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Breaking the single-household assumption in the GTAP framework: An application for the United States

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Abstract

The objective of this paper is to incorporate more detailed information on labor occupations and household groups for the U.S. economy in the GTAP framework, to allow for greater analysis of the impact of policies at the household level. The GTAP Data Base represents the world economy in equilibrium which is closely linked to the GTAP model. The Standard GTAP model is a multi-regional, global trade applied general equilibrium model with a single household for every region of the GTAP Data Base. In this paper, we modify the U.S. data in the GTAP Data Base to include multiple households. The new Data Base will be used with a modified model that explicitly considers multiple households. All other regions/countries in the Data Base are not modified.

In this paper we investigate the economic effects of the potential Trans-Pacific Partnership (TPP), a trade agreement between the US, Australia, Brunei Darussalam[1], Canada, Chile, Malaysia, Mexico, New Zealand, Peru, Singapore and Vietnam. The new model will allow us to analyse the effect of this policy at the household level for the US.

Introduction

The Trans-Pacific Partnership (TPP) started as the Trans-Pacific Strategic Economic Partnership (Pacific-4) Agreement, which involved Brunei, Chile, Singapore, and New Zealand. These four countries completed negotiations in 2005, and as of January 1st 2006, lowered their tariffs by 90% with the commitment to eliminate them completely by 2015.

Starting in 2008, other countries are negotiating to enter the group, these are: US, Australia, Canada, Chile, Malaysia, Mexico, New Zealand, Peru, Singapore and Vietnam. About half of international trade flows through the Asia-Pacific region, making it extremely important for global economic growth. The combined population of TPP member countries is approximately 626 million people and these economies account for US$18.2 trillion or 33% of World's GDP.

The greatest potential of this free trade agreement is its openness for other countries to join. The original TPSEP agreement contains an accession clause and affirms the members' "commitment to encourage the accession to this Agreement by other economies." While the negotiation involves eleven countries at the moment, the hope is that it will eventually expand to include other countries.

Negotiations entail many aspects such as intellectual property rights, but we are only going to evaluate the reduction and removal of import tariffs. The following sections will discuss the data sources and

[1] Unfortunately the GTAP Data Base does not have data for Brunei Darussalam

data adjustments to reveal the household and labor detail for the US in the GTAP framework. The policy simulation design is discussed next, followed by the results and conclusions.

Data

The modifications are implemented using shares so as to retain the underlying values of the GTAP Data Base. The Data Base represents the world economy equilibrium therefore the modifications need to add up to the original data base. The MyGTAP data manipulation program by Minor and Walmsley (2012a) is being used for this purpose. The following information is needed to obtain multiple households: primary factor splits, household consumption splits, and factor ownership shares for redistributing income to the new multiple households.

The latest version of the GTAP Data Base, version 8, is being used for this study (Narayanan et al, 2012). The data base represents the world economy for two reference years, 2004 and 2007. We are using the latest reference year, 2007. The Data Base is composed of 129 regions, 109 countries and 20 aggregated regions, listed in Table A1. The data base also describes 57 sectors, listed in Table A2, for every region.

In order to facilitate computation, the number of regions has been aggregated into 14 single countries and 7 aggregated regions, these are: the US, Australia, Canada, Chile, Malaysia, Mexico, New Zealand, Peru, Singapore, Vietnam, China, India, Japan, Russia, Central and rest of South America, the Europe, the Middle East, South East Asia, Rest of Asia, Africa and Oceania. This aggregation is listed in Table A3. The number of sectors has not been aggregated; we will work with all 57 sectors.

The GTAP Data Based distinguishes labor of two skill types, skilled and unskilled by industry. These two skill types in GTAP have been aggregated to facilitate the division of the primary labor factor into 22 occupations using the shares developed by Carrico et al. (2012)[2]. Carrico et al. (2012) used the Occupational Employment Statistics Survey, from the U.S. Bureau of Labor Statistic as well as the U.S. Department of Agriculture Census of Agriculture to produce occupation-by-sector tables for 2007 and 2010 that distinguish 22 occupations by GTAP sectors, see table A4 for the list of occupations.

The GTAP framework contains only one regional household per country/region and hence we also need data on household consumption and income sources in order to break out more households in the USA. To better describe the US household demand in the GTAP Data Base, we use the Current Expenditure Share Tables from the Consumer Expenditure Survey developed by the US Bureau of Labor Statistics. This distinguishes the consumption expenditure shares of 13 cohorts of income, see Table A5. The goods and services listed in the survey, see Table A6, are being mapped to the 57 GTAP sectors in order to modify the GTAP Data Base, mapping is available in Table A6. These will provide consumption shares.

[2] The decision to aggregate GTAP's labor-skill types was made when it was realized that the 22 occupations did not map nicely to the skilled and unskilled categories currently in GTAP. Also the methodology used to split skilled and unskilled labor in the current GTAP 8 Data Base is based on older data than that collected and hence it was decided that it was not appropriate to keep the old skilled/unskilled splits, when these could be improved.

The mapping of GTAP Sectors against goods and services of the Consumer Expenditure Services leaves 22 sectors unmapped, signaled in Table A2. The reason is that these sectors are mostly inputs into intermediate demand, not private consumption. The GTAP Data Base, however, does show some level of private consumption for several of these intermediate inputs, which also exist in the contributed US IO table. We assign a very small number for these 22 sectors and let the programs re-scale the specified weights in order to maintain the consistency of the GTAP Data Base.

Unfortunately there is currently no data available on factor ownership by households and hence simple assumptions will be made based on what we know about different households.

