b}$ is the average of b_i's. To see this we rewrite the welfare function of the country (3.7) taking into account the equality (3.15):

$$W = \sum_{i=1}^{N} b_i \tau^{\gamma} e_i^{\gamma} k_i^{\beta+\gamma} - \tau K = \left(\frac{\tau\beta}{\lambda(1-\alpha)K}\right)^{\gamma} \sum_{i=1}^{N} b_i (K-k_i)^{\gamma} k_i^{\beta+\gamma} - \tau K =$$
$$= \left(\frac{\tau\beta}{\lambda(1-\alpha)K}\right)^{\gamma} \left(N_1 b_H (K-k_H)^{\gamma} k_H^{\beta+\gamma} + N_2 b_L (K-k_L)^{\gamma} k_L^{\beta+\gamma}\right) - \tau K. \quad (3.19)$$

If we take $b_H = \bar{b} + \Delta$ and $b_L = \bar{b} + \frac{N_1}{N_2}\Delta$, so that $\frac{1}{N}(N_1 b_H + N_2 b_L) = \bar{b}$, then we can show that (3.19) is maximized at $\Delta = 0$, i.e. when $b_H = b_L$:

Proposition 3.1.2 *If k_i's are in equilibrium, (3.19) is maximized at $\Delta = 0$.*

Proof See Appendix A.2

In the special case $N = 2$ - there are 2 governments in the economy - it is possible to write down an explicit solution to (3.8)-(3.10). Indeed, there are only two first-order conditions of type (3.14) in this case, and dividing one over another gives k_i's (and thus g_i's can be computed):

$$k_i = \frac{b_i^{\frac{1}{1-\beta}}}{\frac{1}{K}\left(b_H^{\frac{1}{1-\beta}} + b_L^{\frac{1}{1-\beta}}\right)}; g_H = g_L = \frac{b_H^{\frac{1}{1-\beta}} b_L^{\frac{1}{1-\beta}}}{\frac{1}{K}\left(b_H^{\frac{1}{1-\beta}} + b_L^{\frac{1}{1-\beta}}\right)^2} \frac{\tau\gamma}{\lambda(1-\beta)} \quad (3.20)$$

When $N = 2$ public spending is the same in both jurisdictions, and private capital is invested proportionally to $b_i^{\frac{1}{1-\beta}}$ - government of the advantaged jurisdiction gets extra rents for zero extra efforts. It is straightforward to show that in this case first- and second-order conditions hold for Δ to maximize the total welfare W of the country, where $b_H = \bar{b} + \Delta,\ b_L = \bar{b} - \Delta$.

That the equality (of opportunity) of the local governments - holding productivity frontier, i.e. sum of b_i's, fixed - is welfare-improving for the country is an intuitively appealing result. Indeed, neither private capital supply K nor technological possibilities ($\sum_{i=1}^{N} b_i$) change in this case. Yet, the governments are more disciplined and supply more public capital ($\sum_{i=1}^{N} g_i$) to the economy, thus increasing productivity of private capital, and consequently total output and total welfare of the country's residents.

Equalization of b_i's is, however, only the second-best option for the country: it maximizes the welfare of the country given the level of governments' self-interest λ (minimizes the total amount of unproductive consumption), but it leaves level of corruption in each jurisdiction positive (i.e. $\forall i\ e_i < 1$): $k_i = \frac{K}{N} \Rightarrow e_i = \frac{N-1}{N}\frac{\beta}{\tau\lambda(1-\alpha)} < 1$. Yet, if the country is heterogeneous in terms of b_i's there might be a role for intergovernmental sharing - it may make jurisdictions equally attractive for mobile capital, allowing the residents to rip the benefits of equality of opportunity (and thus competition) between otherwise (more) corrupted governments. Equalizing transfers between local governments are the focus of the next section.

3.2 Equilibrium with intergovernmental transfers

Now we proceed with introducing intergovernmental transfers into the economy. In particular, the question asked in this section is given the self-interested nature of the local governments - as represented by (3.8)-(3.10) - is it possible to increase total welfare of the country by imposing some kind of intergovernmental sharing between them? To answer this question we introduce a benevolent decision-maker into the model, whose objective is to maximize the welfare of the country, and whose instrument is setting rules for revenue-neutral redistribution schemes between governments:

$$\max_{T} \sum_{i=1}^{N} W_i, \tag{3.21}$$

where W_i is the welfare of the resident in the jurisdiction i, and T is some revenue neutral transfer between two local governments.

Note that the objective function (3.21) is purely utilitarian - equity of jurisdictions does not play any role in our analysis.

3.2.1 Design of the transfer

In practice, there is plenty of ways to design an intergovernmental sharing. Probably, the most basic division is on direct transfers - when the money are transfered from one local budget to another - and regional subsidies - when the money are given to the businesses, which invest in the financed jurisdiction. The direct transfers are further split on conditional and unconditional, matching and not matching, earmarked and not earmarked grants meaning that the money are either given based on some performance criteria (conditional), for a specific purpose (matching or earmarked), to enhance some item of spending or tax effort (matching), or without any conditions (unconditional, not matching and not earmarked grant). In case of regional subsidies, the money can be given to businesses in the form of tax breaks or discounts, wage supplements, direct cash, etc. Finally, the financed government may receive money directly from the same tier government, upper tier government, international body, or by raising public debt.

The objective of this section is to analyze the model in case of two most basic cases of intergovernmental transfers - the unconditional not matching and not earmarked grant and the regional subsidy via tax discounts, though in the model both can be given wider interpretations. Both transfers are financed directly by the other local governments.[6] The intuition for the transfers is provided in the end of Section 3.1: taking resources from the advantaged jurisdictions and granting them to the disadvantaged ones potentially increases fiscal capacity of the latter ones to attract mobile capital. More equality between jurisdictions enhances competition between self-interested governments and forces them to divert less money into unproductive consumption. The total supply of public capital may increase, and thus the total output and welfare of the country.

3.2.2 Direct transfer

In the case of direct transfer (grant) to the disadvantaged jurisdictions, the benevolent decision-maker chooses α - the share of advantaged governments' tax revenue to be granted on an equal basis to the disadvantaged governments. Then local governments make their decisions regarding g_i's.

The objective of the benevolent decision-maker is:

$$\max_{\alpha} \sum_{i=1}^{N} W_i - \tau K, \tag{3.22}$$

[6]In the end, any way of financing effectually means transferring the money from one local jurisdiction to another

subject to the strategies of the local governments.

The objectives of the local governments are:

$$\max_{g_H}(1-\alpha)\tau k_H - \lambda g_H, \quad \max_{g_L}\tau(k_L + \alpha\tfrac{N_1}{N_2}k_L) - \lambda g_L \tag{3.23}$$

$$\text{s.t. } \frac{\beta b_i g_i^{\gamma}}{k_i^{1-\beta}} = R + \tau, \tag{3.24}$$

$$0 \leq g_i \leq \tau k_i, \text{ or } 0 \leq e_i \leq 1 \tag{3.25}$$

$$\tag{3.26}$$

The advantaged governments account in their objectives that the part $\alpha\tau k_H$ of their revenues will be taken away, and the disadvantaged governments have this part in their objective functions with the plus sign (total revenue collected from the advantaged jurisdictions $N_1\alpha\tau$ divided by the number of disadvantaged jurisdictions N_2). Note that such transfer scheme is revenue-neutral by the definition.

The following proposition summarizes the outcome of the game with this kind of transfer:

Proposition 3.2.1 *Given the objectives of the local governments (3.23) and the objective function of the benevolent decision-maker (3.21), the optimal* α *- a share of tax revenues to be transfered from advantaged governments to the disadvantaged ones is* 0*:*

$$\alpha^* = 0. \tag{3.27}$$

Proof See the Appendix ∎

The result of the Proposition 3.2.1 is that optimal unconditional not matching not earmarked grant from one government to another, when these governments are self-interested, is 0 - there should not be any transfers. Any positive α leads to an unambiguous decrease in the public spendings in all jurisdictions, and consequently decreases the total welfare of the country. The reason for that is that such revenue sharing promotes not the competition between the governments, but rather their "malevolent" cooperation. The advantaged governments have less incentives to attract investments since they retain less revenues from every unit of capital attracted. At the same time, the disadvantaged governments have k_H - tax base of the advantaged governments - in their objective functions, which gives them an incentive to extend the tax bases in the rival jurisdictions (by producing less public goods in their own jurisdictions, of course). The intermixing of tax bases in the objective functions of the local governments is the main argument of those advocating fiscal equalization

as a tool to alleviate harmful tax competition between jurisdictions. [7] In Kotsogiannis and Schwager (2008) fiscal equalization (direct transfers) is shown to be a tool to stimulate a yardstick competition between governments, i.e. disclose their true types, when the actual tax bases are not known to the voters. However, when the capital income tax rate τ is fixed and there are no informations asymmetries intergovernmental sharing of this kind results into the alleviation of the competition in public services, which is a welfare-reducing process.

In the framework of equality literature, direct transfer analyzed in this section is the policy towards equality of outcome (see Roemer (1998)) - eventual tax revenues of the governments are being equalized without taking into account the efforts that the governments put into earning them. Moral hazard issue, obviously, arises here, and so any positive transfer decreases the efforts of all players in the economy. The regional subsidies - "equality of opportunity"-like policy - is analyzed in the next section.

3.2.3 Regional subsidy

Now the benevolent decision-maker implements the regional subsidies scheme in the country. The rationale behind it is that now it is not the disadvantaged government itself that is subsidized, but it is private capital, which is invested into the disadvantaged jurisdiction. To make the scheme revenue neutral the subsidy comes at a cost of the capital invested in the advantaged jurisdiction. The purpose of the exercise is to smooth the differences between jurisdictions in terms of b_i's, which would equalize opportunities for the governments and make them more disciplined. In the model, regional subsidy means modification of marginal conditions for return on capital (3.3) in the way that favors disadvantaged jurisdiction, i.e. makes unit of private capital invested there either more productive or less costly in terms of taxes. Specifically, to make the analysis reasonably tractable, I assume that every unit of capital invested in a disadvantaged jurisdiction, while still paying income tax τ, receives an ad-valorem subsidy μ_L, which is financed by the analogous ad-valorem payment μ_H for every unit invested in an advantaged jurisdiction. Note that, by definition, $\mu_L > 1$ and $\mu_H < 1$.[8] The after-tax return on capital then becomes:

$$R + \tau = \frac{\beta \mu_i b_i g_i^{\gamma}}{k_i^{1-\beta}}, \ \forall i = 1, ..., N \tag{3.28}$$

[7] See Köthenbürger (2002); Bucovetsky and Smart (2006); Buettner, Hauptmeier, and Schwager (2006); Hindriks, Peralta, and Weber (2008); Gaigné and Riou (2007)

[8] Even though mathematically I do not impose these restrictions and let calculus to decide which signs are optimal

The only difference between (3.28) and (3.3) is that there is an additional multiplier μ_i in the nominator of right-hand side in (3.28). Hence, this subsidy scheme effectively modifies technology parameters b_i's in all jurisdictions: $\tilde{b_i} = \mu_i b_i$. From the one side, such scheme may be interpreted as the one, which reduces cost of investing in the disadvantaged jurisdiction - through capital income tax subsidy or co-payment of some firm's costs. From the other side, the subsidy μ_L can go directly to boost productivity of the private capital, i.e. to increase b_i. For instance, the grant to a local government, earmarked specifically for some kind of public investment, would do the job. Another example, is an expenditure program - i.e. building of roads or telecommunication networks - financed directly by an upper-tier government (benevolent decision-maker). Our concern in this chapter is that the governments are self-interested (which also may concern the benevolent decision-maker, if it has an access to public money). Therefore, the tax subsidy scheme is more preferable in our framework, since it involves neither upper-tier government spending - benevolent decision-maker only sets μ_L and μ_H - nor spending of earmarked money by local governments.

After-tax return on capital $R + \tau$ is the same in both advantaged and disadvantaged jurisdictions. Equating right-hand sides of (3.28) for $i = H, L$ we derive capital supply functions in both jurisdictions:

$$\frac{\beta \mu_H b_H g_H^{\gamma}}{k_H^{1-\beta}} = \frac{\beta \mu_L b_L g_L^{\gamma}}{\left(\frac{K}{N_2} - \frac{N_1}{N_2} k_H\right)^{1-\beta}} \Rightarrow \tag{3.29}$$

$$k_H = \frac{b_H^{\frac{1}{1-\beta}} g_H^{\frac{\gamma}{1-\beta}}}{\frac{1}{K}\left(N_1 b_H^{\frac{1}{1-\beta}} g_H^{\frac{\gamma}{1-\beta}} + N_2 (A b_L)^{\frac{1}{1-\beta}} g_L^{\frac{\gamma}{1-\beta}}\right)}; \tag{3.30}$$

$$k_L = \frac{(A b_L)^{\frac{1}{1-\beta}} g_L^{\frac{\gamma}{1-\beta}}}{\frac{1}{K}\left(N_1 b_H^{\frac{1}{1-\beta}} g_H^{\frac{\gamma}{1-\beta}} + N_2 (A b_L)^{\frac{1}{1-\beta}} g_L^{\frac{\gamma}{1-\beta}}\right)}, \tag{3.31}$$

where $A \equiv \frac{\mu_L}{\mu_H}$.

As in the case of direct transfer, the benevolent decision-maker moves first in this game, local governments pick g_i's after observing μ_i's.

The objective of the benevolent decision-maker is then:

$$\max_{\mu_L,\mu_H} \sum_{i=1}^{N} W_i - \tau K \equiv \max_{A} N_1 f_H + N_2 f_L, \tag{3.32}$$

$$\text{s.t. } \sum_{i=1}^{N} (\mu_i - 1)\frac{b_i g_i^{\gamma}}{k_i^{1-\beta}} = \sum_{i=1}^{N} (\mu_i - 1) k_i f_i = 0 \;\Rightarrow \tag{3.33}$$

$$\Rightarrow \; N_1(1-\mu_H)k_H f_H = N_2(\mu_L - 1)k_L f_L, \tag{3.34}$$

subject also to the strategies of the local governments. Equivalence in (3.32) stems from the fact that capital supplies in both jurisdictions k_H and k_L depend only on A - the relation between μ_L and μ_H - rather then on μ_H and μ_L separately.

(3.33) is the budget constraint for the subsidy scheme to be revenue-neutral - sum of subsidies paid to the capital in the disadvantaged jurisdictions is equal to sum of payments collected from capital in the advantaged jurisdictions. However, since we are interested only in $A = \frac{\mu_L}{\mu_H}$, and (3.33) is one equation with two unknowns, which generally has a continuum of solutions, the benevolent decision-maker effectively has no restrictions on A - whichever is its choice there are always such μ_L and μ_H that $\frac{\mu_L}{\mu_H} = A$ and (3.33) is satisfied.

Note, that $\mu_L = \mu_H = 1 \;\Rightarrow\; A = 1$ ((3.33) holds automatically) means that there are no subsidies for the disadvantaged jurisdictions, and the case is equivalent to the competition of the local governments without the intervention from the center - the case analyzed in the previous section. Logical sequence $A = 1 \;\Rightarrow\; \mu_L = \mu_H = 1$ also holds since μ_L and μ_H cannot be both greater (smaller) than 1 (because $k_H f_H$ and $k_L f_L$ are always positive). $A > 1$ means that the disadvantaged jurisdictions are subsidized, whereas $A < 1$ means that the subsidy goes the other way. In the objective (3.32) I allow A to vary from $-\infty$ to $+\infty$.

The objective of the local governments is similar to (3.8)-(3.10):

$$\max_{g_i} k_i - \lambda g_i, \tag{3.35}$$

$$\text{s.t. } \frac{\beta \mu_i b_i g_i^{\gamma}}{k_i^{1-\beta}} = R + \tau \Rightarrow \frac{\beta b_H g_H^{\gamma}}{k_H^{1-\beta}} = \frac{\beta A b_L g_L^{\gamma}}{k_L^{1-\beta}} \tag{3.36}$$

$$0 \le g_i \le \tau k_i, \text{ or } 0 \le e_i \le 1, \tag{3.37}$$

$$\tag{3.38}$$

The only difference between (3.35)-(3.39) - objective function with regional subsidy - and (3.8)-(3.10) - objective function with no intervention of benevolent decision-maker - is the parameter A, which appears in private capital supplies functions. The

first-order condition (3.12) (with b_L changed to Ab_L) and the equilibrium condition (3.15) though remains to be true.

As it was argued in the Section 3.1, a non-trivial regional subsidy may lead to an improvement of a public service at a local level.Indeed, the governments recognize their advantage/disadvantage and reduce their effort proportionally to the share of capital they expect to achieve (equilibrium condition (3.15)). Equalizing them with the help of regional subsidies equalizes the shares of capital they achieve, and thus leads to increase in overall public capital supply (see (3.17) and the paragraph next to it). The subsidies come at a cost for society though: the resources are being diverted from regions with high b, where all factors are more productive, to the regions with low b. As usual in economics, the optimal solution lies in the middle between two extremes - full equalization of the local governments and maximal rents extraction without diverting resources from productive regions.

To make the analysis tractable, to demonstrate formally the arguments described in the paragraph above we proceed with the special case, when $N = 2$.

In this case it is possible to derive supply functions of private and public capital explicitly. Analogously to (3.20):

$$k_H = \frac{b_H^{\frac{1}{1-\beta}}}{\frac{1}{K}\left(b_H^{\frac{1}{1-\beta}} + (Ab_L)^{\frac{1}{1-\beta}}\right)},\ k_L = \frac{(Ab_L)^{\frac{1}{1-\beta}}}{\frac{1}{K}\left(b_H^{\frac{1}{1-\beta}} + (Ab_L)^{\frac{1}{1-\beta}}\right)}, \tag{3.39}$$

$$g_H = g_L = \frac{b_H^{\frac{1}{1-\beta}}(Ab_L)^{\frac{1}{1-\beta}}}{\frac{1}{K}\left(b_H^{\frac{1}{1-\beta}} + (Ab_L)^{\frac{1}{1-\beta}}\right)^2}\frac{\tau\gamma}{\lambda(1-\beta)} \tag{3.40}$$

It follows from (3.39)-(3.40) that, analogously to the case with no transfers, the public spendings g_H and g_L are the same in both jurisdictions. Now however, both g_H and g_L depend on transfer A - the first jurisdiction cannot now use its advantage on a full scale, since the capital owners weigh higher factor productivity in this jurisdiction versus subsidy, which is granted to them if they invest in the disadvantaged jurisdiction. It is easy to derive the value of transfer A, which maximizes the total public spending:

$$A^* = \frac{b_H}{b_L}. \tag{3.41}$$

A^* maximizes $g_H + g_L$, and equalizes tax bases in both jurisdictions ($k_H = k_L$). It is exactly the transfer scheme, which equalizes the capacities of both local governments to attract investments to their jurisdictions, i.e. A^* neutralizes all prior jurisdictional

advantages and disadvantages. This result supports our reasoning in the Section 3.1 (in particular, (3.17) and the paragraph next to it). Being fiscally equalized (to be able to attract investments) the local governments become engaged in public spending "race to the top" competition. Capital owners no longer see the advantage of the first jurisdiction, and the only thing that matters for them is how much money does a government plan to spend on public capital. Hence the increased (comparing to the no transfer case) production of the public goods, and decreased rents to the office for the government's bureaucrats.

In the Section 3.1, the logical outcome of governments being equalized, and thus total public capital being maximized is that the welfare is maximized when all b_i's are equal (Proposition 3.1.1). This does not hold in the world of regional subsidies - redistribution is not for free. From the point of view of the central government the optimal intergovernmental transfer scheme A is smaller than A^*. This result is summarized in the following proposition.

Proposition 3.2.2 *Let the objective function of the benevolent decision-maker is given by (3.32), and the objectives of the local governments are given by (3.35). Then the optimal transfer A is the solution of the following equation:*

$$-\gamma b_L^{2\theta} A^{(\beta+1)\theta} - (\gamma+\beta) b_H^{\theta} b_L^{\theta} A^{\theta} + (\beta+\gamma) b_H^{\theta} b_L^{\theta} A^{\beta\theta} + \gamma b_H^{2\theta} = 0, \tag{3.42}$$

where $\theta = \frac{1}{1-\beta}$.

