

# Energy sector regulation

## 5<sup>th</sup> module, Spring 2018

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### Course information

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**Course Website:** at my.nes

**Instructor's Office Hours:** by appointment

**Class Time:** see plan at my.nes

**Room Number:**

**TAs:** Evgeny Shudrya

### Course description

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Few markets fulfill the assumptions of perfect competition and the absence of entry and exit barriers. Most markets therefore are impacted by some form of regulation, the most basic (light-handed) forms of which are property rights and contract enforcement, but other markets are subjected to more heavy-handed forms of regulation or government intervention. The energy markets are prime examples of this, especially the electricity and gas industries.

The government can forbid or prescribe certain actions (command-and-control such as emission standards), subject firms to additional financial incentives (by taxes and subsidies or even by creating new markets, such as for pollution permits under cap-and-trade mechanisms), regulate the income and expenditures of firms (under monopoly regulation) or even take over the firm and run it as a state-owned monopolist (a form more prevalent outside of the USA).

Economic theory indicates that governmental regulation or intervention should not increase welfare unless a case can be made for a market failure. In a market failure, the effects of the firms' actions are not all internalized and pecuniarized (such as in pollution emissions or in R&D investments). Another case of market failure is when fixed costs are much higher than marginal costs, the case of natural monopoly (gas and electricity networks are prime examples). In this case a firm cannot recover the fixed costs by charging marginal costs, and moreover, competition will lead to a shake-out with just one single firm, the natural monopolist.

In theory, governmental regulation may thus improve welfare in markets that exhibit strong market failures. A practical problem here is that the government is mostly less efficient and its constituents may pursue a different agenda than maximizing welfare, resulting in costly, overstretched governmental organizations that may intervene in the market too much or apply the wrong interventions. There thus exists also something called "governmental failure".

The course of Regulation covers topics on market power, regulation of monopolies, environmental regulation, and de-regulation and liberalization. The focus of the topic of

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market power introduces the main competition models relating to horizontal and vertical market power. Topics cover the behavior of firms with market power, price-discrimination, remedies for market power, and unbundling of vertically integrated companies. These models are especially relevant for electricity and gas producers and utilities, and thus also the Russian and EU policies on gas and electricity will be discussed.

The focus of the topic of monopoly regulation introduces the standard models of the new economic theory of regulation and discusses to what degree it has (or has not) been applied in the past 20 years. Abstracting from information problems, optimal conditions are derived for pricing in high-fixed cost industries (such as networks). An example of a particularly urgent new version of an otherwise well-known problem in the electricity sector ("the utility dead spiral") is presented.

The focus of the topic of environmental regulation introduces the new regulation that has arisen in response to the problem of global warming. First-best instruments (taxes and cap-and-trade) and second-best instruments (subsidies, emission standards, other forms of command-and-control) and their possible interaction are presented.

The focus of the topic of de-regulation and liberalization introduces some of the problems of governmental failure and the steps taken to de-regulate parts of the industries. De-regulation spurs the need for pricing mechanisms, and this requires well-functioning financial markets. Also, in some cases the regulation by the government may be supplanted by regulation by a private body: the case of self-regulatory organizations. Special attention will be paid to the Russian energy markets.

The course offers theory, empirical and experimental evidence. Students are expected to have background knowledge in economics, be familiar with algebra as well as understand microeconomics.

By completing this course a successful student will be able to

- Analyze and discuss the economic fundamentals of firm behavior in imperfectly competitive markets and the intervention of the government using measures or monopolistic regulation;
- Understand the problem of regulation of a monopoly under imperfect information.
- Understand the key qualities that makes certain industries natural monopolies and how the peculiar qualities should be addressed in regulation;
- Gain insights into the climate policy issues and assess advantages and disadvantages of currently used and future proposed climate policies for the electricity industry and the electricity consumers;
- Discuss research trends within the field of regulation with a group of peers.

The approaches learned in the course would also enable the student to examine economic problems in other related fields such as the theory of industrial organization, energy economics, and environmental economics.

## **Course requirements, grading, and attendance policies**

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**Prerequisites:** Micro 1-2, Math 1-2, Statistics

**Teaching and Work Forms:** 2 lectures per week and (in total) 3 exercise classes. During exercise classes students will be mostly doing exercises, discussing case studies and/or presenting articles.

**Grading policy:** Participants are expected to prepare the readings for the class, and to

actively and constructively participate in class discussions. Final grade for the course will be based on the final exam (70% of the grade), home works (30%). There will be 3 home works in total.

