# DIGITAL CURRENCY/ ANALOG ECONOMY: BITCOIN'S IMPACTS

*what does REMI say?* *sm*

**Presented by Peter Evangelakis, Ph.D., Economist**
**Regional Economic Models, Inc.**

# What is Cryptocurrency?



Photo: Shutterstock

- ☐ Cryptocurrency: A digital asset that serves as a medium of exchange
  - ◘ Relies on cryptography for secure transactions and creation of additional units
  - ◘ Established in 2009, Bitcoin is the first and best-known decentralized cryptocurrency
  - ◘ Over the past several years, other cryptocurrencies have emerged as alternatives
    - ■ Ethereum
    - ■ Litecoin

*what does REMI say?* sm

Sources: Wikipedia, CNET

# Share of Ownership of Bitcoin

| Bitcoin Balance | # of Addresses | % of Addresses | # of Bitcoins Owned | % of all Bitcoins |
|---|---|---|---|---|
| 0 - 0.001 | 147,827,318 | 97.36% | 977.728 | 0.01% |
| 0.001 - 0.01 | 1,343,688 | 0.88% | 5,048.904 | 0.03% |
| 0.01 - 0.1 | 1,497,369 | 0.99% | 43,719.982 | 0.28% |
| 0.1 - 1 | 695,664 | 0.46% | 232,471.638 | 1.49% |
| 1 - 10 | 339,814 | 0.22% | 944,171.963 | 6.04% |
| 10 - 100 | 121,303 | 0.08% | 4,104,283.667 | 26.27% |
| 100 - 1,000 | 15,372 | 0.01% | 3,515,068.854 | 22.50% |
| 1,000 - 10,000 | 1,700 | 0.00% | 3,516,536.296 | 22.51% |
| 10,000 - 100,000 | 120 | 0.00% | 3,115,655.063 | 19.94% |
| 100,000 - 21,000,000 | 2 | 0.00% | 144,462.818 | 0.92% |
| Total | 151,842,350 | 100% | 15,622,396.913 | 100% |

*what does REMI say?* [sm]

# Bitcoin's Rise (and Fall?)

□ Bitcoin's price rose to nearly $20,000 by Dec 2017

□ The price fell, and is now just above $10,000

□ The surge, followed by the 50% decline, raises question: *Is Bitcoin a bubble?*

Source: CoinStopLoss

# U.S. Share of Bitcoin Market

- $174 Billion market cap of Bitcoin Worldwide (February 2018)
  - US is 29.64% of this market as of December 2017
- US Market Share: ~$52 Billion

*what does REMI say?* [sm]

# History of Bubbles

**Asset bubble:** *Price exceeds historical norms and/or intrinsic value*



*Semper Augustus*, most expensive tulip sold during bubble (anonymous watercolor, 17th century)

1. **Dutch Tulip Bubble (1636-1637):** In the first recorded speculative bubble, futures for fashionable tulips soared and then collapsed
2. **South Sea Bubble (1720s):** Investors scooped up shares of Britain's South Sea Company, as directors hyped the riches of a faraway region
3. **Poyais Scheme (1821-1837):** Gen. Gregor MacGregor, Scottish adventurer, lured investors with his stories "Poyais", a fictional Central American territory
4. **Stock Market Boom (1920s):** Feverish speculation helped fuel stocks in the Roaring Twenties; a slowing economy triggered the Wall Street Crash of 1929 and ushered in the Great Depression
5. **Dot-com Bubble (1990s):** Early enthusiasm for early Internet companies drove up NASDAQ; index crashed in early 2000s
6. **Housing Bubble (2000s):** House prices skyrocketed, while subprime lending and condo flipping helped fuel the mania

*what does REMI say?* *sm*

Sources: Investopedia, Stanford Business School, Wikipedia

# Value of Cryptocurrency

- While the price is volatile, the asset's popularity could still have effects on:
  - Commerce
  - Financial services
  - Economic development
  - Energy prices
  - Supply chain technology
  - And more…

- Focus: Commerce, economic development, energy prices

Source: CardFellow

# Cryptocurrency & Commerce

- Some major organizations accept Bitcoin, incl:
  - Overstock, Expedia, Microsoft, Tesla, OkCupid
- Cryptocurrency payment methods lower transaction fees
  - Average credit card processing cost for retailers:
    - 1.95% - 2% on site; 2.30% - 2.50% in online stores
  - Bitpay, Litepay have 0% transaction fees

**01**

**Order**
Order your card and pay the order fee. Once your ID has been verified, we'll ship your card to your home address.

**02**

**Activate**
When your card arrives in the mail, activate the card at litepay.us/card/activate and create a cardholder account.

**03**

**Load**
Load your card with dollars using any Litecoin wallet, or via direct deposit through your employer.

**04**

**Spend**
Spend dollars anywhere debit cards are accepted, or withdraw cash from any compatible ATM.

Source: Lifewire, CNBC, Litepay, Bitpay

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# Bitcoin Mining



Centralized mining operation
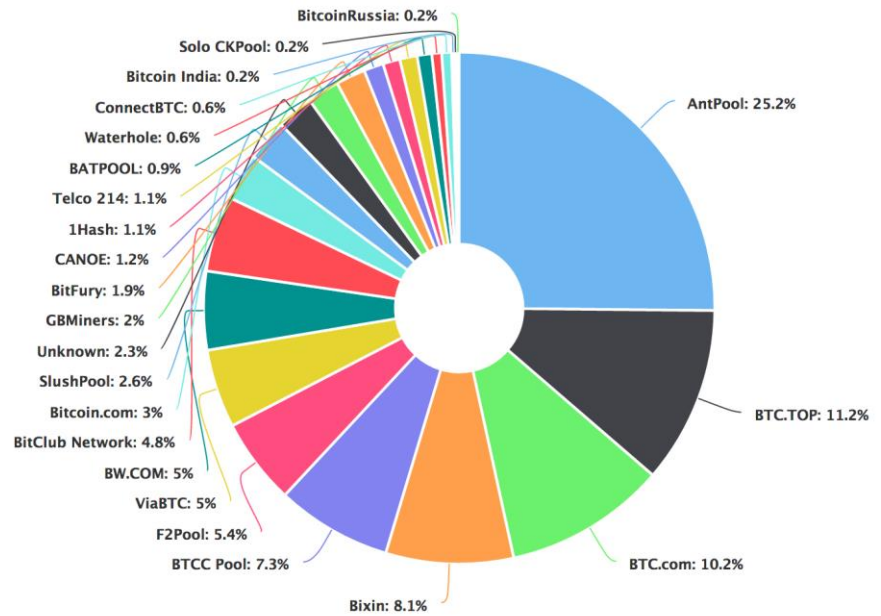


Market share of mining pools

*what does REMI say?* *sm*

# Cost: Energy Demand

**REMI**

### Bitcoin Energy Consumption Index Chart

Click and drag in the plot area to zoom in

Estimated TWh per Year

60 — 50 — 40 — 30 — 20 — 10 — 0

Apr '17    Jul '17    Oct '17    Jan '18

Zoom   1m   3m   6m   YTD   1y   **All**

From   Feb 10, 2017   To   Feb 18, 2018

BitcoinEnergyConsumption.com
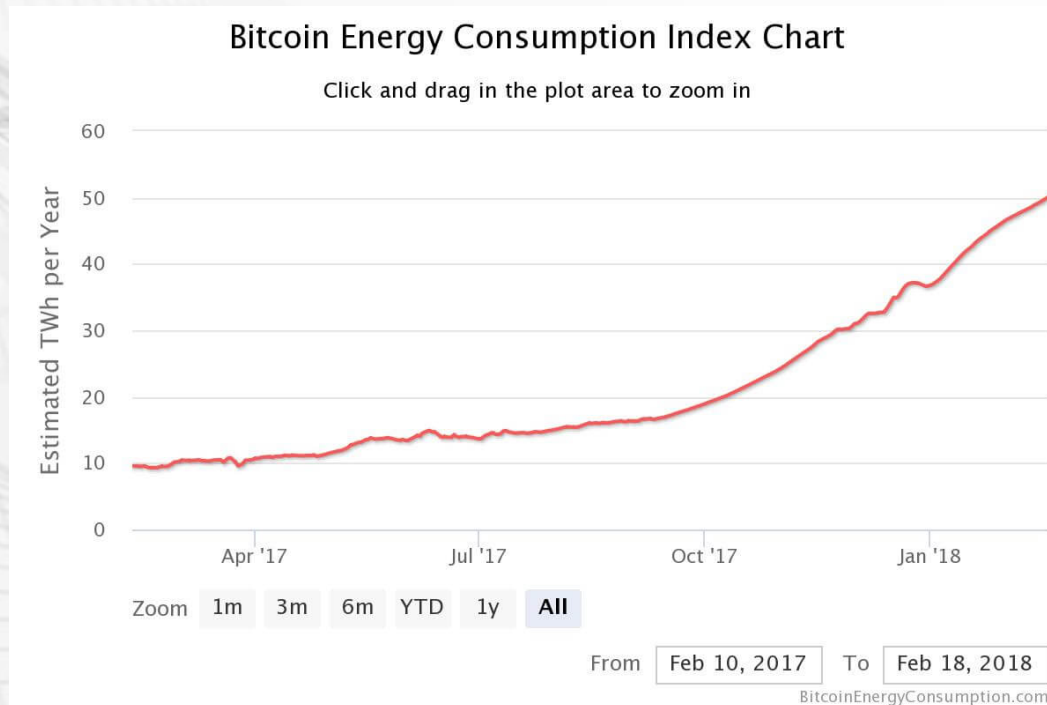
Graphic: Digiconomist

☐ Computation required for Bitcoin demands massive amounts of electricity

☐ Digiconomist, a cryptocurrency blog, estimates consumption:

- ◘ Energy demand rose sharply over past year
- ◘ Bitcoin now surpasses Portugal, Singapore in energy use
- ◘ Litecoin uses simpler computations, mining requires less energy

*what does REMI say? ˢᵐ*

# Regional Operation Impacts

☐ Energy effects depend on region's capacity

- ▫ Cryptocurrency miners have flocked to Wenatchee, Washington due to cheap hydroelectric power

- ▫ Regions with more constrained capacity could see prices increase as a result of intensive mining

Source: CNBC

# Regional Electricity Capacity



- ☐ Regions with low-cost energy attract cryptocurrency miners
  - ☐ Miners are flocking to central Washington State due to cheap hydroelectric power
    - Electricity in the area cost 2-4 cents per kilowatt-hour, compared to more than 10 cents nationwide
    - At least 30 mining operations moved into Chelan, Grant, and Douglas counties; more miners are interested
  - ☐ Mining operations offer costs and benefits
    - Entrepreneurs are setting up businesses in region
    - Four potential miners have asked Chelan County's utility for 100 megawatts each, possibly requiring $40 million of new infrastructure per mine

Source: Wall Street Journal, CNBC

*what does REMI say?* sm

# Risks for Utilities and Consumers

- If utilities build capacity to meet Bitcoin demands, energy producers would be exposed to the volatility of cryptocurrencies
  - *"We're getting requests for service that are just astounding. We do not intend to carry the risk of Bitcoin prices on our system." -* Steve Wright, general manager of the Chelan County Public Utility District, in *Wall Street Journal* interview

- Miners could consume surplus electricity in low-cost regions, driving up prices for other consumers

- New cryptocurrency companies could go bust, after utilities spent millions on upgrading infrastructure

Source: Wall Street Journal

*what does REMI say?* ˢᵐ

# Modeling Scenarios

- Lower Transaction Fees
  - Decrease in Retail Trade Production Costs (U.S.)
- Bitcoin Mining Operation
  - Increase in Data Processing Employment, Decrease in Data Processing Value Added, Increase in Utilities Demand (W)
- Higher Electricity Costs
  - Increase in Electricity Costs for All Industries (W)

- REMI model: Washington + Rest of U.S., 2016-2026

*what does REMI say?* [sm]

