Examining the relationship between theory-driven policies and allowed lost-time back claims in workers' compensation: a system dynamics model

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Background and Significance

- Workers' compensation costly, ↑ back claims
- Often studied with piecemeal approach
- Complex role of financial compensation
  - Poorer clinical prognosis
  - Financially-incentivized behaviour

WSIB 1980-2009, Steenstra et al 2005, Atlas et al 2010, Hirsch et al 2010, Gunderson and Hyatt 2004

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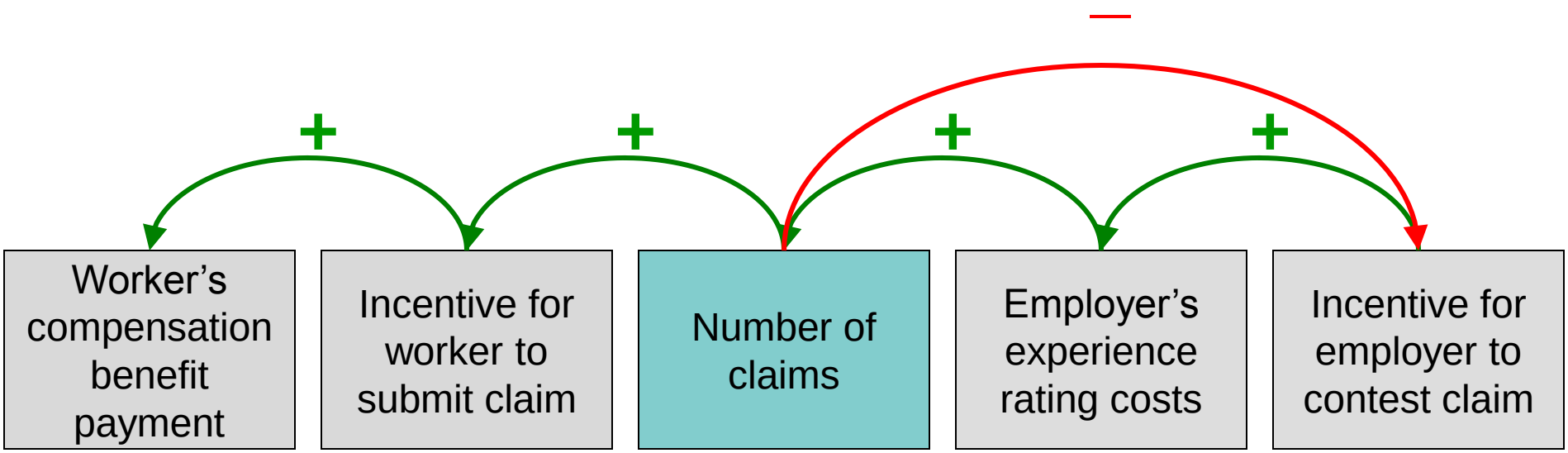
Economic Theory in WC

Legend:
+ Positively related
- Inversely related



Need for system-wide view on policy impact

Hirsch et al 2010, Gunderson and Hyatt 2004

Specific Aims

1. To **develop a model** of the relationship between theory-driven policies and number of lost-time back claims in WSIB over 30-year timeframe.

