

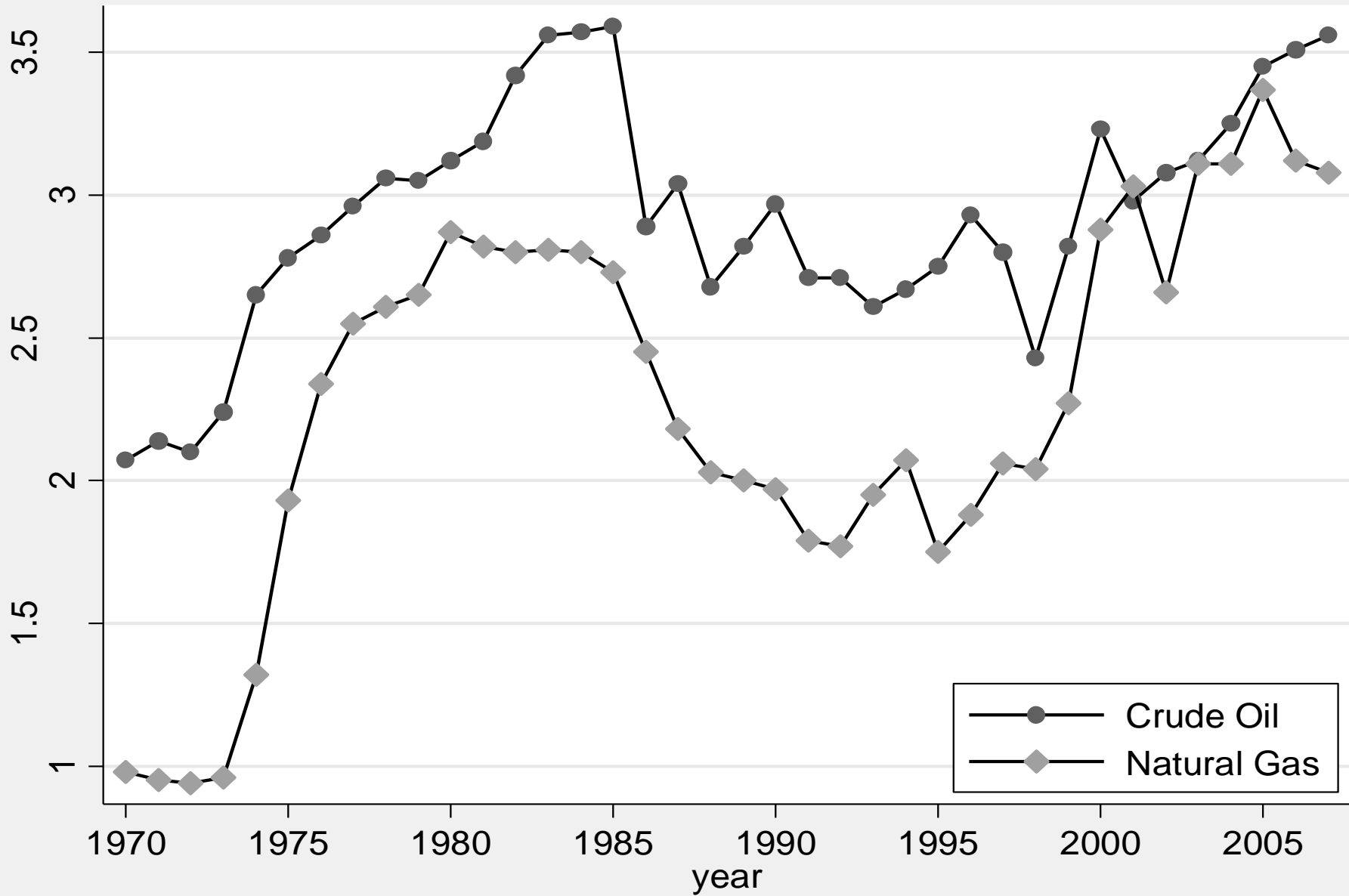
THE DISTRIBUTIONAL IMPACTS OF AN ENERGY BOOM IN WESTERN CANADA

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Data provided by Statistics Canada but analysis and views are of the author.

