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The Role of Pig Diseases in Structural Change in the Canadian Pig Industry

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GenomeCanada

MOTIVATION

- Over the last two decades, the Canadian pig industry has undergone dramatic structural change with a huge decrease in the number of pig farms (70%) and an increase in pig numbers (3-fold) (Statistics Canada, 2017) (Figure 1).
- However, not every census division across Canada experienced the same structural changes.
- From 1996 to 2011, about 56% of the census divisions in Canada went through both pig farm losses and total pig number reductions, 44% had pig farm losses and pig number increases (Statistics Canada, 1997; Statistics Canada, 2014) (Figure 2).
- Therefore, any one-size-fits-all policy resulting from economic analyses conducted at a national level might not benefit farm operators in some regions at all.
- Among the studies examining how the livestock industry has evolved and the forces behind the sector's structural change, few studies have looked at the role of animal disease(s) in an industry's transition.
 - Such analyses could be essential as global epidemics (such as PRRS and PCVAD in pigs) appear to be increasing
 - From an economic point of view, disease outbreaks
 - caused net losses for farmers by reducing the number of marketable pigs (McInerney et al., 1992)
 - shrank profit margins by increasing the costs of disease control and prevention strategies (Office of Audit and Evaluation, 2015).

OBJECTIVE

- Assess how pig diseases (PRRS and PCVAD) have affected structural change in the Canadian pig industry at the individual census district level while controlling for the effect of other key economic explanatory variables over the period 1996 to 2011 (Figure 3).
- Other economic pressures:
 - Implementation of country-of-origin-labeling (COOL) in the U.S.
 - Price variations, etc.
- Investigate the effects of neighborhood, farm and farmer characteristics on the change in farm structures.

EMPIRICAL METHOD

The present study employs **random-effects panel regression models** (Gujarati 2003).

A clustering approach is used to account for spatial autocorrelation (clusters are census agricultural region).

$$Y_{it} = \alpha + \beta_1 F_{it} + \beta_2 FM_{it} + \beta_3 E_{it} + \beta_4 N_{it} + \mu_i + \varepsilon_{it}$$

where

- Y_{it} denotes farm size (i.e., average number of pigs per farm) in the i^{th} CD in year t ,
- α is a constant,
- β_i is the coefficient to be estimated,
- μ_i and ε_{it} are the between-CDs and within-CDs errors, respectively
- F_{it} - farm characteristics, FM_{it} - farmer characteristics, E_{it} - economic variables, N_{it} - neighborhood effects

EMPIRICAL RESULTS

Table 1. Estimates of the economic impacts of various factors on farm size – Comparison among provinces

	AB		ON		QC	
	Coeff	Std. dev	Coeff	Std. dev	Coeff	Std. dev
Provincial level data						
COOL/Food crisis	0.246	0.473	0.444***	0.171	-4.400***	1.286
Peak of pig disease outbreaks	-0.101	0.273	-0.294**	0.135	-3.869***	1.556
Hog-feed price ratio (t)	-0.016	0.01	0.036	0.03	0.435***	0.216
District level data						
Number of pig farms	-0.002**	0.001	0.001***	0	-0.002***	0.002
Neighborhood effect (150km for west, 100km for east)	0.110*	0.066	0.010**	0.005	0.038***	0.028
Neighborhood effect (150-300km for west, 100-200km for east)	0.001	0.003	0.002	0.002	-0.057	0.107
Distance to plant	-0.295***	0.1	-	-	0.848***	0.776
Distance to plant (0.5-1 km) (D)	-	-	-0.215***	0.059	-	-
Distance to plant (1-1.5 km) (D)	-	-	-0.148***	0.069	-	-
Distance to plant (1.5-2 km) (D)	-	-	0.376***	0.067	-	-
Distance to plant (>2 km) (D)	-	-	0.187	0.114	-	-
Distance to ag university	-0.373***	0.123	-0.328***	0.055	-	-
Distance to ag university (0.5-1 km) (D)	-	-	-	-	-2.086***	0.769
Distance to ag university (1-1.5 km) (D)	-	-	-	-	1.660***	0.545
Human population density	-0.024***	0.008	-0.001***	0	-0.010***	0.004
Operator's average age	-0.018*	0.027	0.012	0.008	-0.089***	0.039
Male (D)	0.734*	0.407	0.173**	0.068	0.201	0.204
Live on farm (D)	-0.692***	0.258	-0.082	0.133	0.286*	0.218
Hog farming as primary occupation (D)	-0.116	0.173	-0.127	0.087	0.267	0.223
Family farm as main operating arrangement (D)	-0.329	0.217	0.440***	0.107	-0.035	0.282
Lease land from govt for hog farming (D)	0.007	0.28	-0.034	0.084	-0.278**	0.069
Rent land from others for hog farming (D)	0.371	0.521	0.029	0.021	0.033*	0.669
Crop-shared land for hog farming (D)	-0.237	0.23	0.233*	0.122	-0.694***	0.304
Constant	3.749***	0.692	-0.961	0.823	-3.027	5.074
Overall R_sqr		0.9013		0.8278		0.7679