External Shares used to split the US in the GTAP Data Base

In this section, we discuss the external data that have been utilized to modify the number of households and labor types, these are: factor shares, household consumption shares, and factor ownership shares. While not required, savings rate and capital splitting weights can also be specified for each household.

Labor Shares

Labor splits are defined using the occupations shares developed by Carrico et al. (2012), which are based on the Occupational Employment Statistics Survey, from the U.S. Bureau of Labor Statistic as well as the U.S. Department of Agriculture Census of Agriculture. Table A7 shows the labor weights of 22 occupations by the 57 GTAP sectors used in this paper to split the Labor category.

Commodity Consumption Shares

The commodity consumption shares used in this paper are based on the Consumer Expenditure Survey (CES) listed in Table A8. Several GTAP products are not included in the CES because they include several intermediate goods that are not consumed by households, according to the CES. Table A8 will show an absolute zero in these cases. In the data program, however, we assign a very small number in order to maintain consistency with the GTAP DATA Base because in it, as in the contributed US IO table, there are private consumption figures for some of these intermediates products.

These consumption shares are targets that must be adjusted to assure that the total regional consumption of a given commodity is equal to the original private household consumption by commodity in the GTAP Data Base. Therefore, the data program will recalibrate the inputted shares in order to maintain this consistency.

Factor Ownership Shares

Factor ownership shares define household incomes when combined with factor incomes and is listed in Table A9. Combined with factor earnings, these ownership shares define the household income for the region to be expanded. For the labor categories as defined by occupation, this can be interpreted as shares of the wage bill; specifically, the share of the wage bill by occupation in each household out of the total wage bill across all households within each occupational category. In absence of data on household factor ownership, shares were computed from household wage data from the Bureau of

Labor Statistics (BLS) Consumer Expenditure (CEX) Survey and occupational wage data from the BLS Occupational Employment Statistics (OES) Survey.

The available data was as such:

1) From the CEX Survey:
   a) $\min\_inc_{hhd}$ and $\max\_inc_{hhd}$: household categories as defined by annual income ranges (this provided lower and upper bounds of income per household category)
   b) inc_avg_{hhd}: the mean pre-tax annual income of each household category, combined from all earners within the household
   c) wage_share_{hhd}: the average share of income derived from wages and salary annually per household category
   d) tot_hh_{hhd}: the total number of households per income-based definition
   e) earners: the average number of earners per household category
2) From the BLS Survey:
   a) wmean_{occ}: the weighted, mean pre-tax annual wage (or salary) of workers within each occupation grouping
   b) $\text{wmin}_{occ}$and wmax_{occ}: the minimum and maximum annual wages observed within each occupational grouping

Given this information, the following method was used to obtain the wage bill shares.

1. The average pretax wages and spread of pretax wages per household were computed:

$$wage\_share_{hhd} * inc\_avg_{hhd} = wmean_{hhd}$$
$$wage\_share_{hhd} * \max\_inc_{hhd} = wmax_{hhd}$$
$$wage\_share_{hhd} * \min\_inc_{hhd} = wmin_{hhd}$$

2. The total number of earners in each household was calculated:

$$\sum_{occ} L_{occ,hhd} = tot\_hh_{hhd} * earners_{hhd}$$

3. Then in order to distribute the total number of earners in each household across all occupations, a weighting system was developed to distribute earners to the occupation with a best matched wage.
   a. Weights were calculated as:

$$weight_a = \frac{wmean_{occ}/wmean_{hhd}}{\sum_{occ} wmean_{occ}/wmean_{hhd}}$$

These weights were applied under two mutually binding conditions:

i. When $wmean_{occ} \leq wmax_{hhd}$, essentially when the mean wage for the occupation type is no greater than the upper bound of the appropriate wage class for the household.
ii. When $earners_{hhd} * wmean_{occ} \geq wmin_{hhd}$, meaning that given the average number of earners were all working in this occupation, on average their combined income would be no less than the lower bound of the appropriate wage class for the household.

Both of these conditions must hold, for these weights to be applied to $\sum_{occ} L_{occ,hhd}$.

b. Now the conditions by which the above weights were calculated, however, could not be satisfied by the lower income households which had $wmax_{hhd} < wmin_{occ}$. So secondary weights were generated under the two mutually binding conditions:
   i. When $wmax_{hhd} < wmin_{occ}$, that is when the maximum wage made by the household is not even as high as the lowest reported wage in the given occupation. In other words, the lowest earning household types have wage intervals of which the higher bound, $wmax_{hhd}$, even falls below even the lowest wages of any of the occupations, $wmin_{occ}$.
   ii. When $wmin_{occ} < 20{,}000$; this condition ensures that weights are distributed based on the minimum wage, $wmin_{occ}$, in occupations reporting minimum wages below $20,000, which equates to less than a 9.62 $/hr wage, assuming the BLS-given 2,080 hours worked per year. This is an assumption made so as to try and match the lowest earning households with the lowest earning occupations.

   Considering that $wmax_{hhd} < wmin_{occ}$, in order to find the closest matching wages, weights were computed as

$$weight_b = \frac{wmean_{hhd}/wmin_{occ}}{\sum_{occ} wmean_{hhd}/wmin_{occ}}$$

   such that the occupations with the lowest minimum wages would match better with the low mean wages of the given households.

