JYVÄSKYLÄN YLIOPISTO
UNIVERSITY OF JYVÄSKYLÄ

MANAGEMENT PRACTICES IN FINNISH MANUFACTURING ESTABLISHMENTS: EVIDENCE FROM FMOP

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International Management Surveys Workshop
11.12.2019

Outline

- Background and data (promptly)
- Descriptive statistics
- Methods for regional comparison
- Results
- What’s next?

Background

- First (quantitative) management survey in Finland
  - Questionnaire replicated closely from the 2010 US MOPS
  - Funded by the Strategic Research Council at the Academy of Finland

- Data collected by Statistics Finland
  - Available to researchers from Statistics Finland's research services
  - Via application, see https://www.tilastokeskus.fi/tup/mikroaineistot/index_en.html
  - Possibility of remote access might be country dependent

Data

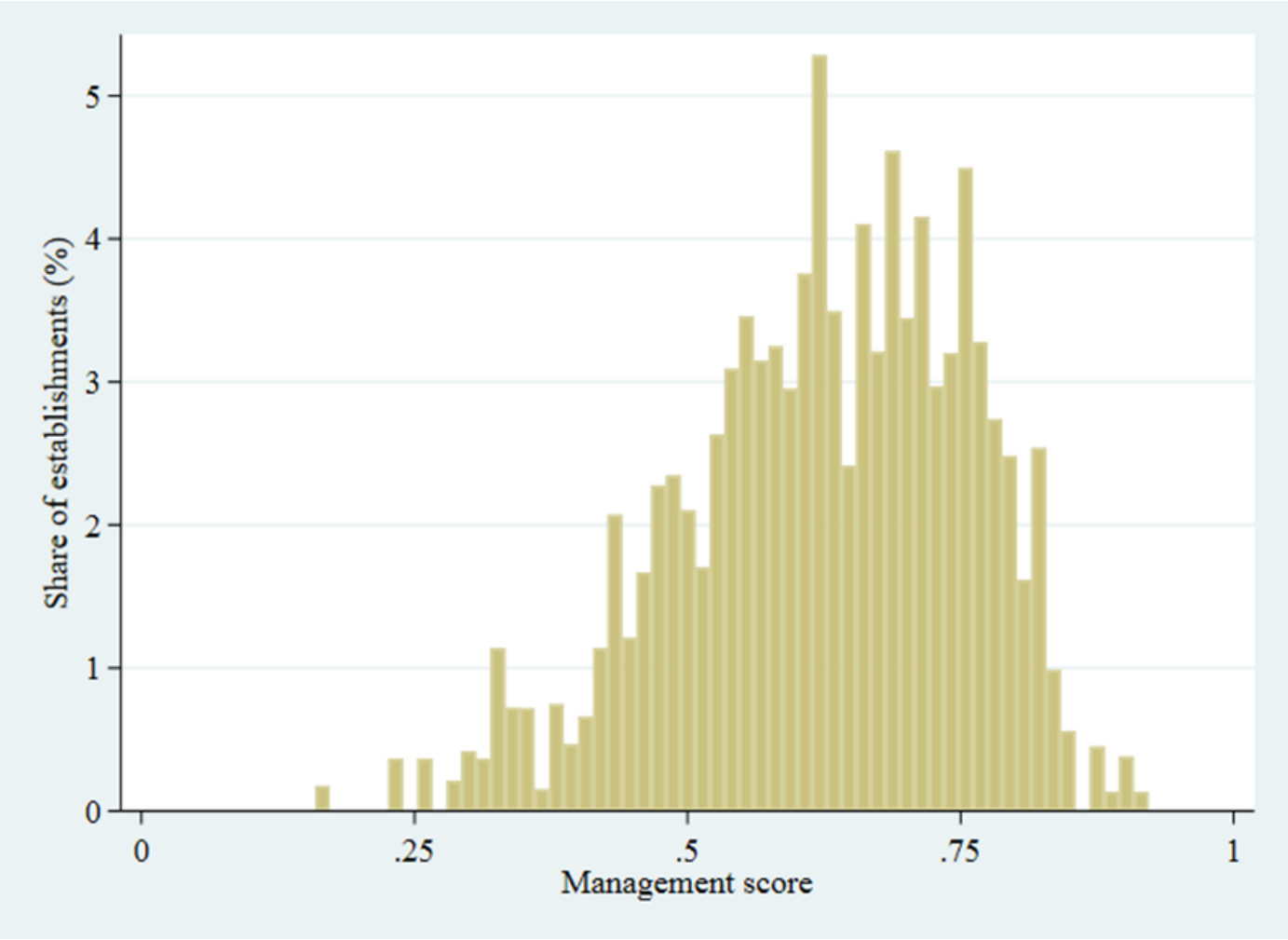
- Reference year 2016, collected in spring 2017
  - Sample consisted of 2509 manufacturing establishments
  - Only establishments within firms of at least 50 employees
  - Final number of respondents 731
- Larger establishments (and firms) more likely to respond
  - Item non-response: > 95% of valid respondents gave at least 10 non-missing responses
- Feedback:
  - Many firms, as a rule, only respond if required by law
  - Difficulties in answering on establishment level (instead of firm level)

Descriptive statistics

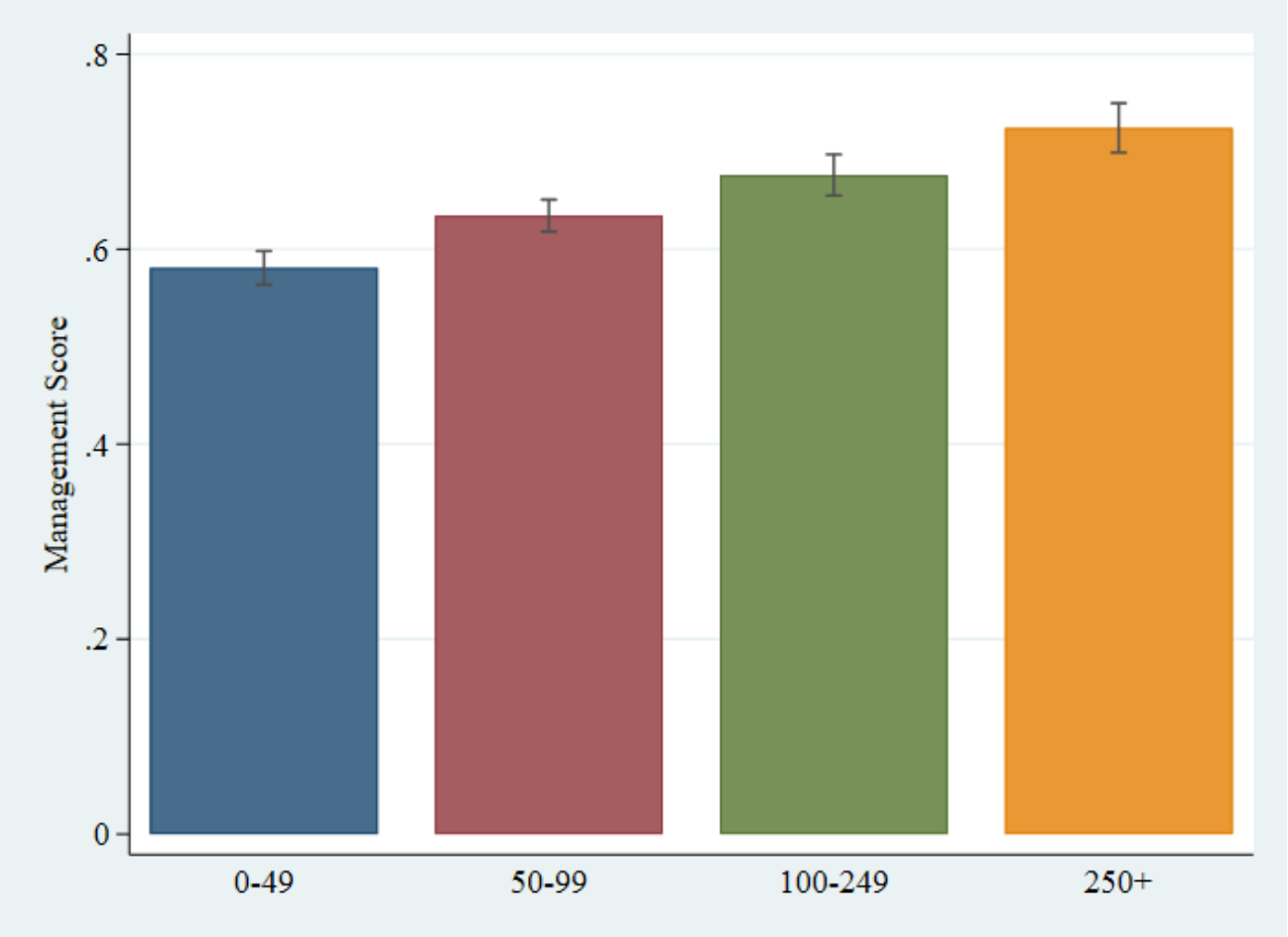
- Distribution of the unweighted management score