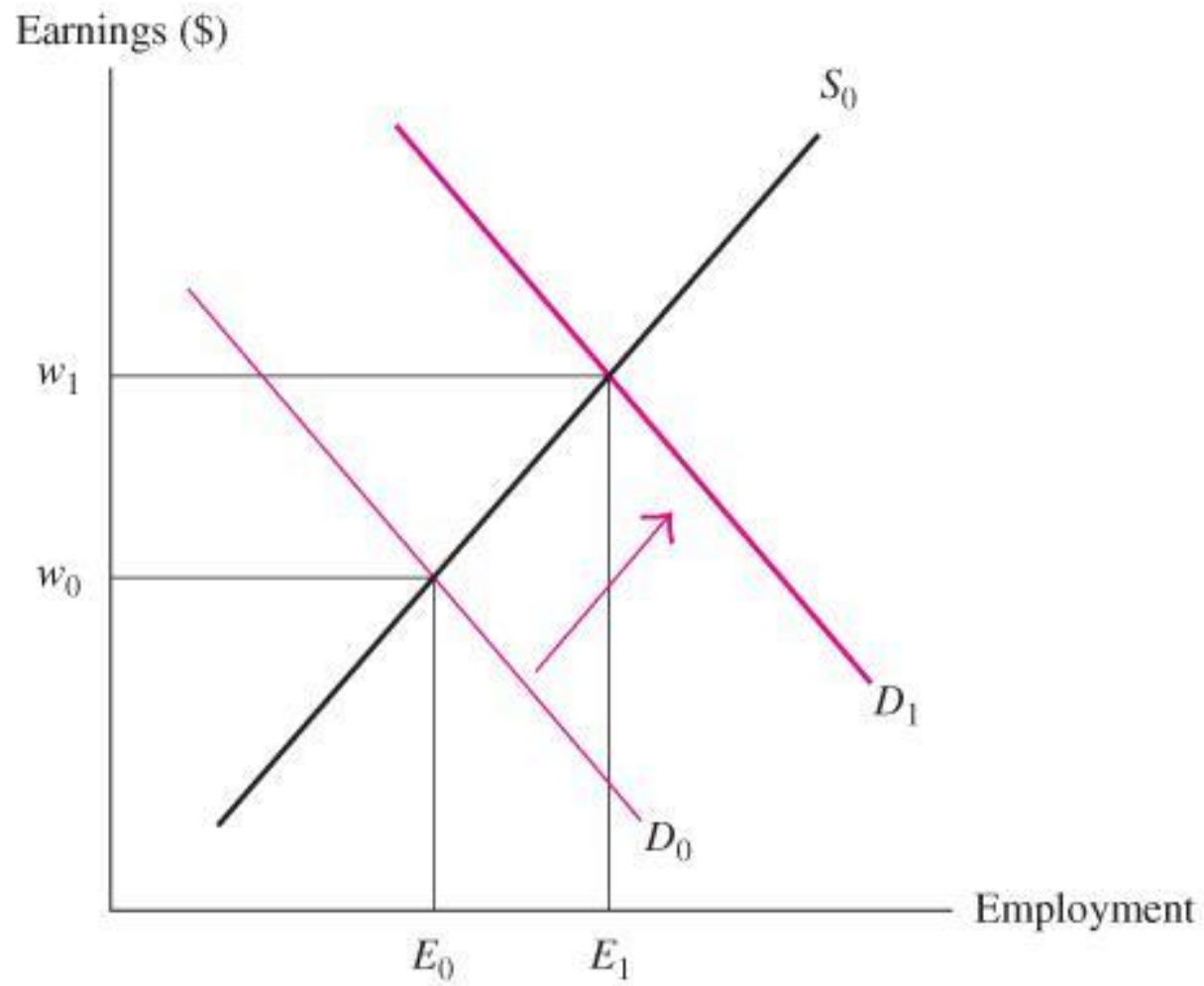
Introduction

- Canada is currently ranked third in the world in proven oil reserves, behind Venezuela and Saudi Arabia and ahead of Iran, Iraq, and Mexico.
- Much of Canada's oil resources are located within the four western provinces of Alberta, British Columbia, Manitoba, and Saskatchewan.
- The majority of oil production in Canada has recently switched from conventional crude oil to the mining and in situ recovery of bitumen from the oil sands.
- Alberta is home to the Athabasca, Cold Lake, and Peace River oil sands deposits. The total land size of these deposits is slightly larger than the state of Wisconsin.



Questions to be addressed

- What are the local labor market impacts of an energy boom or bust in Western Canada?
 - Total employment
 - Total earnings
 - Earnings per worker
 - Population
- What are the distributional impacts of an energy boom in Western Canada?
 - Percentiles of the earnings distribution
 - Poverty
- What does all of this mean for job creation?
 - Job multipliers



Measurement of these impacts

- We want to isolate the exogenous impacts of the labor demand shocks caused by an energy price boom (+) or bust (-).
- This identification uses a quasi-experimental design:
 - Each energy price shock is considered a treatment.
 - LLMs with energy resources receive this treatment.
 - But, we do not know what would have happened to these particular LLMs had the boom or bust not occurred.
 - We need a good counter-factual to fill this in, which is provided by similar LLMs but without energy resources.
 - Those LLMs will not receive the treatment.
- Through the differential changes to our outcomes of interest, both before and after the shock, between areas with and without resources, we can infer the magnitude of each shock across the directly and indirectly impacted industries.

Data source

- Data are from the Canadian Census of Population for 1971, 1981, 1991, 1996, and 2006.
- These data contain the large numbers of individuals necessary to properly represent each LLM.
- Detailed geo-codes to define the LLMs and detailed industry codes were needed (especially for energy extraction), which are not available in the public-access files.
- Restricted-access files were available for 1996 and 2006 and permission was granted to the local Research Data Centre.
- Commission files with the necessary level of variation were obtained from Statistics Canada for the remaining years of 1971, 1981, and 1991 on a cost-recovery basis.