4. With a complete matrix

$$weighted\ L_{occ,hhd} = weight_a * L_{occ,hhd} \cap weight_b * L_{occ,hhd}$$

   $weight_a * L_{occ,hhd}$ was multiplied by $wmean_{occ}$ and $weight_b * L_{occ,hhd}$ was multiplied by $wmin_{occ}$ to obtain a complete matrix of wage bills,

$$wage\ bill_{occ,hhd} = wmean_{occ} * weight_a * L_{occ,hhd} \cap wmin_{occ} * weight_b * L_{occ,hhd}$$

   This was under the assumption that earners across all households earn the same amount per occupation (distinguishing cases between (III.a) and (III.b)); this is distinct from the assumption that workers in each household earn the same amount across all occupations, in terms of calculating the wage bill across the row.

5. The final shares were computed as:

$$\frac{wage\ bill_{occ,hhd}}{\sum_{hhd} wage\ bill_{occ,hhd}} = \frac{wmean_{occ} * weight_a * L_{occ,hhd}}{\sum_{hhd} wmean_{occ} * weight_a * L_{occ,hhd}} \cap \frac{wmin_{occ} * weight_b * L_{occ,hhd}}{\sum_{hhd} wmin_{occ} * weight_b * L_{occ,hhd}}$$

There were several nuances that surfaced when dealing with households in the lower income categories. Firstly, for households earning less than $5,000 there was negative income[3]; instead we used

[3] According to BLS documentation (see question 20 in http://www.bls.gov/cex/csxfaqs.htm#q20) as well as email correspondence with BLS CE Survey staff, these cases appear to be a result of a large proportion of retired, unemployed, and student persons who are living off of loans or savings within these income classes.

the average from years 2001-2004 to replace the negative value for 2007 for the household with an income below $5,000.

Saving and Capital weights

In MyGTAP, we distinguish two savings rates, one for the household and another for government. This is the result of eliminating the regional household, which separates government income from household income and expenditures in the original framework. As before, the two saving rates need to be consistent and add up to the original, un-split, regional household savings rate of the GTAP Data Base.

In terms of capital splitting weights, which are used to allocate depreciation across households, these are based on the proportion of capital rents in household income.

Model and Policy Scenario

This paper uses the newly developed MyGTAP Model (Minor and Walmsley, 2012b) which is an extension to the GTAP model (Hertel, 1997). MyGTAP modifies the original single regional household to allow for multiple private households and a separate government sector for one region. The private households receive income from factors as in standard GTAP model, but it also includes foreign remittances and capital, all of it being used to consume and save. The new model assumes that the government sector gains income from taxes and foreign aid in. Government income is reduced by foreign aid out and other transfers from government to private households.

The policy scenario simulates the potential Trans-Pacific Partnership (TPP) trade agreement between trade agreement between the US, Australia, Canada, Chile, Malaysia, Mexico, New Zealand, Peru, Singapore and Vietnam. The trade agreement encompasses many features for economic integration. In this paper we focus on the comprehensive market access aspect of the agreement which eliminates tariffs and other barriers to goods and services trade. Using MyGTAP we analyze the economic effects of the TPP trade agreement at the household level for the US.

Results

Conclusions

References

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Appendix

Table A1. GTAP Regions

No	Name	No	Name
1	Australia	**39**	Venezuela
2	New Zealand	**40**	Rest of South America
3	Rest of Oceania	**41**	Costa Rica
4	China	**42**	Guatemala
5	Hong Kong	**43**	Honduras
6	Japan	**44**	Nicaragua
7	Korea Republic of	**45**	Panama
8	Mongolia	**46**	El Salvador
9	Taiwan	**47**	Rest of Central America
10	Rest of East Asia	**48**	Caribbean
11	Cambodia	**49**	Austria
12	Indonesia	**50**	Belgium
13	Lao People's Democratic Republic	**51**	Cyprus
14	Malaysia	**52**	Czech Republic
15	Philippines	**53**	Denmark
16	Singapore	**54**	Estonia
17	Thailand	**55**	Finland
18	Viet Nam	**56**	France
19	Rest of Southeast Asia	**57**	Germany
20	Bangladesh	**58**	Greece
21	India	**59**	Hungary
22	Nepal	**60**	Ireland
23	Pakistan	**61**	Italy
24	Sri Lanka	**62**	Latvia
25	Rest of South Asia	**63**	Lithuania
26	Canada	**64**	Luxembourg
27	United States of America	**65**	Malta
28	Mexico	**66**	Netherlands
29	Rest of North America	**67**	Poland
30	Argentina	**68**	Portugal
31	Bolivia, Plurinational Republic of	**69**	Slovakia
32	Brazil	**70**	Slovenia
33	Chile	**71**	Spain
34	Colombia	**72**	Sweden
35	Ecuador	**73**	United Kingdom
36	Paraguay	**74**	Switzerland
37	Peru	**75**	Norway
38	Uruguay	**76**	Rest of EFTA
77	Albania	**111**	Rest of Western Africa

No	Name	No	Name
78	Bulgaria	**112**	Central Africa
79	Belarus	**113**	South Central Africa
80	Croatia	**114**	Ethiopia
81	Romania	**115**	Kenya
82	Russian Federation	**116**	Madagascar
83	Ukraine	**117**	Malawi
84	Rest of Eastern Europe	**118**	Mauritius
85	Rest of Europe	**119**	Mozambique
86	Kazakhstan	**120**	Tanzania United Republic of
87	Kyrgyzstan	**121**	Uganda
88	Rest of Former Soviet Union	**122**	Zambia
89	Armenia	**123**	Zimbabwe
90	Azerbaijan	**124**	Rest of Eastern Africa
91	Georgia	**125**	Botswana
92	Bahrain	**126**	Namibia
93	Iran Islamic Republic of	**127**	South Africa
94	Israel	**128**	Rest of South African Customs Union
95	Kuwait	**129**	Rest of the World
96	Oman		
97	Qatar		
98	Saudi Arabia		
99	Turkey		
100	United Arab Emirates		
101	Rest of Western Asia		
102	Egypt		
103	Morocco		
104	Tunisia		
105	Rest of North Africa		
106	Cameroon		
107	Cote d'Ivoire		
108	Ghana		
109	Nigeria		
110	Senegal		