The solution to this equation A^{**} is unique and lies between 1 and $A^* = \frac{b_H}{b_L}$:

$$1 < A^{**} < \frac{b_H}{b_L}. \tag{3.43}$$

Proof Following (3.39)-(3.40), the welfare function of the country can be rewritten:

$$W = f_H + f_L - \tau K = \left(\frac{\tau\gamma}{\lambda(1-\beta)}\right)^{\gamma} \frac{b_H^{\frac{\gamma}{1-\beta}} A^{\frac{\gamma}{1-\beta}} b_L^{\frac{\gamma}{1-\beta}} (b_H^{\frac{1}{1-\beta}} + A^{\frac{\beta}{1-\beta}} b_L^{\frac{1}{1-\beta}})}{\frac{1}{K}\left(b_H^{\frac{1}{1-\beta}} + (Ab_L)^{\frac{1}{1-\beta}}\right)^{2\gamma+\beta}} - \tau K \tag{3.44}$$

Maximizing W over A gives the equation (3.42).

*Magnitude of A^{**}.*The equation (3.42) can be rewritten in the following form:

$$A^{\theta} = \left(\frac{b_H}{b_L}\right)^{\theta} \frac{\gamma b_H^{\theta} + (\gamma+\beta) b_L^{\theta} A^{\beta\theta}}{(\gamma+\beta) b_H^{\theta} + \gamma b_L^{\theta} A^{\beta\theta}} = \left(\frac{b_H}{b_L}\right)^{\theta} + \frac{\beta\left(\frac{b_H}{b_L}\right)^{\theta}\left(A^{\beta\theta} - \left(\frac{b_H}{b_L}\right)^{\theta}\right)}{(\gamma+\beta)\left(\frac{b_H}{b_L}\right)^{\theta} + \gamma A^{\beta\theta}} \tag{3.45}$$

Since $\beta\left(\frac{b_H}{b_L}\right)^{\theta} < (\gamma+\beta)\left(\frac{b_H}{b_L}\right)^{\theta} + \gamma A^{\beta\theta}$, if A^{**} is the solution to the (3.42) then A^{θ} should lie between $A^{\beta}\theta$ and $\left(\frac{b_H}{b_L}\right)$. Indeed, right-hand side of (3.45) is a convex combination (weighted average) of $\left(\frac{b_H}{b_L}\right)^{\theta}$ and $A^{\beta\theta}$, which means that A^{θ} should lie between these values. This is possible only if $1 < A^{\theta} < \left(\frac{b_H}{b_L}\right)^{\theta}$. Otherwise, if $A^{\theta} < 1$ then it lies to the left of the $[A^{\beta\theta}, \left(\frac{b_H}{b_L}\right)^{\theta}]$ interval. If $A^{\theta} > \left(\frac{b_H}{b_L}\right)^{\theta}$ then it lies to the right of the interval.

Now $\theta = \frac{1}{1-\beta}$ is positive. Therefore, $1 < A^{**} < \frac{b_H}{b_L}$.

Existence of A^{**}.When $A = 1$ the right-hand side of (3.42) is $\gamma(b_H^{2\theta} - b_L^{2\theta}) > 0$, since $b_H > b_L$. At the same time, when $A = \frac{b_H}{b_L}$, the right-hand side is $\beta b_H^{(1+\beta)\theta}(b_L - b_H) < 0$. Since the right-hand side of (3.42) is a continuous function of A and it changes sign between $A = 1$ and $A = \frac{b_H}{b_L}$, the solution A^{**} to the equation (3.42) always exists.

Uniqueness of A^{**}. Suppose there are two different solutions to the equation (3.42) - A_1 and A_2, both greater than 1 and smaller than $\frac{b_H}{b_L}$. Without loss of generality, assume also that $A_1 > A_2$. Inserting A_1 and A_2 into (3.42) and taking the difference between two resulting identities, we get the following:

$$(\beta+\gamma)b_H^{\theta}b_L^{\theta}(A_1^{\beta\theta} - A_2^{\beta\theta}) - \gamma b_L^{2\theta}(A_1^{(\beta+1)\theta} - A_2^{(\beta+1)\theta}) - (\gamma+\beta)b_H^{\theta}b_L^{\theta}(A_1^{\theta} - A_2^{\theta}) = 0. \quad (3.46)$$

Since both $A_1 > 1$ and $A_2 > 1$, $\theta > 0$, and $\beta < 1$, for $A_1^{\theta} > A_2\theta$ $A_1^{\theta} - A_2^{\theta} > A_1^{\beta\theta} - A_2^{\beta\theta}$. Therefore, the only chance that the identity (3.46) holds is when $A_1 = A_2$. ∎

The interpretation of the Proposition 3.2.2 is that the benevolent decision-maker does not fully equalize the capacities of the local governments to attract investments ($A^{**} < A^{*}$). Under the optimal transfer policy government of the b_H-jurisdiction still has an advantage over its competitor, and attracts more capital even if both governments spend the same amount of money on the public capital. Still, A^{**} is unambiguously greater than 1, which means that the non-trivial regional subsidy to the disadvantaged government is welfare-improving for the country.

In its maximization problem the decision-maker weighs two things. From the one side, it wants to enhance competition in public spending between the local governments. It would be done by equalizing fiscal capacities of the governments, i.e. by setting A to $\frac{b_H}{b_L}$. From the other side, the decision-maker wishes to shift capital to the advantaged jurisdiction, as it would be the case if the governments were perfectly benevolent. Indeed, while the public spending in both jurisdictions is the same (under any transfer A) in equilibrium, the output in the advantaged jurisdictions is still $\frac{b_H}{b_L}$ times higher than in the disadvantaged jurisdiction when $k_H = k_L$. By decreasing

A from its most equalizing level ($\frac{b_H}{b_L}$) the benevolent decision-maker induces unanimous decrease in public spending, but the shift of capital from the disadvantaged jurisdiction to the advantaged one offsets the loss in public good production, and leads to the increase in welfare of the country.

3.2.4 Regional subsidy versus no transfers

This section continues to analyze our special case, when $N = 2$ - there are two governments in the economy.

It follows from the Proposition 3.2.2 that if the benevolent decision-maker maximizes the total welfare of the country then it always chooses A greater than 1 - the disadvantaged jurisdiction receives a non-trivial subsidy. Such subsidy enhances "race to the top" competition between the local governments, which improves the integrity (absence of corruption) of both of them. Even though due to the subsidy the capital is shifted from the jurisdiction, which is more productive (where production of the public good is cheaper), the improvement in public service still increases the sum of outputs in both jurisdictions for a given τ, which is our definition of the country's welfare. In this section the question is if all residents benefit from the subsidy, or equivalently - does welfare increase in both jurisdictions, so that the subsidy is the Pareto improvement?

The welfare of a jurisdiction i consists of two parts - the wage income (or retained profit) from domestic production, and the capital income of its residents at home and abroad. Since the capital income of all residents in the country is the same, the welfare of the jurisdiction i eventually takes the following form:

$$W_i = (1 - \beta) f_i + \xi_i \beta W, \tag{3.47}$$

where $W = f_H + f_L - \tau K$ - total welfare of the country. Share β of it is the total capital income received in the country. ξ_i is the share of capital owned by the residents of the jurisdiction i. It ranges from 0, when residents are not capital owners, to 1, when residents own total capital stock in the economy. The capital income increases with the total welfare of the country. If subsidy scheme A is welfare-maximizing, then it maximizes the capital income too. The effect of A on the wage income is, however, twofold. From the one side, each jurisdiction gains from the increase in the public good production due to enhanced "race to the top" competition between local governments. From the other side, introduction of A distorts the tax bases in the jurisdictions - for $A > 1$ capital flights from the advantaged jurisdiction to the disadvantaged - and subsidized - one as compared to the no transfer case.

Following the argument above, both wage and capital income and thus welfare unambiguously increase in the disadvantaged jurisdiction for $A > 1$. To prove this formally note that from (3.39)-(3.40) f_L is:

$$f_L = \frac{cA^{\frac{\beta+\gamma}{1-\beta}}}{\left(b_H^{\frac{1}{1-\beta}} + A^{\frac{1}{1-\beta}} b_L^{\frac{1}{1-\beta}}\right)^{2\gamma+\beta}}, \tag{3.48}$$

were c is some constant. Taking derivative by A it is straightforward to show that its sign is equivalent to the sign of the following expression:

$$\text{sign}(f_L') = \text{sign}\left(\left(\frac{\beta+\gamma}{\gamma}\right)^{1-\beta} \frac{b_H}{b_L} - A\right). \tag{3.49}$$

At $A_L^* = \left(\frac{\beta+\gamma}{\gamma}\right)^{1-\beta} \frac{b_H}{b_L}$ the output in the disadvantaged jurisdiction is maximized. But A_L^* is always greater than 1, which means that f_L decreases on the range $A \in \left[1, \frac{b_H}{b_L}\right]$. Therefore, any A (including A^{**}) from this range is better for the disadvantaged jurisdiction then no transfers ($A = 1$).

The case, which we proved for the disadvantaged jurisdiction, is not necessary true for the advantaged jurisdiction - welfare increases there only if increase in public goods production offsets capital flight from this jurisdiction. Indeed, following the same line of arguments as for the disadvantaged jurisdiction in the previous paragraph, the output of the advantaged jurisdiction f_H is maximized at $A_H^* = \left(\frac{\gamma}{\beta+\gamma}\right)^{1-\beta} \frac{b_H}{b_L}$. A_H^*, however, is never greater than $\frac{b_H}{b_L}$. In fact, if b_H and b_L are sufficiently close, A_H^* may get smaller than 1. Than f_H decreases over the whole range $A \in \left[1, \frac{b_H}{b_L}\right]$, which means that any $A > 1$ reduces the wage income of the residents in b_H-jurisdiction. Note further that A^{**} - the optimal subsidy scheme, which is chosen by benevolent decision-maker, is always between A_L^* and A_H^*, because outside the $[A_H^*, A_L^*]$ interval both f_H and f_L are decreasing, so is the $W = f_H + f_L - \tau K$. Therefore, even if the difference between jurisdictions ($\frac{b_H}{b_L}$) is high, and A_L^* is greater than 1, A^{**} is still in the range, where f_H is decreasing, and so the effect of implementing A^{**} on the welfare of b_H-jurisdiction's residents is not clear.

Using (3.39)-(3.40) and (3.47) the welfare of the advantaged jurisdiction can be

rewritten:

$$W_H(A) = \frac{cA^{\frac{\gamma}{1-\beta}}\left((1-\beta+\xi_H\beta)b_H^{\frac{1}{1-\beta}} + \xi_H\beta A^{\frac{\beta}{1-\beta}}b_L^{\frac{1}{1-\beta}}\right)}{\left(b_H^{\frac{1}{1-\beta}} + A^{\frac{1}{1-\beta}}b_L^{\frac{1}{1-\beta}}\right)^{2\gamma+\beta}} - \xi_H\tau K, \tag{3.50}$$

The question is for which A's from the range $\left(1, \frac{b_H}{b_L}\right]$ is this welfare higher than the welfare in case of no transfers $W_H(1)$. Even though the model in the chapter is structured the way that the math is as simple as possible, there is no simple answer to this question. The following proposition gives a wider answer - it establishes the conditions for all $A \in \left(1, \frac{b_H}{b_L}\right]$ to be welfare-decreasing or welfare-increasing:

Proposition 3.2.3 *Let the welfare of the first jurisdiction is given by (3.50). Then:*

I. W_H decreases comparing to no transfers case for all subsidy schemes $A \in (1, \frac{b_H}{b_L}]$ if

$$\frac{b_H}{b_L}^{\frac{1}{1-\beta}} \leq \frac{(1-\beta)(\gamma+\beta)+\sqrt{D}}{2\gamma(1-\beta+\xi_H\beta)}, \tag{3.51}$$

where $D = (1-\beta)^2(\gamma+\beta)^2 + 4\gamma(1-\beta+\xi_H\beta)\xi_H\beta\gamma$.

II. W_H increases comparing to no transfers case for all subsidy schemes $A \in (1, \frac{b_H}{b_L}]$ if

$$\left(\frac{(1-\beta+\xi_H\beta)\left(\frac{b_H}{b_L}\right)^{\frac{1}{1-\beta}} + \xi_H\beta\left(\frac{b_H}{b_L}\right)^{\frac{\beta}{1-\beta}}}{(1-\beta+\xi_H\beta)\left(\frac{b_H}{b_L}\right)^{\frac{1}{1-\beta}} + \xi_H\beta}\right)^{\frac{1}{2\gamma+\beta}} \frac{\left(\frac{b_H}{b_L}\right)^{\frac{1}{1-\beta}}+1}{\left(\frac{b_H}{b_L}\right)^{\frac{\beta+\gamma}{(1-\beta)(2\gamma+\beta)}}} > 2. \tag{3.52}$$

In the case $\xi_H = 0$ - no ownership of capital by the residents, W_H is equal to the wage profit, (3.51) simplifies to:

$$\left(\frac{\gamma}{\beta+\gamma}\right)^{1-\beta}\frac{b_H}{b_L} \leq 1; \tag{3.53}$$

and (3.52) simplifies to:

$$\frac{\left(\frac{b_H}{b_L}\right)^{\frac{1}{1-\beta}}+1}{\left(\frac{b_H}{b_L}\right)^{\frac{\beta+\gamma}{(1-\beta)(2\gamma+\beta)}}} > 2. \tag{3.54}$$

Proof *(i)* Since W_H is a concave function of A (W_H is effectively weighted sum of f_H and f_L - both concave functions, as shown in the preceding paragraph), to prove part *(i)* we need to show that $W'_H(1) < 0$ - welfare of the residents is decreasing at $A = 1$. Taking derivative of the right-hand side of (3.50), and substituting $A = 1$ we get the condition (3.51). (3.55) is obtained directly, when we set $\xi_H = 0$ (it is also proven in the paragraph preceding the proposition).

(ii) For any A compare $W_H(A)$ and $W_H(1)$:

$$W_H(A) > W_H(1) \Leftrightarrow \tag{3.55}$$

$$\Leftrightarrow A^{\frac{\gamma}{1-\beta}} \left((1-\beta+\xi_H\beta) b_H^{\frac{1}{1-\beta}} + \xi_H \beta A^{\frac{\beta}{1-\beta}} b_L^{\frac{1}{1-\beta}} \right) \left(b_H^{\frac{1}{1-\beta}} + b_L^{\frac{1}{1-\beta}} \right)^{2\gamma+\beta} > \tag{3.56}$$

$$> \left((1-\beta+\xi_H\beta) b_H^{\frac{1}{1-\beta}} + \xi_H \beta b_L^{\frac{1}{1-\beta}} \right) \left(b_H^{\frac{1}{1-\beta}} + A^{\frac{1}{1-\beta}} b_L^{\frac{1}{1-\beta}} \right)^{2\gamma+\beta}. \tag{3.57}$$

If inequality (3.55) holds for $A = \frac{b_H}{b_L}$ then it holds for any $A \in (1, \frac{b_H}{b_L}]$, since $f_H(A) > f_H(1)$ on this range. Inserting $A = \frac{b_H}{b_L}$ into (3.55) we get condition (3.52). Then setting ξ_H to 0 in (3.52) we get (3.54) ∎

The Proposition 3.2.3 tells us that for sufficiently high $\frac{b_H}{b_L}$ and γ - correspondingly, the technological difference between jurisdictions and the elasticity of the output function with respect to public capital - any subsidy scheme from a reasonable range is beneficial for the residents of the first jurisdiction. Indeed, note that $\frac{1}{1-\beta} > \frac{\beta+\gamma}{(1-\beta)(2\gamma+\beta)}$, therefore left-hand side of (3.52) goes to infinity if $\frac{b_H}{b_L}$ goes to infinity. Even if $\xi_H = 0$ - the residents of the advantaged jurisdiction earn capital income neither at home nor abroad - subsidizing the disadvantaged jurisdiction may prove to be beneficial for net-payers solely because their government becomes much more disciplined, and ceases to extract huge rents arising from a sufficiently wide gap between jurisdictions. At the same time, if $\frac{b_H}{b_L}$ is small, or if β - elasticity of the production function with respect to private capital - is high then the residents of the advantaged jurisdiction prefer not to share with their neighbors.

The message of the Proposition 3.2.3 is supported by a numerical simulation exercise I perform next. In the exercise, the specific parameter values are taken, and then the actual optimal subsidy schemes are calculated. Several combinations of β's and γ's are taken: medium/medium ($\beta = 0.4, /\gamma = 0.35$), low/low (0.15/0.15), high/low (0.5/0.15), and low/high (0.15/0.5). This values are compatible with the corresponding empirical estimates.[9] The optimal subsidy schemes are calculated

[9]Values for β and γ between 0.3 and 0.4 are found in Aschauer (1989); Munnell (1990); Aschauer

then for the range of $\frac{b_H}{b_L}$'s from 1 to 3. Note that in the model - when there are no intergovernmental transfers - the difference between the jurisdictions' outputs (GDP's per capita) $\frac{f_H}{f_L}$ is equal to $\left(\frac{b_H}{b_L}\right)^{\frac{1}{1-\beta}}$. Hence, change in technological advantage from $\frac{b_H}{b_L} = 1$ to 3 implies difference in GDP's per capita in corresponding jurisdictions from 1 to 6.2 (medium/medium case), $1-3.7$ (low/low and low/high case), and $1-9$ (high/low case). Though high, these differences are still in the reasonable range of the regional GDP per capita differences on practice. In US in 2006 the per capita output in Delaware was about 3 times higher than the one in the poorest US state Missisipi.[10] The regional differences on a county level inside a state may even get bigger (take more than 4.5 times difference between Collin and Starr counties in Texas). In EU in 2000 the richest regions (Inner London (UK), Brussels (Belgium)) outperformed their poorest counterparts (Ipeiros (Greeece), Reunion (France)) by more than 5 times. Even for neighboring jurisdictions the difference of 2 and more is not that uncommon. Regional inequalities are not less significant in the developing countries. For instance, in 2005 in China the GDP per capita in Jiangsu province was 5.6 times higher than the one in the Guizhou province.

The results of the exercise are depicted on the Figure 3.2.4. The red thick dash-dot line (on all subfigures) sketches the A^{**} - the optimal subsidy scheme for the whole country - for different $\frac{b_H}{b_L}$'s. The blue thick solid line and two black (dotted and dashed) lines (on all subfigures) are reserved by $A_L(\xi_H)$'s - the maximal subsidy schemes, which leave the residents of the first jurisdiction as good as with no transfers to the second jurisdiction (so that $W_H(A_L(\xi_H)) = W_H(1)$). ξ_H is the share of total capital K owned by the residents of the advantaged jurisdiction. 3 options are shown: 0, 0.5, and 1. As one can notice, A^{**} is always greater than 1. At the same time, $A_L(\xi_H)$ remains 1 for sufficiently small $\frac{b_H}{b_L}$'s (equivalent to the maximal difference in GDP per capita from 1.36 in low/high case to 2.89 in high/low case, when $\xi = 0.5$), meaning that any non-trivial intergovernmental transfer reduces the welfare of the advantaged jurisdiction in this range. As the technological advantage of the b_H-jurisdiction increases A_L grows too. Eventually, for sufficiently big $\frac{b_H}{b_L}$'s (equivalent to the minimal GDP per capita difference of $1.48-4.84$ depending on the case) even A^{**} subsidy scheme becomes acceptable for the residents of the first jurisdiction. The results are consistent throughout changes in production function parameters β and γ. The higher is γ's, the lower technological difference $\frac{b_H}{b_L}$ is needed in order for A^{**} to be beneficial for the residents of the advantaged jurisdiction.