- 7% of establishments > 0.8
- 5% of establishments < 0.4

- Analysis of total non-response: distribution skewed towards larger establishments



Size of establishment



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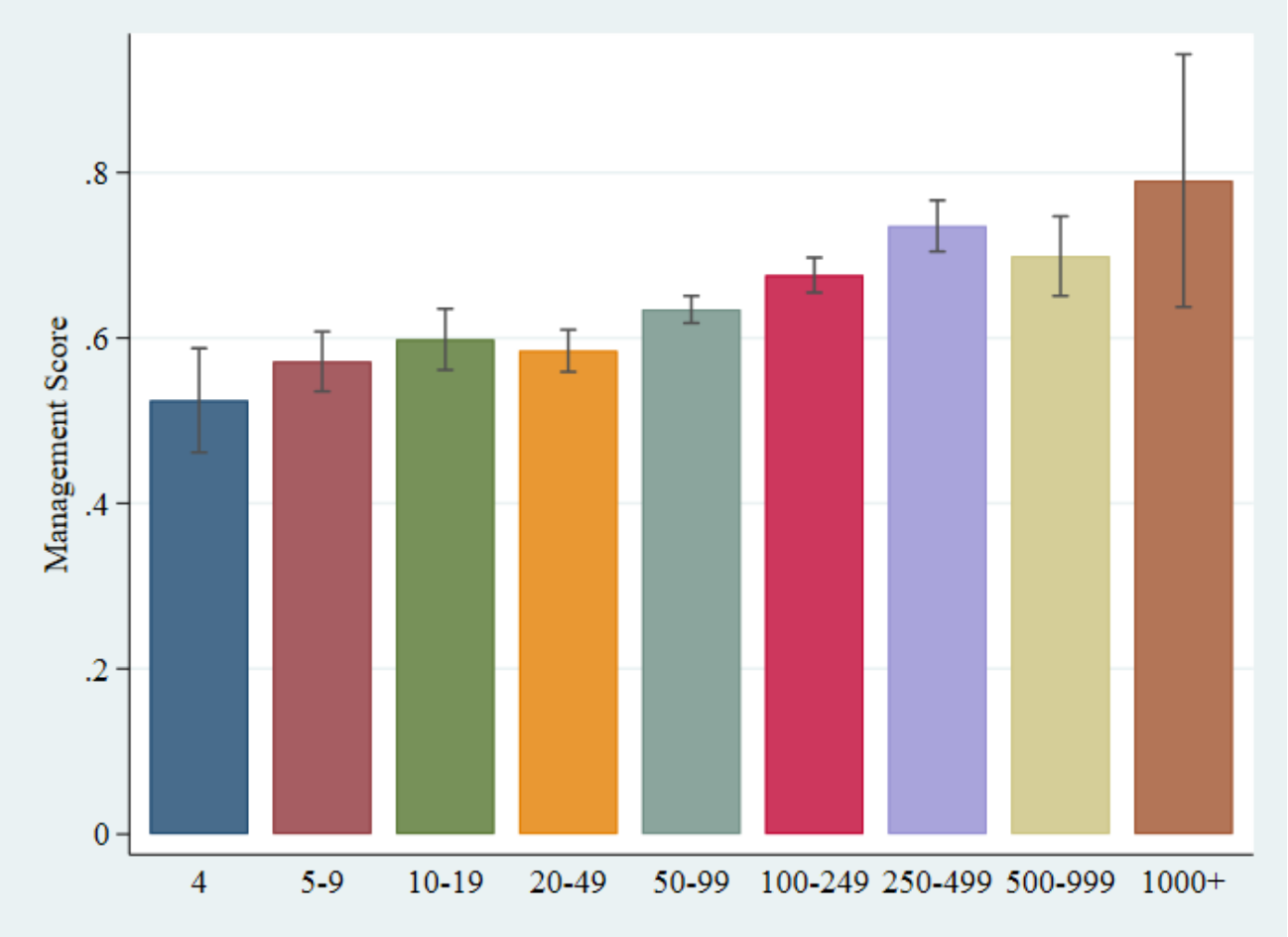
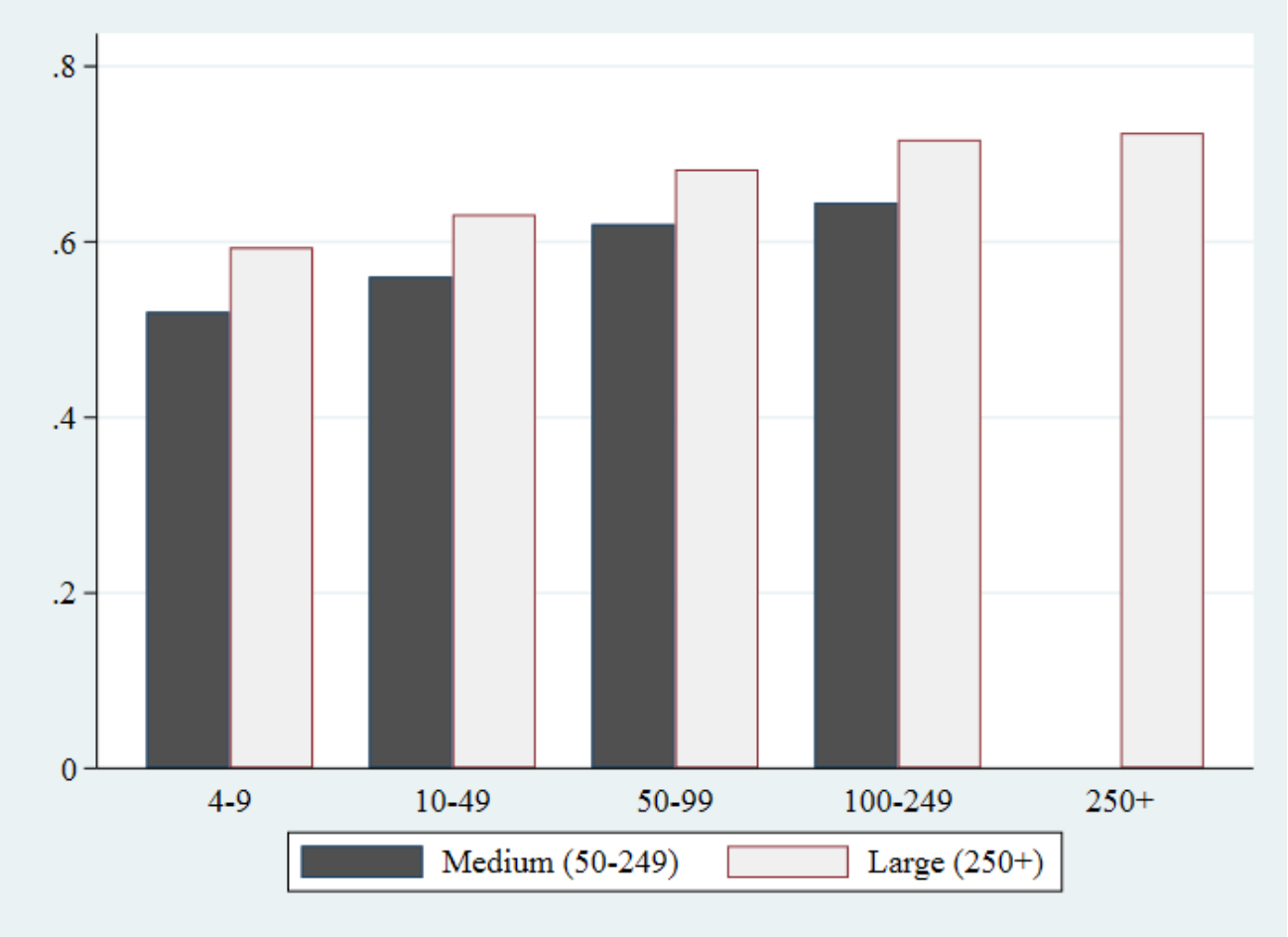
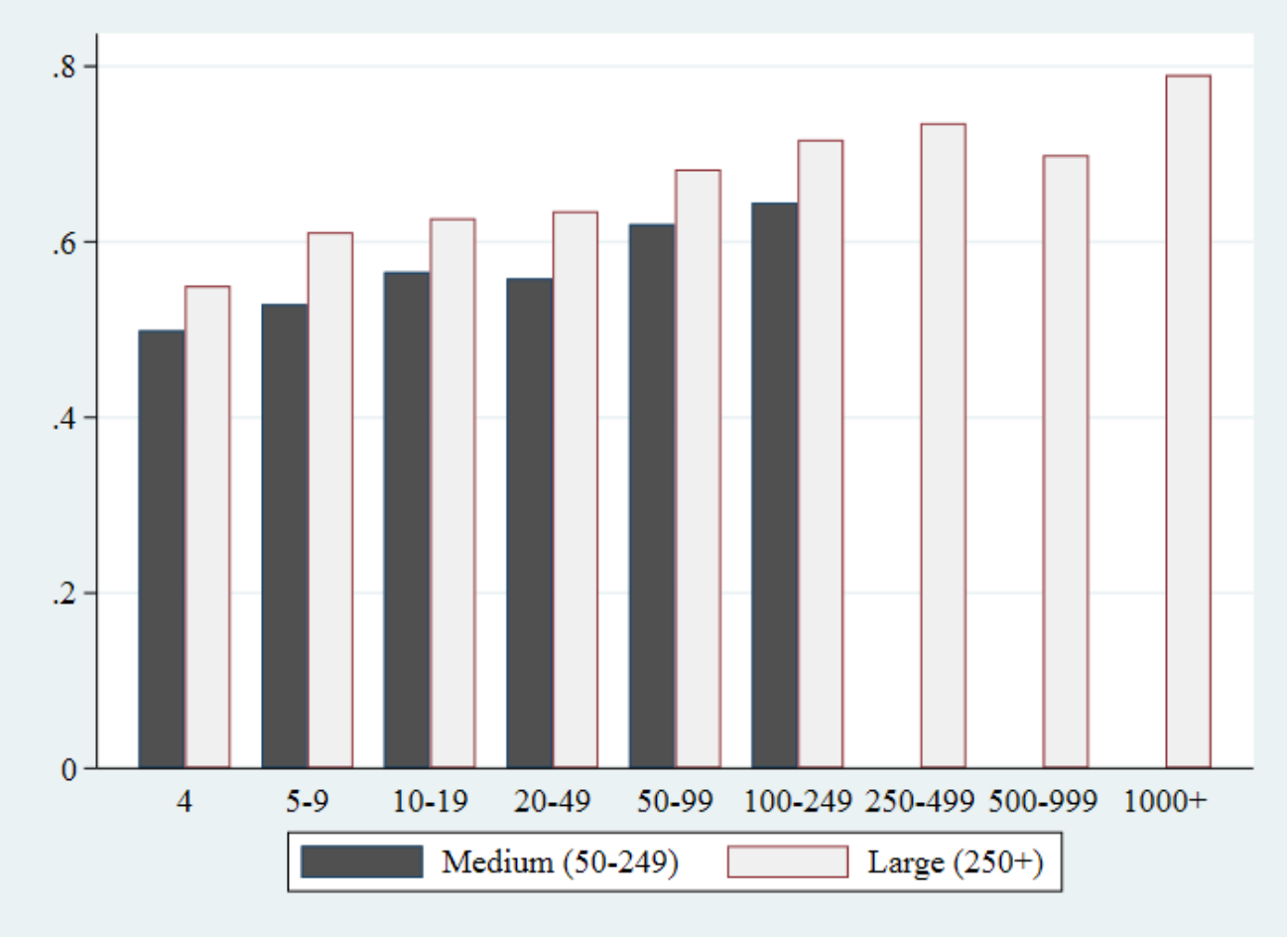


Size of establishment & firm



Size of establishment & firm



Descriptive statistics

	Number of establishments	Total number of employees	Aggregate management score	Unweighted management score
Helsinki-Uusimaa	97	12175	0.71	0.64
West Finland	146	14090	0.67	0.63
South Finland	209	24646	0.68	0.62
North & East Finland	149	15461	0.70	0.63
Total	601	66371	0.69	0.63