Table A2. GTAP Sectors

No	Name	GTAP sector code	Not mapped to CES
1	Paddy rice	PDR	X
2	Wheat	WHT	X
3	Cereal grains nec	GRO	X
4	Vegetables, fruit, nuts	V_F	
5	Oil seeds	OSD	X
6	Sugar cane, sugar beet	C_B	X
7	Plant-based fibers	PFB	X
8	Crops nec	OCR	X
9	Bovine cattle, sheep and goats, horses	CTL	X
10	Animal products nec	OAP	
11	Raw milk	RMK	
12	Wool, silk-worm cocoons	WOL	X
13	Forestry	FRS	X
14	Fishing	FSH	X
15	Coal	COA	X
16	Oil	OIL	X
17	Gas	GAS	X
18	Minerals nec	OMN	X
19	Bovine meat products	CMT	
20	Meat products nec	OMT	
21	Vegetable oils and fats	VOL	
22	Dairy products	MIL	
23	Processed rice	PCR	
24	Sugar	SGR	
25	Food products nec	OFD	
26	Beverages and tobacco products	B_T	
27	Textiles	TEX	
28	Wearing apparel	WAP	
29	Leather products	LEA	
30	Wood products	LUM	X
31	Paper products, publishing	PPP	
32	Petroleum, coal products	P_C	
33	Chemical, rubber, plastic products	CRP	
34	Mineral products nec	NMM	X
35	Ferrous metals	I_S	X
36	Metals nec	NFM	X
37	Metal products	FMP	X
38	Motor vehicles and parts	MVH	
39	Transport equipment nec	OTN	X
40	Electronic equipment	ELE	

No	Name	GTAP sector code	Not mapped to CES
41	Machinery and equipment nec	OME	
42	Manufactures nec	OMF	
43	Electricity	ELY	
44	Gas manufacture, distribution	GDT	
45	Water	WTR	
46	Construction	CNS	X
47	Trade	TRD	
48	Transport nec	OTP	
49	Water transport	WTP	
50	Air transport	ATP	
51	Communication	CMN	
52	Financial services nec	OFI	
53	Insurance	ISR	
54	Business services nec	OBS	
55	Recreational and other services	ROS	
56	Public Administration, Defense, Education, Health	OSG	
57	Dwellings	DWE	

Table A3. Region Aggregation

United States	United States
Canada	Canada
Mexico	Mexico
Chile	Chile
Peru	Peru
Australia	Australia
NZ	New Zealand
China	China, Hong Kong, Taiwan
India	India
Japan	Japan
Russia	Russia
Malaysia	Malaysia
Singapore	Singapore
Vietnam	Vietnam
Central and Rest of South America	Argentina, Bolivia, Brazil, Colombia, Ecuador, Paraguay, Uruguay, Venezuela, Rest of South America, Costa Rica, Guatemala, Honduras, Nicaragua, Panama, El Salvador, Rest of Central America, Caribbean
Europe	Austria, Belgium, Cyprus, Czech Rep, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Norway, Rest of EFTA, Turkey, Albania, Bulgaria, Belarus, Croatia, Romania, Ukraine, Rest of Eastern Europe, Rest of Europe
Middle East	Bahrain, Iran, Israel, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates
Rest of South East Asia	Cambodia, Indonesia, Laos, Philippines, Thailand, Rest of Southeast Asia
Rest of Asia	Korea Rep., Mongolia, Rest of East Asia, Bangladesh, Nepal, Pakistan, Sri Lanka, Rest of South Asia, Rest of Western Asia, Kazakhstan, Kyrgyzstan, Rest of Former Soviet Union, Armenia, Azerbaijan, Georgia
Africa	Egypt, Morocco, Tunisia, Rest of North Africa, Cameroon, Cote d'Ivore, Ghana, Nigeria, Senegal, Rest of Western Africa, Central Africa, South Central Africa, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Tanzania, Uganda, Zambia, Zimbabwe, Rest of Eastern Africa, Botswana, Namibia, South Africa, Rest of South Africa Customs Union
Oceania	Australia, New Zealand, Rest of Oceania
Rest of the World	Rest of North America, Rest of the World

Table A4. Occupations

No	Name	Code
1	Management Occupations	management
2	Business and Financial Operations Occupations	bus_finance
3	Computer and Mathematical Occupations	comp_math
4	Architecture and Engineering Occupations	arch_enginr
5	Life, Physical and Social Science Occupations	sciences
6	Community and Social Service Occupations	social_serv
7	Legal Occupations	legal
8	Education, Training and Library Occupations	education
9	Arts, Design, Entertainment, Sports, and Media Occupations	entertain
10	Healthcare Practitioners and Technical Occupations	health_prac
11	Healthcare Support Occupations	health_sup
12	Protective Service Occupations	protective
13	Food Preparation and Serving Related Occupations	food_service
14	Building and Grounds Cleaning and Maintenance	build_maint
15	Personal Care and Service Occupations	pers_care
16	Sales and Related Occupations	sales
17	Office and Administrative Support Occupations	admin_supp
18	Farming, Fishing and Forestry Occupations	farm_occup
19	Construction and Extraction Occupations	constructn
20	Installation, Maintenance, and Repair Occupations	maint_repr
21	Production Occupations	production
22	Transportation and Material Moving Occupations	transport

