Bård Misund, professor, University of Stavanger Business School

Universitetet i Stavanger

Profits, rents and taxation in Norwegian salmon aquaculture

22. mars 2023

My Background

- M.Sc. Aquaculture Biology (The Norwegian College of Fishery Science, University of Tromsø)
- M.Sc. Finance and Accounting (Norwegian School of Administration and Economics, NHH)
- PhD. Industrial Economics (University of Stavanger)

- 15+ years work experience in seafood and petroleum industries

Research topics

- Financial economics (valuation, project economics, derivatives)
- Commodity price behaviour (volatility, risk premiums)
- Costs and profitability
- Economic rent
- Rent taxation

- Industries
  - Petroleum industry
  - Aquaculture
  - Fisheries

Research funding

Public funding

- Research Council Norwegian (Norges Forskningsråd)
- Norwegian Seafood Research Fund (Fiskeri- og havbruksnæringens Forskningsfinansiering, FHF)*

Industry funding

Funded studies (utredning, ekspertrapport)

- Industry
- Municipalities

* FHF's funds are collected from a 0.3% export fee on Norwegian seafood exports

Recent projects

Topics:

Profits and rents
- Economic rents
- Resource rents
- Rent taxation

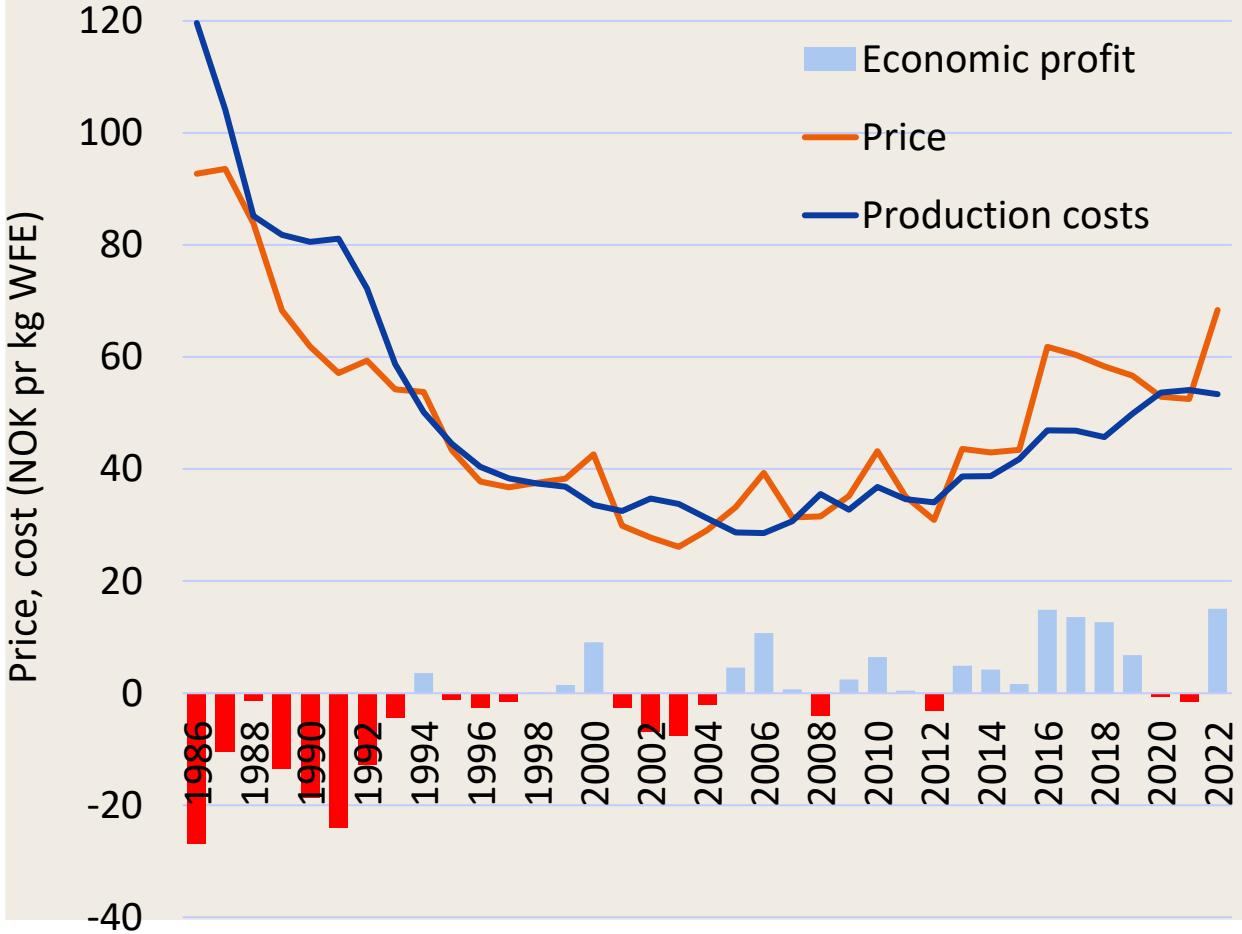
Emerging aquaculture technology
- Closed-containment aquaculture
- Offshore aquaculture
- Land-based aquaculture

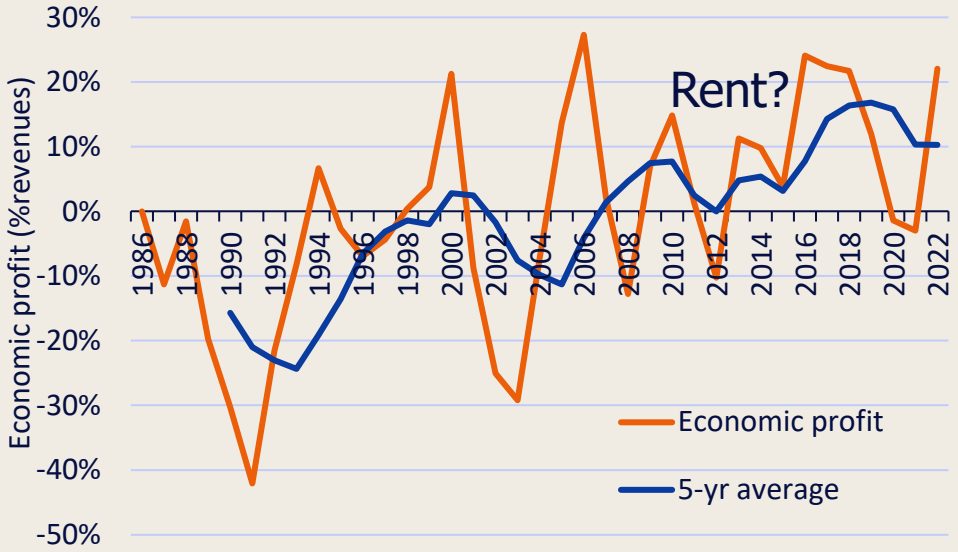
Cost development
- Biological risk
- Diseases and sea lice
- Mortalities

Valuation
- Companies
- Farming licenses

Commodity price behaviour

Substantial increase in profitability over the last 10 years





Inflation-adjusted prices and costs. Economic profit = EBIT – capital costs

A tale of two stories – contrasting views on resource rents in salmon aquaculture

Story 1

- «Natural geography limits the number of aquaculture production sites that have the right seawater temperature, currents, oxygen levels»
- «Farmers have been handed perpetual farming licenses for free or at substantial discounts to market values»
- «All economic profits and economic rents are due to scarce resources (no# production sites), i.e. resource rents»
- «Neutral resource rent taxes will not affect company behaviour or lead to efficiency losses (DWL)»

Regulations, not natural geography, that creates production site scarcity

Story 1

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Nofima-report (2014)

Det som virkelig legger beslag på store sjøområder er det smittehygieniske beslaget, som kommer som et resultat av at Mattilsynet (tidligere Fylkesveterinærene) krever minimumsavstander mellom lokaliteter. Konkrete krav til avstand er ikke nedfelt i lov eller forskrift, men fremkommer i veiledere

Hersoug et al. (2021)

However, the most serious limitation to further access comes from the industry itself. This is due to the need to protect neighboring fish farms, as well as wild fish populations from being affected by salmon lice and diseases (based on a production model with open sea cages). The Norwegian Food Safety Authority has decided that each farm should have at least 2.5 km to the next farm and minimum 5 km distance to a processing plant. Local

Young et al. (2019)

Table 1. Ecological-political factors affecting prospects for expanded aquaculture production in the case nations.

	Canada	Faroe Islands	Iceland	Norway	Sweden	Select academic literature
Disease management for cultured fish health	Major	Major	Major	Major	Minor	[56]
Disease and pathogen transfer to wild stocks	Major	None	Major	Major	Minor	[20,57]
Genetic harm to wild stocks	Major	None	Major	Major	None	[58]
Eutrophication/water quality	None	None	Minor	Minor	Major	[15]
Natural geography (availability of unexploited suitable environments)	None	Major	Minor	Minor	Major	[59]
Political geography (ability to access suitable environments)	Major	None	Major	Minor	Major	[15,50]

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Today's farmers have not obtained their licenses for free

Story 1

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Det har ikke vært gratis DN

Konsesjonene i norsk havbruk er ikke gitt bort til dagens eiere. Staten har drevet et organisert salg av konsesjoner i flere tiår, med kjente, forutsigbare og til og med ønskede konsekvenser.

https://www.dn.no/innlegg/oppdrett/havbruk/grunnrenteskatt/det-har-ikke-vart-gratis/2-1-1395996

Basert på dette anslår vi at den reelle «markedsverdien» på tildelingstidspunktet for alle nåværende konsesjoner med evig varighet, kunne ha vært mellom ni og elleve milliarder kroner, og dermed ikke dramatisk høyere enn de 6,8 milliardene som faktisk er samlet inn.»

https://ilaks.no/ny-kontali-rapport-48-prosent-av-oppdrettsnaeringens-inntjening-har-kommet-de-siste-fire-arene/

Gratis oppdrettskonsesjoner er en myte

Det hevdes ofte at dagens lakseoppdrettere har fått sine tillatelser «gratis eller solgt med sterk rabatt». Dette er en myte, skriver professor Bård Misund.

https://www.finansavisen.no/sjomat/2023/02/03/7982281/gratis-oppdrettskonsesjoner-er-en-myte

Regulation rent, not resource rent

Story 1

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Oglend & Soini (2020)

petroleum income and has been evaluating the basis for such a tax in salmon farming. Our findings suggest that the rent in salmon farming is not a resource rent, but a regulatory rent. The tax should be justified based on efficiently regulating negative externalities, not as a transfer of resource rent to the public as for the petroleum tax. For the sea lice issue, the

Estay & Stranlund (2022): environmental policy in aquaculture creates a policy rent

Neutrality is not possible in practice

Story 1

- «Natural geography limits the number of aquaculture production sites that have the right seawater temperature, currents, oxygen levels»
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- **«Neutral resource rent taxes will not affect company behaviour or lead to efficiency losses (DWL)»**

