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DEVELOPMENT OF THE STATE REGULATION MODEL IN THE BANKING SECTOR

Doctoral Thesis

RIGA TECHNICAL UNIVERSITY

Faculty of Engineering Economics and Management

Institute of Civil Engineering and Real Estate Economics

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DEVELOPMENT OF THE GOVERNMENT REGULATION MODEL IN THE BANKING SECTOR

Doctoral Thesis

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RTU Press

Riga 2023

NATIONAL DEVELOPMENT PLAN 2020

EUROPEAN UNION
European Social Fund

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Anotācija

Finanšu tirgum ir liela nozīme stabilai ekonomikas sistēmas darbībai. Daudzu pasaules valstu pieredze liecina, ka neveiksmes šajā tirgū var radīt nopietnas sociālās sekas, kas, visticamāk, skars ikvienu iedzīvotāju. Šī situācija ir likusi valdībām rīkoties un ieviest regulējumu, kura mērķis ir novērst krīzi, kas izriet no finanšu tirgus neveiksmēm. Gadu gaitā noteikumu apjoms ir ievērojami pieaudzis, īpaši pēc pēdējo desmitgadu krīzēm. No otras puses, ir svarīgi veicināt konkurenci, kas, pēc Smita domām, virza ekonomisko sistēmu uz līdzsvaru un tiek uzskatīta par mūsdienu tirgus ekonomikas pamatelementu. Regulējumam var būt negatīva ietekme uz konkurenci, tāpēc ir svarīgi atrast līdzsvaru starp abiem. Uz pārmērīgas regulēšanas radītajām negatīvajām sekām bieži ir norādījuši tirgus dalībnieki, pārsvarā bažījoties par problēmām, kas ir saistītas ar izmaiņām regulējumā. Daži regulatori ir pat brīdinājuši, ka pārāk sarežģīts regulējums mazina iespēju regulatoram ieraudzīt to, ka finanšu sistēmās veidojas reāli riski.

Promocijas darba mērķis ir izstrādāt valsts regulējuma modeli, lai atrastu līdzsvara punktu, ņemot vērā sabiedrības zaudējumu, kas izriet no tirgus nepilnībām un sekojošām valsts regulējuma izmaksām. Modelis ir izstrādāts banku sektorā finanšu tirgus ietvaros.

Promocijas darbā tika identificētas banku sektora tirgus nepilnības, kas ļauj novērtēt labklājības zudumu (angļu valodā – *deadweight loss*) banku sektorā, kā arī identificēti regulējuma principi valsts regulējuma modeļa izveidošanai. Pamatojoties uz iepriekšminēto, kvantitatīvs regulējuma modelis tika izstrādāts: (a) regulējuma intensitātes mērīšanas skala, (b) metodoloģija sabiedrības zaudējuma novērtējumam (informācijas asimetrija, monopolizācija, negatīvie blakusefekti, tirgus ļaunprātīga izmantošana un citi) un (c) metodoloģija regulējuma izmaksu novērtējumam (regulatora izmaksas, atbilstības izmaksas, netiešās izmaksas). Modelis tika validēts ar eiro zonas vai pasaules datiem atkarībā no modeļa pielietojamības un datu pieejamības. Tāpat pirmo reizi Latvijas banku sektorā tika novērtēta regulējuma intensitāte un līdzsvara punkts starp labklājības zudumu tirgus nepilnību dēļ un regulējuma izmaksām.

Promocijas darbs ir izstrādāts angļu valodā, tā sastāvā ir ievads, trīs daļas, secinājumi un priekšlikumi. Darba apjoms ir 144 lapaspuses, neskaitot pielikumus. Tajā ir iekļautas 38 tabulas, 36 attēli, 65 formulas un 7 pielikumi, kas paskaidro un ilustrē pētījuma saturu. Bibliogrāfijas saraksts ietver 238 informācijas avotus.

Abstract

Financial market is extremely important for the proper functioning of the economy. Experience of many countries in the world shows that failures in this market could lead to serious social consequences affecting, most probably, every citizen. This situation has pushed governments to act and introduce regulations aimed at preventing crisis arising from failures in the financial market. Over the years the extent of the regulations has risen significantly, especially after crises in recent decades. On the other hand, it is important to promote competition, which as per Smith leads economic system towards equilibrium and is considered as the basic building block of modern market economies. Regulation potentially can have adverse effects on the competition, thereby it is important to find the balance between the two. Dangers from overregulation have often been put in the spotlight by market participants, mostly addressing the issue with innovations when regulations scale up. Even some regulators have warned that too complex regulation poses risks for seeing the real risks building in the financial systems.

The objective (aim) of the Doctoral Thesis is to develop the regulation model to find the equilibrium point between the welfare (deadweight) loss arising from market failures and subsequent government regulation costs. Model is developed in the banking sector within the financial market.

In the Doctoral Thesis banking sector market failures were identified, needed for the assessment of the deadweight loss in the banking sector, and principles of regulation were identified, needed for the setup of the regulation model. Based on that quantitative regulation model was developed: (a) the Regulation intensity measurement scale, (b) the methodology for the deadweight loss (information asymmetry, market power imbalances, negative spillovers, market abuse and others) assessment and (c) the methodology for the government regulation costs' (regulatory costs, compliance costs, indirect costs) assessment. Model was validated on the euro area or world data depending on applicability and availability. In the case of Latvia for the first time in the Latvian banking sector the regulation intensity and the equilibrium point between the deadweight loss and regulation costs were assessed.

The Doctoral Thesis has been written in English and comprises of 144 pages, not including 7 annexes. The Doctoral Thesis contains 38 tables, 36 figures and 65 formulas, while the bibliography lists 238 reference sources.

Content

Glossary of the Abbreviations

Abbreviation	Explanation
BCBS	Basel Committee on Banking Supervision
CBA	Cost-Benefit Analysis
DWL	Deadweight loss
EBA	European Banking Authority
ECB	European Central Bank
ESMA	European Securities and Markets Authority
IMF	International Monetary Fund
NPV	Net Present Value
OECD	Organisation for Economic Co-operation and Development
OIRA	Office of Information and Regulatory Affairs
RII	Regulation Intensity Index

Introduction

Topicality of the Research

The financial market is extremely important for the proper functioning of the economy. Experience of many countries in the world shows that failures in this market could lead to serious social consequences affecting, most probably, every citizen. This situation has pushed governments to act and introduce regulations aimed at preventing crisis arising from failures in the financial market. Over the years the extent of the regulations has risen significantly, especially after crises in recent decades.

On the other hand, it is important to promote competition, which as per Smith (2002)[1] leads economic system towards equilibrium and is considered as the basic building block of modern market economies. Regulation potentially can have adverse effects on the competition, thereby it is important to find the balance between the two. Dangers from overregulation have often been put in the spotlight by market participants (Michel, 2016; Reichwald, 2016), mostly addressing the issue with innovations when regulations scale up. Even some regulators have warned that too complex regulation poses risks for seeing the real risks building in the financial systems (Noonan, 2021). In separate interviews with the Financial Times, Norway and Denmark's financial supervision chiefs address the issue of too complex regulation requiring substantial resources to implement them and manage to see the big picture.

Thereby in author's view society needs the financial market where it is possible to find (a) healthy competition among market participants leading to better financial services and (b) financial market regulator, who efficiently & effectively reacts on the unacceptable market practices often leading to the market failures.

History, especially recent experiences, shows that actual problems in the financial markets from society's perspective are (a) too aggressive or too passive market participants, i.e., unacceptable market practices, and (b) overregulation or under-regulation from regulatory authorities.

Thereby author has decided to research the regulation in the banking sector within the financial market to find the proper balance between the competition and the regulation: (a) efficient and effective regulators and (b) minimum necessary burden for the market participants. Author uses following definitions of "efficient" and "effective" inspired by the idea of Drucker (1963):

1. Efficient – quick, with minimum expense & unnecessary effort,
2. Effective – reacts when it is expected and addresses the market failure which has occurred.

The objective (aim) of the Doctoral Thesis is to develop the regulation model to find the equilibrium point between the welfare (deadweight) loss arising from market failures and subsequent government regulation costs. Model is developed in the banking sector within the financial market.

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[1] Publication based on the original in 1776.

The Hypothesis of the Doctoral Thesis: there is an equilibrium point between the welfare (deadweight) loss arising from the market failures and subsequent government regulation costs in the banking sector.

Research questions:

- What are the market failures in the banking sector?
- What is the deadweight loss of those market failures?
- What are the regulation costs in the banking sector?
- What is the equilibrium point between the deadweight loss and regulation costs?

The Main Tasks of the Doctoral Thesis are formulated as follows:

1. To conduct the <u>literature analysis</u> on the banking sector within the financial market:
1.1. Describe the financial market and banking sector (specification of the research object) and the perfect competition model in it,
1.2. Identify the market failures in the banking sector and existing approaches of assessing them,
1.3. Identify the regulation principles of the banking sector and existing approaches of assessing the regulation costs in the banking sector.
2. To <u>develop</u> the regulation model, which consists of:
2.1. Regulation intensity: the methodology for the scale of government intervention assessment,
2.2. Deadweight loss: the methodology for the welfare (deadweight) loss assessment,
2.3. Regulation costs: the methodology for the government regulation costs' (regulatory costs, compliance costs, indirect costs) assessment,
3. To <u>validate</u> the model.

The Object of the Doctoral Thesis is the banking sector participants as a group.

The Subject of the Doctoral Thesis is the government regulation in the banking sector within the financial market.

Assumptions and Limitations. The model is applicable to mixed market economies, which primary rely on the private sector as producer and distributor of goods and services. Validation of the model in some parts has conducted on euro area data due to data availability limitations.

Theoretical Framework of the Research. The theoretical framework of the research is based on the insights of researchers, scientists, governmental and international institutions in the books, scientific articles, study reports, conference materials, documents of the development planning published mainly abroad from 1936 to 2022. Researchers and scientists include, e.g., A. Boot, A. C. Harberger, A. Demirguc-Kunt, A. Renda, A. V. Thakor, B. Grochulski, C. W. Calomiris, D. Anginer, D. Besanko, D. Gale, D. Igan, D. J. Bjornstad, D. L. Rubinfeld, E. Carletti, E. C. Perotti, F. Allen, F. Barde, F. M. Bator, F. Pasiouras, G. A. Akerlof, G. A. Jehle, G. Debreu, G. Dell'Arricia, G. De Nicolò, G. P. Kouretas, H. Bennani, H. Mamaysky, H. Sonnenschein, J. B. Ajefu, J. E. Stiglitz, J. H. Boyd, J. Hertog, J. K. Rosengard, J. M. Keynes, J. Suarez, K. J. Arrow, L. W. McKenzie, L. Laeven, M. A. Brown, M. A. Petersen, M. B. Zhang, M. D. Delis, M.-E. K. Agoraki, M. Shubik, M. Simkovic, M. Spence, M. Zhu, N. G. Mankiw, N. Fanta, P. Gertler, P. Healy, P. J. Reny, R. Braeutigam, R. Horvath,

R. J. Aumann, R. G. Rajan, R. K. Quarles, R. Marquez, R. S. Pindyck, R. Yang, S. Claessens, S. Juko, T. Besley, W. Morrison, W. Novshek.

Governmental and international institutions include the New South Wales (Australia) government, the Organisation for Economic Co-operation and Development (OECD), the European Commission, the European Banking Authority, the European Central Bank, the Basel Committee on Banking Supervision, the World Bank, and the U.S. Congress Research Service.

Methodological Framework of the Research and the Research Design. The methods that were used in the research and overall Research Design are described in the Table 1 (next page):

1. Research structure:
- theoretical background,
- model construction,
- model validation.
2. Justification – motivation to include certain topics in the research.
3. Applied methods – list of quantitative and qualitative methods used in the research.

Scientific Novelty of the Research:

1. Identification of the banking sector market failures, needed for the assessment of the deadweight loss in the banking sector.
2. Identification of the principles of regulation, needed for the setup of the regulation model.
3. Development of the quantitative regulation model:
3.1. Development of the Regulation intensity measurement scale,
3.2. Development of methodology for the deadweight loss assessment (information asymmetry, market power imbalances, negative spillovers, market abuse and others),
3.3. Development of methodology for the regulation costs' assessment (regulatory costs, compliance costs, indirect costs).
4. In the case of Latvia for the first time in the Latvian banking sector:
4.1. The regulation intensity was assessed,
4.2. The equilibrium point between the deadweight loss and regulation costs was assessed.

Table 1.

The Research Design

RESEARCH STRUCTURE		JUSTIFICATION	APPLIED METHODS
Theoretical aspects of the banking sector regulation	Description of the perfect competition model	To identify and characterise the reference points to reveal the nature of market failures	Monographic and descriptive method, induction method, deduction method, graphic method
	Identification of the market failures	To identify and characterise the source of the deadweight loss, which is subject to government intervention in the economy	Monographic and descriptive method, induction method, deduction method, content analysis, mapping, synthesis
	Identification of the principles of regulation	To identify and characterise the source of regulation costs arising from policy measures targeted at minimization of the deadweight loss	Monographic and descriptive method, induction method, deduction method, content analysis, mapping, synthesis, triangulation (incl. expert method)
	Identification of existing approaches of assessing the deadweight loss and regulation costs	To shape the theoretical backbone for the methodology of the Regulation model created by author	Monographic and descriptive method, induction method, deduction method, mapping
Development of the Government Regulation Model	Development of the regulation intensity measurement scale	To create necessary units for functions of deadweight loss and regulation costs' assessment	Induction method, deduction method, analysis, synthesis, scaling
	Development of the deadweight loss assessment functions	To develop banking sector specific functions needed for the identification of equilibrium point	Induction method, deduction method, analysis, synthesis, mathematical analysis
	Development of the regulation costs' assessment functions	To develop banking sector specific functions needed for the identification of equilibrium point	Induction method, deduction method, analysis, synthesis, mathematical analysis

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Table 1 continued

RESEARCH STRUCTURE		JUSTIFICATION	APPLIED METHODS
Validation of the Government Regulation Model	Validation of the regulation intensity measurement scale	To validate the robustness of developed regulation intensity measurement scale	Induction method, deduction method, analysis, scaling, ranking
	Validation of the deadweight loss assessment functions	To validate the robustness of developed functions	Induction method, deduction method, analysis, synthesis, mathematical analysis, iteration method, regression analysis
	Validation of the regulation costs' assessment functions	To validate the robustness of developed functions	Induction method, deduction method, analysis, synthesis, mathematical analysis, regression analysis
	Validation of the overall model	To validate the robustness of the equilibrium point	Induction method, deduction method, analysis
	Feedback from the industry	To validate the robustness of all model aspects	Expert method, survey, analysis

Theses for defence:

1. There have been 12 principles of the regulation with Top 5 covering current regulatory agenda: "cost-benefit balanced", "risk-based", "consistency and competitive neutrality", "high quality transparent decision-making, and enforcement" and "international coordination, convergence, and implementation in policy and rulemaking".

2. Developed quantitative regulation model has following characteristics:

2.1. Regulation intensity measurement scale: it is based on the Regulation Intensity Index with values in the interval [0; 100]. The Regulation Intensity Index is calculated as average from 5 indices: Index from the questionnaire based on the Bank Regulation and Supervision Survey from the World Bank and 4 indices based on the *Index of Economic Freedom*. The regulation intensity for Germany is higher than for the UK and the USA.

2.2. Deadweight loss assessment: the deadweight loss decreases with increased regulation intensity level.

2.3. Regulation costs' assessment: the regulation costs increase with increased regulation intensity level.

3. Equilibrium point exists between the decrease of the deadweight loss and increase of regulation costs with increasing regulation level.

4. In Latvian banking sector the regulation intensity is lower than the equilibrium point.

The research results were published in the journals (including the regulatory economics area specific: *Public Policy and Administration*), the full-text conference proceedings, the chapter in the book and the conference thesis.

List of the Scientific Publications (generally recognized peer-reviewed publications):

Papers in the journals:

1. Šenfelde, M., Freimanis, K. (2021). Assessment of Compliance Costs in the Banking Market. *Economics and Organization of Management*, Vol. 43, No. 3, pp.14-27. ISSN 2307-2318. e-ISSN 2707-9899. Available from: https://doi.org/10.31558/2307-2318.2021.3.2

2. Freimanis, K., Šenfelde, M. (2023). Variables of the Harberger Triangle in the Financial Market. *International Journal of Economics and Business Research*. [In print]. **SCOPUS indexed.**

3. Freimanis, K., Šenfelde, M., Juscius, V. (2023). Assessment of the Deadweight Loss Arising from the Imperfect Competition in the Banking Market. *Public Policy and Administration*, Vol. 22, Nr. 1, p. 9-19. ISSN 1648-2603. ISSN 2029-2872. Available from: https://doi.org/10.5755/j01.ppaa.22.1.33723 **SCOPUS indexed.**

Papers in the full-text conference proceedings:

4. Freimanis, K., Šenfelde, M. (2020). Approach of Scaling the Level of Government Intervention in the Financial Market. *Finance: New Challenges, New Opportunities*, *11th International Scientific Conference "Business and Management 2020"*, Vilnius,

Lithuania, 7 – 8 May 2020. VGTU Press, 2020, pp.407-416. ISBN 978-609-476-231-4. e-ISBN 978-609-476-230-7. ISSN 2029-4441. e-ISSN 2029-929X. Available from: https://doi.org/10.3846/bm.2020.591 **Web of Science indexed.**

5. Freimanis, K., Šenfelde, M. (2021). Methodology for the assessment of regulation costs in the banking market. *International Scientific Conference "Contemporary Issues in Business, Management and Economics Engineering 2021"*, Vilnius, Lithuania, 13 – 14 May 2021. Vilnius Gediminas Technical University, 2021, pp.1-8. e-ISBN 978-609-476-260-4. e-ISSN 2538-8711. Available from: https://doi.org/10.3846/cibmee.2021.600 **Web of Science indexed.**[2]

6. Freimanis, K., Šenfelde, M. (2022). Assessment of the effect of regulator's communication on the financial market participants. *International Scientific Conference "Business and Management 2022"*, Lithuania, Vilnius, 12-13 May 2022. Vilnius Gediminas Technical University, 2022, pp. 466-472. ISBN 978-609-476-288-8. e-ISBN 978-609-476-289-5. ISSN 2029-4441. e-ISSN 2029-929X. Available from: https://doi.org/10.3846/bm.2022.857 **Web of Science indexed.**

7. Freimanis, K., Šenfelde, M. (2023). Assessment of the Deadweight Loss Arising from the Information Asymmetry in the Banking Market. *Scientific Conference on Economics and Entrepreneurship Proceedings,* Riga, Latvia, 13 October 2022. RTU Izdevniecība, pp.49-56. ISSN 2256-0866. Available from: https://doi.org/10.7250/scee.2022.005 **Web of Science indexed.**[2]

8. Freimanis, K., Šenfelde, M. (2023). Development of the Regulation Index in the Banking Market. *International Scientific Conference "Business and Management 2023"*, Lithuania, Vilnius, 11 – 12 May 2023. Vilnius Gediminas Technical University, 2023, pp. 95-101. ISBN 978-609-476-333-5. e-ISBN 978-609-476-334-2. ISSN 2029-4441. e-ISSN 2029-929X. Available from: https://doi.org/10.3846/bm.2023.1078 **Web of Science indexed.**[2]

Chapter in the book:

9. Freimanis, K., Šenfelde, M. (2023). Principles of the optimal government regulation in the financial market. Chapter in the book "New Challenges for the Banking Industry: Searching a Balance Between Corporate Governance, Sustainability, and Innovation." Palgrave Macmillan Studies in Banking and Financial Institutions. Springer Nature: Switzerland.

Conference thesis:

10. Freimanis, K., Šenfelde, M. (2019). Features of the Balanced State Regulatory Framework in the Financial Market. *"Scientific Problems of Engineering Economics of Construction and Real Estate Management, Regions and Territories Development ICEREE'2019" organized within 60th International Scientific Conference of Riga Technical University*: Book of Abstracts, Riga, Latvia, 27 – 28 September 2019. RTU Press, 2019, p.17, ISBN 978-9934-22-369-3.

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[2] Proceedings submitted for evaluation to the Web of Science.

11. Freimanis, K., Šenfelde, M. (2021). Sample Selection Criteria for the Validation of Compliance Cost Assessment Methodology in the Banking Market. *"Scientific Problems of Engineering Economics of Construction and Real Estate Management, Regional and Territorial Development ICEREE'2021" organized within 62nd International Scientific Conference of Riga Technical University*: Book of Abstracts, Riga, Latvia, 30 September 2021. Riga: RTU Press, 2021, pp.41-41. ISBN 978-9934-22-677-9.

12. Freimanis, K., Šenfelde, M. (2023). Development of the Imperfect Competition Measurement Index in the Banking Market. "*12th International Conference on Applied Economics "Contemporary Issues in Economy""*: Book of Abstracts, Olsztyn, Poland, 29–30 June 2023. Olsztyn: Instytut Badań Gospodarczych, 2023, pp. 64. ISBN 978-83-65605-61-0. https://doi.org/10.24136/eep.abs.2023.1

The research results were discussed at international scientific conferences in Latvia, Lithuania, Poland, Ukraine, France, and Spain and were reflected in relevant scientific publications. The comments and suggestions received at the conferences, and during peer reviews of the articles were considered and the appropriate changes in the research were done.

List of Conferences:

1. Riga Technical University, 60th International Scientific Conference of Riga Technical University "Scientific Problems of Engineering Economics of Construction and Real Estate Management, Regions and Territories Development (ICEREE'2019)", 27 – 28 September 2019, Riga, Latvia, conference presentation "*Features of the Balanced State Regulatory Framework in the Financial Market*".

2. International Scientific Conference "Contemporary Issues in Business, Management and Economics Engineering 2021", 13 – 14 May 2021, Vilnius, Lithuania, conference presentation "*Methodology for the assessment of regulation costs in the banking market*".

3. Riga Technical University, 62nd International Scientific Conference of Riga Technical University "Scientific Problems of Engineering Economics of Construction and Real Estate Management, Regional and Territorial Development ICEREE'2021", 30 September 2021, Riga, Latvia, conference presentation "*Sample Selection Criteria for the Validation of Compliance Cost Assessment Methodology in the Banking Market*".

4. International scientific-practical conference "Transformation of Socio-Economic Systems in the Context of the Challenges Faced by Global Economic Development", 7 – 8 October 2021, Vinnitsa, Ukraine, conference presentation "*Assessment of Compliance Costs in the Banking Market*".

5. International Scientific Conference "Business and Management 2022", 12 – 13 May 2022, Vilnius, Lithuania, conference presentation *"Assessment of the effect of regulator's communication on the financial market participants"*.

6. International Scientific Conference "Wolpertinger Annual Conference 2022", 31 August – 3 September 2022, Madrid, Spain, conference presentation *"Principles of the optimal government regulation in the financial market"*.
7. International Scientific Conference "SCEE 2022", 13 October 2022, Riga, Latvia, conference presentation *"Assessment of the deadweight loss arising from the information asymmetry in the banking market"*.
8. International Scientific Conference "Business and Management 2023", 11 – 12 May 2023, Vilnius, Lithuania, conference presentation *"Development of the Regulation Index in the Banking Market"*.
9. International Scientific Conference "12th International Conference on Applied Economics "Contemporary Issues in Economy"", 29–30 June 2023, Olsztyn, Poland, conference presentation *"Development of the Imperfect Competition Measurement Index in the Banking Market"*.
10. International Scientific Conference "Conference on Responsibility and Ethics in Business & Finance", 4 July 2023, Nice, France, conference presentation *"Analysis of Responsibility Failures in the Financial Market Failures"*.

Participation in projects:

The Doctoral thesis was supported by European Social Fund within the Project No. 8.2.2.0/20/I/008 "Strengthening of *Ph.D.* students and academic personnel of Riga Technical University and BA School of Business and Finance in the strategic fields of specialisation" of the Specific Objective 8.2.2 "To Strengthen Academic Staff of Higher Education Institutions in Strategic Specialisation Areas" of the Operational Programme "Growth and Employment".

Practical use of research results: they have been included in the study course "Market Economy's Problems and Policy" of the Master level study programme "Economics".

The content and volume of the Doctoral Thesis. The Doctoral Thesis consists of three Chapters:
1. Literature analysis of the banking sector market failures, banking sector regulation and regulation costs.
2. Development of the Regulation Model.
3. Validation of the Regulation Model.

The volume of the Doctoral Thesis is 144 pages, not including annexes. The Doctoral Thesis contains 38 tables, 36 figures and 65 formulas as well as 7 annexes that provide detailed comments on the information, including tables, in the main part of the Doctoral Thesis.

Chapter 1 of the Doctoral Thesis provides description and analysis of current insights from other scientists, researchers, government, and international institutions regarding existing approaches of assessment of the deadweight loss arising from market failures and assessment of government regulation (from level and cost perspectives).

Chapter 2 of the Doctoral Thesis provides detailed description of the methodologies developed by author to fulfil set tasks:

- the methodology for the scale of government intervention assessment,
- the methodology for the welfare (deadweight) loss assessment,
- the methodology for the government regulation costs' (regulation costs, compliance costs, indirect costs) assessment.

Chapter 3 of the Doctoral Thesis provides validation of developed methodologies and the overall model. The case of Latvia has been reviewed as example. In this Chapter are included comments from the industry, i.e., regulators of the banking sector.

In the appendices detailed tables, calculations and the presentation for regulator have been included.

1. THEORETICAL CONTEXT OF THE BANKING SECTOR REGULATION

Financial market is extremely important for the proper functioning of the economy. Experience of many countries in the world shows that failures in this market could lead to serious social consequences affecting, most probably, every citizen. This situation has pushed governments to act and introduce regulations aimed to prevent crisis arising from failures in the financial market. Over years extent of the regulations has risen significantly, especially after crisis in recent decades.

On the other hand, it is important to promote competition, which as per father of classical economics Adam Smith leads economic system towards equilibrium and is considered as the basic building block of modern market economies. Regulation potentially can have adverse effects on the competition thereby it is important to find the balance between the two.

In this Chapter author analyses existing classifications of principles of the government intervention in the banking sector within the financial market in the form of regulation. Classifications and comments from researchers have been systematized, compared and similarities and differences revealed. Details about the structure of the theoretical part are revealed in the Table 1. and the logic of literature analysis is reflected in Figure 1.1.

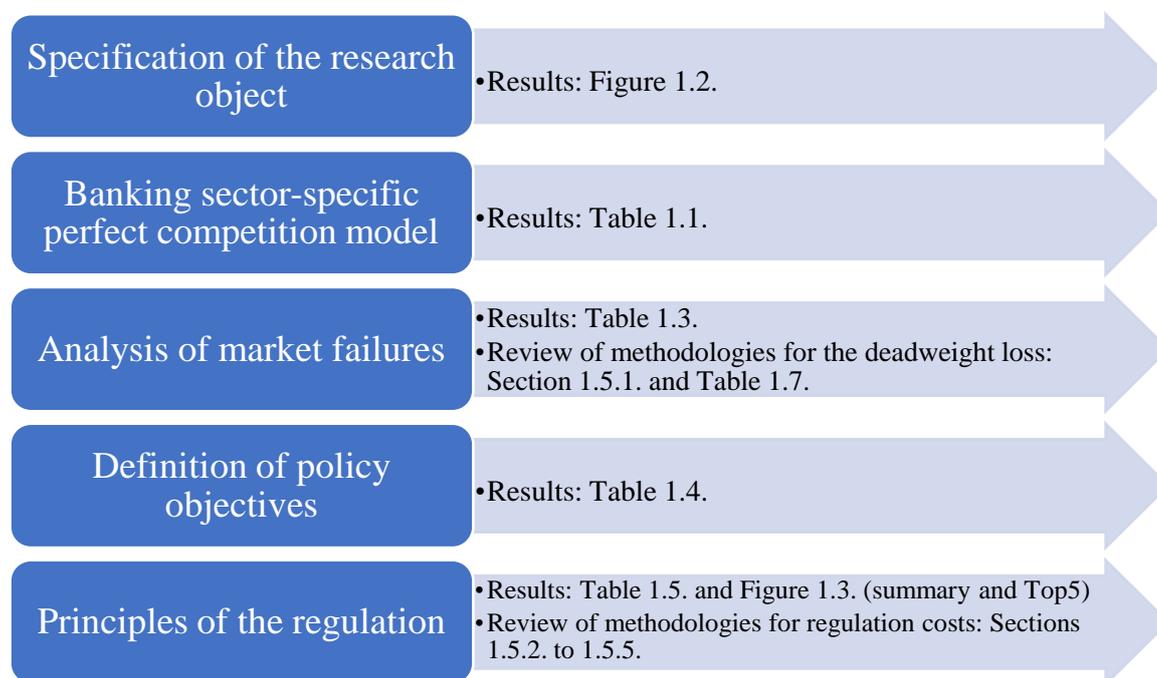|	
Specification of the research object	•Results: Figure 1.2.
Banking sector-specific perfect competition model	•Results: Table 1.1.
Analysis of market failures	•Results: Table 1.3. •Review of methodologies for the deadweight loss: Section 1.5.1. and Table 1.7.
Definition of policy objectives	•Results: Table 1.4.
Principles of the regulation	•Results: Table 1.5. and Figure 1.3. (summary and Top5) •Review of methodologies for regulation costs: Sections 1.5.2. to 1.5.5.

Figure 1.1. The logic of literature analysis (the author's made)

Author research principles of the government intervention in the banking sector in the form of regulation by (a) defining attributes of the well-functioning banking sector, i.e., the specification of the banking sector and then defining the perfect competition in there, (b)

summarizing what market failures have been observed so far in the banking sector and (c) further summarizing policy objectives, instruments, and principles for government regulation. Author has identified in the literature 12 principles of the government regulation, including recently highlighted topic of climate-related risks. In this part of the literature analysis the triangulation method has been used:

1. qualitative text analysis has been used to identify the principles of the regulation,
2. quantitative metric of number of sources has been used to identify the most common principles,
3. expert analysis of 20 foreign supervisory authorities has been used to test the robustness of identified principles. Out of 20 authorities contacted two provided the feedback and comments.

In total 185 sources have been analysed in this Chapter, majority of which are journal papers:

- journal papers: 99 (54%),
- government and international institutions' publications: 52 (28%),
- books: 15 (8%),
- other academic publications, including university working papers: 15 (8%),
- other industry publications: 4 (2%).

Full list of bibliography is disclosed at the end of the Doctoral Thesis.

1.1. Specification of the research object

Author has reviewed the descriptions of financial system and financial market to specify the place of the banking sector within the financial system. Based on the literature analysis in this respect the Figure 1.2. has been developed to visually reflect that place.

Government consulting institutions (OECD, 2010; Congressional Research Service, 2020) specify several functions for the financial system (in some cases author has adjusted the wording for better understanding):

1. Financial intermediation, i.e., transforming savings into productive investments. This function can be organized through financial institutions, e.g., banks, or directly between parties in the capital market.
2. Pooling, management, and transfer of risks. Financial markets ensure general pricing of the risk.
3. Providing payment infrastructure.
4. Offering financial advisory services.
5. Providing liquidity in the capital markets by purchasing and trading securities.
6. Promoting financial disclosures.

Term "financial system" has broader meaning than term "financial market" in the abovementioned descriptions. Juko (2019) has clarified this difference in the Figure 1.2.
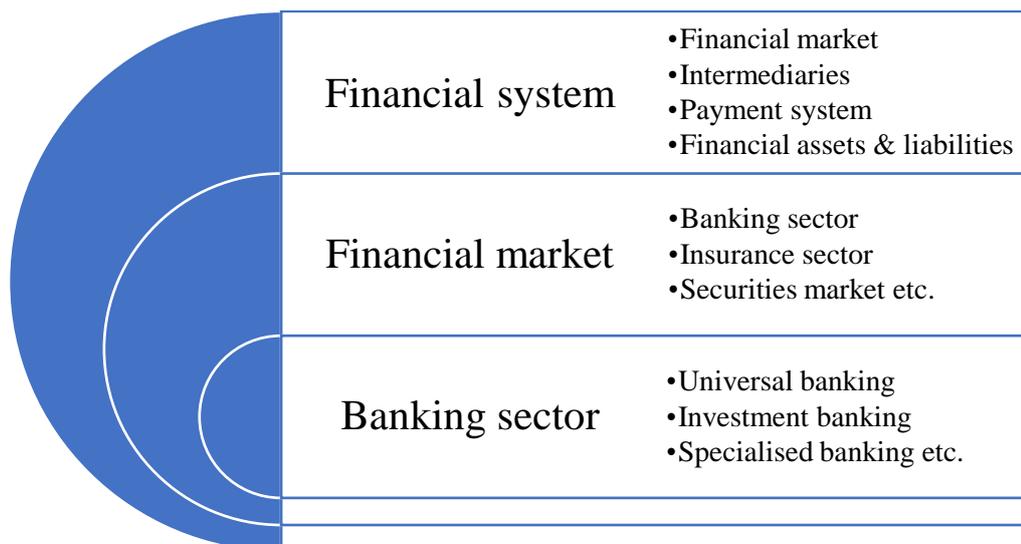
Figure 1.2. Banking sector within the financial system (the author's made based on Juko, 2019; OECD, 2010; Congressional Research Service, 2020)

OECD (2010) stresses the importance of understanding linkages of the financial market with the real economy, i.e., other markets, and activities of the central bank, i.e., monetary policy. Financial markets contribute to efficient allocation of economic resources, support economic growth and resilience, and promote poverty reduction (Juko, 2019).

Special functions of the financial market are defined per Juko (2019) as follows:

1. risk sharing: allowing savers to hold a portfolio of different assets,
2. liquidity: refers to ease with which assets can be exchanged/sold without loss in value,
3. information: the better the available information the lower information (and transaction) costs.

Functioning of financial markets are dependent on how well capitalized and liquid are financial intermediaries. Importance of this aspect was often mentioned in the context of Covid – 19 pandemic crisis (Quarles, 2020).

1.2. Perfect competition in the banking sector

In order to set-up the reference model for the analysis of market failures, author has defined a perfect competition model specifically for the banking sector in the following steps:

- literature analysis of conditions defined for the general perfect competition model,
- synthesis of banking sector-specific perfect competition model. The comparison is then reflected in Table 1.1.

The perfect competition model as defined by Smith in 1776 (Smith, 2002) and Walras (1874), and further developed by Arrow & Debreu (1954), McKenzie (1959), Aumann (1964) and Novshek & Sonnenschein (1987) sets certain conditions for the market summarized by Healy (2015):

1. **Many small price-taking participants**: there are numerous buyers and sellers, none of which can influence the market price substantially, and no single firm or consumer accounts for a large portion of production or purchases.
2. **Identical sellers**: suppliers have full access to the same inputs and production technologies as one another.
3. **Free entry and exit**: many new firms can enter the market on the very same terms as existing ones if the market is profitable and, similarly, firms can exit the industry without incurring extra costs.
4. **Products are identical**: sellers offer the exact same product and buyers are equally willing to buy from any seller.
5. **Perfect information**: Buyers and sellers are fully informed about the quality of products and prices available in the market.

Considering (a) the specification of the banking sector, (b) the description of conditions of perfect competition in any given market and (c) OECD's (2010) comments for the expected outcomes of the well-functioning banking sector author has summarized the description of perfect competition in the banking sector:

1. Effective and efficient allocation of liquidity and capital.
2. Effective and efficient pooling, management and transfer of risks accompanied with correct pricing of risk. This aspect covers prudent risk-taking behaviour as well.
3. Sufficient shock resistance with ability to self-correct.
4. General confidence in the functioning of the banking sector. This aspect covers the condition of "perfect information".

Claessens (2009) structure the competition in the financial market with three dimensions looking for answers to the following questions:

1. financial sector development (including the efficiency of financial services provision):
   a. with greater competition, is the system more developed, e.g., is it larger, does it provide better quality financial products/services, in a static and dynamic way?
   b. is it more efficient, i.e., exhibits a lower cost of financial intermediation, is it less profitable?
   c. is it closer to some competitive benchmark?
2. access to financial services for households and firms (i.e., the availability, or lack thereof, of financial services at reasonable cost and convenience):
   a. whether access to financing, particularly for smaller firms and poorer individuals, but also in general for households, large firms and other agents is improved, in terms of volume and costs, with greater competition?
3. financial sector stability (i.e., the absence of systemic disturbances that have major real sector impact):
   a. whether the banking system has less volatility, fewer financial crises and is generally more robust?

b. whether the banking system's financial integrity higher with more competition?

Financial sector development

Besanko & Thakor (1992) in their research show that, allowing for the fact that financial products are heterogeneous, in the analysis of the allocational consequences of relaxing entry barriers, equilibrium loan rates decline, and deposit interest rates increase, even when allowing for differentiated competition. In turn, by lowering the costs of financial intermediation, and thus lowering the cost of capital for non-financial firms, more competitive banking systems lead to higher growth rates.

Access to financial services

Some market power may be beneficial for access to financing as with too much competition, banks may be less inclined to invest in relationship lending (Rajan, 1992; Petersen, Rajan, 1995). At the same time, because of hold-up problems, too little competition may tie borrowers too much to an individual institution, making the borrower less willing to enter a relationship (Petersen, Rajan, 1994; Boot, Thakor, 2000).

Research shows as well that technological progress lowering production or distribution costs for financial services providers does not necessarily lead to more or better access to finance. Models often end up with ambiguous effects of technological innovations, access to information, and the dynamic pattern of entry and exit on competition, access, stability, and efficiency (e.g., Marquez, 2002; Dell'Ariccia, Marquez, 2004). Increased competition can lead to more access, but also to weaker lending standards, as observed in the sub-prime lending market in the US (Dell'Ariccia, Laeven, Igan, 2008).

Financial sector stability

Perotti and Suarez (2002) show in a formal model that the behaviour of banks today will be affected by both current and future market structure and the degree to which authorities will allow for a contestable, i.e., open, system in the future. In such a dynamic model, current concentration does not necessarily reduce risky lending, but an expected increase in future market concentration can make banks choose to pursue safer lending today. More generally, there may not be a trade-off between stability and increased competition as shown among others by Allen and Gale (2004), Boyd and De Nicolò (2005) and reviewed by Allen and Gale (2007).

Summary has been made in the Table 1.1. (author's made based on Smith, 2002; Walras, 1874; Arrow & Debreu, 1954; McKenzie, 1959; Aumann, 1964; Novshek & Sonnenschein, 1987; Besanko & Thakor, 1992; Rajan, 1992; Petersen, Rajan, 1994; Petersen, Rajan, 1995; Boot, Thakor, 2000; Marquez, 2002; Perotti and Suarez, 2002; Dell'Ariccia, Marquez, 2004; Allen and Gale, 2004; Boyd and De Nicolò, 2005; Allen and Gale, 2007; Dell'Ariccia, Laeven, Igan, 2008; Claessens, 2009; OECD, 2010; Healy, 2015).

Table 1.1.

Banking sector in the perfect competition model

(the author's made based on abovementioned sources)

General concept	Banking sector*

1. No market player can affect price
2. No market barriers
3. All companies receive normal profits
4. Goods and services are homogenous
5. Information available fully for no price
6. Factors of production perfectly mobile
	1. Effective and efficient allocation of liquidity and capital (1 – 6)
	2. Risks:
	   a. Effective and efficient pooling, management, and transfer of risks (1 – 6)
	   b. Correct risk pricing (5)
	   c. Prudent risk behaviour (1)
	3. Sufficient shock resistance (1, 2, 6)
	4. General confidence in the functioning of the financial market (5)

Numbers in brackets correspond to the numbering of general concept

Table 1.1. shows that banking sector specifics reveal in underlining the risk perspective in the market operations.

Ajefu & Barde (2015) stresses the importance of consideration of the equity in the discussion of market effectiveness and efficiency pointing to the concepts of fairness and social justice. This could require looking for some trade-offs between economic efficiency and equity.

1.3. Market failures in the banking sector

Market failures have been assessed based on the reference model of the perfect competition. Thereby the deviation from abovementioned conditions is defined as market failure (OECD, 2010; Ajefu, Barde, 2015). Author has analysed general and banking market-specific market failures, which gives justification for the government's intervention. Result of this analysis is reflected in Table 1.3. Based on those results policy objectives have been analysed and defined, results of which can be seen in Table 1.4.