Local labor markets

Province

(AB: 1, BC: 1, MN: 1, SK: 1) [Total = 4]

Employment Insurance Regions

(AB: 4, BC: 6, MN: 3, SK: 4) [Total = 17]

Economic Regions

(AB: 8, BC: 8, MN: 8, SK: 6) [Total = 30]

Census Divisions

(AB: 19, BC: 28, MN: 23, SK: 18) [Total = 88]

Census Subdivisions

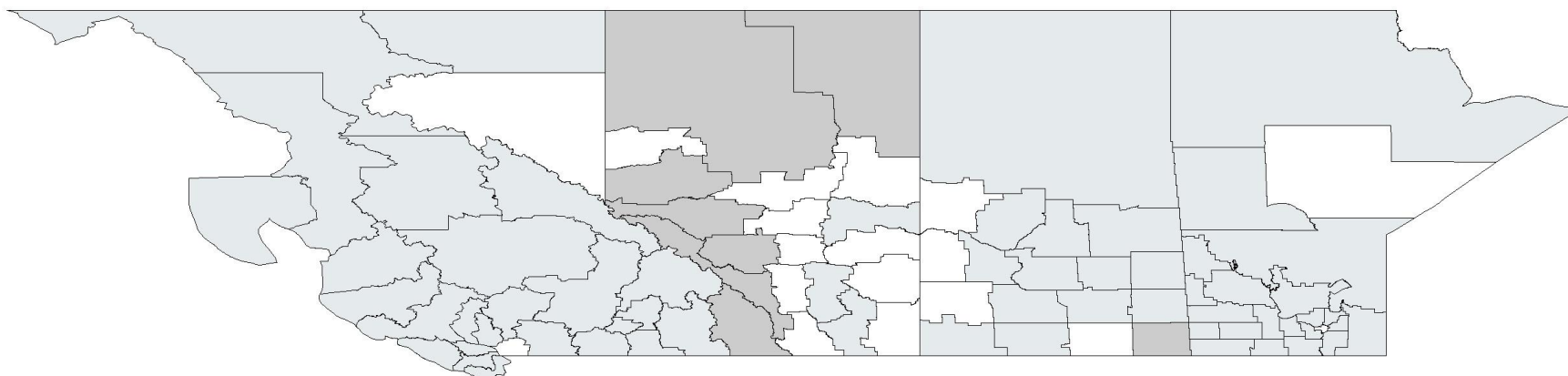
(AB: 452, BC: 816, MN: 298, SK: 1,002) [Total = 2,568]

Treatment and comparison groups

- These definitions are based on the fraction of total earnings attributed to the energy extraction industry that is received in a local labor market. This has been used in the literature.
- The treatment group is constructed from LLMs which derive 10% or more of their total earnings from energy extraction.
- The comparison group is constructed from LLMs which derive less than 5% of their total earnings from energy extraction in the base period and do not exceed 10% in any post-period.
- Those LLMs which are between 5 and 10%, or are “switchers”, or are major cities containing more than 250,000 inhabitants, are all dropped from the analysis.
- In an alternative specification, neighboring LLMs to the treatment LLMs are also dropped from the comparison group.

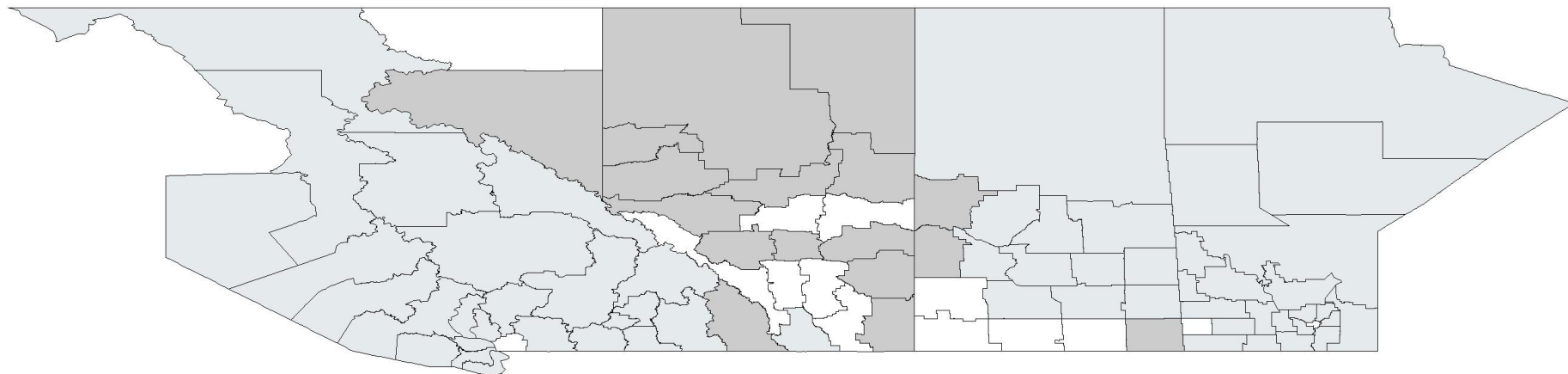
Census Divisions within the Treatment Group, 1971-1991