Smith (2012) & Boadway and Keen (2015): «..if any portion of value is taxed other than the economic rent associated with the resource, distortions are inevitable»

Muzondo (1993): In the presence of negative environmental externalities, and absence of corrective taxes, a Brown tax (cash flow tax) or a neutral resource rent tax may worsen environmental degradation

A tale of two stories – contrasting views on resource rents in salmon aquaculture

Story 2

- «**Environmental and fish welfare regulations** limit the number of aquaculture production sites»
- «Only **4-5%** of licenses owned by current farmers who obtained them for **free**. No evidence of substantial discounts.»
- «Economic rents are a combination of **regulation and inframarginal rents**»
- «The concept of neutral taxation only possible in an ideal world. **Not possible when there is market failure** (e.g. pollution/externalities)»
- «The government's proposal for resource rent taxation is **not neutral**»

Story 1

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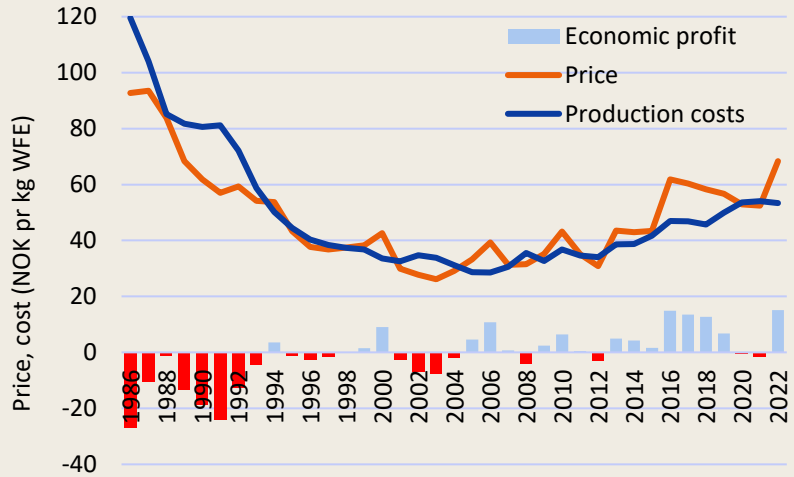
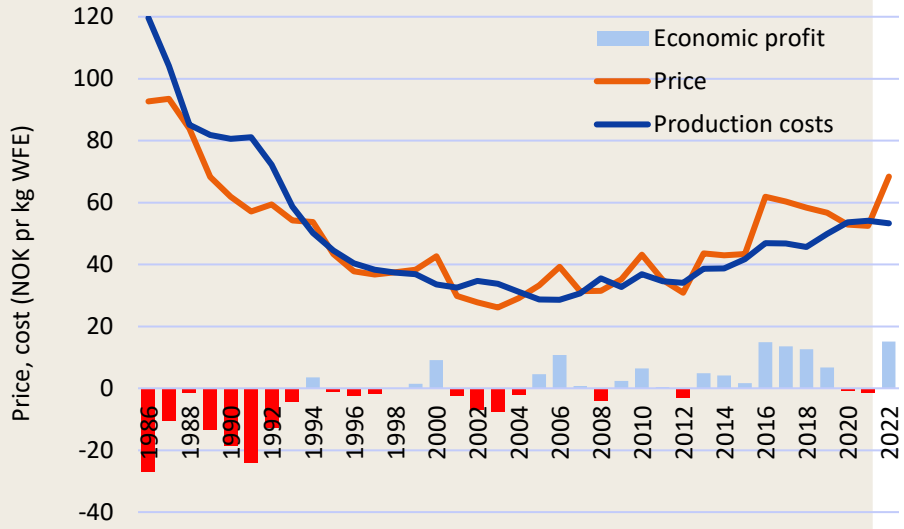
A short history of Norwegian aquaculture

- 1950-1970s: The beginning. The pioneers
- 1980-2005: Growth, productivity improvements, falling prices and costs
- 2005-2012: declining productivity growth, increasing prices and costs
  - Increasing sea lice and other environmental issues
  - Stricter regulations
- 2013-2023: growth stagnation, increasing prices and costs, increased biological costs
  - Stricter regulations
  - Traffic light system (TLS)



Professors Arnason and Bjørndal*

Marshallian Quasi-rent?

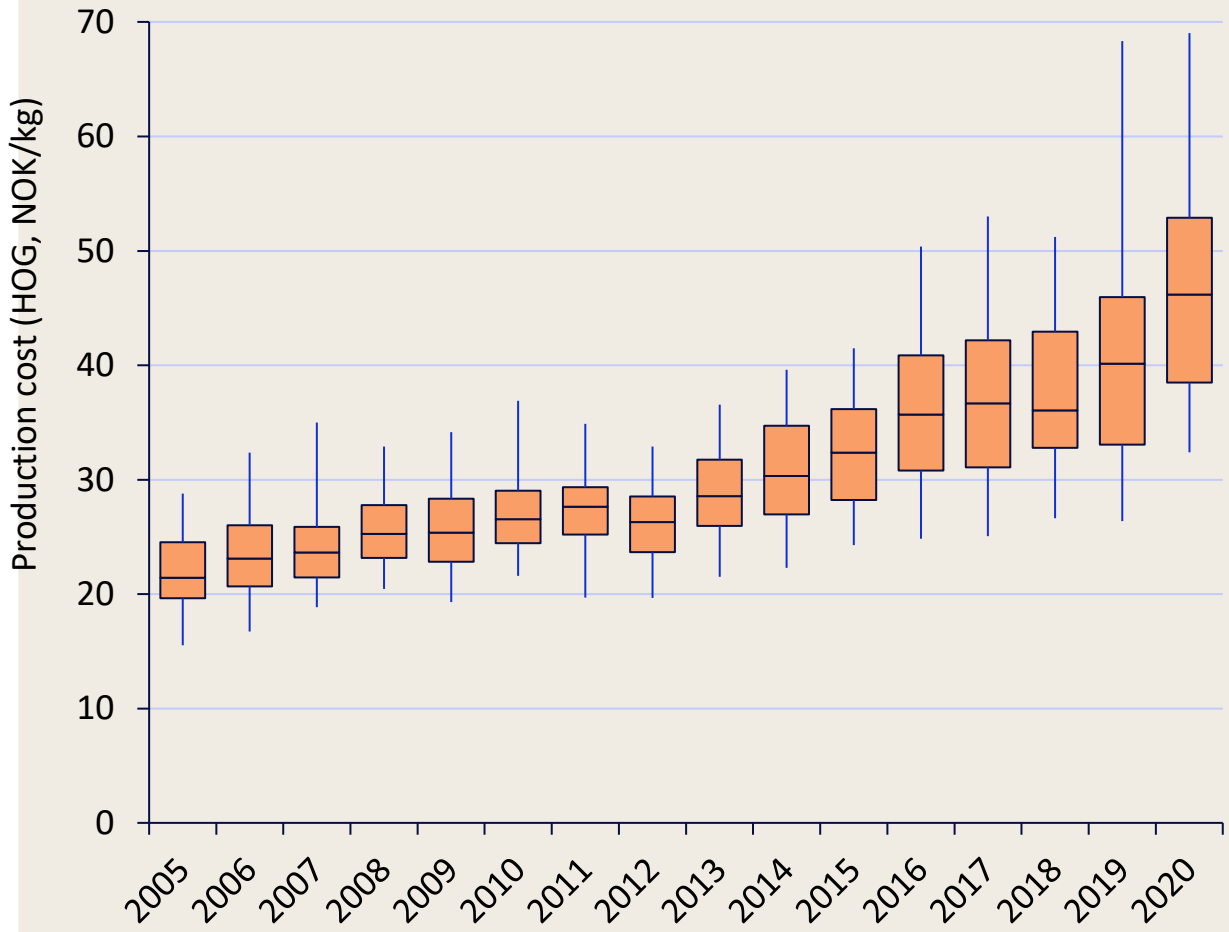


«Den store ekspansjonen av næringa ville heller ikkje vere mogeleg utan etablering av marknader som for 50 år sidan ikkje eksisterte. Det er næringa sjølv som saman med samarbeidspartnarar har utvikla marknadane slik at laks og aure i 2020 vert eksportert til 106 land.»

- Implication: The industry has carried out investments over decades to build the industry and market
- Implication: What happens to aquaculture industry profitability if open-pen farmed salmon is replaced with another species or closed-containment technology?
- The State has also contributed with investments in R&D, infrastructure, regulations and public administration. How should the combined value-creation be shared?

*Op-ed in the Norwegian newspaper: Klassekampen 16. november 2022

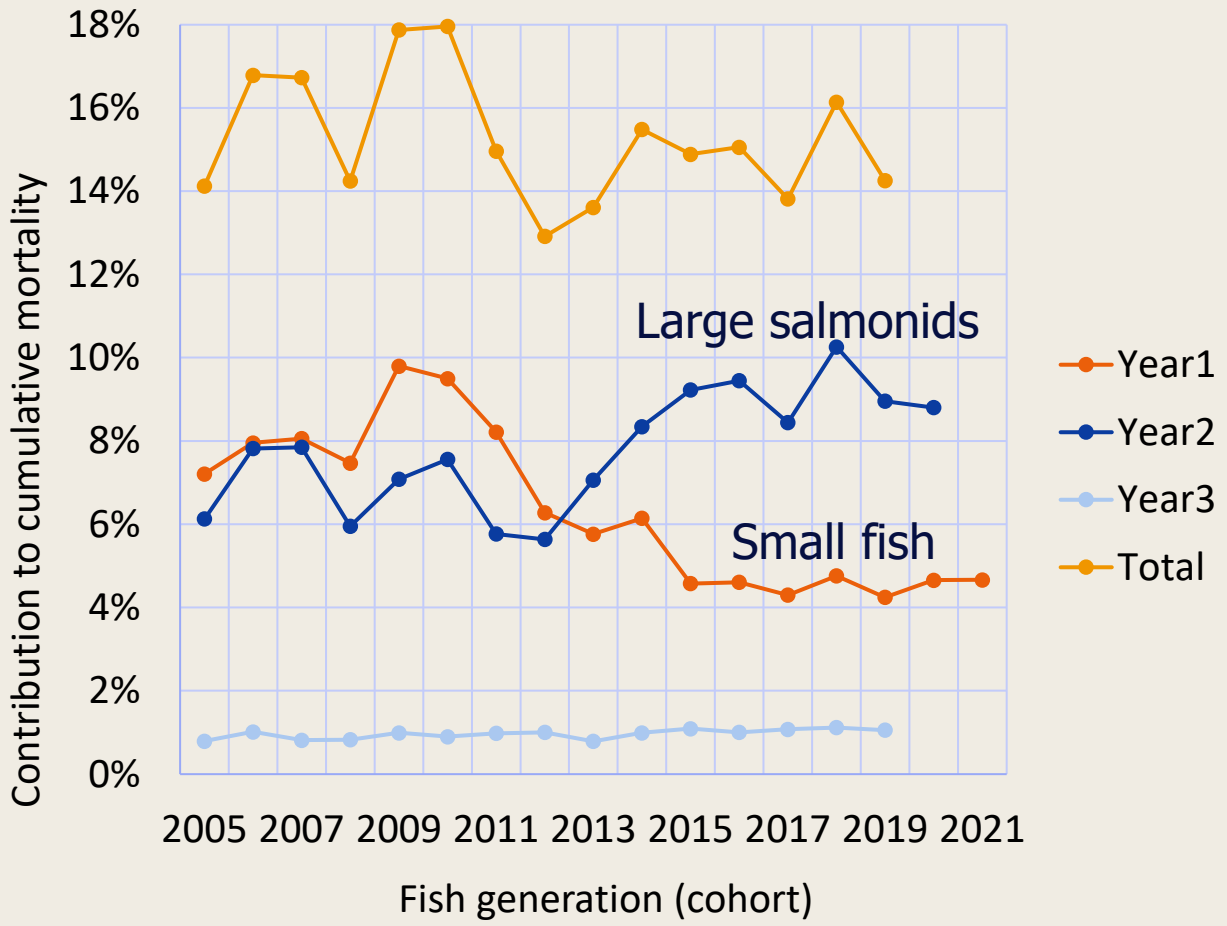
Drivers of costs and prices 2005-2023



- Production costs have increased substantially over the last 10 years.
- Variation in costs have increased dramatically
- Cost increase also seen in Faroe Islands
- Why?