**Attendance policy:** Attendance is not compulsory. However, it will be marked both at the lectures and at the exercise classes and those with attendance below 50% will not be allowed to re-take the final exam.

## Course contents

Lecture		
	<b>A. Imperfectly competitive markets</b>	
1.	<u>A1. Horizontal market power</u> Monopolistic behavior, Competitive fringe, Cournot competition (gas, oil, electricity)	- Biggar Ch. 1 - Tirole Ch. 1 - Tollison (p.575-584) - Carlton Ch. 4
	Increasing market power: Price discrimination (gas, electricity)	- Laffont Ch. 2. - Varian Int Ch.25.3 - Varian Adv Ch. 14.7 - Tirole Ch. 3
2	Reducing market power: Forward markets (gas, oil, electricity)	- Rassenti 2001 - Van Koten 2013, 2016 - VanEijkel 2010 - Allaz & Vila - Brandts 2008 - Bessembinder and Lemmon (2002)
	Reducing market power: Demand response (electricity)	- Brandts 2014 - Rassenti 2003 - Swinand
3	<u>A2. Vertical market power</u> Bundling production and networks: - Vertically integrated companies - EU 3 <sup>rd</sup> package energy regulation and unbundling. (gas, electricity)	- Van Koten 2008 - Kirschen Ch.1
	Bundling generation and retail (electricity)	- Bushnell - Biggar Ch 15, 17
4	<u>A3. Market power Mitigation</u> Ex-ante and ex-post regulation	- Brattle 2007 - Swinand
	<b>B. Regulation of monopolies</b>	
	Rate of Return Regulation, Averch-Johnson, price caps, yardstick competition (gas, oil, electricity)	- Carlton - Crew - Hesselting - Shleifer
5	The new theory of regulation and its usefulness (or lack thereof) (gas, oil, electricity)	- Laffont Ch. 2. - Varian Int Ch.25.3 - Varian Adv Ch. 14.7 - Crew 2004 - Roland
	<b>C. Environmental regulation</b>	
6	First-best instruments, second-best instruments and their interaction. (gas, oil, electricity)	- Baumol, p.36-47 - Fisher, p.164-174 - Joskow 2008
7	Interaction of instruments (cap-and-trade & subsidies) (gas, oil, electricity)	- Boehringen 2009 - Boehringen 2010 - Cramton 2010 - Marc. 2015 - Marc. 2017

	Future and past visions for environmental disasters and successes	<ul style="list-style-type: none"> <li>- Gollier &amp; Tirole 2015</li> <li>- Morris</li> <li>- Smil 2010</li> <li>- Smil 2014</li> <li>- Wilson</li> </ul>
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## Readings

**All literature is available in the library or will be provided.**

*(The literature in italics is not obligatory, but given as reference literature)*

### A. Market power

#### A.1 Horizontal market power

Allaz	Allaz, B., & Vila, J. L. (1993). Cournot competition, forward markets and efficiency. <i>Journal of Economic theory</i> , 59(1), 1-16.
Biggar	Biggar, D.R., Hesamzadeh, M.R. 2014. <i>The Economics of Electricity Markets</i> . Ch 1
Brandts 2008	Brandts, J., Pezanis-Christou, P., Schram, A. 2008. Competition with forward contracts: a laboratory analysis motivated by electricity market design. <i>The Economic Journal</i> , 118(525), 192-214.
Brandts 2014	Brandts, J., Reynolds, S. S., & Schram, A. 2013. Pivotal Suppliers and Market Power in Experimental Supply Function Competition. <i>The Economic Journal</i> .
Rassenti 2001	Rassenti, S. J., Smith, V. L., & Wilson, B. J. 2001. Using experiments to inform the privatization/deregulation movement in electricity. <i>Cato J.</i> , 21, 515.
Rassenti 2003	Rassenti, S. J., Smith, V. L., & Wilson, B. J. 2003. Controlling market power and price spikes in electricity networks: Demand-side bidding. <i>Proceedings of the National Academy of Sciences</i> , 100(5), 2998-3003.
Swinand	Swinand, G., Scully, D., Ffoulkes, S., & Kessler, B. (2010). Modeling EU electricity market competition using the residual supply index. <i>The Electricity Journal</i> , 23(9), 41-50.
Tirole	Tirole, J. 1988. <i>The theory of industrial organization</i> . MIT press. Ch 1
VanKoten 2013	Van Koten, S., Ortmann, A. 2013. Structural versus behavioral remedies in the deregulation of electricity markets: An experimental investigation motivated by policy concerns. <i>European Economic Review</i> , 64, 256-265.
Varian Int	Varian, H.R. 2010. <i>Intermediate Micro Economics</i> . (Ch.25.3)
Varian Adv	Varian, H.R. 1992. <i>Microeconomic Analysis</i> (Ch.14.7)
VanEijkel 2010	VanEijkel, R., & Moraga-González, J. L. (2010). Do firms sell forward for strategic reasons? An application to the wholesale market for natural gas.
<i>Carlton</i>	<i>Carlton, D.W., Perloff, J.M. 2000/2004. Modern industrial organization. Ch. 4</i>
<i>Laffont</i>	<i>Laffont, J. and Martimort, D. 2001. The theory of incentives I: The principal-agent model. (p.37-52)</i>
<i>Tollison</i>	<i>Tollison, R.D. 1982. Rent Seeking: A Survey. Kyklos. (p.575-584)</i>