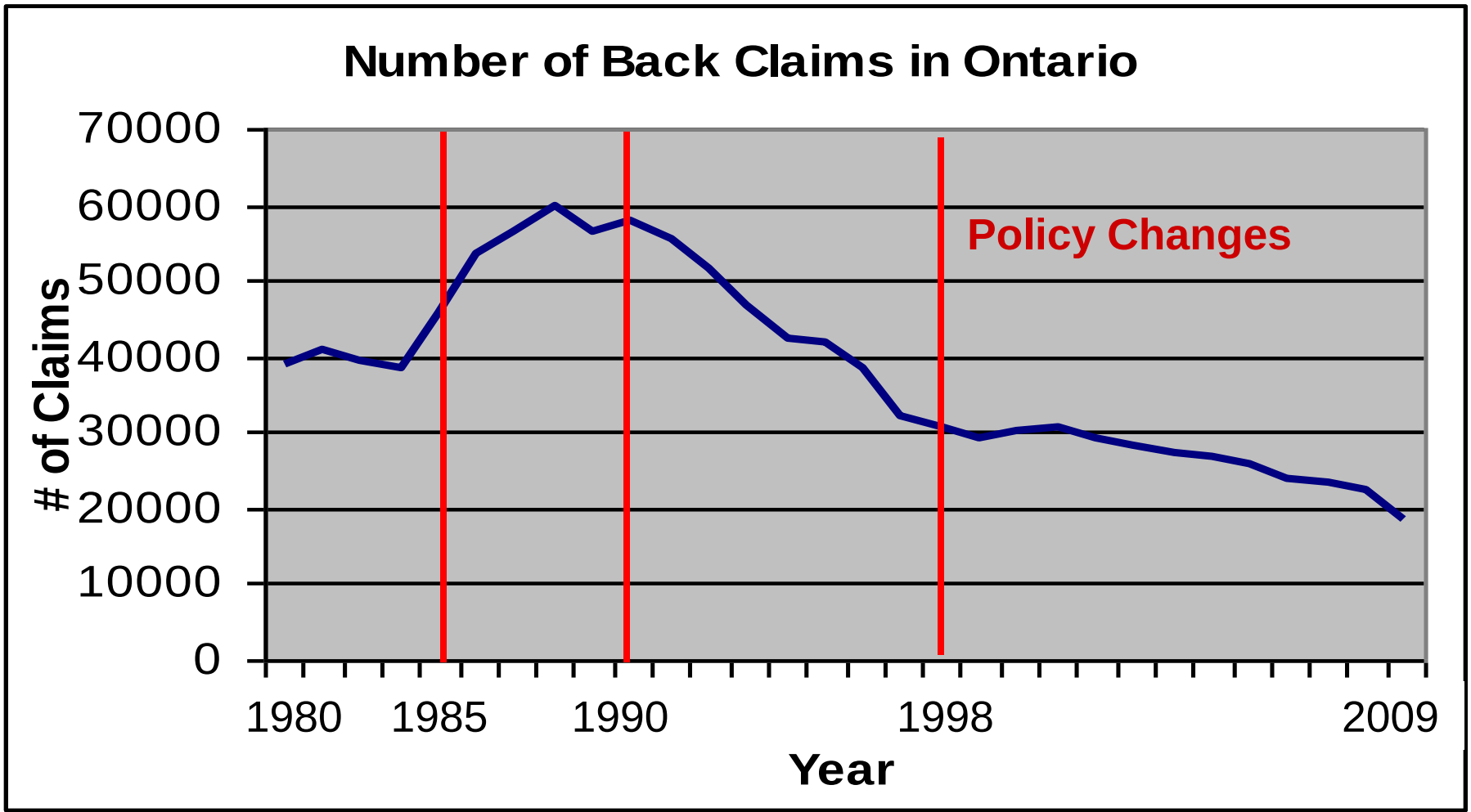
***Hypothesis*:** An economic theory-driven and policy-based model is sufficiently realistic to reproduce historical claims data.

2. To **determine robustness of model** to establish its utility/flexibility in evaluating proposed policy changes.

Hypothesis: Behavior of modeled data will be stable over extended time frame and at extremes of variable input.

Design Architecture

Retrospective, population-based, longitudinal validity study:



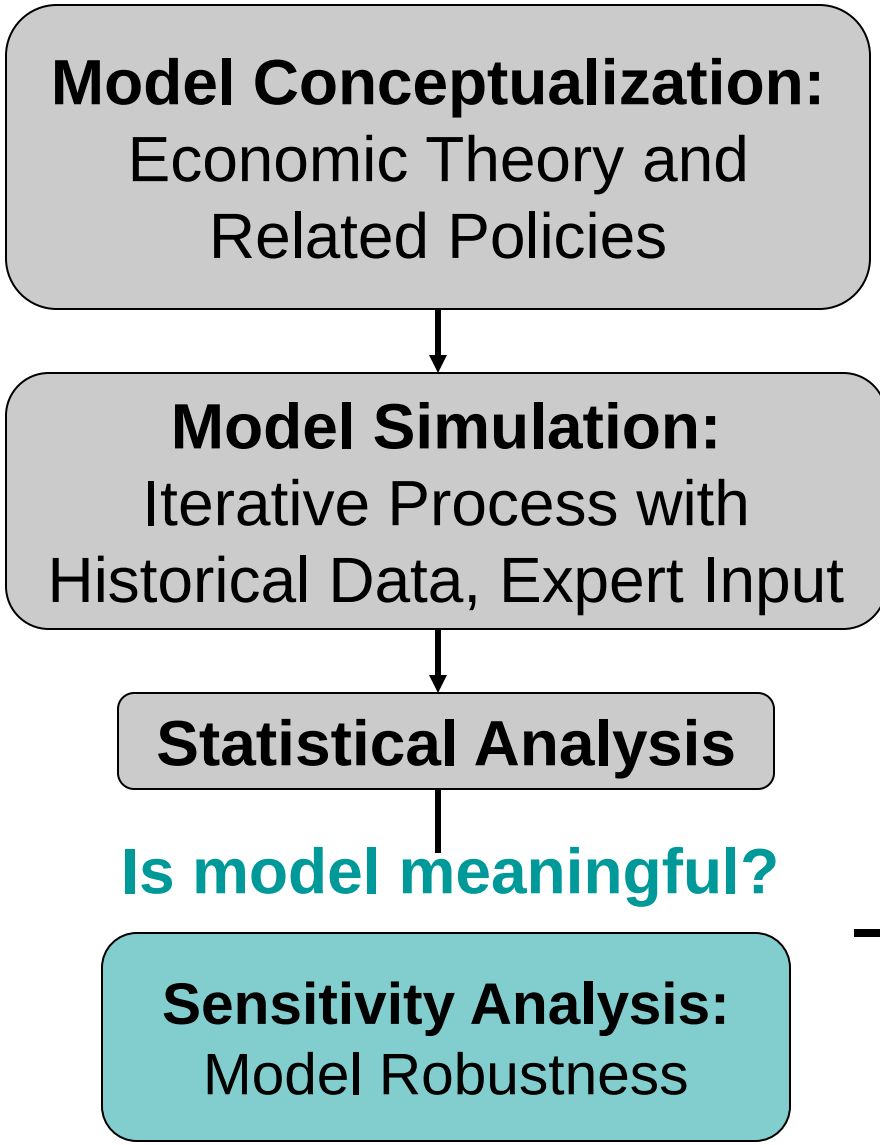
Methods

Modeling - System Dynamics (Vensim®):

Year	Policy
Prior to 1985	Compensation payable - 75% gross Temporary benefits payable below MMR Experience rating not implemented <1984
After 1985	Compensation payable - 90% net Temporary benefits payable below MMR
After 1990	Compensation payable - 90% net Temporary benefits may not be payable <MMR
After 1998	Compensation payable - 85% net Temporary benefits reviewed/adjusted each yr

Sterman 2000; WSIB 2008, 2010

Methods: Model Iteration



Specific Aim 1

Specific Aim 2

Methods: Variables of Interest

Exogenous:
Policies - health practitioner fees

Endogenous (1980-2009):
Policies - compensation benefit payments
Policies - experience rating fees
# of workers eligible to submit claims
# of lost-time back claims