Rank	CD No.	Province	Main city / town	Fraction of total earnings from EE
1	4818	AB	Grande Cache	0.391
2	4816	AB	Fort McMurray	0.323
3	4809	AB	Rocky Mountain House	0.195
4	4815	AB	Banff	0.171
5	4701	SK	Estevan	0.141
6	4814	AB	Edson	0.114
7	4817	AB	Slave Lake	0.111
8	5901	BC	East Kootenay	0.095



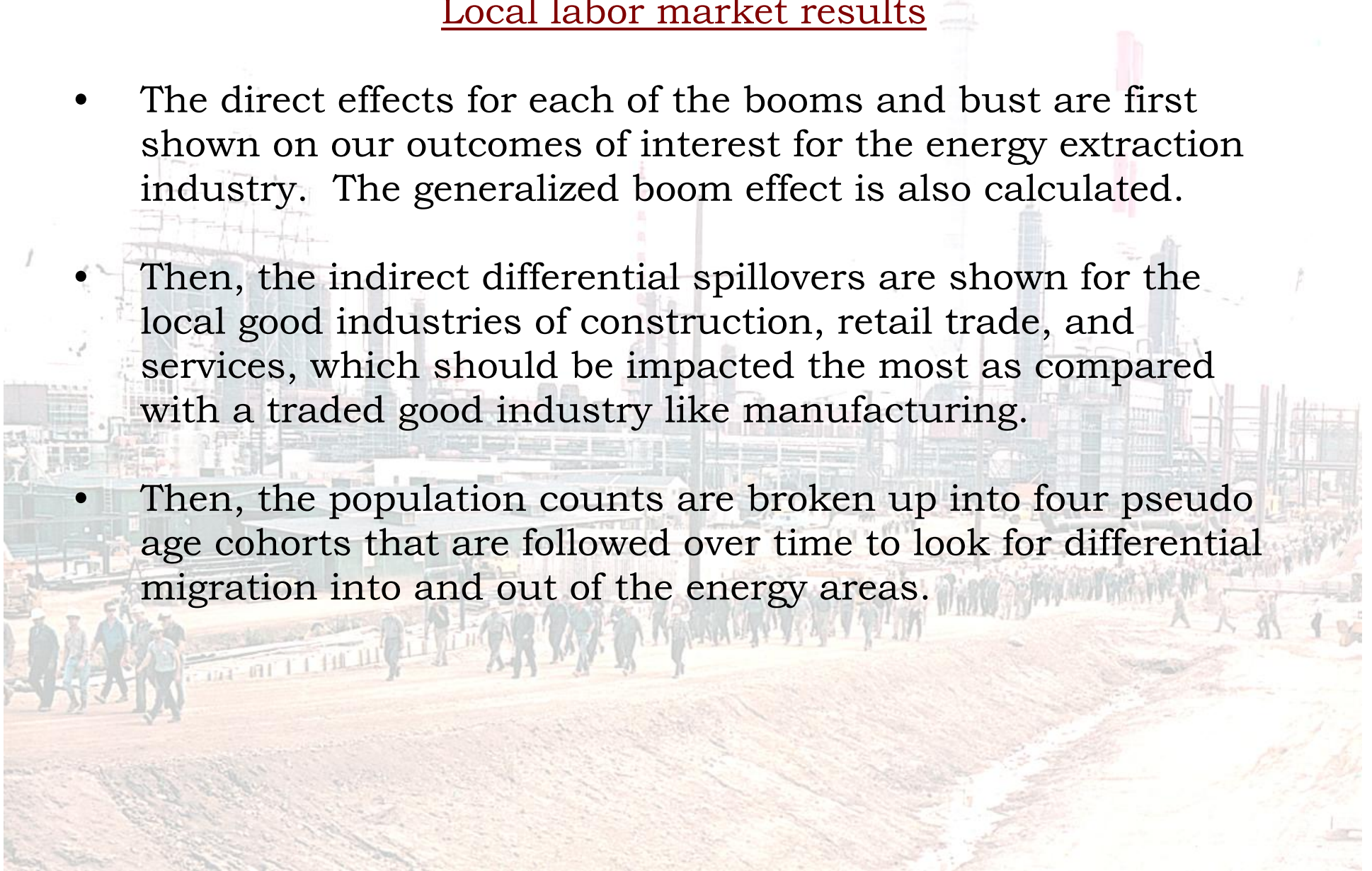
Census Divisions within the Treatment Group, 1996-2006