#### A.2 Vertical market power

Biggar	Biggar, D.R., Hesamzadeh, M.R. 2014. <i>The Economics of Electricity Markets</i> . Ch 15,16,17
BL	Bessembinder, H., & Lemmon, M. L. 2002. Equilibrium pricing and optimal hedging in electricity forward markets. <i>the Journal of Finance</i> , 57(3), 1347-1382
Bushnell	Bushnell, Erin T. Mansur, and Celeste Saravia. 2008. Vertical Arrangements, Market Structure, and Competition: An Analysis of Restructured US Electricity Markets <i>American Economic Review</i> 98(1), 237–266.
Kirschen	Kirschen, D., Strbac, G. 2004. <i>Fundamentals of power system economics</i> . John Wiley & Sons Ltd: Chichester. Chap.1
VanKoten 2008	Van Koten, S., & Ortmann, A. 2008. The unbundling regime for electricity utilities in the EU: A case of legislative and regulatory capture?. <i>Energy Economics</i> , 30(6), 3128-3140.
VanKoten 2016	Van Koten, S. 2016. Silvester Van Koten : Forward Premia in Electricity Markets with Fixed and Flexible Retail Rates: Replication and Extension. <i>RSCAS Working Papers 2016/24</i>
<i>VanKoten 2012</i>	<i>Van Koten, S. 2012. Merchant interconnector projects by generators in the EU: Profitability and allocation of capacity. Energy Policy, 41, 748-758.</i>

#### A.3 Market power & mitigation

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Brattle 2007      The Brattle Group, 2007. Review of PJM's Market Power Mitigation Practices in Comparison to Other Organized Electricity Markets. p. 1-66.

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**B. Regulation of monopolies**

- Biggar Biggar, D.R., Hesamzadeh, M.R. 2014. The Economics of Electricity Markets. Ch 9
- Carlton Carlton, D.W., Perloff, J.M. 2004. Modern industrial organization. Ch. 20 appendix on Averch-Johnson
- Crew Crew, M., & Kleindorfer, P. 2004. Regulatory Economics: Recent Trends in Theory and Practice. ACCC 2004 Regulatory Conference, July.
- Hesseling Dennis Hesseling en Mahir Sari. 2006. The introduction of quality regulation of electricity distribution in The Netherlands. European Energy Law Report III p.127 -145.
- Laffont Laffont, J. and Martimort, D. 2001. The theory of incentives I: The principal-agent model. (p.37-52)
- Roland Roland, G. Transition And Economics: Politics, Markets and Firms, The MIT Press, 2000. (p.205-209)
- Shleifer Shleifer, A. 1985. A theory of yardstick competition. The RAND Journal of Economics, 319-327.
- Varian Int Varian, H.R. 2010. Intermediate Micro Economics. (Ch.25.3)
- Varian Adv Varian, H.R. 1992. Microeconomic Analysis (Ch.14.7)
- Alba Alba, M. M. *The Regulatory Tradeoff between Rent Extraction and Efficiency.*
- Armstrong Armstrong, M., & Sappington, D. E. 2007. Recent developments in the theory of regulation. *Handbook of industrial organization*, 3, 1557-1700.
- Baron Baron, D. P. 1989. *Design of regulatory mechanisms and institutions. Handbook of industrial organization*, 2, 1347-1447.
- Laffont 1994 Laffont, J. J. (1994). *The new economics of regulation ten years after. Econometrica: Journal of the Econometric Society*, 507-537.
- Swedish Swedish Agency for Growth Policy Analysis. 2010. *The Economic Effects of the Regulatory Burden.*