* Inflation-adjusted. Boxplot (boxes = 50% of observations, lines = 90%). Source: Norwegian Directorate of Fisheries

Increased mortalities of large farmed fish



- Overall mortality ~14-16%
- Decreased mortality of fish in their first year in the sea.
- Increased mortality of salmonids in the second year in the sea (i.e. large fish)
- Since ~2012
- Why?

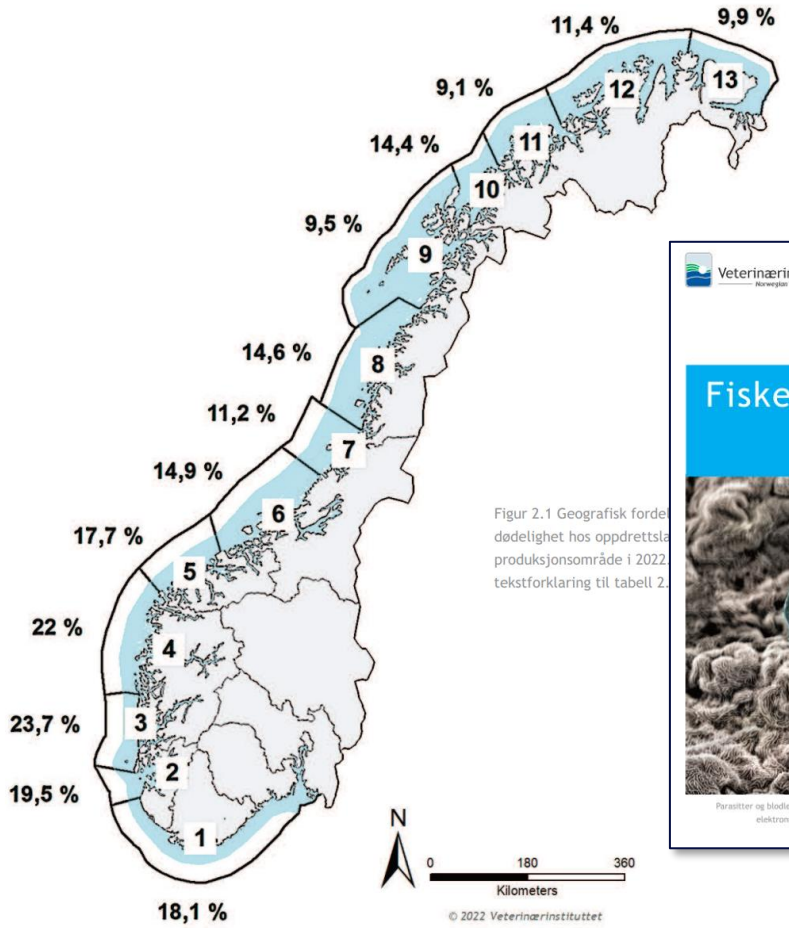
* Data source: Norwegian Directorate of Fisheries and own calculations

Veterinærinstituttet:

Rekordhøy dødelighet i norsk lakseoppdrett

HAVBRUK

Substantial regional differences in mortalities



- Highest mortality in production area 2-4
- Lowest mortalities in Northern Norway
- Similar geographical patterns in costs and profitability
- Why?

Fiskehelserapport 2022: https://www.vetinst.no/rapporter-og-publikasjoner/rapporter/2023/fiskehelserapporten-2022

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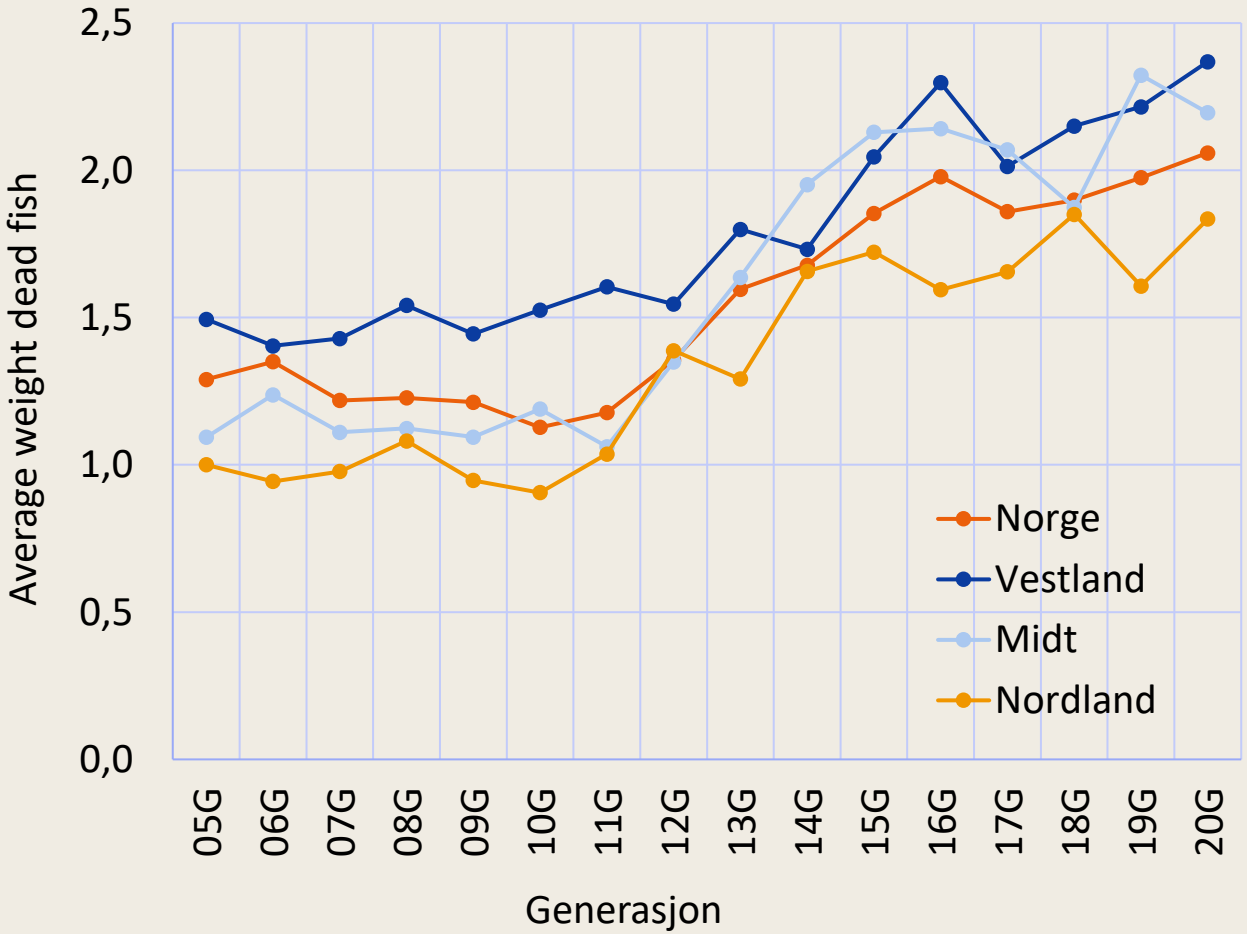
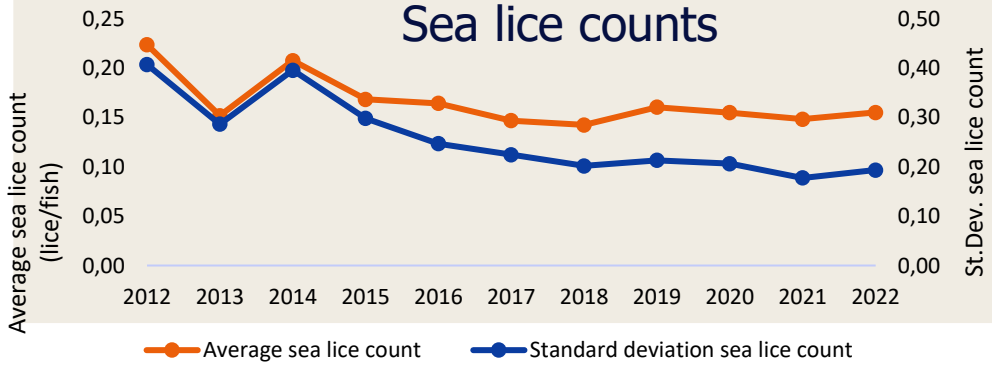
Average weight of dead fish up ~1 kilo