# Model Framework
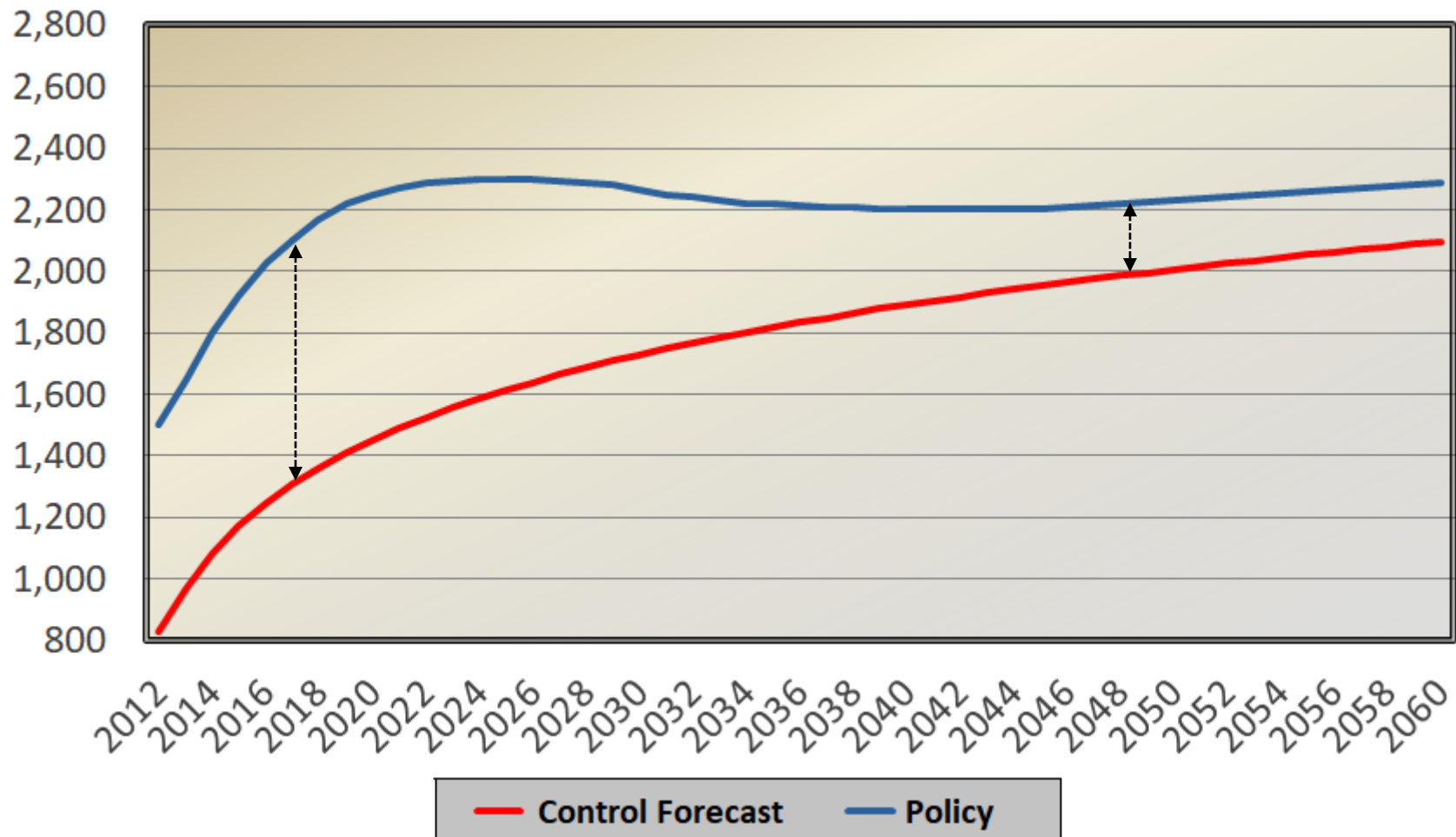
# Model Structure
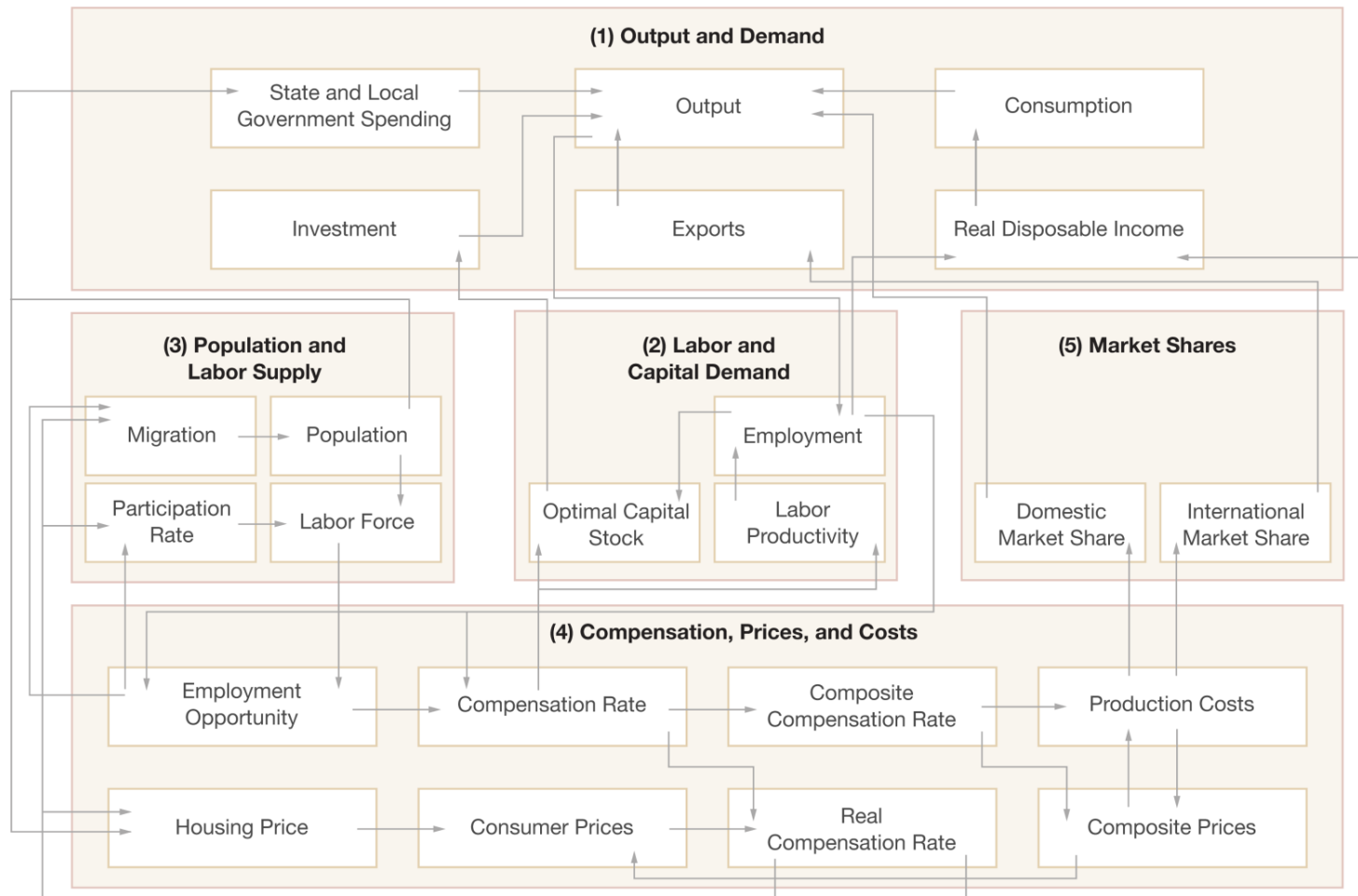
# Lower Transaction Fees

- Assume cryptocurrency allows for 2% decrease in transaction fees in U.S.

- Assume take-up rises steadily from 0% to 100% over 10 years
  - From 0% impact to 2% impact

- Model as percentage decrease in Production Costs in the Retail Trade sector in U.S.

# Lower Transaction Fees

☐ 0-2% drop in Retail Trade Production Cost, linearly increasing take-up

# Lower Transaction Fees

□ Change in production costs across all industries

# Lower Transaction Fees

□ Change in production costs by industry

# Lower Transaction Fees

□ Change in output across all industries
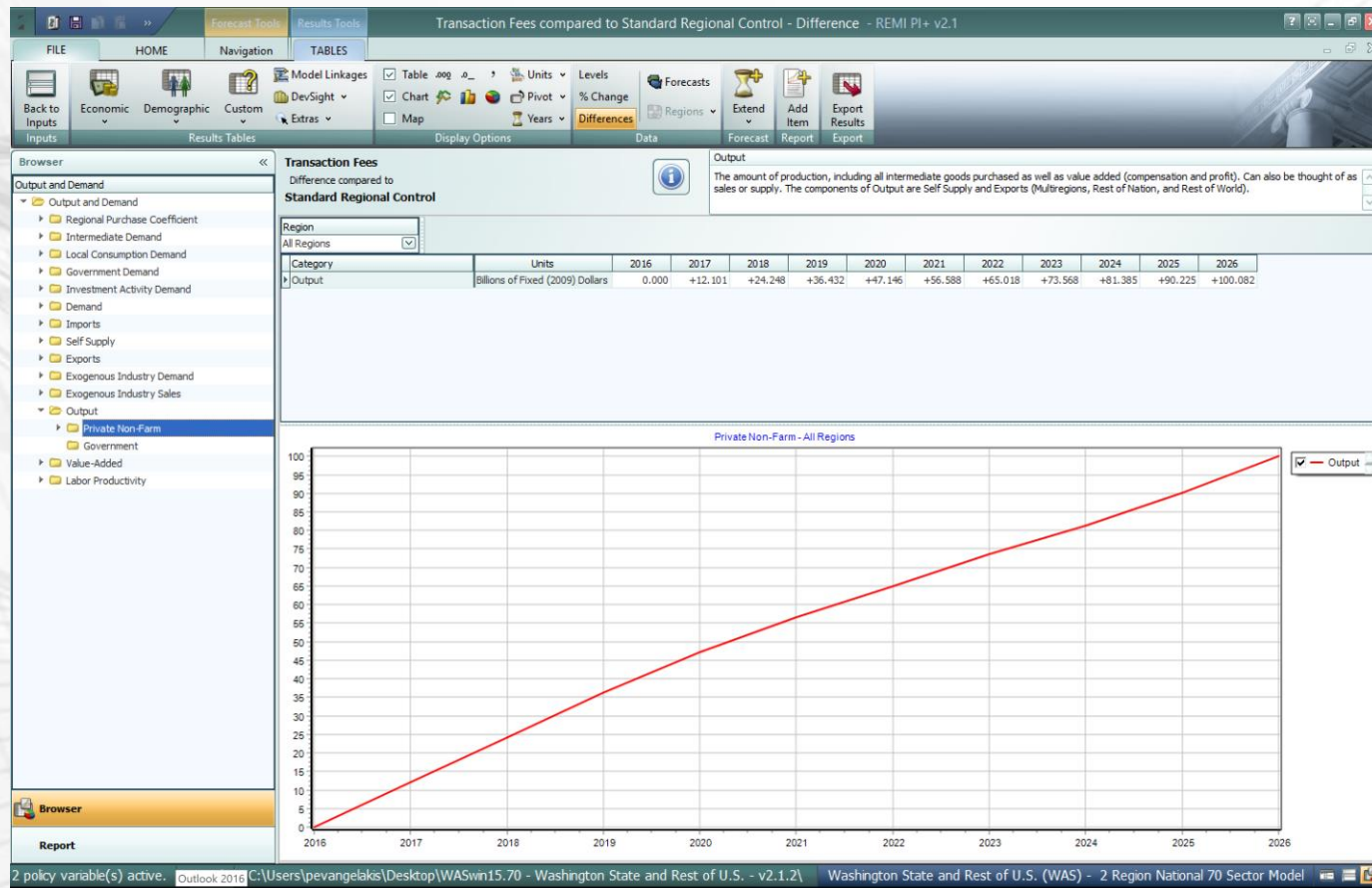


*what does REMI say? ˢᵐ*

# Lower Transaction Fees

□ Change in output by industry
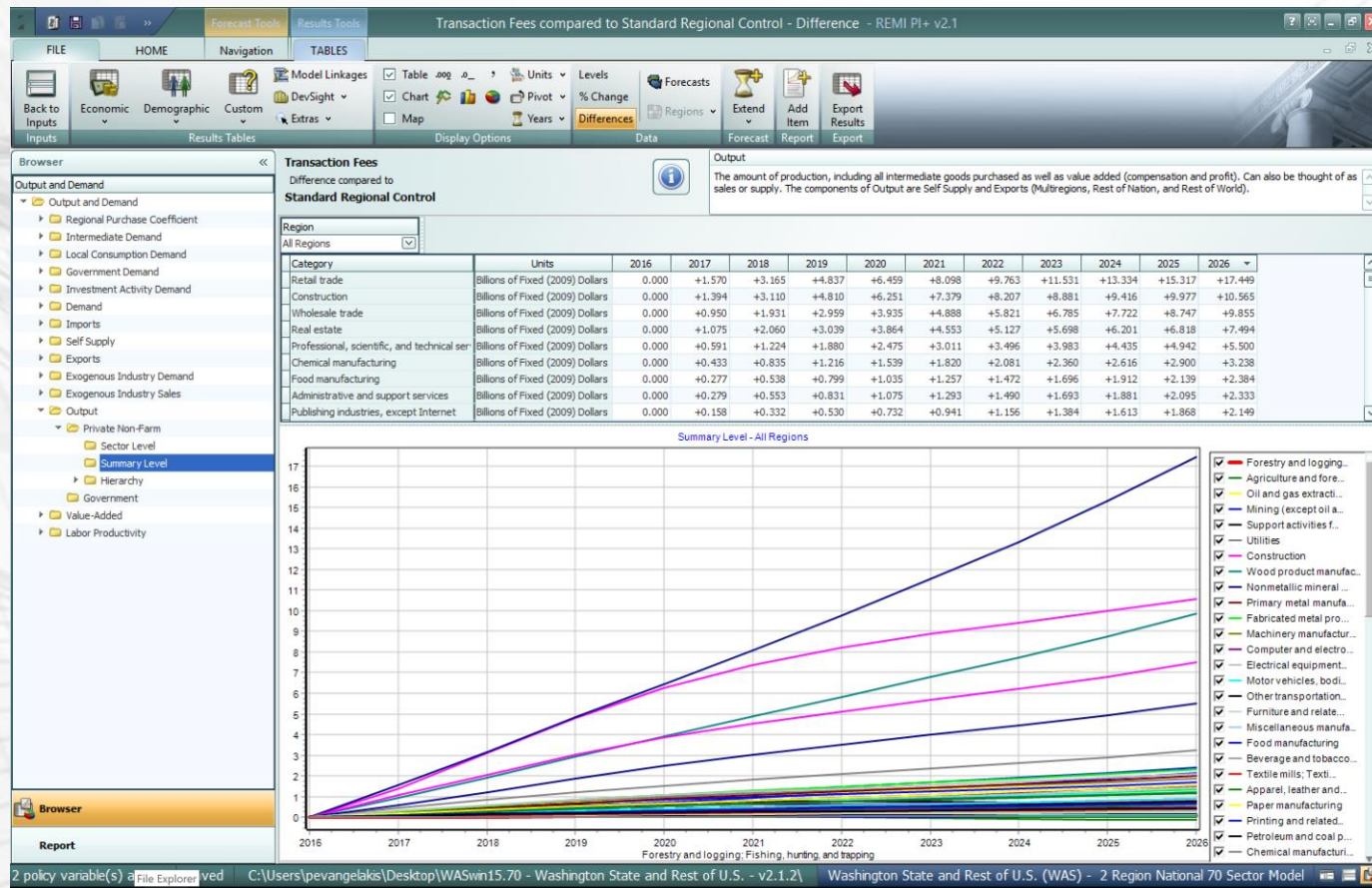
# Lower Transaction Fees
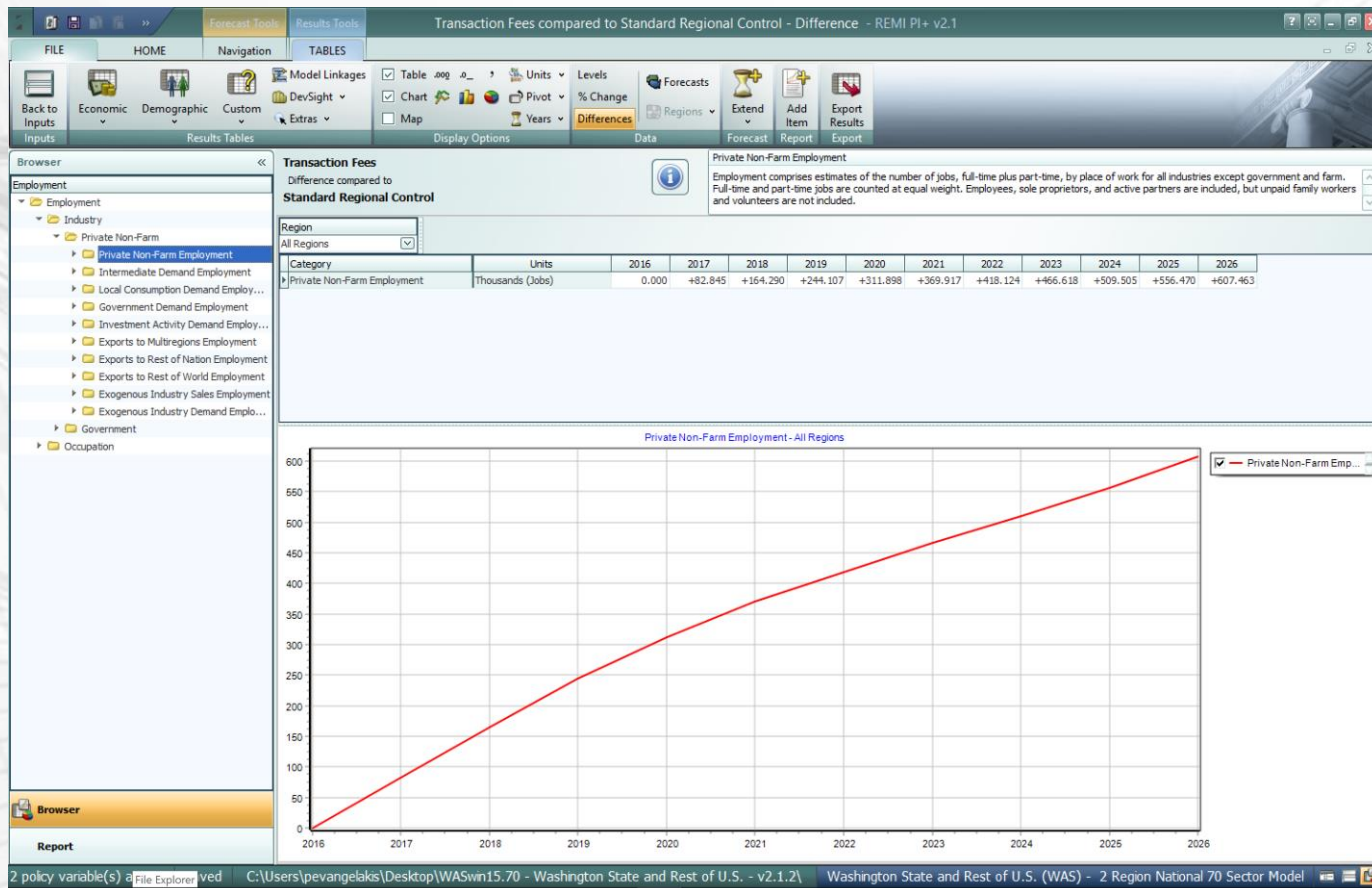
□ Change in employment across all industries