General overview

Bator (1958) structured the discussion regarding market failures introducing definitions and types of market failures. Previously it was more common to discuss each market failure separately, incomplete competition expressed as the monopoly (e.g., Harberger, 1954). Currently there are various approaches how to classify market failures. Two types of market failures – externalities and public goods – are often viewed together (e.g., Mankiw, 2009; Besanko & Braeutigam, 2011; Rubinfeld & Pindyck, 2013; NSW, 2017) as they reflect nature of the good. As per Mankiw (2009) an externality arises when a person engages in an activity that influences the well-being of a bystander and yet neither pays nor receives any compensation

for that effect. Public goods are characterized by excludability (whether people can be prevented from using the good) and rivalry in consumption (does one person's use of the good reduce another person's ability to use it). Separately under the topic of market structure another market failure – incomplete competition – is viewed (e.g., Mankiw, 2009; Besanko & Braeutigam, 2011; Jehle & Reny, 2011; Rubinfeld & Pindyck, 2013; NSW, 2017). Information asymmetry, which gained its significance with Akerlof's "market for "lemons"" (1970), Spence's "job market's signals" (1973) and Stiglitz's "theory of "screening"" (1975), in the textbooks of microeconomics has received less attention and often is reflected in terms of moral hazard and adverse selection (e.g. Besanko & Braeutigam, 2011; Jehle & Reny, 2011; Rubinfeld & Pindyck, 2013), while policy makers even add to the information asymmetry additional dimension of the information failure (e.g. NSW, 2017). Rosengard and Stiglitz have named public goods as "incomplete markets" thereby more emphasizing the nature of market failure which has occurred there (Stiglitz, 2000; Rosengard, Stiglitz, 2015). And on top of that they introduced less commonly discussed market failure "unemployment and other macroeconomic disturbances". Although economists often recognize unemployment as a problem in the economy it is not so common to classify it as a market failure. In author's view it is related to the fact that market failures are often viewed under the framework of microeconomics however Rosengrad and Stiglitz have taken additional macroeconomic perspective there (Stiglitz, 2000; Rosengrad, Stiglitz, 2015).

When it comes to semantics there is no unified approach of how to name the loss which appears to the society when market failures occur. Often it is called as "deadweight loss" emphasizing lost Gross Domestic Product as a "dead weight", however alternative name of the "welfare loss" exists more emphasizing society's welfare loss due to not produced Gross Domestic Product. In the Doctoral Thesis name of "deadweight loss" is preferred however when referring to the articles which use the name of "welfare loss" both names are presented. Author notes that other names are often used as well, e.g., "efficiency loss" referring to the Pareto efficiency, which can be observed in the Figure 1.4. as well.

In the financial market a great attention to the theory of market failures has been received after 2008's economic and financial crisis (e.g., Besley, 2010; Allen & Carletti, 2013; Grochulski & Morrison, 2014). Special attention received necessity for the macroprudential regulation as systemic risks were identified on top of financial risks faced by individual companies (Allen & Carletti, 2013; Grochulski & Morrison, 2014).

Banking sector-specific market failures

There have been several market failures observed in the banking sector:
1. **Asymmetric information**: the deviation from the condition "perfect information". Those imbalances in information that make it costly if not impossible to perfectly monitor the behaviour or situation of market players. Asymmetric information explains some of the key risks in the financial intermediation process, e.g., credit risk, and accounts for the role of financial institutions in this process. There are two types of asymmetric information: moral hazard and adverse selection (OECD, 2010). Lack

of transparency of financial institutions, products and markets was recognized as one of financial market failures leading to the financial market crisis in 2008 (Kawai, Prasad, 2011). The literature is extensive on adverse selection and moral hazard problems in contractual relationships between lenders and firm agents. Chiappori and Salanié (2003) provide a survey of recent theoretical and empirical studies. Finkelstein and Poterba (2006) present an empirical test of asymmetric information that takes advantages of observable private information to distinguish between adverse selection and moral hazard in the insurance market. Dey and Dunn (2006) outline the literature in credit markets surrounding the concepts of sorting by observed risk and sorting by private information. Other empirical studies include Igawa and Kanatas (1990), Ausubel (1991), Calem and Mester (1995), Ausubel (1999), Edelberg (2004), Davidoff and Welke (2004), and Karlan and Zinman (2006). Einav, Finkelstein and Cullen (2010) emphasize that the central force that generates inefficiency in asymmetrically informed markets is that firms' marginal costs are increasing in price. Recent papers on this topic are Stroebel (2016), Hertzberg, Liberman and Paravisini (2018) on maturity choice, Indarte (2021) on consumer bankruptcy, and Gupta and Hansman (2022) on mortgages.

2. **Negative spillovers**: an externality, which has arisen when the costs of individual actions have not incorporated potential broader social costs. In author's view, this is the deviation from the condition "perfect information" as the prices do not fully reflect the actual costs and margin. In the financial market negative spillovers often are informational in nature. If confidence in financial products or institutions evaporate, it can lead to a panic and a rush for the exits (OECD, 2010). Significant part of this failure is systemic risk: one of the most important take-aways from the financial market crisis in 2008 was understanding of interconnectedness of financial institutions and risk-spillovers (Brunnermeier, Crocket, Goodhart, Persaud & Shin, 2009; McSweeney, 2009; Kawai, Prasad, 2011; Grochulski, Morrison, 2014).

3. **Market power imbalances**: the deviation from the condition "Many small price-taking participants" when specific market participant can influence the price due to its market share. Market power imbalances can lead to (a) excessive pricing for financial services and products, (b) inefficient allocation of capital and (c) slower innovation through creation of competing products (OECD, 2010). Bikker and Spierdijk (2009) has structured the determinants of imperfect competition (see the Table 1.1.), dividing them into coordinated factors and unilateral factors (one dimension) and demand and supply side factors (second dimension). Market power imbalances, often referred as imperfect competition or monopolization, has been researched by Harberger (1954), Schwartzman (1960), Kamerschen (1966), Comanor and Leibenstein (1969), Worcester (1973), Cowling and Mueller (1978), Masson and Shaanan (1984), Gisser (1986) and Yoon (2004).

4. **Market abuse**: the deviation from the condition of "perfect information". Due to asymmetric information some of market participants can be involved in inappropriate practices, e.g., market manipulation of share prices. Market abuse can severely

damage general confidence in the financial market leading to even market collapse in worst cases (OECD, 2010). When the financial market crisis in 2008 has been analysed, many researchers refer to the excessive risk taking by financial institutions (Kawai, Prasad, 2011), which, in author's view, could be interpreted as a market abuse.

Table 1.2.

Determinants of imperfect competition

(source: the author's made based on Bikker, Spierdijk, 2009)

	Coordinated factors	Unilateral factors
Supply side factors		
Essential	Few firms	Few firms
	High entry and exit barriers	High entry barriers
	Frequent interaction	Heterogeneous products
Important	Transparency	Structural links
	Symmetry	Adverse selection & Moral hazard*
Demand side factors		
	Low firm-level elasticity of demand, incl. switching costs and lock-in effects	Ditto
	Stable demand	Imperfection in financial advice

*Note: *Original source has only adverse selection mentioned however, in author's view, moral hazard should be added as other type of information asymmetry.*

The framework (Bikker, Spierdijk, 2009) contains a list of coordinated and unilateral factors that increase the probability of a tight oligopoly. Coordinated factors refer to explicit or tacit collusion, while unilateral factors refer to actions undertaken by individual firms without any form of coordination with other firms.

Meanwhile the financial market and banking sector continues to develop and change thereby **new risks and potential market failures emerge**. One of the sources where new emerging risks and subsequent market failures have been widely discussed are the speeches of the central bank's spokespersons. Author analysed the speeches of the European Central Bank (2021), the period of 1997 to 2021 was selected, covering in total amount of 2632 speeches. Author searched for the term "market failure". Technically author has used the following formula to find the abovementioned word in the speeches,

$$N = \frac{x - x'}{y} \qquad (1.1)$$

where N – number of strings found, x – number of characters in the speech, x' – number of characters in the speech, which is exempt from the string to be searched, y – number of characters in the string to be searched.

Results show that the term "market failure" was used once in the title of the speech and 41 times in the text of the speech. In the Table 1.3. author has summarised the banking sector market failures reflected in the speeches.

Table 1.3.

Banking sector market failures in the speeches (the author's made based on European Central Bank, 2021)

Market failures in the scientific literature	Market failures in the speeches
Asymmetric information	- Ineffective market discipline (transparency) - Asymmetric information for customers (banking and investment services) - Information friction - Financial instruments that entail risks that are difficult to assess and price - Complex financial institutions (transparency) - Generalised uncertainty regarding counterparty risk - Moral hazard - Adverse selection - Uncertainty about the definition of green activity
Negative spillovers *Systemic risk*	- Financial contagion - Pricing of climate risk - Investor over-reliance on the rating agencies and models - Pro-cyclicality of the financial system (mark-to-market accounting standards, the dependence of collateral values and leverage ratios on asset prices) - Biased system of incentives that lead investors to excessive risk-taking - Excessive borrowing by financial industry and the private sector due to the prevailing low interest rates - Financial system as a channel for the transmission of shocks - Herd behaviour
Market power imbalances	-
Market abuse	Conflicts of interest, e.g., rating agencies, who are paid by issuers of financial instruments
(Not covered in the literature)	- Fragmentation of market self-regulation - Global imbalances in current account positions and capital flows across major economies - Regulatory arbitrage - Structural inefficiencies in debt and collateral enforcement - Inefficient consumption-led boom-and-bust cycles

Summary in the Table 1.3. shows that much of the focus has been concentrated on the information asymmetry and negative spillovers, in particular systemic risk, while market power imbalances (imperfect competition) and market abuse was not in so much focus for the European Central Bank in observed period.

Analysis of the speeches show that new risks have been identified by the staff of the European Central Bank, which has not been classified yet in the scientific literature, e.g., fragmentation of market self-regulation, regulatory arbitrage etc. Existing failure types as well have some new dimensions, e.g., climate risk related issues in "Asymmetric information" and "Negative spillovers".

New dimension in this analysis recently has significantly gained the ground, i.e., **responsibility perspective**. Based on the financial market failures identified in the literature analysis and ECB's speech analysis the author has highlighted those, who deal with responsibility failures of market participants (see Figure 1.3.).
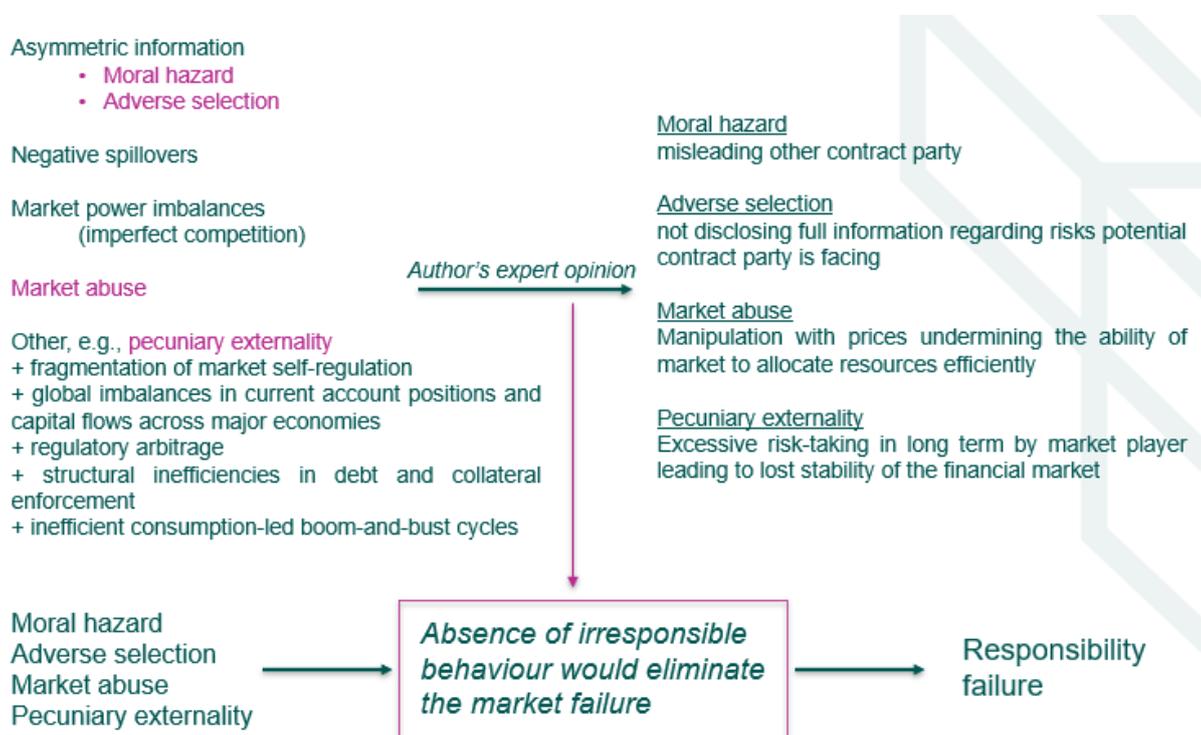
Figure 1.3. Responsibility failures in the financial market failures (the author's made based the sources mentioned above)

Author further is disclosing arguments why certain market failures are treated as responsibility failures:

- Moral hazard – one of the parties in the contract is trying to mislead the other/-s for one's benefit. If such irresponsible behaviour would be absent, the market failure as such would disappear.
- Adverse selection – one of the potential parties in the contract in the process of negotiations on the terms of the contract is not disclosing the full information

regarding the risks the other party would face. The same as with the moral hazard, the absence of this behaviour would lead to disappearance of the market failure.

- Market abuse – manipulation with the prices is treated as inappropriate behaviour of the market participant as it is undermining the basic principle of the market economy to allocate the resources in the most efficient way with the help of market forces.
- Pecuniary externality – market player's management is allocating less capital and liquidity buffers than is socially necessary (but is sufficient for the market player itself) for the financial market to stay stable. This is the case of short-term vs long-term view on the operations of the company thereby deliberate cost shifting to the taxpayers at the later stage is treated as irresponsible behaviour by authors.

Author has analysed the discussion about four abovementioned failures within the same speeches of the European Central Bank (adjusted period): the period of 1997 to 2023 was selected, covering in total amount of 2767 speeches. Authors searched for the terms as per Table 1.4. Terms have been chosen as single phrase to catch all potential conjugations of words. Technically the author has used the Formula (1.1) to find the terms in the speeches.

Table 1.4.

Terms used to search for discussions about market failures (the author's made)

Market failure	Term used in search
Moral hazard	"hazard"
Adverse selection	"adverse"
Market abuse	"abuse"
Pecuniary externality	"pecuniary"

Based on the quantity of terms used, the conclusions have been made on the discussion of responsibility failures in the speeches of the European Central Bank.

Representatives of the European Central Bank address the public approximately every three calendar days in recent years with increasing number of speeches in certain years, e.g., 2008, 2011, 2013 and 2017. The record year with 150 speeches was 2017 (see Figure 1.4.).
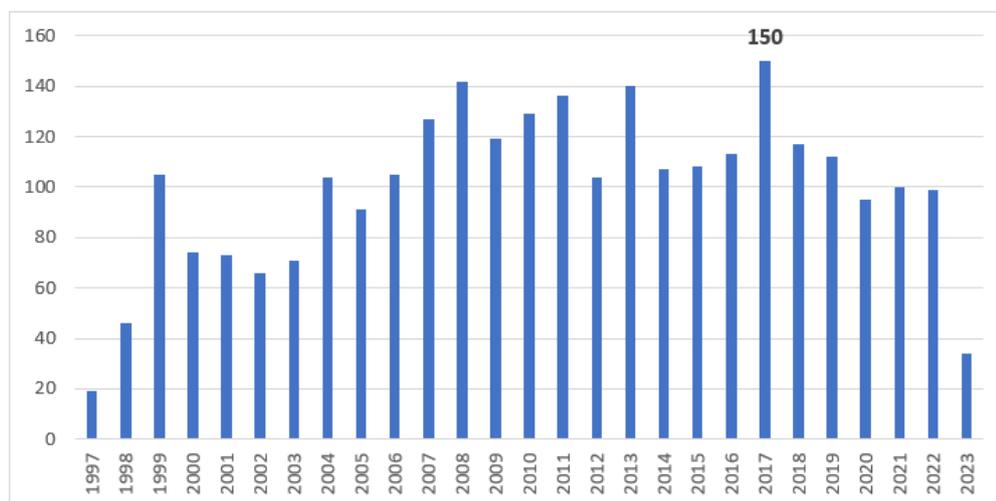
Figure 1.4. Number of speeches made by representatives of the European Central Bank

(the author's made based on European Central Bank, 2023)

In 2020 – 2023 most of the speeches have been made by the President of the European Central Bank and three Executive Board members in total covering 80.5% of speeches (see Table 1.5.).

Table 1.5.

Summary statistics of spokespersons of the European Central Bank, 2020 – 2023

(the author's made based on European Central Bank, 2023)

Spokesperson	Position	No. of speeches	% of total
Christine Lagarde	President	73	22.6
Isabel Schnabel	Member of the Executive Board	69	21.4
Fabio Panetta	Member of the Executive Board	61	18.9
Philip R. Lane	Member of the Executive Board	57	17.6
Luis de Guindos	Vice-President	30	9.3
Frank Elderson	Member of the Executive Board	24	7.4
Yves Mersch	Member of the Executive Board	9	2.8

Summary statistics on the discussion of responsibility failures in the speeches of the European Central Bank have been reflected in Table 1.6.

Table 1.6.

Summary statistics on the discussion of responsibility failures (the author's made

based on European Central Bank, 2023)

Parameter	"hazard"	"adverse"	"abuse"	"pecuniary"
No. of times mentioned	381	1318	60	7
No. of speeches mentioned	252	721	48	7
Average of times mentioned in one speech	1.5	1.8	1.3	1.0
Max times mentioned in one speech	20	10	4	1

Most of times the issues related to the adverse selection have been discussed in the speeches. On average it has been mentioned 1.8 times in one speech, while max it has been mentioned 10 times in one speech. Market abuse and pecuniary externality has been discussed a lot less and it corresponds to conclusions from literature analysis, where those market failures are less discussed.

Market failures are viewed as a justification for the government to intervene (Mankiw, 2009; OECD, 2010; Besanko & Braeutigam, 2011; Rubinfeld & Pindyck, 2013; Ajefu, Barde, 2015) to move the market closer to the perfect competition condition. Government consulting institutions (OECD, 2010; Congressional Research Service, 2020) have defined general policy objectives to be achieved, which links to the conditions of the perfect competition in the financial market (see Table 1.7.).

Table 1.7.

General policy objectives for the banking sector

(the author's made based on OECD, 2010; Congressional Research Service, 2020)

Policy objective	Condition of the perfect competition in the banking sector
Confidence in the financial system and banking sector	General confidence in the functioning of the banking sector. This aspect covers the condition of "perfect information"
Systemic stability (including taxpayer protection against government payouts)	Sufficient shock resistance with ability to self-correct
Safety and soundness of financial institutions	Sufficient shock resistance with ability to self-correct
Market integrity and transparency	(a) Effective and efficient pooling, management and transfer of risks accompanied with correct pricing of risk. This aspect covers prudent risk-taking behaviour as well. (b) General confidence in the functioning of the banking sector. This aspect covers the condition of "perfect information".
Market conduct (including ensuring protection against money laundering and similar fraud) and consumer & investor protection	General confidence in the functioning of the banking sector. This aspect covers the condition of "perfect information"
Efficiency (efficiently allocated capital, pricing reflecting costs, expected return appropriately reflecting risks)	(a) Effective and efficient allocation of liquidity and capital. (b) Effective and efficient pooling, management and transfer of risks accompanied with correct pricing of risk. This aspect covers prudent risk-taking behaviour as well.

Table 1.7. continued

Policy objective	Condition of the perfect competition in the banking sector
Access to financial services to all worthy clients	Sufficient shock resistance with ability to self-correct

At the same time, government intervention is associated with certain costs thereby it should be promoted until benefits from the intervention exceeds the costs (OECD, 2010; Hertog, 2010).

1.4. Principles of the regulation

Based on results in Table 1.3. and Table 1.7. author has defined the principles of regulation. Those principles give foundation for identification of relevant regulation costs. Results of the principles are reflected in Table 1.8. and Figure 1.5.

General overview

Role of the government in respect of addressing market failures was emphasized already in Keynes' (1936) research and later discussed in other research (e.g., Arrow, 1970, 1985; Shubik, 1970; Bjornstad & Brown, 2004; Hertog, 2010; Ajefu & Barde, 2015; Rosengard & Stiglitz, 2015; NSW, 2017).

In those discussions government's intervention in the economy is justified by market failures that have been occurred (Arrow, 1970, 1985; Shubik, 1970; Ajefu & Barde, 2015). Often normative approach is followed (Rosengard & Stiglitz, 2015), when market failures prescribe, what government should do to achieve Pareto efficiency in the market. The practical guidance often is provided in various policy documents (e.g., Bjornstad & Brown, 2004; NSW, 2017).

As per Kay and Vickers (1990) two types of economic regulations can be distinguished: structural regulation and conduct regulation. Structural regulation concerns the regulation of the market structure. Examples are restrictions on entry or exit, and rules mandating firms not to supply professional services in the absence of a recognized qualification. Conduct regulation is used to regulate the behaviour of producers and consumers in the market. Examples are price controls, the requirement to provide in all demand, the labelling of products, rules against advertising and minimum quality standards.

Policy objectives could be achieved by different policy instruments. OECD (2010) is giving an example of what is available to the government for the financial market and banking sector:

1. Surveillance: influence the behaviour and perceptions of market participants thereby deterring misconduct and abuse.
2. Moral suasion with market-based solutions: influence the behaviour of market participants thereby introducing sound corporate governance and risk management practices.

3. <u>Regulation</u>: key policy instrument setting certain outcomes for market participants in clear, pre-determined fashion.
4. <u>Guarantees</u>: guarantee against large-scale losses either from government or market itself (government-imposed requirement to provide guarantees).
5. <u>Lending</u>: provision of liquidity or longer-term lending support to market participants.
6. <u>Subsidies, grants, and programmes</u>: direct financial support to market participants, e.g., through taxes.
7. <u>Government ownership and control</u>: government may establish special government enterprises or take control of existing financial institution in case of financial institution failure.

Principles of the regulation

Regulation is key policy instrument to be used for government intervention in the financial market and banking sector. Author further has summarized the principles of regulation (see the summary in the Table 1.8.):

1. <u>Cost-benefit balance</u>: costs should be lower than expected benefits, incl. from minimized market failures (OECD, 2010; Hertog, 2010; Teall, 2013; Ajefu, Barde, 2015). Crisanto & Ehrentraud (2021) comment on the balance seeking in the Big Tech market, which currently becomes more important due to its size. Llewellyn (2006) stresses the importance of proper institutional structure to keep costs as low as possible considering governance risks.
2. <u>Confidentiality</u>: appropriate confidentiality should be ensured due to the concerns of competition, stability of market and its players and security of physical infrastructure (OECD, 2010; BCBS, 2012, 2021). Crisanto, Ehrentraud (2021) comment on the new tendences in Big Tech, which present challenges for competition, data privacy, and cyber security.
3. <u>Precaution</u>: policymakers should proactively anticipate and address emerging risks and problems and not initiate reforms solely in response to the onset of a crisis (OECD, 2010). Wyplosz (2001) stresses the importance of properly assessing risks of liberalized financial systems to avoid absence of critical financial infrastructure in such systems.
4. <u>Risk based</u>: financial regulation should be oriented to the risks in the financial system and give priority to those risks that, due to their nature or impact, have the greatest potential of compromising the achievement of policy objectives or undermine systemic resiliency (Freixas & Gabillon, 1999; OECD, 2010; Buck, 2015; ESMA, 2016; Mester, 2017). Brunnermeier et al (2009) also emphasize importance of capturing the risk-spillovers from one financial institution to other. BCBS (2012) emphasize the need to develop and maintain a forward-looking assessment of the risk profile of individual banks and banking groups. Current development of Big Tech put challenges to properly identify all the risks

associated with developing market (Crisanto, Ehrentraud, 2021). World Bank (2019b) documents the importance of defining bank regulatory capital narrowly, as the quality of capital matters in reducing bank risk. Meanwhile even some regulators have warned that too complex regulation poses risks for seeing the real risks building in the financial systems (Noonan, 2021). In separate interviews with the Financial Times, Norway and Denmark's financial supervision chiefs address the issue of too complex regulation requiring substantial resources to implement them and manage to see the big picture.

5. Sound incentives: financial regulation should seek to align the incentives of participants with policy objectives by adjusting the nature, form, and strength of directive authority, compulsion, and supervision as appropriate, and using other policy instruments where necessary and appropriate (OECD, 2010; BCBS, 2012; IMF, 2021). Mester (2017) stresses that the regulatory framework must recognize that it creates incentives for financial institutions, their customers, and the regulators themselves and that market forces are always at work.

6. Comprehensiveness: financial regulation should ensure that all identified market failures and broader economic and social needs are properly addressed, at a domestic and global level, and involve the full use of all regulatory tools and mechanisms to achieve policy objectives, including through the combination of regulation with other policy instruments (OECD, 2010; BCBS, 2012; Teall, 2013; BCBS, 2021; IMF, 2021).

7. Consistency and competitive neutrality: financial regulation should be applied in a consistent, "functionally equivalent" manner, i.e., neutral from a product, institutional, sectoral, and market perspective so that similar risks are treated equivalently by regulation (Bhattacharya, Boot & Thakor, 1998; Crampton, 2002; OECD, 2010; BCBS, 2012; Noonan, 2021; Principles for Good Financial Regulators, n/d). Deviation from this approach in the Australian banking system has been criticized by Chester (2020) arguing that oligopoly in the banking market has resulted in the current pricing power remaining above 40% higher than the average of high-income countries. To this category calls for flexibility are added as well (Kozarević, Polić, Perić, 2017).

8. High quality, transparent decision-making, and enforcement (OECD, 2010). Transparent and clear communication is highly appreciated by the market participants. The Institute of Chartered Accountants in England and Wales has published its suggestions for the financial market regulator (Principles for Good Financial Regulators, n/d), where significant focus is dedicated to clear communication and predictability. Simplicity is other perspective of effective regulation element as per BCBS in this respect (2013). Coombs (2016) stresses the importance of theoretical background of regulation in order to avoid "sociological hubris". Groll, Halloran & McAllister (2021) developed a general model of the policy-making process in which legislators delegate authority to regulate financial risk at both the firm (micro-level) and systemic levels (macro-

level). The model explains changes in U.S. financial regulation leading up to the financial crisis in 2008.

9. <u>Systematic review</u>: this assessment should evaluate whether the regulation achieved its specific objective(s) and did so in a cost-efficient manner, and whether the decision-making process could be improved (OECD, 2010).

10. <u>International coordination, convergence, and implementation in policy and rulemaking</u>: financial regulation should, to the extent possible, be comprehensive and consistent internationally, with effective coordination where relevant and gradual convergence over time insofar as policy objectives are shared (OECD, 2010; BCBS, 2012, 2021; Buck, 2015; Mnuchin & Phillips, 2018). Lockwood (2002) notes: "The informal conclusions of this literature are that decentralization yields a higher level of surplus than does centralization if (a) inter-regional externalities are small; (b) regions are relatively heterogenous." Dell'Arricia, Marquez (2006) argues in favour of this approach however notes that it lowers the level of flexibility. Brunnermeier et al (2009) stresses the importance of international cooperation for capital and liquidity adequacy needed to minimize risks in bailouts.

11. <u>Accountability</u>: the regulatory framework needs to be designed so that institutions, regulators, and policymakers can be held accountable for the responsibilities assigned to them (BCBS, 2012; Mester, 2017; BCBS, 2021).

12. <u>Management of climate-related risks</u>: pressure to adapt financial policies and regulatory frameworks to incorporate climate-based considerations is coming from multiple directions, first and foremost from growing awareness in the financial industry itself (Demekas, Grippa, 2021).

Many aspects have been covered by several authors, e.g., "risk based" has been covered 8 times. Meanwhile climate-related responsibilities started to appear only recently. A lot of aspects that BCBS (2012) has included in its principles cover surveillance thereby author has included in the list only those aspects that cover regulation area.

Table 1.8.

Summary table of researchers' conclusions on the principles of regulation

(the author's made based on the sources mentioned in the table)

	Cost-benefit balanced	Confidentiality	Precaution	Risk based	Sound incentives	Comprehensiveness	Consistency and competitive neutrality	High quality, transparent decision-making, and enforcement	Systematic review	International coordination, convergence, and implementation in policy and rulemaking	Accountability	Management of climate-related risks
Bhattacharya, Boot, Thakor, 1998				X			X					
Freixas, Gabillon, 1999				X								
Wyplosz, 2001			X									
Lockwood, 2002										X		
Crampton, 2002							X					
Dell'Arricia, Marquez, 2006										X		
Llewellyn, 2006	X											
Brunnermeier et al, 2009				X						X		
Hertog, 2010	X											
OECD, 2010	X	X	X	X	X	X	X	X	X	X		
BCBS, 2012		X		X	X	X	X			X	X	
Teall, 2013	X					X						
BCBS, 2013				X				X		X		
Ajefu, Barde, 2015	X											
Buck, 2015				X						X		
ESMA, 2016				X								
Coombs, 2016								X				
Mester, 2017				X	X						X	
Kozarević, Polić, Perić, 2017							X					
Panagopoulos, Chatzigagios, Dokas, 2018							X	X				
Mnuchin, Phillips, 2018								X		X		
World Bank, 2019				X								
Chester, 2020							X					
BCBS, 2021		X				X				X	X	

Table 1.8. continued

	Cost-benefit balanced	Confidentiality	Precaution	Risk based	Sound incentives	Comprehensiveness	Consistency and competitive neutrality	High quality, transparent decision-making, and enforcement	Systematic review	International coordination, convergence, and implementation in policy and rulemaking	Accountability	Management of climate-related risks
Crisanto, Ehrentraud, 2021	X	X		X								
Demekas, Grippa, 2021												X
IMF, 2021					X	X						
Noonan, 2021				X			X					
Groll, Halloran, McAllister, 2021				X				X				
Principles for Good Financial Regulators, n/d								X				

68% of sources refer to the following 5 principles: "cost-benefit balanced", "risk-based", "consistency and competitive neutrality", "high quality transparent decision-making, and enforcement" and "international coordination, convergence, and implementation in policy and rulemaking" (see Figure 1.5.). The most important principles in Figure 1.5. are coloured green while all others – blue.

Many aspects that BCBS (2012) has included in its principles cover surveillance thereby author has included in the list only those aspects that cover regulation area.
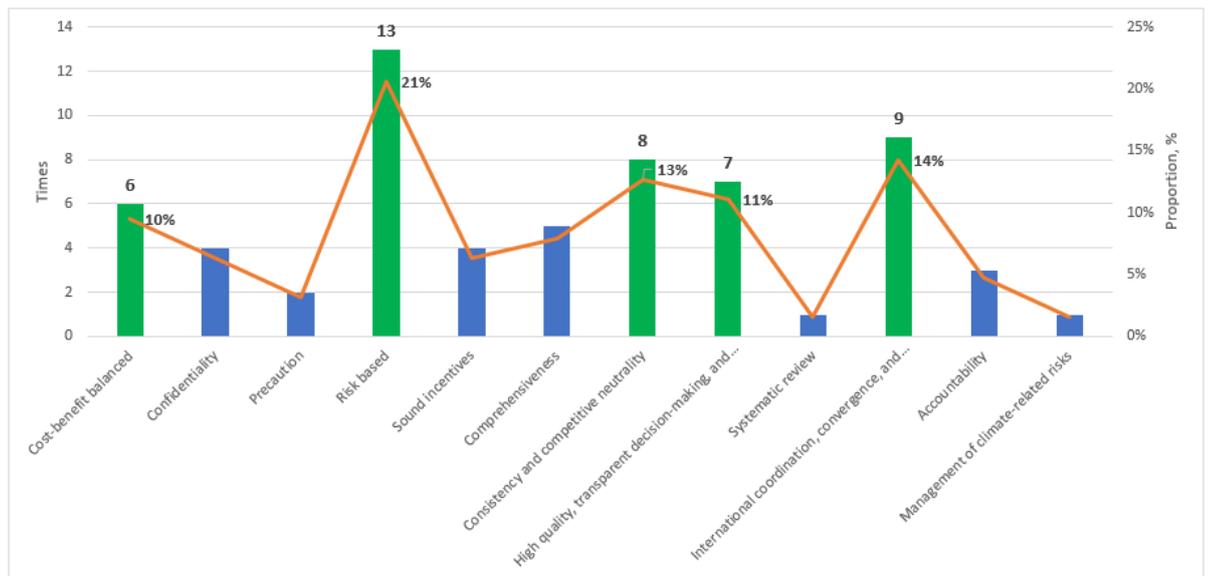
Figure 1.5. Most important principles of regulation (the author's made based the sources mentioned in the Table 1.8.)

Further analysis focus on the "Top5" principles to give background for regulation costs' assessment.

Expert analysis of 20 foreign supervisory authorities has been used to test the robustness of identified principles. The list of authorities contacted is presented below together with the status of the request as of 29 April 2023.

Answered to the request
1. Danish Financial Supervisory Authority,
2. Bank of Slovakia,

Not answered to the request
3. Bank of Lithuania,
4. Estonian Financial Supervision and Resolution Authority,
5. Polish Financial Supervision Authority,
6. German Federal Financial Supervisory Authority,
7. Bank of Italy,
8. Bank of Slovenia,
9. Croatian Financial Services Supervisory Agency,
10. Swedish Financial Supervisory Authority,

Declined the request
11. European Central Bank,
12. French Financial Supervisory Authority (*The Autorité des marches financiers*),

13. Dutch Authority for the Financial Markets – asked to forward the request to the Dutch Central Bank,
14. Luxembourg Financial Supervisory Authority (*The Commission de Surveillance du Secteur Financier*),
15. Finnish Financial Supervisory Authority,
16. Bank of Portugal,
17. Austrian Financial Market Authority,
18. Central Bank of Ireland,

Informed that the request has been sent to the relevant structural unit
19. Belgian Financial Services and Markets Authority, which asked to forward the request to the National Bank of Belgium,
20. Bank of Spain.

The choice of authorities was based on the participation in the euro area or close neighborhood with the Baltic region (Poland, Sweden, and Denmark). Some authorities from the euro area were not possible to contact due to the absence of e-mail and contact form with enabled option to add the file.

Supervisory authorities were asked, whether in their view, Top 5 regulation principles retrieved from literature analysis (abovementioned 5 principles that 68% of sources refer to) cover current regulator's agenda and topicality.

Danish Financial Supervisory Authority on that question commented that "I believe that you have retrieved relevant core principles". Additionally, comment was given that the principle of "cost-benefit balanced" includes "the political choice to decide and accept some growth offer (less economic growth benefit) given the risk aversion, and therefore a risk aversion balancing less likelihood/ probability to suffer high crisis impact".

Bank of Slovakia additionally shared the principles of proportionality, independence, and equal treatment.

1.5. Theoretical backbone of methodologies for the Government Regulation Model

In this Section author elaborates on the results of literature analysis for the deadweight loss arising from market failures and regulation costs derived from the regulation principles:
1. General review of concepts (Hertog, 2010; Fulbert, 2012; Erol, Ordoñez, 2017; Hahn, Sunstein, 2002; Administrative Conference Recommendation, 2014; Masur, Posner, 2015; Perkins, Carey, 2017; Arrow and Lind, 1970; Keeney and Raiffa, 1976; Haimes, 2005; Farrow, 2015; Merisalu, Sundell, Rosén, 2021 and others).
2. Based on market failures revealed in Table 1.3. author has reviewed literature to identify approaches of the deadweight loss assessment arising from market failures,

e.g., Harberger Triangles etc. Results are reflected in Formulas (1.10) to (1.12) and in Table 1.10.

3. Based on the regulation principles and their "Top5" revealed in Table 1.8. and summarized in Figure 1.5. author has reviewed literature to identify approaches of regulation intensity assessment (reflected in Section 1.5.2.) and regulation costs assessment (reflected in Sections 1.5.3. to 1.5.5.). Summary of taxonomy of regulation costs is revealed in Figure 1.18. and the link between the Top5 regulation principles and regulation costs are revealed in Table 1.9.

Table 1.9.

Link between the Top5 regulation principles and regulation costs (the author's made)

Regulation principle	Regulation costs	Comments
Cost-benefit balanced	Regulatory costs, compliance costs	Both – regulator and market participant – consider this principle when deciding on their actions regarding regulation.
Risk-based	Regulatory costs, compliance costs	Both – regulator and market participant – consider this principle when deciding on their actions regarding regulation.
Consistency and competitive neutrality	Indirect costs	This principle covers market environment related matters.
High quality transparent decision-making, and enforcement	Compliance costs	This principle covers the extent of how much efforts will be required from market participant to comply with regulations.
International coordination, convergence, and implementation in policy and rulemaking	Indirect costs	International coordination is often managed through supranational institutions, e.g., European Central Bank. Thereby communication aspects are important as it is one of main tools those institutions use to transmit their policy targets.

General review

Hertog (2010) in the analysis of previous research revealed three types of costs arising from the regulation (calling them as "intervention costs"): regulatory costs, compliance costs and indirect costs. These costs then were put into the context of welfare loss arising from market failures and the concept of the optimal level of welfare loss control were introduced (see Figure 1.6.).
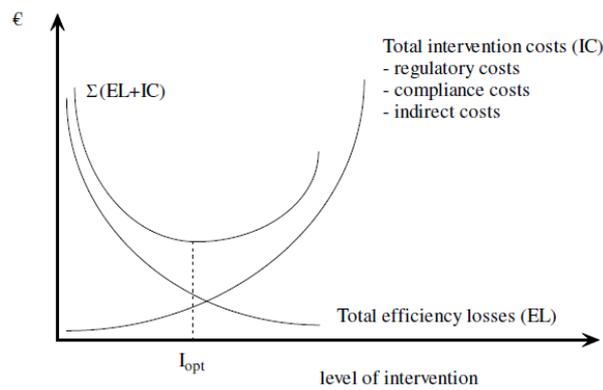
Figure 1.6. Optimal level of welfare loss control (Hertog, 2010)

This concept shows how (a) the deadweight (welfare) loss of market failures decrease and (b) costs of the government intervention increase with the increased level of the government intervention. And in this visualization, it is clearly shown that it is efficient to mitigate market failure till the point where costs arising from regulations are lower than the deadweight (welfare) loss. Hertog (2010) this point defines as "trade-off" between resources allocated to increasing levels of regulatory intervention and decreasing levels of inefficient firm behaviour.

Fulbert (2012) on her analysis found that the overall effect of optimal regulation on social welfare is positive when productivity shocks are sufficiently high (for example, in the subprime banking crisis episode) and economic agents are sufficiently risk averse. Her model implies an **optimal level of regulation** that prevents crises but at the same time is detrimental to growth.

Erol and Ordoñez (2017) research bank relationships in the interbank lending market where banks operate to face liquidity needs and to meet investment possibilities. They show that the interbank network can suddenly collapse when regulations are pushed beyond a **critical level**, with a discontinuous increase in systemic risk as the cross-insurance of banks collapses.

Marchionne, Pisicoli, and Fratianni (2022) examines the optimal level of regulation intensity depending on the probability of crisis, which is other dimension of social costs arising from market failures (see Figure 1.7.).
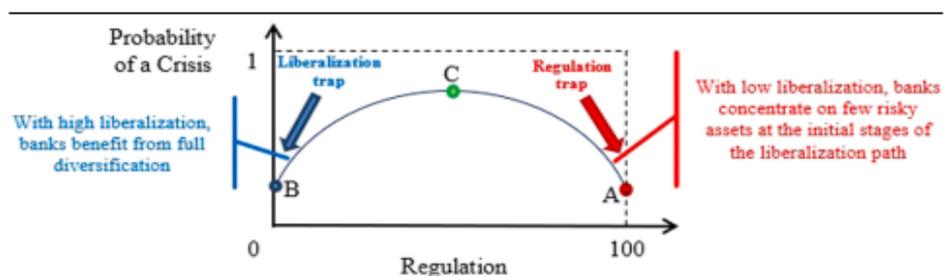

Figure 1.7. Optimal level of regulation intensity (Marchionne, Pisicoli, Fratianni, 2022)

As per Perkins & Carey (2017) Cost-Benefit Analysis (CBA) in the federal rulemaking process is the systematic examination, estimation, and comparison of the potential economic costs and benefits resulting from the promulgation of a new rule. Benefits may include such

outcomes as deaths and injuries avoided, acres of rare habitat saved, or a decreased probability of financial crisis. Costs may include outcomes such as increased production costs for companies, regulation compliance cost to companies, and increased prices for consumers.