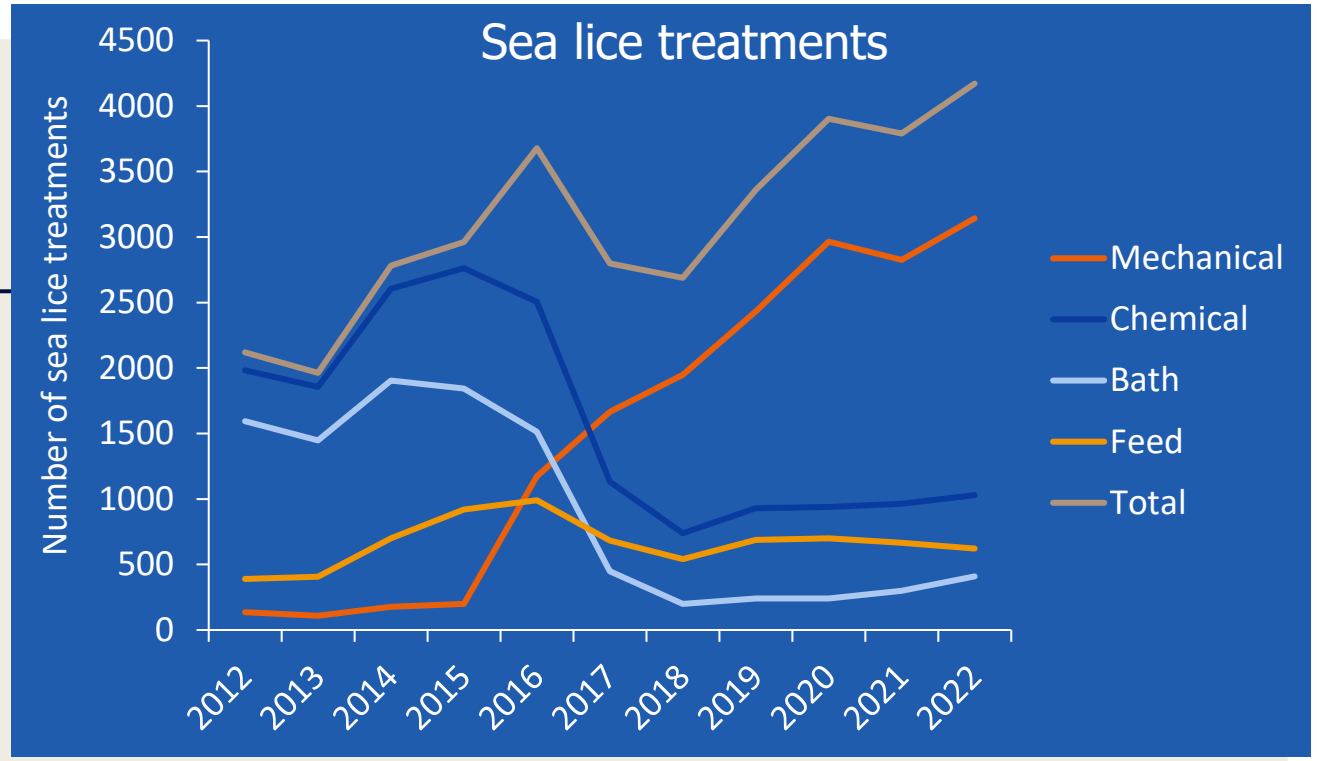


- Approx. doubling of the weight of dead fish since 2012
- Regional differences, but similar trends
- Why?

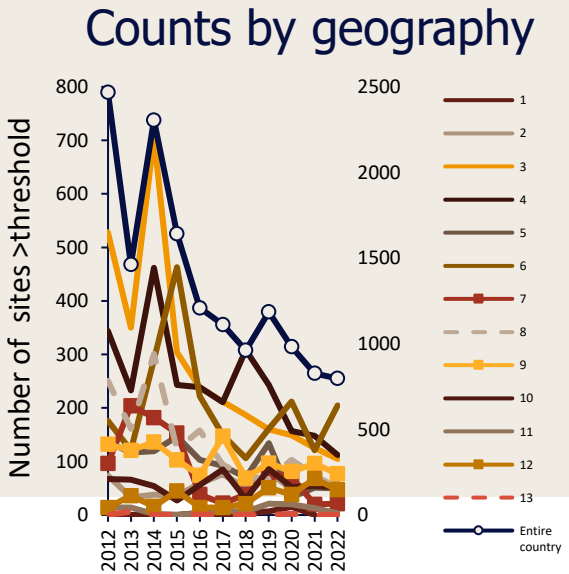
* Data source: Norwegian Directorate of Fisheries and own calculations

The culprit?





* Data: Norwegian Directorate of Fisheries



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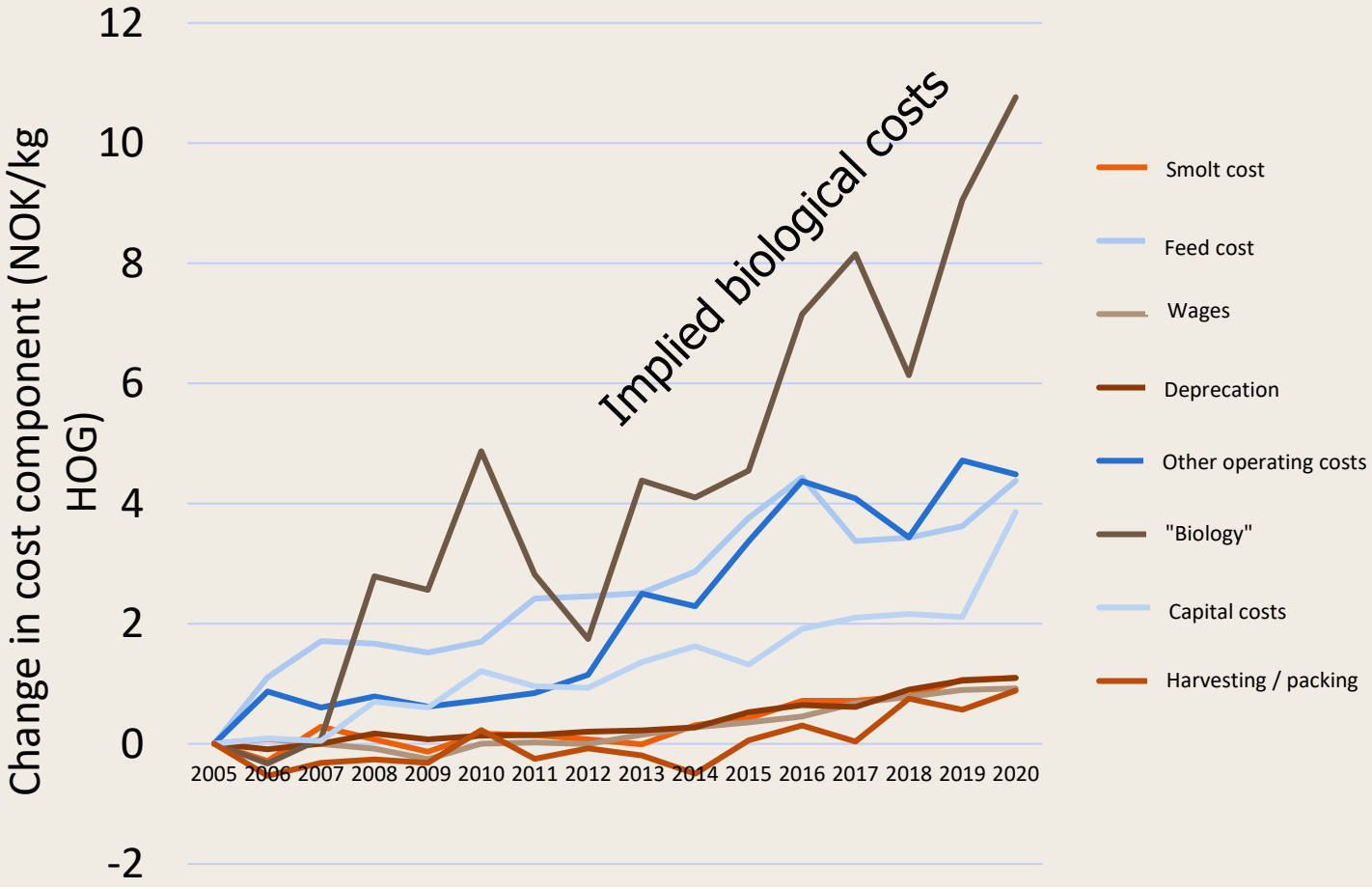
Biological risk is very costly!



Source: Misund (2022) «Kostnadsutvikling i oppdrett av laks og ørret»: https://norceresearch.brage.unit.no/norceresearch-xmlui/handle/11250/3034859

Reasons for increased costs

- Higher prices for input factors
  - NOK depreciation an important co-contributor
  - Recent years: energy crisis, Ukraine, inflation
- Increased capital intensity
  - Regulations
  - Reduced production growth opportunities (post-smolts, new production capacity (MAB), new production technology)
- Biological risk
  - Increased sea lice infection pressure
- Regulations
  - Stricter regulations
  - Regulations&response important co-contributors to reduced fish welfare
- High salmon prices

Biological risk not only a Norwegian phenomenon

Production and smolt release in the Faroe Islands 1971-2021

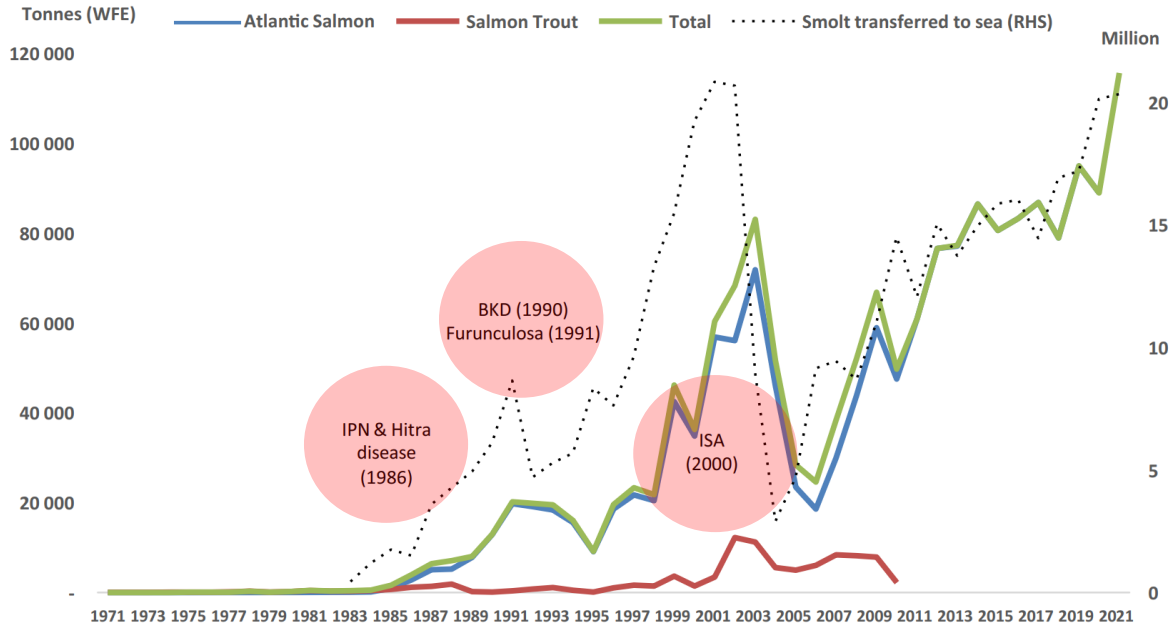


Figure 1. Farmed production of Atlantic salmon, salmon trout, and total, Tonnes (WFE), smolt transfers in the sea (millions), and disease outbreaks (years of the first outbreak), 1971–2021 the Faroe Islands. *Source*: FAO FishStatJ, Statistics Faroe Islands, Avrik Benchmarking, Faroese Fish Farmers Association, Mohr (2015)

- 1971 - 1977: The pioneering period
- 1978-1987: Salmon fever
- 1988-1999: The first sanitary crisis – diseases and bankruptcies
- 2000s: The second sanitary crisis – FDI and more stringent regulations
  - ¾ decrease in Faroese production!

