Insurance and Moral Hazard in Salmon Aquaculture

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Background

- Aquaculture is a high-risk activity involving greater risk than in other food production industries (Pillay, 1994).
  - Products are often raised outside the fish farmers' direct observation

- Rapidly changing production processes in aquaculture has required large investments from fish framers
  - the demand for insurance to share and cover the risks involved has increased significantly within the aquaculture sector

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Background

- Worldwide the global aquaculture insurance market has increased considerably since the mid-1970s
  - The premium paid by aquaculture producers has grown from around US$100 000 in 1974 to an estimated value of US$50 million in 2002
- The availability of commercial aquaculture insurance is not widespread
  - Especially the process of obtaining insurance cover for aquaculture stock mortality is largely limited to the Western world
  - There is a widening gap between the demand for and supply of aquaculture insurance in the world
- According to the insurance industry itself, asymmetric information, moral hazard and adverse selection are among the major constraints to undertake aquaculture insurance activities (Anrooy *et. al*. 2006)

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Moral hazard and Adverse selection

- Moral hazard means that the insured person's or firm's decision may change as a result of taking out insurance. Because the insurance contract reduces the loss associated with the insured event, such changes in behavior will normally increase the probability of the insured event occurring or increase the severity of loss
- Adverse selection means that people or firms who are more likely to suffer the insured event will be more willing to insure at a given rate

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Introduction

- Investigate how insurance affect the producer behavior in Norwegian salmon farming

- Norway has one of the most specialist markets for aquaculture incurrence in the world
  - A group of Norwegian insurance companies has specialized in the aquaculture insurance since salmon farming began in the early 1970s

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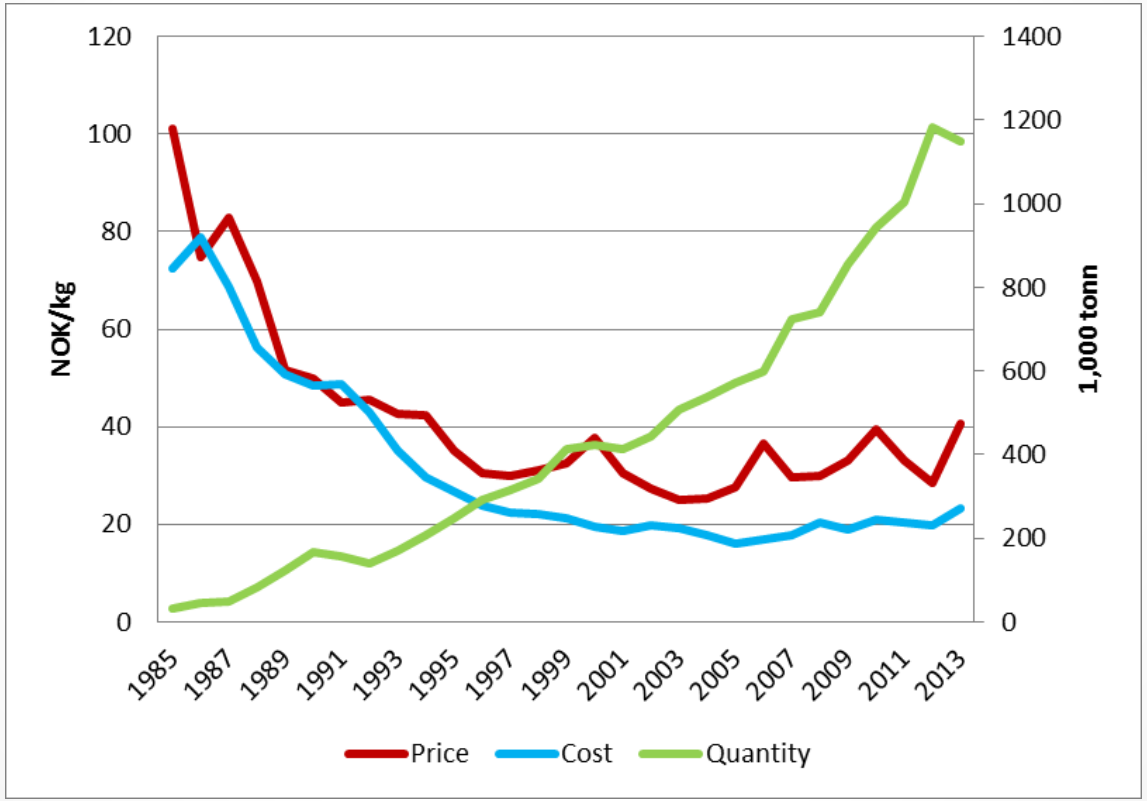
The Norwegian Salmon Aquaculture