# Lower Transaction Fees

□ Change in employment by industry
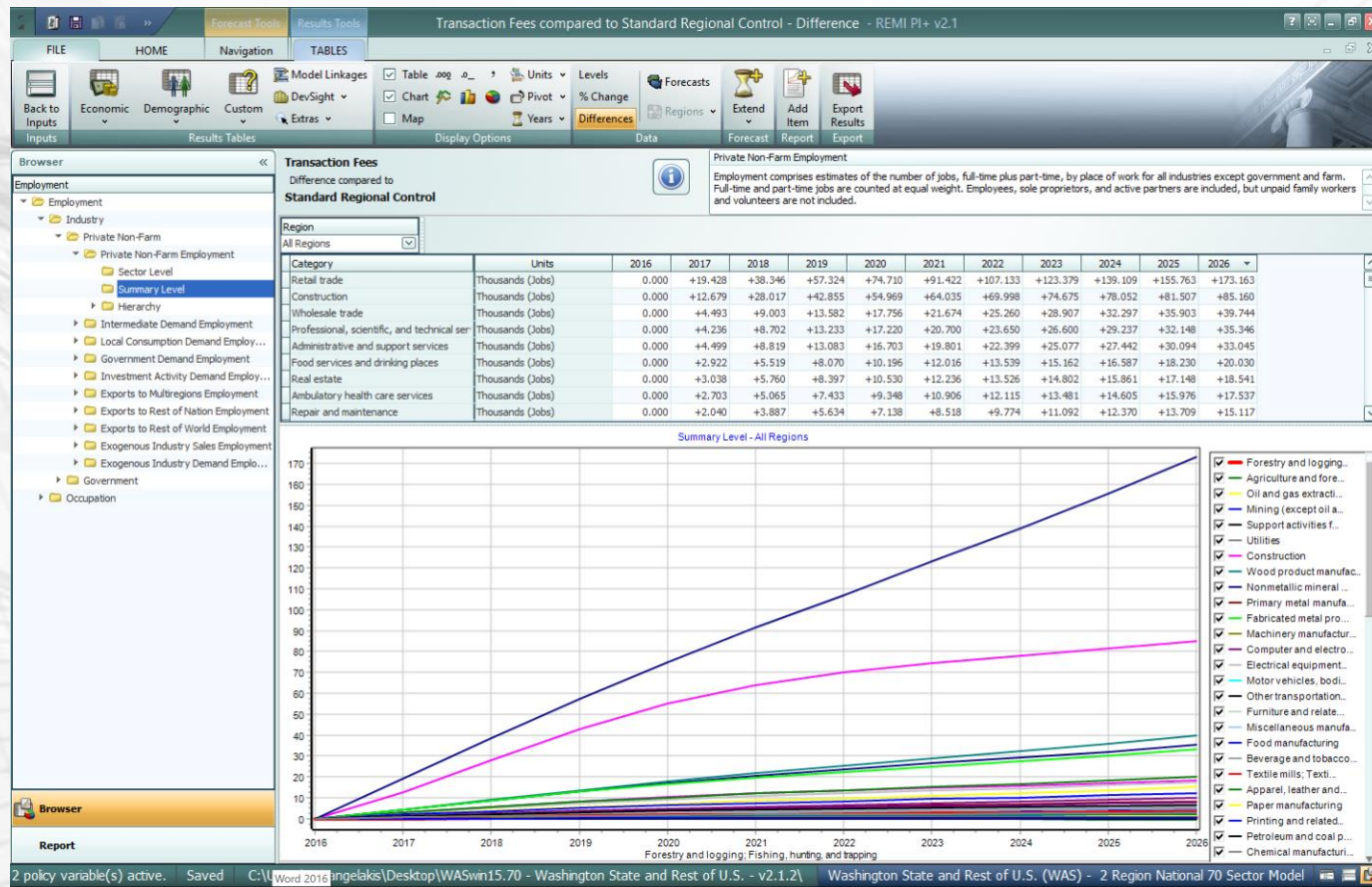
# Lower Transaction Fees

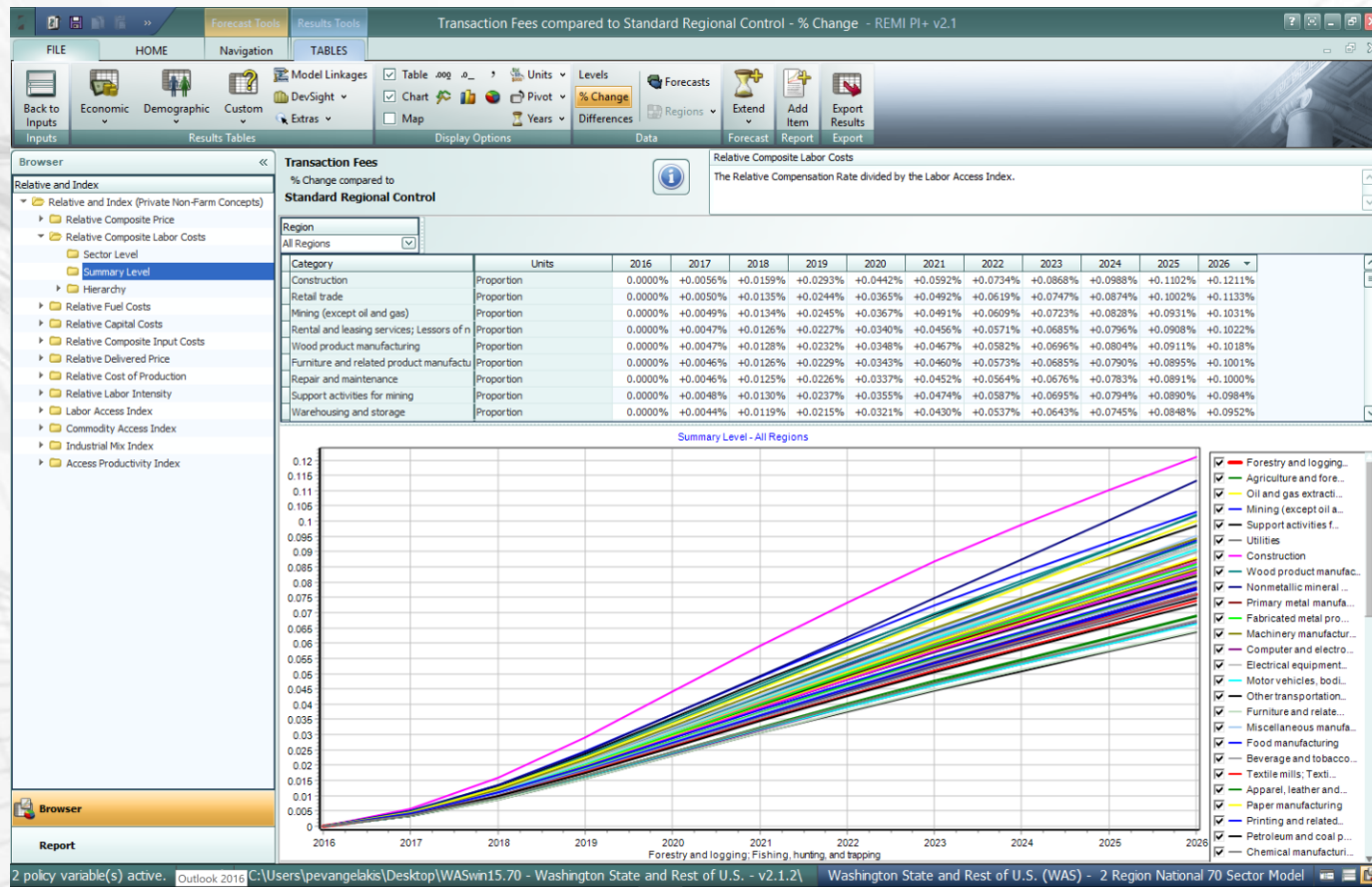☐ Change in compensation rate across all industries
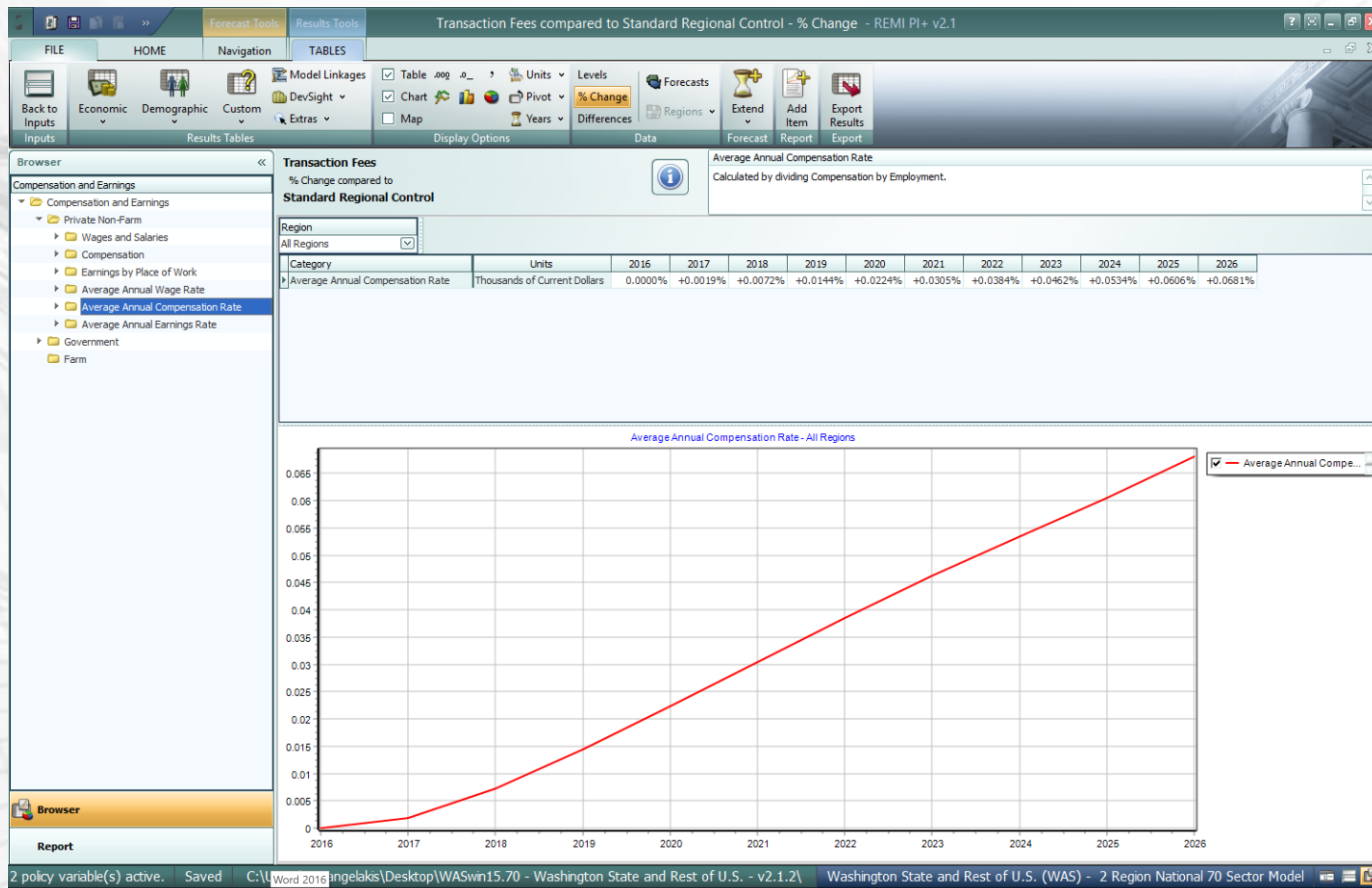