Note 1: Here we only encompass the districts that experienced simultaneous reductions in pig farm numbers and total pig numbers.

Note 1: Province abbreviations. AB-Alberta; ON-Ontario; QC-Quebec

COOL appears to have encouraged farm operators in ON and QC to expand their operations, while have no impacts on farm operations in AB.

AB is a province that greatly relies on interprovincial hog trade. In 2008, 11% of Albertan pigs were exported to other provinces (McEwan, 2010).

During the period of severe disease outbreak, pig farms in ON and QC became smaller

- Affected by pig diseases more severely
- High mortality rate from pig diseases

Number of farms contributes to the industry's transitions in two different directions.

- As the number of farms decreases, farm size might increase to realize scale economies (QC and AB).
- On the other hand, farmers might choose to have smaller farms to meet the needs of high-priced niche market (ON).

Figure 1. Number of pig farms and average number of pigs per farm, Canada, 1996-2016

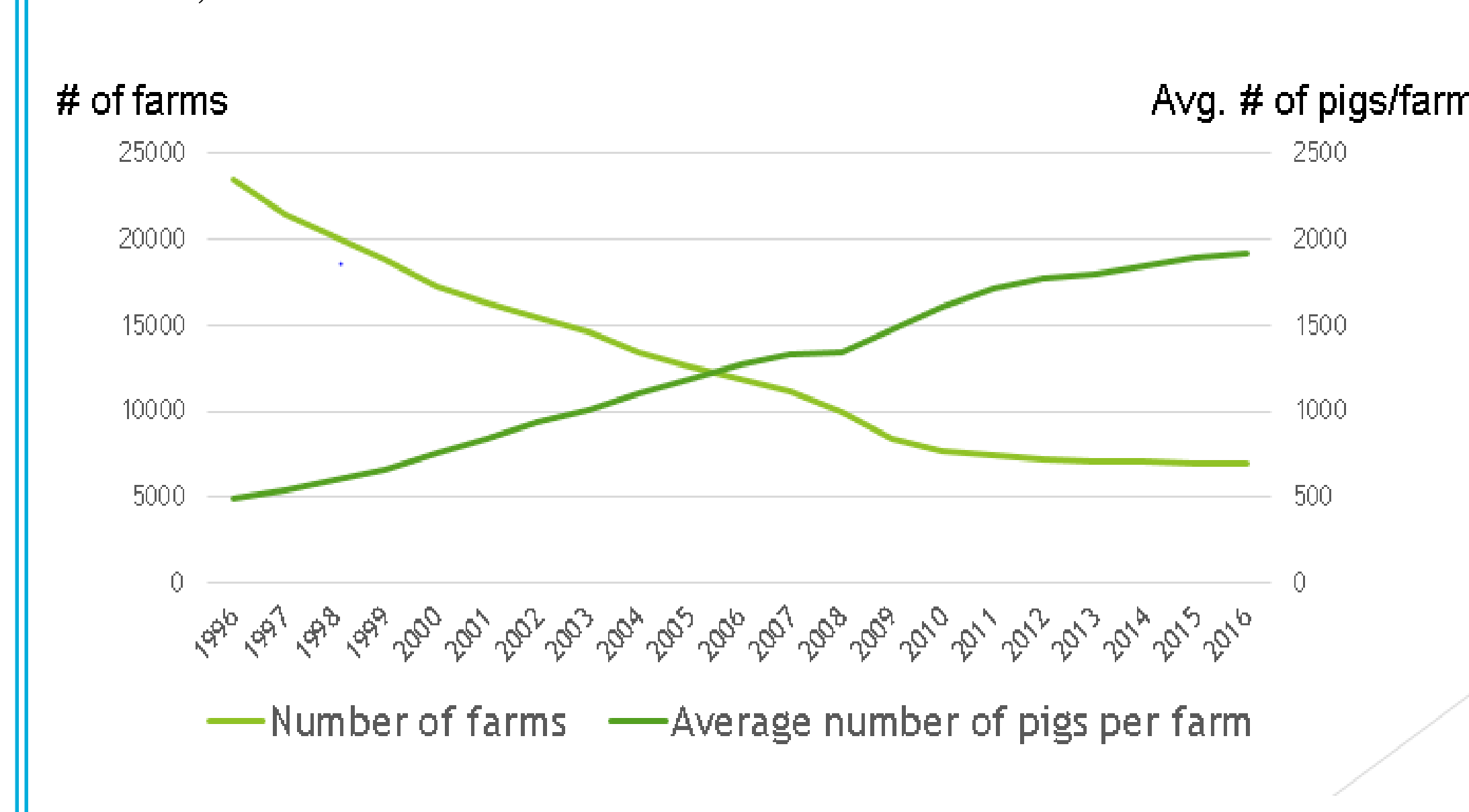
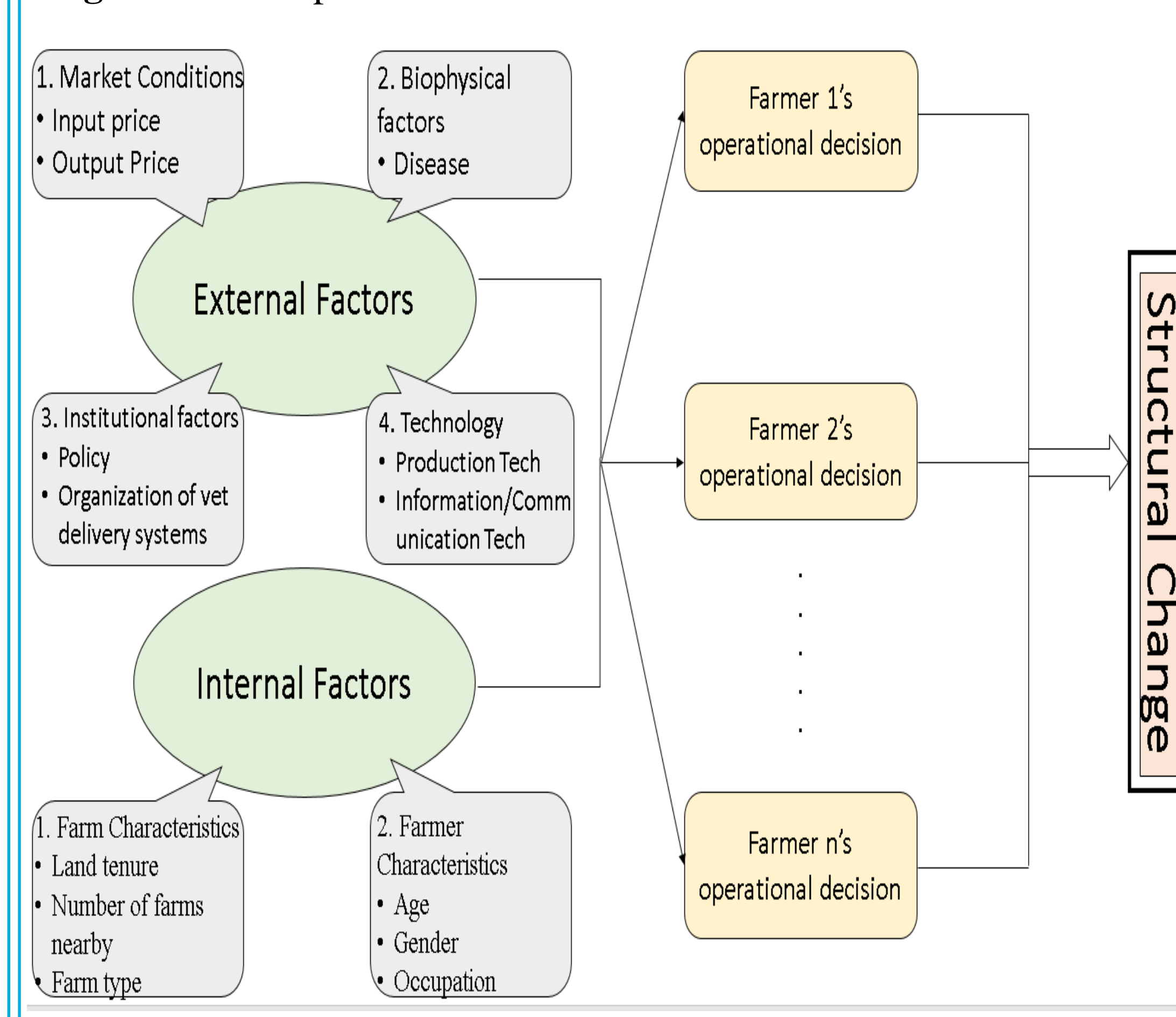


