# Incorporating Industry-Specific Wages and Unemployment into the GTAP Model Framework

-- a US-EU Trade Liberalization Scenario

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The views expressed in these slides do not reflect the views of the U.S. International Trade Commission or any of its individual Commissioners. Hypothetical scenarios intended to illustrate possible insights.

# Outline

- Motivation of the Study

- Simulation
  - comparison of results between standard GTAP and GTAP-LAB model
  - a full bilateral AVE elimination between the United States and the EU (3 regions and 6 sectors)
  - Sensitivity analysis of revising the substitution elasticity between existing and matched labor

- Discussion of the Consistency of the Labor Module with the Theoretical Underpinnings of the GTAP Model

# Motivation of the Study

- The standard GTAP model

➢assumes full employment;

➢has limited ability to account for more realistic labor market features such as sector-specific wages and unemployment

- Apply the GTAP-LAB Model developed by Peterson (2019) to an exercise of tariff liberalization between the United States and the European Union.

- Our goal is to build a CGE model with labor market features

➢compatible with modern labor economics theories

➢have the country and sectoral-level detail that will make it suitable for USITC's statutory work analysis

# Features of the GTAP-LAB Model

- Developed by Peterson (2019): "Incorporating Unemployment into the GTAP Model." *Journal of Global Economic Analysis*, 4(2), 67-107. https://doi.org/10.21642/JGEA.040202AF
- Comparative static model with frictional unemployment incorporated

Labor Types:

- **Existing labor**: employed workers who carry on with their current jobs and don't switch industries
- **Matched labor**: the new hires in each sector
- **Recruiters**: workers who match those who are looking for a job with job vacancies
- **Unmatched labor**: the labor pool that includes all the unemployed individuals who are in the job market and the matched labor is drawn from this pool

# Features of the GTAP-LAB Model

- Peterson (2019) incorporates the matching function into the GTAP-LAB framework. To hire new workers, firms must use labor to match unemployed workers with job openings

- Matching Function:

$$m_j = \mu_j (1 - \bar{n})^{\gamma_j} R_j \left( \sum_k R_k \right)^{-\gamma_j}$$

- Properties:

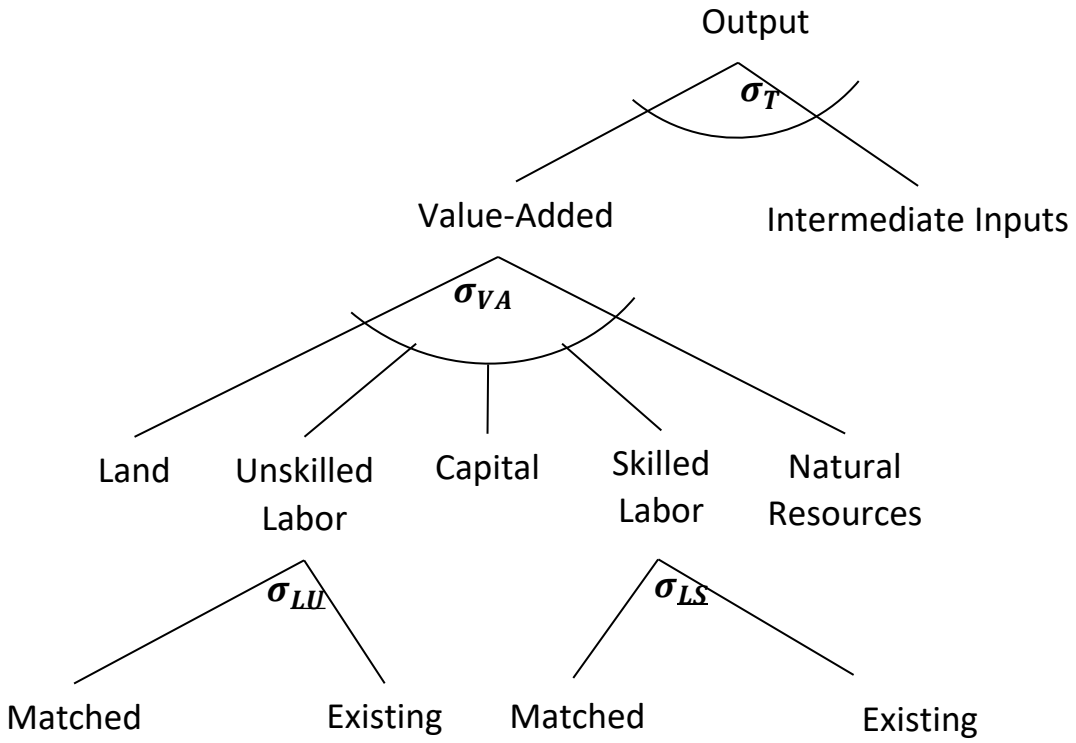
➢ $m_j$ increases with increasing unemployment $(1 - \bar{n})$ and own recruitment effort $R_j$