Model Boundary

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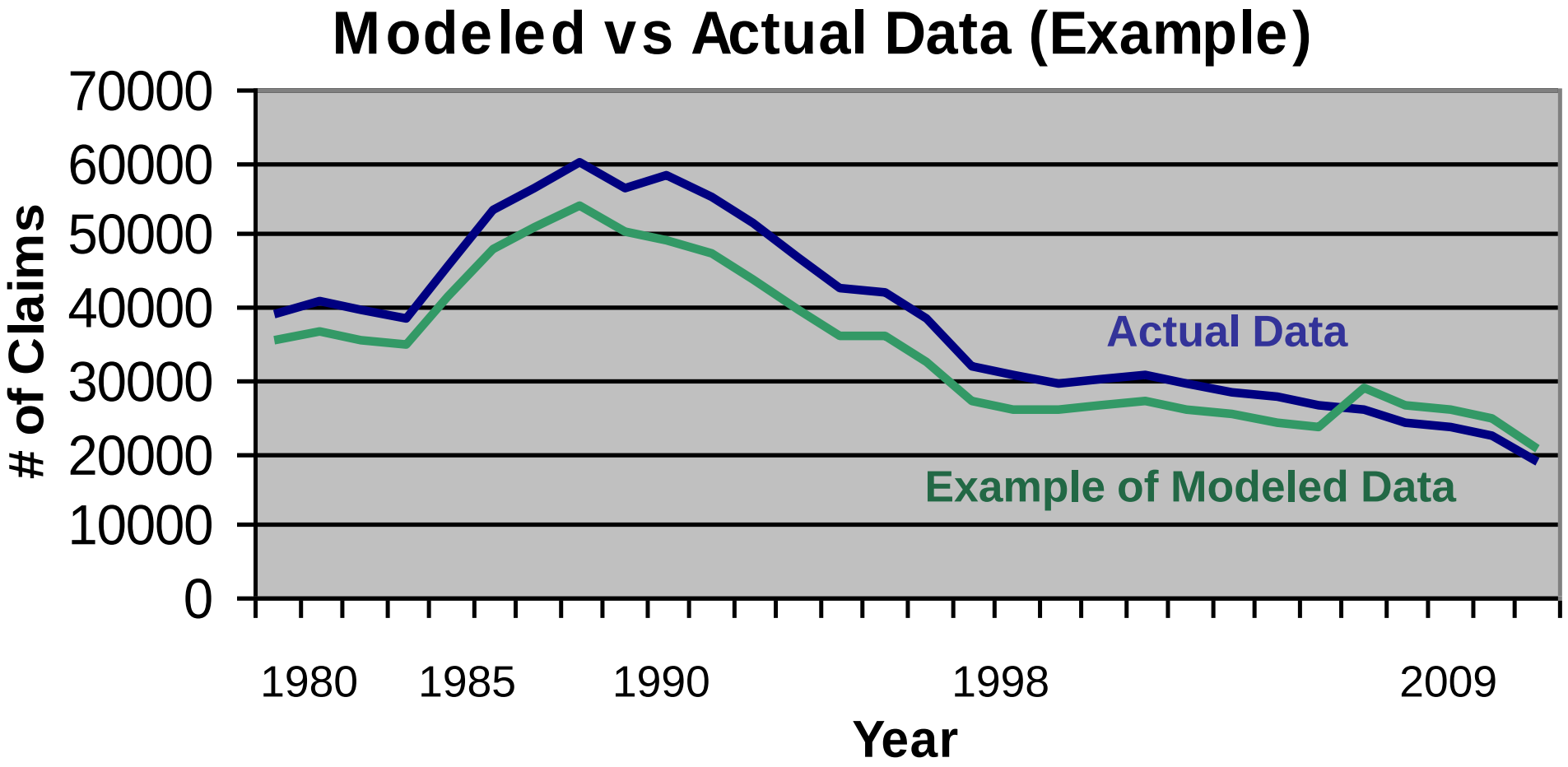
Outcome Measurement

Predicted number of lost-time back claims



Analysis

Aim 1: Is model meaningful?