*what does REMI say?* *sm*

# Lower Transaction Fees

☐ Change in compensation rate by industry
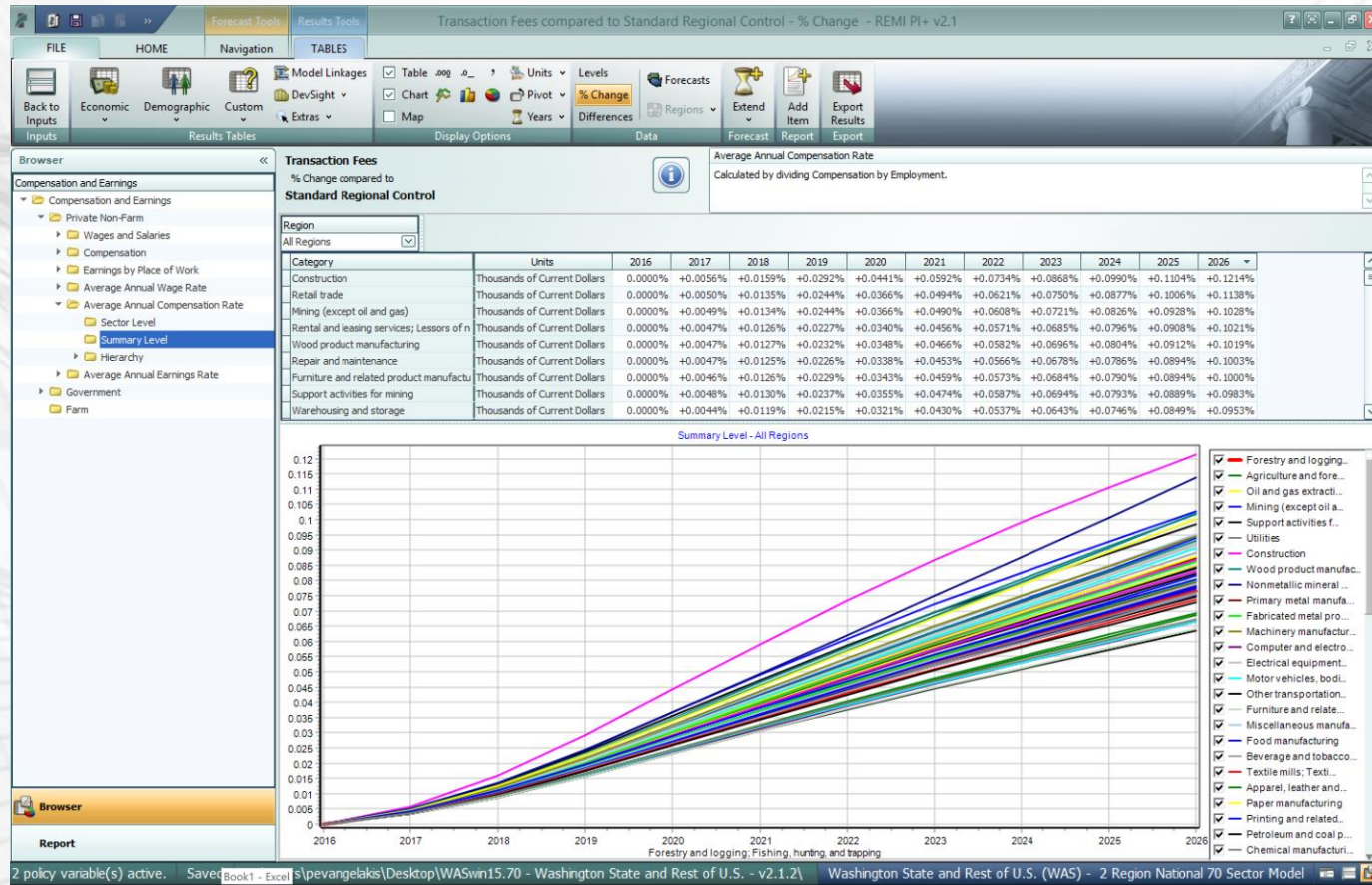


*what does REMI say?* *sm*

# Lower Transaction Fees

□ Change in total disposable personal income
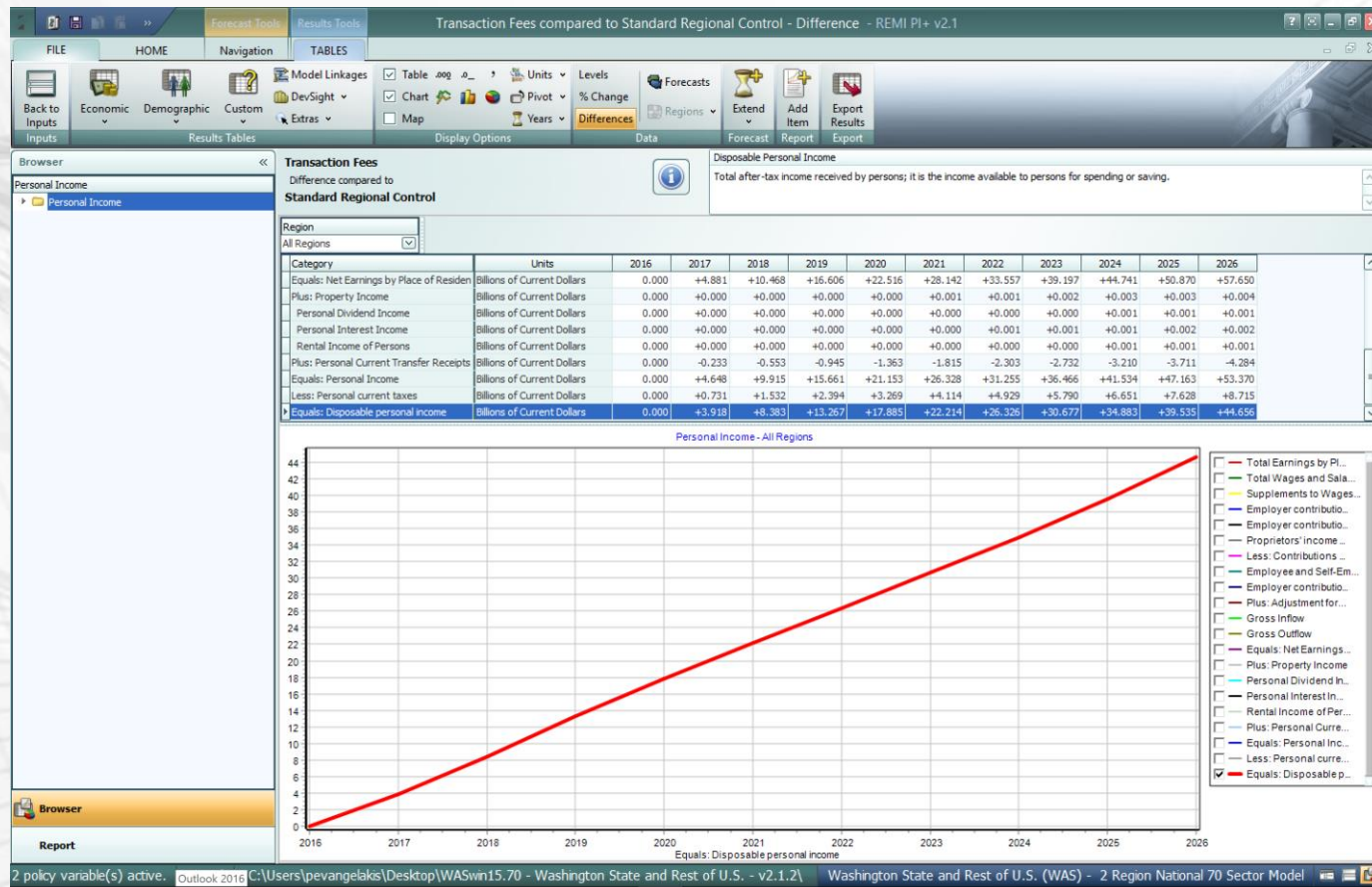
# Lower Transaction Fees

□ Change in labor costs across all industries
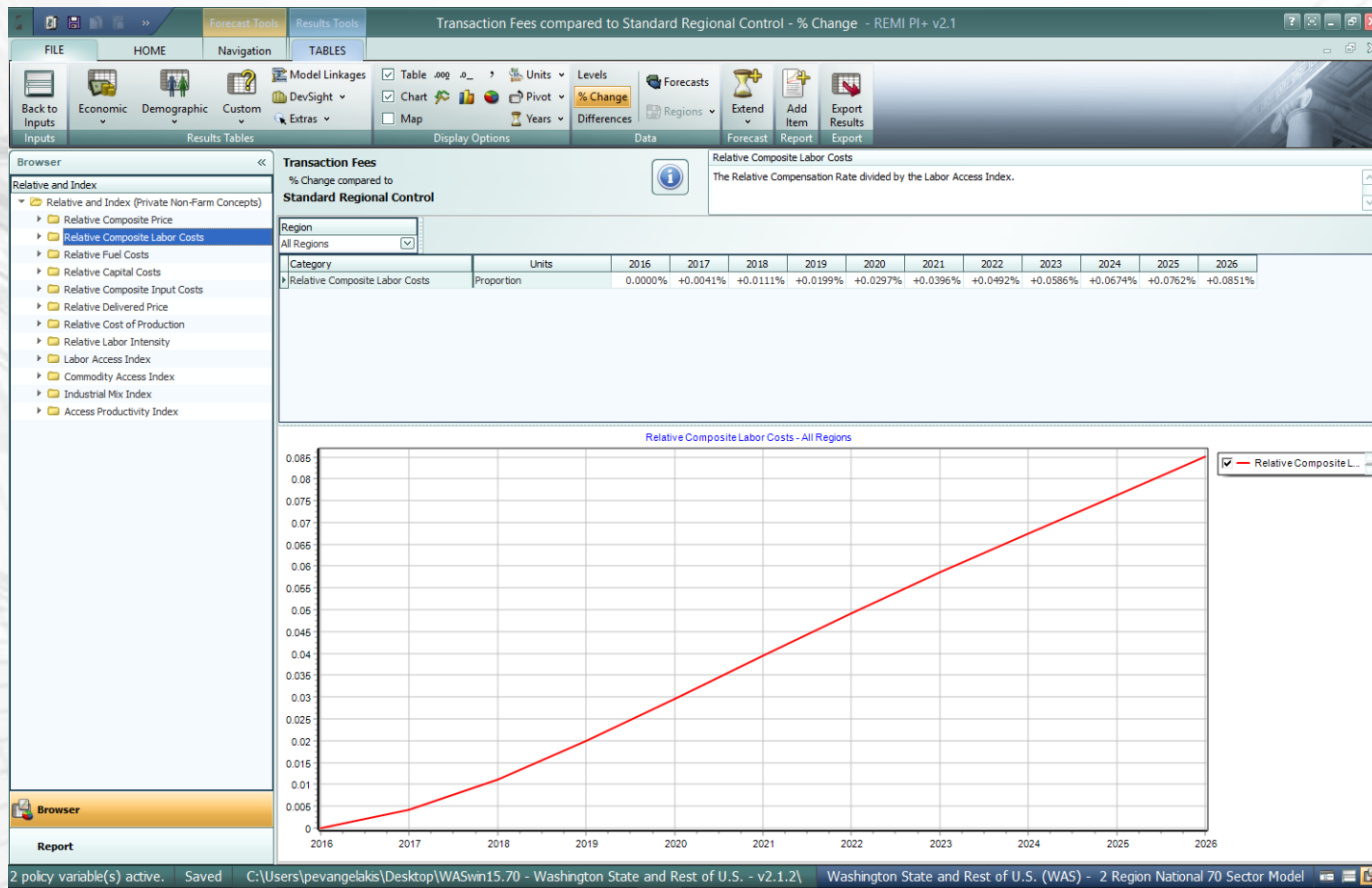
# Lower Transaction Fees