Rank	CD No.	Province	Main city / town	Fraction of total earnings from EE
1	4816	AB	Fort McMurray	0.560
2	4818	AB	Grande Cache	0.411
3	4809	AB	Rocky Mountain House	0.267
4	4814	AB	Edson	0.264
5	4807	AB	Stettler	0.196
6	5955	BC	Peace River	0.177
7	4701	SK	Estevan	0.177
8	4713	SK	Kindersley	0.167
9	4717	SK	Lloydminster	0.158
10	5901	BC	East Kootenay	0.154
11	4817	AB	Slave Lake	0.144
12	4804	AB	Hanna	0.139
13	4812	AB	St. Paul	0.122
14	4808	AB	Red Deer	0.121
15	4819	AB	Grande Prairie	0.108
16	4813	AB	Athabasca	0.105
17	4801	AB	Medicine Hat	0.103



Local labor market results

- The direct effects for each of the booms and bust are first shown on our outcomes of interest for the energy extraction industry. The generalized boom effect is also calculated.
- Then, the indirect differential spillovers are shown for the local good industries of construction, retail trade, and services, which should be impacted the most as compared with a traded good industry like manufacturing.
- Then, the population counts are broken up into four pseudo age cohorts that are followed over time to look for differential migration into and out of the energy areas.



Growth in Employment and Earnings for Energy Extraction Industries within Treatment Areas Only, 1971-2006

Log changes in (Treatment only)	First Boom 1971 to 1981	First Bust 1981 to 1991	Second Boom 1996 to 2006	General Boom 1971 to 2006
Energy Extraction:				
Total Employment	0.892*** (0.265)	-0.061 (0.345)	0.467** (0.228)	0.566** (0.246)
Total Earnings	1.214*** (0.292)	0.001 (0.400)	0.683** (0.256)	0.837** (0.306)
Earnings per worker	0.323*** (0.049)	0.061 (0.073)	0.215*** (0.047)	0.270*** (0.081)

Measurement of differential spillovers

- Differential spillovers into local good industries:

$$\ln(E_{cpt}) - \ln(E_{cpt-1}) = \beta \cdot Treat_{cp} + prov_p \cdot \theta + \varepsilon_{cp}$$

- where:
 - $\ln(E_{cpt})$ is the logged labor market outcome of interest.
 - $Treat_{cp}$ is a binary indicator (1 if the LLM is in the treatment group, 0 if the LLM is in the comparison group, ‘.’ otherwise)
 - $prov_p$ represents provincial fixed effects.
 - c , p , and t refer to CD, province, and year respectively.
- Run between two years at a given time for each of the booms and bust and over both booms for the generalized boom effect.

Differential Growth in Employment and Earnings for All Local Goods Industries
Between Treatment and Comparison Areas, 1971-2006

Log changes in (Treat - Comparison)	First Boom 1971 to 1981	First Bust 1981 to 1991	Second Boom 1996 to 2006	General Boom 1971 to 2006
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Construction:

Total Employment	0.529** (0.231)	-0.088 (0.133)	0.444*** (0.072)	0.507*** (0.129)
Total Earnings	0.718*** (0.247)	-0.260* (0.146)	0.790*** (0.123)	0.800*** (0.171)
Earnings per worker	0.191*** (0.030)	-0.168*** (0.036)	0.345*** (0.067)	0.293*** (0.076)

Differential Growth in Employment and Earnings for All Local Goods Industries Between Treatment and Comparison Areas, 1971-2006

Log changes in (Treat - Comparison)	First Boom 1971 to 1981	First Bust 1981 to 1991	Second Boom 1996 to 2006	General Boom 1971 to 2006
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Retail Trade:

Total Employment	0.663*** (0.182)	0.101* (0.053)	0.087** (0.038)	0.372*** (0.124)
Total Earnings	0.781*** (0.206)	0.053 (0.047)	0.272*** (0.064)	0.535*** (0.133)
Earnings per worker	0.122** (0.048)	-0.049 (0.035)	0.184*** (0.039)	0.165*** (0.042)

Differential Growth in Employment and Earnings for All Local Goods Industries Between Treatment and Comparison Areas, 1971-2006

Log changes in (Treat - Comparison)	First Boom 1971 to 1981	First Bust 1981 to 1991	Second Boom 1996 to 2006	General Boom 1971 to 2006
All Services:				
Total Employment	0.619*** (0.161)	0.210*** (0.059)	0.212*** (0.036)	0.413*** (0.103)
Total Earnings	0.800*** (0.182)	0.121** (0.063)	0.432*** (0.059)	0.633*** (0.115)
Earnings per worker	0.179*** (0.041)	-0.088*** (0.025)	0.219*** (0.026)	0.219*** (0.033)

Differential Growth in Population Across All Cohorts, 1971-2006

Log changes in (Treat - Comparison)	First Boom 1971 to 1981	First Bust 1981 to 1991	Second Boom 1996 to 2006
Aged 15-24 (to 25-34)	0.004 (0.322)	-0.021 (0.046)	0.020 (0.053)
Aged 25-34 (to 35-44)	0.003 (0.284)	-0.073** (0.029)	0.040 (0.032)
Aged 35-44 (to 45-54)	-0.016 (0.251)	-0.073** (0.029)	-0.008 (0.026)
Aged 45-54 (to 55-64)	-0.077 (0.315)	-0.139*** (0.032)	-0.037 (0.024)

Distributional results

- Now we turn our attention to only the latest boom to further ask the question: Who gains from energy booms? Specifically, who gains across the earnings distribution?
- First, we use the same quasi-experimental design to examine the impacts of the boom at five different earnings percentiles (P10, P25, Median, P75, and P90).
- Then, we look more closely at the lower end of the earnings distribution using the number of individuals below the low-income cut-off (LICO) measure as the poverty outcome.
- Then, our poverty findings are compared with the provincial trends in the LICO poverty rate to broaden the story.