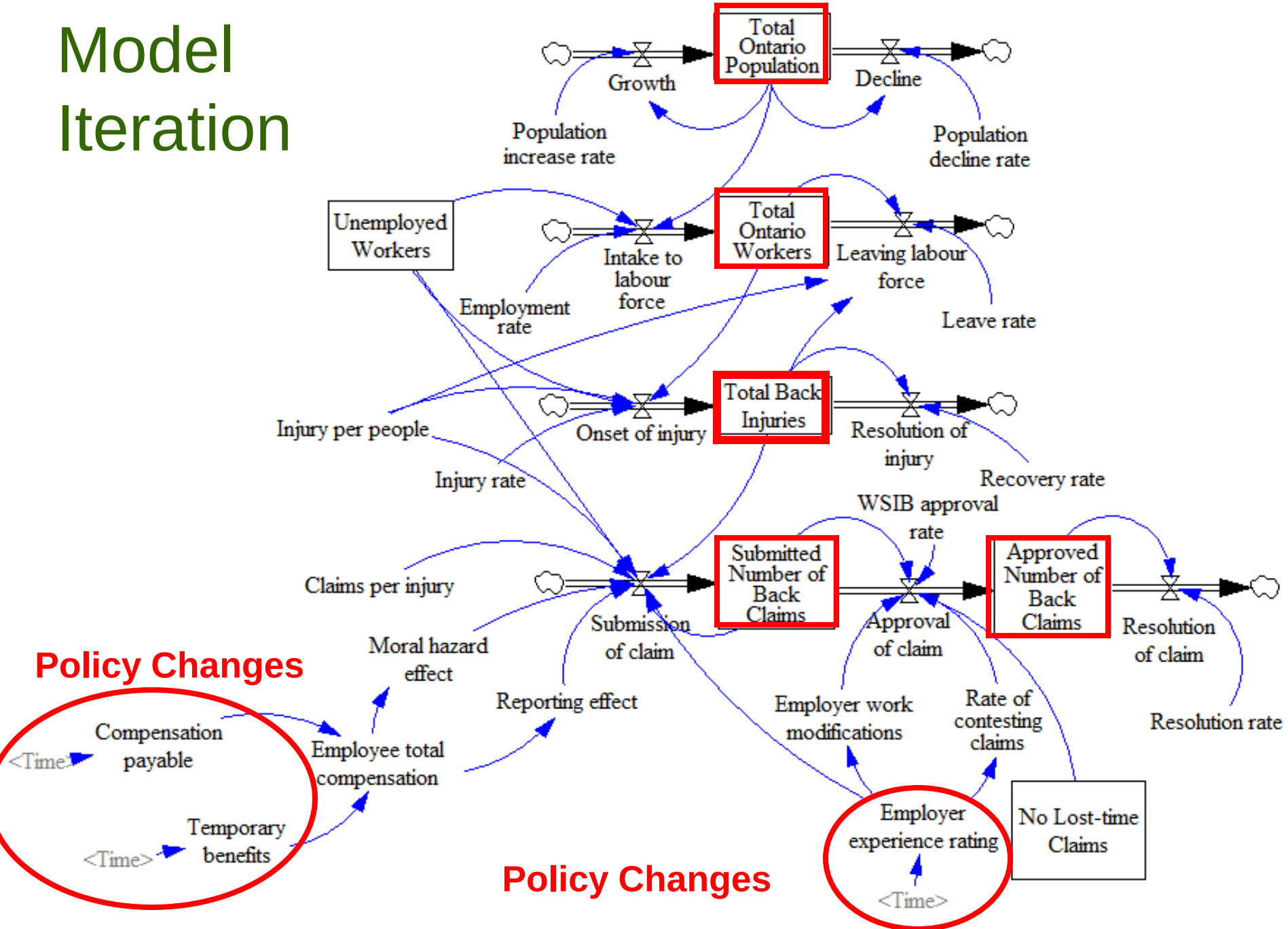
Model Iteration
Coefficient of determination (R^2)
Theil's inequality coefficients (U)
Root mean square error (RMSE)