➢ $m_j$ decreases in recruitment effort in other industries $R_k$

➢ Constant returns to scale

➢ Decreasing returns to own recruitment effort $R_j$

# Features of the GTAP-LAB Model




Substitution Elasticity between Existing and Matched Labor are 2.5 for All Six Sectors for both Unskilled and Skilled Labor; Labor Supply Elasticity is set to 1 for Unskilled and Skilled Labor.

# Modification of labor data in the Standard GTAP database for the United States (all units of labor are in millions)

| | | Food and agriculture | Extraction | Metals | Other manufacturing | Trade and Transportation | Other Services |
|---|---|---|---|---|---|---|---|
| **Existing Labor** | **Unskilled Labor** | 69255 | 16379 | 36004 | 586290 | 501172 | 1073902 |
| | **Skilled Labor** | 70585 | 19068 | 22602 | 368048 | 419116 | 2448066 |
| **Matched Labor** | **Unskilled Labor** | 30111 | 7467 | 9693 | 189441 | 305593 | 790969 |
| | **Skilled Labor** | 30689 | 8693 | 6085 | 118923 | 255558 | 1534983 |
| | **Turnover Rate** | 0.30 | 0.31 | 0.21 | 0.24 | 0.37 | 0.42 |

# Unemployment Rate is Used to Calibrate the Matching Function

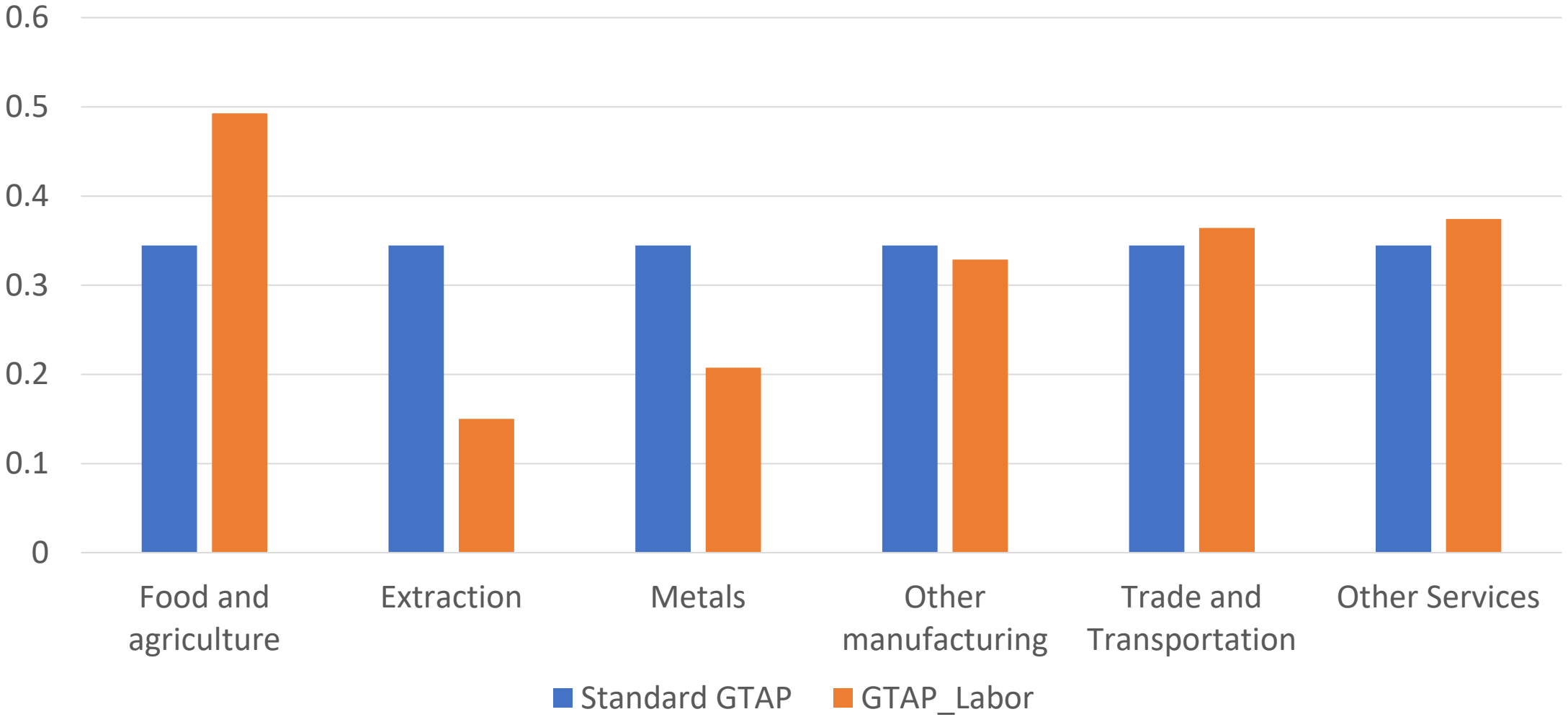
| Education Level | U.S. Unemployment Rate | Labor Category | U.S. Unemployment Rate |
|---|---|---|---|
| **Without high school diploma** | 14.1 | **Unskilled** | 11.8 |
| **High school graduates** | 9.4 | **Skilled** | 7 |
| **Associate's degree or some college** | 8.0 | | |
| **B.S. or higher** | 4.3 | | |
| **National unemployment rate in the U.S.** | 9.0 | | |