Table A5. Income Brackets

No	Lower	Upper	Code
1	<	$5,000	hhless5
2	$5,000	$9,999	hh5
3	$10,000	$14,999	hh10
4	$15,000	$19,999	hh15
5	$20,000	$29,999	hh20
6	$30,000	$39,999	hh30
7	$40,000	$49,999	hh40
8	$50,000	$69,999	hh50
9	$70,000	$79,999	hh70
10	$80,000	$99,999	hh80
11	$100,000	$119,999	hh100
12	$120,000	$149,999	hh120
13	$150,000	<	hh150m

Table A6. Goods and Services from the Consumer Expenditure Survey

No	Name	GTAP sector code
1	Food	
2	Food at home	
3	Cereals and bakery products	
4	Cereals and cereal products	PCR, OFD
5	Bakery products	OFD
6	Meats, poultry, fish, and eggs	
7	Beef	CMT
8	Pork	OMT
9	Other meats	CMT, OMT
10	Poultry	OMT
11	Fish and seafood	OMT
12	Eggs	OAP
13	Dairy products	
14	Fresh milk and cream	RMK, MIL
15	Other dairy products	MIL
16	Fruits and vegetables	
17	Fresh fruits	V_F
18	Fresh vegetables	V_F
19	Processed fruits	OFD
20	Processed vegetables	OFD
21	Other food at home	
22	Sugar and other sweets	SGR, OFD
23	Fats and oils	VOL, OFD
24	Miscellaneous foods	OFD
25	Nonalcoholic beverages	B_T
26	Food prepared by consumer unit on out-of-town trips	OFD
27	Food away from home	TRD
28	Alcoholic beverages	B_T
29	Housing	
30	Shelter	
31	Owned dwellings	
32	Mortgage interest and charges	OFI
33	Property taxes	OSG
34	Maintenance, repairs, insurance, other expenses	DWE, TRD, ISR
35	Rented dwellings	OBS
36	Other lodging	TRD
37	Utilities, fuels, and public services	
38	Natural gas	GDT
39	Electricity	ELY
40	Fuel oil and other fuels	P_C

No	Name	GTAP sector code
41	Telephone services	CMN
42	Water and other public services	WTR, OSG
43	Household operations	
44	Personal services	ROS
45	Other household expenses	TRD, OBS, ROS
46	Housekeeping supplies	
47	Laundry and cleaning supplies	CRP
48	Other household products	OME, OMF,
49	Postage and stationery	PPP, CMN
50	Household furnishings and equipment	
51	Household textiles	TEX
52	Furniture	OMF
53	Floor coverings	TEX
54	Major appliances	OME
55	Small appliances, miscellaneous housewares	OME
56	Miscellaneous household equipment	ELE, LEA, OME
57	Apparel and services	
58	Men and boys	
59	Men, 16 and over	WAP
60	Boys, 2 to 15	WAP
61	Women and girls	
62	Women, 16 and over	WAP
63	Girls, 2 to 15	WAP
64	Children under 2	WAP
65	Footwear	LEA
66	Other apparel products and services	WAP, TRD, ROS
67	Transportation	
68	Vehicle purchases (net outlay)	
69	Cars and trucks, new	MVH
70	Cars and trucks, used	TRD
71	Other vehicles	MVH
72	Gasoline and motor oil	TRD, P_C
73	Other vehicle expenses	
74	Vehicle finance charges	OFI
75	Maintenance and repairs	TRD
76	Vehicle insurance	ISR
77	Vehicle rental, leases, licenses, and other charges	OBS, OSG
78	Public and other transportation	OTP, ATP, WTP
79	Health care	
80	Health insurance	ISR
81	Medical services	OSG

No	Name	GTAP sector code
82	Drugs	CRP
83	Medical supplies	OME
84	Entertainment	
85	Fees and admissions	ROS
86	Audio and visual equipment and services	ELE
87	Pets, toys, hobbies, and playground equipment	OMF, OSG
88	Other entertainment supplies, equipment, and services	OME, OMF, ROS
89	Personal care products and services	CRP, ROS
90	Reading	PPP,
91	Education	OSG
92	Tobacco products and smoking supplies	B_T
93	Miscellaneous	OFI, ROS
94	Cash contributions	OSG
95	Personal insurance and pensions	
96	Life and other personal insurance	ISR
97	Pensions and Social Security	OSG

Table A7. US Labor Splitting Weights (US occupation by GTAP sector)

	PDR	WHT	GRO	V_F	OSD	C_B	PFB	OCR	CTL	OAP	RMK	WOL	FRS	FSH	COA	OIL	GAS	OMN	CMT	OMT
management	0.919	0.919	0.919	0.641	0.919	0.967	0.726	0.799	0.957	0.858	0.658	0.988	0.044	0.941	0.083	0.158	0.158	0.089	0.053	0.053
bus_finance	0	0	0	0	0	0	0	0	0	0	0	0	0.008	0	0.019	0.087	0.087	0.027	0.016	0.016
comp_math	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.006	0.028	0.028	0.006	0.002	0.002
arch_enginr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.036	0.104	0.104	0.037	0.004	0.004
Sciences	0	0	0	0	0	0	0	0	0	0	0	0	0.021	0	0.014	0.08	0.08	0.018	0.006	0.006
social_serv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Legal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0.01	0.01	0.001	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Entertain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0.001	0	0	0
health_prac	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.005	0.005	0.005	0.005	0.003	0.003
health_sup	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Protective	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0	0.001	0	0	0.001	0.002	0.002
food_service	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.003	0.003
build_maint	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0	0.001	0.001	0.001	0.002	0.012	0.012
pers_care	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sales	0	0	0	0	0	0	0	0	0	0	0	0	0.002	0	0.01	0.022	0.022	0.02	0.016	0.016
admin_supp	0	0	0	0	0	0	0	0	0	0	0	0	0.057	0	0.043	0.073	0.073	0.063	0.048	0.048
farm_occup	0.081	0.081	0.081	0.359	0.081	0.033	0.274	0.201	0.043	0.142	0.342	0.012	0.612	0.059	0	0	0	0.001	0.016	0.016
Construct	0	0	0	0	0	0	0	0	0	0	0	0	0.009	0	0.493	0.248	0.248	0.361	0.002	0.002
maint_repr	0	0	0	0	0	0	0	0	0	0	0	0	0.035	0	0.101	0.039	0.039	0.107	0.066	0.066
Production	0	0	0	0	0	0	0	0	0	0	0	0	0.036	0	0.054	0.072	0.072	0.093	0.622	0.622
Transport	0	0	0	0	0	0	0	0	0	0	0	0	0.174	0	0.134	0.071	0.071	0.17	0.13	0.13