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Tools to manage the risk

Risk	Tools to manage risk
Price risk	Forecasting and future markets
Production risk - Disease - Escape - Technical failure - Etc.	Insurance Self-insurance • Firms grow larger and are more internationally diversified • Controlling the level of output risk through input quantities

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Controlling the level of output risk through input quantities

- Feed is found to increase the level of production risk, labor and capital is found to have a risk decreasing effect (Asche and Tveteras 1999; Tveteras 1999; Kumbhakar and Tverteras 2003

- A risk adverse farmers are expected to use less of the inputs that are risk increasing (feed) and more of the input that is risk reducing (labor and capital) than a farmer that is risk natural

- How will insurance affect the input bundle?

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The Estimated Model

$$\ln y_i = \sum_r \beta_r D_r + \sum_k \beta_k \ln x_{ki} + 0.5 \sum_k \sum_l \beta_{kl} \ln x_{ki} \ln x_{li}$$
$$+ \beta_{inc} \ln inc_i + 0.5 \beta_{inc2} \ln inc_i^2 + \sum_k \beta_{kinc} \ln x_{ki} \ln inc$$
$$+ \beta_t t + 0.5 \beta_{t2} t^2 + \sum_k \beta_{kt} \ln x_{ki} t + \beta_{tinc} \ln inc_i t + (v_i - u_i)$$

$$\sigma_i^2 = \exp(\alpha_0 + \alpha_{inc} \ln inc)$$

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Data

- The data are provided by the Norwegian Directorate of Fisheries
- Farm level panel data from 1994 to 2008
- Sample covering more than 50% of the total Norwegian salmon production for most years
- Sample covering the entire Norwegian salmon-producing area

	Mean	Std. Dev.	Min	Max
Production	1251781	2072759	84180	34300000
Feed	1520608	2567443	16250	43200000
Labor	9093	8730	700	134089
Capital	73567	121499	202	1982722
Insurance	341418	368420	193	4484000

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Results: Estimated output elasticities

	MODEL WITHOUT TECHNICAL EFFICIENCY			MODEL WITH TECHNICAL EFFICIENCY		
	Elasticity	**Std. err.**	**p-value**	**Elasticity**	**Std. err.**	**p-value**
ε_{feed}	0.7000	0.0209	0.0000	0.6936	0.0207	0.0000
ε_{labor}	0.3182	0.0795	0.0000	0.2287	0.0832	0.0060
$\varepsilon_{capital}$	0.3674	0.0497	0.0000	0.2970	0.0542	0.0000
RTS	1.3856	0.1051		1.2193	0.1167	
ε_{inc}	0.0776	0.0145	0.0000	0.0594	0.0168	0.0000
TC	0.0201	0.0046	0.0000	0.0203	0.0045	0.0000
TE				0.8282	0.1181	

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Results: The effect of insurance

	MODEL WITHOUT TECHNICAL EFFICIENCY			MODEL WITH TECHNICAL EFFICIENCY		
Elasticities of intensity	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>z
$\partial\varepsilon_{inc}/\partial$lnfeed	0.0361	0.0195	0.0640	0.0267	0.0224	0.2320
$\partial\varepsilon_{inc}/\partial$lnlabor	-0.0665	0.0192	0.0010	-0.0597	0.0208	0.0040
$\partial\varepsilon_{inc}/\partial$lncapital	-0.0193	0.0110	0.0790	-0.0230	0.0126	0.0690
Efficiency parameter						
α_{inc}				-0.4608	0.1626	0.0050

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Conclusions

- In this study we illustrate how insured farmer they take fever precautions against harm

➢ Moral hazard is existent in the Norwegian salmon aquaculture

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Question?

Thank you for the attention!

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