**C. Environmental regulation**

- Baumol Baumol, W. J., & Oates, W. E. (1988). The theory of environmental policy. Cambridge university press, p.36-47.
- Boehringen 2009 Böhringer, C., Rosendahl, K,E, 2009. Green serves the dirtiest. Discussion Papers No. 581, April 2009 Statistics Norway, Research Department
- Boehringen 2010 Böhringer, C., Rosendahl, K,E, 2010. Green promotes the dirtiest: on the interaction between black and green quotas in energy markets. *Journal of Regulatory Economics* 37, 316–325.
- Borenstein 2012 Borenstein, S. 2012. The Private and Public Economics of Renewable Electricity Generation, *Journal of Economic Perspectives*, 26(1), p.67-92.
- Cramton 2010 Cramton, P., Stoft, S. 2010. Price is a better climate commitment. *The Economists'Voice*.
- Fisher Fisher, A.C. 2008 (1981). Resource and Environmental Economics. Chapter 6, p.164-174.
- Hirth 2015 Hirth, L. 2013. The optimal share of variable renewables. How the variability of wind and solar power affects their welfare-optimizing deployment. *The Energy Journal (FEEM Working Paper 90.2013)*.
- Joskow 2008 Joskow, P.L. 2008. Capacity payments in imperfect electricity markets: Need and design. *Utilities Policy*.
- Marc. 2015 Marcantonini, C., Ellerman, D. 2015. *The Energy Journal* 36(4).
- Marc. 2017 Marcantonini, C., & Valero, V. (2017). Renewable energy and CO2 abatement in Italy. *Energy Policy*, 106, 600-613.
- Clémence Clémence, C, Nicolai, J., Pouyet, J. 2011. *The role of abatement technologies for allocating free allowances, DICE Discussion Papers* 34.
- Cloete Cloete. 2014. *Summary of Hirth's "The Optimal Share of Intermittent Renewables. The Energy collective blog.*
- Ellerman Ellerman, A. D, Convery, F. & de Perthuis, C. 2010. *Pricing Carbon: The European Union Emissions Trading Scheme.*
- Hanley Hanley, N.H., Shogren, J.F., White, B. 2007. *Environmental economics in theory and practice. 2nd expected demand. Chapter 5.*
- Joskow 2011 Joskow, P.L. 2011. *Comparing the costs of intermittent and dispatchable electricity generating technologies. American Economic Review: Papers & Proceedings* 2011, 100:3, 238–241.
- Mas-Colell Mas-Colell, A. Whinston, M.D. Green, J.1995. *Microeconomic Theory. Chap 11A, 11B, 11C.*
- Nicolosi Nicolosi, M. 2010. *Wind power integration, negative prices and power system flexibility - an empirical analysis of extreme events in Germany. EWI Working Paper, No. 10/01.*
- Perino Perino, G. 2013. *Private provision of public goods in a second-best world: Cap-and-trade schemes limit green consumerism. CBESS Discussion Paper* 13-01.
- Seade Seade, J. 1985. *Profitable cost increases and the shifting of taxation. University of Warwick Economic Research Paper.*
- Sinn Sinn, H-W. 2012. *The green paradox. The MIT PRes.*
- Smil 2013 Smil, V. 2013. *Reducing the carbon and sulfur load of the atmosphere. Gaia* 22(4), 255-262.
- Stoft, 2008 Stoft, S. 2008. *Carbonomics: How to Fix the Climate and Charge It to OPEC. Diamond Press: Nantucket. www.stoft.com*
- Stoft, 2009 Stoft, S., Crampton, P., 2009. *Global Carbon Pricing: A better climate commitment. Global Energy Policy Center. Research Paper* 90-06.

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- Taylor                      Taylor, G., Tanton, T. 2012. *The hidden cost of wind electricity*. American tradition institute.  
<http://www.atinstitute.org/wp-content/uploads/2012/12/Hidden-Cost.pdf>
- Van Koten 2014            Van Koten, S. 2014. *Do Emission Trading Schemes Facilitate Efficient Abatement Investments? An Experimental Study*. CERGE-EI Working Paper 503.
- VandenBergh            Van den Bergh, K., Delarue, E., & D'haeseleer, W. (2013). *Impact of renewables deployment on the CO2 price and the CO2 emissions in the European electricity sector*. *Energy Policy*, 63, 1021-1031.
- Wiesmeth                Wiesmeth, H. 2012. *Environmental Economic. Theory and Policy in Equilibrium*. Springer: New York. Chapter 5 & 6.