(2000). Lower values (0.15 and 0.15) are found in Dessus and Herrera (2000). For the overview of the empirical literature on this subject, see Romp and de Haas (2007)

[10]District of Columbia has even higher GDP per capita

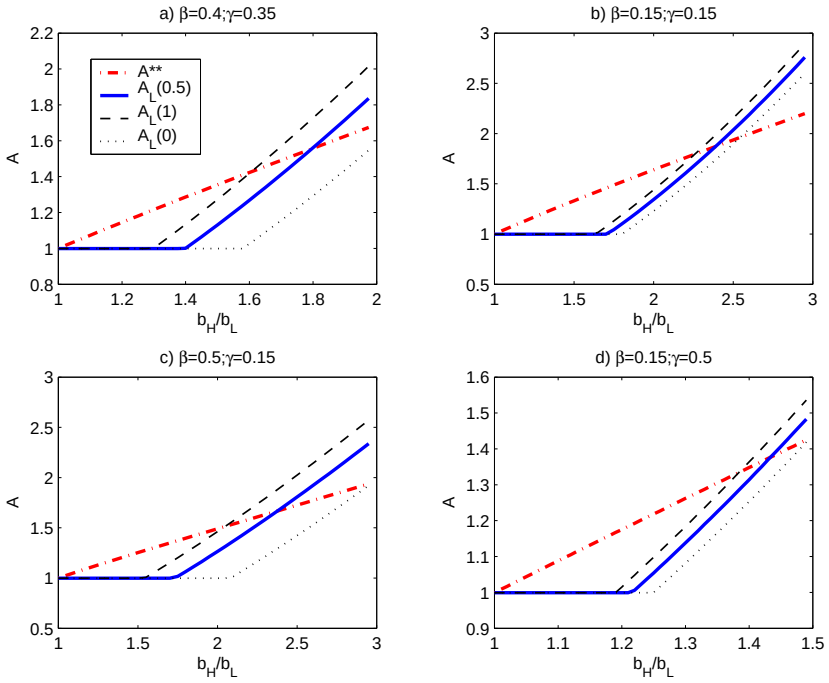


Figure 3.1: Subsidy schemes for different $\frac{b_H}{b_L}$'s

Note: $\frac{b_H}{b_L}$ - technological advantage of one jurisdiction over another; A^{**} - the optimal from the point of view of the whole country subsidy scheme; $A_L(\xi)$ - the maximal subsidy scheme, which as good for the residents of the first jurisdiction as no subsidy ($W_H(A_L(\xi)) = W_H(1)$). $\xi = 0$ - the residents of the advantaged jurisdiction own no capital, $\xi = 0.5$ - half of the capital stock K is owned by the residents of the jurisdiction, $\xi = 1$ - the residents of the jurisdiction own all capital in the economy

The intuition of these results is simple. The bigger is the advantage $\frac{b_H}{b_L}$ of the b_H-jurisdiction the bigger are the benefits ripped by its government without any effort. Therefore, the subsidy scheme, which forces governments to compete with each other, leads to a greater increase in the public spending. Higher γ - the elasticity of the production function with respect to the public capital - means that the increase in the public good production has a higher impact on the country's output and welfare. Therefore, for sufficiently big regional differences and γ the effect of improved integrity of the local governments outweighs the effect of capital flight in the first jurisdiction, which makes the subsidy scheme Pareto optimal.

Chapter 4

Citizen-centric governance indicators: Measuring governance by listening to the people and not the interest groups

The chapter is organized as follows. Section 4.1 discusses conceptual issues in measuring governance, specifies a citizen-centric conceptual framework on measuring governance quality. Section 4.2 presents an empirical framework, data sources and aggregation techniques. Section 4.3 presents preliminary results. In Section 4.4 we discuss the robustness of our results, as well as the contributions and limitations of the empirical approach. A concluding section outlines future research agenda.

4.1 Conceptualizing and measuring governance quality in a comparative context

Governance is a fuzzy yet fashionable buzzword and its use in the literature has exploded in recent years. Dixit (2008) notes that there were only 4 citations in EconLit in the period 1970-1979 compared to 15455 in the most recent period of 2000-2007 and currently Google lists more than 152000 pages of this literature. According to American Heritage, Random House and Merriam Webster dictionaries, governance is equated with government and is defined as the "exercise of authority and control" or "a method or system of government and management" or "the act, process or power of governing". Huther and Shah (1998) defined governance as "a multi-faceted

concept encompassing all aspects of the exercise of authority through formal and informal institutions in the management of the resource endowment of a state. The quality of governance is thus determined by the impact of this exercise of power on the quality of life enjoyed by its citizens" (p.2). The World Bank Governance and Anti-corruption (GAC) Strategy (World Bank, 2007) defines it as "the manner in which public officials and institutions acquire and exercise the authority to shape public policy and provide goods and services" (p.3).

For our current purpose, none of the above definitions with the sole exception by Huther and Shah, is helpful in serving as an operational guide to carry out a comparative review of quality of governance across countries or even of one country over time. This is because of their singular focus on the processes/institutions which do not lend themselves to easy or fair comparability across countries and sometimes not even within one country without conducting deeper analytical studies. There can be little disagreement that same processes and institutions can lead to divergent governance outcomes just as dissimilar processes could yield similar outcomes in two different countries. For example, anti-corruption agencies in countries with fair governance helps curtail corruption but in countries with poor governance prove either to be ineffective or worse a tool for corrupt practices and victimization (Shah, 2007). As another example, budget secrecy prior to its presentation to the parliament is just as important under parliamentary form of government as in Canada, UK, India, New Zealand, as open and participatory budget determination process is to presidential form of government as in the USA. There can be little disagreement that both types of processes have the potential to advance public interest but may succeed or fail in different country circumstances. During the past two decades, we have also seen that single party dominant political systems in China, Malaysia and Singapore have shown dramatic results in improving governance outcomes whereas pluralistic party systems have also shown positive results in other countries such as Brazil and India. Similarly monarchy has shown positive results in UK but unwelcome results in Nepal. Even similar electoral processes do not always lead to representative democracy and may instead yield aristocracy (elite capture) in some countries and corrupt oligarchies in others. In fact, Aristotle's main argument for elections was based upon the premise that these would produce aristocracy, a form of government he considered superior to median voter rule (see Azfar, 2008). Andrews (2008) argues that such "good governance picture of effective government ... constitutes a threat, promoting isomorphism, institutional dualism and "flailing states" and imposing an inappropriate model of government that "kicks away the ladder" today's effective government climbed to reach their current state."(p.2) In any case, such comparisons of processes and institutions out of their context are almost always ideologically driven and value

laden and could not be acceptable as unbiased professional (scientific) judgments. This also explains that while citizens of Bangladesh, China, India and Malaysia over the last decade have experienced remarkable improvement in governance outcomes, available primary indicators fail to capture these accomplishments due to their focus on processes at the neglect of outcomes. Even for the world as a whole, the information revolution by letting the sun shine on government operations, has brought about dramatic improvements in government accountability, but the WGIs with their on one-size-fit all vision of the world, have consistently failed to notice or recognize such a mega change. These indicators rank China in the lowest percentile on voice and accountability but according to the former Auditor General of Canada, China has the most effective public accounts committee anywhere which has a track record of holding government to account for malfeasance (Dye, 2007). Furthermore local governments in China have relatively much larger role in public service provision than most countries. Local governments below the provincial level account for about 54% of consolidated public expenditures in China compared to about 4% in India and about 27% in OECD countries (see Shah and Shah, 2006). Thus having the decision making closer to people, directly elected local governments, and party oversight of local government performance - all work to create a system of voice and accountability that is quite unique to China and not easily comparable to other countries (see Qiao and Shah, 2006). China has also demonstrated superior government effectiveness through its unique and unparalleled success in alleviating poverty and improving the quality of life of its citizens over the past two decades. About two decades ago, China had about 35% of its population below poverty level compared to less than 2% in 2006 (see Shah and Shen, 2007). In conclusions comparisons of governance institutions requires deeper analytical work through in-depth comparative studies rather than aggregate indicators. Such indicators are more usefully used to compare governance outcomes and complementary analytical studies of institutions and process can be used to explain varying outcomes. Of course, governance outcomes also assume commonly shared values but it is relatively less problematic than one-size fit-all prescriptions on processes. To have meaningful governance comparisons across countries and over time, one needs to have concepts which are somewhat invariant to time and place and are focused on citizens' evaluations rather than interest groups' views. To this end, we define *governance as an exercise of authority and control to preserve and protect public interest and enhance the quality of life enjoyed by citizens.* Note that this definition encompasses both the governance environment (quality of institutions and processes) as well as governance outcomes.

4.1.1 Towards a simple framework for assessing country governance quality

Considering a neo-institutional perspective, various orders of government (agents) are created to serve, preserve, protect and promote public interest based upon the values and expectations of the citizens of a state (principals). Underlying assumption is that there is a widely shared notion of the public interest. In return, governments are given coercive powers to carry out their mandates. A stylized view of this public interest can be characterized by four dimensions of governance outcomes.

- *Responsive Governance.* The fundamental task of governing is to promote and pursue collective interest while respecting formal (rule of law) and informal norms. This is done by government creating an enabling environment to do the right things - that is it promotes and delivers services consistent with citizen preferences. Further, the government carries out only the tasks that it is authorized to do that is it follows the compact authorized by citizens at large.

- *Fair (equitable) Governance.* For peace, order and good government, the government mediates conflicting interests, is focused on consensus building and inclusiveness and ensures a sense of participation by all and protection of the poor, minorities and disadvantaged members of the society.

- *Responsible Governance.* The government does it right i.e. governmental authority is carried out following due process with integrity (absence of corruption), with fiscal prudence, with concern for providing the best value for money and with a view to earning trust of the people.

- *Accountable Governance.* Citizens can hold the government to account for all its actions. This requires that the government lets sunshine in on its operations and works to strengthen voice and exit options for principals. It also means that government truly respects the role of countervailing formal and informal institutions of accountability in governance.

Given the focus on governance outcomes, Table 4.1 presents some preliminary ideas for discussion on how to operationalize these concepts in individual country assessments.

The above simple framework captures most aspects of governance outcomes especially those relevant for development policy dialogue and can serve as a useful starting point for a consensus framework to be developed. In any event, there can be

Table 4.1: Governance outcomes and relevant considerations

Governance outcome	Relevant considerations
Responsive governance	• public services consistent with citizen preferences; • direct possibly interactive democracy; • safety of life, liberty and property; • peace, order, rule of law; • freedom of choice and expression; • improvements in economic and social outcomes; • improvements in quantity, quality and access of public services; • improvements in quality of life;
Fair governance	• fulfillment of citizens' values and expectations in relation to participation, social justice, and due process; • access of the poor, minorities and disadvantaged groups to basic public services; • non-discriminatory laws and enforcement; • egalitarian income distribution; • equal opportunity for all;
Responsible governance	• open, transparent and prudent economic, fiscal and financial management; • working better and costing less; • ensuring integrity of its operations; • earning trust; • managing risks; • competitive service delivery; • focus on results;
Accountable governance	• justice-able rights and due process; • access to justice, information; • judicial integrity and independence; • effective legislature and civil society oversight; • recall of officials and rollbacks of program possible; • effective limits to government intervention; • effective restraints to special interest capture.

Source: Shah (2008)

little disagreement that one cannot embark on measuring governance quality without first defining and defending an appropriate framework that measures governance - a point also emphasized by Thomas (2006) and the European Commission (see Nardo et al., 2005). Once a consensus framework is developed then one needs to focus on only a few key indicators that represent citizens' evaluations and could be measurable with some degree of confidence in most countries of the world and could be defended for their transparency and reasonable degree of comparability and objectivity (see Andrews and Shah, 2005 for details and relevant indicators of an approach that emphasizes citizen-centric governance and Shah and Shah, 2006 for citizen-centered local governance and relevant indicators.) . Having an enormous number of indicators which could not be scrutinized, is nothing but a distinct disadvantage for a measure that aims for wider acceptance and confidence.

Implementation of the above framework requires a worldwide survey with uniform questionnaire honing on the four dimensions of governance identified above across countries. Given that such a survey is not available and costly to commission, in the following section, we take a pragmatic approach based upon available survey data to develop rough indexes of governance quality.

4.2 Citizen-centric governance: Empirical framework

Following Table 4.1, public interest is characterized by four dimensions of governance outcomes - responsive governance, fair governance, responsible governance, and accountable governance. Each of these categories is split further on sub-categories in order to characterize a concrete governance outcome (such as improvements in quality of life, safety, peace, etc.) Public opinion survey, with the questions assigned to each subcategory, should be used for the assessment of governance.

The procedure of the assessment consists of the two main steps. First, data source - the raw data from inter-country public opinion survey - is chosen. The responses on questions in the survey, which characterize governance outcomes, are recorded. Second, the responses are aggregated in order to achieve governance index for each country from the sample.

In what follows, we consider both steps in detail.

4.2.1 Data

Reliable, comprehensive and consistent through time and space source of data is essential for qualitative estimation of citizen-centric governance indicators (CGIs). With an additional requirement of being publicly accessible and, preferably, free of charge, such data source hardly exists at present. There is a database of governance-related questions included into different surveys across the world (Governance Surveys Database published by the World Bank). In principle, each of these questions could be included into our estimation (questions taken separately from different polls) if the data is available. However, as the experiments in the construction of surveys suggest (see Bertrand and Mullainathan, 2001, for examples), even the small difference in the formulation of a question (assigned to the same sub-criterion) or the sequence of questions in a survey may bring significant discrepancies in the responses for the same country and same sub-criterion. Therefore, we decided to use only one data source, which covers sufficient amount of countries. Effectively it means, that almost the same questionnaire is used in all participating countries.

The principal data source for our further analysis is the World Values Survey (WVS) project, conducted by WVS Association (see WVS, 2008). Table A2 shows its characteristics in comparison with other potential data sources. WVS provides an acceptable compromise of consistency and coverage for showing an initial picture of citizen-centric governance indicators. On the one hand, WVS publishes quite outdated information (with the time lag of 2-3 years after actual survey was taken), and only a few questions from this survey are relevant for our purposes (since the survey is about cultural values, not governance). On the other hand, WVS provides quite comprehensive geographical coverage (97 countries with all major economies included) combined with acceptable time coverage and questionnaire.

The coding (which is used further in text and in the dataset) and questions assigned to each sub-criterion of governance are presented in the Table A1 of Appendix. As one can see, for a few sub-criteria, specified in the Table 4.1 of the chapter, no survey questions are available. This is a drawback of WVS, as this survey was not constructed to evaluate governance. However, each governance outcome has a sufficient representation by questions in order to get reasonable estimates.

Based on the data from WVS (questions from the Table A1 of Appendix), as well as from the other freely available data sources (AFR, ASB, TI_GCB - see Table A2 for notation), a unique dataset was constructed, which can be used for the evaluation of citizen-centric governance indicators by any researcher. 421994 people's responses (256152 of them by WVS) on 74 different questions (20 from WVS) are recorded in this dataset. 125 countries are covered, 97 of them by WVS. The records in the dataset can be sorted by the gender, income, education of a respondent, as well as

by the sub national administrative unit of his/her residency.

For the reasons explained above our main estimation procedure is based on 3 waves of the World Values Surveys depending on the year when the surveys were taken. Wave 1 includes countries surveyed from 1994 to 1998, wave 2 - from 1999 to 2004, and wave 3 - from 2004 to 2008. In addition to questions from WVS, in the wave 3 we also use one question about corruption from Transparency International Global Corruption Barometer (see TI, 2005).

As an alternative to the WVS, we apply additional data sources in our estimation of citizen-centric governance indicators. In particular, in this chapter we report the results when using Gallup World Poll data points, which are available freely from the Worldwide Governance Indicators (WGI) project (see WBI, 2008).[1] 4 questions from GWP are used in WGI. While this coverage is quite limited, yet it allows us to estimate 3 governance outcomes for a wide range of countries.

4.2.2 Aggregation

The underlying assumption of our empirical investigation is that the quality of governance in a given country directly affects governance outcome, which is being analyzed in a certain survey question. Thus, the answers of survey respondents - citizens of this country - are better for each question the higher is the quality of governance in the country. At the same time, answers of the respondents are random variables, which are subject to personal errors:

$$s_{ijk} = \beta_k g_i + \epsilon_{ijk} \;\Rightarrow\; g_i = \frac{1}{\beta_k} s_{ijk} - \frac{1}{\beta_k} \epsilon_{ijk}, \tag{4.1}$$

where $i = 1, .., M$ is the index of a country, $j = 1, .., N_i$ is the index of a respondent (total number of respondents, obviously, changes from country to country), and $k = 1, .., K$ is the index of a question in a survey (thus of a particular governance outcome). s_{ijk} is the answer on question k of the respondent j in the country i. Each response was normalized by us on a scale from 0 to 1, with 0 being the worst answer, and 1 being the best answer. g_i is the quality of governance in the country i. It does not depend neither on concrete respondent, nor on specific question. Coefficient β_k reflects a degree, to which governance affects the answer of a respondent. Note that it does not depend on country or respondent. Finally, $\epsilon_{ijk} \sim N(0, \sigma_{ik}^2$ is the personal random error of the respondent j in the country i, which may also depend on a

[1] Gallup World Poll, described in the Table A2, is itself very expensive (28 thousands US Dollars per year), and therefore cannot be used as a base for a rigorous, replicable research

specific question. Each error is independently normally distributed with zero mean and the variance σ_{ik}^2, which may depend on country and specific question.

The expression for g_i can be rewritten:

$$g_i = w_k s_{ijk} - w_k \epsilon_{ijk}, \tag{4.2}$$

where $w_k = \frac{1}{\beta_k}$ - are the question-specific weights assigned to each question. The weights are normalized to add up to one - $\sum_{k=1}^{K} = 1$ - so that g_i is between 0 and 1 for each country. For our main estimation, and for further comparative analysis, the weights are exogenously chosen and are reported in the Table A1 of the Appendix. They reflect the relative importance of every question in assessment of governance (i.e. "satisfaction with life in general" is clearly more comprehensive than "satisfaction with health" or "satisfaction with environment"), as well as alleviate certain data deficiencies (i.e. European countries were not asked some questions in the second wave of WVS, so these questions received lower weight). At the same time, the weights can be easily changed to tailor one's specific research agenda or check the robustness of the results.

Given our assumptions, the most efficient, unbiased, and consistent estimator for the governance in country i is just the sample mean of weighted averages of citizens' responses, the estimator for the governance's variance is adjusted sample variation:

$$\hat{g_i} = \frac{1}{N_i} \sum_{j=1}^{N_i} \sum_{k=1}^{K} w_k s_{ijk}, \quad \hat{var}(g_i) = \sum_{k=1}^{K} w_k^2 \frac{1}{N_i - 1} \sum_{j=1}^{N_i} \left(s_{ijk} - \frac{1}{N_i} \sum_{j=1}^{N_i} s_{ijk} \right)^2. \tag{4.3}$$

We gave up more sophisticated data mining approaches (e.g. principal component analysis, canonical analysis or random projections) for the sake of transparency and simplicity. The choice of weights or aggregate procedure does not significantly change the appearing governance picture (see Section 4.4). Our procedure is maximally open and simple in order to allow for a further research and analysis. Besides, in addition to the governance scores we report and analyze the aggregate responses on each question, which makes our indicators "actionable", and allows drawing the conclusions, which are completely independent of weights and aggregation procedure.

4.3 Citizen-centric governance: Preliminary rankings

Based on the estimation procedure described above we report our results in this section. First, we analyze citizen-centric indicators (CGIs) as well as responses on

separate questions in all countries in 3 waves of World Values Surveys and Gallup World Poll. Then we compare the indexes by groups of countries, through time (across 3 waves), and with other governance indicators (in particular, Worldwide Governance Indicators). In the last subsection, we give examples of sub-national CGIs in several countries.

4.3.1 Country rankings: Waves 1 to 3

The countries' citizen-centric governance indicators (CGIs) are presented on the Figure 4.1 and Figure 4.2. On the first figure we show the estimations based on the data from World Values Survey, for the second figure we use the data from Gallup World Poll (see Section 4.2.1 for details about data sources). All 3 waves of WVS surveys are shown on the Figure 4.1: (a) Wave 1 - for surveys taken between 1994 and 1998 (53 countries), (b) Wave 2 - for surveys taken between 1999 and 2004 (71 country), (c) Wave 3 - for surveys taken between 2005 and 2008 (51 country).