Hahn & Sunstein (2002) comments that societal costs and benefits may be difficult to accurately estimate, quantify, and monetize. Therefore, performing most CBAs involves some degree of subjective human judgement and uncertainty, and predicted results are often expressed as a range of values.

Masur & Posner (2015) comments on the challenges, which face CBA approach:

1. behavioural changes of people as they adapt to a new regulation, which are difficult to predict,
2. quantification that must overcome uncertainty over the causal relationship between the regulation and outcomes,
3. monetization, which is difficult for outcomes that do not have easily discernible monetary values.

Variations of CBAs address some of these difficulties, including:

1. cost-effectiveness analysis, which compares costs of alternative regulation (ranging from stringent to lenient) when benefits cannot be accurately quantified or monetized,
2. breakeven analysis, which can establish the likelihood or under what conditions a regulation would be beneficial. In these analyses, the magnitudes of the quantified costs and benefits are compared to determine what values of the unquantified variables would have to be for the regulation to break even or impose no net cost on society,
3. qualitative analysis with expert judgement, in which experienced professionals describe and explain likely effects that cannot be quantified and make a judgement as to how costs compare with benefits,
4. retrospective analysis, which estimates the realized costs and benefits following some period of time – often years – after implementation of rules. This analysis eliminates some uncertainties about what outcomes will be observed under the regulation. However, the results of the analysis still involve assumptions and uncertainty in assessing the degree to which the regulation caused the observed outcomes or estimating what outcomes would have been realized if the regulation had never been implemented (Administrative Conference Recommendation, 2014).

Coates (2015) have introduced four dimensions of Cost-Benefit Analysis: concepts, quantification, process, and mandates. He illustrates the multiple meanings that apparently synonymous uses of "Cost-Benefit Analysis" might have for different speakers or audiences. In his analysis Coates warns that CBA process requirements can also have less desirable effects, however, including delay, regulatory inertia, ill-informed judicial second-guessing, creation of incentives for agencies to engage in CBA for show, and waste of regulatory resources.

Standard Cost-Benefit Analysis is carried out in the world of certainty for individual outcomes and the aggregation of individual values is based on the risk neutrality (Farrow, 2015). Risk preferences in the Cost-Benefit Analysis assess the valuation of individuals, and then typically although not necessarily present the expected value of such valuations (Arrow and Lind, 1970; Keeney and Raiffa, 1976; Haimes, 2005; Farrow, 2015). The value of metric

for Cost-Benefit Analysis and Advanced Cost-Benefit Analysis models (risk adjusted) as per Vining and Boardman (2006) is Net Present Value, shortly – NPV.

As per Farrow (2015) if adjusting the standard NPV formula (1.2), which is expressed as the Present Value of Net Benefit,

$$\text{NPV} = \sum_{t=0}^{n} \frac{B_t - C_t}{(1+r)^t} = \sum_{t=0}^{n} \frac{CS_t + PS_t + GR_t + EX_t}{(1+r)^t} \qquad (1.2)$$

where NPV – Net Present Value, B – benefits, C – costs, CS – consumer surplus, PS – producer surplus, GR – government revenue, EX – externalities,

for risk preference, probability measure is added:

$$\text{ENPV} = \sum_{i=0}^{n} \sum_{t=0}^{n} \left(\pi_i \cdot \frac{RB_{it} - RC_{it}}{D(t)} + \varepsilon_{it} \right) =$$

$$= \sum_{i=0}^{n} \sum_{t=0}^{n} \left(\pi_i \cdot \frac{RCS_{it} + RPS_{it} + GR_{it} + REX_{it}}{D(t)} + \varepsilon_{it} \right) \qquad (1.3)$$

where ENPV – Expected Net Present Value, RB – risk adjusted benefits, RC – risk adjusted costs, RCS – risk adjusted consumer surplus, RPS – risk adjusted producer surplus, GR – government revenue, REX – risk adjusted externalities, D(t) – discount function.

In engineering sciences (Merisalu, Sundell, Rosén, 2021) Risk-Adjusted Cost-Benefit Analysis is performed to balance costs of risk avoidance and risk mitigation activities, i.e.,

1. The risk of not implementing necessary measures, resulting in damages and damage costs for the project owner, the society, and the environment,
2. The risk of implementing measures when not needed, resulting in unnecessary implementation costs.

Merisalu, Sundell, Rosén (2021) has developed the hydrogeological risk management framework for decision support on risk-reducing measure alternatives, which shows the place of Cost-Benefit Analysis within the risk evaluation process and, more broadly, within the risk management process.

Research gap identified by author is in the quantification of the general concept, which looks on the whole market level to assess the overall government intervention level. In further sections author analyses current scientific ideas that could be used in the model of **the Government Regulation Model** considering the insights from Table 1.9.

1.5.1. Deadweight loss measurement

Assessment of the deadweight loss started with so called the Harberger Triangles (Harberger, 1964a; 1964b), where Harberger offered a clear and persuasive derivation of the triangle method of analysing deadweight loss and applied the method to estimate deadweight losses due to income taxes in the United States. Harberger (1966) shortly thereafter produced estimates of the welfare cost of the United States' capital taxes. In a subsequent survey, Harberger (1971) clarified various aspects of this method and addressed several its perceived shortcomings.

Harberger's approach is based on the deviation of market equilibrium measured in terms of price and quantity (see Figure 1.8.).
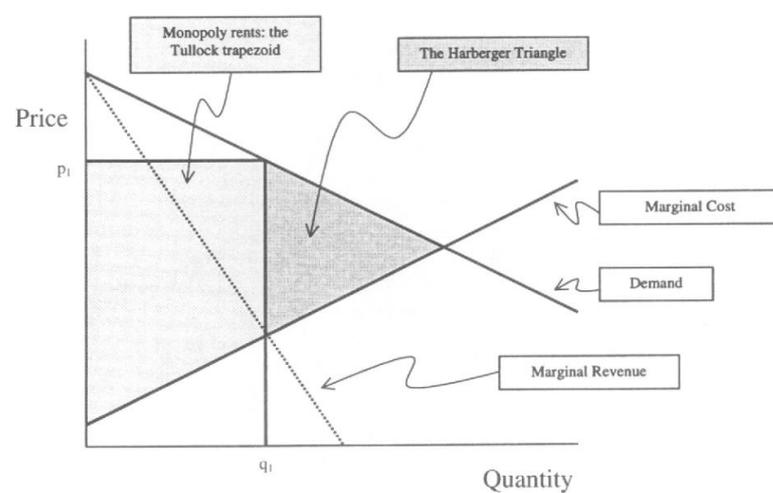
Figure 1.8. The Harberger Triangle (Hines, 1999)

As per Yoon's (2004) comments regarding the Figure 1.8., a firm faces totally different marginal revenue curves depending on whether it is in a competitive market or in a monopolistic market. In a competitive market, a firm is a price taker and must accept the price ruling in the market. Therefore, a perfect competitor faces a horizontal marginal revenue curve at the point where the market price will be. In a monopolistic market, however, firms are aware that they can use their monopoly power. Thus, they can determine both the price and output of their product as a price setter. A monopolist will reduce output when it wants to raise a price, while it will lower a price when it wants to increase output. Increasing output reduces the firm's marginal revenue, and the monopolist firm faces a downward marginal revenue curve.

Thereby if total quantity of output decreases and its social welfare consequently decreases by the area of the triangle ABC (see Figure 1.8. and Figure 1.9.). Such social welfare loss is called the social cost of monopoly because it is caused by the firms who have monopoly power.
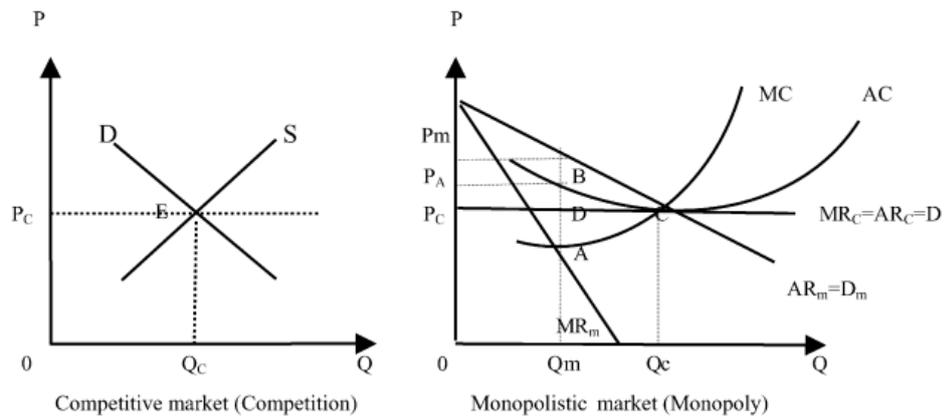
Figure 1.9. Equilibrium in competitive and in monopolistic market (Yoon, 2004)

Deadweight loss can be visualized in the Figure 1.10. if the following assumptions have been ensured:

1. the demand curve is a downward linear and Marshall demand curve, which can measure consumers' surplus more accurately,
2. transition from competition to monopoly may increase both price and cost,
3. long-run average cost and long-run marginal cost are constant and equal, which means that both represent the long-term profit rate of a monopolist based on its average profit rate,
4. there is no price discrimination under monopoly,
5. the price elasticity of demand (η) is 1,
6. the utility function of individual component of society is all equal.

In this case triangle ABE represents the deadweight loss,

$$DWL = \Delta ABE = 0.5 \cdot AB \cdot BE \cdot \eta \tag{1.4}$$

where DWL – deadweight loss, AB – price difference ($P_m – P_c$), BE – quantity difference ($Q_m – Q_c$), η – price elasticity, P_m – price in monopoly, P_c – price in competition, Q_m – quantity in monopoly, Q_c – quantity in competition
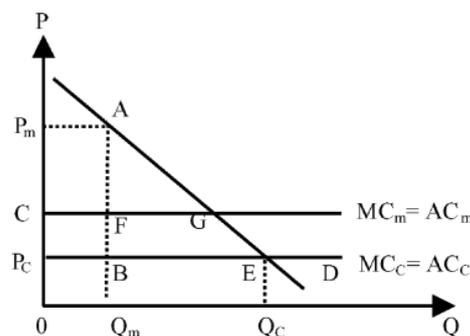
Figure 1.10. Deadweight loss due to monopoly power (Yoon, 2004)

Yoon (2004) measures *AB* as excess profit per unit resulting from shifting a market from competition to monopoly,

$$AB = \frac{TR - TC}{Q_m} \tag{1.5}$$

where TR – total revenue, TC – total costs, Q_m – quantity in monopoly

And *TC* is measured with following components,

$$TC = PC + SM + NOC + CT + KK(r) \tag{1.6}$$

where PC – raw materials, wage and retirement allowance, and overhead costs,

SM – selling and general administrative expense (include all costs for entertainment, advertising, transportation, welfare and conveniences, research and development, fuel and electric power, and rent)

NOC – non-operating costs,

CT – tax and public imposts,

KK – tangible fixed assets, r – ratio of capital gain, which signifies the returns from capital cost.

Yoon (2004) then expresses *BE* from the Formula 1.4.,

$$BE = AB \cdot \frac{Q_m}{P_m} \cdot \eta \tag{1.7}$$

When Formulas 1.4. – 1.7. combined, the deadweight loss can be expressed,

$$DWL = TR - (PC + SM + NOC + CT + KK(r))^2 \cdot \frac{\eta}{2TR} \tag{1.8}$$

$$\frac{DWL}{\eta} = \frac{(TR - TC)^2}{2TR} > 0 \tag{1.9}$$

One of the applications of the Harberger Triangles is the deadweight loss assessment in the taxation, which is relevant to all markets. Tax introduction reduces quantities produced, increases price for the buyer and decreases price for the seller – the difference then creates the tax revenue (see Figure 1.11.).
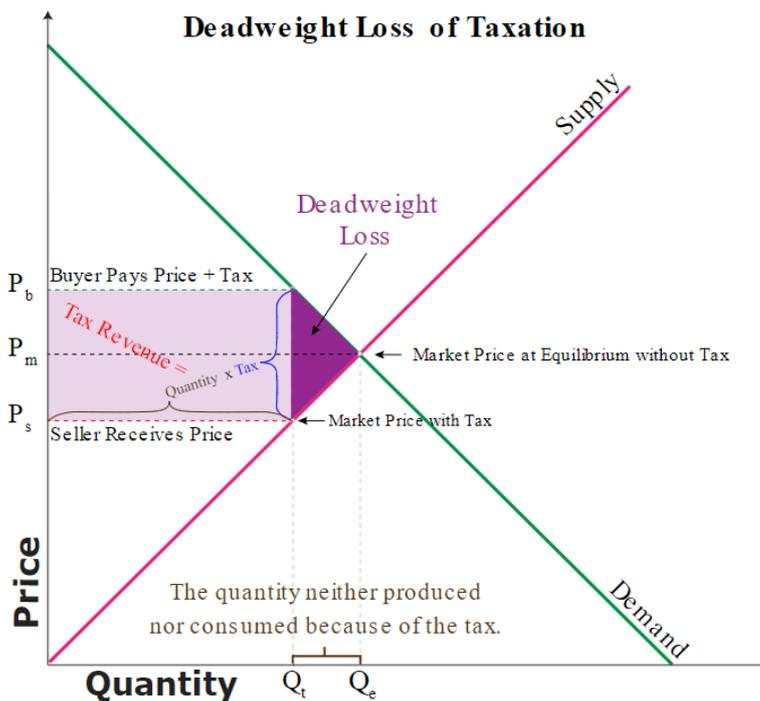
Figure 1.11. The Harberger Triangle in the taxation[3]

In the Figure 1.11. the general case is reflected. Tax revenue and deadweight loss depends on the tax rate. Despite intuition that higher tax rate should produce more tax revenue, this could be wrong due to the deadweight loss (see Figure 1.12.).
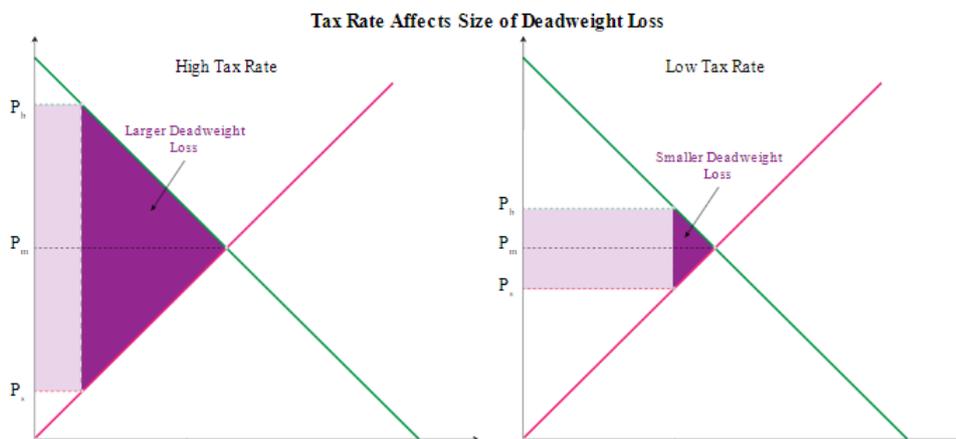
Figure 1.12. Deadweight loss and tax rate[3]

The other factor influencing the tax revenue and the deadweight loss is elasticity of demand and supply. Different combinations affect tax burdens on buyers and sellers, tax revenue and deadweight loss as such (see Figure 1.13.).

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[3] Source of the picture: https://thismatter.com/economics/deadweight-loss-of-taxation.htm
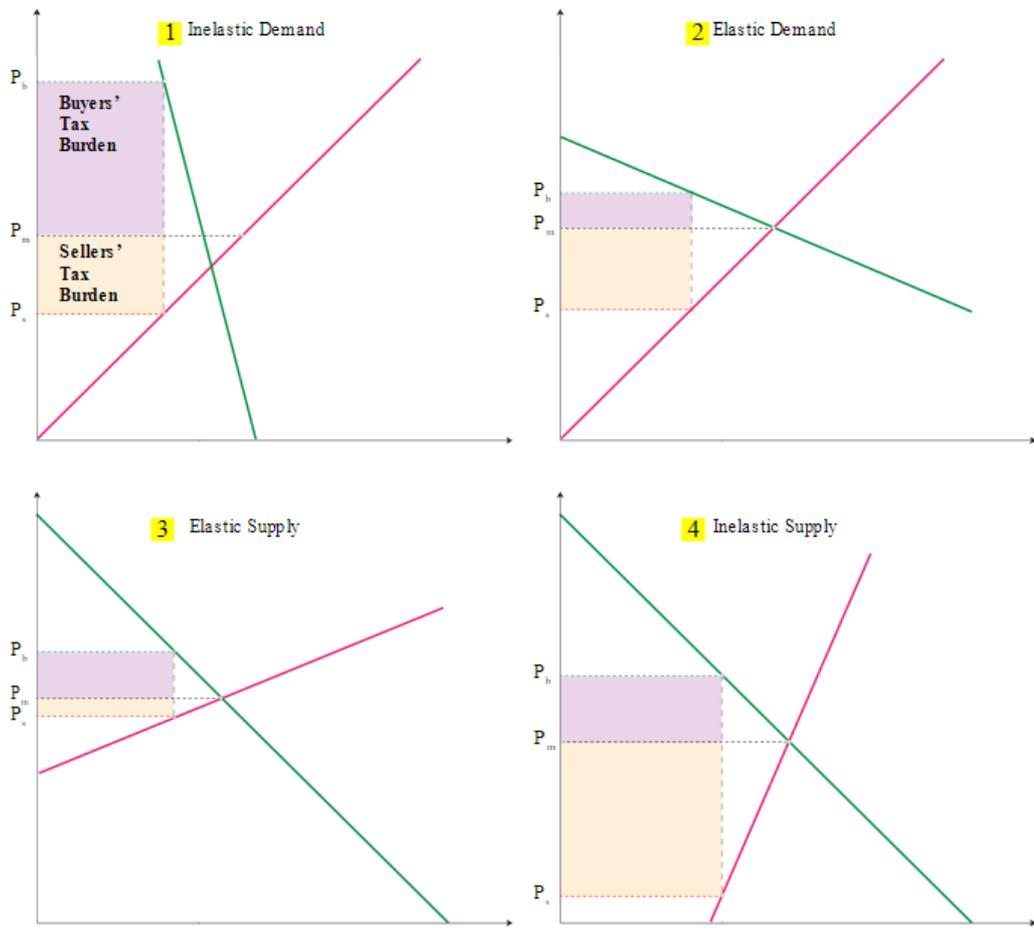
Figure 1.13. Deadweight loss, tax revenue and elasticity of demand and supply[3]

Abovementioned examples and formulas cover simple cases. It is important to introduce the formula for the deadweight loss calculations, which can be used for different functions – both linear and non-linear.

Considering the abovementioned the deadweight loss of market power imbalances can be expressed as

$$\int_{q(X*)}^{q(X)} [D(q) - S(q)]dq \qquad (1.10)$$

where $q(X*)$ – quantity with market power imbalances, $q(X)$ – equilibrium quantity in the competitive market

General idea of the deadweight loss identification and visual interpretation reflected in the Figure 1.8. has been adjusted for the case of information asymmetry, e.g., by Furubotn and Richter (2005). The case with information asymmetry in the supply side is reflected in the Figure 1.14. The deadweight loss is reflected in the triangle from supply function adjustment (S + TC).
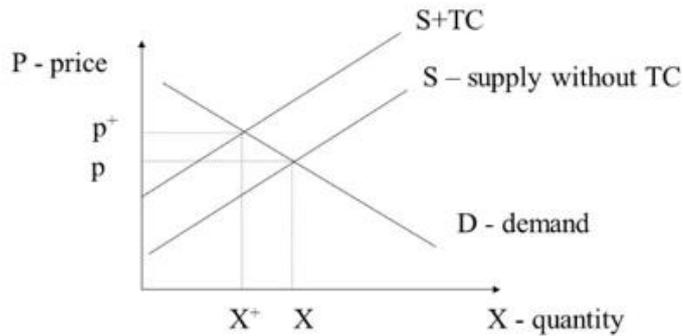
Figure 1.14. Deadweight loss due to information asymmetry (Furubotn, Richter, 2005)

Considering that the demand is expressed as $p = D(q)$, supply without transaction costs (TC): $p = S(q)$ and supply with TC: $p = S*(q)$, the deadweight loss can be expressed as

$$\int\limits_{q(X*)}^{q(X)} [D(q) - p]dq \qquad (1.11)$$

where $q(X*)$ – quantity with asymmetric information, $q(X)$ – equilibrium quantity in the competitive market

The case with negative spillovers (or externalities as referred to in other sources) is reflected in the Figure 1.15. The deadweight loss is reflected in the triangle between the social and marginal costs, i.e.,
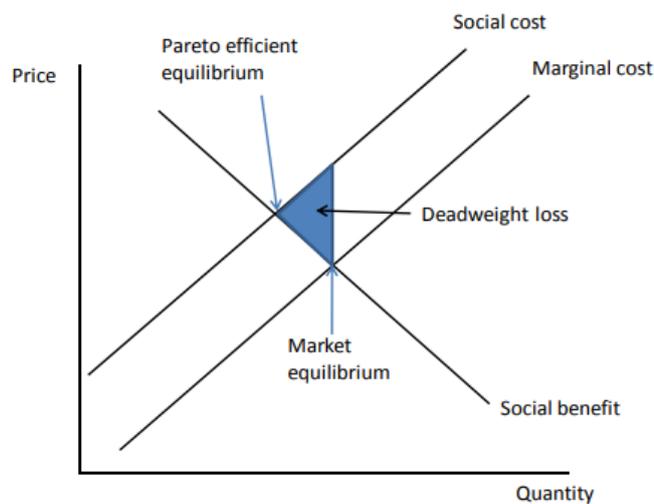
Figure 1.15. Deadweight loss due to negative spillovers/ externalities (Pigou, 1920)

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Considering that the social benefit is expressed as $p = SB (q)$ and social cost: $p = SC (q)$, the deadweight loss can be expressed as

$$\int_{q(X*)}^{q(X)} [SC(q) - SB(q)]dq \qquad (1.12)$$

where $q(X*)$ – quantity with Pareto efficient equilibrium, $q(X)$ – quantity with market equilibrium

Specific case with the deadweight loss calculation should be viewed when subsidies are applied (see Figure 1.16.), however in this doctoral research author skips the case since under normal circumstances financial market, banking sector in particular, are not subject to subsidies.
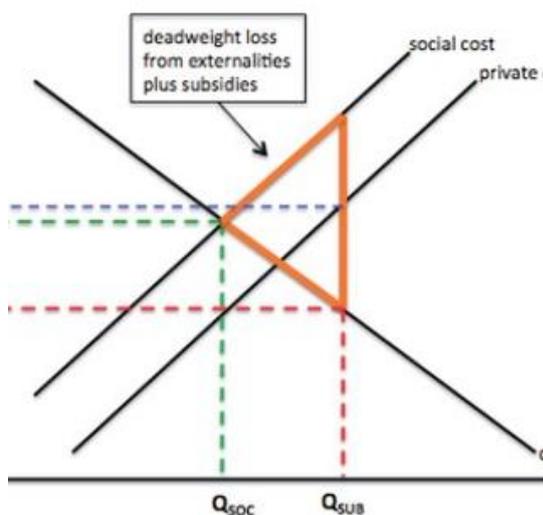
Figure 1.16. Deadweight loss when subsidies are applied (Gopal et al., 2013)

The Harberger Triangle approach has been used further in the financial market to assess different market failures. In the Table 1.10. author summarises what variables have been used as "price" and "quantity".

Table 1.10.

Variables of the Harberger Triangle (the author's made based on the research papers in the table)

Market failure	Research paper	Variable for "price"	Variable for "quantity"
Asymmetric information	DeFusco, Tang, Yannelis, 2022	price, cost, or willingness to pay for the loan as a share of the initial loan amount	share of potential borrowers in the market

Table 1.10. continued

Market failure	Research paper	Variable for "price"	Variable for "quantity"
Asymmetric information/ Market power imbalances	Crawford, Pavanini, Schivardi, 2018	credit price (interest rate)	credit supply
Negative spillovers	BIS, 2018 Cerutti et al., 2017 Bruno, Shin, 2015 Correa et al., 2015 Tonzer, 2015 Cetorelli, Goldberg, 2012	interest rates	bank capital flows
Asymmetric information	Corrado, Schuler, 2017	quadratic loss function	output gap variance volatility of inflation
Asymmetric information	Johnson, So, 2017	*not described*	option-to-stock volume ratios
Asymmetric information	European Central Bank, 2016 Hey, 2003	NPL* price and quality	quantity of NPLs
Asymmetric information	Einav, Finkelstein, 2011	price (and expected cost) of the insurance contract	quantity of insurance demand
Market power imbalances	Oroz, Salas, 2003 Fernández de Guevara et al., 2005	interest rates of loans, deposits, and interbank market	GDP
Market power imbalances	Freixas, Rochet, 1997	interest rates of loans, deposits, and interbank market	*not described*

*NPL – Non-performing loan

Other research mostly covers variables for "price", e.g., international financial spillovers (Fratzscher et al, 2014; Mishra et al, 2014; IMF, 2016). DeFusco, Tang and Yannelis (2022) as price offer "willingness to pay for the loan as a share of the initial loan amount" which could be challenging to observe in data.

1.5.2. Government regulation intensity measurement

Government intervention level depends on the role it has in the economy. Policy Lab of the United Kingdom has developed the framework to describe the roles of government depending on the deepness of intervention (Policy Lab, 2020) with following dimensions (observe the order):
1. Influence
2. Engage
3. Design
4. Develop

5. Resource
6. Deliver
7. Control

More details on the concept are described in the Appendix 1.

In Figure 1.17. Policy Lab (2020) has described the types of intervention depending on the deepness of intervention: from stewardship to laws.

Figure 1.17. Types of intervention (Policy Lab, 2020)

When it come to the quantification approaches of government intervention level and regulation intensity:

- some literature defines the level of intervention from the **government spending** perspective, e.g., Kormendi and Meguire (1985), Ram (1986), Alexander (1994), Evans (1997), Kneller, Bleaney and Gemmell (1998), Afonso and Jalles (2011).
- Gorgens et al. (2003), Loayza et al. (2004), Djankov et al. (2006), Jalilian et al. (2007), Jacobzone et al. (2010) developed the **regulatory indicator** using the data from surveys to construct the indicator values. Some research is using other indicators, like Doing Business, Index of Economic Freedom etc.
- Djankov et al. (2002) in the case with start-up companies used the **number of official procedures to be completed and time taken** to assess the regulatory burden. **Time perspective** was in the focus of Ciccone and Papaioannuou (2007) research when they assessed the time taken to obtain legal status to operate a firm in 1999 as a measure of regulatory burden.

Before 2000s debate about the intervention level and regulation intensity in the financial market was more theoretical. In early 2000s the theoretical debate moved into the empirical field thanks to the World Bank's release of Bank Regulation and Supervision Survey data (World Bank, 2001, 2003, 2007, 2011, 2019a). Based on those data and insights Agoraki et al. (2011), Anginer et al. (2014), Delis & Kouretas (2011) observed and evaluated the regulatory environment and developed several indices, which show different angles of the regulatory

environment. Below are listed the indices and the main logic of questions from questionnaires or assessment logic relevant for the certain index regarding:

(a) Capital requirements – how conservative is the approach of calculating regulatory capital for the purpose of capital adequacy assessment, what is allowed as a capital injection,

(b) Supervisory power – what is the ability of supervisor to influence organizational structure, decisions related to capital and insolvency, rights to approach auditors,

(c) Activity restrictions – score is determined based on the evaluation of bank's restrictions to participate in securities, insurance activities, real estate activities and to own non-financial firms,

(d) Market discipline – what are requirements of banks in relation to public disclosures, what are liabilities for misleading the public etc.,

(e) Diversification – are there in the certain jurisdiction available explicit, verifiable, and quantifiable guidelines on the asset diversification; are banks permitted to issue loans abroad.

Marchionne, Pisicoli, and Fratianni (2022) are investigating the banking sector and as well are using the approach with indices. They define the Regulation Index as "100 – Financial Freedom Index" (Index of Economic Freedom, 2022).

1.5.3. Government regulation costs measurement

Hertog (2010) as examples of government regulation costs mentions (a) information gathering costs for decision making on efficient price level for the firm, (b) monitoring costs of firm's behaviour and (c) enforcement of regulation costs. Jacobzone et al. (2010) highlights activities government need to perform to guarantee quality in the regulation process, which gives another insight into types of costs government face:

- procedures for communicating regulations,
- conducting of regulatory impact analysis,
- having a dedicated body for promoting regulatory policy,
- providing training in regulatory skills,
- formal mechanisms for intergovernmental co-ordination.

Meanwhile OECD for policy makers developed regulatory cost assessment guidance, which includes taxonomy of regulation costs (see Figure 1.18.).
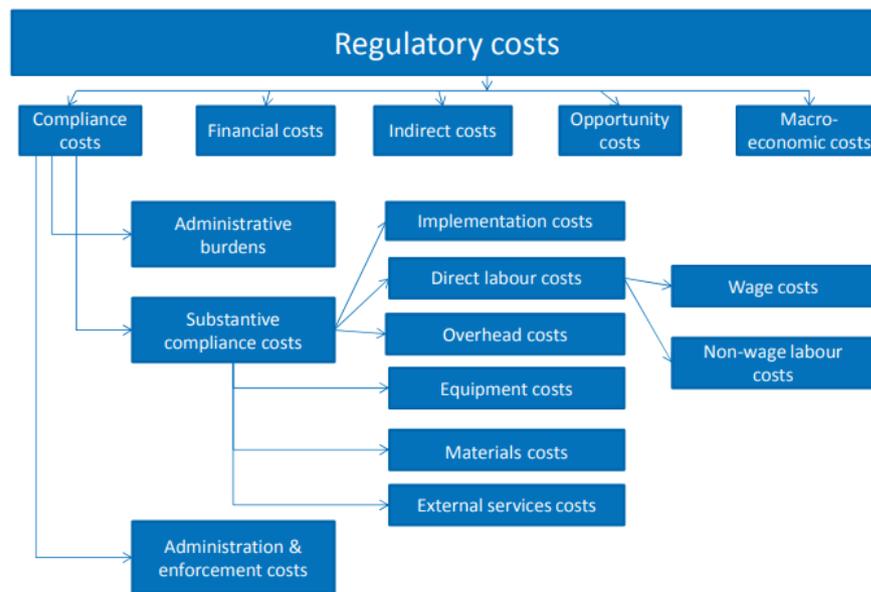
Figure 1.18. Taxonomy of regulation costs (OECD, 2014)

OECD define regulatory costs as all the costs attributable to the adoption of a regulatory requirement, whether direct or indirect in nature and whether borne by business, consumers, government, and its respective authorities (i.e., taxpayers) or other groups (OECD, 2014). As part of regulatory costs are regulation costs, i.e., costs borne by government. In the Figure 1.18. it corresponds to the label "Administration & enforcement costs". OECD considers them into the category of compliance costs since they are related to the achievement of the underlying regulatory objective and are an unavoidable part of the cost of regulation. In OECD's view relevant cost items here are (a) the costs of publicising the existence of the new regulations, (b) developing and implementing new licensing or registration systems, (c) assessing and approving applications and processing renewals, (d) devising and implementing inspection and/or auditing systems and (e) developing and implementing systems of regulatory sanctions to respond to non-compliance. In recent years OECD has not published any updates regarding abovementioned methodology.

When it comes to the measurement of regulation costs Calomiris, Mamaysky, and Yang (2020) proposed the approach using natural language processing methods to measure the flow of regulation based on the regulation's importance. In authors' view this approach is hard to apply to express the regulation depth in terms of currency.

New South Wales Government (NSW, 2008) offers to assess regulatory costs through regulatory charges:

$$RC = UC \cdot P \cdot F \qquad (1.13)$$

where RC – regulatory charges, UC – unit cost (the cost of the fee/licence/permit), P – population (the number of businesses affected), F – frequency (the number of times that the fee for the licence or permit is required to be paid per year)

This approach assumes that all income from market participants is used to cover costs of regulator operations and that no state budget is needed to cover the costs of regulator.

The perspective of regulatory charges has been viewed in the approach Standard Cost Model Network has developed as well (SCM Network, 2006), where regulatory charges has been named as "Direct financial costs" for businesses (see Figure 1.19.).
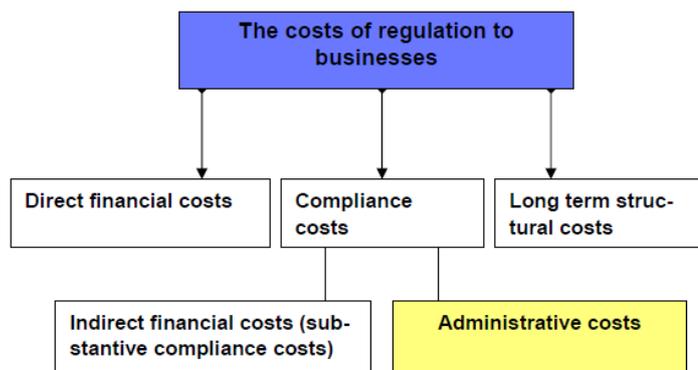
Figure 1.19. Regulation costs for businesses (SCM Network, 2006)

Other authors have not paid much attention to the topic of government regulation costs. Both in the scientific literature and policy making discussions more focus has been put on the compliance cost assessment for individual firms, e.g., in the analysis done by Simkovic and Zhang (2019) quantification of regulation is done by tallying up the number of employees whose work has to do with regulatory compliance.

1.5.4. Compliance costs measurement

Review of current definitions

Hertog (2010) as examples of compliance costs mentions (a) firm's administration costs (time, effort, and resources) to organize compliance with rules set by government (regulator) and (b) productivity losses. At the same time Hertog points that firm ill behave strategically and conceal or disguise any relevant information for the regulator. Meanwhile OECD for policy makers developed regulatory cost assessment guidance, which includes taxonomy of compliance costs (see Figure 1.18.). This guidance is made for specific regulation assessment however authors review ideas reflected there to reuse them if applicable for total regulation burden assessment.

OECD define regulatory costs as all the costs attributable to the adoption of a regulatory requirement, whether direct or indirect in nature and whether borne by business, consumers, government, and its respective authorities (i.e., taxpayers) or other groups (OECD, 2014). As part of regulatory costs are compliance costs, i.e., costs that are incurred by businesses or other parties at whom regulation may be targeted in undertaking actions necessary to comply with the regulatory requirements. In the Figure 1.18. it corresponds to the label "Compliance costs". In OECD's view relevant cost items here are:

(a) the costs of complying with information obligations stemming from government regulation. Information obligations can be defined as regulatory obligations to provide information and data to the public sector or third parties,

(b) implementation costs – the costs regulated entities incur in familiarising themselves with new or amended regulatory compliance obligations, developing compliance strategies, and allocating responsibilities for completing compliance-related tasks,

(c) direct labour costs – the costs of staff time devoted to completing the activities required to achieve regulatory compliance. These costs include the cost of wages paid and non-wage labour costs, including pension contributions, sick leave, annual leave, payroll taxes, personal injury insurance,

(d) overheads – the costs of staff supervision/management, rent, office equipment, utilities, corporate overheads, and other inputs used by staff engaged in regulatory compliance activities,

(e) equipment costs – depreciation and amortization of capital equipment needed to comply with regulations, including machinery and software,

(f) materials costs – the incremental costs incurred in changing some of the material inputs used in the production process to ensure regulatory compliance and

(g) the costs of external services – the cash cost of payments made to external suppliers who are helping achieve regulatory compliance.

In recent years OECD has not published any updates regarding abovementioned methodology.

ICF (2019) based on the approach of Renda et al. (2013) developed the following taxonomy of compliance costs:

(a) direct costs:
    a. direct compliance costs, i.e., charges, compliance costs, administrative burdens, supervisory reporting costs,
    b. hassle costs, i.e., corruption, annoyance, waiting time,

(b) indirect costs:
    a. indirect compliance costs,
    b. substitution effects' costs,
    c. transaction costs,
    d. costs of reduced efficiency, competition, innovation.

This research has introduced the division of one-off and ongoing costs of compliance as well. One-off costs are familiarisation with regulation, staff recruitment costs, training of personnel, legal advice, consultancy fees, investment in or updating IT systems, infrastructure costs, development costs, project management and other costs. On-going costs are data collection, data processing and validation costs, information storage costs, ongoing IT costs (maintenance, support, training), infrastructure costs, training of personnel, audit fees and other costs.

New South Wales Government's (NSW, 2008) approach in the taxonomy is as follows:

(a) substantive compliance costs – related to capital and production costs required by a regulation, e.g., equipment and training,

(b) administrative costs – the costs of demonstrating compliance with a regulation, e.g., paperwork costs and record-keeping.

The same view on compliance cost taxonomy has been shared in the Standard Cost Model (SCM Network, 2006), see Figure 1.19. This model distinguishes administrative costs from administrative burdens, see Figure 1.20.
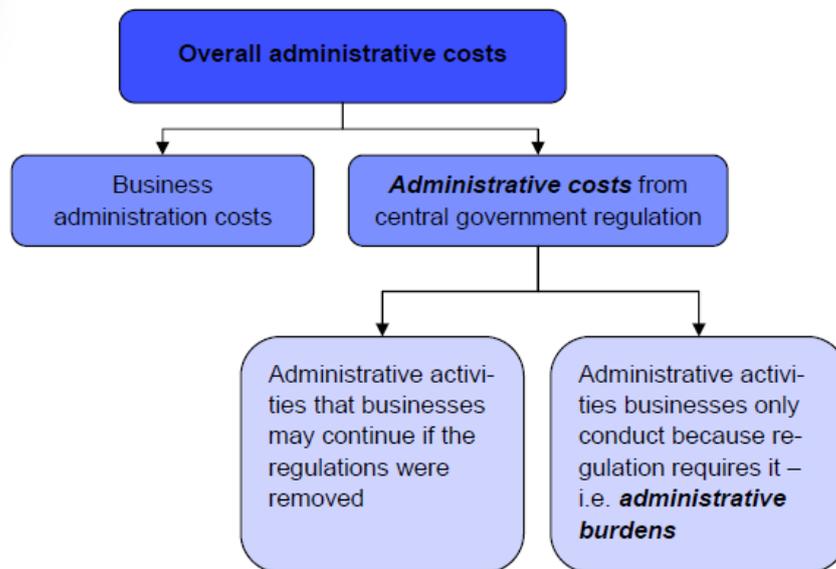
Figure 1.20. Administrative costs vs administrative burdens (SCM Network, 2006)

The approach of "administrative burdens" is used by OECD as well (see Figure 1.16.).

Other authors have offered approaches focusing on the assessment of labour involvement in compliance, e.g., in the analysis done by Simkovic and Zhang (2019) quantification of regulation is done by tallying up the number of employees whose work has to do with regulatory compliance.

Review of current quantification approaches

OECD (2014) has offered following approaches of assessment the selected cost items:
(a) direct labour costs – wage costs are determined by the amount of time taken to complete the required compliance activities and the hourly wage rate of the relevant staff. This approach requires detailed data gathering from the regulated entities,
(b) overheads – 50% of the direct wage costs attributable to regulatory compliance,
(c) equipment costs – estimated the total cost of new equipment purchases prompted by the need to comply with the regulation and discounted by an appropriate percentage amount,
(d) materials costs – market prices for certain products multiplied by relevant quantity. In some cases, adjusted market prices can be used in case the regulation causes shift in the product's demand-supply equilibrium,
(e) the costs of external services – the figure from accounting records.

Simkovic and Zhang (2019) quantification approach is to calculate the percentage of an industry's labour costs paid to perform regulation-related tasks.