Figure 3. Conceptual Framework



DATA

Data by census divisions for all provinces in Canada from 1996 to 2011 are used in this study.

Census data on farm operations as well as other farm and farmer characteristics (Statistics Canada).

Economic variables such as input and output prices (deflated to real levels) (Agriculture and Agri-Food Canada).

Timelines regarding the important events such as COOL implementation that have affected the Canadian pig industry (government reports).

Impact of pig disease on farm structures is captured by a time dummy indicating the dramatic increases in pig diseases cases (PRRS: 2002-2005; PCVAD: 2004-2006).

- The reason that we suddenly had such frequent and severe problems during these periods is that we were dealing with **new and more virulent isolates of the viruses.**

PRRS-Porcine reproductive and respiratory syndrome virus
PCVAD-Porcine circovirus associated disease

RESULTS CONT'D

Price-feed ratio has larger impacts on the size of the farms located in the CDs that experienced pig number increases.

- CDs that experienced pig number increases are dominated by large farms, which used more purchased feed and less homegrown feed as compared to smaller farms.
- Inputs account for a higher share of larger farm costs.

Older farmers in QC are less likely to expand their operations.

Pig diseases have played a more significant role in the divisions experienced total pig number reductions.

Note: The regression results shown in this presentation are derived from the observations (i.e., districts) that experienced continuous pig farm losses across census years.

CONCLUSION

Pig disease(s) did affect the Canadian pig industry's structural change.

Heterogeneity in structural change across different regions does exist.

Pig disease has played a more significant role in the regions that experienced pig farm losses and pig number declines.

Further research should focus on

- Explaining why farmers make different farm structure adjustments in reaction to disease outbreaks
- Investigating how changes in production types have played a role in the industry's transition
 - Due to disease outbreaks, some pig farmers have moved away from traditional farrow-to-finish operations to single phase production.

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References

- McInerney, J. P., K. S., Howe and Schepers, J.A. 1992. A Framework for the Economic Analysis of Disease in Farm Livestock. *Preventive Veterinary Medicine*. 13: 137-154.
- Office of Audit and Evaluation. 2015. *Evaluation of the Control of Diseases in the Hog Industry*. Agriculture and Agri-Food Canada. Available at: <https://tinyurl.com/k5yosrm>
- Gujarati, D. N. 2003. "Basic econometrics." 4th edition, Boston, McGrawHill.
- Statistics Canada. Census of Agriculture, 1996 [Canada] [Microdata]. Ottawa, Ontario: Statistics Canada, 1997.
- Ottawa, Ontario: Data Liberation Initiative, 1997. Accessed via ODESI, March 28, 2017. <https://tinyurl.com/k3phkaw>
- Statistics Canada, 2012. *Number of hogs on farms at end of quarter*. CANSIM Table 003-0004.
- Statistics Canada, 2014. *Census of Agriculture, pigs on census day*. CANSIM Table 004-0223.
- Statistics Canada, 2017. *Hogs statistics, number of hogs on farms at end of semi-annual period*. CANSIM Table 003-0100

Figure 2. Regional differences for regions that experienced simultaneous reductions in pig farm numbers and total pig numbers, Canada, 1996-2011