Reference: Trond Bjørndal & Zvonimir P. Đ. Mrdalo (2023): Salmon aquaculture in the Faroe Islands – historical developments and future prospects, Aquaculture Economics & Management, DOI: 10.1080/13657305.2023.2165196.

What does the history of salmon aquaculture teach us?

- In open cage aquaculture diseases spread, and can become epidemic
  - Norway 1970s, 1980s: bacterial diseases. Later viral diseases. Sea lice extremely difficult to combat in open pen aquaculture
  - Chile: late 2000s: ISA => 2/3 production decrease
  - Faroes: Early 2000s: ISA => 3/4 production decrease
- Increased production levels and farm concentration leads to increased sea lice pressure (on both farmed and wild salmon)
- Very costly!
- **Fish diseases and sea lice worry authorities in all salmon producing countries**
- **Leads to stricter regulations, and higher production costs!**

IntraFish

Fiskehelse

– Det er ingen tvil om at lakselus i et anlegg på Færøyene smitter alle anlegg

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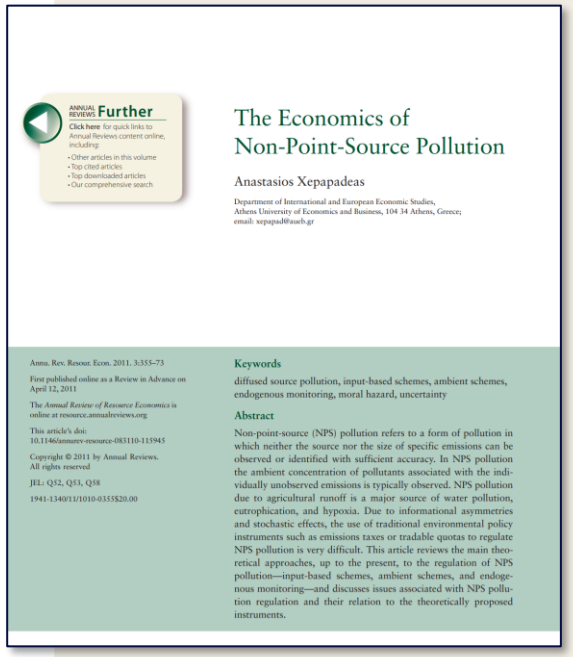
Fish diseases, sea lice and escapees extremely difficult to regulate or tax



Annu. Rev. Resour. Econ. 2011. 3:355–73

First published online as a Review in Advance on April 12, 2011

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JEL: Q52, Q53, Q58

1941-1340/11/1010-0355$20.00

Keywords

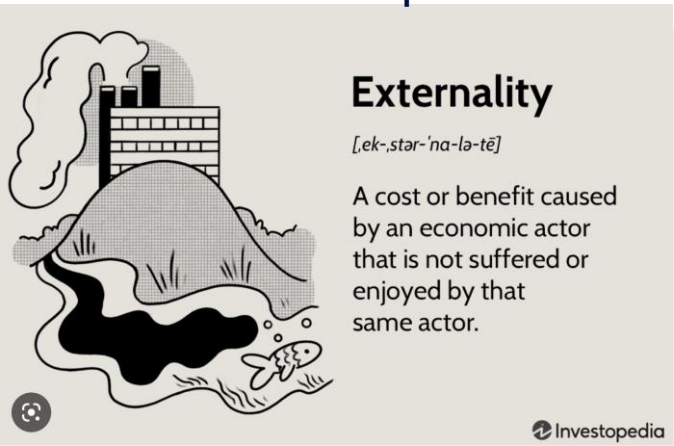
diffused source pollution, input-based schemes, ambient schemes, endogenous monitoring, moral hazard, uncertainty

Abstract

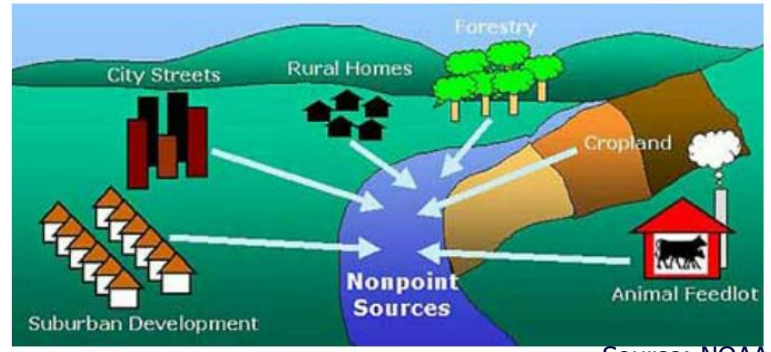
Non-point-source (NPS) pollution refers to a form of pollution in which neither the source nor the size of specific emissions can be observed or identified with sufficient accuracy. In NPS pollution the ambient concentration of pollutants associated with the individually unobserved emissions is typically observed. NPS pollution due to agricultural runoff is a major source of water pollution, eutrophication, and hypoxia. Due to informational asymmetries and stochastic effects, the use of traditional environmental policy instruments such as emissions taxes or tradable quotas to regulate NPS pollution is very difficult. This article reviews the main theoretical approaches, up to the present, to the regulation of NPS pollution—input-based schemes, ambient schemes, and endogenous monitoring—and discusses issues associated with NPS pollution regulation and their relation to the theoretically proposed instruments.

- The biggest externalities in salmon aquaculture are not classic examples of pollution («point-source pollution»)
- More similar to run-offs in agriculture («non-point-source pollution»)
- Non-point-source pollution
  - Regulation is notoriously difficult
  - Textbook solutions of environmental (Pigouvian) taxes not applicable (Xepapadeas, 2011)
- Regulations will be imperfect
  - Sea lice regulations in Norway (Traffic light system) a case in point
    - No reduction in sea lice pressure on wild salmon
    - Chemical delousing methods became ineffective
    - Increased mortality of large farmed salmon

Point-source pollution



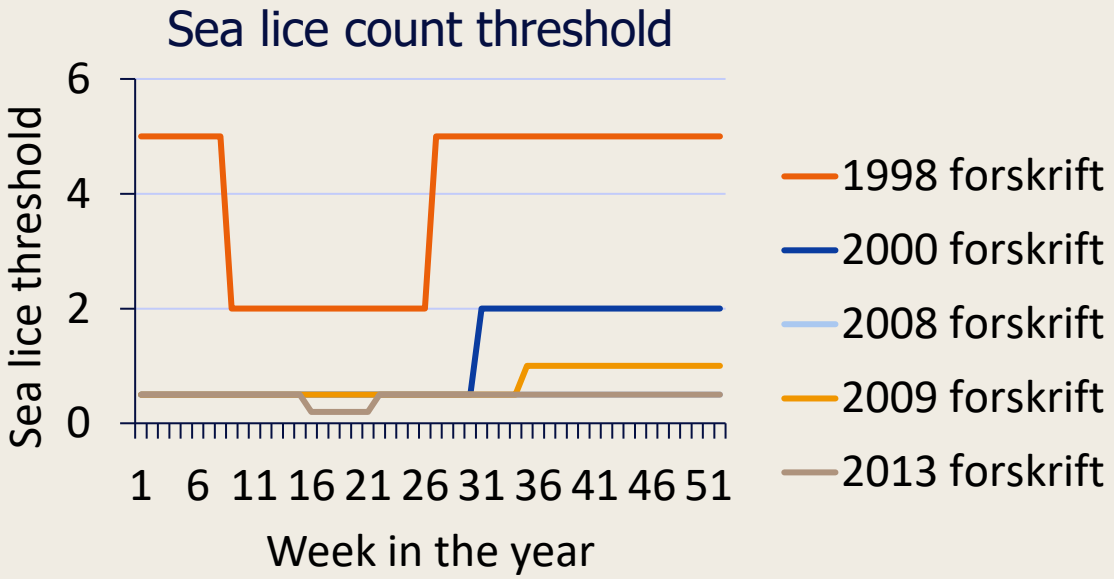
Non-point-source pollution



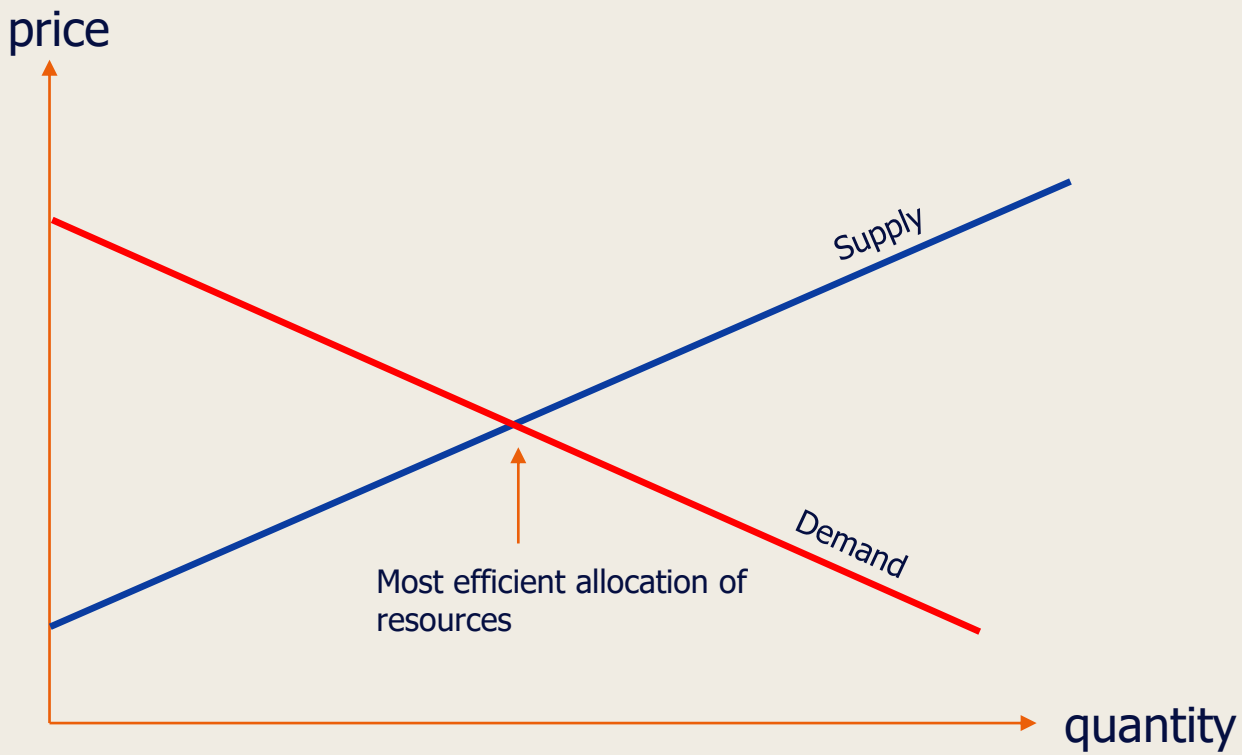
Source: NOAA

Examples of sea lice, disease and escapee regulation in Norway over the last decades