Table A7. US Labor Splitting Weights (continued)

	VOL	MIL	PCR	SGR	OFD	B_T	TEX	WAP	LEA	LUM	PPP	P_C	CRP	NMM	I_S	NFM	FMP	MVH	OTN	ELE
management	0	0.099	0	0.089	0.103	0.124	0.11	0.109	0.108	0.09	0.151	0.105	0.149	0.097	0.074	0.098	0.126	0.073	0.112	0.186
bus_finance	0	0.025	0	0.027	0.028	0.03	0.023	0.024	0.032	0.026	0.045	0.064	0.042	0.02	0.023	0.027	0.039	0.042	0.099	0.07
comp_math	0.007	0.007	0.007	0.004	0.007	0.011	0.008	0.018	0.007	0.004	0.118	0.021	0.023	0.004	0.007	0.008	0.007	0.011	0.067	0.167
arch_enginr	0.048	0.011	0.048	0.012	0.009	0.01	0.012	0.014	0.005	0.019	0.01	0.12	0.056	0.026	0.049	0.049	0.052	0.075	0.254	0.261
sciences	0.059	0.023	0.059	0.018	0.017	0.014	0.004	0.003	0.002	0.005	0.01	0.048	0.081	0.002	0.003	0.008	0.002	0.001	0.004	0.014
social_serv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
legal	0	0	0	0	0	0	0	0	0	0	0.003	0.004	0.002	0	0	0	0	0	0.001	0.004
education	0	0	0	0	0	0	0	0	0	0	0.001	0	0	0	0	0	0	0	0.001	0
entertain	0	0.001	0	0.002	0.001	0.01	0.028	0.019	0.014	0.002	0.152	0.001	0.003	0.005	0	0	0.001	0.003	0.007	0.007
health_prac	0.004	0.001	0.004	0.001	0.001	0.001	0	0	0	0.001	0	0.003	0.004	0.001	0.002	0.002	0.001	0.001	0.002	0.001
health_sup	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
protective	0	0.001	0	0.001	0.001	0.001	0.001	0	0	0.001	0	0.002	0.001	0.001	0.002	0.001	0	0	0.003	0.001
food_service	0	0.007	0	0.013	0.023	0.01	0	0	0	0	0.007	0	0	0	0	0	0	0	0	0
build_maint	0.013	0.007	0.013	0.012	0.015	0.007	0.004	0.006	0.004	0.005	0.003	0	0.003	0.003	0.003	0.004	0.004	0.002	0.002	0.001
pers_care	0	0	0	0	0	0.001	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0
sales	0.024	0.04	0.024	0.072	0.058	0.115	0.053	0.029	0.043	0.044	0.095	0.026	0.043	0.046	0.021	0.031	0.04	0.014	0.01	0.044
admin_supp	0.09	0.089	0.09	0.071	0.082	0.08	0.11	0.088	0.091	0.069	0.118	0.056	0.082	0.08	0.052	0.061	0.089	0.045	0.056	0.053
farm_occup	0.006	0.003	0.006	0.005	0.009	0.017	0	0	0	0.016	0	0	0	0	0	0	0	0	0	0
constructn	0.012	0.004	0.012	0.012	0.005	0.005	0.007	0	0	0.074	0.004	0.049	0.007	0.061	0.029	0.028	0.022	0.034	0.033	0.001
maint_repr	0.108	0.083	0.108	0.102	0.074	0.102	0.05	0.085	0.027	0.05	0.023	0.085	0.063	0.069	0.141	0.097	0.038	0.071	0.068	0.021
production	0.501	0.377	0.501	0.438	0.399	0.277	0.532	0.531	0.627	0.441	0.204	0.367	0.38	0.332	0.508	0.516	0.53	0.576	0.263	0.163
transport	0.129	0.221	0.129	0.12	0.168	0.185	0.06	0.074	0.04	0.154	0.045	0.051	0.058	0.255	0.086	0.067	0.049	0.051	0.018	0.007

Table A7. US Labor Splitting Weights (continued)