Growth in Earnings Across the Distribution for Energy Extraction Industries within Treatment Areas Only, 1996-2006

Log changes in (Treatment only)	Percentiles of the Earnings Distribution				
	P10	P25	Median	P75	P90
Energy Extraction:					
Earnings per worker (using treat)	0.015 (0.123)	0.045 (0.091)	0.092 (0.265)	0.198*** (0.040)	0.255** (0.034)
Earnings per worker (using treat2)

Growth in Earnings Across the Distribution for All Local Goods Industries Between Treatment and Comparison Areas, 1996-2006

Log changes in (Treat - Comparison)	Percentiles of the Earnings Distribution				
	P10	P25	Median	P75	P90
Construction:					
Earnings per worker (using treat)	0.336*** (0.087)	0.226*** (0.065)	0.227*** (0.030)	0.257*** (0.032)	0.275*** (0.037)
Earnings per worker (using treat2)	0.346*** (0.086)	0.231*** (0.066)	0.228*** (0.029)	0.260*** (0.031)	0.276*** (0.036)

Growth in Earnings Across the Distribution for All Local Goods Industries Between Treatment and Comparison Areas, 1996-2006

Log changes in (Treat - Comparison)	Percentiles of the Earnings Distribution				
	P10	P25	Median	P75	P90
Retail Trade:					
Earnings per worker (using treat)	0.223** (0.098)	0.101 (0.064)	0.162*** (0.034)	0.116*** (0.037)	0.137*** (0.027)
Earnings per worker (using treat2)	0.253*** (0.092)	0.134** (0.059)	0.174*** (0.032)	0.124*** (0.036)	0.149*** (0.024)

Growth in Earnings Across the Distribution for All Local Goods Industries Between Treatment and Comparison Areas, 1996-2006

Log changes in (Treat - Comparison)	Percentiles of the Earnings Distribution				
	P10	P25	Median	P75	P90
All Services:					
Earnings per worker (using treat)	0.336*** (0.098)	0.308*** (0.064)	0.227*** (0.034)	0.183*** (0.023)	0.172*** (0.027)
Earnings per worker (using treat2)	0.349*** (0.058)	0.319*** (0.039)	0.232*** (0.032)	0.185*** (0.023)	0.176*** (0.026)

Reduction in the Number of Individuals Below the Low Income Cut Off (LICO)
Between Treatment and Comparison Areas, 1996-2006