Methods

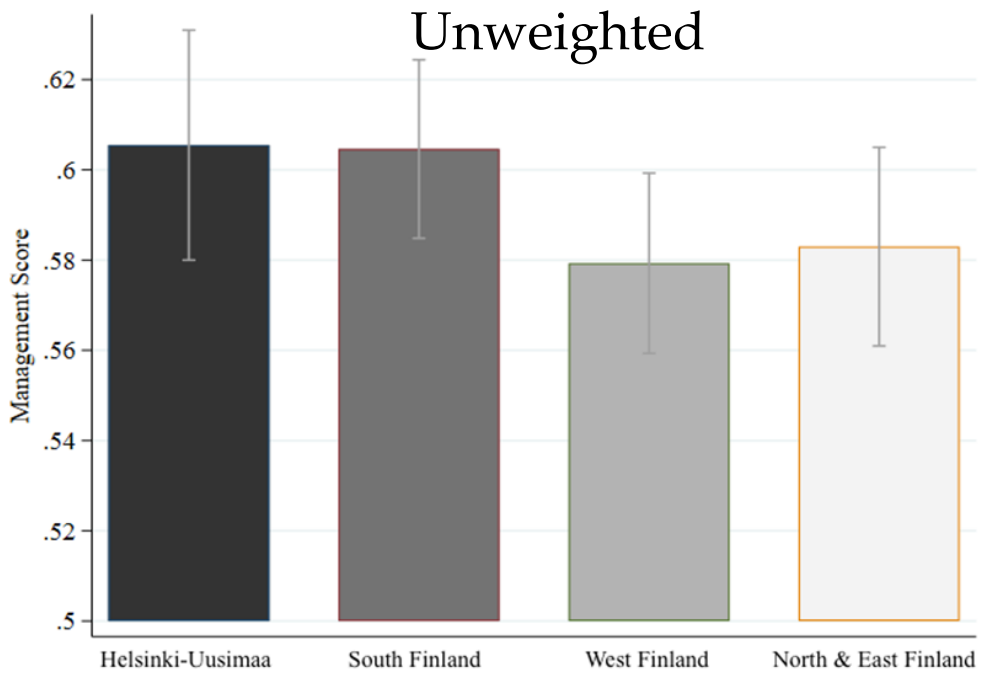
- Allocation of inputs is essential when examining competitiveness

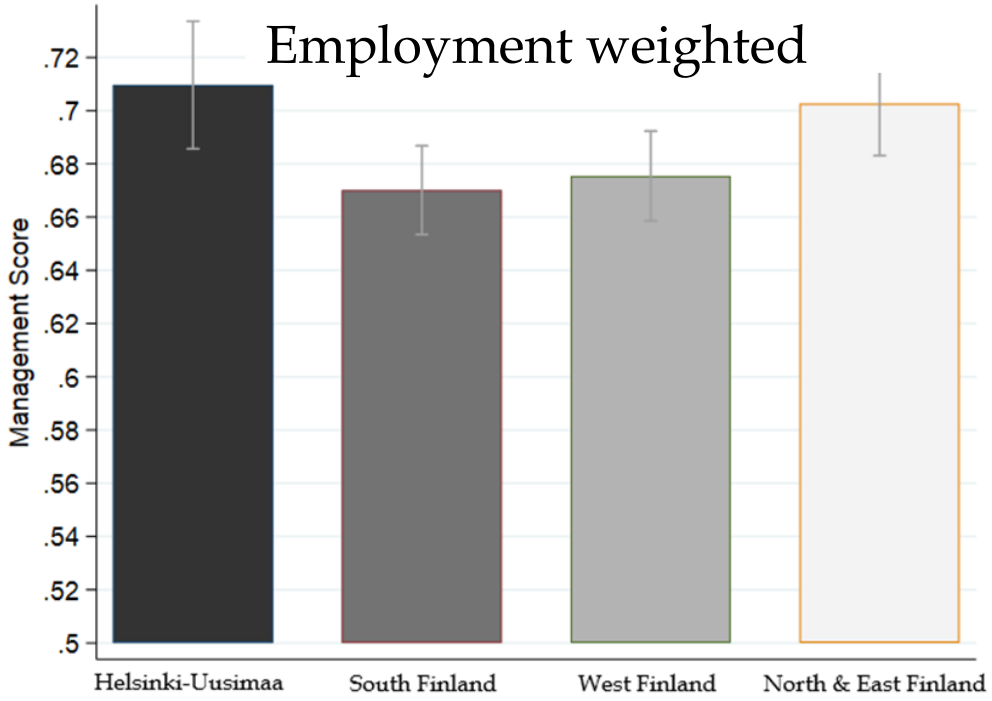
- Olley-Pakes decomposition (Olley & Pakes 1996)
  - Aggregate score (employment weighted) = unweighted score + allocation component
  - No standard errors for the allocation term

- Moment-based approach (Hyytinen, Ilmakunnas & Maliranta 2016)
  - Provides standard errors for the allocation term
  - Enables hypothesis testing

Regional comparison

- Unweighted averages:
  - no indication of regional disparities
- Employment weighted (aggregate) averages:
  - Indication of regional disparities (between Helsinki-Uusimaa and West Finland)
- Allocation term
  - Difference in allocation terms also statistically significant
  - Accounts for 75% of the difference in aggregate score





OP-decomposition and statistical inference

- Aggregate level = unweighted average + allocation term
  - Helsinki-Uusimaa: 0.71 = 0.64 + 0.07
  - West Finland: 0.67 = 0.63 + 0.04
  - South Finland: 0.68 = 0.62 + 0.05
  - North & East Finland: 0.70 = 0.63 + 0.07

- Standard errors for the components
  - *See Hyytinen, A., Ilmakunnas, P. & Maliranta, M. 2016. Olley–Pakes Productivity Decomposition: Computation and Inference. Journal of the Royal Statistical Society*

- Can't include control variables

	Point estimate	95% confidence interval	
		Lower bound	Upper bound
Unweighted average management score			
Helsinki-Uusimaa	0.64	0.61	0.66
West Finland	0.63	0.61	0.65
South Finland	0.62	0.61	0.64
North & East Finland	0.63	0.61	0.65
Allocation term			
Helsinki-Uusimaa	0.07	0.04	0.11
West Finland	0.04	0.01	0.06
South Finland	0.05	0.03	0.08
North & East Finland	0.07	0.02	0.12
Aggregate average management score			
Helsinki-Uusimaa	0.71	0.67	0.75
West Finland	0.67	0.65	0.69
South Finland	0.68	0.65	0.70
North & East Finland	0.70	0.66	0.75