- Sea lice counts (mature female lice/fish)
  - From 2-5 in 1998 to 0.2-0.5 in 2013
- Minimum distances between farming sites
  - From 200m in the 1980s to 5 km today
  - Biosecurity reasons
- Technical standards (NYTEK)
  - Due to escape of salmon
- Limited access to new licenses
  - Environmental and fish health concerns
- Traffic light system
  - Sea lice on wild salmon

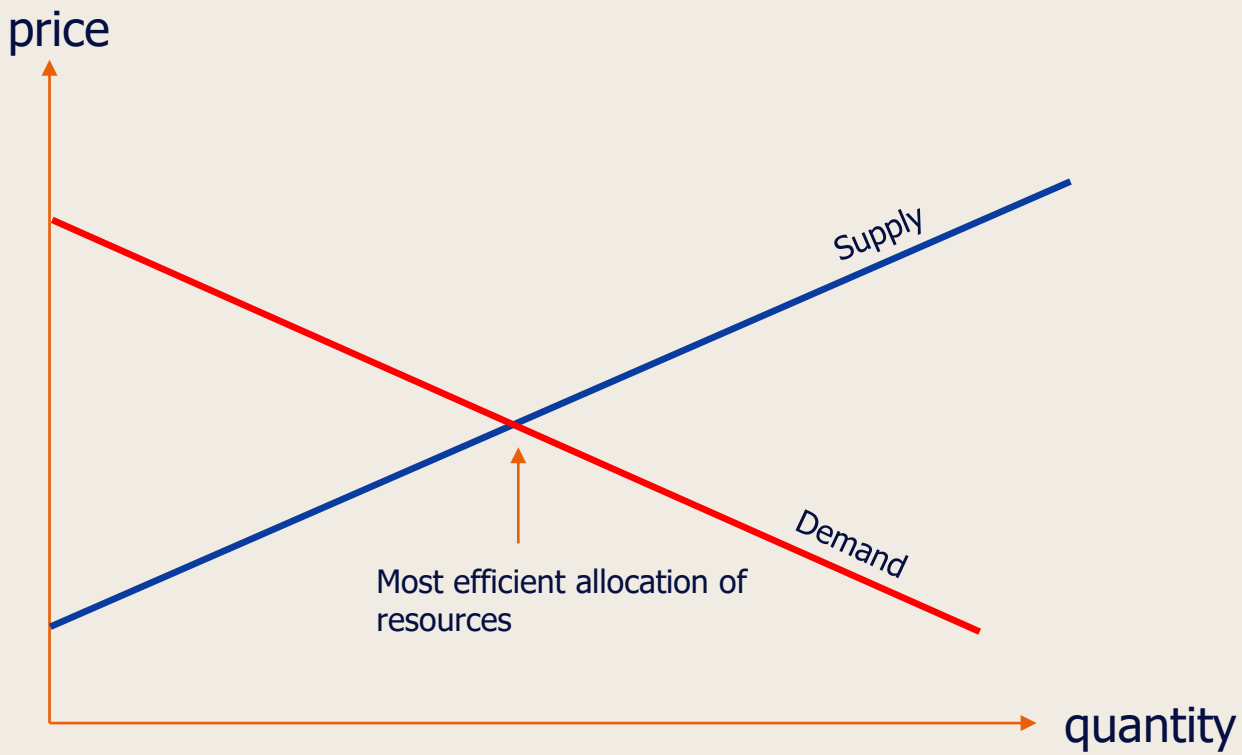


Rents in salmon aquaculture



- A typical perfect competition model
- Assumptions
  - Large number of entities
  - Price takers
  - Homogeneous products
  - **No barriers entry/exit**
  - **No externalities**
  - Perfect factor mobility
  - Perfect information
  - +++++

Rents in salmon aquaculture



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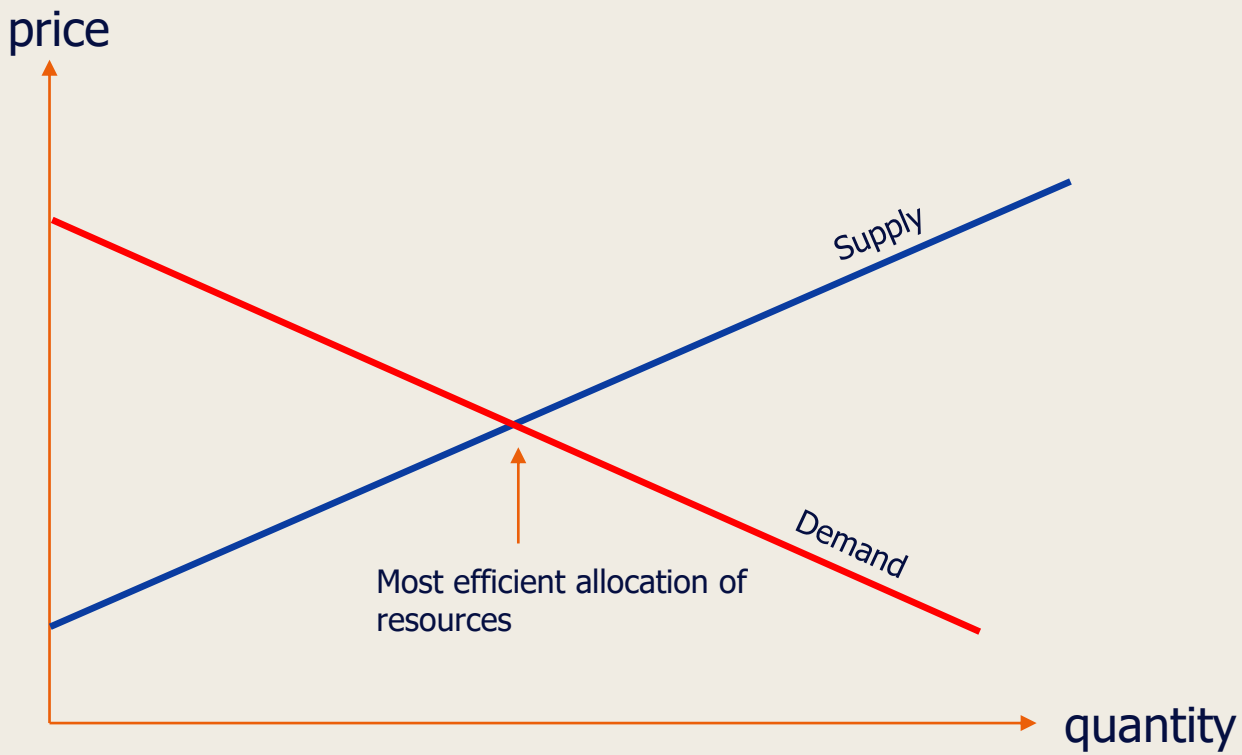
What about externalities?

Rents in salmon aquaculture



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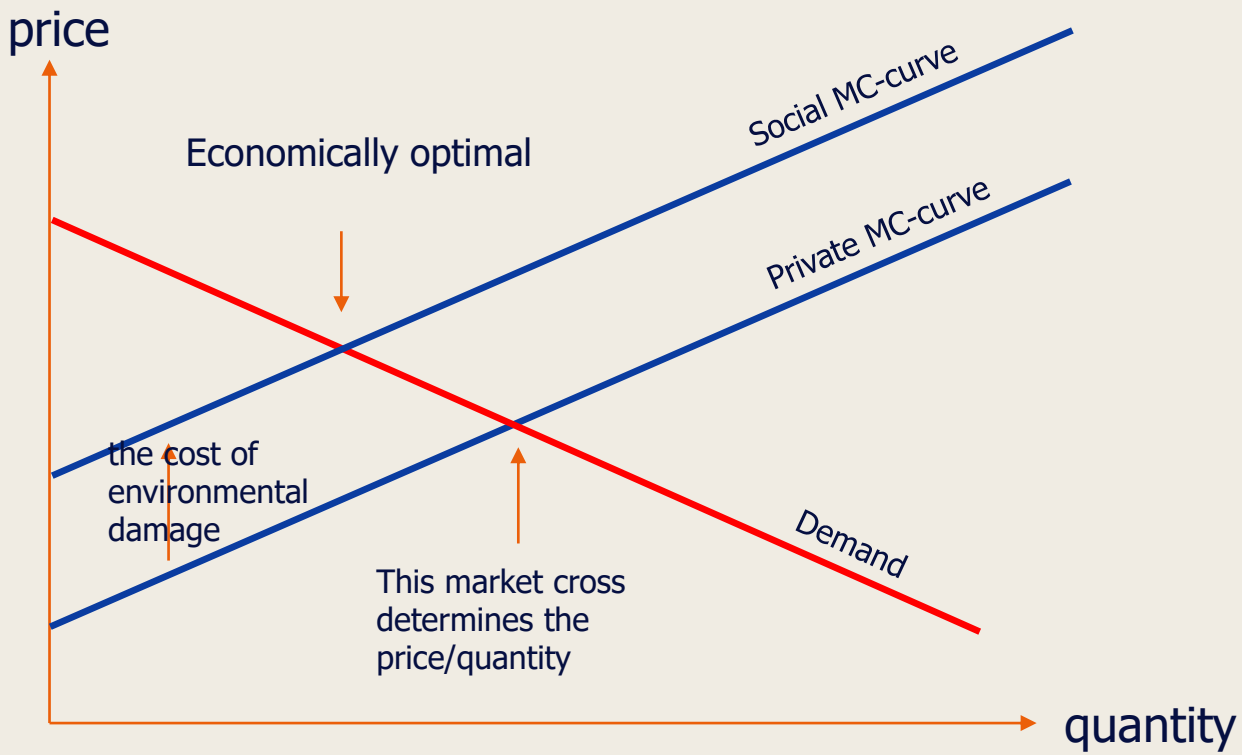
Negative externalities: costs arising from the company's activities that are not borne by the firm itself
Examples: sea lice, disease, escapees

Rents in salmon aquaculture



- Negative externalities
  - The environmental damage cost is not paid by the companies
  - Not included in the firms' basis for decisions
  - Creates a wedge between the companies' supply curve and society's supply curve
  - A form of market failure
  - Results in economic efficiency loss