# Food and Agriculture has the Biggest Reduction in AVEs

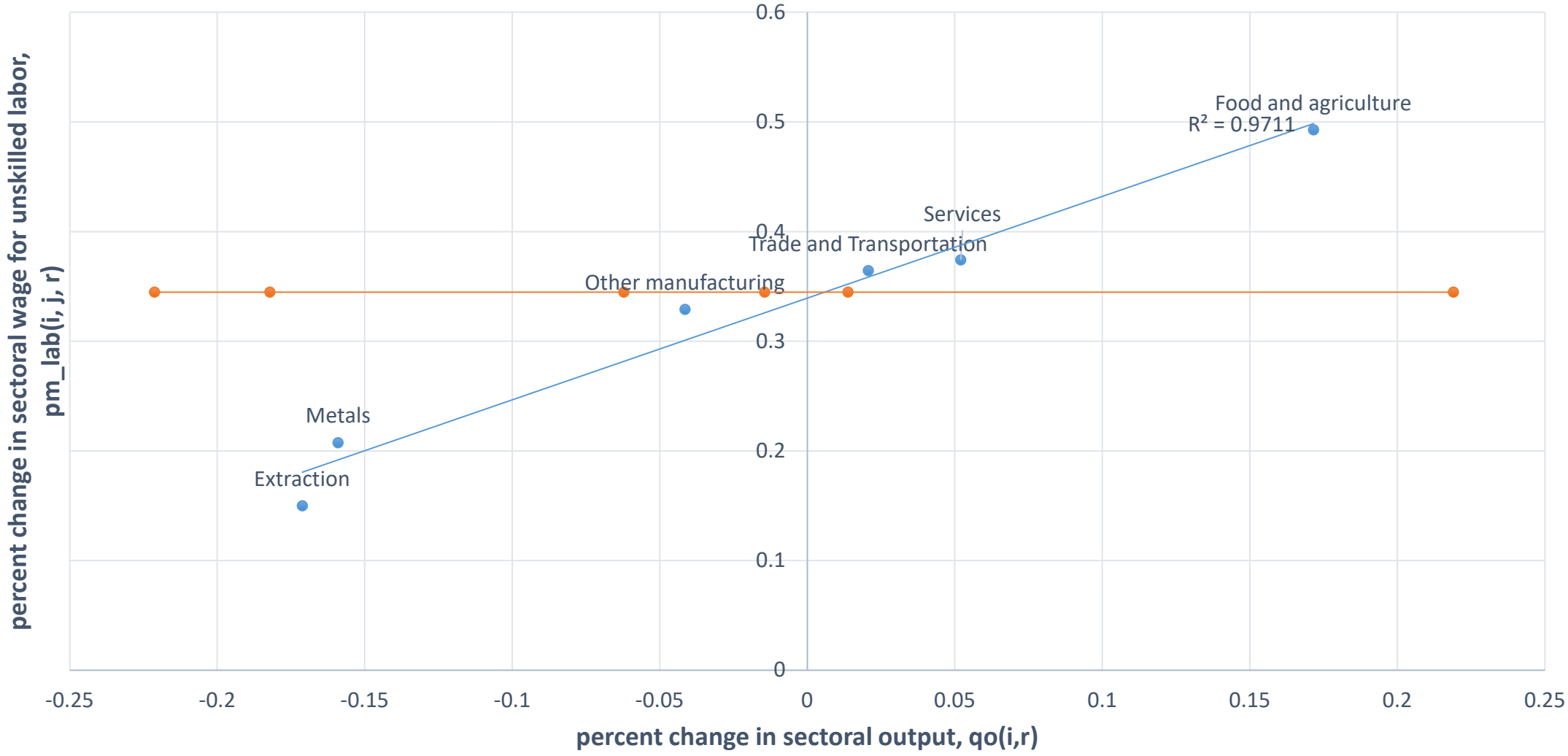
Change in the Power of Tariff Rates (in percent)

| | **EU AVEs on U.S. exports** | **U.S. AVEs on EU exports** |
|---|---|---|
| Food and Agriculture | -7.7 | -2.4 |
| Extraction | -0.3 | -0.1 |
| Metals | -1.7 | -0.9 |
| Other Manufacturing | -1.8 | -1.2 |

# Simulated removal of US-EU bilateral AVEs: Effects on U.S. sectoral wages for unskilled labor, in percent



# Simulated Removal of US-EU bilateral AVEs: Effects of U.S. Sectoral Output and Wages for unskilled labor, in percent in the GTAP-LAB Model



# Simulation Results in GTAP-LAB: Change in Employment in the U.S., measured by Change in Number of Workers (for both Unskilled and Skilled Labor)

| Food and Agriculture | Extraction | Metals | Manufacturing | Trade and Transportation | Other Services | Total |
|---|---|---|---|---|---|---|
| 1,855 | -2,802 | -18 | -1,936 | 8,838 | 42,509 | 48,445 |

- National unemployment rate in the United States declines by 0.37 percent for unskilled labor, and 0.72 percent for skilled labor.