	OME	OMF	ELY	GDT	WTR	CNS	TRD	OTP	WTP	ATP	CMN	OFI	ISR	OBS	ROS	OSG
management	0.158	0.121	0.113	0.093	0.106	0.107	0.088	0.066	0.114	0.029	0.123	0.179	0.145	0.147	0.094	0.078
bus_finance	0.055	0.034	0.078	0.099	0.031	0.04	0.026	0.028	0.041	0.028	0.075	0.286	0.248	0.116	0.039	0.051
comp_math	0.05	0.015	0.041	0.03	0.008	0.001	0.016	0.007	0.01	0.01	0.186	0.062	0.085	0.112	0.004	0.017
arch_enginr	0.156	0.026	0.125	0.072	0.037	0.015	0.005	0.006	0	0.005	0.043	0.001	0.001	0.074	0.001	0.012
Sciences	0.01	0.003	0.024	0.011	0.01	0.001	0.002	0.001	0	0.001	0.012	0.006	0.006	0.028	0.003	0.018
social_serv	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0.001	0	0.039
Legal	0.001	0	0.005	0.005	0.002	0	0	0	0	0.001	0.004	0.007	0.024	0.066	0.001	0.011
Education	0	0	0	0	0	0	0	0	0	0	0.005	0	0	0.003	0.021	0.213
Entertain	0.007	0.021	0.005	0.005	0.002	0.001	0.007	0.001	0	0.001	0.09	0.003	0.004	0.024	0.161	0.009
health_prac	0.003	0	0.004	0.002	0	0	0.025	0.001	0	0.001	0.001	0	0.016	0.023	0.005	0.22
health_sup	0	0	0	0	0	0	0.002	0	0	0	0	0	0.001	0.005	0.004	0.048
Protective	0.001	0.001	0.008	0.005	0	0	0.004	0.003	0	0	0.001	0.002	0.001	0.02	0.03	0.052
food_service	0	0	0	0	0	0	0.178	0.001	0.029	0	0	0	0	0.003	0.114	0.014
build_maint	0.003	0.003	0.003	0.001	0.005	0.003	0.016	0.003	0	0.001	0.001	0.001	0.001	0.047	0.078	0.019
pers_care	0	0	0	0	0	0	0.018	0.005	0.003	0.212	0	0	0	0.003	0.227	0.02
sales	0.049	0.06	0.013	0.038	0.021	0.026	0.312	0.024	0.031	0.008	0.129	0.143	0.188	0.07	0.064	0.004
admin_supp	0.084	0.105	0.121	0.207	0.214	0.071	0.123	0.155	0.089	0.193	0.17	0.309	0.275	0.16	0.088	0.123
farm_occup	0	0	0	0	0.005	0	0.002	0	0	0	0	0	0	0.005	0.002	0.001
constructn	0.007	0.032	0.036	0.098	0.11	0.626	0.004	0.008	0	0	0.001	0	0	0.013	0.008	0.013
maint_repr	0.033	0.026	0.278	0.195	0.117	0.067	0.069	0.064	0.009	0.083	0.156	0.001	0.002	0.024	0.039	0.016
production	0.359	0.496	0.135	0.111	0.303	0.011	0.03	0.016	0.008	0.001	0.002	0	0	0.026	0.003	0.006
transport	0.025	0.055	0.012	0.03	0.03	0.029	0.073	0.61	0.666	0.426	0.002	0	0	0.029	0.017	0.016

Table A8. US Household Consumption Splitting Weights (GTAP sector by Household)

	hhless5	hh5	hh10	hh15	hh20	hh30	hh40	hh50	hh70	hh80	hh100	hh120	hh150m
pdr	0	0	0	0	0	0	0	0	0	0	0	0	0
wht	0	0	0	0	0	0	0	0	0	0	0	0	0
gro	0	0	0	0	0	0	0	0	0	0	0	0	0
v_f	0.010	0.013	0.011	0.010	0.010	0.008	0.009	0.008	0.008	0.006	0.007	0.008	0.007
osd	0	0	0	0	0	0	0	0	0	0	0	0	0
c_b	0	0	0	0	0	0	0	0	0	0	0	0	0
pfb	0	0	0	0	0	0	0	0	0	0	0	0	0
ocr	0	0	0	0	0	0	0	0	0	0	0	0	0
ctl	0	0	0	0	0	0	0	0	0	0	0	0	0
oap	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000
rmk	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.001	0.001	0.001
wol	0	0	0	0	0	0	0	0	0	0	0	0	0
frs	0	0	0	0	0	0	0	0	0	0	0	0	0
fsh	0	0	0	0	0	0	0	0	0	0	0	0	0
coa	0	0	0	0	0	0	0	0	0	0	0	0	0
oil	0	0	0	0	0	0	0	0	0	0	0	0	0
gas	0	0	0	0	0	0	0	0	0	0	0	0	0
omn	0	0	0	0	0	0	0	0	0	0	0	0	0
cmt	0.007	0.007	0.009	0.006	0.007	0.007	0.006	0.006	0.005	0.005	0.004	0.004	0.003
omt	0.013	0.015	0.013	0.011	0.013	0.012	0.011	0.009	0.008	0.008	0.009	0.008	0.006
vol	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000
mil	0.008	0.008	0.008	0.008	0.008	0.007	0.007	0.006	0.007	0.006	0.005	0.005	0.005
pcr	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.001	0.001	0.001
sgr	0.002	0.002	0.001	0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
ofd	0.036	0.041	0.038	0.036	0.035	0.034	0.032	0.029	0.029	0.028	0.024	0.025	0.019
b_t	0.030	0.035	0.030	0.029	0.029	0.028	0.027	0.025	0.021	0.020	0.018	0.017	0.018
tex	0.002	0.003	0.002	0.004	0.003	0.003	0.004	0.004	0.003	0.004	0.003	0.004	0.005
wap	0.038	0.027	0.027	0.021	0.025	0.026	0.026	0.028	0.029	0.028	0.028	0.027	0.031