OLS with controls

Management score	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Employment weighted		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes
West Finland	-0.005	-0.040	-0.010	-0.046*	-0.014	-0.036	-0.019	-0.043	-0.006	-0.052**	-0.009	-0.057**	-0.014	-0.055**	-0.018	-0.058**
	(0.016)	(0.024)	(0.017)	(0.025)	(0.018)	(0.026)	(0.018)	(0.027)	(0.017)	(0.021)	(0.017)	(0.024)	(0.018)	(0.023)	(0.018)	(0.025)
South Finland	-0.013	-0.034	-0.013	-0.036	-0.020	-0.032	-0.020	-0.032	-0.010	-0.039	-0.010	-0.041*	-0.017	-0.040*	-0.017	-0.041
	(0.016)	(0.025)	(0.016)	(0.026)	(0.018)	(0.026)	(0.017)	(0.028)	(0.016)	(0.022)	(0.016)	(0.025)	(0.018)	(0.024)	(0.017)	(0.026)
North & East Finland	-0.007	-0.007	-0.014	-0.019	-0.005	-0.001	-0.013	-0.014	-0.004	-0.008	-0.010	-0.018	-0.001	-0.010	-0.009	-0.020
	(0.017)	(0.032)	(0.017)	(0.028)	(0.019)	(0.033)	(0.019)	(0.030)	(0.017)	(0.030)	(0.017)	(0.027)	(0.019)	(0.031)	(0.019)	(0.029)
Employee education					0.017***	0.005	0.017***	0.005					0.014***	-0.004	0.012**	-0.006
					(0.005)	(0.008)	(0.006)	(0.008)					(0.005)	(0.008)	(0.006)	(0.008)
Productivity (log)									0.030***	0.046***	0.027***	0.043***	0.033***	0.047***	0.029***	0.044***
									(0.007)	(0.009)	(0.007)	(0.009)	(0.007)	(0.009)	(0.007)	(0.010)
Observations	601	601	601	601	517	517	517	517	601	601	601	601	517	517	517	517
Industry Fixed Effects			Yes	Yes			Yes	Yes			Yes	Yes			Yes	Yes
R^2	0.001	0.019	0.039	0.056	0.022	0.020	0.061	0.061	0.044	0.103	0.070	0.123	0.073	0.101	0.0982	0.1243
Prob > F	0.872	0.287	0.003	0.050	0.011	0.395	0.000	0.074	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: The coefficient for each large region shows the difference in the mean of the management score compared to Helsinki-Uusimaa. Productivity (log) is measured as log(revenue/number of employees). Employee education is measured as the employees' average years of schooling for each establishment. Prob > F is the p-value of the F-test. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	Finland			USA		
Establishment size in employees	Score	Share of establishments	Share of employees	Score	Share of establishments	Share of employees
5-9	0.59	35.3 %	5.9 %	0.41	27.5 %	3.0 %
10-19	0.58	26.5 %	9.1 %	0.44	24.1 %	5.3 %
20-49	0.59	21.6 %	16.8 %	0.51	23.9 %	12.0 %
50-99	0.64	9.0 %	15.7 %	0.60	11.5 %	13.1 %
100-249	0.68	5.1 %	19.9 %	0.66	8.9 %	22.0 %
250-499	0.77	1.5 %	13.1 %	0.71	3.0 %	16.6 %
500-999	0.73	0.8 %	12.9 %	0.73	1.1 %	12.3 %
1000-	0.84	0.2 %	6.5 %	0.76	0.5 %	15.6 %
Unweighted	0.60			0.55		
Weighted	0.67			0.65		
Allocation term (%)	10.4 %			15.4 %		

Finland: FMOP data and Official Statistics of Finland (OSF): Finnish enterprises [e-publication].

USA: 2015 MOPS and Census Bureau County Business Patterns

What’s next?

- Repeating survey every 5 years (hopefully)
  - Funding?
  - Research Institute of the Finnish Economy (ETLA) + Statistics of Finland
- Linking with registers and other data sources
  - E.g. Finnish Longitudinal Employer-Employee Data (FLEED)
  - Other countries
- Causal inference with just observational data
  - Causal model using Directed Acyclic Graphs
  - Assumptions shown explicitly and formally
  - Testable implications
  - Formal criteria for identification of causal effects
  - Algorithms automate the identification task

Diagram style

- classic
- SEM-like

View mode

- normal
- moral graph
- correlation graph

Coloring

- causal paths
- biasing paths
- ancestral structure

Effect analysis

- atomic direct effects

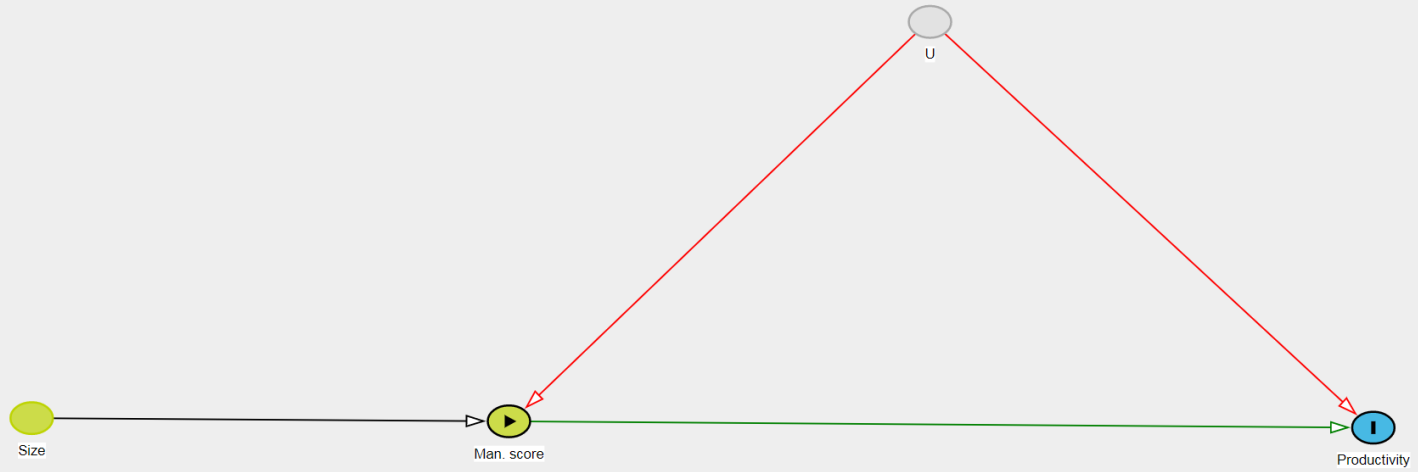
Legend

- exposure
- outcome
- ancestor of exposure
- ancestor of outcome
- ancestor of exposure *and* outcome
- adjusted variable
- unobserved (latent)
- other variable
- causal path
- biasing path

Summary

exposure(s) **Man. score**
outcome(s) **Productivity**
covariates **2**
causal paths **1**

Model | **Examples** | **How to ...** | **Layout** | **Help**



Causal effect identification

Instrumental variable

Instruments and conditional instruments:

- Size

Testable implications

Either the model does not imply any conditional independencies or the implied ones are untestable due to unobserved variables.

Model code

```
Man.%20score E @-0.862,0.036
Productivity O @0.562,0.040
Size 1 @-1.648,0.033
U U @-0.169,-0.257

Man.%20score Productivity
Size Man.%20score
U Man.%20score Productivity
```

You have modified the model code. To draw the modified model, click here: Update DAG

Diagram style
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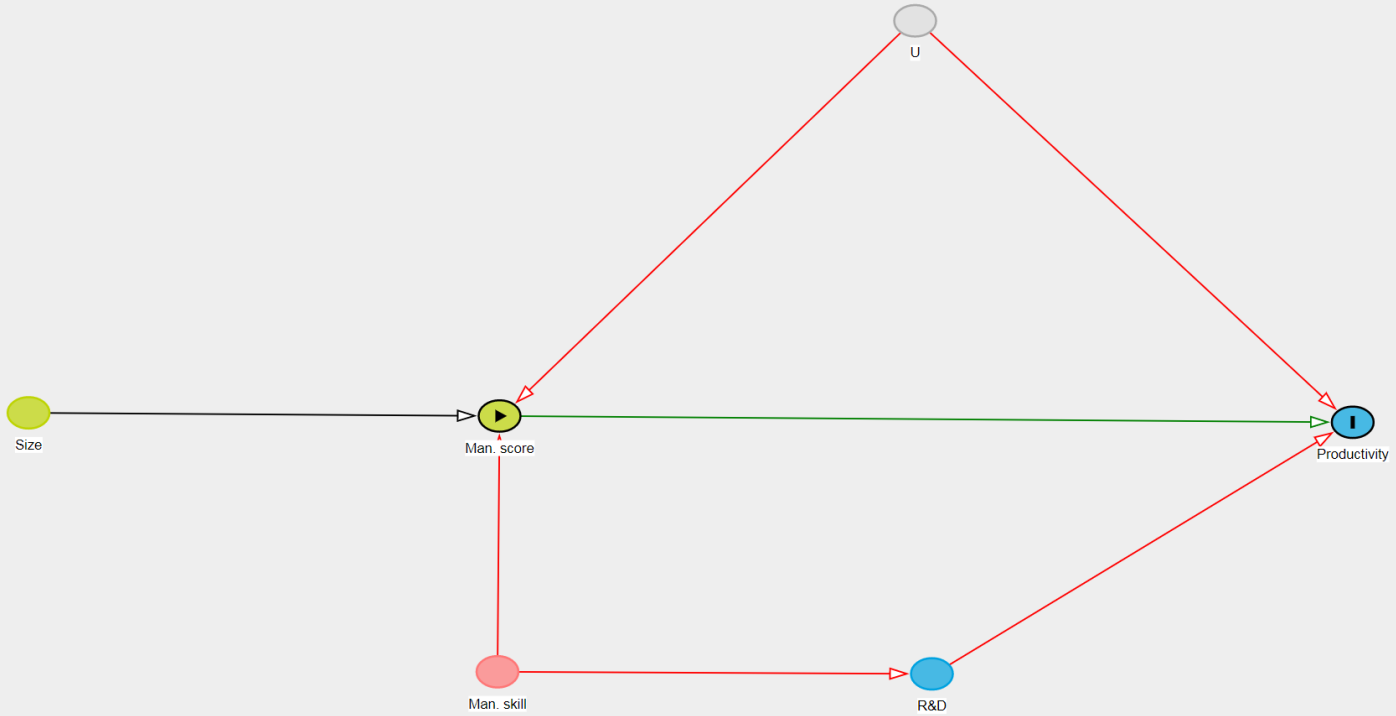
Summary