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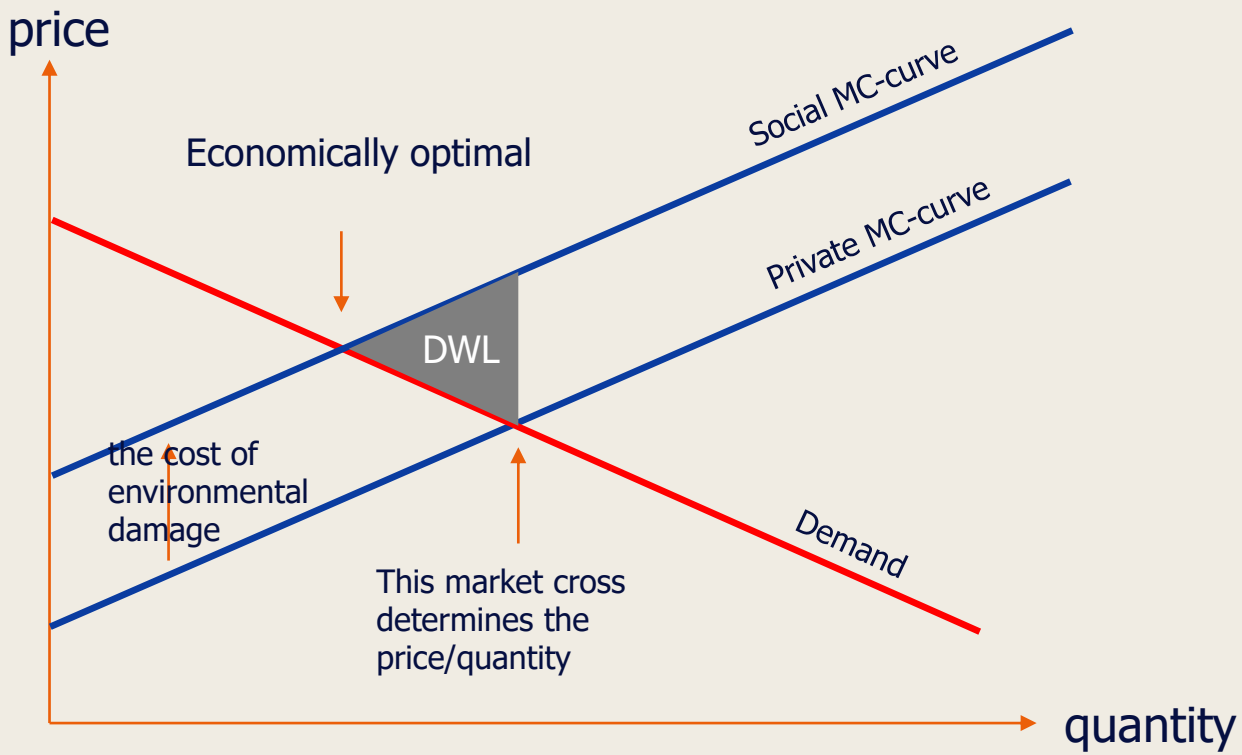
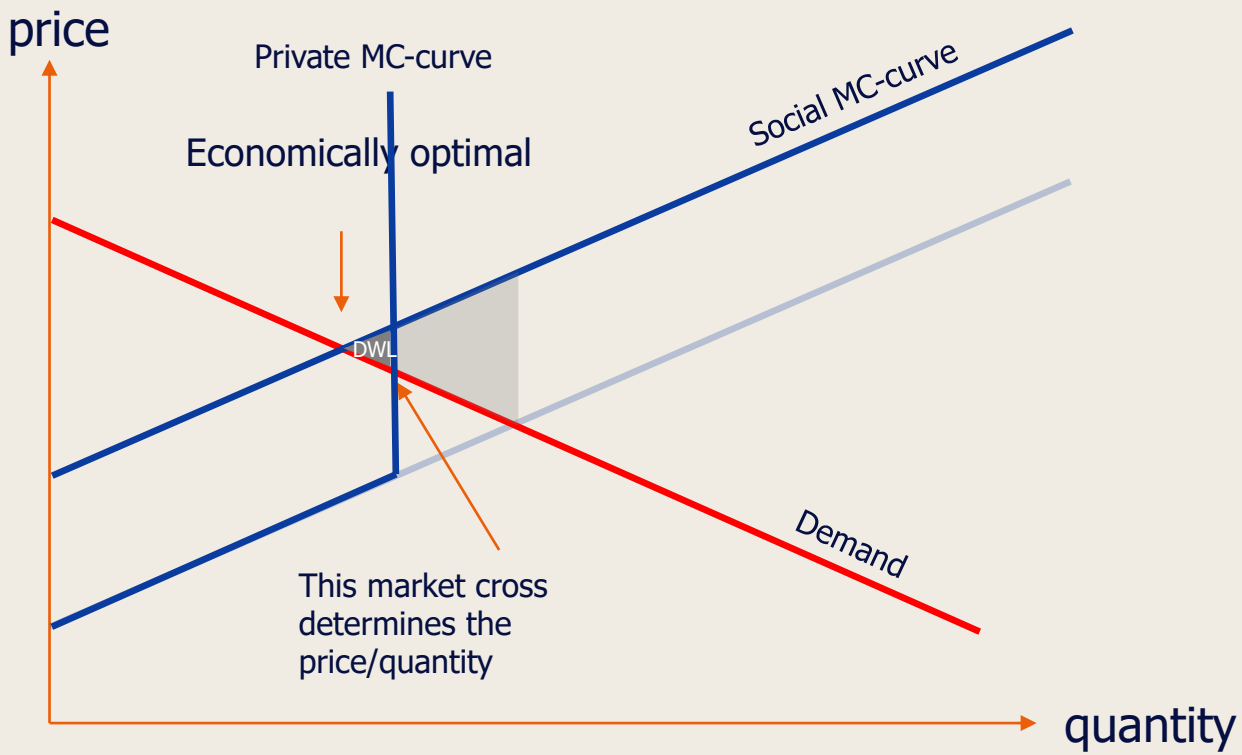
Rents in salmon aquaculture



- Negative externalities
  - The environmental damage cost is not paid by the companies
  - Not included in the firms' basis for decisions
  - Creates a wedge between the companies' supply curve and society's supply curve
  - A form of market failure
  - Results in economic efficiency loss (deadweight loss, DWL)

Negative externalities: costs arising from the company's activities that are not borne by the firm itself
Examples: sea lice, disease, escapees

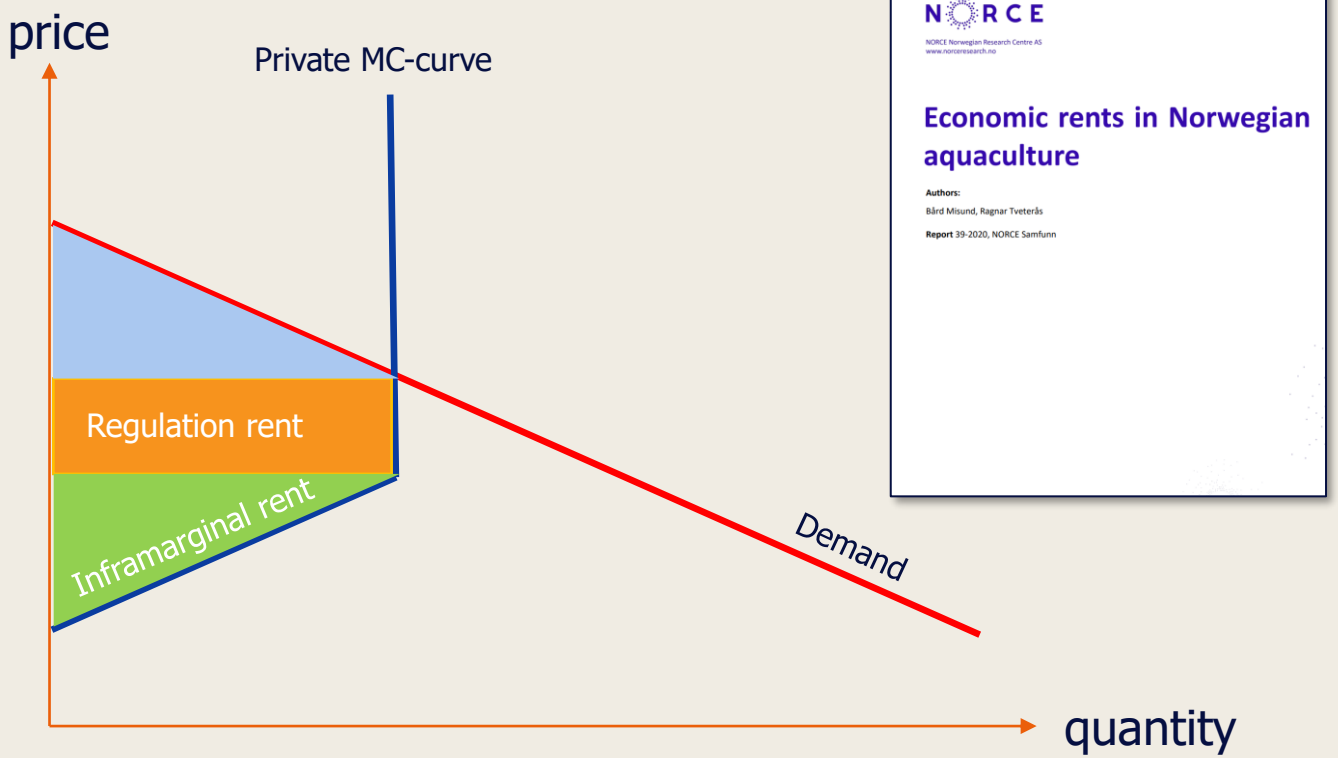
Regulation creates rents



- Environmental regulations
  - Limiting production (let's assume here that there is a quantity regulation)
  - Increases price
- Regulation can give rise to regulation rents
- In this case, concerns about environmental and fish welfare impact of aquaculture

Non-point-source pollution: regulation will be imperfect
Non-point-source pollution: Textbook solutions (environmental / Pigouvian) tax will be ineffective