□ Change in labor costs by industry

# Lower Transaction Fees

☐ Change in production costs by industry (EXCLUDING Retail Trade)
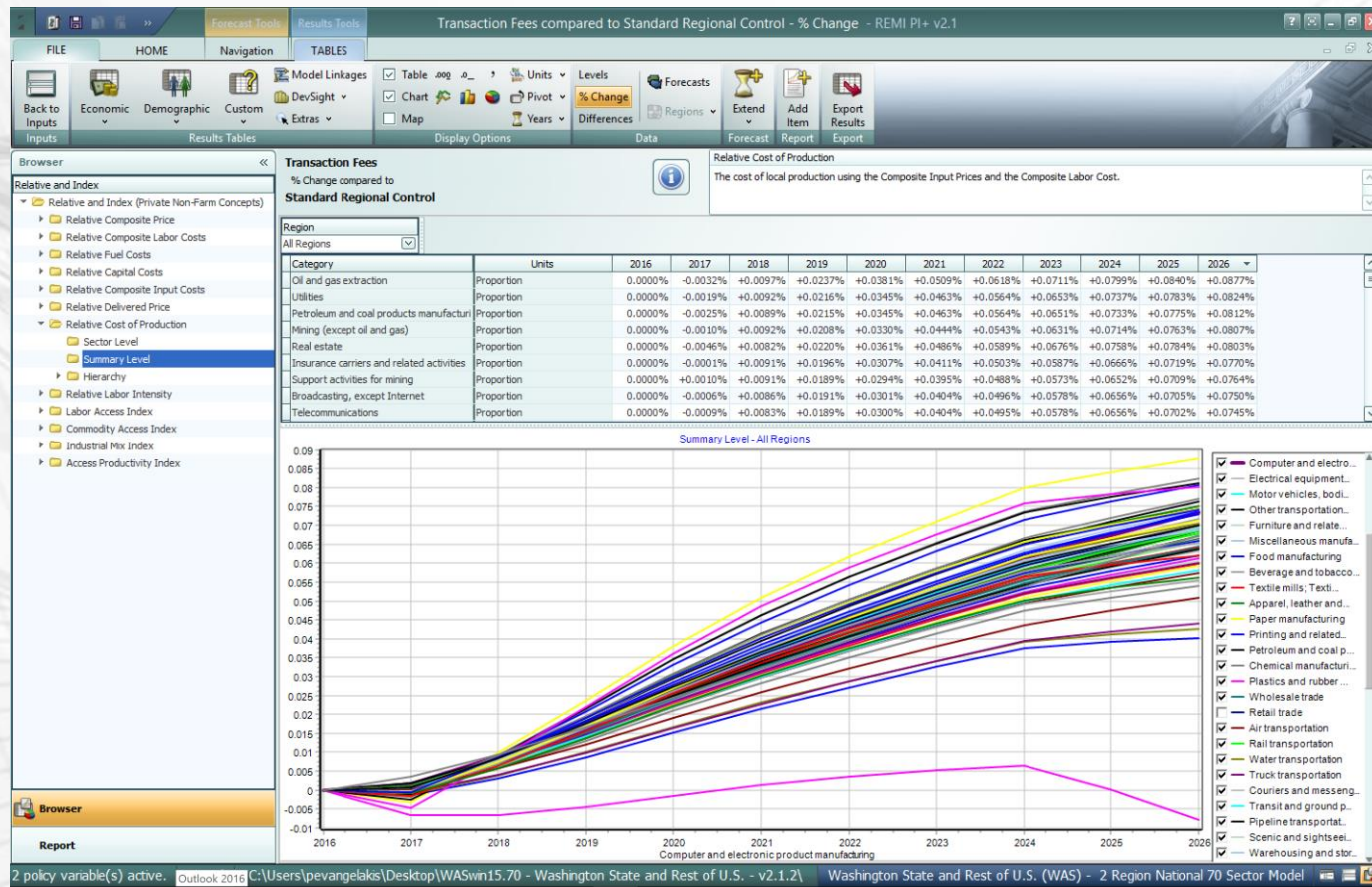
# Lower Transaction Fees
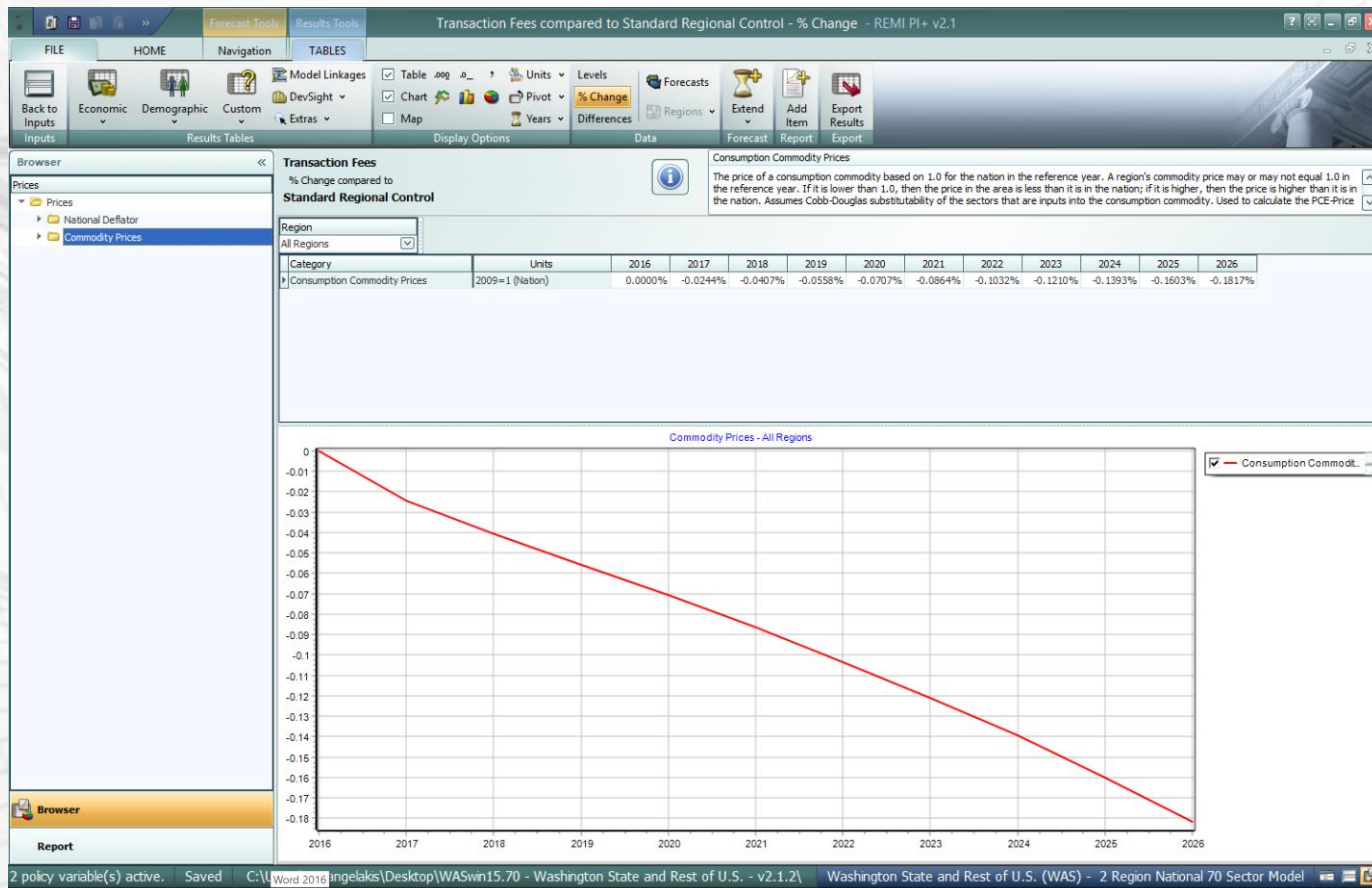
□ Change in prices across all consumption categories