lea	0.015	0.016	0.011	0.009	0.012	0.012	0.013	0.012	0.010	0.011	0.012	0.012	0.014
lum	0	0	0	0	0	0	0	0	0	0	0	0	0
ppp	0.004	0.004	0.005	0.004	0.004	0.004	0.003	0.003	0.004	0.004	0.003	0.004	0.003
p_c	0.026	0.030	0.029	0.031	0.032	0.033	0.032	0.030	0.029	0.026	0.026	0.023	0.017
crp	0.018	0.022	0.026	0.028	0.025	0.023	0.023	0.018	0.018	0.017	0.015	0.016	0.013
nmm	0	0	0	0	0	0	0	0	0	0	0	0	0
i_s	0	0	0	0	0	0	0	0	0	0	0	0	0
nfm	0	0	0	0	0	0	0	0	0	0	0	0	0
fmp	0	0	0	0	0	0	0	0	0	0	0	0	0
mvh	0.014	0.013	0.027	0.032	0.023	0.025	0.023	0.032	0.037	0.049	0.042	0.040	0.035
otn	0	0	0	0	0	0	0	0	0	0	0	0	0
ele	0.028	0.037	0.029	0.026	0.028	0.026	0.028	0.027	0.022	0.025	0.024	0.024	0.023
ome	0.019	0.028	0.017	0.018	0.021	0.019	0.020	0.021	0.021	0.021	0.024	0.021	0.023
omf	0.019	0.016	0.016	0.016	0.018	0.018	0.018	0.020	0.020	0.020	0.027	0.023	0.028
ely	0.036	0.044	0.044	0.040	0.036	0.034	0.031	0.027	0.025	0.023	0.021	0.020	0.017
gdt	0.011	0.013	0.014	0.014	0.012	0.012	0.010	0.010	0.010	0.009	0.009	0.008	0.007
wtr	0.006	0.005	0.006	0.005	0.005	0.005	0.005	0.004	0.005	0.004	0.004	0.004	0.003
cns	0	0	0	0	0	0	0	0	0	0	0	0	0
trd	0.137	0.126	0.132	0.144	0.152	0.153	0.153	0.164	0.161	0.150	0.154	0.150	0.142
otp	0.003	0.002	0.002	0.004	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.006
wtp	0.003	0.002	0.002	0.004	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.006
atp	0.003	0.002	0.002	0.004	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.006
cmn	0.029	0.036	0.034	0.032	0.031	0.030	0.027	0.025	0.026	0.023	0.020	0.019	0.015
ofi	0.057	0.032	0.042	0.048	0.055	0.072	0.076	0.095	0.110	0.112	0.115	0.117	0.104
isr	0.072	0.063	0.088	0.085	0.092	0.080	0.079	0.069	0.065	0.065	0.053	0.062	0.046
obs	0.156	0.184	0.157	0.146	0.117	0.105	0.086	0.061	0.042	0.034	0.027	0.024	0.020
ros	0.031	0.027	0.031	0.036	0.030	0.037	0.037	0.041	0.042	0.047	0.050	0.052	0.061
osg	0.161	0.130	0.126	0.129	0.153	0.165	0.193	0.200	0.222	0.233	0.253	0.259	0.302
dwe	0.004	0.006	0.008	0.009	0.010	0.007	0.007	0.008	0.008	0.007	0.007	0.009	0.008
Total	1	1	1	1	1	1	1	1	1	1	1	1	1

Table A9. US Factor Ownership Shares (Factors by Household)

	hhless5	hh5	hh10	hh15	hh20	hh30	hh40	hh50	hh70	hh80	hh100	hh120	hh150m
Land	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077
Capital	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077
Management	0	0	0	0	0	0	0	0	0	0	0.283	0.302	0.415
bus_finance	0	0	0	0	0	0	0	0	0.193	0.234	0.162	0.173	0.238
comp_math	0	0	0	0	0	0	0	0	0	0.29	0.201	0.215	0.295
arch_enginr	0	0	0	0	0	0	0	0	0	0.29	0.201	0.215	0.295
Sciences	0	0	0	0	0	0	0	0	0.193	0.234	0.162	0.173	0.238
social_serv	0	0	0	0	0	0	0	0.57	0.194	0.236	0	0	0
Legal	0	0	0	0	0	0	0	0	0	0	0.283	0.302	0.415
Education	0	0	0	0	0	0	0	0.49	0.167	0.203	0.14	0	0
Entertain	0	0	0	0	0	0	0	0.49	0.167	0.203	0.14	0	0
health_prac	0	0	0	0	0	0	0	0	0.193	0.234	0.162	0.173	0.238
health_sup	0	0	0	0	0	0.613	0.387	0	0	0	0	0	0
Protective	0	0	0	0	0	0	0.372	0.358	0.122	0.148	0	0	0
food_service	0.047	0.06	0.084	0.398	0	0.411	0	0	0	0	0	0	0
build_maint	0.014	0.019	0.026	0.123	0.633	0.186	0	0	0	0	0	0	0
pers_care	0.057	0.074	0.103	0	0	0.766	0	0	0	0	0	0	0
Sales	0	0	0	0	0	0	0.437	0.42	0.143	0	0	0	0
admin_supp	0	0	0	0	0	0	0.51	0.49	0	0	0	0	0
farm_occup	0.064	0.083	0.116	0	0	0.736	0	0	0	0	0	0	0
Construct	0	0	0	0	0	0	0	0.57	0.194	0.236	0	0	0
maint_repr	0	0	0	0	0	0	0	0.57	0.194	0.236	0	0	0
Production	0	0	0	0	0	0	0.51	0.49	0	0	0	0	0
Transport	0	0	0	0	0	0	0.51	0.49	0	0	0	0	0