New South Wales Government's (NSW, 2008) approach to assess substantive compliance costs is as follows:

$$SCC = UC \cdot P \cdot F \tag{1.14}$$

where SCC – substantive compliance costs, UC – unit cost (the cost of training, equipment or other expenditure), P – population (the number of businesses affected), F – frequency (the amount of training or the number of equipment required),

and administrative costs as follows:

$$AC = I \cdot T \cdot P \cdot F \tag{1.15}$$

where AC – administrative costs, I – inputs (the hourly wages costs, overhead and non-wage costs or the cost of an external service provider), T – time (required to complete the activity, in hours), P – population (the number of businesses affected), F – frequency (the number of times the activity is completed each year).

New South Wales Government's approach has its roots in Standard Cost Model, which uses this type of calculations to assess costs per administrative activities (see Figure 1.21.).
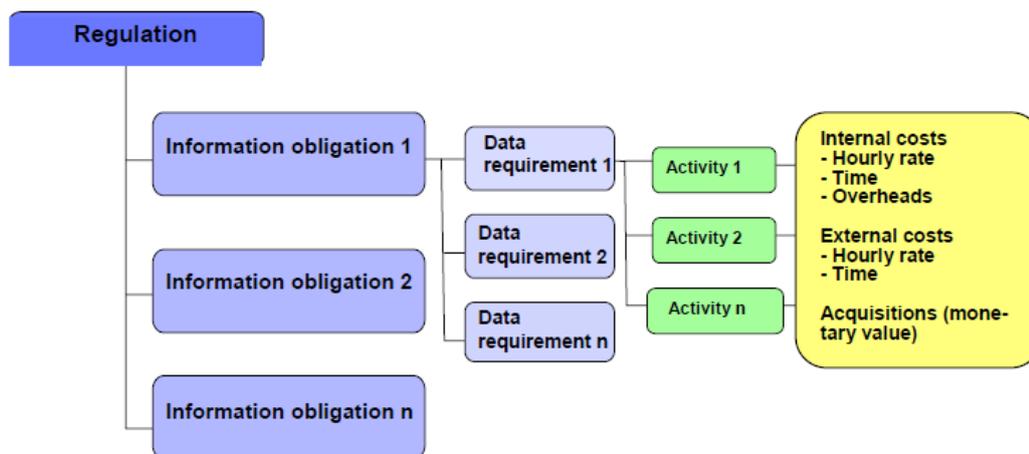
Figure 1.21. Structure of the Standard Cost Model (SCM Network, 2006)

As more high-level approach regulators use the assessment of compliance cost effects based on market surveys, e.g., European Banking Authority's launched questionnaires in 2020 (EBA, 2020) to assess reporting costs. Based on the financial market survey ICF (2019) has found that for banks and financial conglomerates **one-off compliance costs are 2,89% of total operational costs** and **on-going compliance costs – 2.60% of total operational costs**.

1.5.5. Indirect costs measurement

Indirect costs capture all other effects from regulation apart from regulatory and compliance costs. In the Standard Cost Model (SCM Network, 2006) indirect costs are defined as the impact that regulation has on market structures, consumption patterns and the cost of delays. It includes barriers to entry through licensing, holding costs and restrictions on

innovation. In OECD taxonomy (OECD, 2014) financial, opportunity and macroeconomic costs are mentioned.

Map of regulatory impacts is presented in the Figure 1.22.
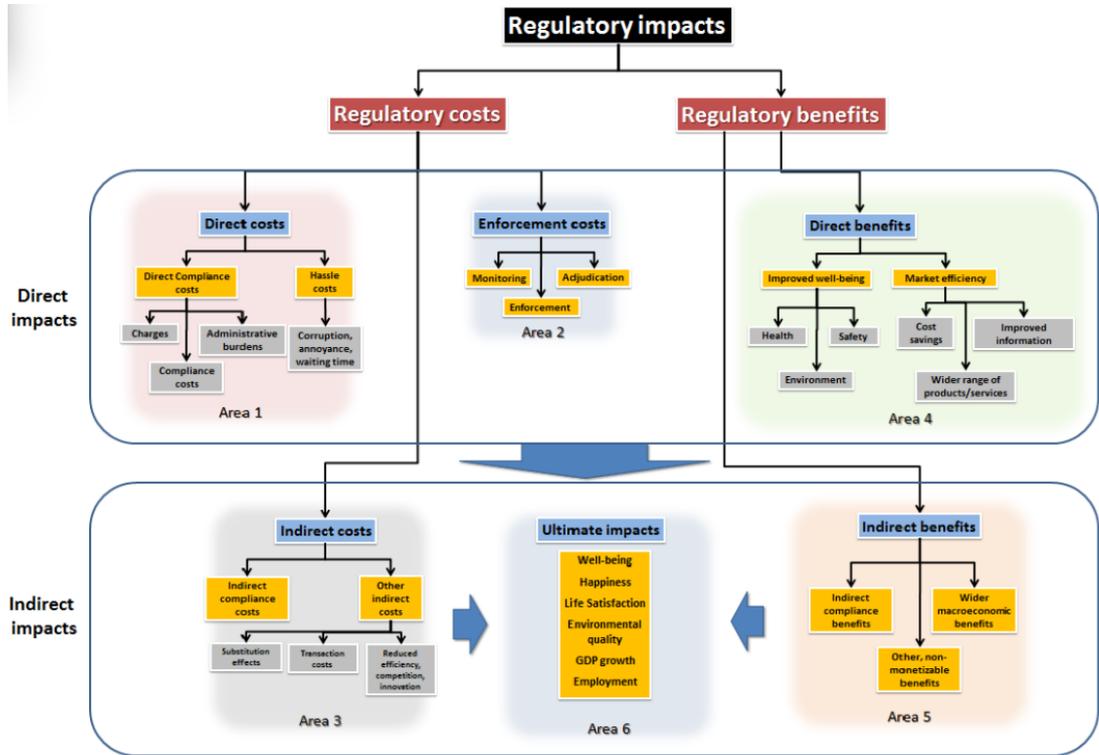
Figure 1.22. Map of regulatory impacts (CEPS, 2013)

In the Standard Cost Model (SCM Network, 2006) indirect costs are quantified as follows,

$$IC = CV \cdot P \cdot I \cdot Q \qquad (1.16)$$

where IC – indirect costs, CV – annual capital value of approvals, P – estimate of percentage borrowed/ spent, I – annual interest rate divided by 365, Q – average delay (in days) to process or gain approvals.

More high-level model is presented by Brian Titley Consulting (2015) using the approach of Partial Equilibrium Analysis. Example in the Figure 1.23. shows situation when newly introduced regulation caused the shift in demand and thereby costs to the society.
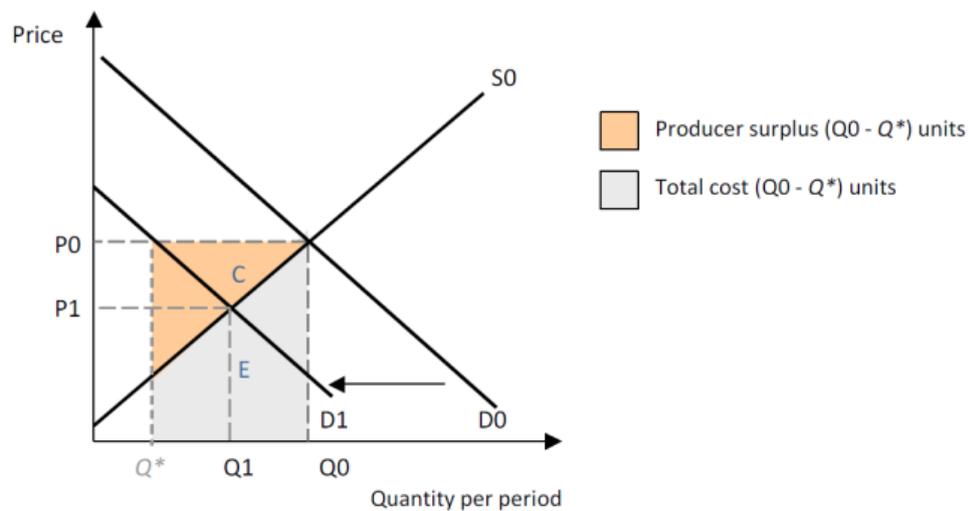
Figure 1.23. Demand shift in the case of introduced regulation (Brian Titley Consulting, 2015)

Effect of the communication

As a special case of indirect costs, the communication of the regulator has been analysed (justification for this is revealed in Table 1.9.). In this doctoral research it has been performed based on collection of speeches by the European Central Bank due to availability of data.

Debate on the impact of policymakers' communication started with Morris and Shin (2002) when dissemination of public information through the media and disclosures by market participants with high public visibility was discussed. Morris and Shin (2002) raised the awareness on the effects of communication to the financial market participants. Since then, several approaches have been developed to assess the effects of communication, e.g., effects of stress tests on returns of bonds and stocks of the financial market participants (Petrella, Resti, 2013; Morgan, Peristiani, Savino, 2014; Candelon, Sy, 2015; Sahin, de Haan, 2016; Flannery, Hirtle, Kovner, 2017; Neretina, Sahin, de Haan, 2020), ways of processing the information about stress tests (Faria-e-Castro et al., 2017; Pacicco, Vena, Venegoni, 2020), effects in a laboratory environment (Ferri, Morone, 2014; Halim et al., 2019; Ruiz-Buforn et al., 2021).

Researchers have analysed the effects of European and the U.S. stress tests on returns of bonds and stocks of the financial market participants (Petrella, Resti, 2013; Morgan, Peristiani, Savino, 2014; Candelon, Sy, 2015; Sahin, de Haan, 2016; Flannery, Hirtle, Kovner, 2017; Neretina, Sahin, de Haan, 2020) using the event study framework. Pacicco, Vena and Venegoni (2020) have contributed with assessment of empirical results how market participants process information about stress test results. They provide factual evidence on how authorities' enhanced communication affects financial markets' stability. Results provide empirical evidence to support Faria-e-Castro et al.'s (2017) theoretical findings, demonstrating that severe stress tests, if enacted in countries with credible fiscal capacity such as the U.S., can lead agents to revise their risk estimations downwards for all banks, notwithstanding their performance in the exercise. Ruiz-Buforn et al. (2021) study the information aggregation process in a laboratory financial market where traders have access to costly private and free public imperfect

information. They show that the reduction in price informativeness is a direct consequence of the overweighting of public information when aggregated in prices.

At the same time central banks have done more broader analysis on central bank communication to the financial markets, e.g., Born, Ehrmann and Fratzscher (2011), who in their research of effects of the central bank's communication on the financial market developed the approach of identification of events in the context of event study framework.

Some researchers analyse effects of communication in the laboratory financial market environment to achieve greater control over variables impacting the outcome, e.g., Ferri and Morone (2014), Halim et al. (2019).

Effect of the communication: *assessment of the effect on the market participant*

Neretina, Sahin and de Haan (2020) to measure the impact of an event have used the term "the abnormal return of a security", which is calculated as the difference between the actual return and the normal return over certain so-called "the event window". The term "the event window" means the period when the event has been observed, measured in days. Normal returns are estimated using the market model as follows,

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \qquad (1.17)$$

where $R_{i,t}$ is the daily return of equity of bank i at time t, and $R_{m,t}$ is the return of a market portfolio (the S&P 500 returns index).

The residuals or abnormal returns (AR) implied by the market model are given by,

$$AR_{i,t} = R_{i,t} - (\hat{\alpha}_i + \hat{\beta}_i R_{m,t}) \qquad (1.18)$$

where the circumflex indicates that the parameter concerned is estimated. The abnormal returns are summed over the relevant window around the event date to compute the cumulative abnormal return (CAR). In their base line model, abnormal returns are cumulated for the 3-day window (-1; +1).

Born, Ehrmann and Fratzscher (2011) for the purpose of the assessment of central bank's communication on the financial stability have used more complex approach considering effects observed in all financial market,

$$\begin{aligned} R_{i,t} = \alpha_{0i} &+ \alpha_{1i} R_{i,t-1} + \alpha_{2i} R_{m,t-1} + \alpha_{3i} R_{m,t} + \alpha_{4i} R_{m,t+1} + \alpha_{5i} D_t + \alpha_{6i} T_{i,t-1} \\ &+ \alpha_{7i} S_{i,t-1} + \alpha_{8i} M_{i,t-1} + \varepsilon_{i,t} \end{aligned} \qquad (1.19)$$

where $R_{i,t}$ is the daily local currency return on the stock market index of the financial market for country i on day t, $R_{m,t}$ is the daily United States dollar return on Datastream's stock market index of the global financial market, and D_t denotes dummy variables for Monday through Thursday. $T_{i,t-1}$ stands for the trend in stock markets covering the 20 days before to the event, $S_{i,t-1}$ stands for the standard deviation of daily stock market returns over the 20 days before the event, and $M_{i,t-1}$ for the so-called "misalignment" of stock indices on the day preceding the event, measured as the percentage deviation of the stock indices from their national average over the entire sample period.

Both approaches differ in the scope of assessed parameters and width of the window.

Picault & Renault (2017) as well have used returns of stocks and volatility to analyse monetary policy communication's effect on the financial market analysing ECB meetings as primary source of communication.

When media perception is analysed, other measures have been used as market variables, e.g., money market rates (Bennani et al., 2019; Ehrmann, Fratzscher, 2009), foreign exchanges rates (Gertler, Horwath, 2018), forward rates (Pesci, 2016), sovereign spreads (Gade et al., 2013).

Effect of the communication: *identification of the event*

Born, Ehrmann and Fratzscher (2011) assessed speeches and interviews of central bank governor with following conditions:

1. each speech was allocated to certain trading day. Communications during weekends were allocated to the following Monday, communications in the evening – such as dinner speeches – to the subsequent trading day,

2. only the first report about a given statement were chosen, which typically originated from a newswire service. This choice has the advantage that the reporting is very timely, usually comes within minutes of each statement, and that it is mostly descriptive without providing much analysis or interpretation. To avoid double counting, all sub-sequent reports or analysis of the same statement were discarded,

3. the search was conducted only in English language.

In these speeches and interviews Born, Ehrmann and Fratzscher (2011) were looking for specific words which characterize the communication related to the financial stability, such as "volatile", "volatility", "risk", "ad-verse", "pressures". Based on the software for automated textual analysis, they computed a score for each individual speech or interview. Then they transformed the resulting scores into a discrete variable, which takes the value of -1 for the lowest third of the distribution, a value of 0 for the middle part of the distribution, and the value of +1 for the upper third of the distribution. That is, a value of +1 corresponds to a relatively optimistic text, while a value of -1 corresponds to a relatively pessimistic statement.

1.6. Conclusions

Considering the findings of the conducted literature analysis, the following has been concluded by author:

1. In total 185 sources have been analysed in the literature analysis, majority of which are journal papers, i.e., 54%.

- Perfect competition in the financial (banking) market

2. Considering (a) the specification of the banking sector, (b) the description of conditions of perfect competition in any given market and (c) OECD's (2010) comments for the expected outcomes of the well-functioning banking sector author has summarized the description of perfect competition in the banking sector:
   a. Effective and efficient allocation of liquidity and capital.
   b. Effective and efficient pooling, management and transfer of risks accompanied with correct pricing of risk. This aspect covers prudent risk-taking behaviour as well.
   c. Sufficient shock resistance with ability to self-correct.
   d. General confidence in the functioning of the banking sector. This aspect covers the condition of "perfect information".

- Market failures

3. Literature review revealed that there are four major types of financial market failures: asymmetric information, negative spillovers, market power imbalances, market abuse.
4. Analysis of the European Central Bank speeches revealed additional types of failures not covered by abovementioned four types: fragmentation of market self-regulation, global imbalances in current account positions and capital flows across major economies, regulatory arbitrage, structural inefficiencies in debt and collateral enforcement, inefficient consumption-led boom-and-bust cycles.

- Principles of regulation

5. Literature review covers the period from 1998 till 2021, reviewing 115 sources, from which 30 sources were selected for analysis. In the literature review author has identified 12 principles of the optimal government regulation: (a) Cost-benefit balance, (b) Confidentiality, (c) Precaution, (d) Risk-based, (e) Sound incentives, (f) Comprehensiveness, (g) Consistency and competitive neutrality, (h) High quality, transparent decision-making and enforcement, (i) Systematic review, (j) International coordination, convergence, and implementation in policy and rulemaking, (k) Accountability, (l) Management of climate-related risks.
6. 68% of sources refer to the following Top5 principles: (a) Cost-benefit balanced, (b) Risk based, (c) Consistency and competitive neutrality, (d) High quality, transparent decision-making, and enforcement, (e) International coordination, convergence, and implementation in policy and rulemaking. Those principles are covering the aspects of regulation costs, risk awareness, quality, and regulatory cooperation.
7. Hertog (2010) in the analysis of previous research revealed three types of costs arising from the regulation: regulatory costs, compliance costs and indirect costs. These costs are derived from the Top5 regulation principles identified in the literature analysis.

- Equilibrium point

8. The deadweight loss decreases with increasing regulation and regulation costs increase with increasing regulation.

9. There is equilibrium point between the two, i.e., the point where deadweight loss equals regulation costs. After this point, there is no economic justification for further increase in regulation intensity. Hertog (2010) this point defines as "trade-off" between resources allocated to increasing levels of regulatory intervention and decreasing levels of inefficient firm behaviour.

10. The deadweight loss and regulation costs are measured in the currency units, e.g., euro, there are no measurement scales for government regulation intensity or intervention level.

2. DEVELOPMENT OF THE GOVERNMENT REGULATION MODEL

Author in this Chapter has discussed the construction principles of the Regulation Model. Basic guidelines for the model construction author have defined based on the inspiration from Johnson and So's (2017) approach of the construction of the multimarket information asymmetry measure:

1. ease of implementation – whether the data are broadly available,
2. clarity of interpretation,
3. empirical effectiveness – the model covers all material cost and other exposures.

In general, the model is reflected in the Figure 2.1., covering the ideas described in the Literature review:

- the deadweight loss decreases with increasing regulation,
- regulation costs increase with increasing regulation,
- there is equilibrium point between the two, i.e., the point where deadweight loss equals regulation costs. After this point, there is no economic justification for further increase in regulation intensity,
- the deadweight loss and regulation costs are measured in the currency units, e.g., *euro*,
- there are no measurement scales for government regulation intensity or intervention level.
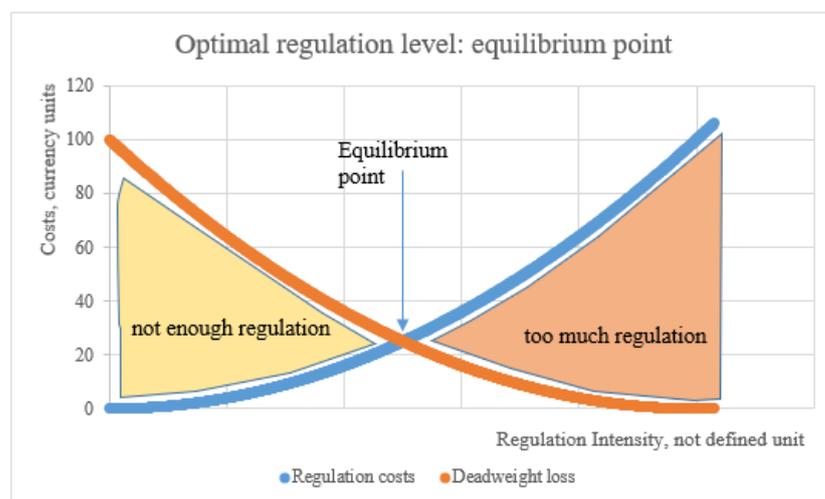
Figure 2.1. General concept of the model (the author's made)

Considering the abovementioned author has developed the approach how to address the following issues:

1. equations for the deadweight loss and regulation costs are needed,
2. measurement scale for evaluation of government regulation intensity is needed.

The summary of the approach is described in the Table 2.1.

Table 2.1.

The concept of the model (the author)

Model bloc	Construction approach	Data source
Deadweight loss assessment	Assessment of not produced GDP (GDP output gap) Values in % of GDP	• Databases of the European Central Bank and Bank of Latvia, • Eurostat
Regulation costs' assessment	Assessment of costs Values in % of GDP	• Databases of the European Central Bank and Bank of Latvia, • Eurostat • Bloomberg • Annual reports of regulators
Additional activity		
Regulation intensity measurement scale	Regulation Intensity Index based on: • Questionnaire with 23 points • Index: *100 – Business Freedom* • Index: *100 – Monetary Freedom* • Index: *100 – Investment Freedom* • Index: *100 – Financial Freedom* Values of Regulation Intensity Index [0; 100]	• World Bank's prepared *the Bank Regulation and Supervision Survey* • *Index of Economic Freedom* database

The deadweight loss is assessed for the following market failures:
- Imperfect competition or market power imbalances,
- Asymmetric information,
- Negative spillovers,
- Market abuse and others.

Regulation costs are assessed for the following cost types:
- Regulatory costs,
- Compliance costs,
- Indirect costs.

Considering the abovementioned, the general concept of the model has developed in the following way (see Figure 2.2.):
- Deadweight loss > Regulation costs. Deadweight loss exceeds the regulation costs, so suggested policy decision would be to increase the regulation intensity.

- Deadweight loss = Regulation costs. Breakeven point, not suggested to further increase the regulation intensity.
- Deadweight loss < Regulation costs. Government intervention is not economically justified as regulation costs exceed the economic loss for the society. Suggested policy decision would be to decrease the regulation intensity.
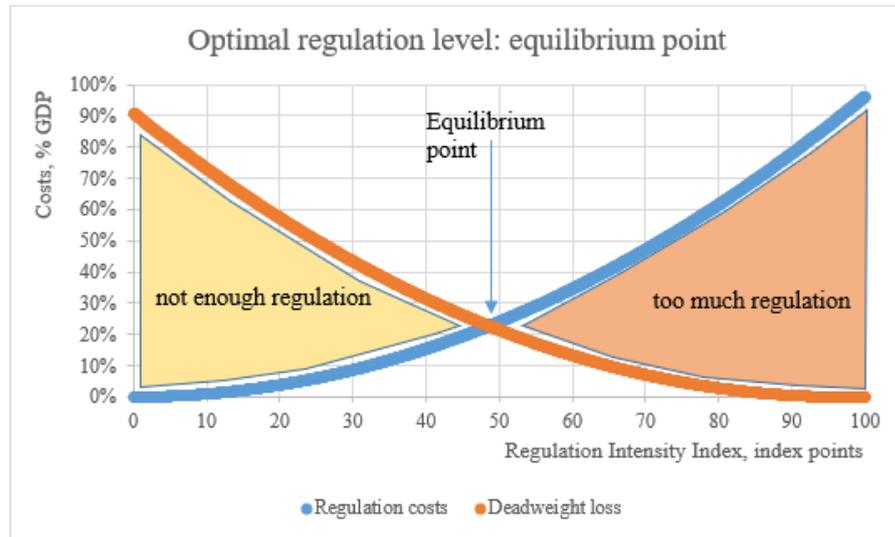
Figure 2.2. The graphical concept of the model (the author's made)

This Chapter is organized in the way to step by step describe the concept reflected in the Table 2.1. and Figure 2.2. It eventually leads to the equilibrium point: $f\,(DWL) = f\,(Reg\ costs)$, where

$$f(DWL) = \left\{DWL_{Reg(1)}; DWL_{Reg(2)}; \ldots; DWL_{Reg(n)}\right\} \tag{2.1}$$

and

$$f(Reg\ costs) = \left\{Reg\ costs_{Reg(1)}; Reg\ costs_{Reg(2)}; \ldots; Reg\ costs_{Reg(n)}\right\} \tag{2.2}$$

In Chapters 2.2. and 2.3. descriptions of methodologies for variables $DWL_{Reg(1)}$, $DWL_{Reg(n)}$, $Reg\ costs_{Reg(1)}$ and $Reg\ costs_{Reg(n)}$ are described. Chapter 2.1. is dedicated to the methodology for the index $Reg(n)$.

Eventually, the equilibrium point is defined as $\left\{DWL_{Reg(n)}; Reg(n)\right\}$, which satisfies the condition: $DWL_{Reg(n)} = Reg\ costs_{Reg(n)}$.

2.1. Regulation intensity measurement scale

To quantify relationships between the level of regulation, regulation costs and the deadweight loss with econometric models it is important to understand how to apply

coordinates for the data points to be included in the modelling. On the axis of dependent variable (Y) as a unit measure for costs the % of GDP is used however on the axis of the independent variable (X) there is no clear unit measure for government regulation intensity. In this section approach of scaling the level of government regulation in the banking market is presented, i.e., how to find the unit measure for the axis of the independent variable.

Based on the ideas from literature review author has decided to create the **Regulation Intensity Index** with values in the range [0;100]. The Regulation Index is calculated as average from 5 indices:

- Index from the questionnaire based on the Bank Regulation and Supervision Survey from the World Bank,
- Index: 100 – *Business Freedom* based on the *Index of Economic Freedom,*
- Index: 100 – *Monetary Freedom* based on the *Index of Economic Freedom,*
- Index: 100 – *Investment Freedom* based on the *Index of Economic Freedom,*
- Index: 100 – *Financial Freedom* based on the *Index of Economic Freedom.*

Index from the questionnaire based on the Bank Regulation and Supervision Survey

Researchers have so far reviewed *the Bank Regulation and Supervision Survey* and made their view on how to measure supervisory burden (Agoraki et al., 2011; Anginer et al., 2014; Delis & Kouretas, 2011). Author reviewed all questions from researchers and marked those, which in authors' view have impact on operation costs either to the bank or the supervisor/regulator (see Appendix 2, Table A1).

Applicability in the Appendix 2, Table A1 is marked as "Yes", non-applicability – "No". If costs arise to the bank, then it is marked as "B". If costs arise to the supervisor, then – "S". Further in the section author shortly describes the justification for applied marks, i.e. "Yes", "No", "B" and "S".

For the **Capital requirements** index all requirements, which are related to the proper calculation of the regulatory capital, are marked as "Yes" as they could lead to the need to hold bigger amount of capital for the bank, which will impose additional costs for it. And some IT and human resource costs will appear as there is need to adjust IT systems and internal reporting procedures in order to report capital amounts properly. In other indices all items affecting reporting are treated as cost imposing as well due to the abovementioned effect on the IT systems and internal procedures.

Capital injections and structure (borrowed funds as initial disbursement) as well affect bank's costs from capital cost perspective considering that bank could be restricted to use more cheap resources.

For the **Supervisory power** index supervisor's rights to take legal action or measures against external auditors are treated as cost affecting right for the bank as auditors most probably will be more cautious in doubtful situations and will propose more conservative approaches which could be more expensive.

Supervisor's rights to order bank's management to constitute additional provisions will affect bank's costs directly and as well impose additional costs for supervisor himself as there

will be need to use IT and human resources to check bank's financial accounts and find respective items.

Supervisor's rights to declare bank insolvent will impose additional costs for both – bank and supervisor – as there will be the need for supervisor to allocate resources for the information collection about the bank to prepare the resolution plan. And bank will face the need to allocate additional resources for the compliance with supervisor's requirements in this respect. Four questions which are mentioned next in the Appendix 2, Table A1 to the abovementioned question are treated as non-applicable as from the cost perspective they overlap.

Questions related to the **Activity restrictions** index are treated as non-applicable from the cost perspective as they limit bank's opportunities to maximize profit from asset al-location thereby here only opportunity cost occur (not gained income) however it is not observable from the financial statements of particular bank.

For the **Market discipline** index subordinated debt as a part of the capital is treated as cost affecting item as it is cheaper capital item com-pared to the ordinary shares or accrued profit.

Items that are related to public disclosure are treated as cost imposing for both – bank and supervisor – as there will be the need for supervisor to allocate resources for disclosed information verification.

Directors' legal liabilities for misleading or erroneous information are treated as cost imposing for the bank due to additional internal procedures which will be produced to minimize the risk of publishing misleading or erroneous information.

Mandatory credit ratings and certified auditor reports as well impose additional costs to the bank as services provided by credit rating agencies.

Deposit insurance protection system will impose additional costs to the bank in the form of regulatory requirements, while to the supervisor – in the form of the system maintenance costs.

For the **Diversification index** guidelines are treated as supervisor's costs due to the need to allocate resources for the development of them.

Permission to make loans abroad is treated as an opportunity for the bank to seek better profits abroad thereby here is more income perspective reflected.

Based on the review described previously author in the Appendix 2, Table A2 has summarized the questions to be used for the scaling the level of government intervention from the cost perspective.

The logic of the score is following the suggestions of the literature (Agoraki et al., 2011; Anginer et al., 2014; Delis & Kouretas, 2011), i.e., when certain requirement is treated as restrictive, however in this case logic is adjusted for the cost effect. Score is "1" when requirement is restrictive and imposing additional costs either for the bank or the supervisor, otherwise it is "0". Total score is 0, 1, 2, … or 21.

On top author has identified few areas not covered by the questionnaires from the literature (Agoraki et al., 2011; Anginer et al., 2014; Delis & Kouretas, 2011):

(a) Anti-Money Laundering/Combating the Financing of Terrorism (AML/CFT) – this area in recent years has got a lot of attention from the supervisor, significantly increasing operational costs for both: the supervisor and the bank. Non-compliance with those requirements have caused insolvency for the several banks in the Baltic region within few recent years,

(b) Fit and proper (suitability) requirements for the bank's management – in this area the Basel Committee on Banking Supervision has issued guidelines (BCBS, 2015) and European Banking Authority has publicly disclosed the plans of introducing new requirements (EBA, 2019). This will impose additional costs for the banks as the scope of suitable candidates for high-level vacancies will narrow.

Abovementioned gaps are added to the table in the Appendix 2, Table A2 to the section of Supervisory power index. With this adjustment the total score grows to 23.

Based on the description above author has developed the simple formula 2.3. for calculation of Index value from the questionnaire:

$$I_1 = \frac{n}{23} \cdot 100 \tag{2.3}$$

where n – value of assessment from the questionnaire.

Indices from *the Index of Economic Freedom*

Four other indices have been used from the Index of Economic Freedom (2022). Overall score for this index is assessed based on the following components covering four areas of economy as follows:

- Rule of Law:
  - Property Rights
  - Government Integrity
  - Judicial Effectiveness
- Government Size:
  - Tax Burden
  - Government Spending
  - Fiscal Health
- Regulatory Efficiency:
  - Business Freedom
  - Labour Freedom
  - Monetary Freedom
- Open Markets:
  - Trade Freedom
  - Investment Freedom
  - Financial Freedom

As an example the index values for Latvia in 2022 are reflected in the Figure 2.3. Overall score is "74.8" with one score (Fiscal Health) even exceeding the level of "90.0", i.e., "91.4".
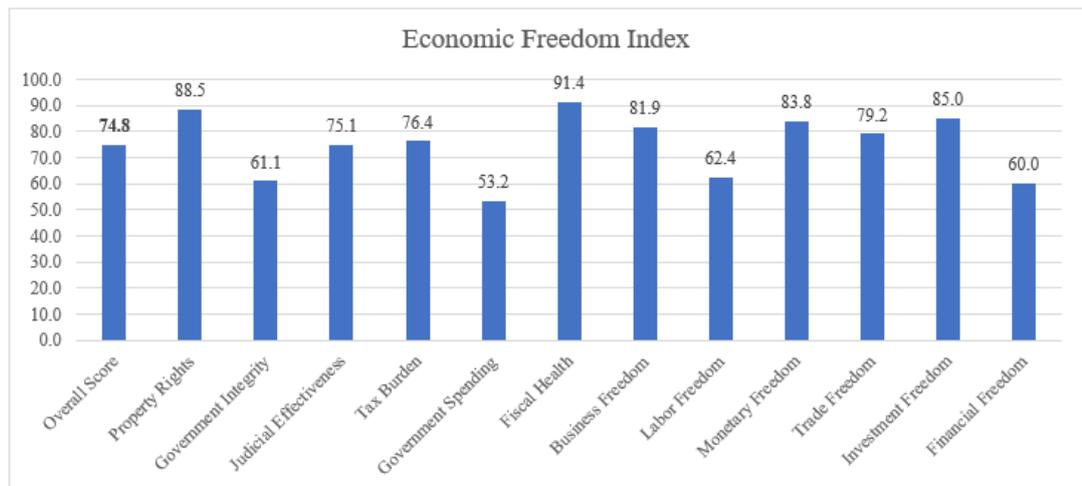
Figure 2.3. Index values for Latvia in 2022 (the author's made based on Index of Economic Freedom, 2022)

These assessments have been collected for years. In Figure 2.4. dynamics of the values for Latvia have been reflected as an example.
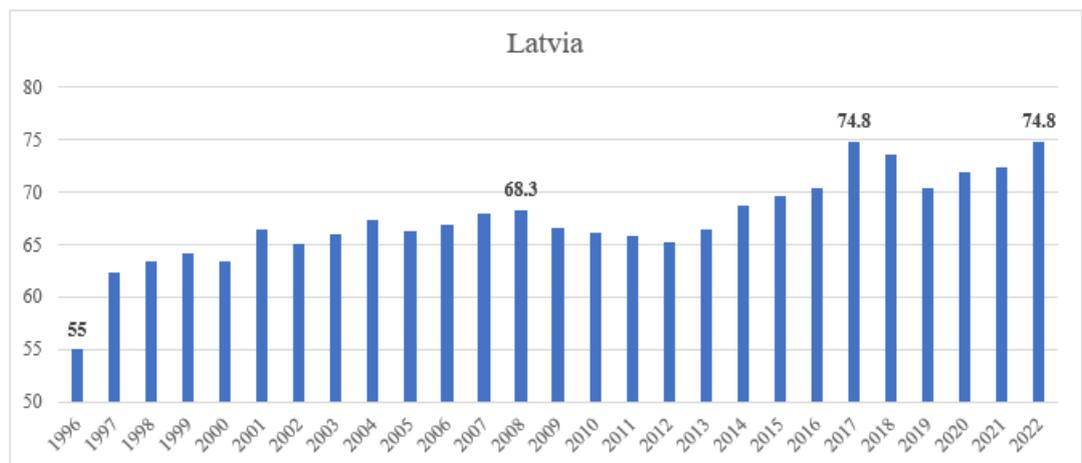
Figure 2.4. Index values for Latvia from 1996 to 2022 (the author's made based on Index of Economic Freedom, 2022)

The area "Rule of Law" in the Regulation Intensity Index covering banking market is already fully covered by the World Bank's Bank Regulation and Supervision Survey, which explores the legal environment in every detail. The area "Government Size" is more attributed to the general government and not so directly related to the banking market activities. Meanwhile the areas "Regulatory Efficiency" and "Open Markets" would contribute to the Regulation Intensity Index with indicators for specific cultural behaviour of market participants, consumer preferences, everyday interaction with authorities and other aspects falling outside of the scope of the World Bank's Bank Regulation and Supervision Survey.

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Considering the abovementioned, the overall **Regulation Intensity Index** could be expressed as follows,

$$RII = a_1I_1 + \cdots + a_7I_7 \qquad (2.4)$$

with

$$I_{2,\dots,7} = 100 - x \qquad (2.5)$$

where x – *Business Freedom, Labour Freedom, Monetary Freedom, Trade Freedom, Investment Freedom, Financial Freedom.*

In order to make decision regarding the index components, author has analysed the data from 30 European countries (see Table 2.2., Appendix 3. Table 4.2. and Table 4.3.).

Table 2.2.

Regulation Intensity Index components for selected countries (source: author's made based on World Bank, 2019; Index of Economic Freedom, 2022)

Component	Germany	UK	USA	Russia
I_1	82.6	69.6	69.6	69.6
I_2	16.7	7.1	16.2	21.6
I_3	**47.2**	**26.5**	**10.6**	**47.5**
I_4	22.1	18.8	23.4	34.9
I_5	**14.0**	**14.0**	**13.4**	**22.2**
I_6	20.0	10.0	15.0	70.0
I_7	30.0	20.0	20.0	70.0

Results show that the result from the latest World Bank's Bank Regulation and Supervision Survey (I_1) is similar for the UK, USA, and Russia. This underlines the main issue with this survey – it shows that from the legal point of view Russia is on the same level as the UK and USA. This issue then is corrected with relevant economic freedom indices – all of them show higher values for Russia. When it comes to comparison between Germany, the UK and USA, in almost all cases Germany has higher values, which corresponds to the expectations. The UK and USA have mixed results between them – in some cases the UK has higher values, in other – USA.

Table 2.3.

Regulation Intensity Index for selected countries (source: author's made based on World Bank, 2019; Index of Economic Freedom, 2022)

Values of a_1/ a_2…a_7	Germany	UK	USA	Russia
0% / 17%	25.0	16.1	16.4	44.4
14% / 14%	33.1	23.6	23.9	47.9
25% / 13%	39.4	29.5	29.7	50.7
50% / 8%	53.8	42.8	43.0	57.0
75% / 4%	68.2	56.2	56.3	63.3
100% / 0%	82.6	69.6	69.6	69.6

Results of comparison show that the more important is the result of the World Bank's Bank Regulation and Supervision Survey the more stringent in regulatory requirements becomes Germany. This draws a conclusion that in other aspects of regulation Germany is comparatively less regulated. The opposite result can be concluded from the data of Russia: other economic indices indicate more restrictions than the World Bank's Bank Regulation and Supervision Survey. The more weight is put on economic indices, the higher the value of the Regulation Index. The results of the UK and USA in all cases show similarly low regulation level. For these countries economic indices indicate a significantly higher level of freedom.

When reviewing all six components from the Index of Economic Freedom two indices were identified as to be excluded for the purposes of banking sector regulatory analysis – *Labour Freedom* and *Trade Freedom*. Those indices cover wider economic effects and could create unnecessary volatility in the analysis of banking sector.

Thereby from those six components four have been selected to include in the Regulation Intensity Index: *Business Freedom*, *Monetary Freedom*, *Investment Freedom*, *Financial Freedom*. Those components are most close to the banking sector regulation. As well it was important to select up to $4 - 5$ indices so the first index from the questionnaire have sufficient weight on the overall Regulation Intensity Index.

For Latvia those indices in 2022 had values of 81.9; 83.8; 85.0 and 60.0 respectively.

Considering that abovementioned indices reflect the freedom of certain economic activities, for regulation purposes inverse values have been selected as shown in formula 2.6.:

$$I_{2,\dots,5} = 100 - x \qquad (2.6)$$

where x – *Business Freedom, Monetary Freedom, Investment Freedom, Financial Freedom.*

Based on the formulas 2.4. and 2.6., the overall **Regulation Intensity Index** is expressed as follows with parameter a_i to be validated,

$$RII = a_1 I_1 + \dots + a_5 I_5 \qquad (2.7)$$

Adding the result from Formula 2.3. and 2.6., the final result is as follows,

$$RII = a_1 \cdot \frac{n}{23} \cdot 100 + a_2 I_2 + \dots + a_5 I_5 \qquad (2.8)$$

2.2. Deadweight loss assessment

Generally, following the logic reflected in the Figure 1.8. and Formula 1.4. the deadweight loss can be assessed as the sum from deadweight losses of separate market failures (identified in the Chapter 1.3.), i.e.,

$$DWL_{Reg(n)} = DWL_{as} + DWL_{spill} + DWL_{abuse} + DWL_{power} + DWL_{other} \qquad (2.9)$$

Where $DWL_{Reg(n)}$ – deadweight loss at single point or the RII, DWL_{as} – deadweight loss from asymmetric information, DWL_{spill} – deadweight loss from negative spillovers, DWL_{abuse} – deadweight loss from market abuse, DWL_{power} – deadweight loss from market power imbalances, DWL_{other} – deadweight loss from other market failures.

Formula 2.9. corresponds to the deadweight loss at single point of the Regulation Intensity Index (RII). Function graphically reflected in Figure 2.2. can be written as in Formula 2.1.

Based on the information in the Table 1.3. and Table 1.10. author has proposed the variables for "price" and "quantity" to be used for the Harberger Triangles' assessment (see Table 2.4.). The proposal has based on the review of approaches of other researchers (Table 1.10.) and comments from the European Central Bank on market failures (Table 1.3.).

Other perspective of the proposal of variables is to be able to measure it in the currency units or percentages so that the deadweight loss can be assessed in the terms of currency.

Table 2.4.

Proposed variables of the Harberger Triangle (the author's made)

Market failure	Variable for "price"	Variable for "quantity"
Asymmetric information Market power imbalances	Interest rates (deposits, loans)	Exposure of deposits and loans on banks' balance sheets
Negative spillovers	Interest rates (market)	Bank capital flows (cash flow)
Market abuse	Accruals for issued loans and guarantees	Exposure of loans on banks' balance sheets and guarantees on off-balance sheets

In the case of the asymmetric information other researchers look for the price of certain financial instruments (Crawford, Pavanini, Schivardi, 2018) or costs associated with it (Corrado, Schuler, 2017). Interest rates of deposits and loans are broadly available in most of the statistical databases, e.g., Eurostat, local central statistical bureaus. Subsequently the variable for "quantity" is proposed as "Exposure of deposits and loans on banks' balance sheets".