# Lower Transaction Fees
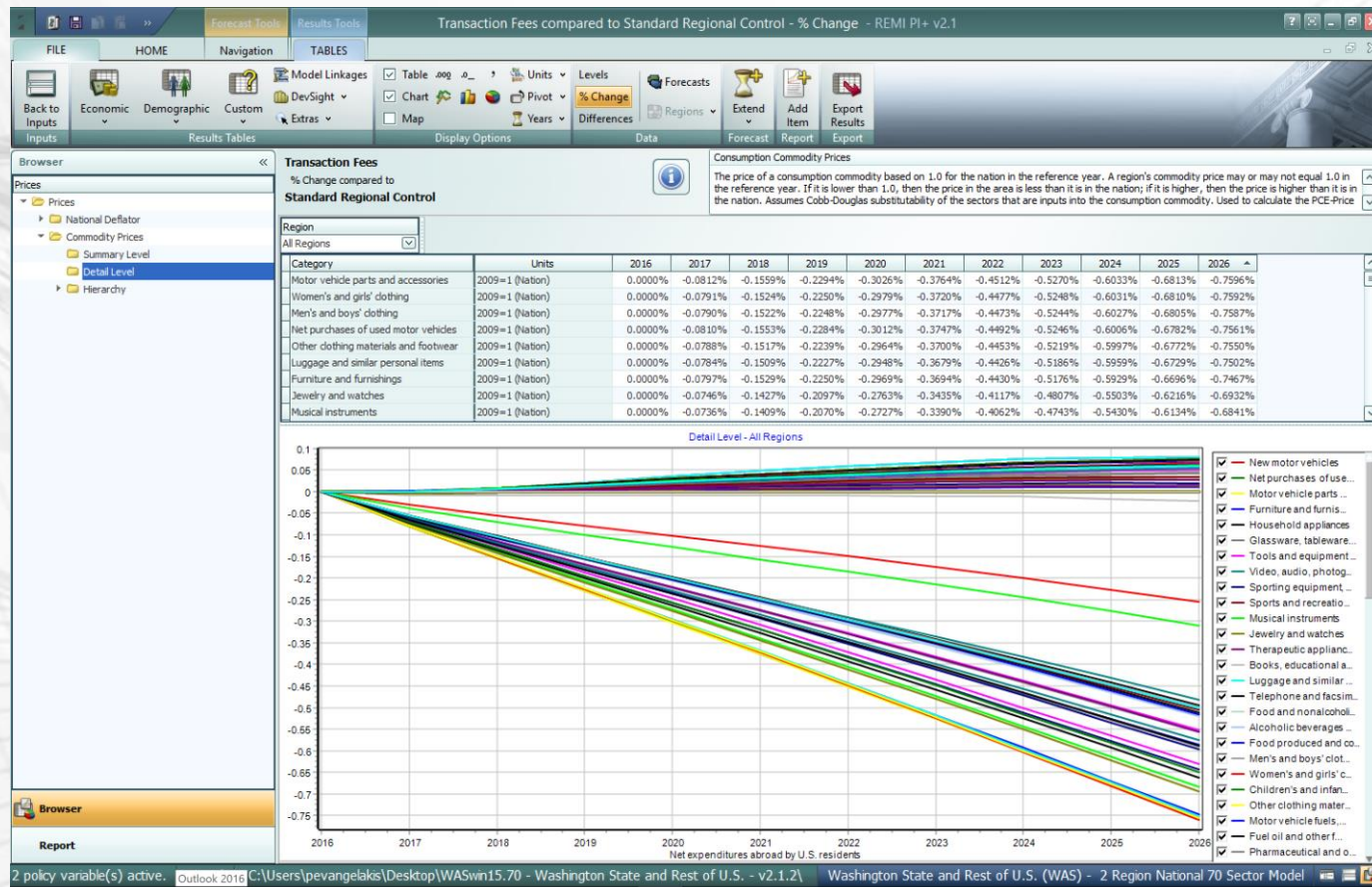
□ Change in prices by consumption category

# Lower Transaction Fees
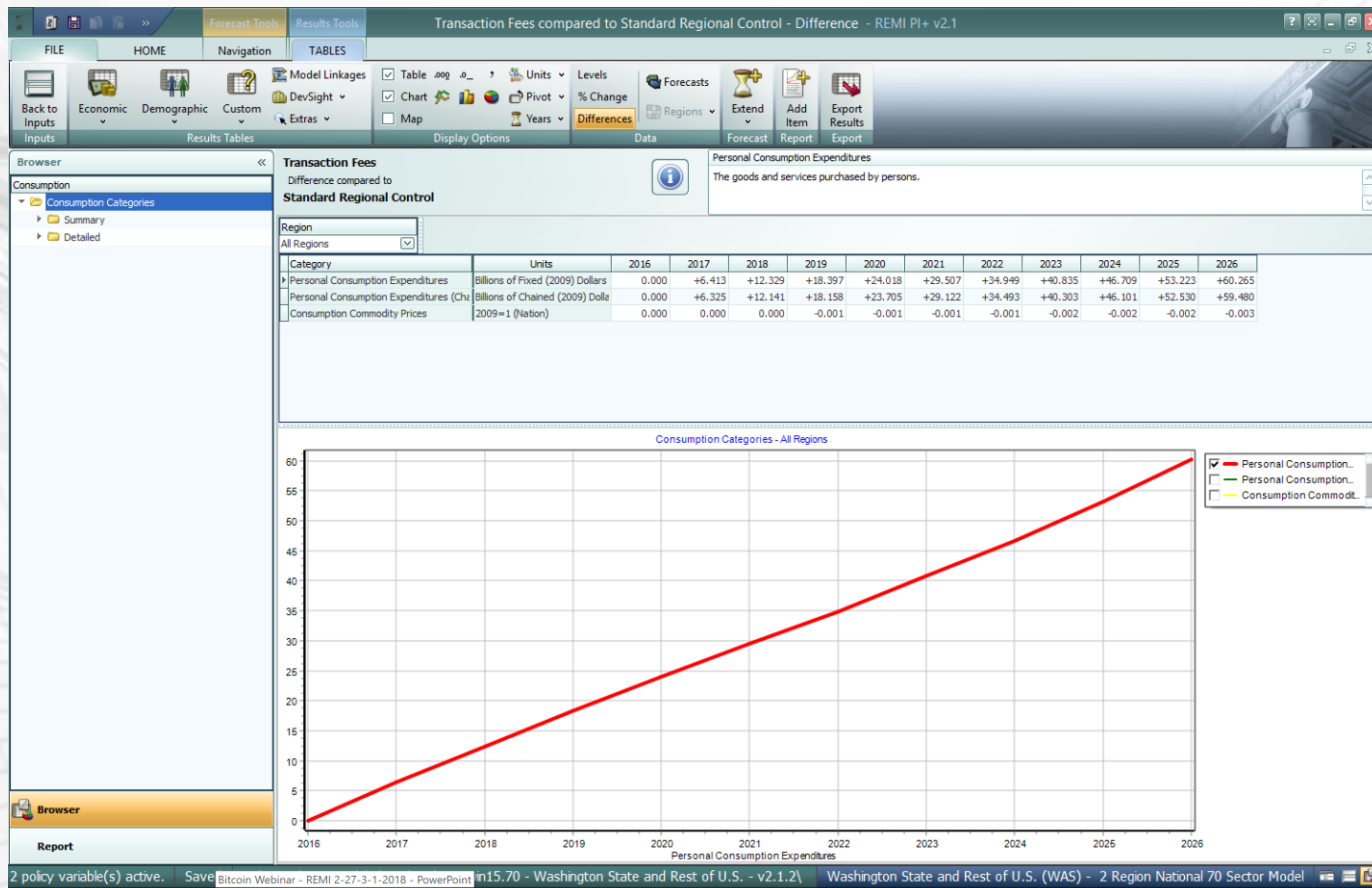
□ Change in total consumption

# Lower Transaction Fees
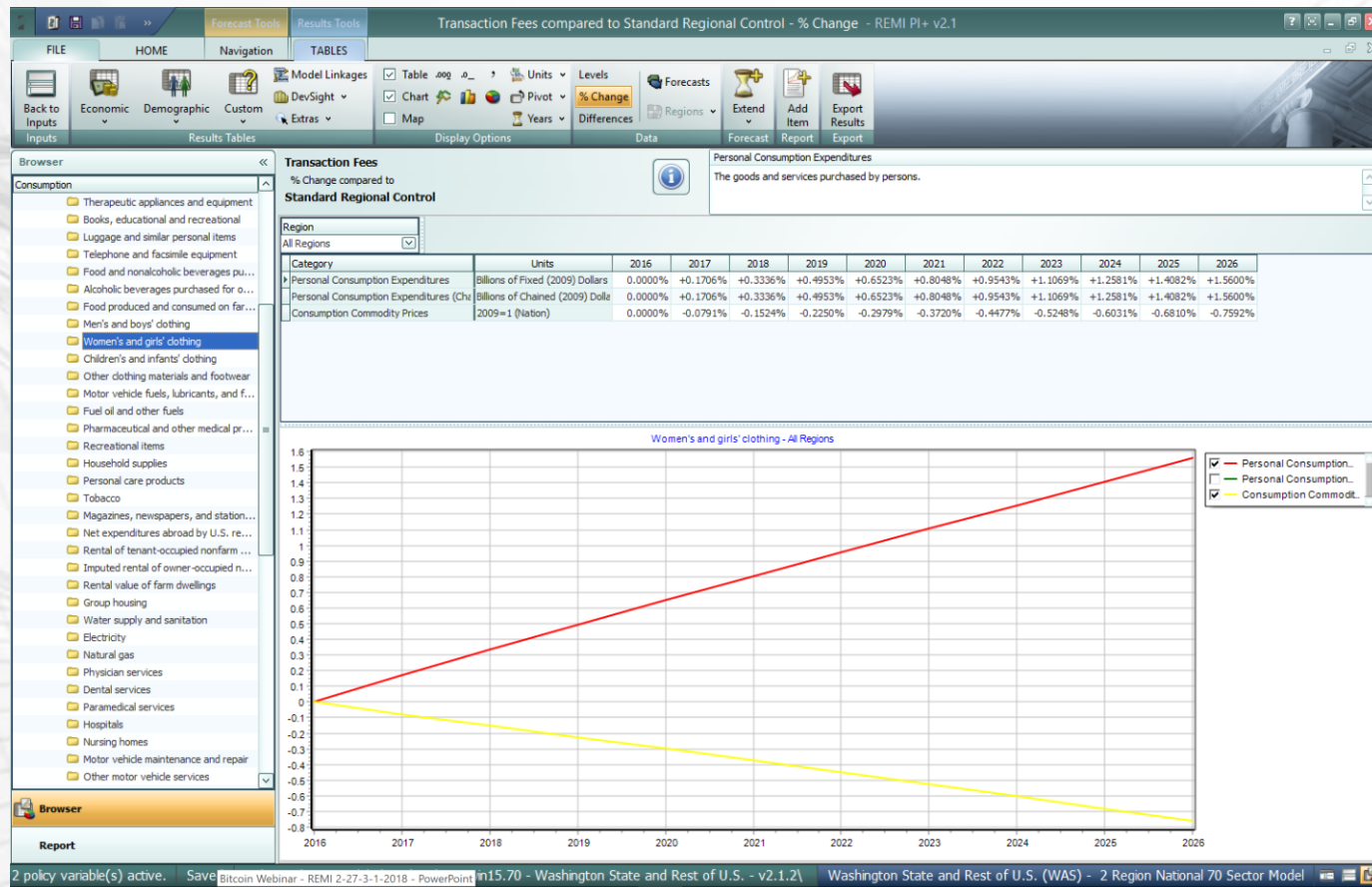
□ Change in consumption and price of women's clothing

# Lower Transaction Fees

□ Price elasticity of consumption for women's clothing

**Options**

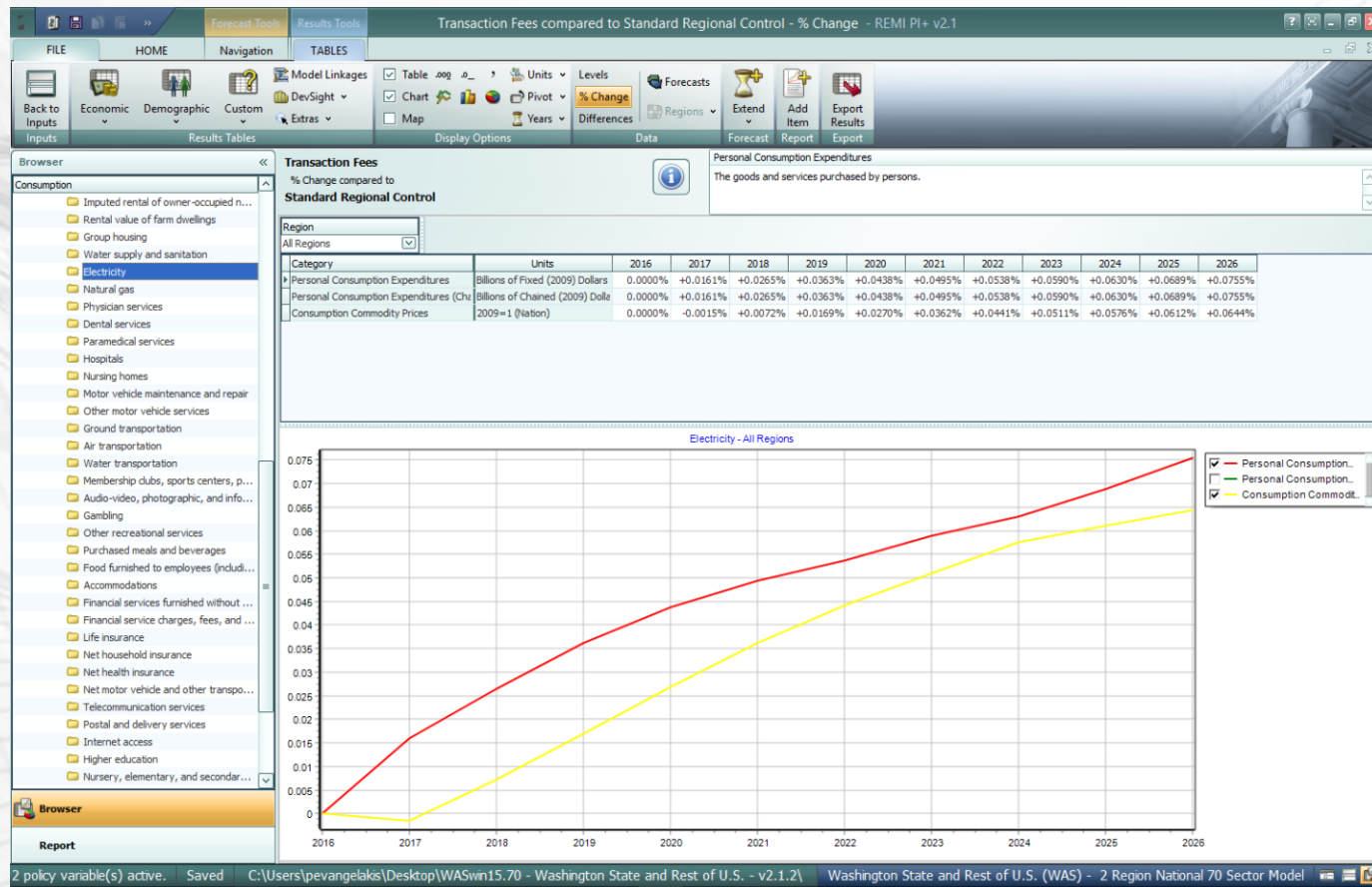Modify the consumer price elasticity for the policy variable

| Commodity | Elasticity |
|---|---|
| Women's and girls' clothing | -1.6500 |

The consumer price change will enter the model with the specified elasticity which will cause an additional change in consumer spending to adjust for a higher or lower elasticity assumption, as appropriate. The price elasticity is the responsiveness of the consumption of the good to a change in its price.

# Lower Transaction Fees



□ Change in consumption and price of electricity



*what does **REMI** say?* *sm*

# Lower Transaction Fees

☐ Price elasticity of consumption for electricity

**Options**

Modify the consumer price elasticity for the policy variable

| Commodity | Elasticity |
|-----------|-----------|
| Electricity | -0.6600 |

The consumer price change will enter the model with the specified elasticity which will cause an additional change in consumer spending to adjust for a higher or lower elasticity assumption, as appropriate. The price elasticity is the responsiveness of the consumption of the good to a change in its price.

# Bitcoin Mining Operation

- Case study: average Bitcoin mining operation
  - 56 Employees (incl. 6 in management)
  - Power Usage 7.5 kWh a day (11,000 homes worth)
    - $328,500 annual cost at $0.12 per kWh
    - $260,500 above industry standard
      - Decrease in Value Added in Data Processing
      - Increase in Demand for Utilities

  - Focus on Washington State

# Bitcoin Mining Operation

☐ 56 employees & $260,500 lower Value Added for Data Processing, higher Demand for Utilities in Washington State

**Policy Variable Inputs**

Active  Edit  Group

☐ ☑ ✏ 56 Employees in Data Processing

| Active | View | Category | Detail | Region | Units | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|--------|------|----------|--------|--------|-------|------|------|------|------|------|------|------|------|
| ☑ | 🔍 | Employment | Industry (Exogenous Production): Internet publishing and bro | Washington | Units | 0 | 56 | 56 | 56 | 56 | 56 | 56 | 56 |

☐ ☑ ✏ Increase in Demand for Utilities

| Active | View | Category | Detail | Region | Units | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|--------|------|----------|--------|--------|-------|------|------|------|------|------|------|------|------|
| ☑ | 🔍 | Exogenous Final Demand | Utilities | Washington | 2009 Fixed National $ (M) | 0 | 0.2605 | 0.2605 | 0.2605 | 0.2605 | 0.2605 | 0.2605 | 0.2605 |

☐ ☑ ✏ Decrease in Value Added

| Active | View | Category | Detail | Region | Units | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|--------|------|----------|--------|--------|-------|------|------|------|------|------|------|------|------|
| ☑ | 🔍 | Value Added with no effect on Sales or Employment | Internet publishing and broadcasting; ISPs, search portals, ar | Washington | 2009 Fixed National $ (M) | 0 | -0.2605 | -0.2605 | -0.2605 | -0.2605 | -0.2605 | -0.2605 | -0.2605 |

*what does REMI say?* [sm]