The maps of citizen-centric governance evaluations are, in our opinion, more convenient tool for analysis than the tables with more than 100 records, though those are also available from authors at the request. On the Figure 4.1 we split our sample of countries into 3 broad categories (6 categories on the Figure 4.2): from dark-green high-governance-quality countries to light-green low-governance-quality countries. While developed countries (especially Scandinavian countries and Switzerland) show stable and high grades, it is rather unexpected that East Asian countries (especially, Vietnam, China) are relatively high rated. In some countries of the Middle East (Jordan, Saudi Arabia) the popular support of the government is also "unexpectedly" high. At the same time, countries of Central and Eastern Europe are always in the lowest percentiles of the samples.

In the Figure 4.3 we compare citizen-centric governance indicators with corresponding Worldwide Governance Indicators (WBI, 2008), which are considered to be the "gold standard" of governance assessment by the media. The scale changes from dark-green for countries, which were severely underestimated by WGIs, to dark-red for countries, which were greatly overestimated. 27 out of 82 countries in our sample were over- or underestimated at a significance level less than 25% (9 at a level less than 5%) by WGIs in comparison to our assessments. The pattern described in the paragraph above is supported: Middle East and East Asian countries are mostly underestimated (with China, Vietnam, Iran and Saudi Arabia being the leading outliers), while Central and Eastern European countries are too praised by WGI (Latvia, Lithuania, Moldova and Hungary being the leading outliers). Apparently, our indicators reflect last decade's obvious successes of East Asian and Middle

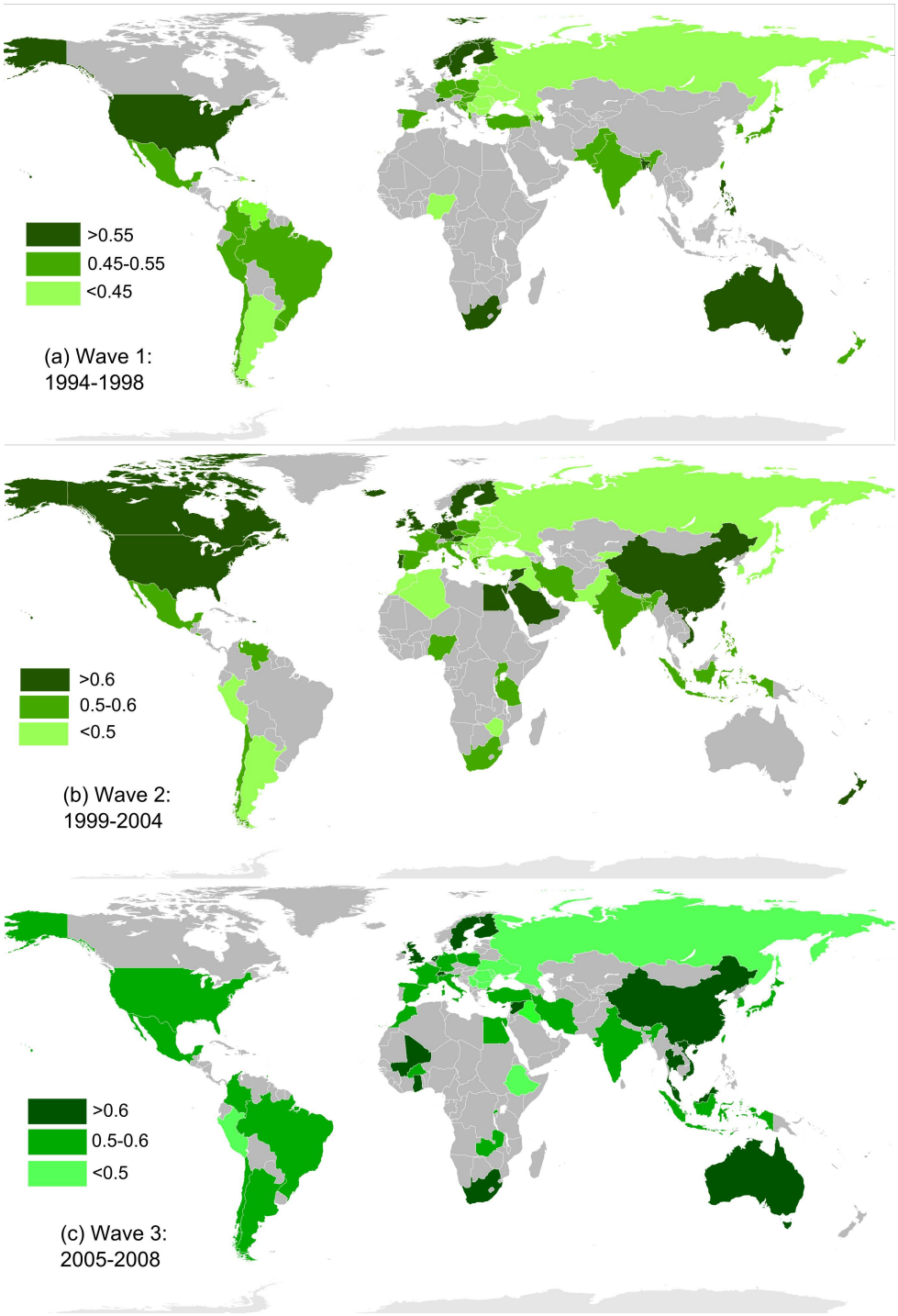


Figure 4.1: Citizen-centric governance indicators (data source - WVS, waves 1-3)

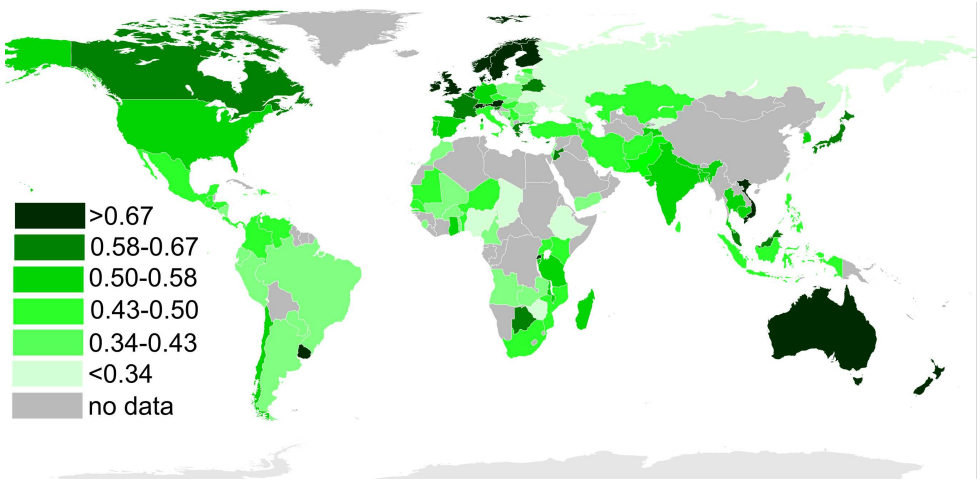
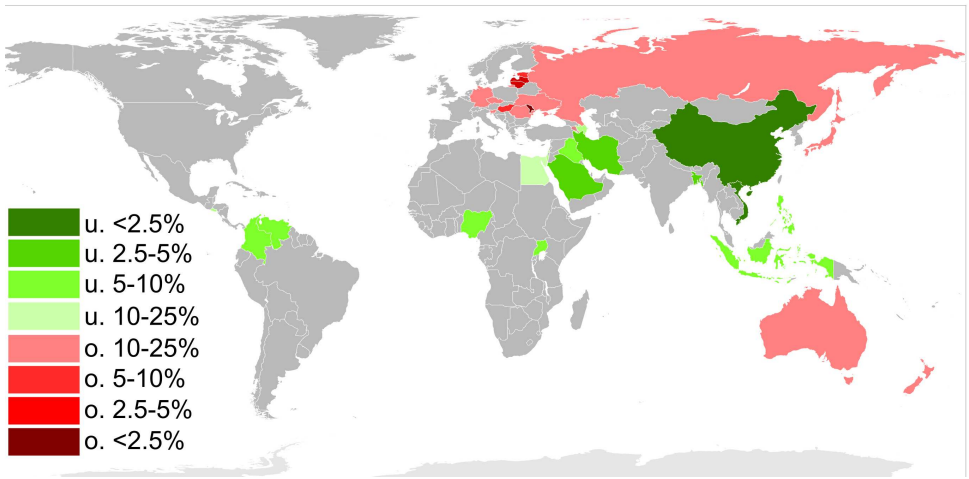
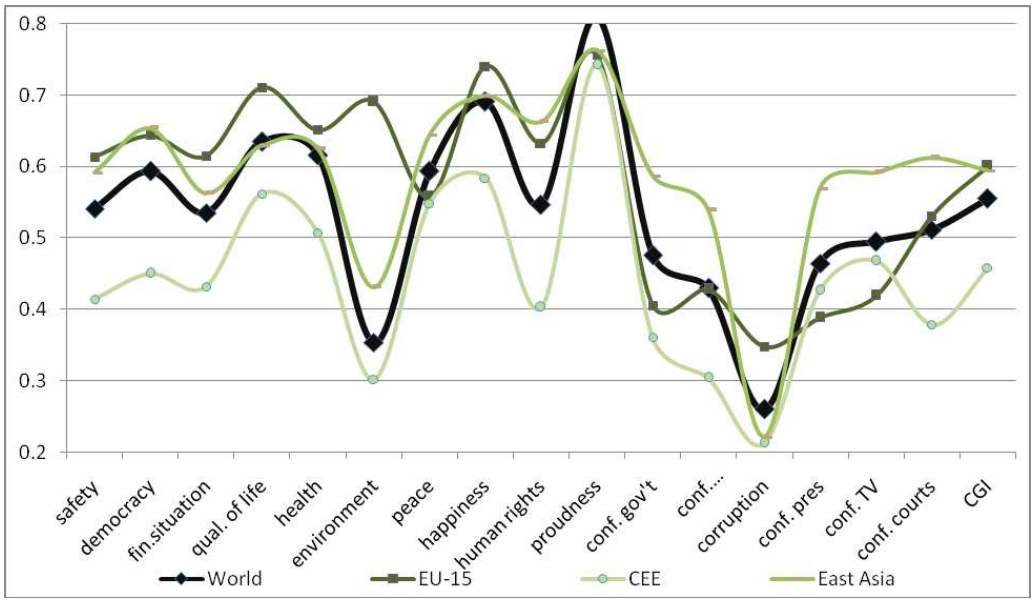


Figure 4.2: Citizen-centric governance indicators (data source - GWP)



Note: u. X-Y% means that the country was underestimated by WGI in comparison to CGI at the significance level between X and Y%; *o. X-Y%* means that the country was overestimated by WGI in comparison to CGI at the significance level between X and Y%. The time period considered is 1994-2005, aggregate CGIs are taken, WGIs are averaged over all 6 components

Figure 4.3: CGI vs. WGI (Worldwide Governance Indicators)



Note: Averages on each governance outcome (as is defined in the Table A1) in the selected groups of countries: *World* - the whole sample, *EU-15* - countries from European Union before the extension of 2004, *CEE* - Central and Eastern European countries, *East Asia* - East Asian countries (China, Taiwan, India, Indonesia, Korea, Malaysia, Vietnam, Thailand)

Figure 4.4: WVS wave 3: governance outcomes by groups of countries

East countries in economic outcomes. At the same time, WGIs rely more on the Anglo-Saxon institutional design of a government, which does not always lead to desired governance outcomes given local historical and institutional contexts (see our discussion in the Introduction).

To analyze the disaggregate data, in the Table 4.2 we depict top performing countries in each governance outcome separately. It can be seen that Western European countries dominate in the group of outcomes ascribed to Responsive Governance, with the questions about overall life satisfaction, satisfaction with the health, environment, happiness. At the same time, the categories related to the trust and confidence in government, media, courts, and army are dominated by the East Asian (Vietnam, China, India, Malaysia, etc.), some African (Mali, Rwanda, etc.), and Middle East (Jordan, Egypt) countries.

The pattern described above can be clearly seen on the Figure 4.4. Here we depict regional averages by each governance outcome (based on the data from the third

Table 4.2: WVS wave 3: top performers by each governance outcome

Governance category	Top-performers
Responsive governance	
safety of life, order, rule of law	Vietnam, Jordan, Rwanda, Finland, Australia
freedom of choice and expression	Ghana, Vietnam, Jordan, Switzerland, Sweden
improvements in economic and social outcomes	Switzerland, Mexico, Sweden, Finland, Netherlands
improvements in quality of life: general	Colombia, Mexico, Switzerland, Finland, Argentina
improvements in quality of life: health	Jordan, Andorra, Malaysia, Switzerland, Cyprus
improvements in quality of life: environment	Sweden, Germany, Finland, Slovenia, Switzerland
peace	Vietnam, Jordan, Turkey, India, Mali
happiness	Mexico, UK, Sweden, Trinidad and Tobago, Switzerland
Fair governance	
social justice, respect for human rights	Finland, Vietnam, Switzerland, India, Ghana
government represents the whole country	Ghana, Trinidad and Tobago, Colombia, Mali, Thailand
Responsible governance	
earning trust: exec. branch	Vietnam, Jordan, China, Malaysia, Mali
earning trust: leg. branch	Vietnam, China, Rwanda, Jordan, South Africa
corruption	Netherlands, Spain, Finland, Switzerland, UK
Accountable governance	
access to information, independent mass media - press	Vietnam, India, Jordan, China, Rwanda
access to information, independent mass media - television	Vietnam, India, Egypt, South Africa, Iraq
judicial integrity and independence	Vietnam, Jordan, Rwanda, Malaysia, Turkey

Note: For each governance outcome, assessed by questions from Table A1, top performers are 5 countries with the highest average response

wave of WVS). It can be seen that the curve of the EU-15 group - "old" members of the European Union - is almost always above other curves in the dimension of Responsive Governance (till the "happiness" point on the X-axis). When it comes to the questions about Responsive and Accountable Governance (confidence in parliament, government, press, TV, courts) the curve steeps down. The curve of the East Asian countries, while mostly above the world's average, rises above the curve of EU-15 only in trust-related dimensions. Similar properties (though with somewhat lower averages) have the curves of Middle East and African countries (the curves are not depicted in the figure to keep at least some tractability). The curve of Central and Eastern European countries (CEE) is always below East Asian curve, as well as the world's average. Particularly low (relative to others) citizens of CEE countries evaluate their confidence in police ("safety" on X-axis) and respect for human rights in their respective countries ("human rights" on the X-axis).

The fact that people in the East Asia, Middle East and Africa trust their governments more than the people in developed countries of Western Europe and North America may not only reflect the overall public satisfaction (or dissatisfaction) with governance outcomes. In depressed countries, it may also be the result of people's fear to disclose their true opinion about government. Alternatively, when mass media in a country are controlled by the government, people in this country may be indoctrinated to believe and trust those on the top. In the Section 4.4.2 we analyze these possible effects and their magnitude for the countries from our sample.

4.3.2 Intertemporal comparison

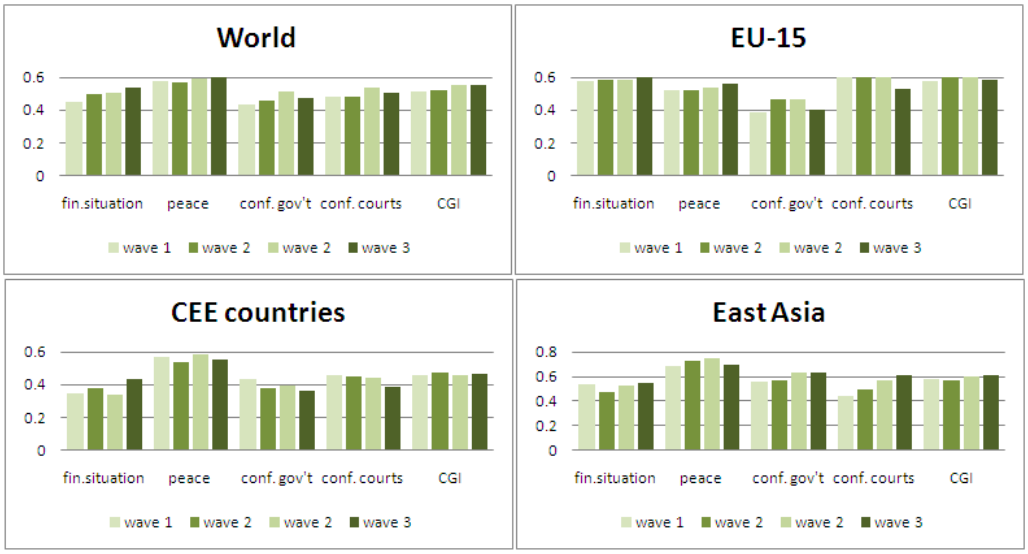
The consistent through time questionnaires of the WVS and repeated surveys during three waves allow us to assess the progress of the governance in certain countries. In particular, citizens of 41 country were surveyed both during the first wave of WVS (1994-98) and during the second wave (1999-2004). Surveys both from the second wave and the third wave (2005-2008) are available for 33 countries.

In the Table 4.3 we report the countries, which achieved the biggest progress in each governance outcome (both from Wave 1 to Wave 2, and from Wave 2 to Wave 3). Not surprisingly, the list is dominated by the developing and the countries in transition - of 110 positions (10 governance outcomes plus CGIs themselves) only 14 are taken by developed countries (Spain and Germany between waves 1 and 2, and Japan between waves 2 and 3). These numbers clearly reflect the fact of life level increase and stable economic growth in certain parts of the world. Especially it concerns the speedy economic recovery of CEE countries after the horrible post-communist "hangover" of the 90s. The most commonly mentioned countries are

Table 4.3: CGI (WVS): top performers by the progress in time

Governance outcome	Top-performers: Wave 1 to Wave 2	Top-performers: Wave 2 to Wave 3
Total CGI	Nigeria, Germany, Venezuela, Latvia, Finland	Turkey, Russian Federation, Jordan, South Africa, India
Responsive governance		
safety of life, order, rule of law	Macedonia, Bangladesh, Nigeria, Venezuela, Latvia	India, Morocco, Japan, China, Korea
improvements in economic and social outcomes	Venezuela, Moldova, Spain, Nigeria, Argentina	Turkey, Jordan, Argentina, Korea, South Africa
improvements in quality of life: general	Estonia, Bulgaria, Moldova, Venezuela, Slovenia	Turkey, Jordan, Russian Federation Ukraine, Moldova
improvements in quality of life: health	Nigeria, South Africa, Mexico, Bangladesh, BiH	Moldova, Jordan, Argentina, Indonesia, Morocco
peace	Bangladesh, Latvia, India, New Zealand, Macedonia	Bulgaria, Italy, South Africa, Chile, Mexico
Responsible governance		
earning trust: executive branch	Venezuela, Nigeria, New Zealand, Spain, Albania	Turkey, Iraq, South Africa, Argentina, Korea
earning trust: legislative branch	Nigeria, New Zealand, Venezuela, Spain, Germany	Morocco, Turkey, South Africa, Korea, India
Accountable governance		
ind. mass media - press	Bangladesh, Germany, Slovenia, Sweden, India	Bulgaria, Morocco, Vietnam, Jordan, India
ind. mass media - TV	Albania, India, Bangladesh, Nigeria, Venezuela	Morocco, Iraq, Vietnam, Jordan, Egypt
judicial integrity and ind.	Macedonia, Bangladesh, Nigeria, Venezuela, Latvia	India, Japan, Morocco, China, Turkey

Note: Top performers - in each governance outcome (as defined in the Table A1) 5 countries with the biggest mean difference between corresponding waves

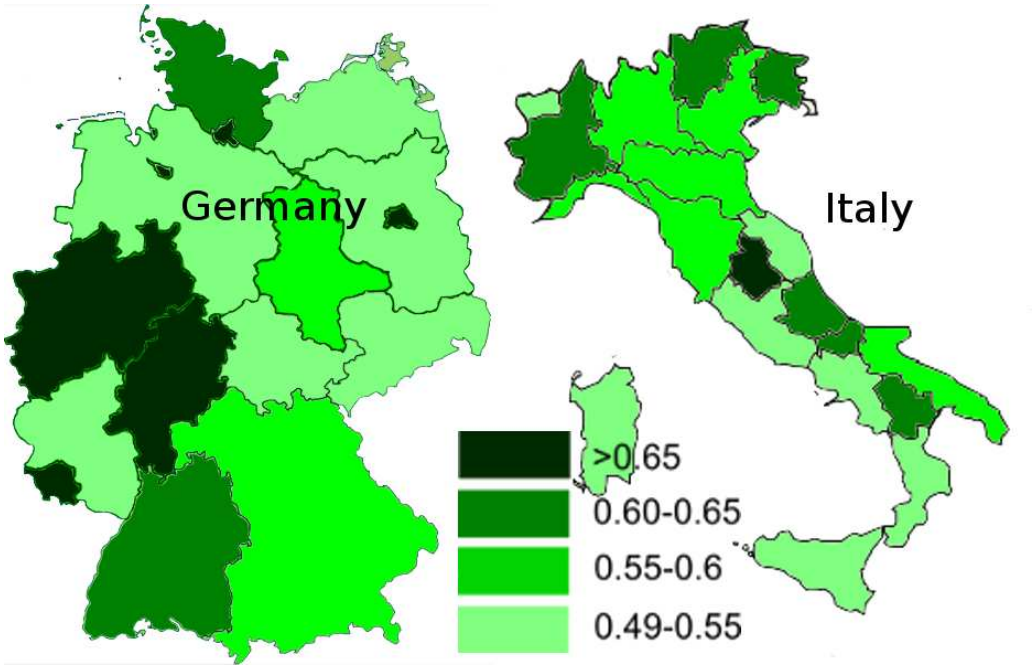


Note: Progress in time for some governance outcomes and CGI in 4 regions. First 2 columns for each outcome compare wave 1 and wave 2 over common sample of countries, columns 3 and 4 compare wave 2 and wave 3 over common sample of countries. Governance outcomes included are: "satisfaction with financial situation in the household", "peace" (confidence in the army), "confidence in government", and "confidence in courts". The regions: *World* - all countries in the samples, *EU-15* - European Union members before the extension of 2004, *CEE countries* - Central and Eastern European Countries, *East Asia* - East Asian countries.