Log changes in (Treat - Comparison)	Second Boom 1996 to 2006
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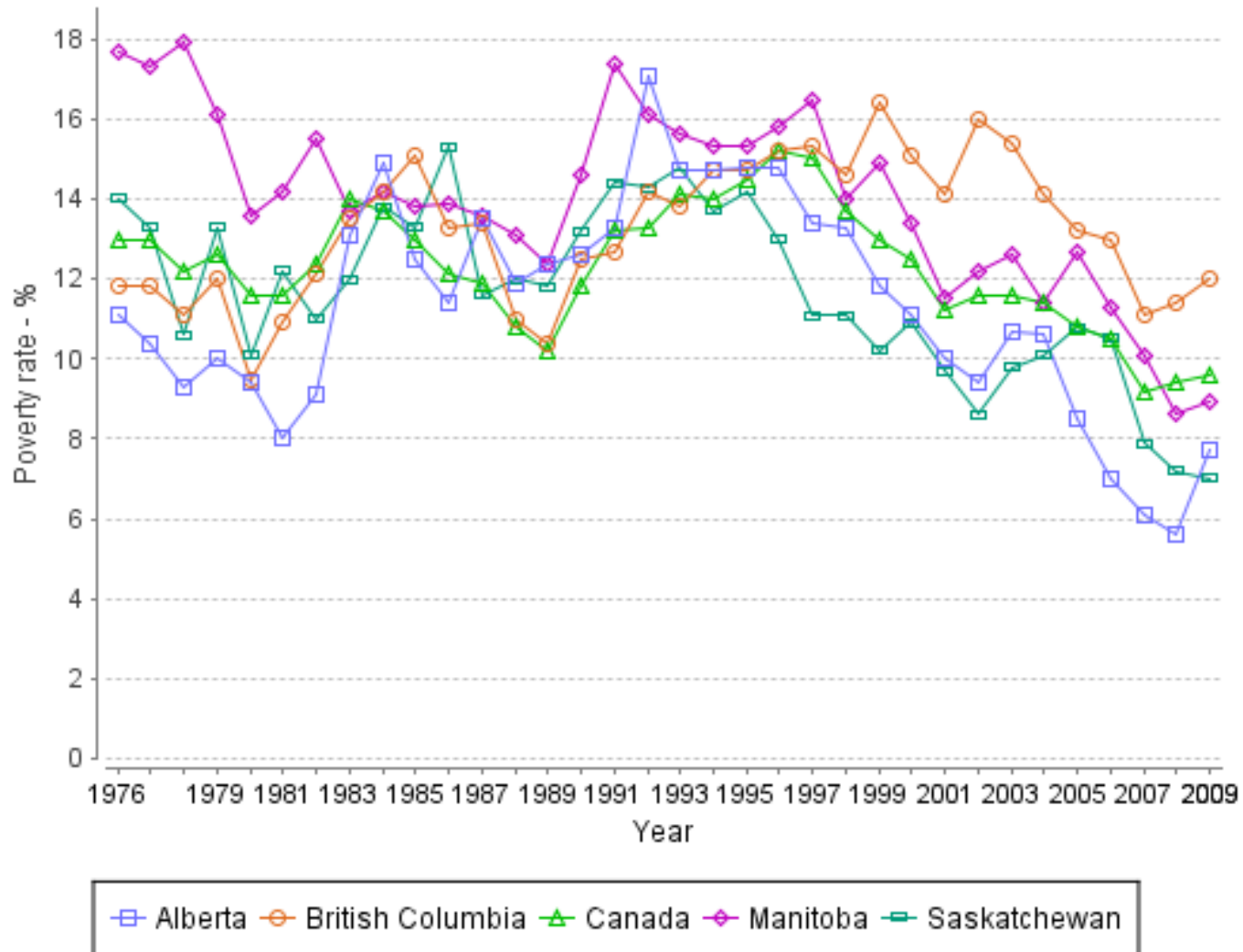
Population:

# of Poor Individuals (using treat)	-0.328*** (0.045)
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# of Poor Individuals (using treat2)	-0.339** (0.043)
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Poverty Rates by Province

Poverty Measure: After-tax LICO



Job creation in local labor markets

- To identify the magnitude of the employment spillover effects, we examine the job-for-job or job multiplier effect in LLM:

$$\Delta \ln(Emp_{cp}^{NE}) = \alpha + \beta \cdot [\Delta \ln(Emp_{cp}^{EE}) \cdot W_{cp}] + \varepsilon_{cp}$$

- where $W_{cp} = Emp_{cpt-1}^{EE} / Emp_{cpt-1}^{NE}$ which is the ratio of energy extraction to non-energy extraction employment in the previous period. This allows the beta coefficient to be interpreted as number of jobs created or lost in a specific non-energy sector for every energy extraction job created.
- Run between two years at a given time for each of the booms (no bust) and over both booms for the generalized boom effect. Treatment is used as the instrument to obtain IV estimates.