Author has derived variables for negative spillovers from Table 1.10. with additional comment that interest rates are meant to be market rates, e.g., EURIBOR or government bond yields, and capital flow is reflected from the cash flow perspective in the reporting.

In the case of market abuse most of market failures are related to deterioration of asset quality due to loss of confidence and transfer of shocks (see Table 1.3.). Thereby author

proposes to use the measure of asset quality, which is broadly available in specialized databases (World Bank, IMF, ECB, local central banks) or in the financial statements of banks: accruals for issued loans and guarantees. Subsequently the variable for "quantity" is proposed as "Exposure of loans on banks' balance sheets and guarantees on off-balance sheets" to have proper link with the variable for "price".

Market power imbalances are mostly covering the failure of market to achieve the perfect competition thereby the proper approach for the variable for "price" should be market position, which for banking industry is proportion of total assets. Subsequently the variable for "quantity" is proposed as "Exposure of total assets in the banking sector (currency units)".

For other market failures author proposes to use the same approach as for the information asymmetry considering that this approach is the most general and easy applicable for various situations.

Asymmetric information

Further paragraphs present the approach how to calculate the deadweight loss arising from the information asymmetry using the following variables: "price" – loan interest rates, "quantity" – exposure of loans on banks' balance sheets. Outcome of it is the equation for assessment of the deadweight loss arising from the information asymmetry.

Asymmetric information should result in additional charges due to higher risk associated with lack of full understanding of the project or business activity to be co-financed by the bank. Johnson and So (2017) in the analysis of financial market trading activities concluded that informed traders in the financial market face a leverage constraint that generates a trade-off between smaller price impact in equity markets and additional leverage in options markets. Because informed traders receive correlated signals, this trade-off causes the fraction of informed trade occurring in options versus equity markets to fluctuate over time depending on the nature of the signals informed traders receive. In contrast, uninformed traders' choice of trading venues is relatively uncorrelated, and thus the fraction of uninformed trade in each market is relatively stable over time. As a result, periods of heightened information asymmetry manifest in abnormally high or low option-to-stock volume ratios, relative to the level of ratios that occurs in the absence of private information.

Following the logic of Johnson and So (2017) there should be higher interest rate costs for the business due to the insufficient information for the bank. So, the bank has higher risk which is then priced in the interest rate.

To develop the methodology for the assessment of economic losses due to information asymmetry author evaluated available data on the market level, e.g., national, and supranational statistical databases, reports of supervisory authorities and financial statements of banks regarding credit balances, interest incomes and interest rates.

At first, author defines the function following the logic in Formula 1.11., i.e.,

$$i = f(bal) \tag{2.10}$$

where *bal* – exposure of loans on the bank balance sheet, *i* – loan interest rates.

Subsequently, the deadweight loss from asymmetric information can be expressed as the integral from exposures (*bal*), i.e.,

$$DWL_{as} = \int_{q(X*)}^{q(X)} [D(q) - p]dq = \int_{bal(i*)}^{bal(i)} [D(bal) - i]dbal \qquad (2.11)$$

where *bal(i*)* – exposures with loan interest rates considering asymmetric information, *bal(i)* – exposures with loan interest rates without asymmetric information.

Empirical literature on testing for asymmetric information (Chiappori, Salanié, 2000; Einav, Jenkins, Levin, 2012; Ioannidou, Pavanini, Peng, 2022) shows that collaterals are used in the models to capture the presence of asymmetric information. Thereby author has used the following approach to assess the deadweight loss:

$$DWL_{as} = \int_{bal(i*)}^{bal(i)} [D_1(bal) - D_2(bal)]dbal \qquad (2.12)$$

where $D_1(bal)$ – demand function of uncollateralized loans, $D_2(bal)$ – demand function of collateralized loans.

Demand function *i = D(bal)* is econometrically assessed based on actual transaction data with following approach to data collection and function's assessment:

1. additional control variable of market reference rate, e.g., 3-month EURIBOR or 6-month EURIBOR, which are the most popular reference rates in the loan contracts in the eurozone. This variable is influencing the interest payments of bank's clients, subsequently should be included in the modelling interest income for the bank. In the period when those reference rates were negative in most of the loan contracts adjustment were made to apply "0%" rate. This aspect is taken account in this model.
2. additional control variable of bank's administrative costs, e.g., cost-to-income ratio, which measures bank's operational efficiency.

Demand function is based on the actual data since only concluded loan agreements represent the sample of loan applications which were eligible for financing considering all selection criteria (creditworthiness, sufficient amount of initial cash etc.) – thereby representing the customers able to pay.

Market power imbalances

Further paragraphs present the approach how to calculate the deadweight loss arising from the market power imbalances (imperfect competition) using the following variables: "price" – loan interest rates, "quantity" – exposure of loans on banks' balance sheets. Outcome of it is the equation for assessment of the deadweight loss arising from the market power imbalances.

Imperfect competition is measured by many different indices reflecting the level of monopoly power in the chosen market. One of the most popular indices is Herfindahl-Hirschman index used mostly by authorities when mergers and acquisitions appear in the markets (Horizontal Merger Guidelines, 2015).

$$HHI = \sum_{i=1}^{N} (MS_i)^2 \qquad (2.13)$$

where MS_i – market share of the company in the market, N – number of companies in the market

Values of HHI range from 0 till 10 000 and it is sensitive to slightest changes in the market. As per Horizontal Merger Guidelines (2015) market are classified into three types:
1. Unconcentrated Markets: HHI below 1500
2. Moderately Concentrated Markets: HHI between 1500 and 2500
3. Highly Concentrated Markets: HHI above 2500

Considering that HHI is sensitive to changes there have been thresholds introduced to interpret those changes:
1. *Small Change in Concentration*: Mergers involving an increase in the HHI of less than 100 points are unlikely to have adverse competitive effects and ordinarily require no further analysis.
2. *Unconcentrated Markets*: Mergers resulting in unconcentrated markets are unlikely to have adverse competitive effects and ordinarily require no further analysis.
3. *Moderately Concentrated Markets*: Mergers resulting in moderately concentrated markets that involve an increase in the HHI of more than 100 points potentially raise significant competitive concerns and often warrant scrutiny.
4. *Highly Concentrated Markets*: Mergers resulting in highly concentrated markets that involve an increase in the HHI of between 100 points and 200 points potentially raise significant competitive concerns and often warrant scrutiny. Mergers resulting in highly concentrated markets that involve an increase in the HHI of more than 200 points will be presumed to be likely to enhance market power. The presumption may be rebutted by persuasive evidence showing that the merger is unlikely to enhance market power.

Following the abovementioned logic author has introduced the threshold for analysis of the banking market – 100 points. If changes in the banking market's HHI are above this threshold the deadweight loss is assessed based on the approach described further.

Further analysis done by author shows that small countries tend to have higher HHI values, which possibly may be an overestimate of the monopoly power (see Figure 2.5.).
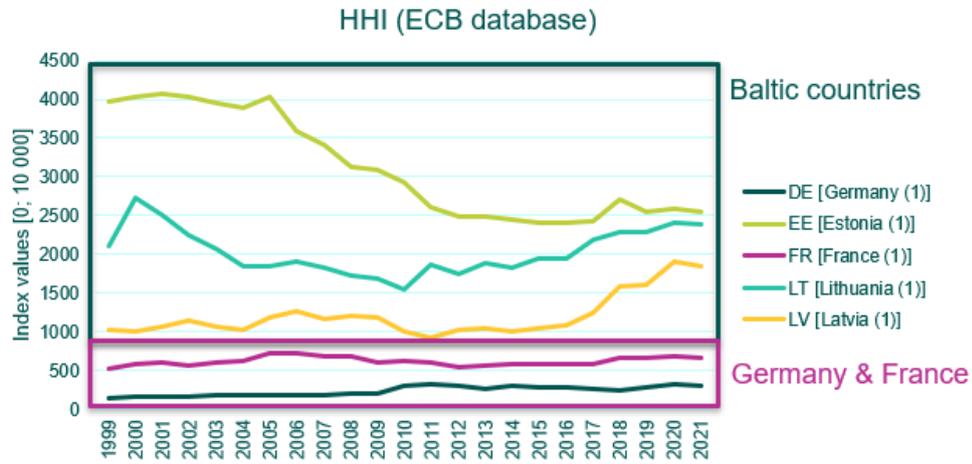
Figure 2.5. HHI values for large and small countries (author's made based on ECB Statistical Data Warehouse, 2022)

Using econometric analysis for 27 European Union countries and the United Kingdom, author concluded that small countries tend to have higher HHI values. Evaluation was done based on Formula (2.13.2) and (2.13.3), i.e.,

$$GPD = f(HHI) \tag{2.13.2}$$

$$GPD = a \cdot HHI^3 + b \cdot HHI^2 + c \cdot HHI + d \tag{2.13.3}$$

Explanatory power of Formula (2.13.3) is 51%, with p-values < 5%.

Following this conclusion, adjusted HHI is developed by author (see Formula 2.13.4).

$$\widehat{HHI} = HHI \cdot (1 + \alpha) \tag{2.13.4}$$

Adjustment

$$\alpha = (L - \bar{L}) \tag{2.13.5}$$

where L – country level index, $\bar{L}$ – average Euro area index

was done using non-structural measure of the Lerner index (simplified version after Demirgüç-Kunt and Martínez Pería, 2010), i.e.,

$$L = \frac{\left(\frac{profit}{assets}\right)}{\left(\frac{revenue}{assets}\right)} \tag{2.13.6}$$

Then based on the data availability in the ECB Statistical Data Warehouse (2022) Formula 2.13.6. was further developed, i.e.,

$$L = \frac{\left(\frac{profit}{assets}\right)}{\left(\frac{revenue}{assets}\right)} = \frac{ROA}{\left(\frac{operating\ expenses}{assets}\right) \cdot \frac{1}{CI}} \tag{2.13.7}$$

where *CI* – Cost-to-Income ratio, *ROA* – Return on Assets

Based on the previously described approach in the Chapter 1.6.1. and Formula 2.10., the deadweight loss from market power imbalances can be expressed as the integral from exposures (*bal*), i.e.,

$$DWL_{power} = \int_{q(X*)}^{q(X)} [D(q) - S(q)]dq = \int_{bal(i*)}^{bal(i)} [D(bal) - S(bal)]dbal \qquad (2.14)$$

where *bal(i*)* – exposure with excess interest rate level, *bal(i)* – exposure with equilibrium interest rate level.

Excess interest rate level is interpreted as the interest rate in the case when market's HHI change has been more than 100 points.

Demand function *i = D(bal)* is econometrically assessed based on actual transaction data with the same approach as disclosed above in the case of information asymmetry.

Supply function *i = S(bal)* is econometrically assessed based on:

- actual transaction data with the same approach as disclosed above in the case of demand function,
- before equilibrium point: breakeven amounts to be supplied by banks to the banking market are assessed based on the Lending Margins, which represent the difference between the cost of basic funds for banks (deposits) and the income of basic sources of income in the traditional banking – loans. Some parts of the Lending Margins are used to cover costs of operations for banks thereby Adjusted Lending Margins are calculated:

$$ALM = LM \cdot \frac{(1 - CI)}{100} \qquad (2.15)$$

where *LM* – lending margin, *ALM* – adjusted lending margin, *CI* – Cost-to-income ratio

  Adjusted Lending Margin then is deducted from the Interest Rates to assess the lowest rate supplier (the bank) is going to accept to provide loans to the banking market.

- after equilibrium point: additional amounts not supplied to the market are assessed based on the Loan-to-Deposit ratio. In case the Loan-to-Deposit ratio is lower than 1,0 all amounts above this threshold are considered as available to the market if demanded.

Negative spillovers

Further paragraphs present the approach how to calculate the deadweight loss arising from the negative spillovers using the following variables: "price" – interest rates in the financial market, "quantity" – bank capital flows (cash flow). Outcome of it is the equation for assessment of the deadweight loss arising from the negative spillovers.

Based on the previously described approach and Formula 2.10., the deadweight loss from negative spillovers can be expressed as the integral from exposures (*bal*), i.e.,

$$DWL_{spill} = \int_{q(X*)}^{q(X)} [SC(q) - SB(q)]dq = \int_{bal(i*)}^{bal(i)} [SC(bal) - SB(bal)]dbal \qquad (2.16)$$

where *bal(i*)* – capital transfer balance of observable economy before the shift of interest rates of major economy, *bal(i)* – capital transfer balance of observable economy after the shift of interest rates of major economy.

Market abuse

Further paragraphs present the approach how to calculate the deadweight loss arising from the market abuse using the following variables: "price" – accruals for issued loans and guarantees, which are recognized in the Profit & Loss statement in relevant period, expressed as percentage from total exposure, "quantity" – exposure of loans on banks' balance sheets and guarantees on off-balance sheets. Outcome of it is the equation for assessment of the deadweight loss arising from the market abuse.

Specifics in this case is that market abuse cases are observed based on the information in the media and thereby calculation is done only in the period when particular case is observed. Thereby the deadweight loss is assessed as excess accruals made by financial intermediaries to reflect losses from the relevant case.

Based on the previously described approach, the deadweight loss from market abuse can be expressed as the sum from excess accruals, i.e.,

$$DWL_{abuse} = \sum_{i=1}^{N} (Exc - Acc) \cdot bal \qquad (2.17)$$

where *Exc* – excess accruals, *Acc* – normal level of accruals, *bal* – exposure of loans on banks' balance sheets and guarantees on off-balance sheets, *N* – number of periods when market abuse was observed.

If other market failures need to be assessed, the approach is expected to be similar to Formula 2.17. – excess level of measure will be assessed (interest rates, accruals etc.) and multiplied by relevant quantity (exposures of loans, deposits, or any off-balance sheet items), i.e.,

$$DWL_{other} = \sum_{i=1}^{N} (Exc - Norm) \cdot bal \qquad (2.18)$$

where *Exc* – excess level of measure, *Norm* – normal level of measure, *bal* – exposure of loans, deposits, or any off-balance sheet items, *N* – number of periods when market failure was observed.

2.3. Regulation costs' assessment

Regulation costs are assessed for the following cost types:
- Regulatory costs,
- Compliance costs,
- Indirect costs.

Similar to the deadweight loss Formulas 2.19., 2.21. and 2.23. correspond to the regulation costs at single point of the Regulation Intensity Index. Function graphically reflected in Figure 2.2. can be written as *f (Reg costs)*.

2.3.1. Modelling the regulatory costs

Definitions

Based on the literature review in the Chapter 1 author has defined the government regulatory costs as follows:
(a) administration costs:
    a. to develop and implement regulatory systems,
    b. to assess applications,
    c. to process renewals.
(b) enforcement costs:
    a. to develop and implement auditing systems,
    b. to develop and implement sanctioning systems.

Regulatory costs' assessment process

Based on the input from previous research described above author has developed the following regulatory costs' assessment process (see Figure 2.6.):

Source Identification phase
(a) Relevant authorities: currently in many countries there have been authorities appointed for micro-prudential regulation (firm level financial stability supervision) and macroprudential regulation (industry and economy level financial stability supervision), and authority appointed for policy making in the banking market (usually this authority is responsible for all financial market).
(b) Relevant report: authorities prepare annual budget and/ or annual financial report. As a data source annual financial report is preferred as it contains cost numbers

referring to the costs occurred. For policy makers other approach is developed as publicly is not available information about budget numbers of certain departments within Ministry of Finance.
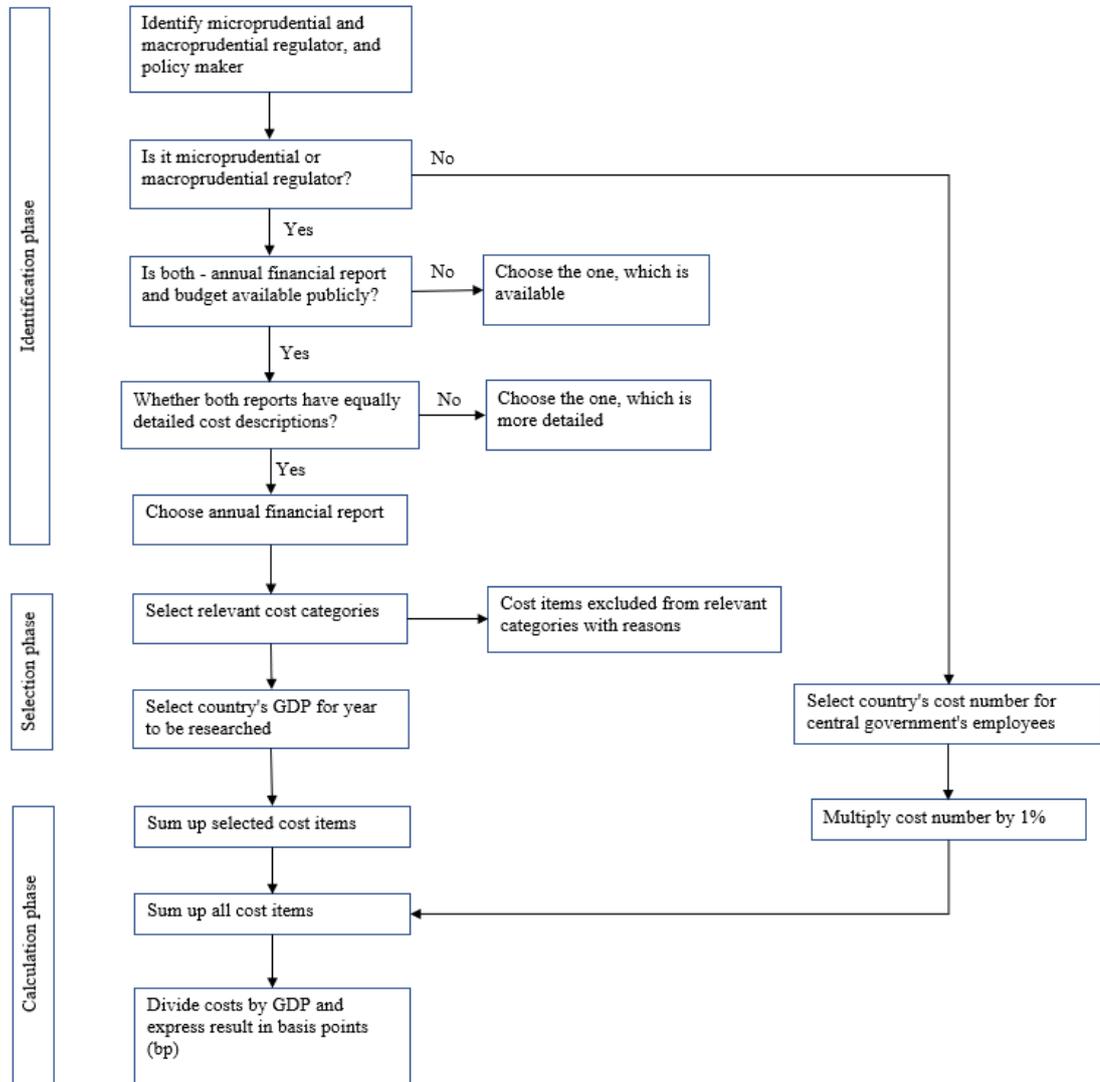
Figure 2.6. Regulatory costs' assessment process flow chart (source: the author's made)

Cost Selection phase
(a) Relevant cost categories: (a) costs related to labour, including professional development, (b) technology costs, (c) professional consultations, (d) public relations and (e) facilities related costs. There could be reasons requiring excluding some items due to their irrelevance for the purpose of this assessment, e.g., recharges from other periods or one-off costs.
(b) GDP for the year to be researched: this number will be used for further calculations described in the next phase.

Calculation phase

(a) Cost items from reports of microprudential and macroprudential regulators are summed up.

(b) For the Central Bank only administrative costs are considered. Costs related to the financial market activities are excluded. Example from the Bank of Latvia is reflected in the Figure 2.7. Black rectangle shows costs included in the calculation.

PROFIT AND LOSS STATEMENT

(in thousands of euro)

	Note	2021	2020
Net interest income	33	**123 981**	139 537
Interest income		165 248	190 313
Interest expense		–41 267	–50 776
Net result of financial operations, recognition of revaluation result in profit and loss statement and financial risk provisions		**–50 235**	–68 947
Realised gains arising from financial operations	34	357	44 471
Recognition of revaluation result on financial assets and positions in profit and loss statement	23, 35	–36 618	–35 237
Provisions for market risk and credit risk	36	–13 974	–78 181
Net expense from fees and commissions		**–3 951**	–3 394
Fees and commissions income		981	949
Fees and commissions expense		–4 932	–4 343
Income from equity securities and participating interest	37	**14 575**	18 605
Net result of pooling of monetary income	38	**–34 342**	–27 701
Other operating income	39	**3 591**	1 268
NET INCOME		**53 619**	59 368
Remuneration	40	**–16 403**	–16 867
Social security costs and solidarity tax	40	**–3 582**	–3 764
Banknote and coin acquisition costs	41	**–1 831**	–1 546
Depreciation of fixed assets and amortisation of intangible assets	14	**–3 802**	–3 851
Other operating expenses	42	**–7 093**	–6 694
PROFIT FOR THE YEAR		**20 908**	26 646

Figure 2.7. Administrative costs from Central Bank's financial report (Bank of Latvia, 2021)

(c) For policy maker the following approach has been developed: total staff costs are multiplied by 1% as on average financial market policy department is one of the 10 policy making departments within the Ministry of Finance and Ministry of Finance is one of the 10 ministries in the government.

(d) Sum of costs are divided by GDP to have possibility to compare countries with different scale. Result is expressed in basis points due to the small number.

Summing up the abovementioned, the regulatory costs should be assessed as follows,

$$y_n = MiP_n + MaP_n + \frac{1}{a} \cdot \frac{1}{b} \cdot SC \tag{2.19}$$

where y – regulatory costs, MiP – applicable microprudential regulator's costs, MaP – applicable macroprudential regulator's costs, SC – government's staff costs, a – number of ministries in the government, b – number of policy-making departments within the responsible ministry (e.g., Ministry of Finance)

2.3.2. Modelling the compliance costs

Definitions

Author considering approaches of other scientists in this research has chosen to use broader definition of compliance costs – certain fraction of one-off and ongoing operational costs. This approach would be more general and thereby would allow to compare results of different banking market participants.

Quantification approach

Following the definition, costs' assessment formula is set as follows:

$$y_n = (0{,}2 \cdot \alpha_n + \beta) \cdot x \tag{2.20}$$

n = 1, …, 5

where y – bank's compliance costs, EUR; x – bank's operational costs, EUR; α – coefficient corresponding to one-off costs; β – coefficient corresponding to ongoing costs.

Parameters α, β should be assessed in each case individually. Coefficient for ongoing costs is expected to be above 0 in all financial reporting years. Coefficient for one-off costs is expected to be above 0 in years when significant regulation has been approved by the regulator:

(a) in the year set as significant,

(b) four following years after the significant year. Such approach is motivated by the fact that major part of one-off costs in the banking sector usually will be related to the IT development, which will be accounted as an asset with depreciation of five years. This idea is supported by ICF (2019) research showing that the most important cost item across all fives sectors included in the survey analysis was "Investment in/updating IT" (and especially, "development of IT"). Thereby coefficient "0,2" means depreciated part of one-off costs in any given year.

In the Doctoral Thesis author has used parameters α, β based on the financial market survey ICF (2019), which has found that for banks and financial conglomerates one-off

compliance costs are 2,89% of total operating costs and on-going compliance costs – 2,60% of total operating costs. Those numbers were calculated based on the cost information collected from European banks as of 2017, see Figure 2.8.

ICF (2019) analysis showed the following typical cases of one-off costs:

- all five sectors included in the survey analysis, except asset managers, incurred high one-off costs for MiFID I/MiFID II/MiFIR (close to 1% of their total operating costs or more),
- all five sectors included in the survey analysis, except investment banks, incurred high one-off costs for Solvency II – this was especially true for insurers/re-insurers (more than 3,5% of their total operating costs),
- banks and financial conglomerates incurred higher one-off costs for SRM (1,30% of their total operating costs) than other sectors.

		Banks and financial conglomerates	Investment banks	Asset managers	Insurers/re-insurers	Financial markets
Total one-off costs (EUR 000)	Median	3,149	66,045	183	1,264	18,212
	Mean	55,566	151,283	21,468	17,542	86,101
Total one-off costs (as % of total operating costs)	Median	1.40%	1.84%	1.69%	2.72%	1.71%
	Mean	2.89%	2.15%	3.11%	3.74%	2.55%
Total ongoing costs (EUR 000)	Median	1,075	34,329	290	730	3,400
	Mean	42,847	128,322	32,122	32,403	39,606
Total ongoing costs (as % of total operating costs)	Median	1.11%	1.67%	3.28%	1.35%	1.75%
	Mean	2.60%	2.95%	3.84%	2.18%	3.23%

Figure 2.8. Total costs of compliance with EU financial legislation, by sector (ICF, 2019)

Research shows that ongoing costs were affected as well by new regulations (ICF, 2019):

- MiFID I/MiFID II/MiFIR and SRM were the legislations that generated the highest ongoing costs for most sectors,
- insurers/re-insurers incurred high ongoing costs for Solvency II (more than 1% of their total operating costs),
- financial markets incurred higher ongoing costs for CRR/CRD IV (1.28% of their total operating costs) than other sectors.

At the same ICF's research show that costs increased significantly compared to the research conducted based on cost numbers as of 2009:

- ongoing costs increased from 0,63% to 2,60%,

- one-off costs increased by 33%.

Thereby in author's view numbers from ICF (2019) research should be adjusted assuming that further regulations could have effect on banks' compliance costs:

- considering that in the period 2009 – 2017 were introduced a lot of new regulations following the economic crisis, where one of the main conclusions was under-regulation of financial market participants,
- considering that over 8 years ongoing costs increased by approx. 0,25%-points per year, ongoing costs further should be increased by 0,10%-points per year (rounded down the half of increase in observed period),
- considering that over 8 years one-off costs increased by approx. 0,12%-points per year, one-off costs further should be increased by 0,05%-points per year (rounded down the half of increase in observed period).

Considering abovementioned compliance costs should be assessed in two ways:

- one-off costs (α_0 in Formula 2.21),
- ongoing costs (β_0 in Formula 2.21).

Thereby Formula 2.18 should be adjusted as follows,

$$y_n = \begin{cases} n = 1, \ldots, 8: (0,2 \cdot (\alpha_0 + n \cdot 0,12\%) + \beta_0 + n \cdot 0,25\%) \cdot x \\ n = 9, \ldots: (0,2 \cdot (\alpha_8 + (n-8) \cdot 0,05\%) + \beta_8 + (n-8) \cdot 0,10\%) \cdot x \end{cases} \qquad (2.21)$$

where $\alpha_0 = 1,94\%$, $\beta_0 = 0,63\%$ (corresponds to year 2009 and any prior year)

2.3.3. Modelling the indirect costs

Following the approach of Brian Titley Consulting (2015) indirect costs are assessed as changes in the demand/ supply due to regulatory changes. Those changes most probably will cause higher interest rates and dropping loan volumes. Assessment could be done after significant regulation comes into force (new regulatory document or material changes in existing documentation), i.e., the following formula should be used,

$$y_n = (q_n - q_{n-1}) \cdot (i_n - i_{n-1}) \qquad (2.22)$$

where y – bank's indirect costs, q – loan volumes, i – interest rates

Guiso, Sapienza and Zingales (2007) found that in Italy where banking market entry was more restricted, the cost of credit was higher and - contrary to expectations – access to credit lower. The only benefit of these restrictions was a lower proportion of bad loans. This finding should be incorporated in the Formula 2.22. as opposite – cost reducing – effect. Loan quality typically is assessed by accruals, thereby adjusted formula should be as follows,

$$y_n = (q_n - q_{n-1}) \cdot (i_n - i_{n-1}) - (acc_{n-1} - acc_n) \qquad (2.23)$$

where acc – accruals of loans

Further approach of assessing the effect of communication has been described as special case of indirect costs as disclosed in Section 1.5.5.

Effect of the communication: *adjustments to previous approaches*

Author has chosen to continue the work of Petrella, Resti (2013), Morgan, Peristiani, Savino (2014), Candelon, Sy (2015), Sahin, de Haan (2016), Flannery, Hirtle, Kovner (2017), Neretina, Sahin and de Haan (2020) enlarging the scope of covered events. Those researchers focused on the stress tests as events affecting returns of financial market participants' equities and bonds. Author moves further with speeches from central bank spokespersons, which have been released several times per month. Those events have certain specifics covered to released information about stress tests' results:

1. they happen more frequently thereby it is expected to have more short-term effect as new speech is in place in a few days or weeks at latest,
2. they have more general nature as target is all financial market thereby it is expected that only speeches with more optimistic or pessimistic tone should affect returns of financial market participants' equities and bonds.

Meanwhile Hwang, Lustenberger, and Rossi (2021) in conclusions of their analysis of the effect central bank speeches have on business executives' opinions of their central banks' impact on the economy notes that central bank governors provide a consistent message over time, whereas other board members are more likely to convey diverging messages that confuse the receivers. This could lead to ambiguous results in the analysis.

Effect of the communication: *adjustment of the event identification*

When it comes to speech allocation to specific trading day author uses similar approach as presented per Born, Ehrmann and Fratzscher (2011), i.e., each speech is allocated to certain trading day. Communications during weekends are allocated to the following Monday, communications in the evening – to the subsequent day of trade.

When several speeches appear on the same day, author is choosing the one, whose speaker has the position of the governor of the central bank. This approach is selected considering findings of Hwang, Lustenberger, and Rossi (2021) about consistency of provided messages. It could happen that two different governors are speaking on the same day. In such a case the governor of higher rank has been selected.

In order to assess speeches author uses the following approach: each speech has categorized as "optimistic +", "optimistic", "neutral", "pessimistic" or "pessimistic –", based on the number of certain words in the speech. In the case of "optimistic +" speech number of optimistic words is at least two times higher than number of pessimistic words. The same is applicable for the "pessimistic –" speech: number of pessimistic words is at least two times higher than the number of optimistic words. Those two more polarized categories have been selected considering that speeches are of more general nature (not directly targeted to some specific financial market participant normally) and slightly optimistic or pessimistic speeches are not expected to affect returns of that financial market participant's equities or bonds.

In the Table 2.5. are summarized words used for the speech assessment, i.e., "recovery", "stable" (and "stability"), "grow" (and "growth"), "positive" and "sustainable" (and "sustainability") for optimistic speech and "un-certainty", "volatile" (and "volatility"), "adverse", "recession" and "pressure" for pessimistic speech.

Table 2.5.

Words used for the speech assessment

(the author's made)

Speech category	Word	Used in search
Optimistic	Recovery	"recover"
Optimistic	Stable/ stability	"stab"
Optimistic	Grow/ growth	"grow"
Optimistic	Positive	"positive"
Optimistic	Sustainable/ sustainability	"sustainab"
Pessimistic	Uncertainty	"uncertain"
Pessimistic	Volatile/ volatility	"volatil"
Pessimistic	Adverse	"adverse"
Pessimistic	Recession	"recession"
Pessimistic	Pressure	"pressure"

Further in the search author uses shortened versions of those words to catch various contexts and expressions these words are used in. Technically author has used the following formula to find abovementioned words in the speeches,

$$N = \frac{x - x'}{y} \tag{2.24}$$

where N – number of strings found, x – number of characters in the speech, x' – number of characters in the speech, which is exempt from the string to be searched, y – number of characters in the string to be searched.

Next step is to assess the speech, i.e., when optimistic words are more than pessimistic words, the speech is assessed as optimistic. Vice versa, if pessimistic words are more than optimistic words, the speech is assessed as pessimistic. If those numbers are equal, the speech is assessed as neutral. On top that come special cases with "optimistic +" and "pessimistic –" assessment described before.

Effect of the communication: *adjustment to the assessment of the effect on the market participant*

Author has chosen the approach of assessing normal and abnormal returns to assess the reaction from central bank's communication.

For assessing normal returns Formula (1.17) has been used with a note that $R_{m,t}$ is the return of relevant market portfolio, e.g., S&P500 for U.S. market or EURO STOXX 50 for euro area market (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain), or country specific indices in the euro area, like CAC40

in France and DAX in Germany. Considering Born, Ehrmann and Fratzscher (2011) approach with daily stock market returns over the 20 days prior to the event, author has chosen to use one event (one speech) per month so at least 15 working days are available for the model of normal returns training purposes.

Abnormal returns are calculated based on the Formula (1.18) with the comment that window has been adjusted. Considering that the day prior to the central bank communication is not relevant as market participants have not heard it yet so price is not expected to include effects. Window is adjusted to 5 working days so it looks like (0; +4). Cumulative abnormal return (CAR) is calculated to see the full effect.

In the Table 2.6 author has summarized the assessment of financial market participant's reaction on the central bank communication.

<div align="right">Table 2.6.</div>

<div align="center">Summary of market participant's reaction</div>

<div align="center">(the author's made)</div>

Speech category	Value of CAR	Assessment of reaction
Optimistic	CAR > 0	Expected reaction (positive)
	CAR < 0	Adverse reaction (negative)
	CAR = 0	No reaction
Pessimistic	CAR > 0	Adverse reaction (positive)
	CAR < 0	Expected reaction (negative)
	CAR = 0	No reaction
Neutral	CAR > 0	Adverse reaction (positive)
	CAR < 0	Adverse reaction (negative)
	CAR = 0	Expected reaction (no reaction)

For optimistic speech expected reaction is positive CAR, subsequently for pessimistic speech – negative CAR. Other reactions are "adverse" or "no reactions".

Effect of the communication: *assessment for the model*

In order to assess the annual communication related indirect costs and include them into the model, the following formula has been developed:

$$Com = 0.5 \cdot \sum_{i=1}^{n} CAR \cdot fi \cdot qty + 0.5 \cdot \sum_{i=1}^{m} CAR \cdot fi \cdot qty \qquad (2.25)$$

where *Com* – communication related indirect costs, *fi* – value of chosen financial instrument in selected time period, *qty* – quantity of chosen financial instrument in selected time period, *n* – number of periods during the first year, *m* – number of periods during the second year.

The approach is to assess the average number of two years to minimize the effect of fluctuations in the financial markets on the assessment of indirect costs.

Typical practical issue is the availability of data for the full assessment of the effect on the country level. In case, e.g., only one bank in the country can be assessed through this approach, the effect on the country level is approximated via extrapolation, i.e.,

$$CCom = Com \cdot \frac{k}{l}$$
(2.26)

where *CCom* – communication related indirect costs on the country level, k – total banking assets in the country, l – total assets of the bank, whose communication effect was assessed with Formula (2.25).

2.4. Conclusions

Considering the analytical results and empirical findings of the conducted research, the following has been concluded by author:

1. The Government Regulation Model consists of the methodology for the index *Reg(n)* and for the equilibrium point: *ƒ (DWL) = ƒ (Reg costs).*

Index *Reg(n)*: Regulation intensity measurement scale

2. In this doctoral research the regulation intensity measurement scale is based on the Regulation Intensity Index with values in the interval [0; 100]. The Regulation Intensity Index is calculated as average from 5 indices: Index from the questionnaire based on the Bank Regulation and Supervision Survey from the World Bank and 4 indices based on the *Index of Economic Freedom.*

3. Index from the questionnaire based on the Bank Regulation and Supervision Survey is assessed based on the 23 questions from the survey covering topics of the capital requirements, supervisory power, activity restrictions, market discipline, asset diversification, Anti-Money Laundering/Combating the Financing of Terrorism topic and fit and proper (suitability) requirements for the bank's management.

4. Four indices based on the *Index of Economic Freedom* cover limitations on business, monetary, investment and financial freedoms.

Equilibrium point *ƒ (DWL)*: Deadweight loss assessment

5. Deadweight loss is assessed for the following market failures:
   - Imperfect competition or market power imbalances,
   - Asymmetric information,
   - Negative spillovers,
   - Market abuse and others.

6. Developed formulas correspond to the deadweight loss at single point of the Regulation Intensity Index.

7. To analyse the deadweight loss with the Harberger Triangle, author proposes to use the following variables:
    a. Imperfect competition or market power imbalances: as variable for "price" to use the interest rates on loans and/ or deposits. As variable for "quantity" to use the exposure of deposits and/ or loans on banks' balance sheets,
    b. Asymmetric information: as variable for "price" to use the interest rates on loans and/ or deposits. As variable for "quantity" to use the exposure of deposits and/ or loans on banks' balance sheets,
    c. Negative spillovers: as variable for "price" to use the interest rates from financial market indicators. As variable for "quantity" to use the bank capital flows (cash flow),
    d. Market abuse and others: as variable for "price" to use the accruals for issued loans and guarantees. As variable for "quantity" to use the exposure of loans on banks' balance sheets and guarantees on off-balance sheets.
8. Abovementioned variables cover insights revealed in the literature and central bank speeches' analysis and are broadly available in most of the statistical databases, specialized databases or in the financial statements of banks.
9. In the calculations it is important to exclude the effect of GDP growth and inflation thereby exposure should be adjusted by relevant ratios prior to running the deadweight loss calculations.
10. Empirical literature on testing for asymmetric information shows that collaterals are used in the models to capture the presence of asymmetric information.
11. Demand function is based on the actual data since only concluded loan agreements represent the sample of loan applications which were eligible for financing considering all selection criteria (creditworthiness, enough initial cash etc.) – thereby representing the customers able to pay.
12. Herfindahl-Hirschman index (HHI) is used to assess the level of monopolization in the banking sector. Author has introduced the threshold for analysis of changes of HHI in the banking sector – 100 points.

Equilibrium point *f (Reg costs)*: Regulation costs' assessment

13. Regulation costs are assessed for the following cost types:
    - Regulatory costs,
    - Compliance costs,
    - Indirect costs.
14. Developed formulas correspond to the regulation costs at single point of the Regulation Intensity Index.
15. Regulatory costs are assessed through regulatory costs' assessment process, which consists of Source Identification phase, Cost Selection phase and Calculation phase.
16. The following cost categories are included in regulatory costs: (a) costs related to labour, including professional development, (b) technology costs, (c) professional

consultations, (d) public relations and (e) facilities related costs. For the Central Bank only administrative costs are considered. Costs related to the financial market activities are excluded.

17. <u>Compliance costs</u> are assessed through certain fraction of one-off and ongoing operational costs.

18. In the Doctoral Thesis author has used parameters α, β based on the financial market survey ICF (2019), which has found that for banks and financial conglomerates one-off compliance costs are 2,89% of total operating costs and on-going compliance costs – 2,60% of total operating costs. This was used as a basis, on which further adjustments were made.

19. <u>Indirect costs</u> are assessed as changes in the demand/ supply due to regulatory changes based on the effect on interest rates and loan volumes.

20. Higher restrictions affect the proportion of bad loans, which was considered in the formula.

21. Special attention was paid to communication effects in the context of indirect costs.

Overall model

22. The equilibrium point is defined as $\{DWL_{Reg(n)}; Reg(n)\}$, which satisfies the condition: $DWL_{Reg(n)} = Reg\ costs_{Reg(n)}$.