Figure 4.5: CGI (WVS) waves 1-3: progress over time by regions

Nigeria, Venezuela, Latvia, Bangladesh, Moldova between waves 1 and 2, and Turkey, Russian Federation, Jordan, India and South Africa between waves 2 and 3.

The governance in the world (over the sample of countries surveyed by WVS) statistically significantly (at the level of less than 1%) increased from wave 1 to wave 2 (see Figure 4.5) - in contrast to the WGI's world of unchanging governance quality, - but practically did not change from wave 2 to wave 3. As it can be seen from the figure the main driver of the growth in world's quality of governance was increasing (in practically all regions) satisfaction of the citizens with their financial situation. This trend was kept from wave 2 to wave 3 as well, but the overall progress was apparently mitigated by the fall of confidence in governments, courts, army, etc. in developing and countries in transition (though CEE countries still ended up progressing from wave 2 to wave 3).



Note: left side - Germany, survey of 2006; right side - Italy, survey of 2006. The scale is common to both countries.

Figure 4.6: Subnational CGI (WVS): examples

4.3.3 Subnational CGIs

Our estimation procedure as well as dataset collected allows us to extend citizen-centric governance indicators from countries to their subnational units. The idea is to aggregate the citizens' responses not over the whole country, but over its jurisdictions. For the Wave 3 of WVS there are 1121 of them in the sample - usually the second tier of a country's administrative structure (in some countries - groups of second tier jurisdictions).

The examples of some countries are given in the Figure 4.6. On the left we depict Germany, and on the right - Italy. Both countries were surveyed in 2006. In Germany rich industrial lands[2] of Hessen, Nordrhein-Westfalen and Saarland together with independent cities of Bremen, Hamburg and Berlin are the most satisfied with their governments. At the same time, the scores are much lower in the poorer eastern part

[2]Länder in German - second tier jurisdictions in the country

of the country - only in Sachsen-Anhalt citizen's gave their government more than 0.55 (the score of the land is 0.56). Surprising are the average scores received by the governments of rich southern states - Baden-Würtemberg and Bayern.

The relative correspondence between richness of a jurisdiction and its government's score is also kept in Italy. Most regions of the rich country's North score more than 0.55. At the same time, most of the poorer South - with the exception of Abruzzo, Molise, and Basilicata regions - is below 0.55.

Subnational CGIs is, to our knowledge, the first attempt to assess governance at less aggregate than the country level. Analyzing these may prove to be helpful in empirical research on decentralization and governance, decentralization and welfare, difference between capital and non-capital regions, industrialized and rural regions, etc.

4.4 Robustness

Combination of survey data with the simple aggregation procedure raises quite a few questions about the validity and reliability of our results. In this section we are trying to resolve some of them. First, we provide some arguments in favor of our aggregation procedure and overall analysis of the data. Second, we give a critical assessment of the data we have available.

4.4.1 Alternative aggregation techniques

Transparency, simplicity and possibility to tailor the assessment procedure for one's research agenda are the main reasons behind adopting our aggregation procedure - taking weighted averages of citizens' responses. Besides, some questions are relatively more important and comprehensive for assessing governance, which cannot be detected by mechanized data mining algorithms. In addition, many of our findings and conclusions concern directly separate governance outcomes (responses on a separate question), which does not depend on aggregation procedure.

Nevertheless, we use alternative aggregation techniques to test the robustness of our results. In particular, we apply uniform weights to our data, as well as we use averaging over percentile rankings (the way it is done in the Doing Business project - Djankov, 2007). Naturally, both methods produce slightly different rankings comparing to our main methodology. In particular, European countries lose some positions and East Asian countries gain - the result of increased reliance on the governance outcomes, which are related to trust and confidence in governmental institutions. However, only 11 of 51 countries in case of uniform weights (10 out of 51

in case of averaged percentile rankings) significantly change their standing (according to classification provided in the Figure 4.1, wave 3 - when country changes one of three categories).

4.4.2 Adjusting the data

In our estimation we use survey data from countries around the world, and the public opinion in a country - especially about the issues related to the government - might be influenced by factors, which we would definitely like to account for. One of the factors is so-called "intimidation" effect, when people are afraid to express their true - negative - opinion about their government, because they think they could be punished for that. Another factor, frequently mentioned in the literature, is the "indoctrination" effect, when mass media in a country praise the government so much, that it has a significant positive impact on public opinion. Another factor is the degree of citizen activism and perceived role of government in a country. In particular, Norris (1999) argues about the emergence in the 70s in developed countries of the class of so called "critical citizens" - people, who were becoming more and more critical and demanding towards their governments despite their obvious successes.

Taking into account 3 factors mentioned above ("intimidation", "indoctrination", "critical citizenship") we conclude that in general a response on a question about governance outcome of an individual might be affected not only by the quality of governance in a country. The true model can be rewritten in the following way:

$$s_{ijk} = \alpha_{ik} + \beta_k g_i + \gamma_{ik} int_{ij} + \eta_{ik} ind_{ij} + \mu_{ik} cr\_cit_{ik} + \epsilon_{ijk}, \tag{4.4}$$

where similarly to the notation from Section , s_{ijk} is a response of an individual j in a country i on a question k, g_i is the quality of governance in a country i, , and ϵ_{ijk} is a citizen-, country- and question-specific error. int_{ij}, ind_{ij}, cr_cit_{ij} are the degrees of intimidation, indoctrination and critical citizenship of an individual j in a country i. γ_{ik}, η_{ik} and μ_{ik} - depending on country and question - are the coefficients of our interest.

The estimation of γ_{ik}, η_{ik} and μ_{ik} is not possible from the model above, since we do not observe governance g_i (this is in fact what we are trying to assess). However, the problem can be resolved if we note, that for some questions (governance outcomes) there are no effects of intimidation, indoctrination or critical citizenship, and for some there are. For instance, when an individual is asked about the satisfaction with her/his health, it is likely that she/he will not be intimidated to say true. At the same time, questions like "Do you have confidence in your government?" are most

probably subject to all above mentioned effects. Therefore, by taking the difference between the answers on these questions we can get rid of the governance on the right-hand side while intimidation, indoctrination and critical citizenship effects remain. The estimation model than become:

$$diff_{ij} = \frac{1}{K_1}\sum_{k=1}^{K_1} s_{ijk} - \frac{1}{K_2 - K_1}\sum_{k=K_1+1}^{K_2} s_{ijk} = \alpha_i' + \gamma_i int_{ij} + \mu_i ind_{ij} + \eta_i cr\_cit_{ij} + \epsilon_{ij}', \tag{4.5}$$

where $s_{ijk},\ k = 1, .., K_1$ are the citizens' answers on the questions, which are exposed to the biasing effects (intimidation, indoctrination, critical citizenship), $s_{ijk},\ k = K_1 + 1, .., K_2$ are the answers on the questions with no role for above mentioned effects. Therefore, the left-hand side of our model is the difference between the averages of the two groups of questions (governance outcomes). Assuming that these groups of governance outcomes explain governance to the same degree (average β_k's are the same) we get rid of the quality of governance in the right-hand side, and can test for $\gamma_{ik},\ \eta_{ik}$ and μ_{ik} directly. After taking into account these effects the estimator for the quality of governance can then be expressed as:

$$g_i = \frac{1}{N_i}\sum_{j=1}^{N_i}\sum_{k=1}^{K} w_k s_{ijk} - \sum_{k=1}^{K} w_k \frac{1}{N_i}\sum_{j=1}^{N_i}(\gamma_i int_{ij} + \mu_i ind_{ij} + \eta_i cr\_cit_{ij}) \tag{4.6}$$

g_i is now the weighted average of people's responses (the formula we adopted in the main body of the chapter) less the effects of intimidation, indoctrination and critical citizenship - averaged over all residents of a country surveyed and multiplied by the weight of the questions in the survey, which are exposed to these effects.

We assume the following questions (governance outcomes) to be independent from the bias effects:

- How satisfied are you with the financial situation of your household? (improvements in economic and social outcomes)
- All things considered, how satisfied are you with your life as a whole these days? (improvements in quality of life: general)
- All in all, how would you describe your state of health today? (health)
- How serious you consider poor water quality, air quality, sewage and sanitation to be here in your own community? (environment)
- Taking all things together would you say you are [happy, unhappy]? (happiness)

On the opposite, the following questions (governance outcomes) are assumed to be exposed to bias effects:

- How much confidence do you have in government? (trust: executive branch)
- How much confidence do you have in parliament? (trust: legislative branch)
- How much confidence do you have in press? (trust: press)
- How much confidence do you have in television? (trust: television)
- How much confidence do you have in courts? (trust: courts)

Testing for the intimidation, indoctrination and "critical citizenship" effects

We use 2 types of estimation procedures to extract γ_i, η_i and μ_i - effects of intimidation, indoctrination and "critical citizenship" in a country i. First, we test for indoctrination (η_i) on an individual level, since there can hardly be any proxy for biasedness of mass-media (indoctrination) on a country-level. On a contrary, it is hard to come up with the proxies for personal intimidation and "critical citizenship" (this effect was in fact defined only for countries as a whole). That is why we use country-level regressions to identify these effects.

As the proxy for indoctrination we take the frequency, with which an individual exposes her- or himself to media - TV and press. Specifically, we use questions "Did you watch TV during the last week?" and "Did you read newspapers last week?" from the World Values Survey. The more people watch TV or read newspaper the more they are exposed to possible indoctrination (or excessive criticism of mass-media). The exact estimation model then becomes:

$$diff_{ij} = \alpha'_i + \eta_{1i} tv_{ij} + \eta_{2i} press_{ij} + \theta_i demogr_{ij} + \epsilon'_{ij}, \tag{4.7}$$

where tv_{ij}, $press_{ij}$ are the dummies for watching TV and reading newspapers last week (as it was posed in the questions of the survey), $demogr_{ij}$ is a set of individual demographic variables (we take respondent's education, income, age, marital status, political activism - participation in demonstrations, boycotts, signing petitions).

We report the results in the Table 4.4. The main conclusion from it is that even though developing countries, especially those in Middle East and East Asia, seem to be indoctrinated, the mass media bias is also present in many developed countries - Japan, Sweden, Switzerland, USA, France. This might be the outcome not of state monopoly (or dictate) on mass media, but of too optimistic or patriotic news

coverage in these countries. The magnitude of the indoctrination effect ranges from 0.02 (except for Ukraine and Rwanda, where those who watch TV are actually more critical towards the government) to 0.12, which combined with on average 75% of respondents watching TV or reading newspaper, may lead for some countries to a decrease in our estimates of governance by 0.005-0.03 points.[3]

Intimidation and "critical citizenship" effects are estimated on a country level. Specifically, as a proxy for the intimidation level in a country we use the average score of the country in the "Freedom in the World" ranking - an annual publication of the Freedom House, where political and civil rights of the citizens are assessed. As for the "critical citizenship" effect, we follow Pippa Norris (Norris, 1999) in her definition of a "critical citizen", and define the country to be in the stage of "critical citizenship" if it had been classified "free" by the Freedom House for at least ten years before the survey was conducted (long period of stable democracy), and the GDP per capita in this country (taken from IMF) was more than 10 thousands US dollars (wealthy population). Most OECD countries together with Slovenia and Chile enter the group. The estimation model than becomes:

$$diff_i = \alpha + \gamma freedom_i + \mu cr\_cit_i + \theta demogr_i + \epsilon_i, \tag{4.8}$$

where $freedom_i$ is an index of Freedom House, cr_cit_i is the "critical citizenship" dummy defined above, and $demogr_i$ is a set of demographical country-specific variables (average level of education, share of married population, share of males, average age).

The estimation results are presented in the Table 4.5. As one can see from the table, both freedom of the county and its being in the stage of "critical citizenship" are highly statistically significant in explaining biases on responses on trust-related questions in the WVS surveys. The directions of the effects are what would be intuitively foreseen. In the Freedom House ranking a country has the higher score the less civil and political rights its citizens have: 1 is the best score, 7 is the worst. Therefore, negative γ in our estimation means that the intimidation effect plays a greater role in less free countries. 1 score up in the Freedom House ranking of a country makes the citizens of this country to be more cautious in answering government-related questions in a survey, and consequently overestimate their governments in trust-related questions by 0.03 points. For a completely depressed country (with the score 7) the effect on our governance estimate would be -0.07 points. From the other side, residents of the countries, which are in a stage of "critical citizenship", do have significantly less confidence in their governments then they should have had. If not

[3]Note that our estimates of governance are assessed on a scale from 0 to 1.

Table 4.4: Mass media bias in public opinion

Media bias, magnitude (η_{1i}, η_{2i})	TV	Press
0.08 - 0.12	Japan, Mexico, India, Slovenia, Cyprus, Ethiopia	Thailand, Cyprus
0.04 - 0.08	Sweden, Switzerland, Brazil, Turkey, Peru, Moldova, Indonesia, Vietnam, Serbia, Egypt, Andorra, Burkina Faso, Zambia, France	Jordan, Malaysia
0.02-0.04	China	USA, Mexico, Brazil, Romania, Egypt
≈ 0	Argentina, Australia, Bulgaria, Chile, Taiwan, Colombia, Finland, Germany, Ghana, Italy, Republic of Korea, Mali, Morocco, Netherlands, Poland, Russian Federation, South Africa, Spain, Trinidad and Tobago, United Kingdom	
-0.08 - -0.02	Ukraine, Rwanda	Indonesia

Note: First column - ranges for point OLS estimates are reported. For each range, only the countries, for which coefficients are different from 0 at a significance level less than 5%, are reported. "≈ 0" range - countries with no significant TV or press bias. Sample of the countries used - WVS wave 3 (except Iran, Iraq, Hong Kong, New Zealand, where questions about mass media were not asked)

Table 4.5: Effects of indoctrination and "critical citizenship"

Dependent variable - *diff*	Coef.	Std. Err.	P>t	95% conf. int.	
freedom	-0.03^{***}	0.007	0.000	-0.05	-0.02
cr_cit	0.09^{***}	0.025	0.001	0.04	0.14
F(6,157)	17.65				
Prob¿F	0.00				
R-squared	0.4				
Adj. R-squared	0.38				
No. of observations	164				

Note: *** - significant at less than 1% level. Method of estimation - OLS. Sample - countries surveyed by World Values Survey during all 3 waves.

too "critical", residents of these countries would give their governments score 0.09 points higher, which would be reflected in the increase of citizen-centric indicator on about 0.03.

Even though we find statistically significant effects of indoctrination, intimidation and "critical citizenship" in some countries, the magnitude of these effects is not particularly immense. For example, Vietnam with our score of 0.72 is not a free country based on criteria of Freedom House (it had rank 6 in 2005), and there is a moderate (0.05) effect of indoctrination on television. Together these effects would cut citizen-centric governance indicator in Vietnam by 0.07 points. New indicator would be 0.65 - still in the highest 20th percentile of the sample. Apparently, there are other reasons for some governments to score so high in the public opinion polls. In case of East Asia the main of them is probably last decade's stable economic growth and development in the region (as it is argued for China by Wang, 2005). At the same time, poor economic performance, political conflicts and corruption in the 90s (and for many countries up until today) in Central and Eastern European countries keep the scores the governments in this regions extremely low.

Chapter 5

Conclusion

The main conclusion of this dissertation is that the quality of governance has a significant impact on interjurisdictional competition. It impacts the strategies of countries when setting income taxes on mobile factors (Chapter 2), and thus the distribution of capital over jurisdictions (in particular, the flows of foreign direct investments). It is also shown to be a major force in defining the effectiveness of intergovernmental sharing between advantaged and disadvantaged jurisdictions (Chapter 3). At the same time, the precise and credible empirical measurement of the governance's quality is extremely hard as it is shown in Chapter 4. Nevertheless, the attempt to do it - when the welfare of citizens is taken to be the main criterion for good governance - is done in that chapter.

The main result of the Chapter 3 is that if the governments of 2 countries are different in their efficiency (i.e. one of them is able to produce more public good out of the same revenue) then the more efficient government charges the higher corporate income tax rate. It can do so, because besides the high tax rate it offers to the potential investors a qualitative public infrastructure, which reduces the cost of their production. At the same time, less efficient government is not able to compete in the level of public good provision, so it chooses to attract the firms with low taxes.

The main result of the chapter is, however, contingent on two major assumptions. First is that the profit function of an investor is concave enough in public good. Second is that the countries should be sufficiently different in their efficiency. If at least one of the conditions does not hold then both governments have incentives to deviate, and there are no equilibria in pure strategies. At best, governments are involved in the mixed strategies, and set tax rates in a random manner.

The theoretical conclusions of the work are in general supported by anecdotal empirical evidence. However, further investigations in this field are needed in order

to make robust conclusions.

The main message of the Chapter 3 is that the intergovernmental sharing between jurisdictions in a country can enhance the efficiency of public service in this country. Such an outcome is the case when local governments are (partially) self-interested and care about extracting rents from holding the office. In addition, jurisdictions, which are administered by these governments, exogenously differ in factor productivities: given the same factor inputs, the output in advantaged jurisdictions is higher than the output in disadvantaged ones. Implementing intergovernmental sharing scheme in the country - when the disadvantaged jurisdictions are subsidized by the advantaged ones - equalizes the capacities of the local governments to attract investments, and thus enhances competition in public spending between them (which may be basically called "race to the top" competition). The "race to the top" competition leads to increased levels of public spending in all jurisdiction, and increases welfare of the whole country. This holds, however, only if instead of financing the disadvantaged governments the transfers go directly to the businesses investing in the disadvantaged jurisdictions as a subsidy. In the former case, any non-zero transfer would unambiguously decrease the welfare of the country, since the financing governments would have less incentive to attract capital, and the financed governments would have a "perverse" incentive to increase the grant they are going to receive.

The optimal from the point of view of the welfare of the country transfer does not fully equalize the governments - the advantaged government still has some advantage over the disadvantaged one. This happens because the benevolent decision-maker has two objectives in its optimization. First, it wants to equalize the local governments to promote competition between them, which drive the decision toward the increase in transfer. Second, it wants to shift the production to the advantaged jurisdiction, since it is the place with "real" higher productivity of factors, as opposed to "artificial" advantage (created by the transfer) in the disadvantaged jurisdiction.