Aim 2: Sensitivity Analysis

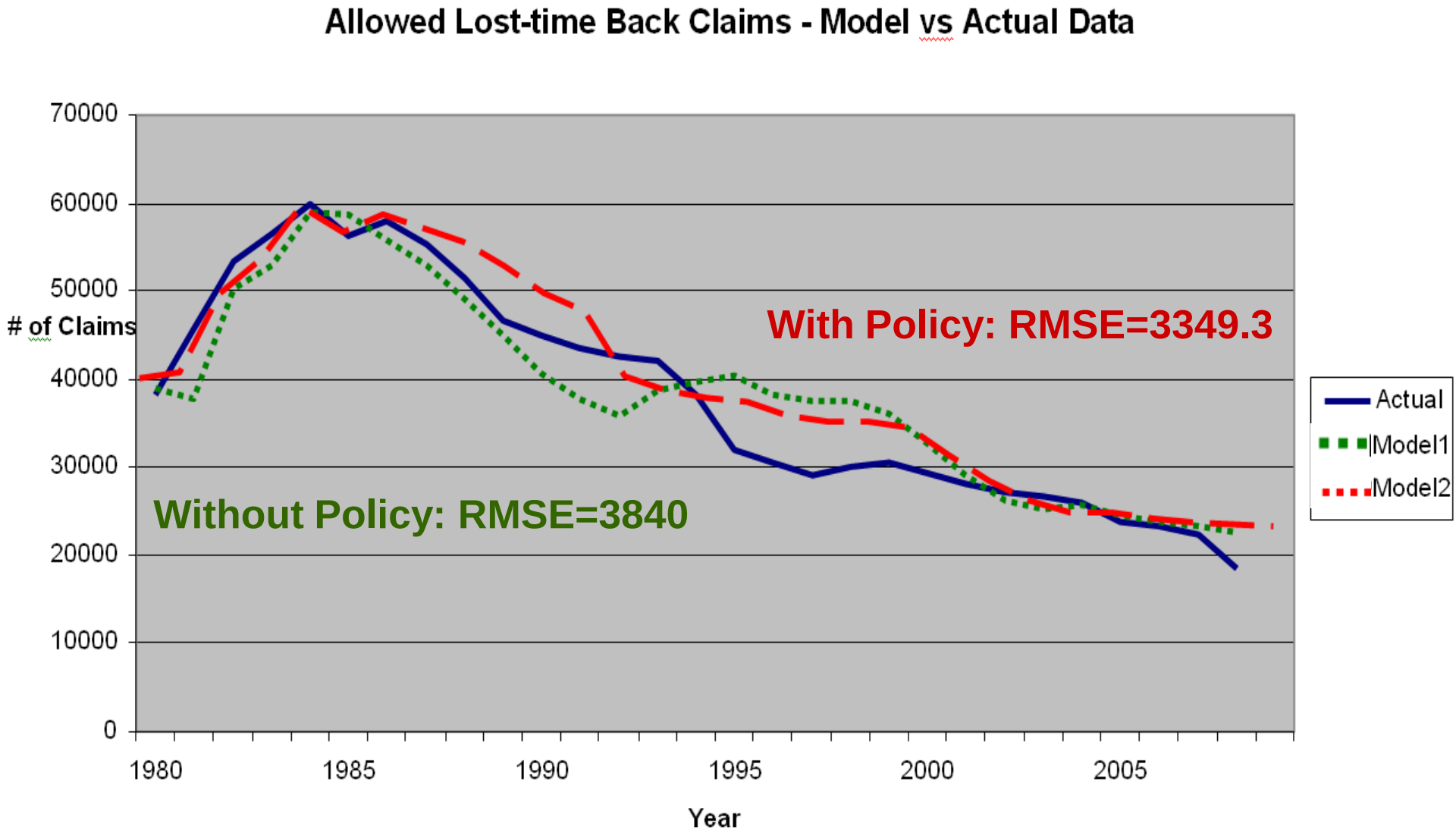
- Output at negative # or ∞?