23. The deadweight loss $DWL_{Reg(n)}$ is defined as sum of all deadweight losses from identified market failures, i.e.,

$$DWL_{Reg(n)} = \begin{pmatrix} \int\limits_{bal(i*)}^{bal(i)} [D_1(bal) - D_2(bal)]dbal \\ \bigcup \int\limits_{bal(i*)}^{bal(i)} [D(bal) - S(bal)]dbal \\ \bigcup \int\limits_{bal(i*)}^{bal(i)} [SC(bal) - SB(bal)]dbal \\ \bigcup \sum\limits_{i=1}^{N}(Exc - Acc)\cdot bal \bigcup \sum\limits_{i=1}^{N}(Exc - Norm)\cdot bal \end{pmatrix}$$

24. The regulation costs $Reg\ costs_{Reg(n)}$ are defined as sum of all identified regulation cost types, i.e.,

$$Reg\ costs_{Reg(n)} = \left(\begin{array}{c} MiP_n + MaP_n + \dfrac{1}{a} \cdot \dfrac{1}{b} \cdot SC \\ \displaystyle\bigcup \begin{cases} n = 1, \dots, 8: (0{,}2 \cdot (\alpha_0 + n \cdot 0{,}12\%) + \beta_0 + n \cdot 0{,}25\%) \cdot x \\ n = 9, \dots : (0{,}2 \cdot (\alpha_8 + (n-8) \cdot 0{,}05\%) + \beta_8 + (n-8) \cdot 0{,}10\%) \cdot x \end{cases} \\ \displaystyle\bigcup (q_n - q_{n-1}) \cdot (i_n - i_{n-1}) - (acc_{n-1} - acc_n) \\ \displaystyle\bigcup \left(0.5 \cdot \sum_{i=1}^{n} CAR \cdot fi \cdot qty + 0.5 \cdot \sum_{i=1}^{m} CAR \cdot fi \cdot qty \right) \cdot \dfrac{k}{l} \end{array} \right)$$

3. VALIDATION OF THE GOVERNMENT REGULATION MODEL

Validation of the model is done by model blocs as of Table 2.1.:
- Deadweight loss assessment
- Regulation costs' assessment
- *Additional activity:* Regulation measurement scale

Validation is performed based on the data from the databases of the European Central Bank, Bank of Latvia, Eurostat, Bloomberg, annual reports of regulators, World Bank's Bank Regulation and Supervision Survey and database of the Index of Economic Freedom.

Validation logic is set by each bloc separately:
- Deadweight loss assessment: validation done with selected euro area countries or euro area in general covered by the database of the European Central Bank considering that some data are needed on detailed level.
- Regulation costs' assessment: validation done with euro area countries or selected countries outside of the euro area if data are available.
- *Additional activity:* Regulation measurement scale: validation done with 4 selected countries, representing different regulations. Considering that the World Bank's Bank Regulation and Supervision Survey and database of the Index of Economic Freedom covers all world, the geographical region is not the limitation.

Each of the blocs have their research hypothesis:
- Deadweight loss assessment: the deadweight loss decreases with increased regulation intensity level.
- Regulation costs' assessment: the regulation costs increase with increased regulation intensity level.
- *Additional activity:* Regulation measurement scale: hypothesis is that the regulation intensity for Germany will be higher than for the UK, USA, and Russia.

The order of subsections follows the order of blocs as mentioned above.

To show the combined result of the overall model, case of Latvia has been viewed. Details are revealed in Section 3.4.

3.1. Validation of the regulation intensity measurement scale

Index from the questionnaire based on the Bank Regulation and Supervision Survey

For the methodology's validation purpose, the World Bank's database of the recently conducted survey on the bank regulation has been used (World Bank, 2019a). This survey has defined questions in a different way compared to the literature on previously mentioned indices (Agoraki et al., 2011; Anginer et al., 2014; Delis & Kouretas, 2011) thereby author adjusted the scaling model (see Appendix 2. Table A3) to be able to use results from abovementioned survey

(all changes marked bold). On top of that for the identified gaps new questions have been selected from the World Bank's survey.

Additionally, in the Appendix 2. Table A3 questions have been numbered so later in the Table 3.1 it is easier to follow-up on them.

Methodology's validation is performed for the selected countries: Germany, the United Kingdom (UK), the United States of America (USA) and the Russian Federation (Russia). Those countries have selected as they represent different approaches in the regulation of economy and subsequently financial market. It is expected that the most stringent regulatory requirements will be in Germany, followed by UK, USA and finally the less stringent requirements will be in Russia. Author has set the hypothesis that the regulation intensity for Germany will be higher than for the UK, USA, and Russia, in other words, the order of countries in their stringency of regulatory requirements will be as follows: Germany, UK, USA, Russia.

The rationale for such hypothesis is that Germany and USA are pretty different from the approach of how much government is allowed to regulate the economy. Germany has followed so called "social capitalism" approach where government is very actively regulating the economy. USA vice-versa has followed more liberal approach. UK has stayed somewhere in the middle between two abovementioned countries. Russia however has been less developed in the context of financial markets and their regulation and subsequently it is expected to have less regulatory requirements and associated costs imposed to the banks.

Table 3.1.

Scaling of intervention level for selected countries (the author's made based on World Bank, 2019a)

Question	Germany	UK	USA	Russia
Capital requirements index				
1.	Yes 1	Yes 1	Yes 1	Yes 1
2.	Yes 1	No 0	No 0	No 0
3.	Yes 1	Yes 1	Yes 1	Yes 1
4.	Yes 1	Yes 1	Yes 1	Yes 1
5.	Yes 1	Yes 1	Yes 1	No 0
6.	No 0	No 0	No 0	No 0
7.	Yes 0	Yes 0	Yes 0	Yes 0
8.	Yes 0	Yes 0	Yes 0	Yes 0
Supervisory power index				
9.	Yes 1	No 0	Yes 1	Yes 1
10.	Yes 1	Yes 1	Yes 1	Yes 1
11.	Yes	Yes	Yes	Yes

Table 3.1. continued

Question	Germany	UK	USA	Russia
	1	1	1	1
12.	No	No	No	No
	1	1	1	1
13.	Yes	No	Yes	Yes
	1	0	1	1
14.	Yes	Yes	Yes	Yes
	1	1	1	1
Market discipline index				
15.	No	No	No	Yes
	1	1	1	0
16.	Yes	Yes	Yes	Yes
	1	1	1	1
17.	Yes	Yes	Yes	Yes
	1	1	1	1
18.	Yes	Yes	Yes	Yes
	1	1	1	1
19.	Yes	Yes	Yes	Yes
	1	1	1	1
20.	No	No	No	No
	0	0	0	0
21.	Yes	Yes	No	Yes
	1	1	0	1
22.	Yes	Yes	Yes	Yes
	1	1	1	1
Diversification index				
23.	Yes	Yes	No	Yes
	1	1	0	1
Total	**19**	**16**	**16**	**16**

Results show that abovementioned hypothesis is confirmed: the regulation intensity for Germany is higher than for the UK, USA, and Russia. It should be noted that UK, USA, and Russia have the same value. Expectation in general is that Russia will report higher regulation level. Obviously, this index, which captures mainly regulatory documents, is reflecting more or less the same level of regulation restrictions as for other major economies – the UK and the USA. In the Table 3.2. index values have been calculated based on the values of "n" (see Formula 2.3.).

Table 3.2.

Questionnaire index values (the author's made)

	Germany	UK	USA	Russia
Index	82,6	69,6	69,6	69,6

Indices from *the Index of Economic Freedom*

Here in the Table 3.3. index values and subsequent inverse values are reflected for Germany, UK, USA, and Russia. This index captures other aspects of restrictions, not only

formal documents. Thereby it is obvious that Russia reports expected higher level of regulatory restrictions.

Table 3.3.

Economic Freedom index values (the author's made based on Index of Economic Freedom, 2022)

	Germany	UK	USA	Russia
Business Freedom	87.2	79.1	87.5	62.5
Monetary Freedom	79.5	83.0	82.3	68.0
Investment Freedom	80.0	80.0	85.0	30.0
Financial Freedom	70.0	80.0	80.0	30.0
100 – Business Freedom	12.8	20.9	12.5	37.5
100 – Monetary Freedom	20.5	17.0	17.7	32.0
100 – Investment Freedom	20.0	20.0	15.0	70.0
100 – Financial Freedom	30.0	20.0	20.0	70.0

Combined index

Summarising the results, in Table 3.4. the Regulation Intensity Index is reflected for selected countries. Combined index, which captures both – regulatory documents and regulatory practises – show more accurate view on the situation in the country. Parameter α was validated with following values:

$\alpha_1 = 0\%, \alpha_2 = 17\%, \dots, \alpha_5 = 17\%$

$\alpha_1 = 14\%, \alpha_2 = 14\%, \dots, \alpha_5 = 14\%$

$\alpha_1 = 25\%, \alpha_2 = 13\%, \dots, \alpha_5 = 13\%$

$\alpha_1 = 50\%, \alpha_2 = 8\%, \dots, \alpha_5 = 8\%$

$\alpha_1 = 75\%, \alpha_2 = 4\%, \dots, \alpha_5 = 4\%$

$\alpha_1 = 100\%, \alpha_2 = 0\%, \dots, \alpha_5 = 0\%$

As the most appropriate approach considering the need to balance all aspects of regulation was chosen:

$\alpha_1 = 14\%, \alpha_2 = 14\%, \dots, \alpha_5 = 14\%$

Table 3.4.

Regulation Intensity Index values (the author's made)

	Germany	UK	USA	Russia
Regulation Intensity Index	33.2	29.5	27.0	55.8

The combined Regulation Intensity Index show a bit changed order of countries in their stringency of regulatory requirements: Russia, Germany, UK, USA. Thereby conclusion is that the Regulation Intensity Index's result corresponds to the common sense. Thereby the original hypothesis is partially confirmed.

Results from other European countries are reflected in Table 3.5.

Table 3.5.

Regulation Intensity Index values (the author's made)

	Austria	Belgium	Bulgaria	Croatia
Regulation Intensity Index	32.4	33.8	38.6	41.7
	Cyprus	Czech Republic	Denmark	Estonia
Regulation Intensity Index	34.7	34.6	21.5	32.7
	Finland	France	Germany	Greece
Regulation Intensity Index	29.6	33.7	34.3	42.3
	Hungary	Ireland	Italy	Lithuania
Regulation Intensity Index	37.1	28.8	37.5	32.0
	Luxembourg	Malta	Netherlands	Poland
Regulation Intensity Index	30.4	34.1	27.7	32.7
	Portugal	Romania	Slovak Republic	Slovenia
Regulation Intensity Index	38.0	42.5	37.8	39.9
	Spain	Sweden		
Regulation Intensity Index	32.1	28.7		

3.2. Validation of the methodology of deadweight loss assessment

The research hypothesis for this section is as follows: the deadweight loss decreases with increased regulation intensity level. This hypothesis is validated in two parts:

- calculation of the deadweight loss corresponding to the single point of the Regulation Intensity Index for each of the identified market failures. Deadweight loss assessment is validated as per Formulas (2.9), (2.12), (2.14), (2.16), (2.17) and (2.18). Basic approach for geographical choice was to look for the euro area data, but some exceptions were made with comments on the reason. Details are revealed in Table 3.6.
- econometric assessment of the relationship between the deadweight loss and regulation intensity. This assessment is performed for one country – Latvia. Based on the results conclusion about the hypothesis is set and results have been included in the overall model.

Econometric models were tested for the presence of heteroscedasticity. In most cases the significance level of 5% were used to decide whether the null hypothesis cannot be rejected. If other significance levels were used, it was indicated.

Table 3.6.

Deadweight loss validation (the author's made)

Market failure	Formula	Area selected for validation	Principal results
Asymmetric information	(2.12)	Euro area	9.4 bn EUR
Market power imbalances	(2.14)	Sample of 9 countries from the euro area*	1.6 bn EUR (Latvia) 1.1 bn EUR (Slovenia) 0.4 bn EUR (Malta) 0.3 bn EUR (Luxembourg) No deadweight loss for others
Negative spillovers	(2.16)	Euro area	No deadweight loss**
Market abuse and others***	(2.17), (2.18)	Euro area	0.7 – 1.6 tn EUR

*Calculation depends on the Herfindahl-Hirschman index, which is assessed only on the level of individual countries

** The euro area does not report significant capital flows when material changes in interest rates occurred

***Due to the data limitations analysed together

Deadweight loss assessment from asymmetric information

Author has validated the methodology based on euro area data from the European Central Bank and local regulator (Bank of Latvia, 2022; ECB Statistical Data Warehouse, 2022; FCMC Statistics, 2022).

$D_1(bal)$ – demand function of uncollateralized loans was assessed based on the data of consumer loans, which do not use collaterals as risk minimization measure. Interest rate data excludes the most popular money market index used for loans – 3-month EURIBOR.

The function is econometrically assessed as follows:

$$D_1(bal) = -0.0114bal + 13.973 \qquad (3.1)$$

where *bal* – credit balance amount

$D_2(bal)$ – demand function of collateralized loans was assessed based on the data of mortgages, which use collaterals as risk minimization measure. Interest rate data excludes the most popular money market index used for loans – 3-month EURIBOR.

The function is econometrically assessed as follows:

$$D_2(bal) = -0.0013bal + 7.473 \qquad (3.2)$$

where *bal* – credit balance amount

Example of correlogram is reflected in Figure 3.1.
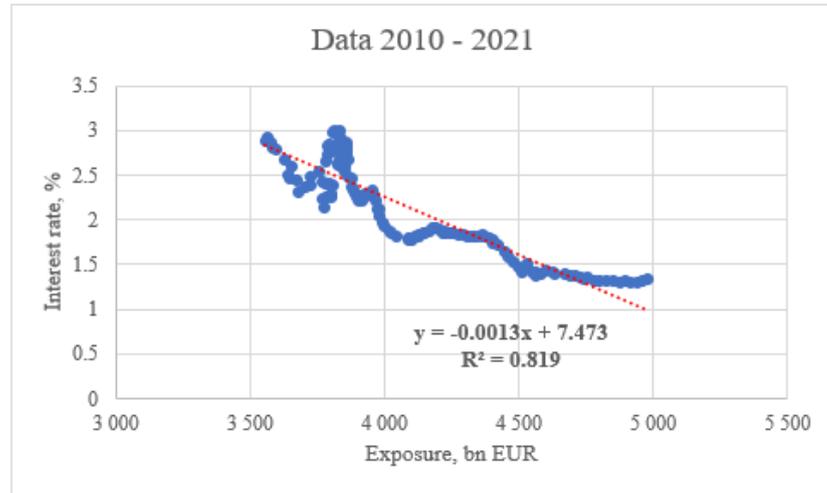
Figure 3.1. Demand function of collateralized loans (the author's made based on ECB Statistical Data Warehouse, 2022)

R^2 for functions are 66% and 82% respectively and variables are statistically significant with probability of 95%.

Finally, the deadweight loss can be assessed as follows,

$$DWL_{as} = \int_{bal(i*)}^{bal(i)} [-0.0101bal + 6.5]dbal \qquad (3.3)$$

This function can be used in the euro area banking market for the assessment of information asymmetry. Including in this formula amounts of *bal (i)* and *bal (i*)*, which are 650 and 600 bn EUR respectively, the following results can be obtained,

$$DWL_{as} = \int_{600}^{650} [-0.0101bal + 6.5]dbal = 9.375 \ bn \ EUR \qquad (3.4)$$

Data has excluded cost-to-income ratio as for the all the euro area data points start only from Q2 2015.
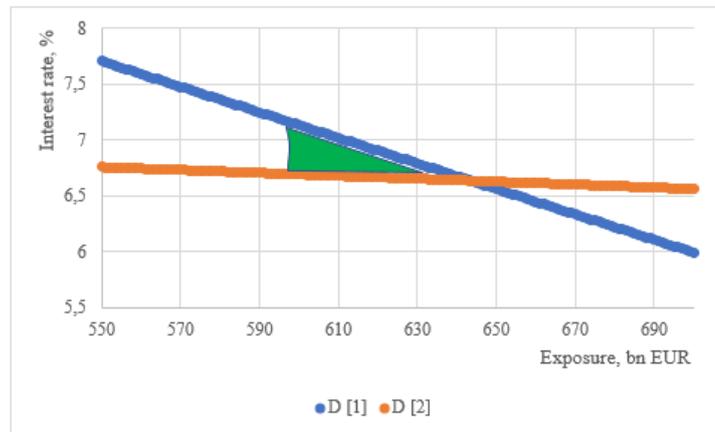
Figure 3.2. Visualization of the deadweight loss (the author's made)

Results show that the deadweight loss arising from the information asymmetry in the euro area banking market is approximately 9.375 bn EUR. Visualization of this result as a green square is reflected in Figure 3.2.

The hypothesis is confirmed based on the results above.

Deadweight loss assessment from market power imbalances

Author validated the methodology based on euro area data from the European Central Bank and local regulator (Bank of Latvia, 2022; ECB Statistical Data Warehouse, 2022; FCMC Statistics, 2022) for the sample of euro area countries:

1. representing different sizes, e.g., Germany vs Latvia, geographical regions, e.g., Malta vs France, and development levels, e.g., Slovenia vs Luxembourg,
2. covering approximately 50% of total number of euro area countries (9 out of 19) at the end of 2022,
3. data covers the period from 2003 to 2022.

Validation for this market failure was performed on the country level data since Herfindahl-Hirschman index is assessed only on country level data. And this index is the backbone of analysis whether monopolization or de-monopolization processes happened at all.

Results of econometric analysis are reflected in Table 3.7. (demand functions) and in Table 3.8. (supply functions). The assessment of the functions is based on the data series from 2003 to 2022 with subsets where necessary.

Table 3.7

Demand functions for selected countries (the author's made based on ECB Statistical Data Warehouse, 2022)

Country	Demand function	Basic statistics of regression	
		R²	p-values
Austria	$5,8 \cdot 10^{-5} x^2 + 0.0327x - 2,5532$	83,5%	1%; 4%
Belgium	$-0,0061x + 3,706$	92,8%	$7,5 \cdot 10^{-33}\%$

Table 3.7. continued

Country	Demand function	Basic statistics of regression	
		R²	p-values
Germany	$16,242x^3 - 137,55x^2 + 386,1x - 357,71$	91,6%	$5,4 \cdot 10^{-10}\%; 5,8 \cdot 10^{-10}\%;$ $7,0 \cdot 10^{-10}\%$
France	$4,1721x^3 - 30,815x^2 + 74,799x - 58,238$	88,7%	$0,07\%; 0,07\%; 0,09\%$
Luxembourg	$-0,0002x^2 + 0.0397x + 0,4761$	78,3%	$0,01\%; 0,02\%$
Latvia	$0,7006x^2 - 16,82x + 105,87$	44,6%	$0,6\%; 0,6\%$
Malta	$0,0172x^3 - 0,6593x^2 + 7,9931x - 28,575$	72,3%	$0,2\%; 0,2\%; 0,2\%$
Slovakia	$0,0002x^3 - 0,0379x^2 + 2,1338x - 37,264$	90,7%	$0,5\%; 0,6\%; 0,6\%$
Slovenia	$0,1208x^3 - 7,569x^2 + 157,33x - 1082,5$	66,3%	$0,2\%; 0,2\%; 0,2\%$

Assessed based on data series 2003 – 2022 with subsets

Demand functions' parameter assessment shows that functions can be assessed with high degree of explanatory power and statistical significance of variables. Exceptions here are Latvia and Slovenia, which have average explanatory power. For some countries, e.g., Belgium, functional relationship was strongly linear, i.e., linear function with high degree of explanatory power, while for other countries, e.g., Germany, France, Malta, Slovakia, functional relationship was cubic. In some cases, even cubic relationship did not grant high degree of explanatory power, e.g., Slovenia. Deeper analysis of data shows that functional relationships are stronger when data of larger economies are analyzed, e.g., France or Germany, which could be explained by lower variances in total numbers of bank balance sheet items.

Table 3.8

Supply functions for selected countries (the author's made based on ECB Statistical

Data Warehouse, 2022)

Country	Demand function	Basic statistics of regression	
		R²	p-values
Austria	$-0,0095x + 4,5155$	83,8%	$1,4 \cdot 10^{-22}\%$
Belgium	$-0,0064x + 3,4988$	78,2%	$7,9 \cdot 10^{-18}\%$
Germany	$19,788x^3 - 169,95x^2 + 484,09x - 456,18$	91,8%	$2,4 \cdot 10^{-5}\%; 3,2 \cdot 10^{-5}\%;$ $4,3 \cdot 10^{-5}\%; 5,8 \cdot 10^{-5}\%$
France	$-28,752x^4 + 289,98x^3 - 1093,5x^2$ $+ 1826,2x - 1138$	90,1%	$0,07\%; 0,07\%; 0,09\%$
Luxembourg	$0,0006x^2 - 0,1488x + 11,124$	62,7%	$0,13\%; 0,15\%$
Latvia	$-2,5311x^2 + 58,154x - 329,04$	44,5%	$5,2\%; 5,3\%$
Malta	$-0,1764x^2 + 3,9942x - 21,032$	54,0%	$3,4 \cdot 10^{-4}\%; 4,1 \cdot 10^{-4}\%$
Slovakia	$0,0008x^3 - 0,1469x^2 + 8,6093x - 166,19$	57,0%	$3,9 \cdot 10^{-6}\%; 7,5 \cdot 10^{-6}\%;$ $15,0 \cdot 10^{-6}\%$
Slovenia	$0,1206x^3 - 7,5212x^2 + 155,68x - 1067,9$	67,9%	$4,9\%; 5,4\%; 6,1\%$

Assessed based on data series 2003 – 2022 with subsets

Supply functions' parameter assessment show that functions can be assessed with medium-to-high degree of explanatory power and statistical significance of variables. More

countries here have average explanatory power. Conclusions in the assessments of supply functions are like the ones made with demand function assessments and described above.

Results of demand and supply functions' parameter assessment are used to assess the deadweight loss of selected countries due to imperfect competition in banking markets. This calculation is reflected in Table 3.9 together with Herfindahl-Hirschman index to show changes in the market concentration in the context of deadweight loss. To exclude the effects of GDP growth and inflation from assessment adjusted number of 2022 has been calculated. This adjusted number has been used for the deadweight loss calculation purposes.

Table 3.9

HHI and calculated Deadweight loss for selected countries (the author's made based on ECB Statistical Data Warehouse, 2022; Eurostat, 2022)

Country	HHI		Exposures, bn EUR			Interest rates, %		Deadweight loss	
	2017	2022	2017	2022	2022*	2017	2022	bn EUR	% GDP
Austria	374	407	321	392	360	3,5	3,1	N/A	N/A
Belgium	1 102	1 319	294	388	353	1,9	1,4	N/A	N/A
Germany	250	289	2 560	3 072	2 870	1,7	1,2	N/A	N/A
France	574	661	2 183	2 759	2 578	1,6	1,2	N/A	N/A
Luxembourg	256	293	113	130	112	1,8	1,5	0,3	0,4
Latvia	**1 237**	**1 848**	12	11	8,5	4,5	6,8	**1,6**	**4,6**
Malta	1 599	1 701	10	12	9,8	2,6	2,2	0,4	2,7
Slovakia	1 332	1 511	49	65	57	1,9	1,1	N/A	N/A
Slovenia	1 133	1 415	19	21	17,7	2,8	1,9	1,1	2,1

GDP growth and inflation adjusted data

Jenny and Weber (1983) assessed on the whole economy that deadweight loss could be up to 12% from GDP. Their data covered French economy. From this angle data in the Table 3.8 seem to be relevant as max value is for Latvia (4,6% from GDP), which experienced the most significant increase in the banking market concentration from the sample. Thereby the deadweight loss calculations for selected countries show results corresponding to the expectation to be lower than 12%. A lot of countries experienced insignificant changes in market concentration which are reflected in the data – exposures increased, and interest rates decreased.

In the cases where the deadweight loss has been observed, it is possible the follow on the build-up of the deadweight loss, e.g., in Latvia (see Figure 3.3.). These results are closely related to the development of HHI over the same period. HHI in 2021 in Latvia was slightly higher than in 2018, i.e., 1912, thereby calculated deadweight loss number is slightly higher. In the case of Latvia, the growth of monopolization indicator was the most significant.
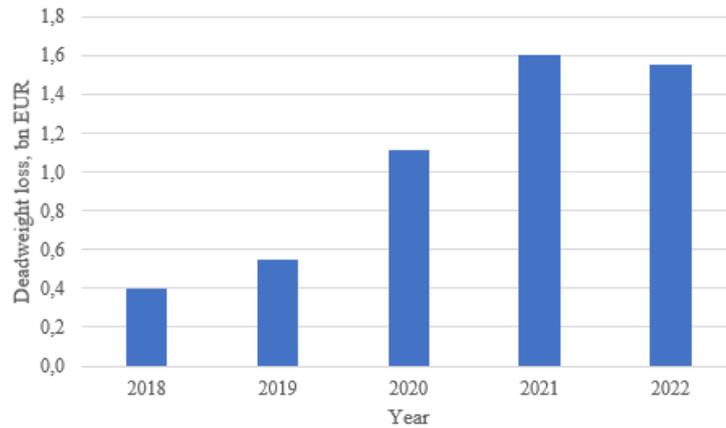
Figure 3.3. Build-up of the deadweight loss in Latvia (the author's made)

Deadweight loss assessment from negative spillovers

The author has validated the methodology based on euro area data from the European Central Bank (ECB Statistical Data Warehouse, 2022).

Data shows that the euro area does not report significant capital flows when material changes in interest rates occur (see Figure 3.4.), thereby no deadweight loss can be assessed due to this market failure.
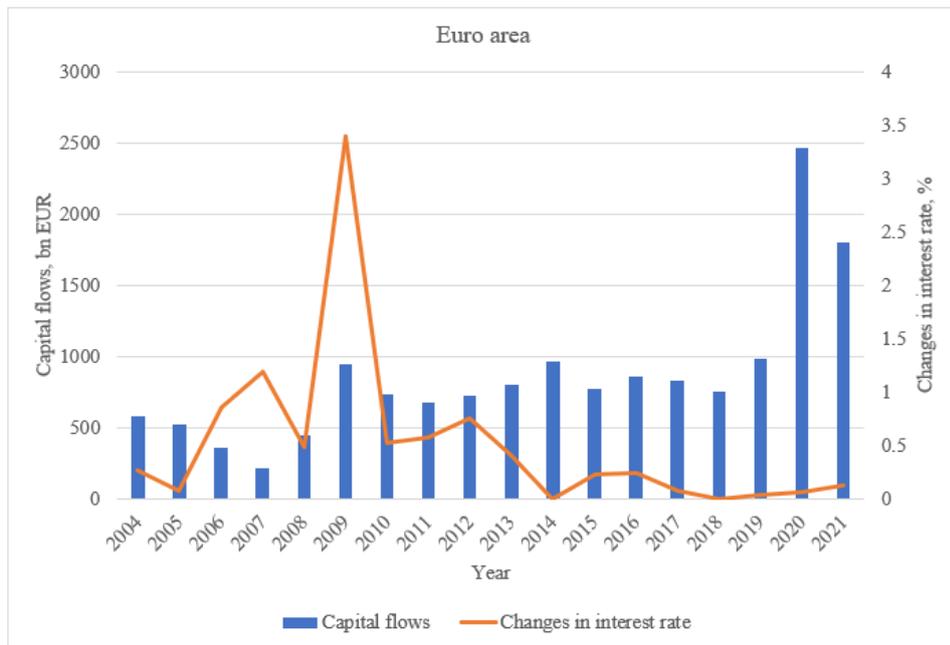
Figure 3.4. Capital flows and changes in interest rates (the author's made based on ECB Statistical Data Warehouse, 2022)

Deadweight loss assessment from other market failures

The author has validated the methodology for market abuse and other market failures based on euro area data from the European Central Bank (ECB Statistical Data Warehouse, 2022).

In Table 3.10., the author has summarized the results of analysis of excess provisions in the euro area in the period 2007 – 2021, which corresponds to data availability in the European Central Bank.

Table 3.10.

Average excess level of provisions in the euro area (the author's made based on ECB Statistical Data Warehouse, 2022)

Year	Provisions, % of total assets	Excess provisions, % of total assets	Assets, tn EUR	Excess provisions, tn EUR
2012	3.93%	0.61%	221.2	1.4
2013	4.12%	0.80%	200.8	1.6
2017	3.42%	0.10%	700.6	0.7

Results show that the hypothesis is confirmed, and excess accruals have been reported. In total in 2012, 2013 and 2017 they amount to 3.7 tn EUR.

Relationship between the deadweight loss and regulation intensity

Summarizing the results from

- Asymmetric information: Functions in Formulas (3.5.) and (3.6.), assessed in the same way as functions in Formulas (3.1.) and (3.2.). Functions D_1 and D_2 are assessed (ECB Statistical Data Warehouse, 2022) as follows,

$$D_1(bal) = -0.1997 \cdot bal^2 - 0.0864 \cdot bal + 12.67 \qquad (3.5)$$

$$D_2(bal) = -0.0478 \cdot bal^2 + 2.9265 \cdot bal - 41.076 \qquad (3.6)$$

Functions 3.5. and 3.6. have moderate explanatory power, which is expected due to comparably low amount of data to get better statistical significance.
- Market power imbalances: Tables 3.7., 3.8. and Figure 3.4. and with additional calculations needed specifically for the case of Latvia,
- Negative spillovers: in this case the results from euro area were used, which did not indicate any market failure there,
- Market abuse and other market failures: excess accruals were assessed in the same way as in Table 3.9.,

the deadweight loss was assessed through years and combined with results of the Regulation Intensity Index for Latvia (see Appendix 3). As a result, the equation for deadweight loss was econometrically assessed,

$$DWL = -0.0067 \cdot Reg(n) + 0.2794 \tag{3.7}$$

The equation has explanatory power of 82% and *p-value* significantly less than 1%. Based on this result, the conclusion was made: the deadweight loss decreases with increased regulation intensity level. **The hypothesis is confirmed**.

Excel macro code, used to assess the deadweight loss

To calculate integrals used in the formulas of deadweight loss in Table 3.8., Excel VBA was used. It contains the procedure and the function. The function is used to optimize the code of the procedure. The logic of calculation is based on the concept of the numerical integration, where the integral is approximated over trapezoidal areas, i.e.,

$$\int_{x_0}^{x_1} f(x)dx \approx \frac{y_0 + y_1}{2} \cdot (x_1 - x_0) \tag{3.8}$$
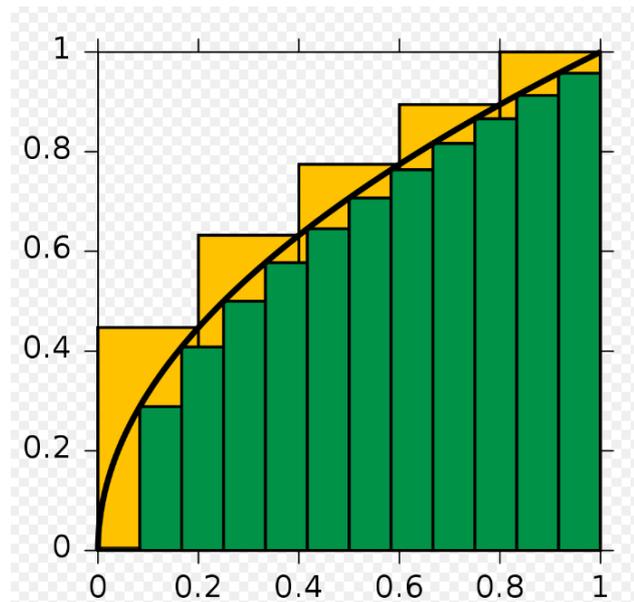
Figure 3.5. Integral approximation

In the calculation 1000 intervals were chosen to balance between the speed of execution and preciseness of approximation.

The procedure is described as follows:

"Sub IntegralCalc()

a = Range("C6").Value

b = Range("C7").Value

n = 1000

h = (b - a) / n

I = h * (f(a) + f(b)) / 2

For m = 2 To n

   I = I + f(a + h * (m - 1)) * h

Next

Range("C3").Value = I

End Sub"

The function is described as follows:

"Function f(x)

p1 = Range("C10").Value

p2 = Range("C11").Value

p3 = Range("C12").Value

p4 = Range("C13").Value

p5 = Range("C14").Value

f = p1 * x ^ 4 + p2 * x ^ 3 + p3 * x ^ 2 + p4 * x + p5

End Function"

3.3. Validation of the methodology of regulation costs' assessment

The research hypothesis for this section is as follows: the regulation costs increase with increased regulation intensity level. Regulation costs' assessment is validated as per Formulas (2.19), (2.21), (2.23) and (2.25). Basic approach for geographical choice was to look for the euro area data, but some exceptions were made with comments on the reason. Details are revealed in Table 3.11. Regulation costs are assessed for the following cost types:

- Regulatory costs,
- Compliance costs,
- Indirect costs.

Econometric models were tested for the presence of heteroscedasticity. In most cases the significance level of 5% were used to decide whether the null hypothesis cannot be rejected. If other significance levels were used, it was indicated.

Table 3.11.

Regulation costs' validation (the author's made)

Regulation costs	Formula	Area selected for validation	Principal results
Regulatory	(2.19)	Europe, North America,	Hypothesis confirmed

Table 3.11. continued

		Russia*	
Compliance	(2.21)	Baltics**	Hypothesis confirmed
Indirect	(2.23) (2.25)	Euro area (major European banks)***	Hypothesis rejected

Area matched with the Regulation Intensity Index validation (slightly wider)

**Area chosen narrower due to more detailed data requirements*

***Communication effect's details revealed for two major European banks, but costs assessed on the euro area level*

On top of that, numbers for Latvia were assessed to combine them into the overall model in Section 3.4.

3.3.1. Regulatory costs' assessment

To validate the methodology author combined the concept described in Figure 1.4. and the process described in Figure 2.4. Based on the regulation level measurement methodology described in the Section 2.1. author has assessed the government regulation intensity level in the countries of the European Union, the United Kingdom, the United States, Canada, and Russia (see Table 3.12.). This assessment has been combined with regulation cost assessment to test the function IC in the Figure 1.4. For this test, the following countries were chosen to evaluate different levels of the government intervention: Latvia, Lithuania, Estonia, Poland, Bulgaria, Finland, Czech Republic, Denmark, Croatia, France. Choice of countries was based on several arguments to capture representative selection:

(a) countries that match the area of Regulation Intensity Index,
(b) countries with different levels of regulation,
(c) countries with different level of economic development,
(d) countries with different geographical location,
(e) countries showing different points in World Bank's Bank Regulation and Supervision Survey.

Table 3.12.

Regulation level of selected countries (the author's made based on the developed methodology and source: World Bank, 2019a; Index of Economic Freedom, 2022)

Country	Regulation level, points in questionnaire	Index from questionnaire	1 – BF	1 – MF	1 – IF	1 – FF	Regulation Intensity Index
Austria	18	78,3	25,1	18,5	10,0	30,0	32,4
Bulgaria	**17**	73,9	37,3	12,0	30,0	40,0	38,6
Denmark	**12**	52,2	9,3	15,9	10,0	20,0	21,5
Greece	16	69,6	25,9	20,9	45,0	50,0	42,3
Estonia	**18**	78,3	24,7	20,4	10,0	30,0	32,7
Italy	18	78,3	28,3	16,0	15,0	50,0	37,5
Latvia	**19**	82,6	22,5	18,9	15,0	40,0	35,8
Luxembourg	18	78,3	31,2	17,4	5,0	20,0	30,4

Table 3.12. continued

Country	Regulation level, points in questionnaire	Index from questionnaire	1 – BF	1 – MF	1 – IF	1 – FF	Regulation Intensity Index
Netherlands	17	73,9	18,6	16,0	10,0	20,0	27,7
Portugal	19	82,6	20,3	17,0	30,0	40,0	38,0
Slovakia	17	73,9	38,7	21,4	25,0	30,0	37,8
Finland	**20**	87,0	10,6	15,2	15,0	20,0	29,6
Hungary	18	78,3	38,9	18,2	20,0	30,0	37,1
Sweden	18	78,3	12,0	18,0	15,0	20,0	28,7
United States	16	69,6	16,2	23,4	15,0	20,0	28,8
Russia	16	69,6	21,6	34,9	70,0	70,0	53,2
Belgium	18	78,3	21,9	23,9	15,0	30,0	33,8
Czech Republic	**20**	87,0	27,6	18,5	20,0	20,0	34,6
France	**17**	73,9	18,8	20,9	25,0	30,0	33,7
Croatia	**19**	82,6	39,3	21,5	25,0	40,0	41,7
Ireland	17	73,9	16,9	13,0	10,0	30,0	28,8
Cyprus	16	69,6	23,1	16,0	25,0	40,0	34,7
Lithuania	**16**	69,6	24,8	15,4	20,0	30,0	32,0
Malta	14	60,9	32,9	21,8	15,0	40,0	34,1
Poland	**14**	60,9	34,6	17,9	20,0	30,0	32,7
Romania	18	78,3	36,9	17,3	30,0	50,0	42,5
Slovenia	19	82,6	20,7	16,4	30,0	50,0	39,9
Spain	16	69,6	33,2	12,5	15,0	30,0	32,1
Germany	19	82,6	16,7	22,1	20,0	30,0	34,3
United Kingdom	16	69,6	7,1	18,8	10,0	20,0	25,1
Canada	14	60,9	18,1	22,8	20,0	20,0	28,4

BF: Business Freedom, MF – Monetary Freedom, IF – Investment Freedom, FF – Financial Freedom

All data correspond to year 2019

Data for methodology validation (process in Figure 2.4.) purposes has been retrieved from:

(a) relevant Financial Supervisory Authorities home pages (FKTK, n.d. a; Finantsinspektsioon, n.d. a; Komisja Nadzoru Finansowego, n.d.; FIN-FSA, n.d.; FSC, n.d.; Danish Financial Supervisory Authority, n.d.; ACPR, n.d.),

(b) central banks home pages (Latvijas Banka, n.d.; Lietuvos Bankas, n.d.; Eesti Pank, n.d.; Narodowy Bank Polski, n.d.; Suomen Pankki, n.d.; Bulgarian National Bank, n.d.; Danmarks Nationalbank, n.d.; Czech National Bank, n.d.; Croatian National Bank, n.d.; Banque de France, n.d.) and

(c) Eurostat (n.d. a; n.d. b) for the financial market policy making authority cost assessment and for GDP data tables in current prices.

In the Selection phase several cost items were excluded from relevant categories due to the following reasons:

(a) other period cost recharge with no details on reasons (1 case),

(b) one-off costs not related to business-as-usual (1 case).

Full table with calculation results is enclosed in the Appendix 4. Table A5.

Author based on the table in the Appendix 2 run the econometric test on the function IC, which explains relationship between government regulation level and regulation costs. If used polynomial function with order 3, R-squared is approx. 44%, which is medium result (see Formula 3.9.):

$$y = -8 \cdot 10^{-7}x^3 + 7 \cdot 10^{-5}x^2 - 0.0023x + 0.0234 \qquad (3.9)$$

where: y – regulation costs to GDP (basis points); x – Regulation Intensity Index.

Results show that **the hypothesis is confirmed** that the regulatory costs increase with increased regulation level.

Outliers in abovementioned relationship is, e.g., Latvia, which comparably to neighbours has high regulatory costs, measured as per cent from GDP. If compared to Lithuania, Latvian regulatory costs are two times higher.

3.3.2. Compliance costs' assessment

To validate the methodology authors combined the concept described in Figure 1.4. and the formula (2.18.) described previously. The methodology is tested by the largest banks in the Baltic States:

- Baltic banking market specifics is comparably high integrity level – many banks operate here on pan-Baltic level considering operational and legal models,
- Model is tested on individual banks to better understand whether macro-level numbers could make sense.

Based on previously developed methodology author has assessed the government regulation intensity level in the Baltic countries (see Table 3.13.). In the table two parts are reflected of the government regulation intensity level calculation – level of points arising from the Bank Regulation and Supervision Survey from the World Bank and final calculation of the Regulation Intensity Index as described in the Chapter 2.

Full disclosure of answers and points of the questionnaire is available in the Appendix 5. Table A6 and Table A7. Several adjustments were made in the data as inconsistencies were discovered (comments in the Appendix 5). Further in the analysis Baltic average figures are used.

Table 3.13.

Regulation level of the Baltic countries (the author's made based on World Bank, 2001, 2003, 2007, 2011, 2019a, 2021)

Country	Regulation intensity level					
	2001	2003	2007	2011	2019	2021
Regulation intensity level, points of questionnaire						
Lithuania	12	12	14	20	19	19
Latvia	10	12	13	18	20	20
Estonia	16	16	15	20	20	20
Baltic countries (average)	12.7	13.3	14.0	19.3	19.7	19.7
Regulation intensity level, Regulation Intensity Index						
Lithuania	21.7	18.7	17.6	20.5	20.8	21.8
Latvia	18.4	19.1	20.4	24.5	22.1	22.2
Estonia	17.3	14.2	14.6	18.8	20.6	21.0
Baltic countries (average)	19.1	17.3	17.5	21.2	21.2	21.7

Table 3.13. shows that not all years in the period of 2001 – 2021 are covered. As for further calculation purposes those figures are needed, linear approximation approach has been used by authors, e.g., for year 2002 figure of 13.0 has been calculated using formula: 12.7 + (13.3 – 12.7)/ 2.