Chapter 4 provides a conceptual framework for measuring governance quality using citizens' evaluations consistently across countries and over time. It further provides empirical illustration - using the data from World Values Survey Association - of the usefulness of the methodology by developing governance quality rankings for 120 countries. These rankings significantly differ from those provided by available indicators that mostly capture foreigners' (mostly interest groups) or arm-chair experts' opinions.

The surveys of WVS project are certainly subject to important limitations. They are not conducted in the same year for all countries, and the questionnaires may slightly differ from country to country, which may produce significant departures from objective estimation. It is also possible that in spite of the claims to the contrary by

the survey organization, the survey may not be based on stratified random sampling for some countries due to practical difficulties (for instance, WVS for Vietnam).

Notwithstanding these limitations, the dataset constructed by us has important merits. The governance-related questions and answers are reported on the level of individual respondents in our dataset, which gives researchers a great flexibility in composing the rankings. In particular, it is possible to compose rankings among the people with higher education, different genders, income, etc. Most importantly and contrary to many other indicators, the data used in our estimation are freely accessible, and can be easily used by other researchers to replicate or modify our estimation procedure.

Ideally though our theoretical framework should be implemented using a world poll employing a uniform questionnaire across countries and over time. The World Gallup Poll or a similar instrument might offer such opportunity in the near future.

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Appendix A

Appendix

A.1 Proofs of propositions in Chapter 2

A.1.1 Lemma 2.1.1

Firm s compares its after-tax profits in both countries:

$$\Pi_A = p - c - \tau_A + sg_A^\theta \text{ vs. } \Pi_B = p - c - \tau_B + sg_B^\theta \tag{A.1}$$

Immediately few cases are clear:

- If $\tau_A \geq \tau_B$ and $g_A \leq g_B$[1] then firm of any type will pay less taxes in country B and receive more public inputs. Therefore, $\hat{s}_B = 1$.
- On a contrary, if $\tau_A \leq \tau_B$ and $g_A \geq g_B$ then all firms will invest in country A: $\hat{s}_B = 0$
- The case, we are interested in, is when $\tau_A > \tau_B$ and $g_A > g_B$. Firm s will invest in country B if:

  $$\Pi_A = p - c - \tau_A + sg_A^\theta < \Pi_B = p - c - \tau_B + sg_B^\theta \tag{A.2}$$

  With the given restrictions on tax rates and levels of public good provision we can solve this inequality directly. The solution is:

  $$s < \frac{\tau_A - \tau_B}{g_A^\theta - g_B^\theta} = \hat{s} \tag{A.3}$$

[1] We assume that tax rates and levels of public good provision cannot be equal simultaneously. If it is so, then $\hat{s}_B$ is undetermined

Therefore,

$$\hat{s}_B = \begin{cases} \hat{s} & \text{if } \tau_A - \tau_B < g_A^\theta - g_B^\theta, \\ 1 & \text{otherwise,} \end{cases} \tag{A.4}$$

which was needed to prove.

Note that $\tau_A \neq \tau_B$ in this case, so $\hat{s}$ is never 0. Moreover, $\hat{s}$ is the solution of the equation:

$$\Pi_A = \Pi_B, \tag{A.5}$$

i.e. if difference in tax rates is sufficiently small (refer to equation (A.4)) then $\hat{s}$ is the type of firm, which is indifferent between investing in either of two countries.

- The final case, when $\tau_A < \tau_B$ and $g_A < g_B$ will lead us to the inequality, similar to (A.3), only with the reverse sign. As a result, $\hat{s}_B = 1 - \hat{s}$, if again the difference in tax rates is not too big. Otherwise, $\hat{s}_B = 0$.

A.1.2 Lemma 2.2.2

Let us check second order conditions for the objective function (2.12) of the government A.

Denoting the function by $Rev_A = Rev_A(\tau_A, g_A)$, the second derivatives of Rev_A will look the following way:

$$\frac{\partial^2 Rev_A}{\partial \tau_A^2} = -\frac{2}{\Delta}, \tag{A.6}$$

$$\frac{\partial^2 Rev_A}{\partial \tau_A \partial g_A} = \frac{\tau_A - \tau_B}{\Delta^2}\theta g_A^{\theta-1} + \frac{\tau_A}{\Delta^2}\theta g_A^{\theta-1}, \tag{A.7}$$

$$\frac{\partial^2 Rev_A}{\partial g_A^2} = -\frac{2\tau_A(\tau_A - \tau_B)}{\Delta^3}(\theta g_A^{\theta-1})^2 + \frac{\tau_A(\tau_A - \tau_B)}{\Delta^2}\theta(\theta-1)g_A^{\theta-2}, \tag{A.8}$$

where $\Delta = g_A^\theta - g_B^\theta$.

The solution (2.9) is indeed the maximal point of the function Rev_A if:

I. $\frac{\partial^2 Rev_A}{\partial \tau_A^2} < 0$;

II. $\frac{\partial^2 Rev_A}{\partial \tau_A^2}\frac{\partial^2 Rev_A}{\partial g_A^2} - (\frac{\partial^2 Rev_A}{\partial \tau_A \partial g_A})^2 > 0$.

The requirement (I) is obvious, since $\Delta > 0$ by our assumption.

As for the requirement (II), if we substitute the expressions for partial derivatives (A.6)-(A.7) and make some basic calculations we will get:

$$\frac{\partial^2 Rev_A}{\partial \tau_A^2}\frac{\partial^2 Rev_A}{\partial g_A^2} - \left(\frac{\partial^2 Rev_A}{\partial \tau_A \partial g_A}\right)^2 = \frac{\theta}{\Delta^4} g_A^{\theta-2}(-\tau_B^2 \theta g_A^{\theta} + 2\Delta\tau_A(\tau_A - \tau_B)(1-\theta)). \quad \text{(A.9)}$$

After inserting (2.9)-(2.10) the expression simplifies to:

$$\frac{\theta}{\Delta^4} g_A^{\theta-2}\tau_A^2 \left(-\frac{1}{2}\theta\left(\frac{2b\theta}{9}\right)^{\frac{\theta}{1-\theta}} + \frac{3}{2} - \frac{3}{2}\theta\right). \quad \text{(A.10)}$$

Therefore, the requirement (II) is equivalent to:

$$\frac{\partial^2 Rev_A}{\partial \tau_A^2}\frac{\partial^2 Rev_A}{\partial g_A^2} - \left(\frac{\partial^2 Rev_A}{\partial \tau_A \partial g_A}\right)^2 > 0 \;\Leftrightarrow\; -\frac{1}{2}\theta\left(\frac{2b\theta}{9}\right)^{\frac{\theta}{1-\theta}} + \frac{3}{2} - \frac{3}{2}\theta > 0, \quad \text{(A.11)}$$

which is true if and only if the inequality (2.17) holds:

$$b < \frac{9}{2\theta}\left(\frac{3-3\theta}{\theta}\right)^{\frac{1-\theta}{\theta}} \quad \text{(A.12)}$$

The maximal feasible b (denote it by b^*, so that $b^* = \frac{9}{2\theta}(\frac{3-3\theta}{\theta})^{\frac{1-\theta}{\theta}}$) goes to infinity as θ goes to 0, and goes to 4.5 as θ goes to 1.

To complete the proof of the lemma, we need to check the second order conditions for the objective function (2.13) of the government B, which we denote by Rev_B.

Similarly to the case with the government A we can write down the second-order partial derivatives of (2.13):

$$\frac{\partial^2 Rev_B}{\partial \tau_B^2} = -\frac{2}{\Delta}, \quad \text{(A.13)}$$

$$\frac{\partial^2 Rev_B}{\partial \tau_B \partial g_B} = \frac{\tau_A - \tau_B}{\Delta^2}\theta g_B^{\theta-1} + \frac{\tau_B}{\Delta^2}\theta g_B^{\theta-1}, \quad \text{(A.14)}$$

$$\frac{\partial^2 Rev_B}{\partial g_B^2} = -\frac{2\tau_B(\tau_A - \tau_B)}{\Delta^3}(\theta g_B^{\theta-1})^2 + \frac{\tau_B(\tau_A - \tau_B)}{\Delta^2}\theta(\theta-1)g_B^{\theta-2}, \quad \text{(A.15)}$$

From (A.13) we can see that the requirement (I) for Rev_B is fulfilled. At the same time, after some basic calculations, one can show that the requirement (II) for Rev_B is equivalent to:

$$\frac{\partial^2 Rev_B}{\partial \tau_B^2}\frac{\partial^2 Rev_B}{\partial g_B^2} - \left(\frac{\partial^2 Rev_B}{\partial \tau_B \partial g_B}\right)^2 > 0 \;\Leftrightarrow\; \tau_A^2 \theta g_B^{\theta} > 0, \quad \text{(A.16)}$$

which is always true. Therefore, if condition (2.17) holds, then both functions Rev_A and Rev_B are maximized in (2.9)-(2.10), which was needed to prove.

A.1.3 Lemma 2.2.5

Let us find the derivative of f:

$$f' = 2^{\frac{\theta}{1-\theta}} \left(-\frac{1}{\theta^2} + \frac{1}{\theta} \ln 2 \frac{1}{(1-\theta)^2} - 2\ln 2 \frac{1}{(1-\theta)^2} \right) \tag{A.17}$$

As a result, $f' < 0$ if and only if:

$$-(1 + 2\ln 2)\theta^2 + (\ln 2 + 2)\theta - 1 < 0. \tag{A.18}$$

This is the quadratic equation with regard to θ. Its discriminant is:

$$D = \ln 2(\ln 2 - 4) < 0 \tag{A.19}$$

Therefore, $f' < 0$, and f is decreasing everywhere.

Finally, simple calculations show that $f(\frac{1}{2}) = 0$.

A.1.4 Lemma 2.2.8

If government A faces (τ_B^I, g_B^I) and decides to play the "decrease" strategy, then its objective is:

$$\max_{\tau_A, g_A} \ \tau_A \frac{\tau_B^I - \tau_A}{g_B^{I\theta} - g_A^\theta} - \frac{g_A}{b} \tag{A.20}$$

Then from the first-order condition for τ_A we have:

$$\tau_A = \frac{1}{2}\tau_B^I = \frac{1}{6}\Delta, \tag{A.21}$$

where, as usual, $\Delta = g_A^{I\theta} - g_B^{I\theta}$. The first-order condition for g_A assures some positive level of the public good provision in the country A in equilibrium. Denote it by g. Finally, let $s \leq 1$ be the share of firms investing in A. Let us compare the revenues from playing "increase" strategy and "decrease" strategy:

$$Rev_A^I - Rev_A^D > \frac{4}{9}\Delta - \frac{g_A^I}{b} - \frac{1}{6}\Delta s + g > \frac{4}{9}\Delta - \frac{g_A^I}{b} - \frac{1}{6}\Delta \tag{A.22}$$

After some calculations we obtain:

$$Rev_A^I - Rev_A^D = \left(\frac{\theta}{9}\right)^{\frac{\theta}{1-\theta}} \left(\frac{5}{18}(2b)^{\frac{\theta}{1-\theta}} - \frac{5}{18} - \frac{2\theta}{9} \right) \tag{A.23}$$

For any $b > 1$ $Rev_A^I - Rev_A^D$ increases with θ, $0 \leq \theta \leq 1$. At the same time, when $\theta = 0$ $Rev_A^I - Rev_A^D = 0$, which completes the proof.

A.1.5 Lemma 2.2.9, proof (contrinued)

Equation (2.38) implicitly defines b^* as a function of θ:

$$-\frac{5}{\theta}\left((2b^*)^{\frac{\theta}{1-\theta}}-1\right)+2b^*-1=0 \tag{A.24}$$

We can use the implicit differentiation of this expression to find the sign of $(b^*)'$. By taking differentials from the both its sides, and grouping of additives, we get:

$$b^{*\prime}=-\frac{\frac{1}{\theta}\left((2b^*)^{\frac{\theta}{1-\theta}}-1\right)-(2b^*)^{\frac{\theta}{1-\theta}}\frac{1}{(1-\theta)^2}\ln 2b^*}{\frac{\theta}{5}\left(-\frac{5}{\theta}\theta(2b^*)^{\frac{\theta}{1-\theta}}\frac{\theta}{1-\theta}+2\right)} \tag{A.25}$$

Now, from the equation (2.38) we have for any b^*:

$$-\frac{5}{\theta}(2b^*)^{\frac{\theta}{1-\theta}}=-\frac{5}{\theta}-2b^*+1. \tag{A.26}$$

By applying this identity to (A.25) we can immediately see that the denominator of $b^{*\prime}$ is negative for any θ between 0 and $\frac{1}{2}$:

$$\frac{\theta}{5}\left(-\frac{5}{\theta}(2b^*)^{\frac{\theta}{1-\theta}}\frac{\theta}{1-\theta}+2\right)=\frac{\theta}{5}\left(-\frac{5}{1-\theta}-\frac{\theta}{1-\theta}2b^*+\frac{\theta}{1-\theta}+2\right)<0 \tag{A.27}$$

As for the nominator, by taking its derivative with respect to θ (taking b^* as fixed) it easy to see that it is a monotone (decreasing) function of θ for any θ between 0 and $\frac{1}{2}$ and for any b greater than 1. Now,

$$\left(\frac{1}{\theta}\left((2b^*)^{\frac{\theta}{1-\theta}}-1\right)-(2b^*)^{\frac{\theta}{1-\theta}}\frac{1}{(1-\theta)^2}\ln 2b^*\right)\Bigg|_{\theta=0}=0, \tag{A.28}$$

$$\left(\frac{1}{\theta}\left((2b^*)^{\frac{\theta}{1-\theta}}-1\right)-(2b^*)^{\frac{\theta}{1-\theta}}\frac{1}{(1-\theta)^2}\ln 2b^*\right)\Bigg|_{\theta=\frac{1}{2}}=4b^*-2-8b\ln 2b<0. \tag{A.29}$$

Therefore, the nominator of (A.25) is also negative for any feasible θ. As a result, $b^{*\prime}<0$. Finally, simple calculation shows that $b^*(\frac{1}{2})=4.5$.

A.1.6 Lemma 2.2.10

To prove the lemma we need to employ a somewhat different notation and methodology. Suppose, the government B faces (τ_A^I, g_A^I)-strategy of the government A, and suppose its strategy is to set:

$$\tau_B \;\mapsto\; \tau_A^I+\epsilon, \quad g_B \;\mapsto\; g_A^I+\eta, \tag{A.30}$$

where ϵ and η are some positive numbers. The B's revenue of doing so is:

$$Rev_B^I = (\tau_A^I + \epsilon)\left(1 - \frac{\epsilon}{(g_A^I + \eta)^\theta - {g_A^I}^\theta}\right) - g_A^I - \eta. \tag{A.31}$$

Now, by the Lagrange theorem:

$$\Delta = (g_A^I + \eta)^\theta - {g_A^I}^\eta = \theta\tilde{g}^{\theta-1}\eta, \tag{A.32}$$

where $\tilde{g}$ is somewhere between g_A^I and $g_A^I + \eta$. Denote $\theta\tilde{g}^{\theta-1}$ by k. The only thing we need to know about k is that it is smaller than $\frac{9}{2b}$. Indeed:

$$\tilde{g} > g_A^I \;\Rightarrow\; k = \theta\tilde{g}^{\theta-1} < \theta {g_A^I}^{\theta-1} = \frac{9}{2b}. \tag{A.33}$$

The alternative strategy for the government B - to mimic government A - brings the following revenues:

$$Rev_B^M = \tau_A^I - g_A^I. \tag{A.34}$$

Then the difference between the revenues is:

$$Rev_B^I - Rev_B^M = (\tau_A^I + \epsilon)\left(1 - \frac{\epsilon}{k\eta}\right) - g_A^I - \eta - \tau_A^I + g_A^I = \frac{-\epsilon^2 + (k\eta - \tau_A^I)\epsilon - k\eta^2}{k\eta}. \tag{A.35}$$

Only if $k > 4$ there exist ϵ and η such that $Rev_B^I - Rev_B^M > 0$ - it is optimal for the government B to play the "increase" strategy. However for such k,

$$k < \frac{9}{2b} \;\Rightarrow\; \frac{9}{2b} > 4 \;\Rightarrow\; b < \frac{9}{8}. \tag{A.36}$$

A.1.7 Lemma 2.2.11

If the government A plays the "decrease" strategy, and the government B plays the "increase" strategy then in equilibrium $\tau_A < \tau_B$ and $g_A < g_B$, so their objective functions are the following:

$$\max_{\tau_A, g_A} \; \tau_A \frac{\tau_B - \tau_A}{g_B^\theta - g_A^\theta} - \frac{g_A}{b}, \tag{A.37}$$

$$\max_{\tau_B, g_B} \; \tau_B \left(1 - \frac{\tau_B - \tau_A}{g_B^\theta - g_A^\theta}\right) - g_B, \tag{A.38}$$

Taking first-order conditions and solving the corresponding equations we obtain:

$$\tau_B = \frac{2}{3}\Delta,\ \tau_A = \frac{1}{3}\Delta, \tag{A.39}$$

$$g_A = \left(\frac{\theta b}{9}\right)^{\frac{1}{1-\theta}},\ g_B = \left(\frac{2\theta}{9}\right)^{\frac{1}{1-\theta}}, \tag{A.40}$$

where $\Delta = g_B^\theta - g_A^\theta$.

Immediate thing to see is that if $b > 2$ then $g_A > g_B$, which contradicts our assumption. Therefore, for $b > 2$ equilibrium of that kind does not exist.

Let us see now if government B has an incentive to mimic when $b < 2$:

$$Rev_B^D - Rev_B^M = \frac{4}{9}\Delta - g_B - \frac{1}{3}\Delta + g_A = \left(\frac{\theta}{9}\right)^{\frac{1}{1-\theta}}\left(2^{\frac{\theta}{1-\theta}} - b^{\frac{\theta}{1-\theta}} - 2^{\frac{1}{1-\theta}} + b^{\frac{1}{1-\theta}}\right). \tag{A.41}$$

For $b < 2$ and θ between 0 and 1 this expression is smaller than 0, so the government B has always an incentive to deviate from the "increase" strategy.

A.2 Proofs of propositions in Chapter 3

A.2.1 Proof of the statement on page 39

We need to prove that the second derivative of (3.8) is negative whenever (3.12) holds. For simplicity denote:

$$f(g_i) \equiv \beta^{\frac{1}{1-\beta}} b_i^{\frac{1}{1-\beta}} g_i^{\frac{\gamma}{1-\beta}};\quad A \equiv \sum_{j \neq i} \beta^{\frac{1}{1-\beta}} b_j^{\frac{1}{1-\beta}} g_j^{\frac{\gamma}{1-\beta}}. \tag{A.42}$$

Obviously, $f' > 0$, $f'' < 0$, and A does not depend on g_i. Then (3.12) can be rewritten:

$$\frac{\tau f'(g_i)}{\frac{1}{K}(f(g_i) + A)} - \frac{\tau f(g_i)}{\frac{1}{K^2}(f(g_i) + A)^2} f'(g_i) - \lambda = 0, \tag{A.43}$$

which is equivalent to:

$$\frac{\tau f'(g_i)}{\frac{1}{K}(f(g_i) + A)}\left(1 - \frac{\tau f(g_i)}{\frac{1}{K}(f(g_i) + A)}\right) = \lambda. \tag{A.44}$$

From (A.43) the second derivative of (3.8) is the following:

$$\frac{\tau f''(g_i)}{\frac{1}{K}(f(g_i)+A)} - \frac{\tau f'(g_i)}{\frac{1}{K^2}(f(g_i)+A)^2} f'(g_i) - \\ - f'(g_i)\left(\frac{\tau f'(g_i)}{\frac{1}{K^2}(f(g_i)+A)^2} - \frac{2\tau f'(g_i) f(g_i)}{\frac{1}{K^3}(f(g_i)+A)^3}\right) - \frac{\tau f(g_i)}{\frac{1}{K^2}(f(g_i)+A)^2} f''(g_i). \quad \text{(A.45)}$$

(A.45) can be rearranged:

$$\frac{\tau f''(g_i)}{\frac{1}{K}(f(g_i)+A)}\left(1 - \frac{\tau f(g_i)}{\frac{1}{K}(f(g_i)+A)}\right) - \\ - \frac{\tau\left[f'(g_i)\right]^2}{\frac{1}{K^2}(f(g_i)+A)^2}\left(1 - \frac{\tau f(g_i)}{\frac{1}{K}(f(g_i)+A)}\right) < 0, \quad \text{(A.46)}$$

since by (A.44):

$$1 - \frac{\tau f(g_i)}{\frac{1}{K}(f(g_i)+A)} > 0. \quad \text{(A.47)}$$

A.2.2 Proof of the Proposition 3.1.1

Assume $b_i > b_j$.