# Bitcoin Mining Operation

□ Change in employment by industry
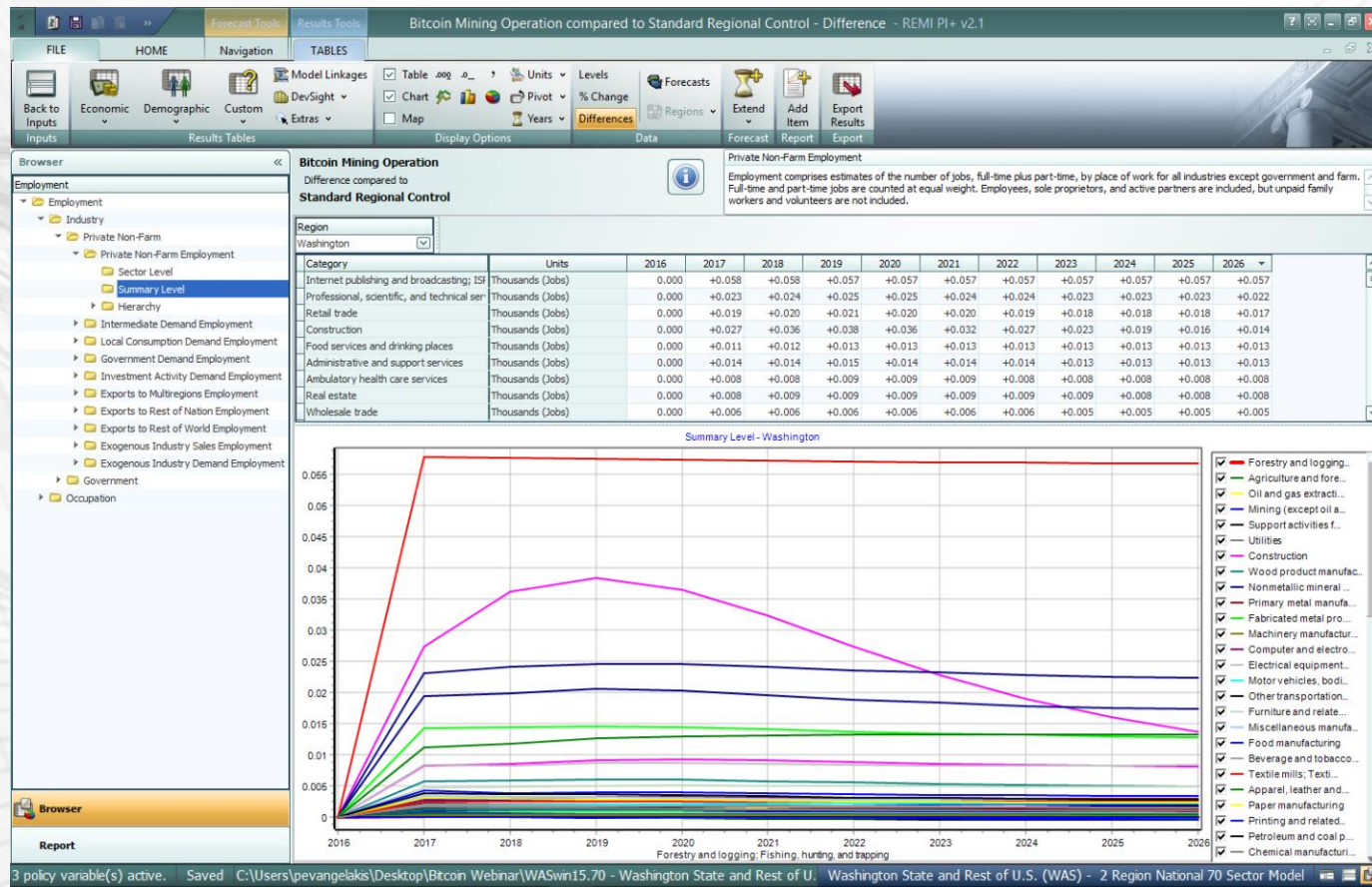


*what does REMI say?* *sm*
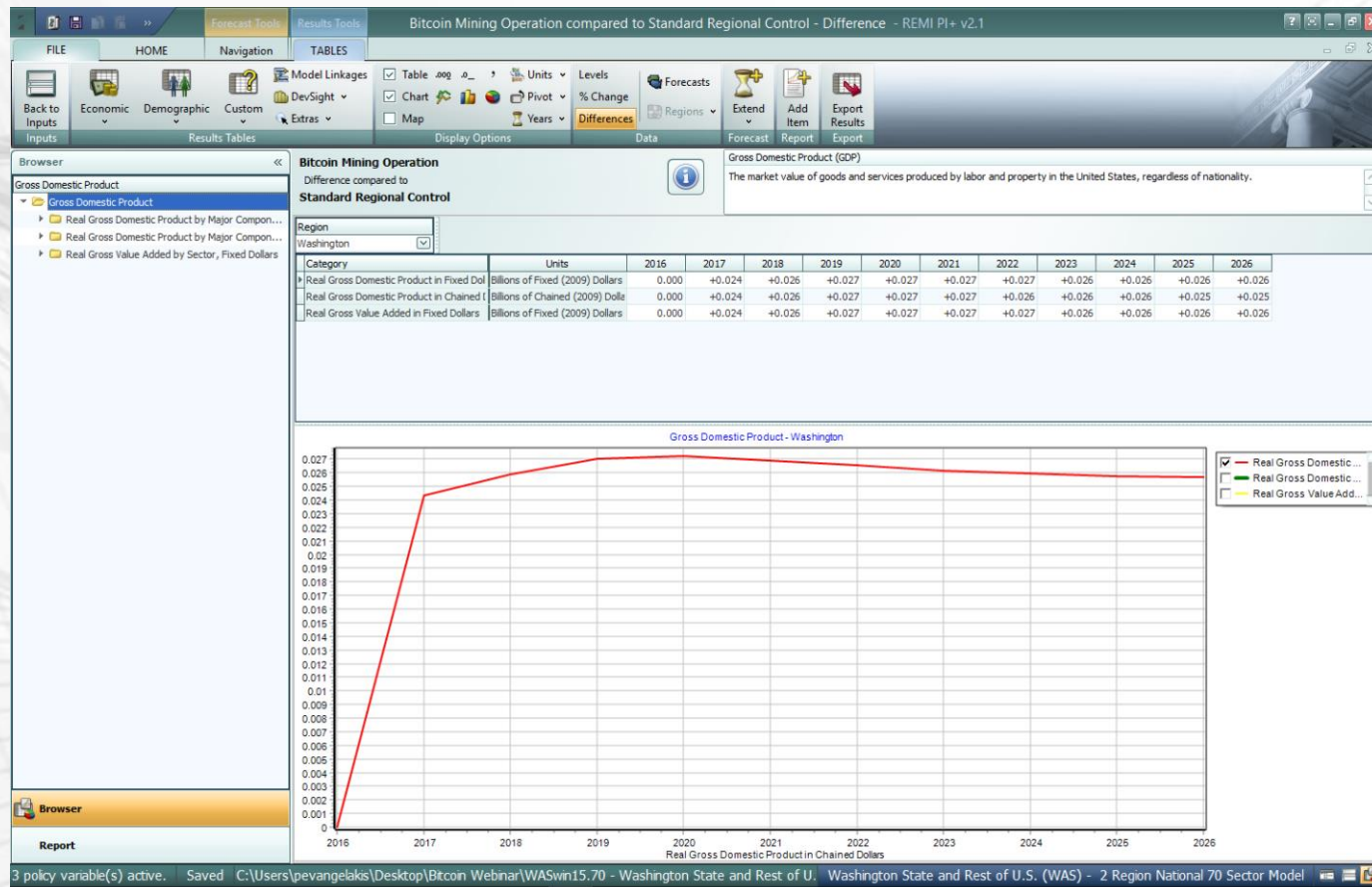
# Bitcoin Mining Operation

□ Change in output by industry
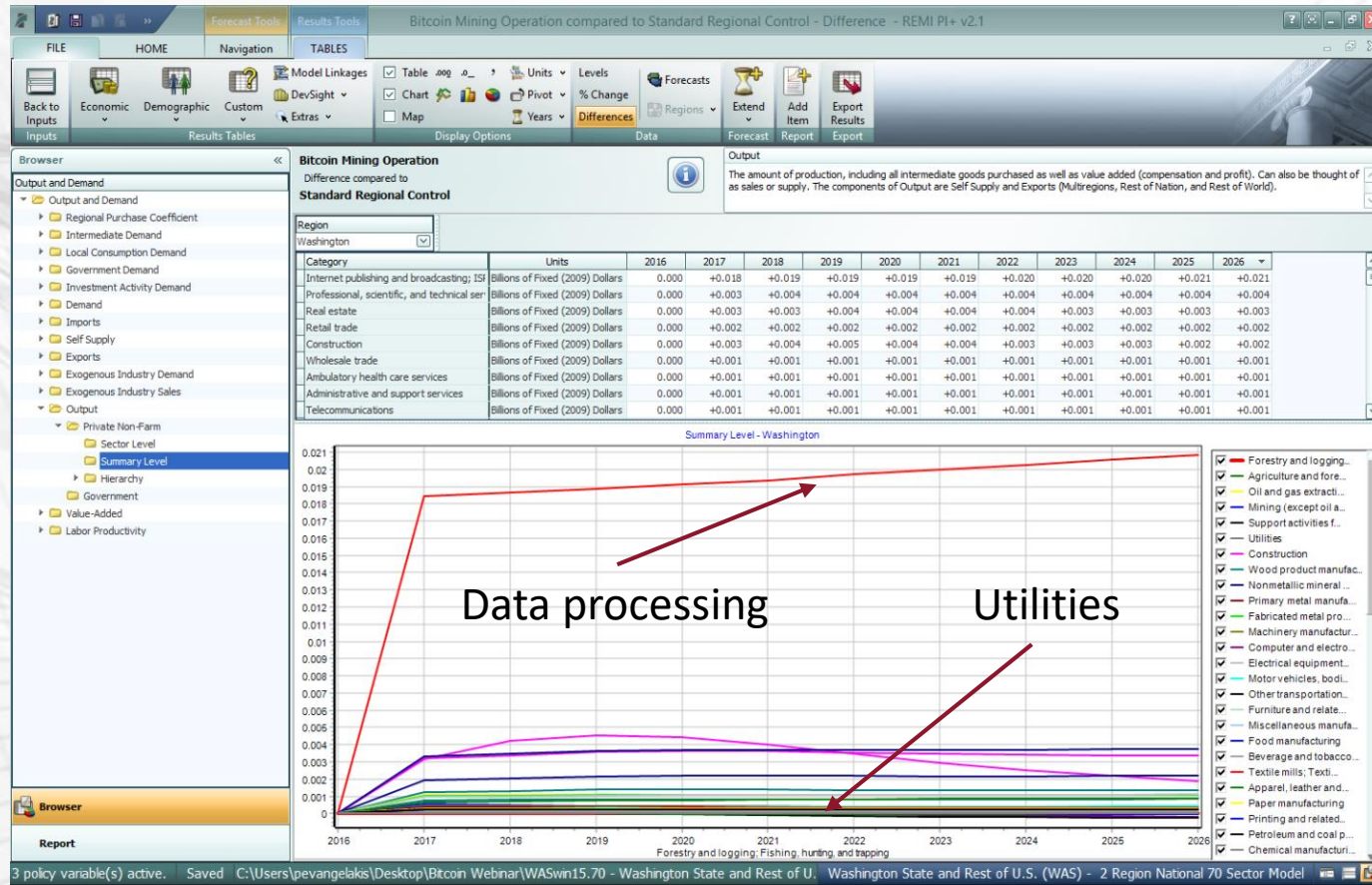
# Bitcoin Mining Operation

□ Change in regional GDP

# Bitcoin Mining Operation
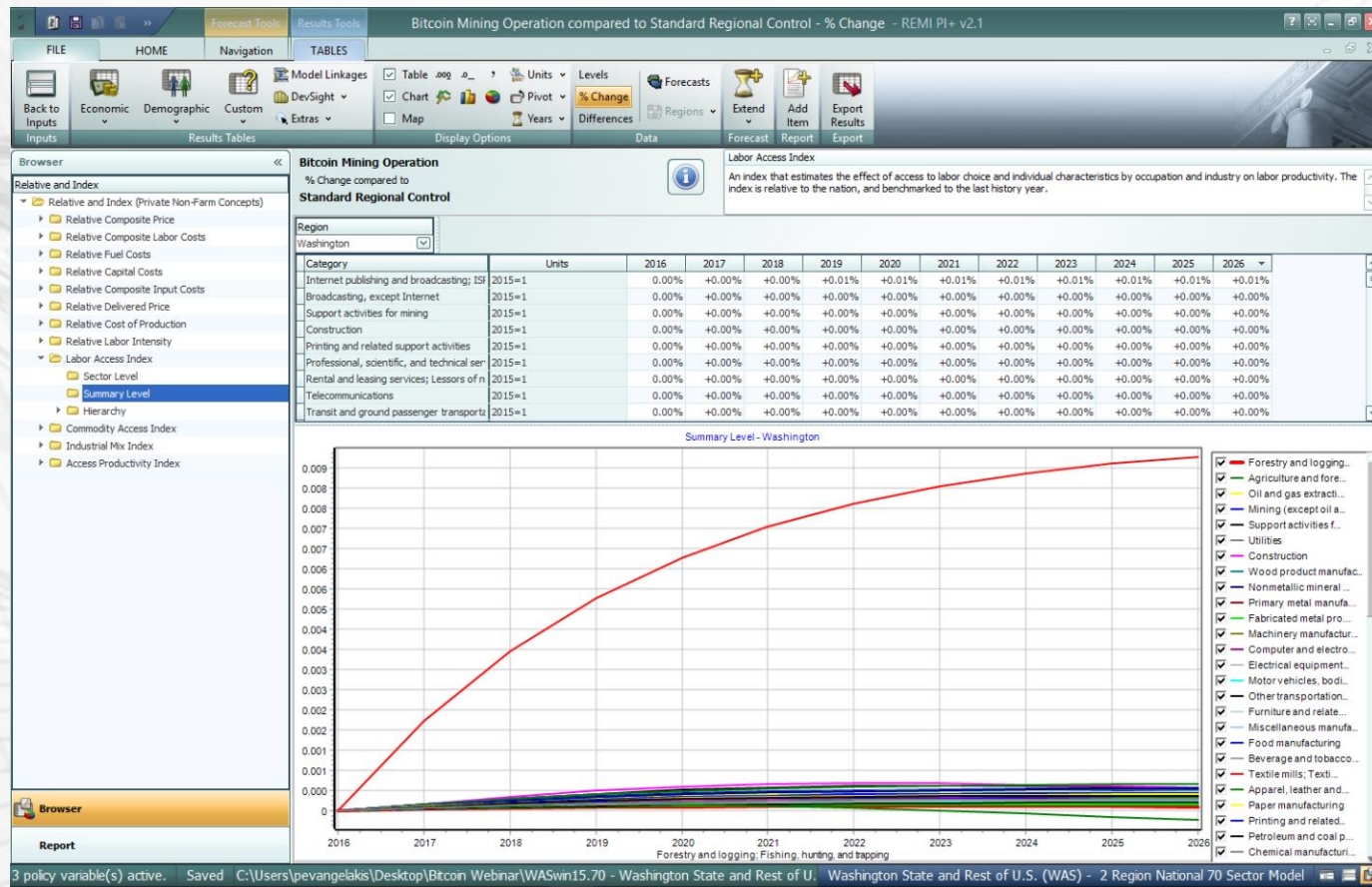
□ Change in access to skilled labor

# Higher Electricity Costs

- Assume 1% increase in Electricity Cost for All Industries

- Focus on Washington State

# Higher Electricity Costs

☐  1% Electricity Cost increase for All Industries in Washington State

| Policy Variable Inputs | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Active | Edit | Group | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ☐ ☑ 🖉 | | Increase in Energy Costs across all industries | | | | | | | | | | | |

| | Active | View | Category | Detail | Region | Units | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ☑ | 🔍 | Fuel Cost | Electricity, All Industries | Washington | Percent | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