Parameters α, β were assumed based on the European financial market survey ICF (2019): $\alpha = 2.89\%, \beta = 2.60\%$. Interpretation of the significant regulation was based on the official European Commission's website stating all basic financial market regulations (European Commission, n.d.). Criteria for the scope of regulations to be reviewed were as follows:

(a) Regulation should fall within the period of 2001 – 2021,
(b) Regulations should be related to the operations of commercial banks, exceptions included:
    a. insurance and pensions regulations,
    b. investments funds regulations,
    c. general company reporting and auditing requirements.

Following regulations were included in the review (ordered by year): see Appendix 6.

List of regulations in Appendix 6 shows that year 2014 is clearly the exception with the number of regulations that came into force. Thereby in this analysis authors have chosen year 2014 as the significant year.

Compliance costs are used from financial statements of major Baltic banks, based on the data collected by Bloomberg Finance L.P. (n.d.). Data are adjusted to reflect reporting standards as per IFRS 16 by Bloomberg. Time series of major Baltic banks were reviewed, and two banks were chosen for validation based on the conclusions in Table 3.14. – Swedbank AB, SEB AB.

Table 3.14.

Choice of banks for validation (the author's made based on Bloomberg Finance L.P., n.d.;

FKTK, n.d. b; Lietuvos bankas, 2020; Finantsinspektsioon, n.d. b)

Major Baltic bank	Criteria for selection			
	Market share > 5%	Data available in Bloomberg	Available > 5 reported years*	Selected for validation
Citadele Banka	Yes	No	-	No
SEB	Yes	Yes	Yes	**Yes**
Swedbank	Yes	Yes	Yes	**Yes**
Rietumu Banka AS	Yes	Yes	No	No
Siauliu Bankas AB	Yes	Yes	No	No
LHV Pank AS	Yes	Yes	No	No
Luminor Bank AS	Yes	Yes	No	No

Available position "Total Operating Expenses"

Additionally, author adjusted data by the inflation rate, calculated from the annual data of Harmonised Index of Consumer Prices, HICP (2015 = 100), collected from the Eurostat (n.d. c) for Estonia, Latvia, and Lithuania.

Author based on the data described in the previous section run the econometric test on the function IC, which explains relationship between government intervention level and bank's compliance costs. It is expected that relationship of Compliance costs' function will be the same or like the function IC.

If used polynomial function with order 3, R-squared is in the range 74% - 90% (see Formulas (3.10) to (3.13), and more details in the Appendix 5, Table A8 and Table A9).

Functions for Swedbank are as follows:

$$y = 0.7043x^3 - 34.58x^2 + 563.6x - 3008 \tag{3.10}$$

$$y = 4 \cdot 10^{-5}x^3 - 0.0023x^2 + 0.0464x - 0.3067 \tag{3.11}$$

where: y – compliance costs, m EUR or % GDP; x – government intervention level (points) or Regulation Index.

Functions for SEB are as follows:

$$y = 0.6308x^3 - 31.418x^2 + 520.94x - 2817.7 \tag{3.12}$$

$$y = 4 \cdot 10^{-5}x^3 - 0.0021x^2 - 0.0395x + 0.2486 \tag{3.13}$$

where: y – compliance costs, m EUR or % GDP; x – government regulation intensity level (points) or Regulation Intensity Index.

R-squared for the functions are in the range 74% - 90%, all orders of variable x are statistically significant with probability 94 – 95% (see p-values in the Appendix 5, Table A8 and Table A9).

Polynomial function with order 3 was suitable for function's assessment considering that increase in the intervention level did not immediately result in the compliance cost increase. Relationship in broad terms is like what Hertog (2010) predicted however additional insights have been observed – when the intervention becomes more intense the cost rise increases. Polynomial function within specified range is the one able to capture such type of relationship. Results show that **the hypothesis is confirmed** that the compliance costs increase with increased regulation level.

3.3.3. Indirect costs' assessment

Considering the list of significant regulations disclosed in the previous Chapter, year 2014 was chosen for observations of interest rate changes in the euro area, based on data from the European Central Bank (ECB Statistical Data Warehouse, 2022).

Result shows that no interest rate increase was observed after introduction of significant number of regulations (see Figure 3.6.).

Figure 3.6. Average interest rate in the euro area (the author's made based on ECB Statistical Data Warehouse, 2022)

Results show that **the hypothesis is rejected** that general indirect costs increase with increased regulation level. Further the special case of the effect of communication was analysed.

Effect of the communication: *Data used in the research*

Author has selected the speeches of the European Central Bank (2021). European Central Bank issue speeches regularly (every week), however author has selected the sample of speeches to cover most important topics, which can affect financial market, and to provide space for opportunity to train the model of normal returns. The list of selected speeches is disclosed in the Table 3.15. The sample covers 2020 and 2021, in total 24 speeches.

Table 3.15.

The list of selected speeches

(the author's made based on European Central Bank, 2021)

Date	Speaker*	Topic
08.12.2021	Isabel Schnabel	Monetary policy and financial stability
15.11.2021	Luis de Guindos	Recovery from the pandemic crisis and challenges for the financial sector
16.10.2021	Christine Lagarde	Globalisation after the pandemic
13.09.2021	I. Schnabel	New narratives on monetary policy and the spectre of inflation
24.08.2021	I. Schnabel	The rise of non-bank finance and its implications for monetary policy transmission
11.07.2021	C. Lagarde	Climate Change and Central Banks: Analysing, Advising and Acting
28.06.2021	L. de Guindos	Euro area banks in the recovery
06.05.2021	C. Lagarde	Towards a green capital markets union for Europe
26.04.2021	Philip R. Lane	Maximising the user value of statistics: lessons from globalisation and the pandemic
27.03.2021	P. R. Lane	Stabilising the economic outlook
22.02.2021	C. Lagarde	Investing in our climate, social and economic resilience: What are the main policy priorities?
25.01.2021	Fabio Panetta	Sustainable finance: transforming finance to finance the transformation
16.12.2020	F. Panetta	Keeping cyber risk at bay: our individual and joint responsibility
26.11.2020	P. R. Lane	Monetary policy in a pandemic: ensuring favourable financing conditions
19.10.2020	Yves Mersch	The ECB's monetary policy amid the pandemic
28.09.2020	C. Lagarde	Hearing at the Committee on Economic and Monetary Affairs of the European Parliament
27.08.2020	P. R. Lane	The pandemic emergency: the three challenges for the ECB
22.07.2020	L. de Guindos	Building the Financial System of the 21st Century
08.06.2020	C. Lagarde	Hearing at the Committee on Economic and Monetary Affairs of the European Parliament
22.05.2020	P. R. Lane	International inflation co-movements
16.04.2020	I. Schnabel	The ECB's response to the COVID-19 pandemic
02.03.2020	L. de Guindos	Remarks at the European Economic and Financial Centre

Table 3.15. continued

Date	Speaker*	Topic
06.02.2020	L. de Guindos	The euro area financial sector: opportunities and challenges
27.01.2020	Y. Mersch	Asset price inflation and monetary policy

*Notes: *Positions of speakers: Luis de Guindos – Vice-President of the ECB, Frank Elderson – Member of the Executive Board of the ECB and Vice-Chair of the Supervisory Board of the ECB, Isabel Schnabel, Philip R. Lane, Fabio Panetta – Members of the Executive Board of the ECB, Christine Lagarde – President of the ECB, Yves Mersch – Member of the Executive Board of the ECB and Vice-Chair of the Supervisory Board of the ECB*

As financial market participant was selected the largest euro area's bank BNP Paribas SA (France) and as market index – CAC40, and Deutsche Bank (Germany) and as market index – DAX. Thereby two most important economies accounting for half of the euro area GDP with their largest banks are covered. These market players are most affected by the decisions and communication of the European Central Bank (hereinafter – ECB) in the banking sector due to their significant exposure. Two different markets as well are chosen to validate results, i.e., looking for potentially opposite reactions to the same signal.

Effect of the communication: *Validation results*

Author performed the speech assessment based on the speeches of the ECB reflected in the Table 3.15. (European Central Bank, 2021). Results of this assessment are disclosed in the Table 3.16. With column "Balance" is understood difference between the numbers of optimistic and pessimistic words (optimistic minus pessimistic words).

Table 3.16.

Summary of speech assessment

(the author's made based on European Central Bank, 2021)

Date	Optimistic	Pessimistic	Balance
08.12.2021	58	10	48
15.11.2021	30	1	29
16.10.2021	34	14	20
13.09.2021	34	4	30
24.08.2021	6	0	6
11.07.2021	5	0	5
28.06.2021	25	7	18
06.05.2021	20	1	19
26.04.2021	1	0	1
27.03.2021	0	3	-3
22.02.2021	10	2	8
25.01.2021	10	0	10
16.12.2020	4	0	4
26.11.2020	32	19	13
19.10.2020	19	6	13
28.09.2020	9	6	3
27.08.2020	1	0	1

Table 3.16. continued

Date	Optimistic	Pessimistic	Balance
22.07.2020	11	6	5
08.06.2020	23	1	22
22.05.2020	1	4	-3
16.04.2020	10	12	-2
02.03.2020	11	5	6
06.02.2020	17	4	13
27.01.2020	13	1	12

As a next step econometrically were assessed parameters for Formula (1.17), which in the case of BNP Paribas are as follows,

$$R_{i,t} = 0 + 1{,}439 \cdot R_{m,t} + \varepsilon_{i,t} \tag{3.14}$$

and in the case of Deutsche Bank,

$$R_{i,t} = -0{,}001 + 1{,}351 \cdot R_{m,t} + \varepsilon_{i,t} \tag{3.15}$$

Both models have moderate description power and low error level, statistics are enclosed in the Table 3.17. In both cases parameter for $R_{m,t}$ is statistically significant with 95%.

Table 3.17.

Summary of model statistics

(the author's made based on Bloomberg Finance L.P., n/a)

Parameter	BNP Paribas	Deutsche Bank
Observations	388	388
Multiple R	0.834	0.769
R Squared	0.695	0.591
Standard Error	0.016	0.019
p-value	1.5×10^{-101}	7.4×10^{-77}

Based on the Formula (1.18) with results of formulas (3.14) and (3.15) abnormal values were calculated, and CAR values summed for BNP Paribas and Deutsche Bank. Further in the Table 3.18. results of CAR are matched with results from the speech assessment (see the Table 3.15.).

Table 3.18.

Summary of model statistics (CAR)

(the author's made based on Bloomberg Finance L.P., n/a; European Central Bank, 2021)

Date	CAR, BNP	CAR, Deutsche	Balance (speech)
08.12.2021	-0.3%	1.3%	48
15.11.2021	-3.0%	-3.1%	29
16.10.2021	-0.5%	1.0%	20
13.09.2021	3.4%	3.6%	30
24.08.2021	0.5%	-0.4%	6
11.07.2021	-0.5%	-1.4%	5
28.06.2021	-2.2%	-1.7%	18
06.05.2021	4.4%	2.9%	19
26.04.2021	5.4%	18.8%	1
27.03.2021	-2.8%	-5.3%	-3
22.02.2021	3.7%	9.1%	8
25.01.2021	-3.6%	-1.4%	10
16.12.2020	-4.5%	-1.7%	4
26.11.2020	2.4%	0.3%	13
19.10.2020	-0.5%	8.8%	13
28.09.2020	-2.0%	4.2%	3
27.08.2020	-2.2%	-5.2%	1
22.07.2020	-1.3%	-2.2%	5
08.06.2020	-0.8%	5.3%	22
22.05.2020	20.3%	7.6%	-3
16.04.2020	-3.0%	-1.1%	-2
02.03.2020	-8.1%	-10.7%	6
06.02.2020	4.9%	17.4%	13
27.01.2020	1.4%	12.0%	12

Results in the Table 3.18. shows that no speech was neutral (number of pessimistic and optimistic words equal). Most of the speeches were optimistic signalling about ECB's desire to push for the drive in the economy.

Based on those results author summarized BNP Paribas and Deutsche Bank reactions on the statements from the European Central Bank in the Table 3.19.

Table 3.19.

Summary of market participant's reaction

(the author's made based)

Speech category	Value of CAR	Assessment of reaction		
		Reaction	BNP	Deutsche
Optimistic	> 0	Expected:	8	12
	< 0	Adverse:	13	9
	= 0	No:	0	0
Pessimistic	> 0	Adverse:	1	1

Table 3.19. continued

	< 0	Expected:	2	2
	= 0	No:	0	0
Neutral	> 0	Adverse:	n/a*	n/a
	< 0	Adverse:	n/a	n/a
	= 0	Expected:	n/a	n/a

*Note: *No neutral speeches*

Table 3.19. shows that trends in the case of BNP Paribas and Deutsche Bank are similar. A lot of reactions are as expected however adverse reactions are substantial. This could signal about market participant's critical approach to the ECB's statements.

Based on data from Table 3.18. and BNP Paribas and Deutsche Bank stock price and volume data, communication costs are assessed by Formula (2.25).

Table 3.20.

Summary of communication costs

(the author's made based on Bloomberg Finance L.P., n/a)

Bank	2020	2021	Average
BNP Paribas	12.12 mEUR	-16.62 mEUR*	-2.25 mEUR
Deutsche Bank	-88.97 mEUR	-34.59 mEUR	-61.78 mEUR

Minus means the effect opposite to costs

In case the result is revealed with minus sign, the conclusion is that communication had mostly positive, cost-averse effect, i.e., no additional indirect costs due to communication should be added to the model. Summary in Table 3.20. shows exactly this case.

In case the result is revealed without minus sign, further step is to extrapolate those costs to the country level by Formula (2.26).

3.4. Validation of the overall model

As mentioned in the beginning of this Chapter, to show the combined result of the overall model, case of Latvia has been viewed. Thereby further the calculations for Latvia have been described.

The overall model is validated on the data of Latvia:

- Regulation intensity measurement scale as per the Section 3.1.,
- Calculations of the deadweight loss as per the Section 3.2.,
- Calculations of the regulation costs as per the Section 3.3.

Regulation Intensity Index

Regulation Intensity Index values for Latvia (see Table 3.21.) show that in 2022 regulatory restrictions regarding Business Freedom, Monetary Freedom and Investment Freedom have lessened. A lot of improvements in those areas happened in the period of 2005

– 2008. At the same time regulatory restrictions regarding Financial Freedom and areas covered by the Bank Regulation and Supervision Survey have become more significant. This area shows opposite tendencies – restrictions have gradually increased from value of 43,5 in 1996 to 87,0 in 2022 showing the effect of increasing number of regulatory documents (laws, rules etc.).

Overall Regulation Intensity Index is slightly lower in 2022. Details regarding the Regulatory Index from 1996 to 2022 are reflected in the Appendix 3. Table A4.

Table 3.21.

Regulation Index values for Latvia (the author's made based on Bank Regulation and Supervision Survey, 2019; Index of Economic Freedom, 2022)

	100 – BF	100 – MF	100 – IF	100 – FF	BS	RII
2022	18,1	16,2	15,0	40,0	87,0	35,3
Average 1996 – 2022	24,9	22,8	24,6	38,1	68,9	35,9

BF: Business Freedom, MF – Monetary Freedom, IF – Investment Freedom, FF – Financial Freedom, BS – Bank Regulation and Supervision Survey

Deadweight loss

Deadweight loss is assessed for the market failures at the end of Section 3.2. Those results were used in the overall model. Visualization of the result from Formula (3.7.) is reflected in Figure 3.7.
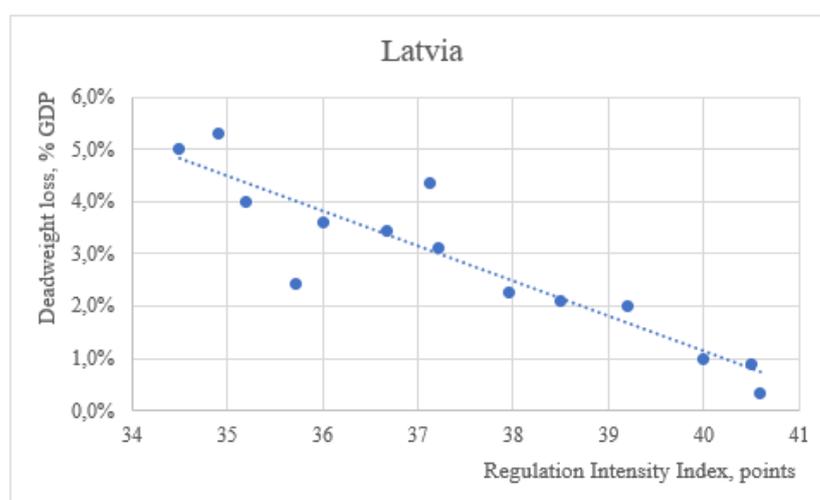

Figure 3.7. Relationship between the deadweight loss and regulation intensity (the author's made)

Regulation costs

In the Table 3.22. regulatory costs in two major positions are disclosed – the Bank of Latvia and the Financial and Capital Market Commission (FCMC).

Table 3.22.

Regulatory costs in Latvia* (the author's made based on Bank of Latvia, 2022)

Year	Bank of Latvia, mln EUR	FCMC, mln EUR	% GDP
2011	27,9	5,2	0,17%
2012	29,3	5,8	0,16%
2013	42,2	6,3	0,21%
2014	34,8	6,9	0,18%
2015	33,4	7,4	0,17%
2016	39,4	8,6	0,19%
2017	37,6	9,9	0,18%
2018	36,1	10,7	0,16%
2019	36,7	10,8	0,15%
2020	32,7	10,8	0,14%
2021	32,7	11,2	0,13%

As major exposures only microprudential and macroprudential regulators included

Regarding compliance costs data for Latvia are assessed based on the Formula (2.21) and reflected in the Table 3.23.

Table 3.23.

Compliance costs in Latvia (the author's made based on ECB Statistical Data

Warehouse, 2022)

Year	Operational costs, m EUR	One-off compliance costs		Ongoing compliance costs		% GDP
		% Op costs	m EUR	% Op costs	m EUR	
2008	979,6	1,94%	19,0	0,63%	6,2	0,10%
2009	823,0	1,94%	16,0	0,63%	5,2	0,11%
2010	785,0	2,06%	16,1	0,88%	6,9	0,13%
2011	700,1	2,18%	15,3	1,13%	7,9	0,12%
2012	680,9	2,30%	15,7	1,38%	9,4	0,11%
2013	716,9	2,42%	17,3	1,63%	11,7	0,13%
2014	720,1	2,54%	18,3	1,88%	13,5	0,13%
2015	782,0	2,66%	20,8	2,13%	16,7	0,15%
2016	912,2	2,78%	25,4	2,38%	21,7	0,19%
2017	903,2	2,90%	26,2	2,63%	23,8	0,19%
2018	755,5	2,95%	22,3	2,73%	20,6	0,15%
2019	684,5	3,00%	20,5	2,83%	19,4	0,13%
2020	661,0	3,05%	20,2	2,93%	19,4	0,13%
2021	695,7	3,10%	21,6	3,03%	21,1	0,13%

In Formula (3.16.) compliance costs' function in the context with Regulation Intensity Index has been reflected. Considering comparably low data amount and large scale, explanatory power for functions is medium: 61%.

$$Compl\ costs = -2 \cdot 10^{-6} \cdot Reg(n)^3 + 0.0002 \cdot Reg(n)^2 - 0.0053 \cdot Reg(n) + 0.0598 \qquad (3.16)$$

When it comes to indirect costs, results in Section 3.3.3., including Figure 3.6. and summary Table 3.20. are applicable to Latvia as well due to the membership of the euro area.

In other words, nor interest rates nor the reaction of financial market indicators to the communication of the European Central Bank as special case of policy transmission tools indicate any indirect regulation costs for Latvia.

Result of regulation costs' relationship with regulation intensity are reflected in the Figure 3.8. and Formula 3.17. The equation has an explanatory power of 66% and *p-value* less than 1%.

$$Reg\ costs = 0.0001 \cdot Reg(n) - 0.0025 \qquad (3.17)$$

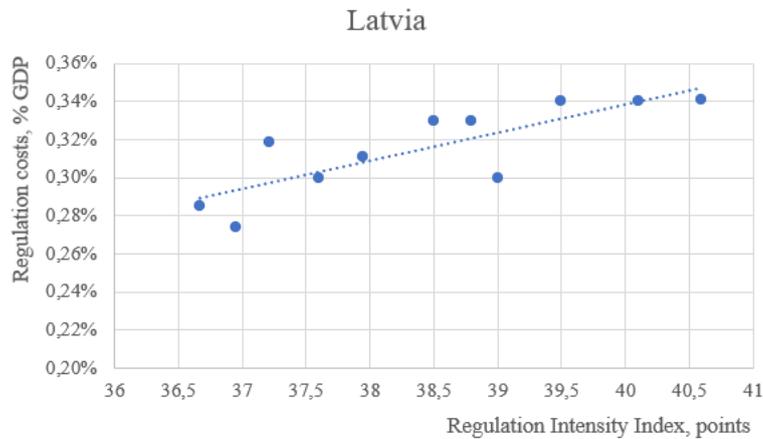Figure 3.8. Relationship between the regulation costs and regulation intensity (the author's made)

Overall model

When results of the function in Formula 3.7. (Figure 3.7.) and the function in Formula 3.17 (Figure 3.8.) are combined, the overall model shows that:

- Equilibrium regulation costs are 0.36% from GDP,
- Equilibrium Regulation Intensity Index is 41.0,
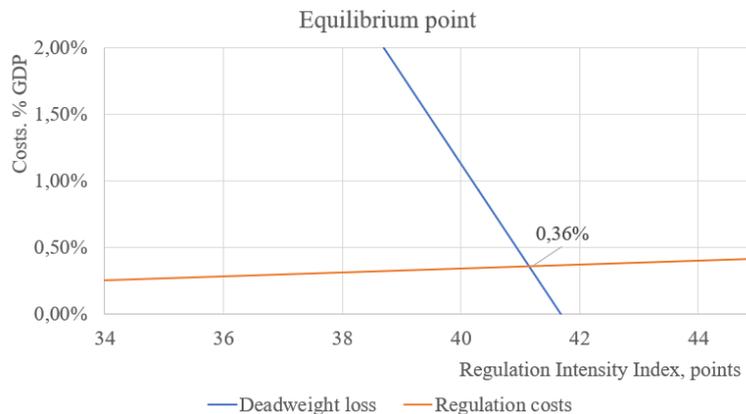- In 2022 in Latvia Regulation Intensity Index was 35.3.

Figure 3.9. Equilibrium point in the case of Latvia (the author's made)

Based on the results, the following conclusion has been made by the author: considering the deadweight loss from market failures there is potential to increase the regulation intensity of the Latvian banking sector.

3.5. Feedback from the industry

Author has prepared the presentation to communicate research results to the regulator of Latvian banking market and receive feedback. Presentation is available in Appendix 6.

The following questions were asked after presenting the material:

- Whether, in your view, all material banking market failures are disclosed in research?
- Do you have any comments or suggestions regarding the model construction approach (Table 2.1.)?
- Does approximations of regulations costs, in your view, are acceptable?
- Do you have any other comments or suggestions?

The material was sent to the Bank of Latvia on 3 January 2023. Answer was received on 24 January 2023. The following comments were given by the representative of the Bank of Latvia:

- All material banking market failures are disclosed. Additionally, was comment made that the market failure of pecuniary externality would be worth considering in the analysis of the systemic risk of the financial system.
- Suggestion was given to test several sets of parameters of the Regulation Intensity Index.
- It was indicated that Herfindahl – Hirschmann Index could be inappropriate for the analysis of monopoly power in the case of small countries. Suggestion was made to test robustness with alternative approaches.
- Approximations of regulations costs are acceptable however narrowing to the banking sector was suggested. Comments about indirect costs were given.

- Suggestion was made to include in the model specifics of market structures of individual countries, e.g., how significant is SME lending in overall portfolio, how big is shadow economy, how significant is the effect of seasonally fluctuating industries etc.

Comments were analysed and considered in the update of the Doctoral Thesis:

- The market failure of pecuniary externality was left out of scope of this research due to the limitation of the banking sector in the financial market.
- Suggestion to test several sets of parameters of the Regulation Intensity Index was implemented – results are reflected in Table 2.3.
- Issues with Herfindahl – Hirschmann Index (HHI) were additionally discussed in the Section 2.2. In Figure 2.5. author presented results of analysis of 27 European Union countries and the United Kingdom showing that comment made by representative of the Bank of Latvia is supported by data. Subsequently adjusted HHI was developed, including non-structural approaches.
- Narrowing to the banking sector was implemented.
- Suggestions regarding specifics of market structures of individual countries was not included due to limited scope of the research, i.e., the primary goal was to develop overarching model for democratic economies with limited adjustments for individual specifics. Nevertheless, author has noted those suggestions as useful input for further research.

On 11 March 2023 presentations for international regulators have been sent. However, regulators either did not respond to the request or declined to review with kind comment that currently regulators are busy with high priority operational issues. The positive answer was received only from Danish Financial Supervisory Authority and Bank of Slovakia, who commented on the principles of regulation: this discussion is reflected in Section 1.4.

3.6. Conclusions

Considering the analytical results and empirical findings of the conducted research, the following has been concluded by author:

1. Validation is performed based on the data from the databases of the European Central Bank, Bank of Latvia, Eurostat, Bloomberg, annual reports of regulators, World Bank's Bank Regulation and Supervision Survey and database of the Index of Economic Freedom.

Validation of regulation measurement scale

2. Methodology's validation is performed for the selected countries: Germany, the United Kingdom (UK), the United States of America (USA) and the Russian Federation (Russia). Those countries have selected as they represent different approaches in the regulation of economy and subsequently financial market. Author

has set the <u>hypothesis that the regulation intensity for Germany will be higher than for the UK, USA, and Russia</u>. Results of the combined Regulation Intensity Index show that abovementioned hypothesis is partially confirmed: <u>the regulation intensity for Germany is higher than for the UK and the USA, but lower than Russia's</u>.

3. In author's view in general the approach for scaling works as expected from the viewpoint of regulatory requirements' stringency. Validation of this methodology showed that questions in the banking supervision surveys are reflecting changes in the regulatory frameworks thereby this methodology requires regular update and validation.

4. Author recognizes that it is particularly important to continue:
   - regular update of the methodology as in the banking sector could appear new aspects which should be considered,
   - the adjustment of the methodology with new realities our economies face, including climate change and epidemiological perspectives.

Validation of the model of deadweight loss assessment

5. Deadweight loss assessment is validated corresponding to the single point of the Regulation Intensity Index for each of the identified market failures.

6. The deadweight loss decreases with increased regulation intensity level. The hypothesis is confirmed.

<u>Asymmetric information</u>

7. Results show that the deadweight loss arising from the information asymmetry in euro area banking market is approximately 9.375 bn EUR.

8. Data has excluded cost-to-income ratio as for the all the euro area data points start only from Q2 2015. In other currency areas or local country-level assessments this ratio could be included as well.

<u>Market power imbalances</u>

9. Author validated the methodology based on euro area data from the European Central Bank and local regulator (Bank of Latvia, 2022; ECB Statistical Data Warehouse, 2022; FCMC Statistics, 2022) for the sample of euro area countries:
   - representing different sizes, e.g., Germany vs Latvia, geographical regions, e.g., Malta vs France, and development levels, e.g., Slovenia vs Luxembourg,
   - covering approximately 50% of total number of euro area countries (9 out of 19) at the end of 2022.

10. Validation for this market failure was performed on the country level data since Herfindahl-Hirschman index is assessed only on country level data. And this index is the backbone of analysis whether monopolization or de-monopolization processes happened at all.

11. Demand functions' parameter assessment show that functions can be assessed with high degree of explanatory power and statistical significance of variables. Exceptions here are Latvia and Slovenia, which have average explanatory power. Supply

functions' parameter assessment show that functions can be assessed with medium-to-high degree of explanatory power and statistical significance of variables. More countries here have average explanatory power.

12. Deadweight loss calculations for selected countries show results corresponding to the expectation to be lower than 12% - maximum value is 4,6% for Latvia, which experienced the most significant increase in the banking market concentration from the sample.

<u>Negative spillovers and other market failures</u>

13. Data shows that the euro area does not report significant capital flows when material changes in interest rates occur thereby no deadweight loss can be assessed due to negative spillovers.

14. Results for deadweight loss assessment of other market failures show that the hypothesis is confirmed, and excess accruals have been reported.

Validation of the model of regulation costs

15. Regulation costs are assessed for the following cost types:
   - Regulatory costs – hypothesis is confirmed that the regulatory costs increase with increased regulation level.
   - Compliance costs – hypothesis is confirmed that the compliance costs increase with increased regulation level.
   - Indirect costs – hypothesis is rejected that general indirect costs increase with increased regulation level.

16. <u>Overall, hypothesis is confirmed that </u>the regulation costs increase with increased regulation level.

17. Basic approach for geographical choice was to look for the euro area data, but some exceptions were made with comments on the reason.

<u>Regulatory costs</u>

18. Results show that **the hypothesis is confirmed** that the regulatory costs increase with increased regulation level. However, an exception was captured: countries with the highest level of government intervention (Finland, Czech Republic) reported comparably low intervention costs thereby functional relationship in the high-end of government intervention scale changed which was not predicted by Hertog. In author's view there are indications of other factors which have major impact on the result. One of them could be recently arising RegTech – technology solutions for more efficient regulator's activities.

<u>Compliance costs</u>

19. Author has made following conclusions to the research conducted:

- Results show that **the hypothesis is confirmed** that the compliance costs increase with increased regulation level,
- Additional insight was captured: when the intervention becomes more intense the cost rise increases,
- Methodology validation identified econometric equations with the determination coefficient (R-squared) above 84% and statistical significance of variables above 94%.

<u>Indirect costs</u>

20. Results show that **the hypothesis is rejected** that indirect costs increase with increased regulation level due to the absence of those costs.

21. Analysis of the selected speeches show that most of them were optimistic signalling about ECB's desire to push for the drive in the economy. In the validation process author has the following conclusions:
- models measuring normal returns could be improved due to their moderate description power,
- meanwhile models have low error level and
- parameter for $R_{m,t}$ is statistically significant with 95%.

22. A lot of reactions (BNP Paribas and Deutsche Bank to speeches of ECB's spokespersons) are as expected, i.e., optimistic speeches cause positive reaction and pessimistic speeches – negative. However adverse reactions are observed as well, mostly optimistic speeches that cause negative reaction, which could signal about market participant's critical approach to ECB's statements.

23. Regarding communication costs conclusion is that communication had mostly positive, cost-averse effect, i.e., no additional indirect costs due to communication should be added to the model.

Validation of the overall model

24. Overall model shows that:
- Equilibrium regulation costs are 0.36% from GDP,
- Equilibrium Regulation Index is 41.0,
- In 2022 in Latvia Regulation Index was 35.3,

25. Considering the deadweight loss from market failures there is potential to increase the regulation of the Latvian banking market.

26. Suggestions from the industry (Bank of Latvia as regulator of the Latvian financial market) were considered and several adjustments of the model was implemented:
- Suggestion to test several sets of parameters of the Regulation Intensity Index was implemented – results are reflected in Table 2.3.
- Issues with Herfindahl – Hirschmann Index (HHI) were additionally discussed in the Section 2.2. In Figure 2.5. author presented results of analysis of 27 European

Union countries and the United Kingdom showing that comment made by representative of the Bank of Latvia is supported by data. Subsequently adjusted HHI was developed, including non-structural approaches.

- Narrowing to the banking sector was implemented.

27. International regulators however did not comment on the model as such. The only answers were received from Danish Financial Supervisory Authority and Bank of Slovakia, who commented on the principles of regulation: this discussion is reflected in Section 1.4. International supervisory authorities were asked, whether in their view, Top 5 regulation principles retrieved from literature analysis (abovementioned 5 principles that 68% of sources refer to) cover current regulator's agenda and topicality. They responded positively.

CONCLUSIONS AND RECOMMENDATIONS

Considering the findings of the conducted literature analysis, analytical results and empirical findings of the conducted research, the following has been concluded by author:

1. Literature review revealed that there are four major types of financial market failures: asymmetric information, negative spillovers, market power imbalances, market abuse. Analysis of the European Central Bank speeches revealed additional types of failures not covered by abovementioned four types: fragmentation of market self-regulation, global imbalances in current account positions and capital flows across major economies, regulatory arbitrage, structural inefficiencies in debt and collateral enforcement, inefficient consumption-led boom-and-bust cycles.

2. In the literature review author has identified 12 principles of the optimal government regulation. 68% of sources refer to the following Top5 principles: (a) Cost-benefit balanced, (b) Risk based, (c) Consistency and competitive neutrality, (d) High quality, transparent decision-making, and enforcement, (e) International coordination, convergence, and implementation in policy and rulemaking. Those principles are covering the aspects of regulation costs, risk awareness, quality, and regulatory cooperation.

3. Hertog (2010) in the analysis of previous research revealed three types of costs arising from the regulation: regulatory costs, compliance costs and indirect costs. These costs are derived from the Top5 regulation principles identified in the literature analysis.

4. The deadweight loss decreases with increasing regulation and regulation costs increase with increasing regulation. There is equilibrium point between the two, i.e., the point where deadweight loss equals regulation costs. After this point, there is no economic justification for further increase in regulation intensity. Hertog (2010) this point defines as "trade-off" between resources allocated to increasing levels of regulatory intervention and decreasing levels of inefficient firm behaviour.

5. The Government Regulation Model consists of the methodology for the Regulation Intensity Index *Reg(n)* and for the equilibrium point: $f(DWL) = f(Reg\ costs)$.

6. The Regulation Intensity Index is calculated as average from 5 indices:
   - Index from the questionnaire based on the Bank Regulation and Supervision Survey from the World Bank,
   - Index: 100 – *Business Freedom* based on the *Index of Economic Freedom,*
   - Index: 100 – *Monetary Freedom* based on the *Index of Economic Freedom,*
   - Index: 100 – *Investment Freedom* based on the *Index of Economic Freedom,*
   - Index: 100 – *Financial Freedom* based on the *Index of Economic Freedom.*

7. The Deadweight loss is assessed for the following market failures:
   - Imperfect competition or market power imbalances,
   - Asymmetric information,
   - Negative spillovers,
   - Market abuse and others.

8. Developed formulas correspond to the deadweight loss at single point of the Regulation Intensity Index. To analyse the deadweight loss with the Harberger Triangle, author proposes to use the following variables:
   - Imperfect competition or market power imbalances: as variable for "price" to use the interest rates on loans and/ or deposits. As variable for "quantity" to use the exposure of deposits and/ or loans on banks' balance sheets,
   - Asymmetric information: as variable for "price" to use the interest rates on loans and/ or deposits. As variable for "quantity" to use the exposure of deposits and/ or loans on banks' balance sheets,
   - Negative spillovers: as variable for "price" to use the interest rates from financial market indicators. As variable for "quantity" to use the bank capital flows (cash flow),
   - Market abuse and others: as variable for "price" to use the accruals for issued loans and guarantees. As variable for "quantity" to use the exposure of loans on banks' balance sheets and guarantees on off-balance sheets.

9. In the cross-year calculations it is important to exclude the effect of GDP growth and inflation thereby exposure should be adjusted by relevant ratios prior to running the deadweight loss calculations.

10. Regulation costs are assessed for the following cost types:
    - Regulatory costs,
    - Compliance costs,
    - Indirect costs, including the effect of communication.

11. Developed formulas correspond to the regulation costs at single point of the Regulation Intensity Index.

12. The equilibrium point is defined as $\{DWL_{Reg(n)}; Reg(n)\}$, which satisfies the condition: $DWL_{Reg(n)} = Reg\ costs_{Reg(n)}$.

13. The deadweight loss $DWL_{Reg(n)}$ is defined as sum of all deadweight losses from identified market failures, i.e.,
    - Imperfect competition or market power imbalances expressed as integral between demand and supply functions. Supply function includes adjustments of Adjusted Lending Margin and Loan-to-Deposit ratios,
    - Asymmetric information expressed as integral between demand functions of uncollateralized loans and collateralized loans,
    - Negative spillovers expressed as integral of bank capital flows,
    - Market abuse and others expressed as sum of excess accruals or other excess ratios.

14. The regulation costs $Reg\ costs_{Reg(n)}$ are defined as sum of all identified regulation cost types, i.e.,
    - Regulatory costs expressed as operational costs of microprudential, macroprudential regulators and financial market policy maker's labour costs,

- Compliance costs expressed as sum of one-off costs and ongoing costs with initial values of $\alpha_0 = 1,94\%$, $\beta_0 = 0,63\%$ (corresponds to year 2009 and any prior year),
- Indirect costs expressed as multiplication of changes in loan volumes and interest rates with adjustment of changes in accrual values. Additionally, the effect of communication has been included expressed as sum of Cumulative abnormal return (CAR) adjusted by total banking assets in the country.

15. Validation of the Overall model shows that:
- Equilibrium regulation costs are 0.36% from GDP,
- Equilibrium Regulation Intensity Index is 41.0,
- In 2022 in Latvia Regulation Intensity Index was 35.3,
- Considering the deadweight loss from market failures there is potential to increase the regulation of the Latvian banking market.

16. The Hypothesis of the Doctoral Thesis: there is an equilibrium point between welfare (deadweight) loss arising from the market failures and subsequent government regulation costs in the banking sector. Considering the research results **<u>the Hypothesis is confirmed</u>**.

17. Summary of the Theses for defence:
- Regulation measurement scale: The regulation intensity for Germany is higher than for the UK and the USA.
- Deadweight loss assessment: the deadweight loss decreases with increased regulation intensity level.
- Regulation costs' assessment: the regulation costs increase with increased regulation intensity level.
- Equilibrium point exists between the decrease of the deadweight loss and increase of regulation costs with increasing regulation level.
- In Latvian banking sector the regulation intensity is lower than the equilibrium point.

18. Summary of the research questions:
- Market failures in the banking sector: see point 1.
- Deadweight loss of those market failures: see point 7.
- Regulation costs in the banking sector: see point 10.
- The equilibrium point between the deadweight loss and regulation costs: see point 12.

Considering the methodological basis, the analytical framework, the experimental conduct, and the acquired results of the conducted research as well as their interpretation, the following has been **recommended** by author:

For the regulator of the financial market:

1. To include the deadweight loss and regulation costs' assessment in annual reports of the regulator to inform stakeholders regarding overall situation in the regulation area.
2. To use this assessment in the communication with stakeholders to justify current regulation burden.
3. To cooperate with financial market policy makers in the government to properly assess all regulatory costs and identify any indirect costs from the regulation.

For the financial market policy maker:

4. To contribute information in regulatory costs assessment and identification of any indirect costs.
5. To validate regulator's calculations and contribute with alternative view to the discussion of the deadweight loss and regulation costs' assessment and equilibrium point identification.

For the financial market participants:

6. To contribute with alternative view to the discussion of the deadweight loss and regulation costs' assessment and equilibrium point identification.
7. To propose alternative approaches how to tackle the financial market failures and subsequently help to minimize the deadweight loss, which then could be used as justification for lessening the regulation burden.