From (3.4) it follows:

$$\frac{k_i}{k_j} = \left(\frac{b_i}{b_j}\right)^{\frac{1}{1-\beta}} \left(\frac{g_i}{g_j}\right)^{\frac{\gamma}{1-\beta}}. \quad \text{(A.48)}$$

From (3.14):

$$\frac{g_i}{g_j} = \frac{k_i}{k_j}\frac{K-k_i}{K-k_j}. \quad \text{(A.49)}$$

Combining the two we get:

$$\left(\frac{k_i}{k_j}\right)^{\frac{1-\beta-\gamma}{\gamma}} = \left(\frac{b_i}{b_j}\right)^{\frac{1}{1-\beta}} \frac{K-k_i}{K-k_j}. \quad \text{(A.50)}$$

Note, that under our assumptions, $1-\gamma-\beta > 0$ and $1-\beta > 0$.

Now suppose $k_j \geq k_i$ (despite $b_i > b_j$). Then $\left(\frac{k_i}{k_j}\right)^{\frac{1-\beta-\gamma}{\gamma}} \leq 1$ but $\left(\frac{b_i}{b_j}\right)^{\frac{1}{1-\beta}} > 1$ and $\frac{K-k_i}{K-k_j} \geq 1$, which contradicts to (A.50). Hence k_i must be greater than k_j (and it is easy to check that it does not contradict to (A.50)).

Now, we have that $k_i > k_j$. From (3.15) it follows that $e_i < e_j$. ∎

A.2.3 Proof of the Proposition 3.1.2

Assume all k_i's are in equilibrium according to the objective of the governments (3.8)-(3.10). From (3.9) it follows that:

$$\frac{k_H}{k_L} = \left(\frac{b_H}{b_L}\frac{g_H^\gamma}{g_L^\gamma}\right)^{\frac{1}{1-\beta}}. \tag{A.51}$$

From the other side, (3.15) tells us that:

$$\frac{g_H}{g_L} = \frac{k_H}{k_L}\frac{K-k_H}{K-k_L} \tag{A.52}$$

Combining (A.51) and (A.52) and recalling that τK and $\left(\frac{\tau\beta}{\lambda(1-\alpha)K}\right)^\gamma$ are constants, the maximization of (3.19) is equivalent to:

$$\max_{\Delta} W = N_1(\bar{b}+\Delta)(K-k_H)^\gamma k_H^{\beta+\gamma} + N_2(\bar{b}-\frac{N_1}{N_2}\Delta)(K-k_L)^\gamma k_L^{\beta+\gamma} \tag{A.53}$$

$$\text{s.t. } k_L(\bar{(}b)+\Delta)(K-k_H)^\gamma k_H^{\beta+\gamma} = k_H(\bar{b}-\frac{N_1}{N_2}\Delta)(K-k_L)^\gamma k_L^{\beta+\gamma}, \tag{A.54}$$

$$k_L = \frac{K}{N_2} - \frac{N_1}{N_2}k_H. \tag{A.55}$$

Denote $A_H = (K-k_H)^\gamma k_H^{\beta+\gamma}$ and $A_L = (K-k_L)^\gamma k_L^{\beta+\gamma}$. Then Lagrangian for (A.53)-(A.56) is:

$$\mathcal{L} = N_1(\bar{b}+\Delta)A_H + N_2(\bar{b}-\frac{N_1}{N_2}\Delta)A_L - \psi(k_L(\bar{b}+\Delta)A_H - k_H(\bar{b}-\frac{N_1}{N_2}\Delta)A_L. \tag{A.56}$$

The first-order conditions for (A.56) are:

$$\Delta: \; N_1A_H - N_2\frac{N_1}{N_2}A_L - \psi k_L A_H + \psi\frac{N_1}{N_2}k_H A_L = 0, \tag{A.57}$$

$$k_H: \; N_1(\bar{b}+\Delta)A_H^{'} + N_2(\bar{b}-\frac{N_1}{N_2}\Delta)A_L^{'} + \psi(\bar{b}+\Delta)A_H\frac{N_1}{N_2} - \psi k_L(\bar{b}+\Delta)A_H^{'} - \tag{A.58}$$

$$-\psi(\bar{b}-\frac{N_1}{N_2}\Delta)A_L - \psi(\bar{b}-\frac{N_1}{N_2}\Delta)A_L^{'} = 0, \tag{A.59}$$

where $A'_H = k_H^{\beta+\gamma-1}(K-k_H)^{\gamma-1}(\beta(K-k_H)+\gamma K)$ and $A'_L = -\frac{N_1}{N_2}k_L^{\beta+\gamma-1}(K-k_L)^{\gamma-1}(\beta(K-k_L)+\gamma K)$. Solution to (A.57)-(A.58) is:

$$\Delta = 0 \;\Rightarrow\; k_H = k_L = \frac{K}{N},\; \psi = 0. \tag{A.60}$$

This is the maximum of (3.19), since W is concave in k_H for any Δ. ∎

A.2.4 Proof of the Proposition 3.2.1

Since $k_H = \frac{K}{N_2} - \frac{N_1}{N_2}k_L$, the objectives of the local governments (3.23) can be rewritten:

$$\max_{g_H}(1-\alpha)\tau k_H - \lambda g_H, \quad \max_{g_L}(1-\alpha)\tau k_L + \alpha\tau\tfrac{K}{N_2} - \lambda g_L \tag{A.61}$$

$$\text{s.t. } \frac{\beta b_i g_i^{\gamma}}{k_i^{1-\beta}} = R(\eta) + \tau, \tag{A.62}$$

$$0 \le g_i \le \tau k_i, \text{ or } 0 \le e_i \le 1 \tag{A.63}$$

$$\tag{A.64}$$

The objective (A.61)-(A.63) is equivalent to (3.8)-(3.10), only the share of tax revenues going to local governments' budgets is changed from τ to $\tilde{(\tau)} = \tau(1-\alpha) \le \tau$.

From (A.53)-(A.56) it follows that the optimal k_i's do not depend directly on τ (or $\tilde{\tau}$) - there is no τ in (A.53)-(A.56). From (3.15):

$$g_i = k_i\left(1 - \eta\frac{k_i}{K}\right)\frac{\tilde{\tau}\gamma}{\lambda(1-\beta)}, \tag{A.65}$$

and from (3.19):

$$W = \left(\frac{\tilde{\tau}\beta}{\lambda(1-\alpha)K}\right)^{\gamma}\sum_{i=1}^{N} b_i(K-\eta k_i)^{\gamma}k_i^{\beta+\gamma} - \tau K, \tag{A.66}$$

where k_i's do not depend on $\tilde{\tau}$. Hence, any positive intergovernmental transfer α unambiguously decreases the welfare of the country. The optimal policy is no transfer:

$$\alpha^* = 0. \tag{A.67}$$

∎

A.3 Citizen-centric governance indicators: supporting tables

Table A1: Governance outcomes: weights and questions assigned

Code	Governance criteria	Questions assigned	Weights used			
			1	2	3	comp.
A	**Responsive governance**		0.6	0.6	0.6	0.6
11	public services consistent with citizen preferences	How satisfied are you with the way the people in national office are handling the country's affairs?	0.25	0.15	0	0
21	safety of life, order, rule of law	How much confidence do you have in police?	0.05	0.05	0.03	0.1
31	freedom of choice and expression	How satisfied are you with the way the democracy is developing in your country?	0.15	0.15	0	0
32		How democratically is your country being governed today?	0	0	0.1	0
41	improvements in economic and social outcomes	How satisfied are you with the financial situation of your household?	0.2	0.2	0.2	0.3
51	improvements in quality of life: general	All things considered, how satisfied are you with your life as a whole these days?	0.25	0.35	0.25	0.4
61	improvements in quality of life: health	All in all, how would you describe your state of health today?	0.05	0.05	0.05	0.1
71	improvements in quality of life: environment	How serious you consider poor water quality to be here in your own community?	0	0	0.03	0
72		How serious you consider poor air quality to be here in your own community?	0	0	0.03	0
73		How serious you consider poor sewage and sanitation to be here in your own community?	0	0	0.03	0
81	peace	How much confidence do you have in armed forces?	0.05	0.05	0.03	0.1

Table A1: (continued)

Code	Governance criteria	Questions assigned	Weights used			
			1	2	3	comp.
91	inmprovements in quality of life: happiness	Taking all things together would you say you are [happy, unhappy]?	0	0	0.25	0
B	**Fair governance**		0.1	0.1	0.1	0.1
11	social justice, respect for human rights	How much respect is there for individual human rights nowadays in the country?	0.8	0.8	0.8	0.8
21	government represents the whole country	How proud are you to be your nationality?	0.2	0.2	0.2	0.2
C	**Responsible governance**		0.15	0.15	0.15	0.15
11	earning trust: executive branch	How much confidence do you have in government?	0.2	0.2	0.3	0.5
19	earning trust: legislative branch	How much confidence do you have in parliament?	0.2	0.2	0.3	0.5
21	corruption	Would you say that this country is run by a few big interests looking out for themselves, or that it is run for the benefit of all people?	0.3	0.3	0	0
22		In your view, does corruption affect your personal and family life, business environment, political life not at all, to a small extent, to a moderate extent, or to a large extent?	0	0	0.4	0

Table A1: (continued)

Code	Governance criteria	Questions assigned	Weights used			
			1	2	3	comp.
31	open, transparent and prudent economic, fiscal and financial management	How satisfied are you with the way the people in national office are handling the country's affairs?	0.3	0.3	0	0
D	**Accountable governance**		0.15	0.15	0.15	0.15
11	access to information, independent mass media - press	How much confidence do you have in press?	0.25	0.25	0.25	0.25
18	access to information, independent mass media - television	How much confidence do you have in television?	0.25	0.25	0.25	0.25
21	judicial integrity and independence	How much confidence do you have in courts?	0.5	0.5	0.5	0.5

Note: The data source for all (but C24) questions is World Values Survey (WVS, 2008). Question C24 was taken from Transparency International Global Corruption Barometer (TI, 2005). The coding corresponds to the coding used in our dataset. *Weights used*: *1* - for wave 1 (1994-98) of WVS, *2* - for wave 2 (1999-2004), *3* - or wave 3 (2004-08), *comp.* - for comparison between these 3 waves. Weights of sub-categories are given within the category (A, B, C, or D)

Table A2: Existing sources of data and their main features

Name	Code	Geographical coverage		Years	Freq., y.	Data access		Relevancy
		Num.	Region			Free	Lag, y.	
World Values Survey	WVS	97	worldwide	1994-2008	3-6	yes	2-3	average
Afrobarometer	AFR	20	Sub-Saharan Africa	2001-2008	3	yes	1-2	high
Asiabarometer	ASB	25	East Asia	2003-2006	2	yes	1-2	high
Business Environment and Enterprise Performance Survey	BEEPS	26	Central and Eastern Europe	1999-2005	3	yes	1-2	low
Transparency International Global Corruption Barometer	TI_GCB	62	worldwide	2004-2008	1	yes	<1	very low
Latinobarometro	LBO	18	Latin America	2004-2007	1	no	1	high
Eurobarometer	EUB	30	Europe	1973-2008	0.5	yes	<1	very high
Gallup World Poll	GWP	130	worldwide	2007-2008	1	no	n.a.	n.a.
GWP - datapoints from World Bank Institute (WBI) (2008)	GWP WGI	119	worldwide	2007	1	yes	0	low

Note: Number - the total number of countries, which participated in all waves of survey; *Freq.* - average time period in years, in which a country is surveyed; *Lag* - the time period in years between taking a survey and posting data; *Relevancy* - correspondence of questions in a questionnaire to the subcriteria of governance from the Table 4.1, given on the scale: very low-low-average-high-very high.

Table A3: Citizen-centric governance indicators: aggregate and disaggregate data by country, waves 1-3

country	year	N	A										B		C					D			prec	**CGI**	var
			11	21	31	37	41	51	61	74	81	91	11	21	11	19	21	24	31	11	18	21			
WAVE 1																									
Albania	1998	999	38	65	..	..	40	42	75	..	56	..	..	81	46	54	21	..	38	33	39	65	83	**45**	0.6
Azerbaijan	1997	2002	42	46	52	..	40	49	66	..	53	..	58	86	77	64	22	..	42	36	40	46	100	**48**	0.6
Argentina	1995	1079	35	32	..	..	44	66	68	..	32	..	..	81	33	26	12	..	35	41	36	32	83	**42**	0.8
Australia	1995	2048	43	63	..	..	60	73	77	..	59	..	..	90	36	40	32	..	43	32	38	63	83	**55**	0.7
Bangladesh	1996	1525	74	42	..	..	56	60	62	..	56	..	..	92	70	72	60	..	74	61	59	42	83	**62**	0.7
Bosnia and Herzegovina	1998	1200	48	68	..	..	40	50	66	..	77	..	..	80	63	53	43	..	48	50	54	68	83	**53**	0.8
Brazil	1997	1149	49	40	..	..	50	68	73	..	63	..	..	82	43	31	25	..	49	53	49	40	83	**52**	1.1
Bulgaria	1997	1072	36	49	..	..	29	41	64	..	72	..	..	77	54	45	27	..	36	46	60	49	83	**43**	0.8
Belarus	1996	2092	22	40	29	..	25	37	51	..	65	..	34	68	50	35	17	..	22	44	47	40	100	**34**	0.5
Chile	1996	1000	51	49	..	..	55	66	67	..	53	..	..	81	50	40	32	..	51	48	51	49	83	**54**	0.8
China	1995	1500	..	..	..	..	57	65	74	..	..	..	..	76	..	..	..	..	..	..	..	..	32	**63**	2.7
Colombia	1997	6025	31	48	..	..	78	81	75	..	57	..	..	94	39	30	21	..	31	46	49	48	83	**54**	0.8
Croatia	1996	1196	44	56	..	..	40	58	63	..	67	..	..	75	51	46	34	..	44	36	36	56	83	**49**	0.8
Czech rep.	1998	1147	35	45	..	..	46	60	63	..	44	..	..	73	37	30	18	..	35	45	48	45	83	**45**	0.7
Dominican rep.	1996	417	17	28	..	..	53	68	73	..	41	..	..	89	27	27	8	..	17	43	46	28	83	**40**	0.8
Estonia	1996	1021	30	47	43	..	33	44	57	..	46	..	43	63	48	44	15	..	30	51	58	47	100	**41**	0.5
Finland	1996	987	42	69	..	..	63	75	74	..	68	..	..	78	40	40	28	..	42	40	50	69	83	**57**	0.6
Georgia	1996	2008	30	37	31	..	23	41	62	..	48	..	32	86	45	39	6	..	30	52	53	37	100	**36**	0.6
Germany	1997	2026	38	54	52	..	58	66	66	..	45	..	53	53	32	35	29	..	38	31	35	54	100	**49**	0.5
Hungary	1998	650	40	52	..	..	44	54	60	..	54	..	..	80	44	42	18	..	40	37	44	52	83	**46**	0.7
India	1995	2040	41	43	..	..	57	61	67	..	73	..	..	88	52	56	29	..	41	57	53	43	83	**52**	1.0

Table A3: (continued)

country	year	N	A										B		C					D			prec	**CGI**	var
			11	21	31	37	41	51	61	74	81	91	11	21	11	19	21	24	31	11	18	21			
Japan	1995	1054	28	63	..	..	59	62	65	..	56	..	..	62	40	37	23	..	28	59	58	63	83	**50**	0.5
Korea, rep.	1996	1249	42	49	..	..	52	..	73	..	61	..	..	..	47	39	17	..	42	57	55	49	66	**47**	0.8
Latvia	1996	1200	30	37	32	..	29	43	56	..	36	..	36	59	40	33	4	..	30	48	52	37	100	**36**	0.5
Lithuania	1997	1009	29	34	38	..	34	44	59	..	45	..	35	60	44	39	10	..	29	58	60	34	100	**38**	0.5
Macedonia	1998	995	28	36	..	..	41	52	71	..	46	..	..	86	28	25	26	..	28	33	36	36	83	**39**	0.9
Mexico	1996	2364	33	35	..	..	69	73	65	..	54	..	..	87	42	44	29	..	33	49	48	35	83	**51**	0.8
Moldova	1996	984	27	37	26	..	23	30	51	..	53	..	30	70	43	41	17	..	27	41	47	37	100	**32**	0.6
New Zealand	1998	1201	31	68	..	..	61	74	78	..	56	..	..	87	30	30	22	..	31	41	44	68	83	**52**	0.7
Nigeria	1995	1996	29	32	..	..	52	62	76	..	46	..	..	81	33	32	11	..	29	56	58	32	83	**44**	1.1
Norway	1996	1127	64	67	..	..	64	74	78	..	60	..	..	80	57	58	72	..	64	42	49	67	83	**65**	0.5
Pakistan	1997	733	..	33	..	..	41	..	69	..	92	..	..	94	..	..	..	..	..	54	59	33	38	**51**	1.3
Peru	1996	1211	49	34	..	..	46	60	64	..	50	..	..	92	46	28	57	..	49	42	45	34	83	**49**	1.0
Philippines	1996	1200	47	54	..	..	56	65	66	..	62	..	..	89	55	56	41	..	47	65	64	54	83	**57**	0.9
Poland	1997	1153	40	51	..	..	37	60	56	..	67	..	..	89	43	40	20	..	40	48	49	51	83	**47**	0.8
Puerto Rico	1995	1164	48	55	..	..	66	79	72	..	59	..	..	95	52	37	39	..	48	52	45	55	83	**59**	0.9
Romania	1998	1239	27	43	..	..	32	43	64	..	72	..	..	76	32	31	20	..	27	41	49	43	83	**38**	0.8
Russian federation	1995	2040	17	36	..	..	26	38	50	..	63	..	..	65	32	31	7	..	17	43	47	36	83	**31**	0.7
Serbia and Montenegro	1996	1520	36	46	..	..	34	52	63	..	58	..	..	71	41	39	31	..	36	35	36	46	83	**43**	0.9
Slovakia	1998	1095	41	43	..	..	40	56	62	..	58	..	..	77	44	37	34	..	41	46	49	43	83	**46**	0.7
Slovenia	1995	1007	40	49	..	..	48	61	59	..	47	..	..	84	45	35	22	..	40	46	52	49	83	**48**	0.7
South Africa	1996	2935	48	65	..	..	42	56	75	..	52	..	..	92	59	58	56	..	48	52	58	65	83	**55**	1.1