exposure(s) **Man. score**
outcome(s) **Productivity**
covariates **4**
causal paths **1**

Model | **Examples** | **How to ...** | **Layout** | **Help**



Causal effect identification

Instrumental variable

Instruments and conditional instruments:

- Man. skill | R&D
- Size

Testable implications

The model implies the following conditional independences:

- Man. score ⊥ R&D | Man. skill
- Size ⊥ Man. skill
- Size ⊥ R&D

Export R code

Model code

```
Man.%20score E @-0.862,0.036
Man.%20skill 1 @-0.865,0.225
Productivity O @0.562,0.040
R%26D 1 @-0.141,0.226
Size 1 @-1.648,0.033
U U @-0.169,-0.257

Man.%20score Productivity
Man.%20skill Man.%20score
R%26D
```

Diagram style

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View mode

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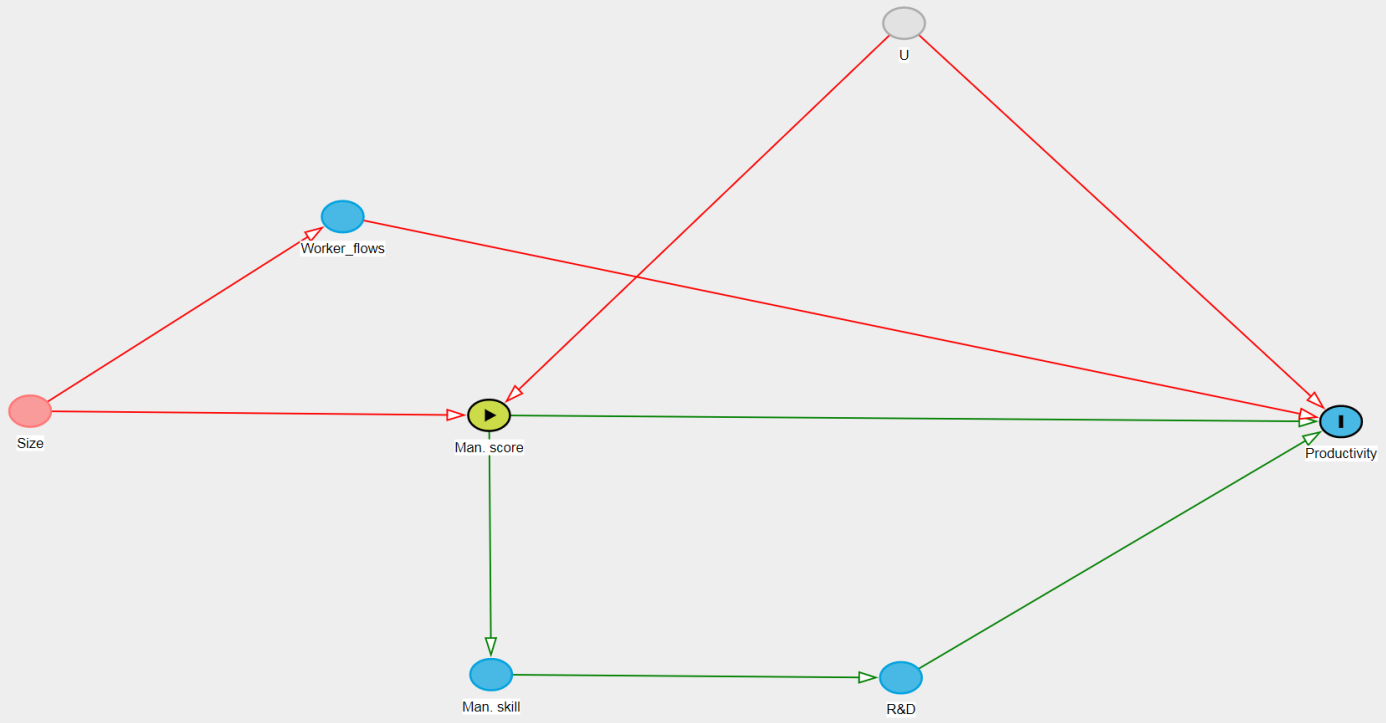
Summary

exposure(s)	**Man. score**
outcome(s)	**Productivity**
covariates	**5**
causal paths	**2**

Model | **Examples** | **How to ...** | **Layout** | **Help**



Causal effect identification

Instrumental variable

Instruments and conditional instruments:

- Size | Worker_flows

Testable implications

The model implies the following conditional independences:

- Man. score ⊥ R&D | Man. skill
- Man. score ⊥ Worker_flows | Size
- Productivity ⊥ Man. skill | Man. score, R&D
- Size ⊥ Man. skill | Man. score
- Size ⊥ R&D | Man. skill
- Size ⊥ R&D | Man. score
- Man. skill ⊥ Worker_flows | Size
- Man. skill ⊥ Worker_flows | Man. score
- R&D ⊥ Worker_flows | Size

Show all ...