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APPENDICES

Appendix 1. Roles of government

Government as a system

POLICY LAB

Influence	Engage	Design	Develop	Resource	Deliver	Control
1 Advising Advising citizens and signposting options to help them find support	**2 Listening** Creating platforms for citizens and stakeholders to protect vested rights and interests.	**3 Connecting** Encourage experts and citizens to co-create change.	**4 Championing** Building a case for change and retain alliances for action.	**5 Charging** Collecting charges for service for example prescriptions, passports or parking.	**6 Nudging** Applying behavioural science or encouraging voluntary codes.	**7 Devolving** Devolving decisions to frontline staff, other authorities or citizens.
8 Lobbying Using existing networks and platforms to influence an issue or cause.	**9 Informing** Providing data, sharing knowledge. For example public information advice.	**10 Engaging** Engaging citizens, stakeholders and partners to deliberate on an issue of importance.	**11 Agreeing** Formal agreements e.g. Memoranda of Understanding (MOU).	**12 Incentivising** Promoting behaviour change through grants, subsidies or other incentives.	**13 Educating** Providing materials so citizens know what's available to them.	**14 Providing assurance** Providing assurance / checks and balance on powers.
15 Agenda setting Build awareness & confidence in new opportunities by providing thought leadership.	**16 Consulting** Consulting the public or stakeholders on an issue to understand needs and impact.	**17 Analysing** Analysing and interpreting data from local and international contexts.	**18 Partnering** Establishing formal partnerships on an issue of importance to parties.	**19 Contracting** Utilising public procurement to encourage supply chain innovation.	**20 Building** Making infrastructure investments & public commissions e.g. highways.	**21 Licensing** Providing licenses e.g. Taxis, bars & clubs, traders & markets, and health & safety.
22 Role modelling Role modelling culture or values through local, national or international presence.	**23 Convening** Drawing together expertise from across system. Including deliberative approaches e.g. citizen juries.	**24 Forecasting** Foresight, horizon scanning and predictive analytics.	**25 Planning** Setting strategy and making plans e.g. Industrial Strategy.	**26 Co-funding** Co-funding activity and pooling budgets with domestic or international partners.	**27 Providing** Delivering services directly or indirectly through funding and target setting.	**28 Regulating** Ensuring regulation enables the intended policy outcomes. Also amending rules, statutory instruments and orders.
29 Auditing Auditing and reviewing activities to inform action.	**30 Collaborating** Collaborating with different actors from across the system to deliver outcomes.	**31 Modelling** Modelling different scenarios, shaping and deciding on delivery models.	**32 Commissioning** Commissioning services and outsourcing contracts. Also decommissioning as needed.	**33 Targeting** Utilising initiatives to influence on a particular issue e.g. Cultural programmes	**34 Reforming** Harnessing political will for change to improve outcomes.	**35 Intervening** Making an intervention to correct or improve a market or social context e.g. correcting market failure.
36 Governing Establishing governance and setting up formal structures such as boards.	**37 Negotiating** Early engagement on a shared interest or issue including diplomacy.	**38 Testing** Testing, prototyping and learning to establish efficacy of a proposed intervention.	**39 Interpreting** Translating policies across different places and jurisdictions.	**40 Investing** Investing in various forms including Inward investment and foreign direct investment.	**41 Safeguarding** Overseeing the welfare of vulnerable groups.	**42 Enforcing** Support enforcement and harmonise regulatory compliance environment.
43 Publishing Publishing plans, priorities, guidance and reviews.	**44 Running elections** Running democratic services and elections.	**45 Piloting** Small scale trials to learn lessons and establish an evidence base for change.	**46 Drafting** Publishing proposals for consultation and pre-legislative scrutiny e.g. white papers and bills.	**47 Funding** Direct finance to stimulate markets or deliver positive outcomes.	**48 Preventing** Intervening early or investing in preventative measures e.g. Public health.	**49 Sanctioning** Putting in place sanctions e.g. embargoes and political trade restrictions.
50 Scrutinising Establishing scrutiny committees for example section 15 powers.	**51 Setting standards** Harmonising and setting standards for different stakeholders.	**52 Evaluating** Evaluating efficacy of activities or interventions to establish value for money and impact.	**53 Legislating** (Primary and Secondary) Supporting a bill through parliament and enacting legislation.	**54 Recovering** Recovering debt and other actions to address fraud and error.	**55 Protecting** Protecting consumer rights and supply-chain. Upholding of standards.	**56 Prosecuting** Powers to investigate and prosecute criminal offences e.g. Local Gov Act 1972.

'Softer' powers often shared with others ↑

Patterns of action across local, national and international contexts

More 'formal' power often associated with governments ↑

Table A1. Applicability of questions for the scaling of intervention level from the cost perspective
(source: author's made based on Agoraki et al., 2011; Anginer et al., 2014; Delis & Kouretas, 2011)

Question	Applicable
Capital requirements index	
Is the minimum required capital asset ratio risk-weighted in line with Basel guidelines?	Yes/ B/ S
Does the ratio vary with market risk?	Yes/ B
Before minimum capital adequacy is determined, whether this item is deducted from the book value of capital: market value of loan losses not realized in accounting books?	Yes/ B
Before minimum capital adequacy is determined, whether this item is deducted from the book value of capital: unrealized losses in securities portfolios?	Yes/ B
Before minimum capital adequacy is determined, whether this item is deducted from the book value of capital: Unrealized foreign exchange losses?	Yes/ B
Are the sources of funds to be used as capital verified by the regulatory/ supervisory authorities?	Yes/ S
Can the initial or subsequent injections of capital be done with assets other than cash or government securities?	Yes/ B
Can initial disbursement of capital be done with borrowed funds?	Yes/ B
Supervisory power index	
Does the supervisory agency have the right to meet with external auditors to discuss their report without the approval of the bank?	No
Are auditors required by law to communicate directly to the supervisory agency any presumed involvement of bank directors or senior managers in illicit activities, fraud, or insider abuse?	No
Can supervisors take legal action against external auditors for negligence?	Yes/ B
Can the supervisory authorities force a bank to change its internal organizational structure?	No
Are off-balance sheet items disclosed to supervisors?	Yes/ B
Can the supervisory agency order the bank's directors or management to constitute provisions to cover actual or potential losses?	Yes/ B/ S
Can the supervisory agency suspend director's decision to distribute dividends?	No
Can the supervisory agency suspend director's decision to distribute bonuses?	No
Can the supervisory agency suspend director's decision to distribute management fees?	No
Can the supervisory agency supersede bank shareholder rights and declare bank insolvent?	Yes/ B/ S
Does banking law allow supervisory agency or any other government agency (other than court) to suspend some or all ownership rights of a problem bank?	No
Regarding bank restructuring and reorganization, can the supervisory agency or any other government agency (other than court) supersede shareholder rights?	No
Regarding bank restructuring & reorganization, can supervisory agency or any other government agency (other than court) remove and replace management?	No
Regarding bank restructuring & reorganization, can supervisory agency or any other government agency (other than court) remove and replace directors?	No
Activity restrictions index	
Restriction to participate in securities activities	No
Restriction to participate in insurance activities	No
Restriction to participate in real estate activities	No
Restriction to own non-financial firms	No
Market discipline index	

Question	Applicable
Is subordinated debt allowable (or required) as part of capital?	Yes/ B
Are financial institutions required to produce consolidated accounts covering all bank and any non-bank financial subsidiaries?	Yes/ B
Are off-balance sheet items disclosed to public?	Yes/ B/ S
Must banks disclose their risk management procedures to public?	Yes/ B/ S
Are directors legally liable for erroneous/ misleading information?	Yes/ B
Do regulations require credit ratings for commercial banks?	Yes/ B
Is an external audit by certified/licensed auditor a compulsory obligation for banks?	Yes/ B
Does accrued, though unpaid interest/ principal enter the income statement while loan is non-performing?	No
Is there an explicit deposit insurance protection system?	Yes/ B/ S
Diversification index	
Are there explicit, verifiable, and quantifiable guidelines regarding asset diversification?	Yes/ S
Are banks permitted to make loans abroad?	No

Table A2. Scaling the level of government intervention from the cost perspective
(source: author's made based on Agoraki et al., 2011; Anginer et al., 2014; Delis & Kouretas, 2011)

Question	Score
Capital requirements index	
Is the minimum required capital asset ratio risk-weighted in line with Basel guidelines?	Yes = 1 No = 0
Does the ratio vary with market risk?	Yes = 1 No = 0
Before minimum capital adequacy is determined, whether this item is deducted from the book value of capital: market value of loan losses not realized in accounting books?	Yes = 1 No = 0
Before minimum capital adequacy is determined, whether this item is deducted from the book value of capital: unrealized losses in securities portfolios?	Yes = 1 No = 0
Before minimum capital adequacy is determined, whether this item is deducted from the book value of capital: Unrealized foreign exchange losses?	Yes = 1 No = 0
Are the sources of funds to be used as capital verified by the regulatory/ supervisory authorities?	Yes = 1 No = 0
Can the initial or subsequent injections of capital be done with assets other than cash or government securities?	Yes = 0 No = 1
Can initial disbursement of capital be done with borrowed funds?	Yes = 0 No = 1
Supervisory power index	
Can supervisors take legal action against external auditors for negligence?	Yes = 1 No = 0
Are off-balance sheet items disclosed to supervisors?	Yes = 1 No = 0
Can the supervisory agency order the bank's directors or management to constitute provisions to cover actual or potential losses?	Yes = 1 No = 0
Can the supervisory agency supersede bank shareholder rights and declare bank insolvent?	Yes = 1 No = 0
Identified gap: Are there requirements in the area of Anti-Money Laundering/ Combating the Financing of Terrorism (AML/CFT)	Yes = 1 No = 0
Identified gap: Are there requirements regarding Fit and proper (suitability) requirements for the bank's management	Yes = 1 No = 0

Question	Score
Market discipline index	
Is subordinated debt allowable (or required) as part of capital?	Yes = 0 No = 1
Are financial institutions required to produce consolidated accounts covering all bank and any non-bank financial subsidiaries?	Yes = 1 No = 0
Are off-balance sheet items disclosed to public?	Yes = 1 No = 0
Must banks disclose their risk management procedures to public?	Yes = 1 No = 0
Are directors legally liable for erroneous/ misleading information?	Yes = 1 No = 0
Do regulations require credit ratings for commercial banks?	Yes = 1 No = 0
Is an external audit by certified/licensed auditor a compulsory obligation for banks?	Yes = 1 No = 0
Is there an explicit deposit insurance protection system?	Yes = 1 No = 0
Diversification index	
Are there explicit, verifiable, and quantifiable guidelines regarding asset diversification?	Yes = 1 No = 0

Table A3. Adjusted scaling of the level of government intervention from the cost perspective (source: author's made based on Agoraki et al., 2011; Anginer et al., 2014; Delis & Kouretas, 2011; Bank Regulation and Supervision Survey, 2019)

Question	Score
Capital requirements index	
1. Is the minimum required capital asset ratio risk-weighted in line with Basel guidelines? **Is capital adequacy assessed based on Basel I, Basel II or Basel III?**	Yes = 1 No = 0
2. Does the ratio vary with market risk? **Whether regulatory minimum capital requirements cover credit, market, operational and other risks?**	Yes = 1 No = 0
3. Before minimum capital adequacy is determined, whether this item is deducted from the book value of capital: market value of loan losses not realized in accounting books? **Is the following item deducted from Tier 1 regulatory capital: unrealized losses in fair valued exposures?**	Yes = 1 No = 0
4. Before minimum capital adequacy is determined, whether this item is deducted from the book value of capital: unrealized losses in securities portfolios? **Is the following item deducted from Tier 1 regulatory capital: investment in the capital of certain banking, financial and insurance entities which are outside the scope of consolidation?**	Yes = 1 No = 0
5. Before minimum capital adequacy is determined, whether this item is deducted from the book value of capital: Unrealized foreign exchange losses? **Is the following item deducted from Tier 1 regulatory capital: gain on sale related to securitisation transactions?**	Yes = 1 No = 0
6. Are the sources of funds to be used as capital verified by the regulatory/ supervisory authorities?	Yes = 1 No = 0
7. Can the initial or subsequent injections of capital be done with assets other than cash or government securities?	Yes = 0 No = 1
8. Can initial disbursement of capital be done with borrowed funds? **Is Tier 2 capital legally allowed in regulatory capital?**	Yes = 0 No = 1

Question	Score
Supervisory power index	
9. Can supervisors take legal action against external auditors for negligence? **In cases where the supervisor identifies that the bank has received an inadequate audit, does the supervisor have the powers to take actions against bank or external auditor?**	Yes = 1 No = 0
10. Are off-balance sheet items disclosed to supervisors?	Yes = 1 No = 0
11. Can the supervisory agency order the bank's directors or management to constitute provisions to cover actual or potential losses?	Yes = 1 No = 0
12. Can the supervisory agency supersede bank shareholder rights and declare bank insolvent?	Yes = 1 No = 0
13. *Identified gap: Are there requirements in the area of Anti-Money Laundering/ Combating the Financing of Terrorism (AML/CFT)* **Does the banking supervisory agency have a specific mandate set out in written form for the prevention of financial crime (anti-money laundering / combating financing of terrorism)?**	Yes = 1 No = 0
14. *Identified gap: Are there requirements regarding Fit and proper (suitability) requirements for the bank's management* **Are Fit and proper requirements for the Board and senior management mandatory?**	Yes = 1 No = 0
Market discipline index	
15. Is subordinated debt allowable (or required) as part of capital? **Is subordinated debt allowed as part of Tier 1 capital?**	Yes = 0 No = 1
16. Are financial institutions required to produce consolidated accounts covering all bank and any non-bank financial subsidiaries? **Are banks required to prepare consolidated accounts for accounting purposes?**	Yes = 1 No = 0
17. Are off-balance sheet items disclosed to public?	Yes = 1 No = 0
18. Must banks disclose their risk management procedures to public?	Yes = 1 No = 0
19. Are directors legally liable for erroneous/ misleading information?	Yes = 1 No = 0
20. Do regulations require credit ratings for commercial banks?	Yes = 1 No = 0
21. Is an external audit by certified/licensed auditor a compulsory obligation for banks? **Is an audit by a professional external auditor required for all banks in your jurisdiction?**	Yes = 1 No = 0
22. Is there an explicit deposit insurance protection system?	Yes = 1 No = 0
Diversification index	
23. Are there explicit, verifiable, and quantifiable guidelines regarding asset diversification? **Are there any regulatory rules or supervisory guidelines regarding asset diversification?**	Yes = 1 No = 0

Appendix 3. Regulation Intensity Index for European countries

Table A4. Regulation Intensity Index for Latvia
(the author's made based on Bank Regulation and Supervision Survey, 2019; Index of Economic Freedom, 2022)

Year	1-BF	1-MF	1-IF	1-FF	BS	Reg Index
1996	30.0	58.9	50.0	50.0	43.5	46.5
1997	15.0	42.6	30.0	30.0	43.5	32.2
1998	30.0	34.0	30.0	30.0	43.5	33.5
1999	30.0	27.1	30.0	30.0	43.5	32.1
2000	30.0	21.5	30.0	30.0	43.5	31.0
2001	30.0	16.8	30.0	30.0	43.5	30.1
2002	30.0	15.6	30.0	30.0	52.2	31.6
2003	30.0	15.1	30.0	30.0	52.2	31.5
2004	30.0	14.2	30.0	30.0	56.5	32.1
2005	30.0	15.2	30.0	30.0	56.5	32.3
2006	25.0	19.2	30.0	30.0	56.5	32.1
2007	25.5	25.8	30.0	30.0	56.5	33.6
2008	25.2	26.2	30.0	30.0	78.3	37.9
2009	26.2	28.9	30.0	40.0	78.3	40.7
2010	27.1	33.0	20.0	50.0	78.3	41.7
2011	27.2	26.5	20.0	50.0	78.3	40.4
2012	24.1	20.9	20.0	50.0	87.0	40.4
2013	24.3	21.7	20.0	50.0	87.0	40.6
2014	17.5	20.3	15.0	50.0	87.0	38.0
2015	17.9	16.2	15.0	50.0	87.0	37.2
2016	21.4	15.2	15.0	40.0	87.0	35.7
2017	20.2	13.5	25.0	40.0	87.0	37.1
2018	19.9	12.7	15.0	40.0	87.0	34.9
2019	22.5	18.9	15.0	40.0	87.0	36.7
2020	23.0	19.8	15.0	40.0	87.0	37.0
2021	23.5	20.4	15.0	40.0	87.0	37.2
2022	18.1	16.2	15.0	40.0	87.0	35.3

Table A4.2. Regulation Index components for European countries (source: author's made based on World Bank, 2019; Index of Economic Freedom, 2022)

Component/Country	I_1	I_2	I_3	I_4	I_5	I_6	I_7
Austria	78.3	25.1	31.3	18.5	14.0	10.0	30.0
Bulgaria	73.9	37.3	31.6	12.0	14.0	30.0	40.0
Denmark	52.2	9.3	13.6	15.9	14.0	10.0	20.0
Greece	69.6	25.9	47.5	20.9	19.0	45.0	50.0
Estonia	78.3	24.7	42.8	20.4	14.0	10.0	30.0
Italy	78.3	28.3	48.9	16.0	14.0	15.0	50.0
Latvia	82.6	22.5	26.7	18.9	14.0	15.0	40.0
Luxembourg	78.3	31.2	54.1	17.4	14.0	5.0	20.0
Netherlands	73.9	18.6	39.7	16.0	14.0	10.0	20.0
Portugal	82.6	20.3	55.7	17.0	14.0	30.0	40.0
Slovakia	73.9	38.7	46.6	21.4	14.0	25.0	30.0
Finland	87.0	10.6	49.7	15.2	14.0	15.0	20.0
Hungary	78.3	38.9	35.3	18.2	14.0	20.0	30.0
Sweden	78.3	12.0	46.1	18.0	14.0	15.0	20.0
Belgium	78.3	21.9	39.0	23.9	14.0	15.0	30.0
Czech Republic	87.0	27.6	21.9	18.5	14.0	20.0	20.0
France	73.9	18.8	54.8	20.9	19.0	25.0	30.0
Croatia	82.6	39.3	56.0	21.5	14.0	25.0	40.0
Ireland	73.9	16.9	24.7	13.0	14.0	10.0	30.0
Cyprus	69.6	23.1	40.5	16.0	14.0	25.0	40.0
Lithuania	69.6	24.8	36.4	15.4	14.0	20.0	30.0
Malta	60.9	32.9	38.7	21.8	14.0	15.0	40.0
Poland	60.9	34.6	36.1	17.9	14.0	20.0	30.0
Romania	78.3	36.9	35.5	17.3	14.0	30.0	50.0
Slovenia	82.6	20.7	38.8	16.4	14.0	30.0	50.0
Spain	69.6	33.2	42.2	12.5	14.0	15.0	30.0

Table A4.3. Regulation Index for European countries (source: author's made based on World Bank, 2019; Index of Economic Freedom, 2022)

Values of a_1/ $a_2...a_7$/ Country	0% / 17%	14% / 14%	25% / 13%	50% / 8%	75% / 4%	100% / 0%
Austria	21.5	29.4	35.7	49.9	64.1	78.3
Bulgaria	27.5	34.0	39.1	50.7	62.3	73.9
Denmark	13.8	19.2	23.4	33.0	42.6	52.2
Greece	34.7	39.6	43.4	52.1	60.9	69.6
Estonia	23.7	31.3	37.3	51.0	64.6	78.3
Italy	28.7	35.6	41.1	53.5	65.9	78.3
Latvia	22.9	31.2	37.8	52.7	67.7	82.6
Luxembourg	23.6	31.3	37.3	50.9	64.6	78.3
Netherlands	19.7	27.3	33.3	46.8	60.4	73.9
Portugal	29.5	36.9	42.8	56.1	69.3	82.6
Slovakia	29.3	35.5	40.4	51.6	62.8	73.9
Finland	20.8	30.0	37.3	53.9	70.4	87.0
Hungary	26.1	33.4	39.1	52.2	65.2	78.3
Sweden	20.9	28.9	35.2	49.6	63.9	78.3
Belgium	24.0	31.6	37.5	51.1	64.7	78.3
Czech Republic	20.3	29.7	37.0	53.6	70.3	87.0
France	28.1	34.5	39.5	51.0	62.5	73.9
Croatia	32.6	39.6	45.1	57.6	70.1	82.6
Ireland	18.1	25.9	32.1	46.0	60.0	73.9
Cyprus	26.4	32.5	37.2	48.0	58.8	69.6
Lithuania	23.4	29.9	35.0	46.5	58.0	69.6
Malta	27.1	31.8	35.5	44.0	52.4	60.9
Poland	25.4	30.4	34.3	43.2	52.0	60.9
Romania	30.6	37.3	42.5	54.4	66.3	78.3
Slovenia	28.3	35.9	41.9	55.5	69.0	82.6
Spain	24.5	30.8	35.8	47.0	58.3	69.6

Table A5. Regulatory costs calculations for selected countries

2019	Questionnaire, points	Regulation Index	Microprudentional supervisor, mln EUR	Macroprudentional supervisor, mln EUR	Policy maker, mln EUR	Total regulation costs, mln EUR	GDP at current prices, mln EUR	Total regulation costs, bp to GDP
Latvia	19	35.8	10.8	33.3	1.7	45.8	30 463.3	0.15%
Lithuania	16	32.0	✕	33.9	2.2	36.1	48 797.4	0.07%
Estonia	18	32.7	7.0	19.6	1.3	27.8	28 112.4	0.10%
Poland	14	32.7	37.1	219.9	21.0	278.0	532 329.2	0.05%
Finland	20	29.6	34.8	108.0	7.4	150.2	240 561.0	0.06%
Bulgaria	17	38.6	8.7	65.5	2.9	77.1	61 239.5	0.13%
Czech Republic	20	34.6	✕	96.9	7.8	104.7	223 950.3	0.05%
Denmark	12	21.5	54.1	122.2	9.3	185.7	312 747.2	0.06%
Croatia	19	41.7	✕	53.1	3.0	56.2	54 237.9	0.10%
France	17	33.7	187.6	2 154.0	107.8	2 449.4	2 425 708.0	0.10%

Table A6. Answers on the questions of the questionnaire
(source: author's made based on the World Bank, 2001, 2003, 2007, 2011, 2019a, 2021)

	2001			2003			2007			2011			2019			2021		
	LT	LV	EE	LT	LV	EE	LT	LV	EE	LT	LV	EE	LT	LV	EE	LT	LV	EE
1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	No	No	Yes	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	No	No	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	No	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	No	Yes	No	No	Yes	No	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	Yes	Yes	No	Yes	Yes	No	No	No	No	No	No	No	Yes	No	No	Yes	No	No
8	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	No	No	No	No	No	No	No
9	No	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
11	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	No	Yes	No	No
13	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes
14	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
15	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	No	Yes	No
16	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
17	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
18	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
19	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
20	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
21	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
22	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
23	No	No	No	Yes	No	Yes	Yes	No	No	Yes	No	No	No	Yes	No	No	Yes	No

■ No answer provided, authors' view reflected, which is based on the data in 2003 or regulation was not in force at that time
■ Inconsistent values, value changed to the opposite
■ Inconsistent values, however no changes done

Table A7. Full disclosure of the intervention level measured in points

	2001			2003			2007			2011			2019			2021		
	LT	LV	EE	LT	LV	EE	LT	LV	EE	LT	LV	EE	LT	LV	EE	LT	LV	EE
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
3	0	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1
4	1	0	1	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1
5	1	0	1	0	0	1	0	0	1	0	0	0	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	0	0	1	0	0	1	1	1	1	1	1	1	0	1	1	0	1	1
8	0	0	0	0	1	0	0	1	0	1	0	1	1	1	1	1	1	1
9	0	0	1	0	0	1	1	0	1	1	0	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	1	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	0	0
13	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	0	1	1
14	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
15	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1	1	0	1
16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
18	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
23	0	0	0	1	0	1	1	0	0	1	0	0	0	1	0	0	1	0
	12	10	16	12	12	16	14	13	15	20	18	20	19	20	20	19	20	20
Average BAL	12.7			13.3			14.0			19.3			19.7			19.7		

Table A8. Function's IC test (Swedbank)

Regression Statistics	
Multiple R	0.949
R Square	0.901
Adjusted R Square	0.877
Standard Error	4.281
Observations	16

ANOVA

	df	SS	MS	F	Signifi-cance F
Regression	3	2 011.177	670.392	36.577	0.000
Residual	12	219.937	18.328		
Total	15	2 231.115			

	Coeffi-cients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 90.0%	Upper 90.0%
Intercept	-3 008.045	920.325	-3.268	0.007	-5 013.262	-1 002.829	-4 648.329	-1 367.761
X Variable 1	563.602	171.780	3.281	0.007	189.325	937.880	257.441	869.764
X Variable 2	-34.580	10.570	-3.272	0.007	-57.610	-11.551	-53.419	-15.742
X Variable 3	0.704	0.214	3.284	0.007	0.237	1.172	0.322	1.086

Table A9. Function's IC test (SEB)

Regression Statistics	
Multiple R	0.920
R Square	0.846
Adjusted R Square	0.816
Standard Error	6.671
Observations	19

ANOVA

	df	SS	MS	F	Significance F
Regression	3	3 679.205	1 226.402	27.559	0.000
Residual	15	667.513	44.501		
Total	18	4 346.718			

	Coeffi-cients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 90.0%	Upper 90.0%
Intercept	-2 817.700	1 345.377	-2.094	0.054	-5 685.303	49.903	-5 176.214	-459.186
X Variable 1	520.940	250.645	2.078	0.055	-13.298	1 055.178	81.546	960.334
X Variable 2	-31.418	15.406	-2.039	0.059	-64.254	1.419	-58.424	-4.411
X Variable 3	0.631	0.312	2.019	0.062	-0.035	1.297	0.083	1.178

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Appendix 6. List of regulations for Compliance costs' assessment

2002

Financial conglomerates - Directive (2002/87/EC)

Financial collateral - Directive 2002/47/EC

2003

Prospectus - Directive 2003/71/EC

2004

Markets in financial instruments (MiFID) - Directive 2004/39/EC

2007

Payment services (PSD1) - Directive 2007/64/EC

2009

Cross-border payments - Regulation (EC) No 924/2009

E-money - Directive 2009/110/EC

2012

Single euro payments area (SEPA) - Regulation (EU) 260/2012

Short selling - Regulation (EU) No 236/2012

Derivatives (EMIR) - Regulation (EU) No 648/2012

2013

Banking prudential requirements - Directive 2013/36/EU

Banking prudential requirements - Regulation (EU) No 575/2013

Single supervisory mechanism - Council Regulation (EU) No 1024/2013

2014

Bank recovery and resolution - Directive 2014/59/EU

Deposit guarantee schemes - Directive 2014/49/EU

Single resolution mechanism - Regulation (EU) No 806/2014

Mortgage credit directive 2014/17/EU

Payment accounts - Directive 2014/92/EU

Key information documents for packaged retail and insurance-based investment products (PRIIPs) - Regula-tion (EU) No 1286/2014

Markets in financial instruments (MiFID 2) - Directive 2014/65/EU

Markets in financial instruments (MiFIR) - Regulation (EU) No 600/2014

Market abuse - Regulation (EU) 596/2014

Market abuse - Directive 2014/57/EU

2015

Payment services (PSD2) - Directive (EU) 2015/2366

Securities financing transactions (SFTR) - Regulation 2015/2365

2016

Benchmark - Regulation (EU) 2016/2011

2017

Prospectus - Regulation (EU) 2017/1129

- Modelis kopumā der jebkuram tirgum, tomēr pētīts tiek tikai banku tirgus
- Sabiedrības zaudējums tiek novērtēts šādām tirgus neveiksmēm:
  - Monopolizācija (angļu – *imperfect competition*)
  - Informācijas asimetrija (angļu – *asymmetric information*)
  - Negatīvie blakusefekti (angļu – *negative spillovers*)
  - Pārējās kopā
- Regulēšanas izmaksas tiek novērtētas šādās pozīcijās:
  - Regulatora darbības izmaksas (angļu – *regulatory costs*)
  - Atbilstības nodrošināšanas izmaksas (angļu – *compliance costs*)
  - Netiešās izmaksas (angļu – *indirect costs*)
- Modelis validēts ar *euro* zonas datiem (Eiropas Centrālās Bankas datubāze, Eurostat, Latvijas Bankas dati), kā arī Pasaules Bankas un *Index of Economic Freedom* datubāžu datiem

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Modeļa veidošanā ievēroti šādi **principi**:
1. Piemērošanas vienkāršība (vai dati ir pēc iespējas plaši pieejami)
2. Interpretācijas skaidrība
3. Efektivitāte (modelis aptver visas būtiskās izmaksu u.c. pozīcijas)

Modeļa bloks	Veidošanas pieeja	Datu avots
Intervences (*x* ass) skala	Regulēšanas indekss, kas balstīts uz aptauju ar 23 jautājumiem un 4 ekonomiskās brīvības indeksiem Vērtības intervālā [0; 100]	Pasaules Bankas apkopotā *Bank Regulation and Supervision Survey,* *Index of Economic Freedom* datubāze
Sabiedrības zaudējuma novērtēšana	Negūtā IKP novērtējums Vērtības % IKP	Eiropas Centrālās Bankas, *Eurostat* un Latvijas Bankas datubāzes
Regulēšanas izmaksu novērtēšana	Izmaksu novērtējums Vērtības % IKP	Eiropas Centrālās Bankas, *Eurostat* un Latvijas Bankas datubāzes, *Bloomberg,* regulatoru gada pārskati

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## #6 | Intervences/ regulēšanas intensitātes skala | RTU
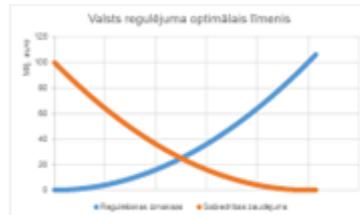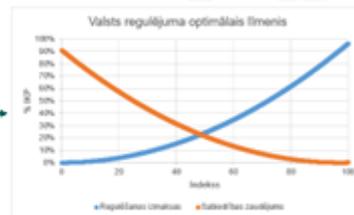
- Indekss, kas sastāv no vidējās vērtības no <u>pieciem indeksiem</u>:
- Pasaules Bankas aptaujas *Bank Survey* indekss:
  - 23 jautājumi regulēšanas intensitātes novērtēšanai, kas skar 4 jomas:
    - kapitāla prasības (angļu – *capital requirements*)
    - regulatora iespējas ietekmēt uzraugāmā darbību (angļu – *supervisory power*)
    - tirgus disciplīna (angļu – *market discipline*)
    - aktīvu diversifikācijas prasības (angļu – *diversification*)
  - Iespējamās vērtības: no 0 līdz 100 (reāli skaitļi), aprēķināts kā $\frac{n}{23} \cdot 100$
  - Piemēri jautājumiem:
    - kapitāla prasības: «*Whether regulatory minimum capital requirements cover credit, market, operational and other risks?*»
    - regulatora iespējas ietekmēt uzraugāmā darbību: «*Can the supervisory agency supersede bank shareholder rights and declare bank insolvent?*»
    - tirgus disciplīna: «*Must banks disclose their risk management procedures to public?*»
    - aktīvu diversifikācijas prasības: «*Are there explicit, verifiable, and quantifiable guidelines regarding asset diversification?*»
- 4 regulācijas indeksi no *Index of Economic Freedom* datubāzes:
  - 1 – *Business Freedom*
  - 1 – *Monetary Freedom*
  - 1 – *Investment Freedom*
  - 1 – *Financial Freedom*

- Vispārējā pieeja tirgus neveiksmju kvantitatīvai vērtēšanai: sabiedrības zaudējums = «*The Harberger Triangle*» laukums

Price

Quantity

*piemērs monopolizācijas gadījumā
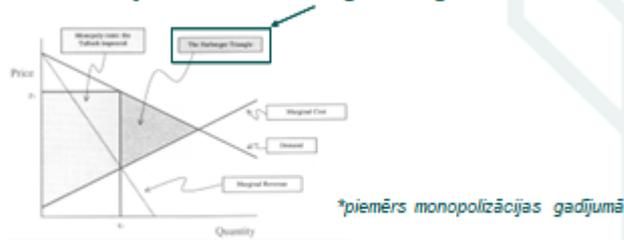
- Doktora darba pētījumā piedāvāts variants tirgus neveiksmju (monopolizācija, informācijas asimetrija, negatīvie blakusefekti, citi) novērtēšanai **banku tirgū**
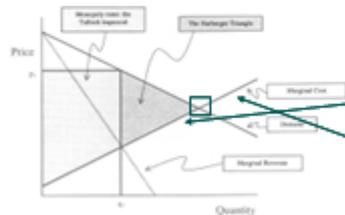
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- VISPĀRĒJĀ PIEEJA

Monopolizācija

Laukums starp pieprasījuma un piedāvājuma funkcijām:

$$DWL_{(monopol)} = \int\limits_{q(X*)}^{q(X)} \left(D(q) - S(q) \right) dq$$

Price

Quantity

- PIELĀGOJUMI BANKU TIRGŪ

q(X) un *q(X*)*:

Tirgus starp dažādiem monopolizācijas līmeņiem tiek novērtēts ar Hefindahl-Hirschman indeksa *(HHI)* palīdzību

Pieprasījuma funkcija *D(q)*:

Ekonometriski novērtēta, balstoties uz noslēgtajiem kredīta darījumiem

Piedāvājuma funkcija *S(q)*:

Pieprasījuma funkcijas dati ar korekcijām:

➤ Pirms līdzsvara punkta

$$S(q) = D(q) \cdot \left(1 - LM \cdot \frac{(1 - CI)}{100} \right)$$

LM – Lending Margin, CI – Cost-to-income ratio

➤ Pēc līdzsvara punkta

$$S(q) = D(q) \cdot \left(1 + \frac{100 - LDR}{100} \right), LDR < 100$$

LDR – Loan-to-Deposit ratio

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#9 Sabiedrības zaudējuma novērtēšana (3) — RTU

- Validācija ar *euro* zonas datiem (Eiropas Centrālās Bankas datubāze, Eurostat, Latvijas Bankas dati):
  - Pieprasījuma funkciju piemēri:
    - Beļģija: $-0{,}0061q + 3{,}706$ (R^2 92,8%; p-value $7{,}5 \cdot 10^{-33}$%)
    - Vācija: $16{,}242q^3 - 137{,}55q^2 + 386{,}1q - 357{,}71$ (R^2 91,6%; p-values $q \cdot 10^{-10}$%)
  - Piedāvājuma funkciju piemēri:
    - Beļģija: $-0{,}0064q + 3{,}4988$ (R^2 78,2%; p-value $7{,}9 \cdot 10^{-18}$%)
    - Vācija: $19{,}788q^3 - 169{,}95q^2 + 484{,}09q - 456{,}18$ (R^2 91,8%; p-values $q \cdot 10^{-5}$%)
  - Aprēķina rezultāti norādīja uz rezultātu, kas uzrādīja sabiedrības zaudējumu pie būtiskām HHI izmaiņām

Valsts	HHI		Ekspozīcija, mljrd. EUR			Procentu likmes, %		Sabiedrības zaudējums	
	2017	2022	2017	2022	2022*	2017	2022	mljrd. EUR	% IKP
Austrija	374	407	321	392	360	3,5	3,1	N/A	N/A
Beļģija	1 102	1 319	294	386	353	1,9	1,6	N/A	N/A
Vācija	250	269	2 560	3 072	2 870	1,7	1,2	N/A	N/A
Francija	574	601	2 160	2 759	2 570	1,6	1,2	N/A	N/A
Luksemburga	256	293	113	130	112	1,8	1,5	0,3	0,4
Latvija	1 237	1 646	12	11	8,5	4,5	6,8	1,6	4,6
Malta	1 599	1 701	10	12	9,8	2,0	2,2	0,4	2,7
Slovākija	1 332	1 511	49	65	57	1,9	1,1	N/A	N/A
Slovēnija	1 133	1 415	19	21	17,7	2,8	1,9	1,1	2,1

#10 Sabiedrības zaudējuma novērtēšana (4) — RTU

- Citu tirgus neveiksmju aprēķina pieejas:
  - Informācijas asimetrija

$$DWL_{as} = \int_{bal(t+)}^{bal(t)} [D_1(bal) - D_2(bal)]\, d.bal$$

  D_1 – pieprasījuma funkcija kreditiem bez nodrošinājuma
  D_2 – pieprasījuma funkcija kreditiem ar nodrošinājumu
  bal – kreditu apjoms bilancē

  - Negatīvie blakusefekti

$$DWL_{spill} = \int_{bal(t+)}^{bal(t)} [SC(bal) - SB(bal)]\, d.bal$$

  SC – sabiedrības izmaksas
  SB – sabiedrības ieguvums
  bal – kapitāla plūsmas bilance

  - Pārējie

$$DWL_{abuse} = \sum_{i=1}^{N} (Exc - Acc) \cdot bal$$

$$DWL_{other} = \sum_{i=1}^{N} (Exc - Norm) \cdot bal$$

  Exc – uzkrājumu vai cita rādītāja līmenis virs normas
  Acc – uzkrājumu normas līmenis
  Norm – cita rādītāja normas līmenis
  bal – kreditu apjoms bilancē

Regulatora darbības izmaksas

- Izmaksu veidi
  - Administrācijas izmaksas
    - IT sistēmu attīstība un uzturēšana
    - Pieteikumu apstrāde
    - Licenču pagarināšana un ar to saistītā uzraudzība
  - Regulējuma ieviešanas izmaksas
    - Audita sistēmu un procesu attīstība un uzturēšana
    - Sankcionēšanas sistēmu un procesu attīstība un uzturēšana
- Personāla izmaksas ietvertas iepriekš minētajās kategorijās
- Izmaksas novērtētas, balstoties uz gada pārskatos pieejamo informāciju mikroprudenciālajam un makroprudenciālajam regulatoram, kā arī valsts budžetā – politikas veidotājam centrālajā valdībā
  - Centrālās Bankas gadījumā tiek nemtas vērā administratīvās izmaksas, t.i, netiek nemtas vērā pozīcijas gada pārskatā pirms pozīcijas «tīrie ienākumi»
  - Politikas veidotājam nemta vērā darbinieku proporcija, kas atbild par finanšu tirgus politikas veidošanu valdībā
  - No aprēķina izņemtas izmaksu pozīcijas, kuras neattiecas uz *business-as-usual* piemēram, citu periodu izmaksu pārgrāmatojums bez paskaidrojumiem, vienreizējas izmaksas

$$y_n = MiP_n + MaP_n + \frac{1}{a} \cdot \frac{1}{b} \cdot SC$$

MiP – mikroprudenciālā regulatora izmaksas
MaP – makroprudenciālā regulatora izmaksas
SC – valdības personāla izmaksas

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Atbilstības nodrošināšanas izmaksas

- Izmaksu veidi
  - Vienreizējās izmaksas regulējuma ieviešanas brīdī
  - Regulārās izmaksas
- Kvantitatīvai novērtēšanai izmantots Eiropas Komisijas pētījums par atbilstības izmaksām finanšu tirgū
  - 2009.gada vienreizējās izmaksas veidoja 1,94%, bet regulārās – 0,63% no operacionālajām izmaksām: šie dati izmantoti kā sākumpunkts
  - Dati par 2017.gadu izmantoti, lai lineāri novērtētu pieaugumu 8 gadu laikā un izdarītu pieņēmumu par pieaugumu nākamajos gados:
    - pieņēmums, ka turpmāk pieauguma ātrums varētu būt lineāri aptuveni divas reizes mazāks

$$y_n = \begin{cases} n = 1,\dots,8 \colon \left(0{,}2 \cdot (\alpha_0 + n \cdot 0{,}12\%) + \beta_0 + n \cdot 0{,}25\%\right) \cdot x \\ n = 9,\dots \colon \left(0{,}2 \cdot (\alpha_8 + (n-8) \cdot 0{,}05\%) + \beta_8 + (n-8) \cdot 0{,}10\%\right) \cdot x \end{cases}$$

$\alpha_0 = 1{,}94\%, \beta_0 = 0{,}63\%$

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#13 Regulēšanas izmaksu novērtēšana (3) RTU

Netiešās izmaksas

- Izmaksas, kas ietekmē tirgus struktūru, pieprasījuma tendences u.tml.
- Pieprasījuma un/ vai piedāvājuma izmaiņas tiek skatītas caur procentu likmju un kredītu apjomu izmaiņu tūlīt pēc regulējuma ieviešanas
- Ņemot vērā Guiso, Sapienza and Zingales (2007) secinājumu par kredītu kvalitātes uzlabošanos pēc regulējuma ieviešanas Itālijas banku tirgū, uzkrājumu izmaksu samazinošais efekts arī tiek ņemts vērā

$$y_n = (q_n - q_{n-1}) \cdot (i_n - i_{n-1}) - (acc_{n-1} - acc_n)$$

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#14 Kopējais modelis RTU

- Modelis apvieno sabiedrības zaudējumu un regulēšanas izmaksas

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Kristaps Freimanis was born in 1989 in Jurmala. He received his Master's degree in Economics (2017) and Bachelor's degree in Financial Engineering (2014) from the Riga Technical University. Kristaps Freimanis has more than 10-years long industry experience in various financial and risk management positions. Currently, he is Head of Financial Planning and Analysis in the biggest electricity distribution system operator in Latvia, JSC *Sadales tīkls*. His research interests include state economic policy, market failures and regulation. His research results have been published in peer-reviewed journals, the chapter in the book and the proceedings of international scientific conferences. The research results are included in the study courses that Kristaps Freimanis teaches at the Riga Technical University.

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