Regulation and inframarginal rents



NORCE

NORCE Norwegian Research Centre AS
www.norceresearch.no

Economic rents in Norwegian aquaculture

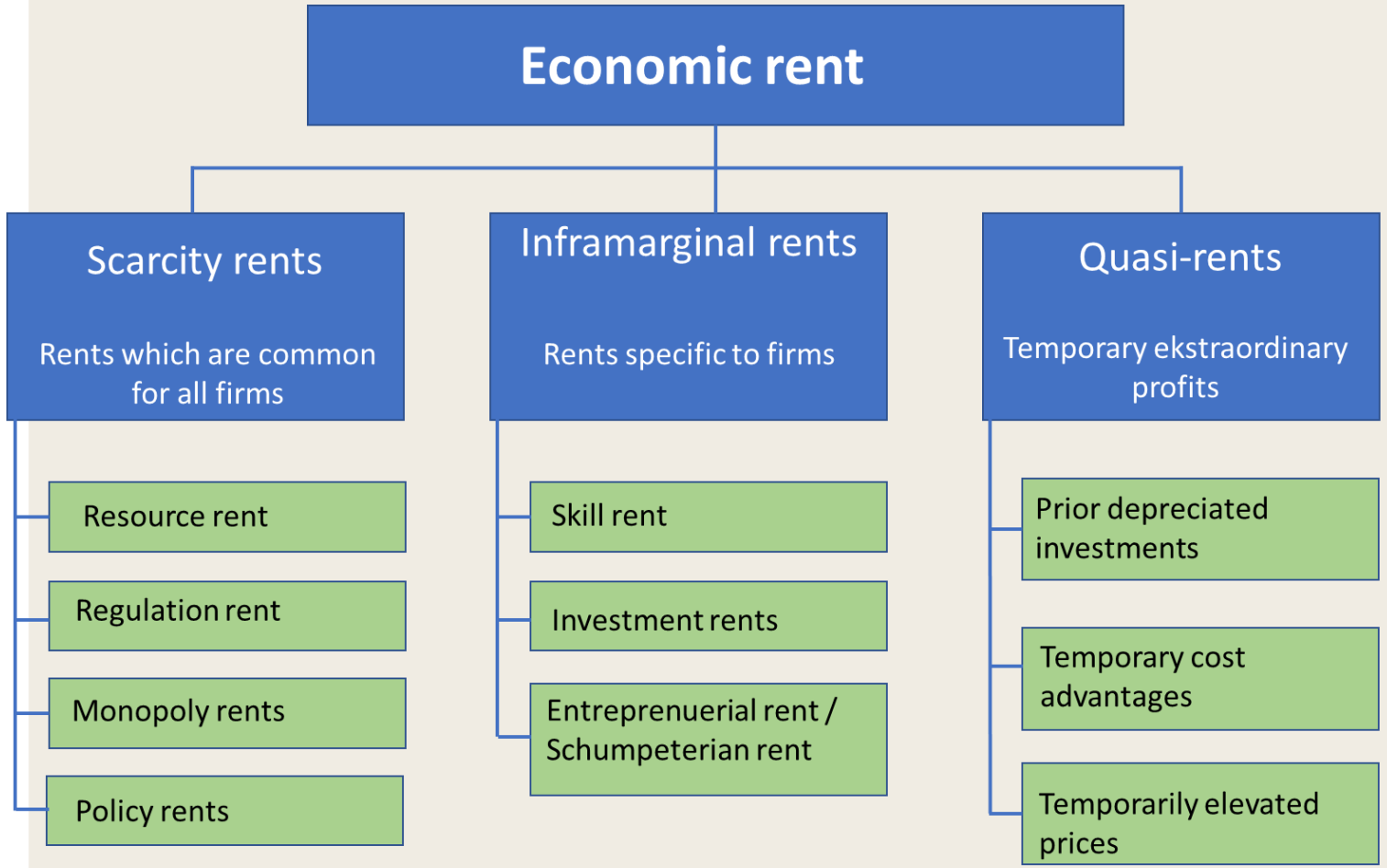
Authors:
Bård Misund, Ragnar Tveterås

Report 39-2020, NORCE Samfunn

- The environmental / biosecurity regulations can create regulation rents
- Differences in costs between companies result in inframarginal rents
  - Abilities/skills?
  - Investments?
  - Production site quality?

Misund&Tveterås (2020) «Economic rents in Norwegian aquaculture»: https://norceresearch.brage.unit.no/norceresearch-xmlui/handle/11250/2837743

The anatomy of economic rents



- Rents arises due to various forms of scarcity
- How much is due to nature?
- How much is due to regulations?
- How much is due to skill?
- How much is due to previous efforts/investments?

See also Misund&Tveterås (2023) consultation response:
https://www.regjeringen.no/no/dokumenter/horing-grunnrenteskatt-pa-havbruk/id2929159/?uid=89a2eb60-59f3-4df3-8734-57b53f6af11f

How to tax the rents in aquaculture?

- Taxation of regulation rents is difficult, because fish disease and environmental regulations are at the root of the high profits
- Taxation of rents is difficult, because regulation is imperfect, unable to correct the market failure
- Environmental taxation does not seem to be a viable/efficient option
- Taxation and regulations can make things worse
  - Muzondo (1993): neutral taxes may perform worse than nonneutral taxes in the presence of negative externalities
  - Oglend&Soini (2020): current regulation may exacerbate externalities
  - Larsen&Vormedal (2021): current sea lice regulation inefficient & leads to declining fish welfare
  - Jeong et al. (2022): sea lice counts regulation follow Goodhart's law
- Taxation of some types of rents undesirable (e.g. skill rents)
- Quasi-rents (temporary profitability) are a poor basis for taxation
  - E.g. profit impact from changes in the NOK/USD or NOK/EUR.
- Impossible to design a tax that surgically targets specific rents

- High profits combined with the industry's willingness to pay for new license capacity is a very strong signal to politicians to tax the industry more
- Immobile industry: good base for taxation
- Need to carefully examine impact on economic efficiency
- Need to take into account market failure

Many types of taxes

- Many ways to tax rents

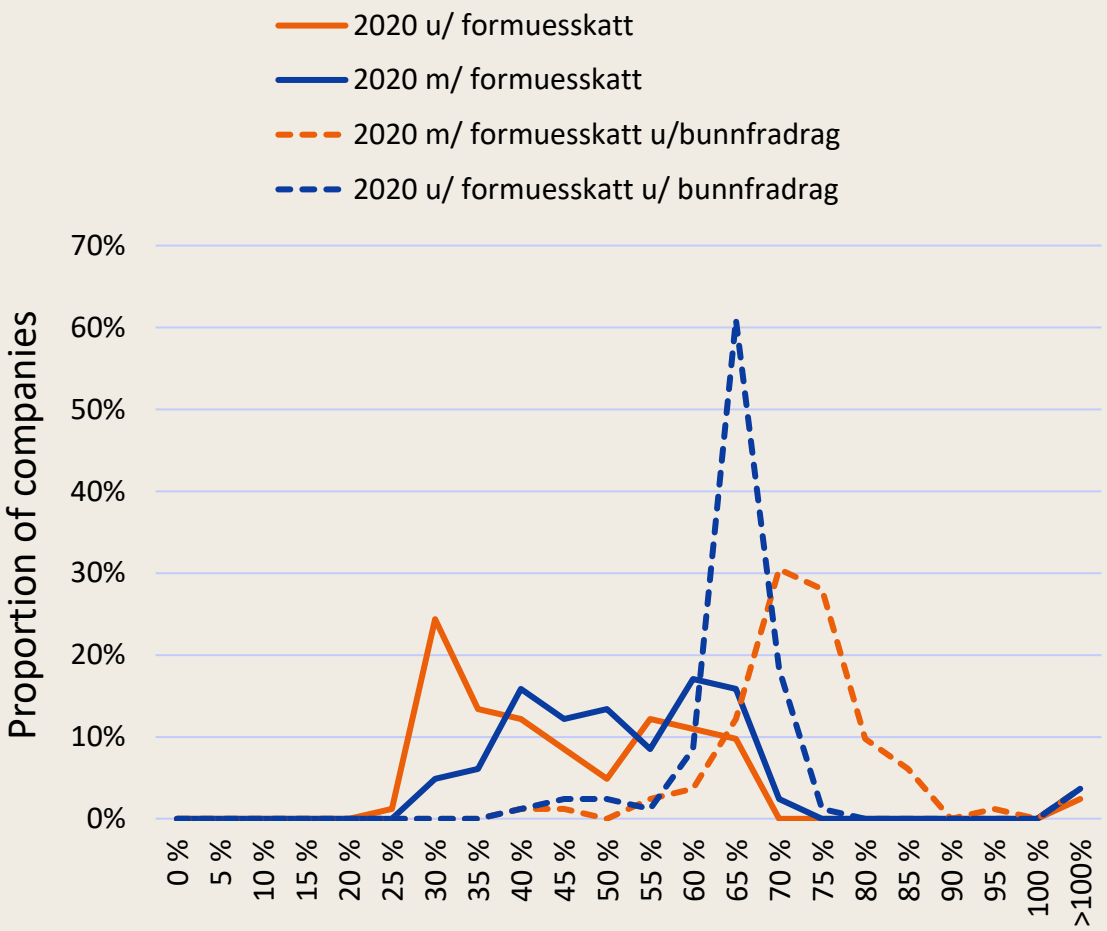
1. Royalties, sales tax
2. Profit taxes (corporate income tax, modified Brown tax, Brown (cash flow) tax
3. Lump sum
4. Public ownership
5. ...∞

Taxation of environmental damage is a different form of taxation. Resource rent taxes are not payment for environmental damage!!!

Pros and cons of different taxes

- Choice of tax (or combination of taxes) will depend on politicians' preferences wrt
  - Level of tax
  - Stability of tax revenues
  - Exposure to market risk
  - Exposure to biological risk
  - Tax's impact on investments
  - Tax's impact on reinvestment of retained capital
  - Sustainable development
  - Future growth prospects for the industry

Need to look at the total picture: Taxation of salmon aquaculture in Norway



A plethora of taxes and fees

- Production fee and natural resource fee: 1-1.5 NOK/kg
- R&D fee: 0.6% of revenues
- Property fee: 0.2-0.7% of asset
- Corporate income tax: 22% of profits
- Resource rent tax: 51.3% of after-tax profits
- Payment for new production capacity: 120 MNOK/license
- Wealth tax on market values of licenses: 1.1% of value
- Dividend tax on dividends to pay wealth tax: 37.84%

Government's proposal for resource rent tax. Graph ignores payments for new licenses.

Sustainable growth opportunities?

Limited growth opportunities with conventional technology

- In Norway: Very difficult to achieve substantial production growth in open sea cages.
- Regulations likely to become stricter
- The same situation in other producer countries

New opportunities for growth

1. Land-based (issues: costly, land, energy)
2. Offshore (issues: costly, tougher technology, unchartered territory)
3. Semi-closed containment aquaculture technology (issues: costly, many concepts, underdeveloped technology)
4. Submerged technology

Conclusions: Lessons from Norway

- Need to understand origin of profits and rents:
  - Regulation rent, not resource rent
  - Related to society's concerns for environment and fish welfare
  - Existence of rents that should not be taxed / poor tax bases
  - Biological risk & regulations increase costs

- Need to use appropriate (and efficient) mix of regulations and taxes. Focus on:
  - More efficient use of resources
  - Sustainable production growth
  - Coherency/consistency between instruments in the tool box / regulatory&fiscal framework

- Need to carefully assess impact of rent taxation on
  - Fish welfare and environmental impact
  - Resource use efficiency
  - Opportunities for future sustainable production growth
  - Ability to raise capital for new investments
    - I.e. reliance on internal vs external capital
  - Production/biological risk/environmentakl degradation

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Takk for meg!

Universitetet i Stavanger