Sterman 2000

Model Iteration



Results



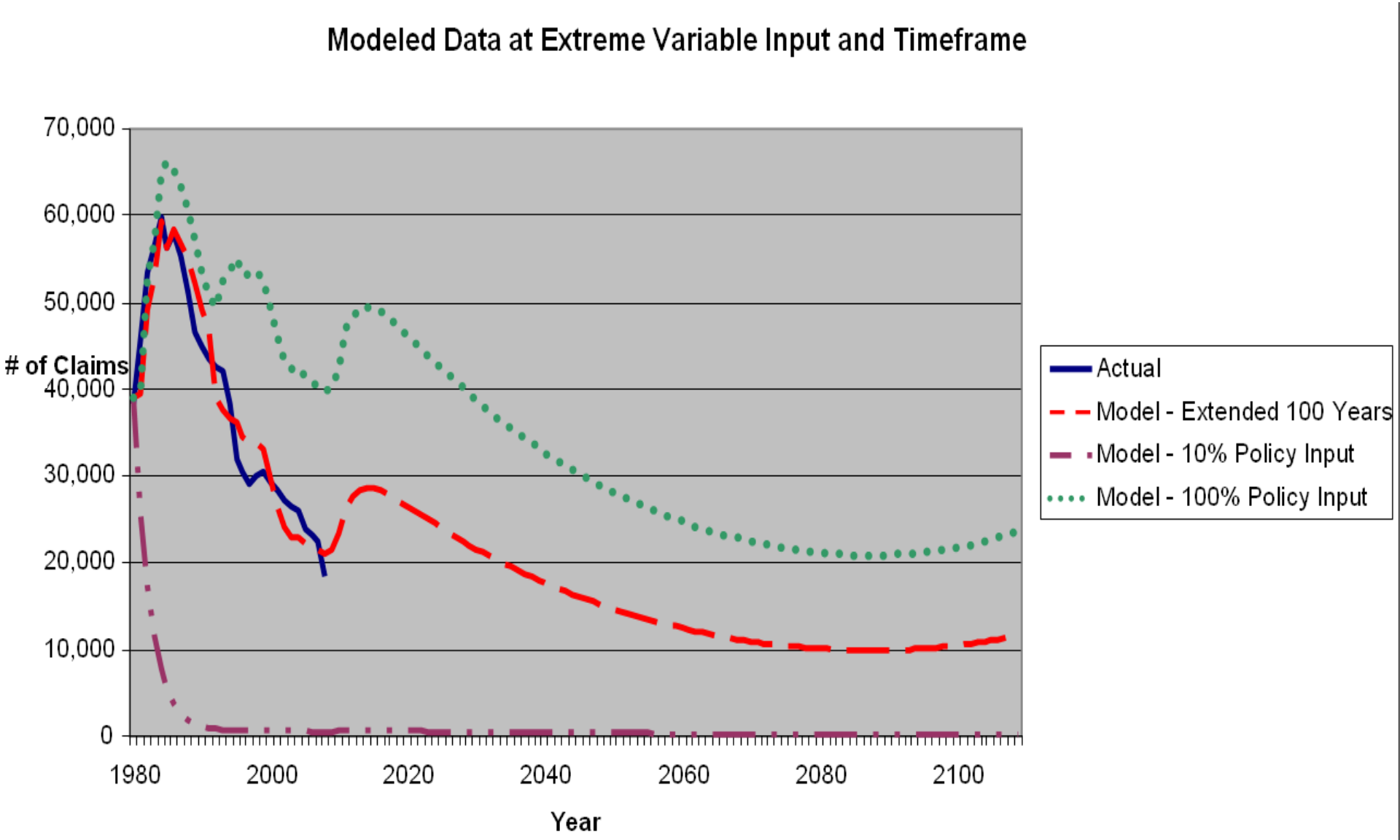
Input of policy changes improved RMSE by 13%

Results

Variable	Inequality Coefficient (U)	Coefficient of Determination (R^2)
Lost-time Back Claims (***before*** policy changes)	0.107	0.882
Lost-time Back Claims (***after*** policy changes)	0.080	0.934

Sensitive drivers of modeled data:
Unemployment, multiple back injuries, no lost-time claims

Results of Sensitivity Analysis



Discussion

- Policies were minor drivers of modeled data
  - Consistent with previous literature
- Sensitive drivers of modeled data:
  - Unemployment, multiple injuries, no lost-time claims
- Study limitations
  - Use of administrative data, model is “useful”

Loesler et al 1995; Brooker et al 1997; Ruseckaite et al 2011, Smith et al 2011, 2012; Box 1987

Summary

- Economic-based policies played minor role
- Other drivers influenced back claims in model
- Developed a robust model that is predictive of historical lost-time back claims
- Innovative model helps guide policy research

Acknowledgements

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Questions?