Table A3: (continued)

country	year	N	A										B		C					D			prec	**CGI**	var
			11	21	31	37	41	51	61	74	81	91	11	21	11	19	21	24	31	11	18	21			
Spain	1995	1211	29	54	..	..	52	62	70	..	44	..	..	85	37	40	33	..	29	46	44	54	83	**47**	0.7
Sweden	1996	1009	45	65	..	..	58	75	78	..	52	..	..	78	45	47	41	..	45	39	50	65	83	**57**	0.6
Switzerland	1996	1212	54	58	..	..	70	78	79	..	47	..	..	67	49	45	39	..	54	35	40	58	83	**59**	0.6
Taiwan	1994	780	44	54	..	..	57	62	64	..	62	..	..	60	58	48	48	..	44	46	50	54	83	**54**	0.6
Turkey	1996	1907	34	61	..	..	47	58	68	..	86	..	..	90	43	45	20	..	34	49	48	61	83	**49**	0.9
Ukraine	1996	2811	21	39	25	..	22	33	50	..	60	..	27	60	43	39	12	..	21	44	47	39	100	**31**	0.5
UK	1998	1093	..	..	..	..	..	73	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15	**73**	4.7
USA	1995	1542	45	61	..	..	62	74	78	..	72	..	..	92	41	40	27	..	45	39	39	61	83	**56**	0.7
Uruguay	1996	1000	35	49	..	..	64	68	74	..	37	..	..	89	41	41	23	..	35	53	51	49	83	**51**	0.9
Venezuela	1996	1200	19	34	..	..	44	64	76	..	59	..	..	97	31	28	16	..	19	57	53	34	83	**42**	1.1
WAVE 2																									
Albania	2002	1000	26	58	34	..	42	46	74	..	51	..	41	89	54	45	35	..	26	40	52	58	100	**44**	0.7
Algeria	2002	1282	32	60	41	..	55	52	62	..	63	..	38	89	49	34	13	..	32	47	45	60	100	**47**	0.9
Argentina	1999	1280	33	32	44	..	50	70	71	..	35	..	34	85	28	23	10	..	33	44	40	32	100	**45**	0.7
Austria	1999	1522	..	64	60	..	..	78	..	..	45	..	63	81	..	46	..	..	..	41	..	64	60	**66**	0.9
Bangladesh	2002	1500	62	51	62	..	51	53	66	..	68	..	61	90	76	78	44	..	62	75	69	51	100	**59**	0.6
Belgium	1999	1912	..	50	44	..	..	71	..	..	41	..	56	64	..	41	..	..	..	41	..	50	60	**56**	1.1
Bosnia and herzegovina	2001	1200	35	57	39	..	43	53	71	..	58	..	39	66	39	34	19	..	35	38	42	57	100	**45**	0.7
Bulgaria	1999	1000	..	47	37	..	..	50	..	..	54	..	40	67	..	36	..	..	..	37	..	47	60	**45**	1.5
Belarus	2000	1000	..	43	37	..	..	42	..	..	61	..	41	63	..	40	..	..	..	44	..	43	60	**43**	1.3
Canada	2000	1931	53	68	57	..	65	76	80	..	59	..	68	87	44	43	47	..	53	42	44	68	100	**63**	0.6
Chile	2000	1200	55	53	53	..	52	68	71	..	48	..	54	87	53	39	35	..	55	47	51	53	100	**56**	0.7
China	2001	1000	59	60	65	..	52	61	70	..	80	..	73	68	79	76	83	..	59	59	62	60	100	**64**	0.6
Croatia	1999	1003	..	47	31	..	..	63	..	..	56	..	51	74	..	33	..	..	..	31	..	47	60	**50**	1.2

Table A3: (continued)

country	year	N	A										B		C					D			prec	**CGI**	var
			11	21	31	37	41	51	61	74	81	91	11	21	11	19	21	24	31	11	18	21			
Czech rep.	1999	1908	..	43	42	..	..	67	..	..	39	..	56	69	..	28	..	..	..	44	..	43	60	**53**	1.0
Denmark	1999	1023	..	72	59	..	..	80	..	..	55	..	78	80	..	49	..	..	..	41	..	72	60	**70**	0.8
Egypt	2000	3000	77	78	77	..	47	48	70	..	59	..	63	94	55	62	31	..	77	62	61	78	100	**62**	1.1
El Salvador	1999	1254	..	51	..	..	59	72	71	..	49	..	..	93	43	35	26	..	..	48	52	51	70	**58**	1.3
Estonia	1999	1005	..	41	42	..	..	55	..	..	42	..	52	60	..	37	..	..	..	45	..	41	60	**48**	1.1
Finland	2000	1038	..	73	53	..	..	76	..	..	69	..	75	83	..	46	..	..	..	43	..	73	60	**68**	0.7
France	1999	1615	..	57	48	..	..	67	..	..	55	..	54	75	..	40	..	..	..	38	..	57	60	**57**	1.1
Germany	1999	2036	..	59	59	..	..	71	..	..	49	..	62	63	..	41	..	..	..	42	..	59	60	**61**	0.9
Greece	1999	1142	..	36	51	..	..	63	..	..	59	..	58	80	..	33	..	..	..	37	..	36	60	**53**	1.1
Hungary	1999	1000	..	44	40	..	..	53	..	..	45	..	52	79	..	38	..	..	..	36	..	44	60	**48**	1.3
Iceland	1999	968	..	68	55	..	..	78	..	..	42	..	72	88	..	61	..	..	..	44	..	68	60	**68**	0.7
India	2001	2002	52	42	56	..	44	46	68	..	84	..	65	87	53	52	34	..	52	64	65	42	100	**52**	0.7
Indonesia	2001	1004	36	52	40	..	61	66	70	..	63	..	59	80	52	46	30	..	36	53	56	52	100	**54**	0.6
Iran	2000	2532	59	56	55	..	53	60	75	..	..	..	61	95	62	63	51	..	59	44	50	56	97	**58**	0.8
Iraq	2004	2325	..	..	..	..	49	47	74	..	55	..	39	90	40	..	30	..	..	..	54	..	60	**48**	1.6
Ireland	1999	1012	..	73	56	..	..	80	..	..	58	..	67	91	..	41	..	..	..	44	..	73	60	**69**	0.9
Israel	2001	1199	..	..	..	..	..	67	..	..	..	..	..	78	..	..	..	..	..	..	..	..	23	**68**	4.9
Italy	1999	2000	..	59	42	..	..	69	..	..	51	..	56	75	..	41	..	..	..	42	..	59	60	**58**	1.0
Japan	2000	1362	28	49	45	..	57	61	65	..	57	..	54	59	37	34	16	..	28	59	58	49	100	**49**	0.5
Jordan	2001	1223	63	83	59	..	44	51	76	..	85	..	62	89	78	62	31	..	63	59	57	83	100	**60**	0.7
Korea, rep.	2001	1200	39	49	42	..	53	58	73	..	57	..	47	64	40	24	12	..	39	56	56	49	100	**48**	0.6
Kyrgyzstan	2003	1043	38	29	39	..	52	61	67	..	53	..	38	74	38	38	17	..	38	46	51	29	100	**45**	0.8
Latvia	1999	1013	..	42	40	..	..	47	..	..	47	..	50	73	..	35	..	..	..	46	..	42	60	**46**	1.3
Lithuania	1999	1018	..	37	35	..	..	47	..	..	48	..	31	55	..	27	..	..	..	60	..	37	60	**41**	1.4
Luxembourg	1999	1211	..	60	64	..	..	76	..	..	50	..	73	77	..	54	..	..	..	46	..	60	60	**67**	0.9

Table A3: (continued)

country	year	N	A										B		C				D				prec	**CGI**	var
			11	21	31	37	41	51	61	74	81	91	11	21	11	19	21	24	31	11	18	21			
Macedonia	2001	1055	26	48	27	..	38	46	72	..	51	..	36	78	20	17	7	..	26	33	35	48	100	**37**	0.9
Malta	1999	1002	..	59	64	..	..	80	..	..	62	..	62	91	..	49	..	..	..	40	..	59	60	**67**	0.8
Mexico	2000	1535	44	34	42	..	63	79	70	..	53	..	48	91	39	28	27	..	44	45	47	34	100	**53**	0.8
Moldova	2002	1008	31	38	27	..	34	40	50	..	54	..	31	60	39	38	9	..	31	46	49	38	100	**36**	0.6
Morocco	2001	2264	46	51	44	..	49	56	77	..	66	..	42	95	54	25	23	..	46	41	36	51	100	**49**	0.9
Netherlands	1999	1003	..	57	59	..	..	76	..	..	44	..	70	65	..	51	..	..	..	53	..	57	60	**65**	0.6
New Zealand	2004	954	..	63	..	..	63	77	72	..	62	79	69	89	45	42	..	..	..	37	43	48	73	**63**	0.7
Nigeria	2000	2022	59	39	57	..	59	65	87	..	49	..	56	87	49	47	28	..	59	62	68	39	100	**57**	0.8
Pakistan	2001	2000	43	35	27	..	28	43	69	..	79	..	53	93	42	68	11	..	43	55	55	35	100	**43**	0.5
Peru	2001	1501	45	33	45	..	46	60	64	..	37	..	46	90	35	28	43	..	45	39	40	33	100	**47**	0.7
Philippines	2001	1200	49	58	47	..	53	63	67	..	65	..	71	94	51	57	39	..	49	63	65	58	100	**58**	0.8
Poland	1999	1095	..	55	44	..	..	58	..	..	62	..	51	89	..	40	..	..	..	50	..	55	60	**54**	1.5
Portugal	1999	1000	..	58	62	..	..	67	..	..	61	..	57	91	..	47	..	..	..	57	..	58	60	**62**	1.0
Puerto Rico	2001	720	47	57	54	..	72	83	75	..	55	..	53	98	49	39	48	..	47	48	39	57	100	**62**	0.7
Romania	1999	1146	..	47	32	..	..	47	..	..	72	..	36	77	..	28	..	..	..	45	..	47	60	**44**	1.6
Russian Federation	1999	2500	..	34	19	..	..	41	..	..	61	..	25	65	..	27	..	..	..	36	..	34	60	**35**	1.4
Saudi Arabia	2003	1502	..	..	..	..	69	70	84	..	..	..	62	89	..	..	41	..	..	60	63	..	58	**67**	1.5
Serbia and Montenegro	2001	2260	38	43	41	..	33	51	65	..	58	..	48	65	36	33	29	..	38	36	39	43	100	**43**	0.7
Singapore	2002	1512	71	..	..	..	63	69	..	..	..	..	..	82	..	..	77	..	71	..	..	..	53	**69**	1.2
Slovakia	1999	1331	..	45	33	..	..	56	..	..	62	..	53	65	..	42	..	..	..	47	..	45	60	**50**	1.2
Slovenia	1999	1006	..	50	45	..	..	69	..	..	45	..	45	81	..	36	..	..	..	57	..	50	60	**56**	1.1

Table A3: (continued)

country	year	N	A										B		C				D				prec	**CGI**	var
			11	21	31	37	41	51	61	74	81	91	11	21	11	19	21	24	31	11	18	21			
South Africa	2001	3000	44	56	48	..	45	59	81	..	51	..	51	86	51	49	32	..	44	53	61	56	100	**53**	0.9
Spain	1999.5	2409	46	53	56	..	58	67	72	..	44	..	58	81	46	48	40	..	46	45	43	53	100	**56**	0.6
Sweden	1999	1015	44	62	52	..	..	74	..	..	47	..	63	76	..	50	..	..	44	48	..	62	74	**60**	0.7
Tanzania	2001	1171	53	63	63	..	28	32	70	..	86	..	67	91	78	74	52	..	53	70	72	63	100	**54**	1.1
Turkey	2001	4607	34	62	25	..	37	51	68	..	80	..	28	82	43	39	17	..	34	34	37	62	100	**43**	0.9
Uganda	2001	1002	55	56	58	..	43	52	73	..	71	..	60	85	72	69	50	..	55	63	62	56	100	**57**	0.8
UK	1999	1000	..	60	50	..	..	71	..	..	69	..	59	79	..	42	..	..	..	26	..	60	60	**60**	1.0
Ukraine	1999	1195	..	36	27	..	..	40	..	..	61	..	31	57	..	33	..	..	..	46	..	36	60	**38**	1.5
USA	1999	1200	55	62	56	..	61	74	81	..	71	..	62	89	44	44	37	..	55	38	38	62	100	**60**	0.6
Venezuela	2000	1200	54	41	57	..	58	72	..	..	59	..	49	97	53	36	63	..	54	59	58	41	97	**58**	0.9
Vietnam	2001	1000	80	82	86	..	55	61	66	..	88	..	86	92	91	91	91	..	80	72	78	82	100	**75**	0.5
Zimbabwe	2001	1002	36	61	37	..	24	33	72	..	58	..	36	88	52	50	18	..	36	55	57	61	100	**41**	0.9
WAVE 3																									
Andorra	2005	1003	..	53	..	49	59	68	72	44	..	73	60	75	41	..	..	..	..	43	41	41	88	**58**	1.4
Argentina	2006	1002	..	31	..	67	61	75	70	16	38	73	44	87	41	25	..	20	..	41	39	30	100	**52**	1.1
Australia	2005	1421	..	69	..	68	59	70	66	45	69	76	64	88	44	42	..	..	..	30	35	51	94	**60**	0.8
Brazil	2006	1500	..	43	..	58	54	74	67	37	62	75	47	72	45	29	..	..	..	43	41	47	94	**57**	0.8
Bulgaria	2006	1001	..	51	..	37	34	47	52	22	64	53	35	73	38	29	..	14	..	48	58	40	100	**41**	0.7
Burkina Faso	2007	1534	..	51	..	52	41	51	65	10	61	67	54	94	48	41	..	..	..	52	55	47	94	**51**	0.7
Chile	2005	1000	..	54	..	66	52	68	57	39	55	69	49	84	46	32	..	..	..	45	47	35	94	**55**	1.8
China	2007	2015	..	67	..	64	55	64	59	56	75	65	71	65	77	77	..	22	..	62	63	68	100	**62**	0.6
Colombia	2005	3025	..	48	..	59	..	81	64	..	58	78	45	96	49	31	..	25	..	44	47	39	82	**58**	0.7
Cyprus	2006	1050	..	58	..	64	62	71	71	28	63	74	58	80	51	49	..	..	..	40	42	61	94	**61**	1.5

Table A3: (continued)

country	year	N	A										B		C					D			prec	**CGI**	var
			11	21	31	37	41	51	61	74	81	91	11	21	11	19	21	24	31	11	18	21			
Egypt	2008	3051	..	..	..	..	43	53	58	3	..	64	..	91	..	..	..	..	..	56	67	..	61	**51**	1.7
Ethiopia	2007	1500	..	40	..	36	43	44	60	14	47	63	38	88	36	35	..	28	..	35	36	37	100	**42**	0.6
Finland	2005	1014	..	75	..	71	67	76	62	69	71	74	81	83	56	52	..	47	..	42	50	67	100	**67**	0.6
France	2006	1001	..	59	..	62	57	66	66	..	57	75	..	72	34	39	..	21	..	40	38	40	86	**55**	0.8
Germany	2006	2064	..	61	..	61	56	68	64	69	49	67	61	62	33	33	..	29	..	39	41	53	100	**56**	1.8
Ghana	2007	1534	..	53	..	83	46	57	71	29	69	75	72	97	65	60	..	29	..	56	65	60	100	**60**	0.7
Hong Kong	2005	1252	..	65	..	..	57	60	55	..	52	63	64	54	53	50	..	29	..	55	59	..	81	**57**	0.5
India	2006	2001	..	60	..	61	48	53	61	27	76	67	73	89	54	60	..	27	..	69	67	65	100	**57**	0.7
Indonesia	2006	2015	..	50	..	61	58	66	64	27	64	73	63	79	54	43	..	22	..	52	57	51	100	**57**	0.5
Iran	2007	2667	..	57	..	47	56	60	60	14	59	65	43	84	53	49	..	..	..	44	51	51	94	**53**	0.6
Iraq	2006	2701	..	..	..	..	41	38	57	..	60	47	35	93	56	..	..	..	..	..	65	..	65	**46**	1.3
Italy	2005	1012	..	63	..	53	61	65	63	55	59	69	52	77	36	39	..	17	..	37	32	50	100	**54**	0.4
Japan	2005	1096	..	57	..	65	57	67	53	49	61	73	51	60	38	34	..	..	..	60	59	66	94	**59**	0.4
Jordan	2007	1200	..	85	..	75	60	68	76	19	88	72	65	90	81	61	..	..	..	64	65	83	94	**67**	2.4
Korea, rep.	2005	1200	..	53	..	60	51	60	64	49	51	66	58	69	46	35	..	12	..	56	57	48	100	**53**	3.2
Malaysia	2006	1201	..	64	..	67	61	65	72	37	71	77	64	88	67	60	..	31	..	58	62	68	100	**63**	0.4
Mali	2007	1534	..	64	..	67	53	57	62	16	76	73	72	96	65	55	..	..	..	56	62	61	94	**61**	0.8
Mexico	2005	1560	..	36	..	62	68	80	61	35	59	83	53	92	45	31	..	21	..	48	47	40	100	**59**	0.7
Moldova	2006	1046	..	32	..	45	42	49	51	21	41	49	33	60	37	34	..	29	..	43	49	35	100	**41**	0.6
Morocco	2007	1200	..	58	..	44	44	47	70	13	63	68	56	83	54	47	..	..	..	51	55	60	94	**52**	0.5
Netherlands	2006	1050	..	53	..	62	65	75	65	..	45	78	..	69	36	38	..	49	..	39	42	46	86	**60**	1.6
Peru	2008	1500	..	29	..	51	52	67	50	15	35	65	33	..	26	22	..	12	..	33	34	21	98	**43**	0.7
Poland	2005	1000	..	48	..	52	46	67	54	29	60	71	55	86	31	27	..	14	..	45	46	40	100	**50**	0.7
Romania	2005	1776	..	43	..	53	42	53	50	44	70	52	40	73	33	28	..	..	..	47	51	36	94	**46**	0.7
Russian Federation	2006	2033	..	37	..	37	41	57	44	..	60	58	..	75	44	34	..	26	..	40	45	40	86	**46**	1.1

Table A3: (continued)

country	year	N	A										B		C				D			prec	**CGI**	var
			11	21	31	37	41	51	61	74	81	91	11	21	11	19	21	24	31	11	18	21			
Rwanda	2007	1507	..	76	..	..	38	44	40	32	..	65	..	92	..	69	..	..	..	62	55	70	74	**54**	0.7
Serbia	2006	1220	..	39	..	46	42	56	54	18	49	56	33	78	34	30	..	..	..	33	33	35	94	**43**	0.6
Slovenia	2005	1037	..	43	..	54	59	69	55	59	42	66	49	82	36	31	..	..	..	39	43	39	94	**55**	0.5
South Africa	2007	2988	..	57	..	71	52	67	70	26	58	72	63	91	64	60	..	27	..	56	65	60	100	**60**	4.2
Spain	2007	1200	..	55	..	71	54	70	65	..	50	68	56	84	46	49	..	48	..	45	41	52	94	**59**	0.5
Sweden	2006	1003	..	63	..	73	67	75	70	83	48	80	67	76	45	52	..	..	..	41	51	62	94	**68**	1.0
Switzerland	2007	1241	..	66	..	74	76	78	72	59	49	79	74	74	57	51	..	43	..	42	41	63	100	**67**	1.5
Taiwan	2006	1227	..	43	..	66	56	62	68	57	44	68	58	54	38	25	..	7	..	30	28	42	100	**51**	1.3
Thailand	2007	1534	..	46	..	67	62	69	65	50	52	77	68	95	45	43	..	26	..	49	51	64	100	**61**	0.5
Trinidad and Tobago	2006	1002	..	38	..	57	57	70	68	56	46	79	39	96	37	31	..	..	..	35	38	41	94	**57**	1.4
Turkey	2007	1346	..	66	..	55	55	72	59	18	82	73	41	93	59	56	..	23	..	36	38	68	100	**56**	0.9
UK	2006	1041	..	62	..	61	64	73	67	..	67	81	..	81	39	41	..	33	..	28	39	55	86	**61**	1.3
Ukraine	2006	1000	..	38	..	35	40	52	46	19	52	61	37	67	35	30	..	23	..	46	49	37	100	**43**	1.2
USA	2006	1249	..	61	..	59	54	70	69	37	71	76	59	85	44	36	..	25	..	37	38	53	100	**56**	2.3
Vietnam	2006	1495	..	85	..	77	59	68	54	41	93	72	79	93	93	92	..	..	..	81	87	84	94	**73**	0.4
Zambia	2007	1500	..	49	..	63	49	56	64	37	55	59	51	83	47	44	..	..	..	51	55	52	94	**54**	0.8

Note: The table presents citizen-centric governance indicators for all countries and waves of surveys as well as mean responses by each question used in estimation. The data source for all (but C24) questions is World Values Survey (WVS, 2008). Question C24 was taken from Transparency International Global Corruption Barometer (TI, 2005). *year* - year of the survey. *N* - number of respondents. Columns 4 to 23 - mean responses to each question used in our estimation, the coding corresponds to the coding used in our dataset. *prec* - weights-adjusted amount of questions actually asked in a country during a survey (some questions were not asked in some countries), weights for each question are given in the Table A1. *CGI* - citizen-centric governance indicators, point estimates. *var* - estimates of variance of CGIs. All numbers are given in percentages (including variance).