# Changes in Welfare and Household Income in the U.S.

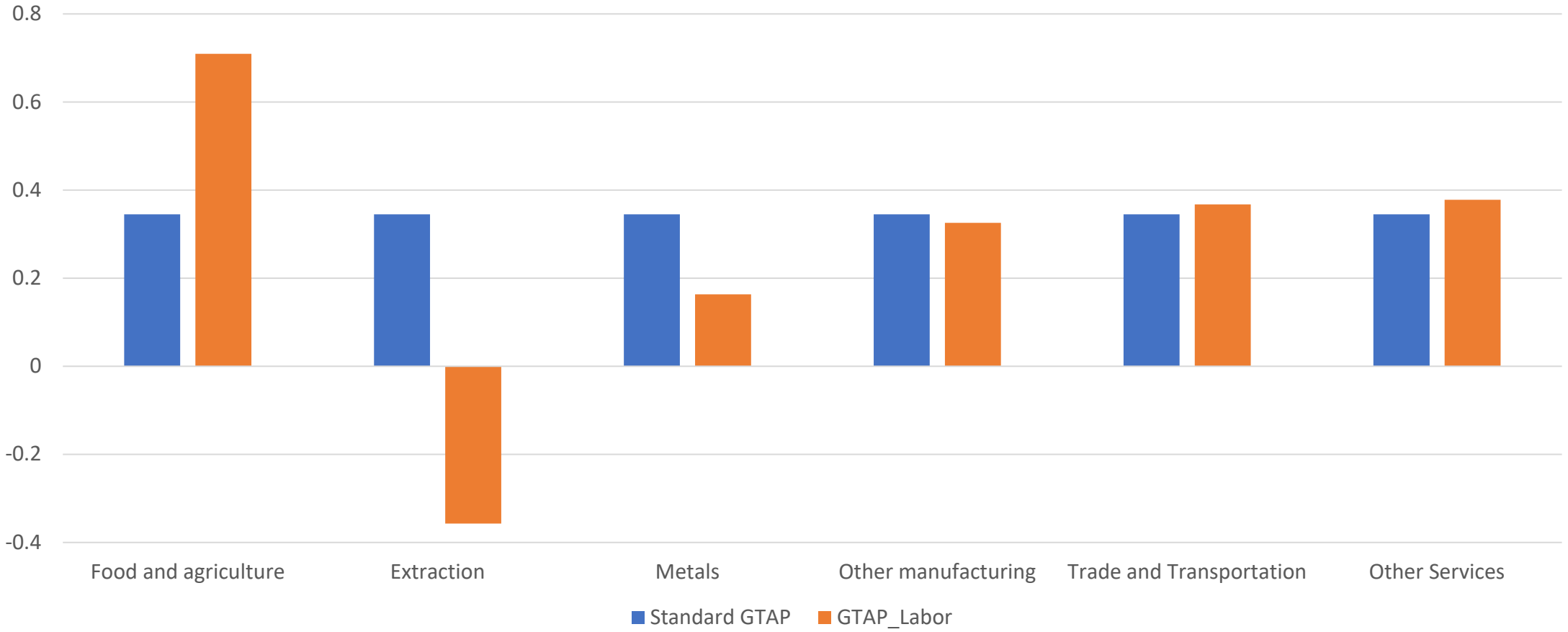
| | Standard GTAP | GTAP-LAB |
|---|---|---|
| **(percent change)** | | |
| **Household Income** | 0.323 | 0.394 |
| **Total Utility** | 0.065 | 0.107 |
| **(in million dollars)** | | |
| **Welfare Change (measured in EV)** | 8,839 | 14,564 |

# Sensitivity Analysis:  Revisions to the GTAP-LAB Model

- Substitution Elasticity between Existing and Matched Labor

| | **Unskilled Labor** | **Skilled Labor** |
|---|---|---|
| Food and Agriculture | 0.2 | 0.2 |
| Extraction | 0.2 | 0.2 |
| Metals | 1 | 2.5 |
| Other manufacturing | 1 | 2.5 |
| Trade and Transportation | 2.5 | 2.5 |
| Other services | 2.5 | 2.5 |

# Sensitivity Analysis: Simulated removal of US-EU bilateral AVEs, Effects on U.S. sectoral wages for unskilled labor, in percent



# Discussion: Consistency of the Labor Module with the Theoretical Underpinnings of the GTAP Model

- The matching function comes from the work of Hafstead and Williams (2018), which incorporates the matching function in a two-sector dynamic general equilibrium model. Meanwhile, Hafstead and Williams (2018) builds their model based on a matching model developed by Shimer (2010), which is a forward-looking dynamic model to analyze unemployment.

➢ Possible consistency issue in applying a matching function derived from a forward-looking dynamic framework into a comparative static model

Another option is to incorporate a wage curve into the GTAP model framework.

➢ The wage curve was initially developed by Blanchflower and Oswald (1995), which is empirically estimated using the historical wage and unemployment data

➢ When incorporating a wage curve into the GTAP model, is it the case that it is incorporating both equilibrium and disequilibrium (cyclical) unemployment?