Select References

1. Gunderson M, Hyatt D. Some benefit considerations in workers' compensation. Accessed March 1, 2011: http://www.llbc.leg.bc.ca/public/pubdocs/bcdocs/345628/gunderson_hyatt_consider.pdf
2. Hirsch BT. Incentive effects of workers' compensation. Clinical Orthopaedics and Related Research 1997; 336: 33-41.
3. Steenstra IA, Verbeek JH, Heymans MW, Bongers PM. Prognostic factors for duration of sick leave in patients sick listed with acute low back pain: a systematic review of the literature. Occup Environ Med 2005; 62: 851-860.
4. Atlas SJ, Toteson TD, Blood EA, Skinner JS, Pransky GS, Weinstein JN. The impact of workers' compensation on outcomes of surgical and nonoperative therapy for patients with a lumbar disc herniation SPORT. Spine 2010; 35(1): 89-97.
5. Sterman JD. Business Dynamics: System Thinking and Modeling for a Complex World. Boston, Mass: Irwin/McGraw-Hill, 2000.
6. Homer J, Jones A, Seville D, Essien J, Milstein B, Murphy D. The CDC's diabetes systems modeling project: developing a new tool for chronic disease prevention and control. Accessed March 1, 2011: http://www.sustainer.org/pubs/Diabetes_System%28ISDC04%29.pdf
7. Hirsch G, Homer J, Evans E, Zielinski A. A system dynamics model for planning cardiovascular disease interventions. Am J Public Health 2010; 100(4): 616-22.
8. Soklaridis S, Ammendolia C, Cassidy D. Looking upstream to understand low back pain and return to work: psychosocial factors as the product of system issues. Social Science and Medicine 2010; 71: 1557-1566.
9. Slaughter P, Pinfold P, Flintoff V, Gort E, Thiel E, Blackstien-Hirsch P, et al. *Focus Groups in Health Services Research at the Institute for Clinical and Evaluative Sciences* (Rep. No. 99-02-TR) 1999. Toronto: Institute for Clinical and Evaluative Sciences.
10. Workplace Safety and Insurance Board. Statistical support to the annual reports, 1988-2009.

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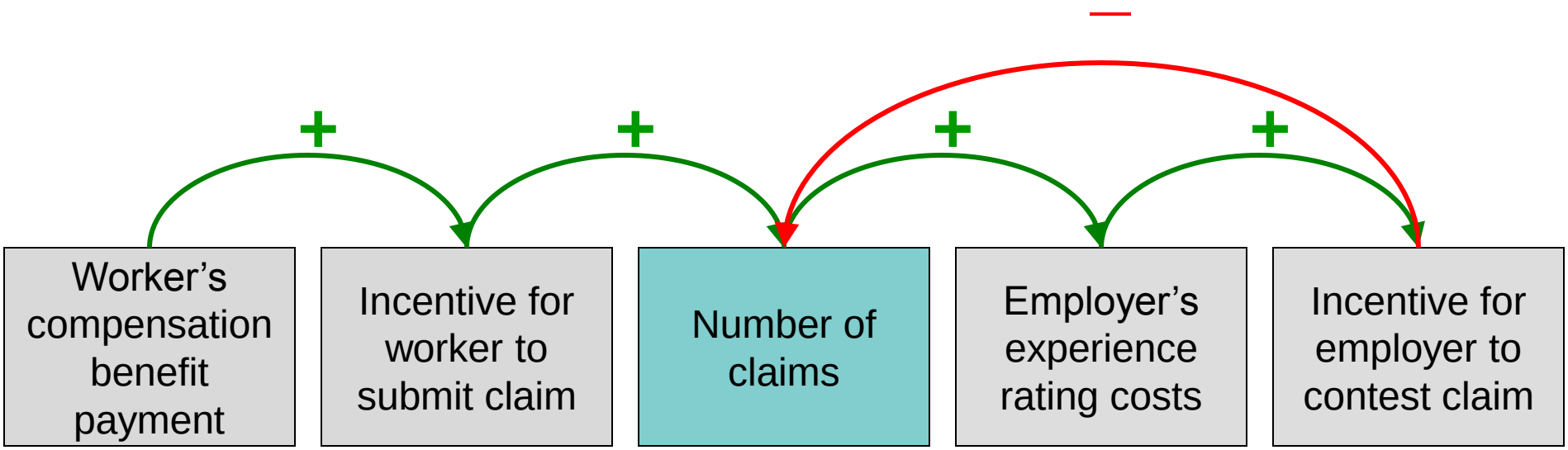

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Methods: 2nd Model Iteration