Export R code

Model code

```
Man.%20score E @-0.862,0.036
Man.%20skill 1 @-0.858,0.228
Productivity O @0.562,0.040
R%26D 1 @-0.174,0.230
Size 1 @-1.629,0.033
U U @-0.169,-0.255
Worker_flows 1 @-1.107,-0.112

Man.%20score Man.%20skill
Productivity
```

You have modified the model code. To draw the modified model, click here: Update DAG

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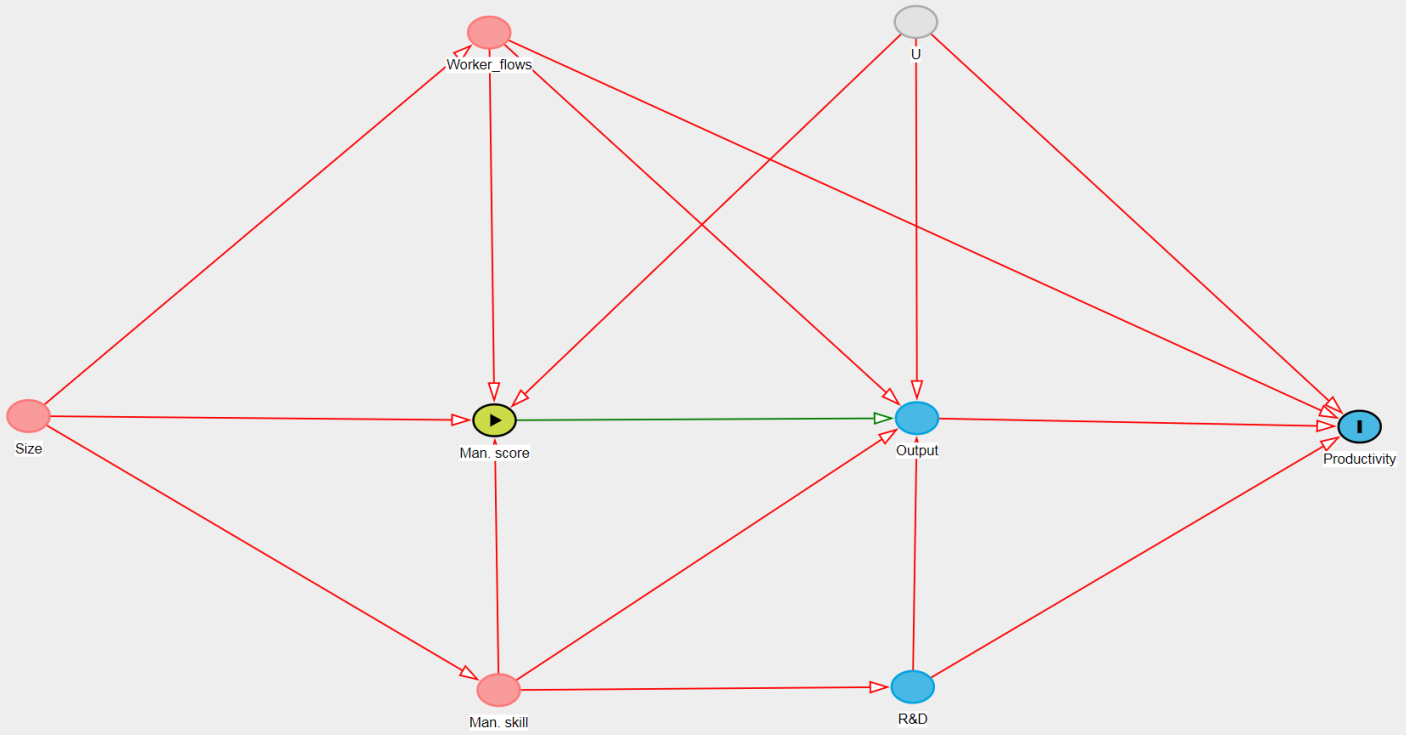
- biasing path

Summary

exposure(s) **Man. score**
outcome(s) **Productivity**
covariates **6**
causal paths **1**

Model | **Examples** | **How to ...** | **Layout** | **Help**



Causal effect identification

Instrumental variable

Instruments and conditional instruments:

- Size | R&D, Worker_flows, Man. skill

Testable implications

The model implies the following conditional independences:

- Man. score ⊥ R&D | Man. skill
- Size ⊥ R&D | Man. skill
- Man. skill ⊥ Worker_flows | Size
- R&D ⊥ Worker_flows | Size
- R&D ⊥ Worker_flows | Man. skill

Export R code

Model code

```
Man.%20score 1 @-0.862,0.036
Man.%20skill 1 @-0.855,0.232
Output 1 @-0.167,0.034
Productivity 0 @0.562,0.040
R%26D 1 @-0.174,0.230
Size 1 @-1.629,0.033
U U @-0.169,-0.255
Worker_flows 1 @-0.871,-0.247

Man.%20score Output
```

You have modified the model code. To draw the modified model, click here: Update DAG

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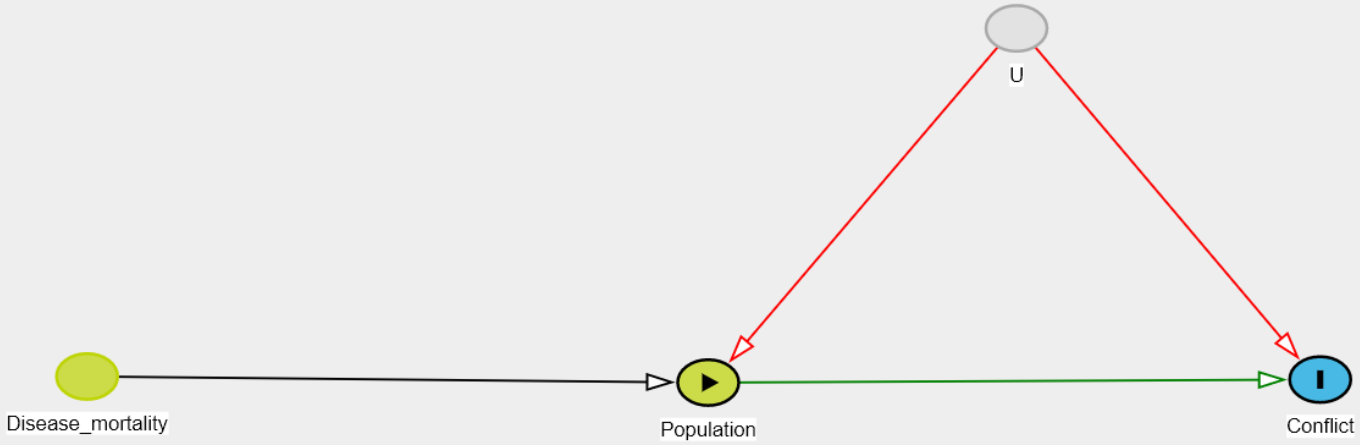

Causal effect identification

Instrumental variable

Instruments and conditional instruments:

- Disease_mortality

Testable implications

Either the model does not imply any conditional independencies or the implied ones are untestable due to unobserved variables.

Model code

```
Conflict O @0.957,0.585
Disease_mortality 1
@-1.951,0.575
Population E @-0.486,0.596
U U @0.241,-0.645

Disease_mortality Population
Population Conflict
U Conflict Population
```

Diagram style

- classic
- SEM-like

View mode

- normal
- moral graph
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Coloring