*what does **REMI** say?* ᵗᵐ
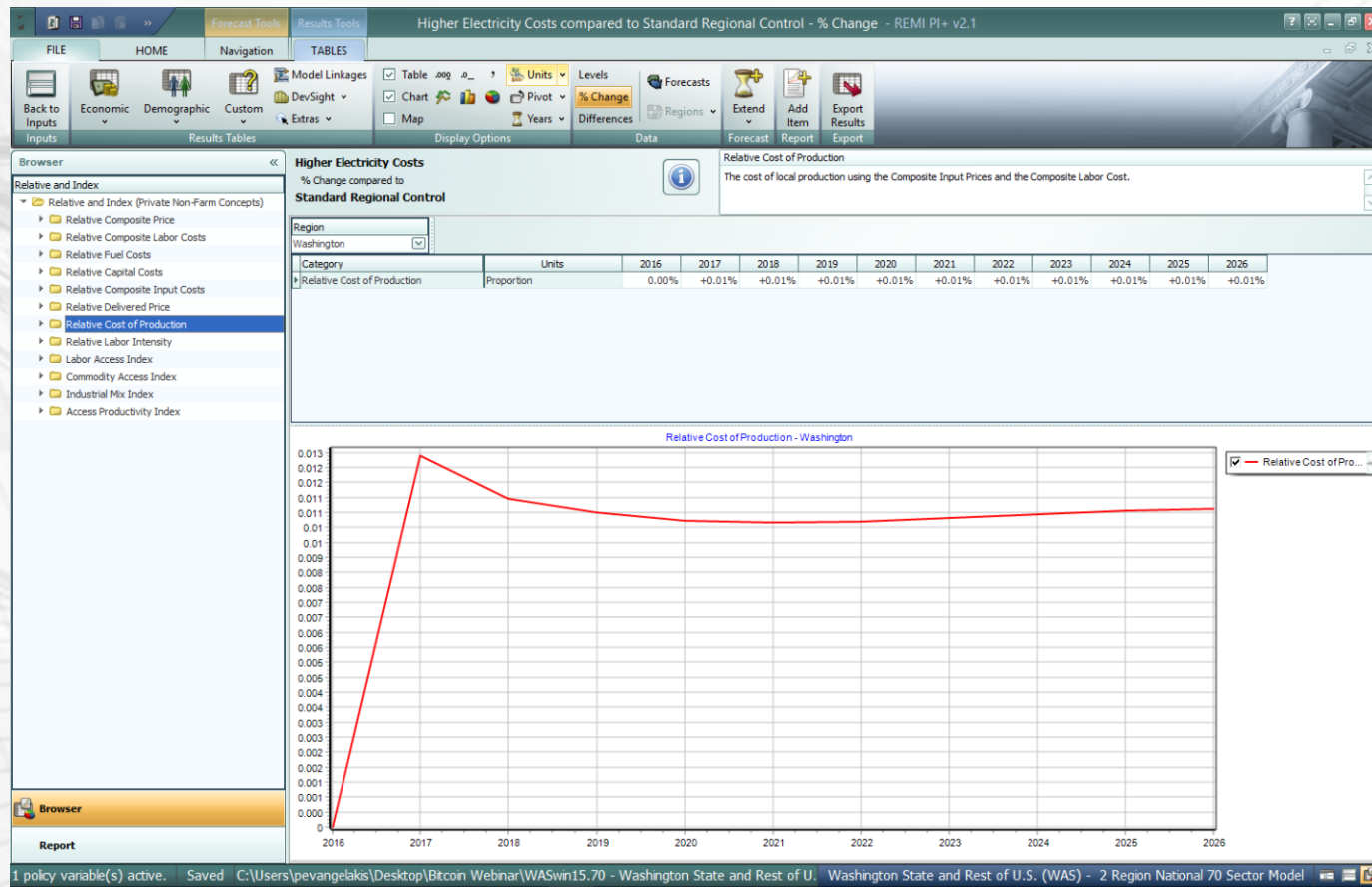
# Higher Electricity Costs

□ Change in fuel costs by industry

# Higher Electricity Costs
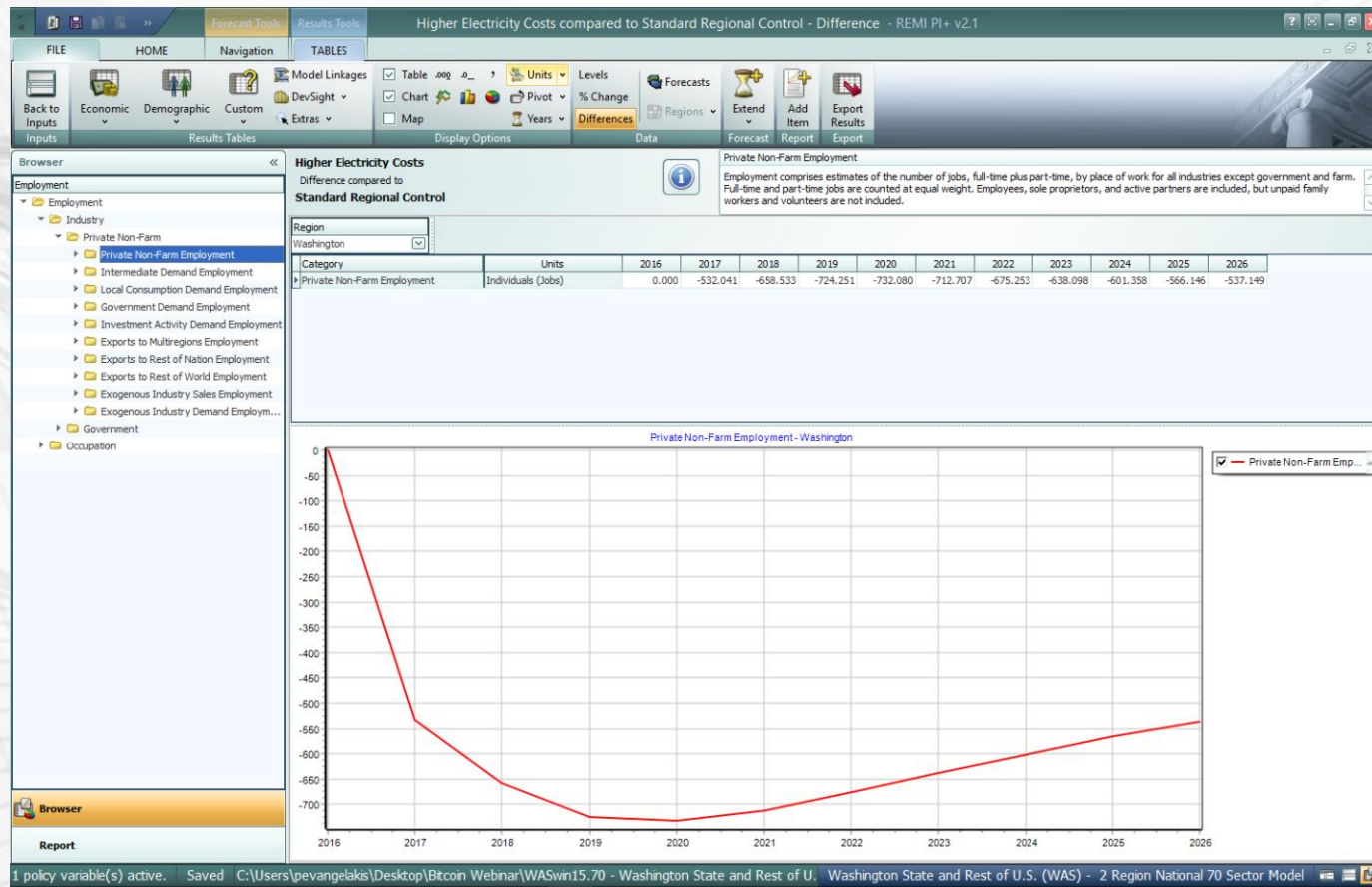
□ Change in production costs across all industries
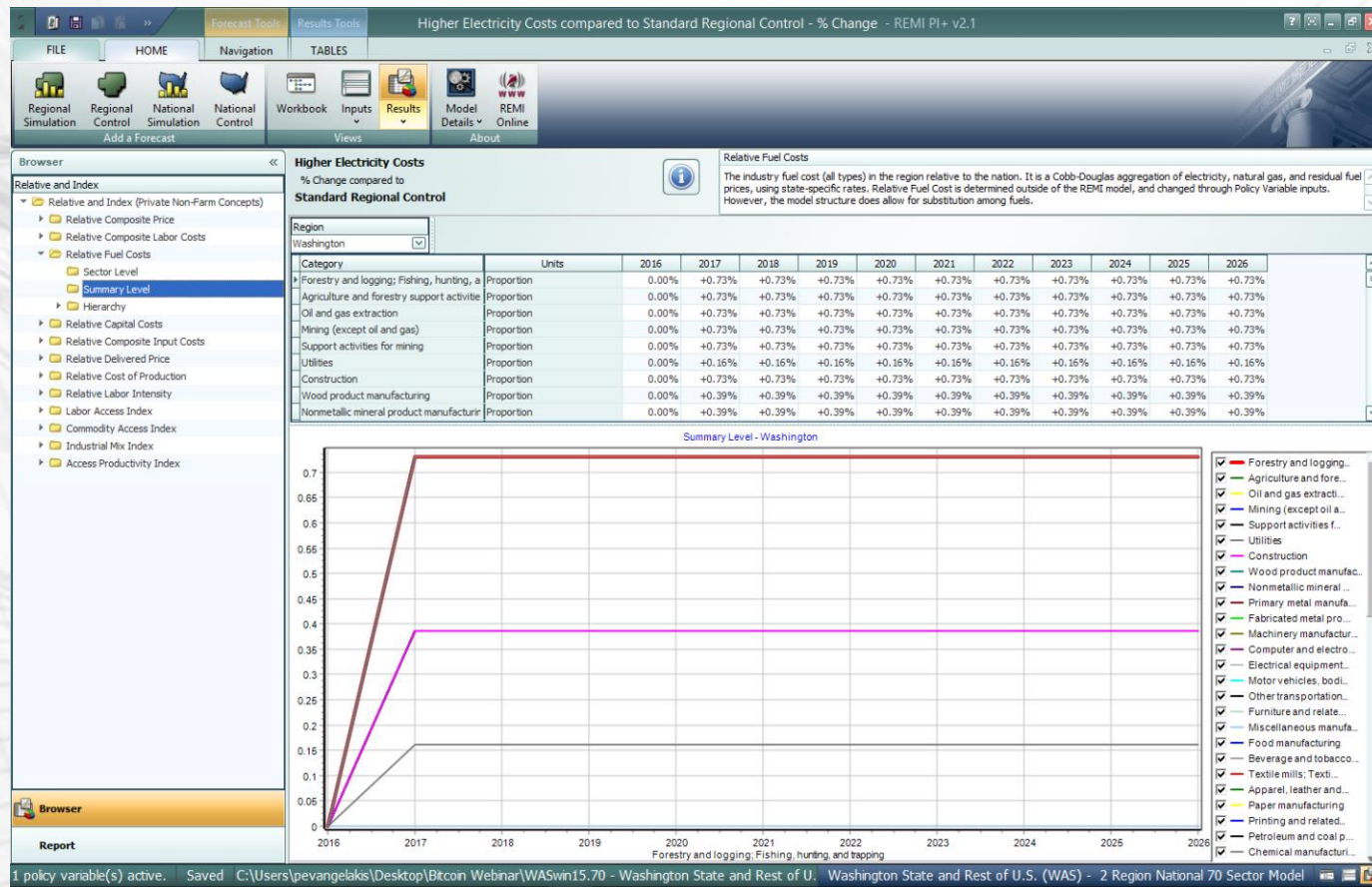


*what does REMI say?* *sm*

# Higher Electricity Costs
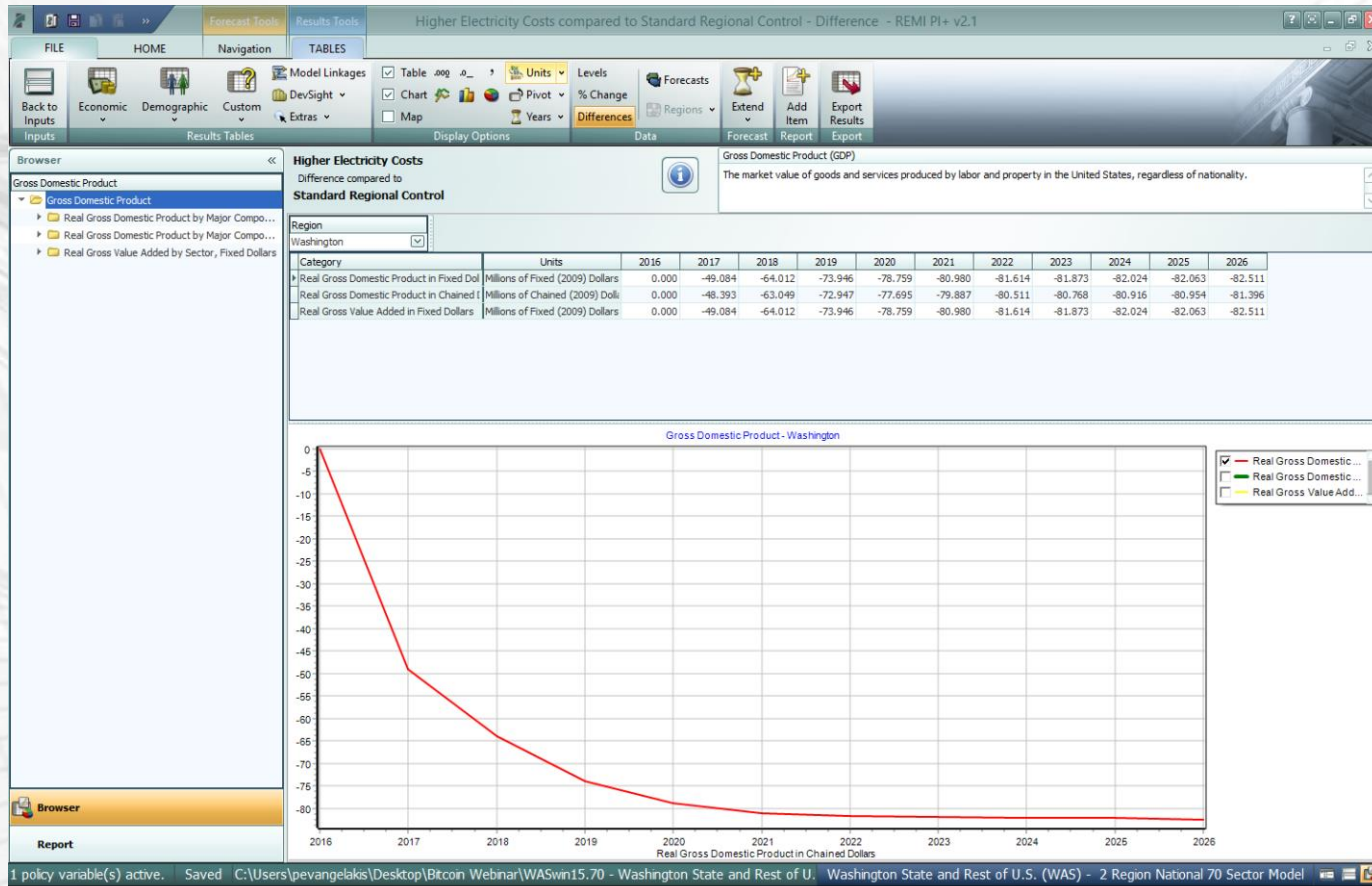
□ Change in employment across all industries

# Higher Electricity Costs

□ Change in regional GDP



*what does REMI say?* *sm*

# Conclusion

- Whether or not Bitcoin is a bubble, cryptocurrency can have real impacts on the economy
- These include:
    - Lowering transaction fees for retail purchases
    - Creating jobs and potential agglomeration economies
    - Increasing electricity prices
    - Use of blockchain technology to improve supply chains
- Still plenty of room to innovate and generate additional impacts, still plenty to learn