Local Job Multipliers with Treatment as IV for the Boom Periods, 1971-2006

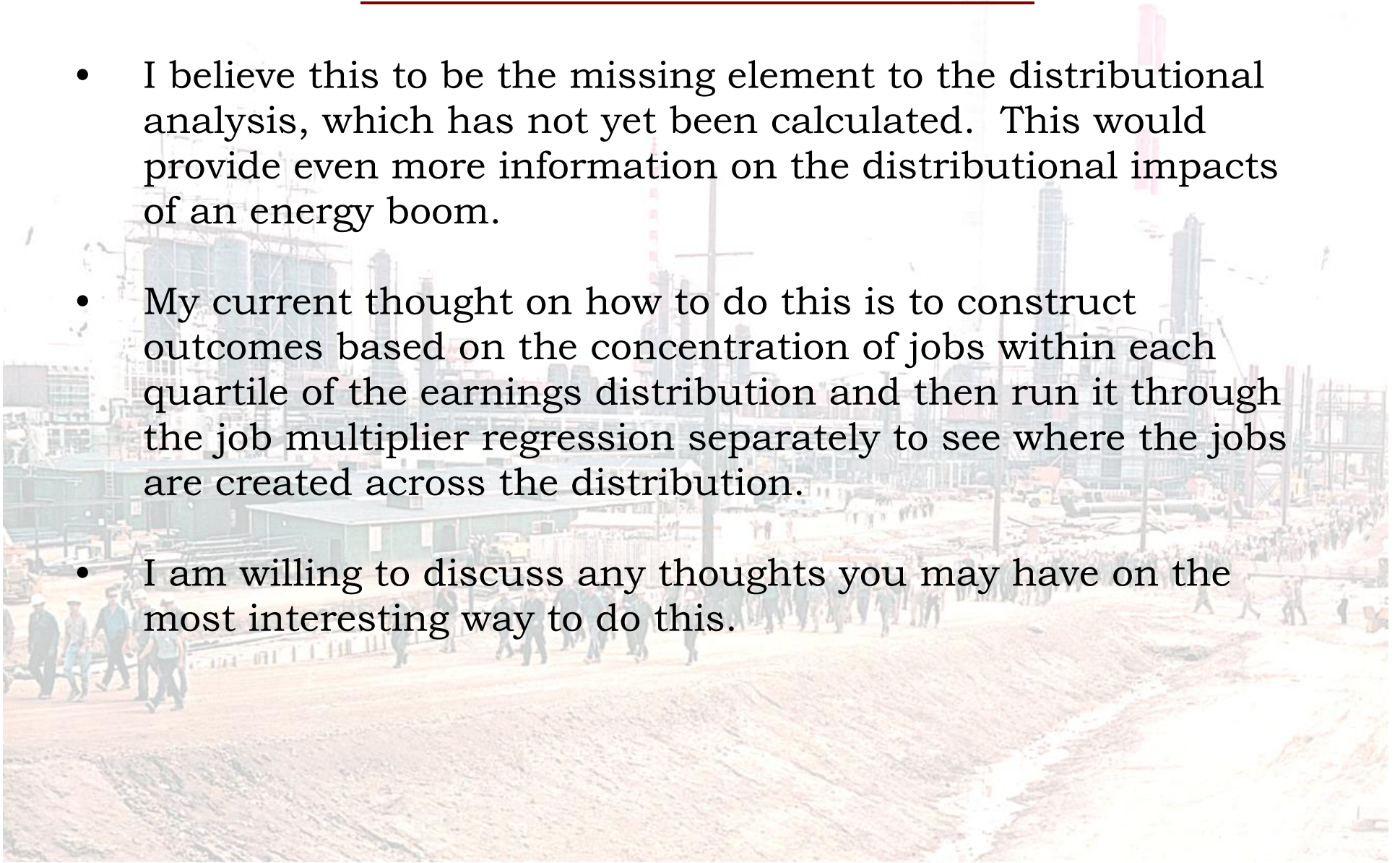
Log changes in (with treat as IV)	First Boom 1971 to 1981	Second Boom 1996 to 2006	General Boom 1971 to 2006
Construction	0.122 (0.145) [35.26]	0.401** (0.154) [33.45]	0.287* (0.147) [34.62]
Retail Trade	0.171*** (0.057) [39.23]	0.219** (0.105) [24.80]	0.200** (0.092) [39.56]
All Services	0.357** (0.160) [51.98]	0.707** (0.279) [33.45]	0.459** (0.194) [48.22]
Manufacturing	-0.000 (0.042) [25.23]	0.094 (0.059) [20.04]	-0.000 (0.057) [33.09]

Local Job Multipliers for Boom Periods with an Alt Comp Group, 1971-2006

Log changes in (with treat2 as IV)	First Boom 1971 to 1981	Second Boom 1996 to 2006	General Boom 1971 to 2006
Construction	0.103 (0.144) [30.08]	0.387** (0.152) [25.82]	0.256* (0.142) [29.08]
Retail Trade	0.156** (0.060) [31.92]	0.143 (0.111) [19.17]	0.186* (0.096) [32.37]
All Services	0.343** (0.165) [42.43]	0.542** (0.271) [25.09]	0.434** (0.201) [39.58]
Manufacturing	-0.001 (0.042) [20.43]	0.130** (0.063) [15.67]	0.001 (0.057) [26.86]

Job creation across the distribution

- I believe this to be the missing element to the distributional analysis, which has not yet been calculated. This would provide even more information on the distributional impacts of an energy boom.
- My current thought on how to do this is to construct outcomes based on the concentration of jobs within each quartile of the earnings distribution and then run it through the job multiplier regression separately to see where the jobs are created across the distribution.
- I am willing to discuss any thoughts you may have on the most interesting way to do this.



Summary of the local labor market results

- The direct impacts of each boom lead to substantial gains in earnings and employment within energy extraction industry, while the bust period shows stagnation for this industry.
- The indirect impacts to the non-energy sectors are smaller than energy extraction, but are significant in both boom periods for all local good industries. There are also losses experienced during the bust, at least in earnings per worker.
- Differential population changes are only significant (and are negative) during the bust.
- Job creation in energy extraction does exhibit modest positive spillovers into local sector job creation in construction, retail trade, and especially services.

Summary of the distributional results

- The direct impacts of the latest boom lead to gains in the upper half of the earnings distribution, while leaving the middle and lower portions of the distribution virtually unchanged for the energy extraction industry.
- The indirect impacts to the non-energy sectors lead to gains across the earnings distribution, with the largest gains coming at the bottom of the distribution and most often tapering off in the movement up the distribution.
- The reduction of poverty attributed to the latest energy boom is substantial. That said, the caveat must be kept in mind that busts most likely cause differential increases in poverty, so this large reduction may just be offsetting an increase.
- Job creation may be calculated across the distribution as well. Again, any thoughts on how best to do this are welcome.