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Effect analysis

- atomic direct effects

Legend

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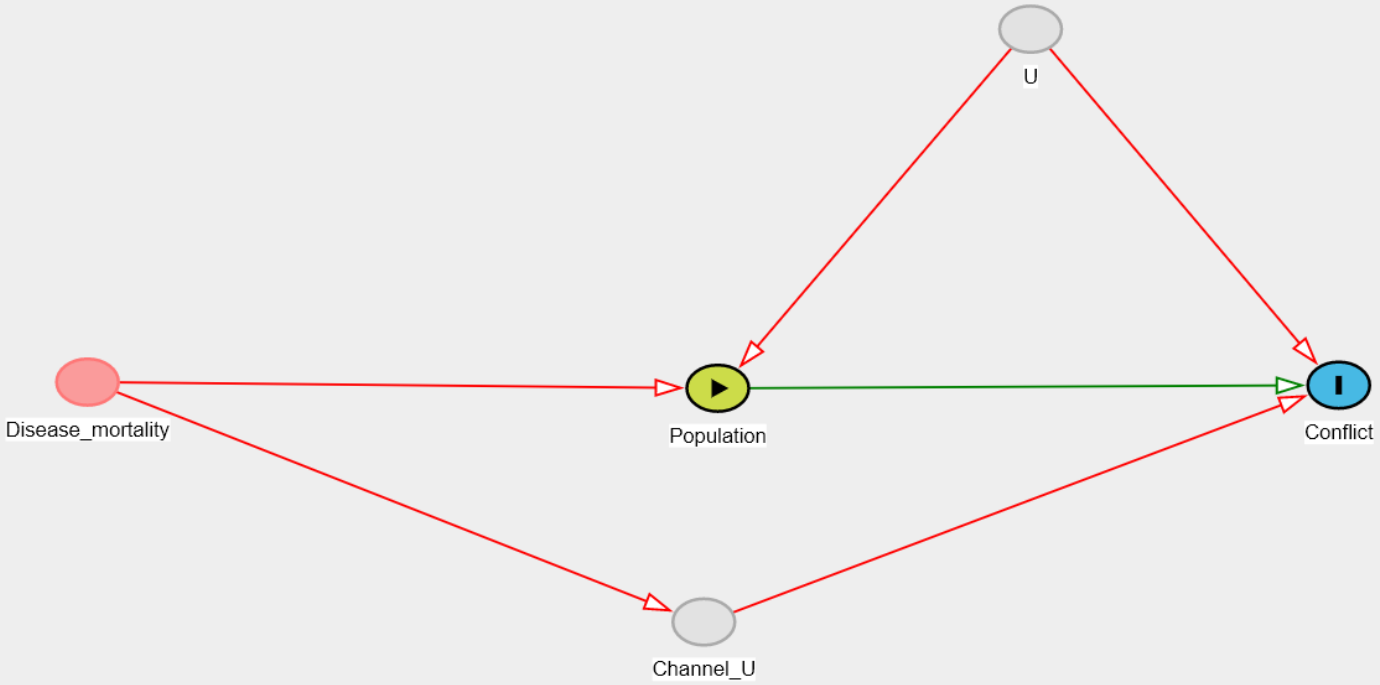
Summary

exposure(s) **Population**
outcome(s) **Conflict**

Model | **Examples** | **How to ...** | **Layout** | **Help**



Causal effect identification

Instrumental variable

There are no instruments or conditional instruments in this DAG.

Testable implications

Either the model does not imply any conditional independencies or the implied ones are untestable due to unobserved variables.

Model code

```
Channel_U U @-0.519,1.404
Conflict O @0.957,0.585
Disease_mortality 1
@-1.951,0.575
Population E @-0.486,0.596
U U @0.241,-0.645

Channel_U Conflict
Disease_mortality Channel_U
Population
```

Diagram style

- classic
- SEM-like

View mode

- normal
- moral graph
- correlation graph

Coloring

- causal paths
- biasing paths
- ancestral structure

Effect analysis

- atomic direct effects

Legend

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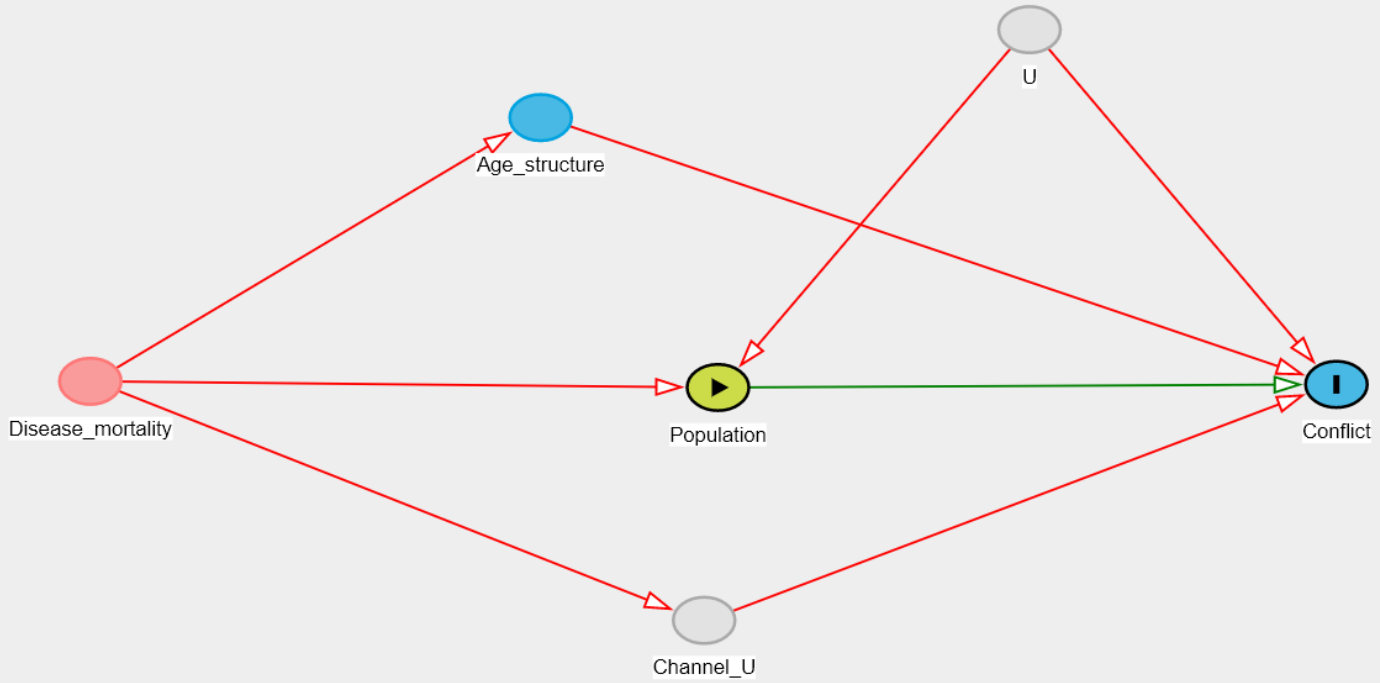
Summary

exposure(s) **Population**
outcome(s) **Conflict**

Model | **Examples** | **How to ...** | **Layout** | **Help**



Causal effect identification

Instrumental variable

There are no instruments or conditional instruments in this DAG.

Testable implications

The model implies the following conditional independences:

- Population ⊥ Age_structure | Disease_mortality

Export R code

Model code

```
Age_structure 1
@-0.900,-0.340
Channel_U U @-0.519,1.404
Conflict O @0.957,0.585
Disease_mortality 1
@-1.951,0.575
Population E @-0.486,0.596
U U @0.241,-0.645

Age_structure Conflict
```

References

- Hyytinen, A., Ilmakunnas, P. & Maliranta, M. 2016. Olley–Pakes productivity decomposition: computation and inference. Journal of the Royal Statistical Society Series A: Statistics in Society 179 (3), 749-761.
- Official Statistics of Finland (OSF): Finnish enterprises [e-publication]. Helsinki: Statistics Finland [referred: 2.12.2019].
- Textor, J., van der Zander, B., Gilthorpe, M.K., Liskiewicz, M. & Ellison, G. 2016. Robust causal inference using directed acyclic graphs: the R package 'dagitty'. International Journal of Epidemiology 45(6):1887-1894.

Thank you!