

Quantifying and Accounting for Differences in Quality in Service Sectors: A Bilateral Price Comparison between United States and Japan

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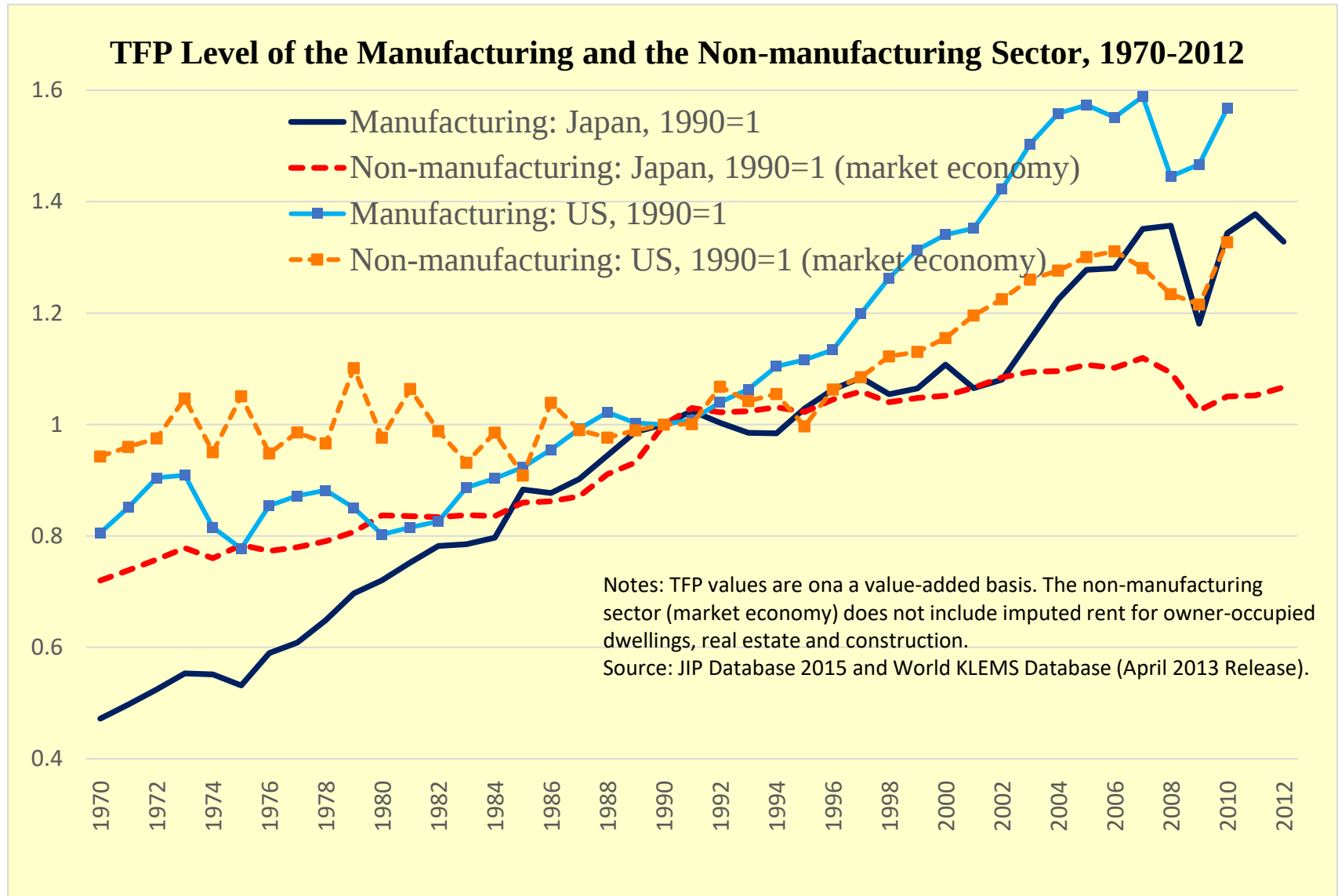
Main Questions

This paper tries to answer three main questions:

- Are there quality differences in services between US and Japan that are not captured in the official PPP by the World Bank (ICP)?
- If any, how can we estimate them?
- Are they quantitatively important?

Some Background

Productivity of Japanese Service Sector Relative to USA



Labor Productivity in some service industries in Japan and the USA

	JP LP (\$1/hour)	US LP (\$1/hour)	Relative Productivity
Hotels and restaurants	4.745	14.265	0.333
Transport and storage	15.711	36.571	0.430
Post and telecommunications	83.494	117.076	0.713
Financial intermediation	45.692	92.302	0.495

From Takizawa (2016). PPP based value added divided by labor hours.

ICP's Global Core List

“structured product descriptions”

Item Code	111111101	111111102	111111103	111111104	111111105	111111106
Item Name	Steamed or fried whole fish, with side dish, at restaurant	Fish fillet, with side dish, at restaurant	Salad, starter, at restaurant	Breaded escalope, at restaurant	Pizza with tomato and chesse topping, at restaurant	Spaghetti bolognaise, at restaurant
Quantity	1	1	1	1	1	1
Unit of measurement	Portion	Portion	Portion	Portion	Portion	Portion
Category (of restaurant)	Middle class	Middle class	Middle class	Modest	Modest	Modest
Type	Main course, local or regional fish	Main course, local or regional specie, evening	Starter, à la carte, evening	Main course, à la carte, lunchtime	Main course, à la carte, evening	Main course, à la carte, evening
Serving size	250 gram fish	1 portion	1 portion	1 portion	25-31 cm	1 portion
Main dish	Steamed or fried whole fish	Grilled sea fish fillet	Cold salad (lettuce, onion, tomatoes, cucumber, crouton or pepper)	Pork/chicken	Pizza with tomato and cheese topping	Spaghetti with meat and tomato sauce
Side dish	2 (e.g. rice and vegetables)	2 (e.g. rice and vegetables)	No	No	No	No
Price includes	Compulsory services charges and tips	Compulsory services charges and tips	Compulsory services charges and tips	Compulsory services charges and tips	Compulsory services charges and tips	Compulsory services charges and tips
Exclude		Frozen, pre-packaged	Meat or additional protein item		Pizza with meat toppings; American-style deep pan pizza	
Specify	Type of fish	Type of fish				
						7

Item Code	110732101	110732102	110732103	110732104	110732105
Item Name	Urban (city) bus, 5-15 km	Urban (city) bus, monthly	Interurban (InterCity) bus, 50 km	Interurban (InterCity) bus, 150 km	Interurban (InterCity) bus, 350 km
Quantity	1	1	1	1	1
Unit of measurement	Ticket	Ticket	Ticket	Ticket	Ticket
Transportation Type	Urban bus	Urban bus	Urban bus	Urban bus	Urban bus
Ticket type	One way fare, for adult passenger	Monthly pass, for adult passenger	One way fare, for adult passenger	One way fare, for adult passenger	One way fare, for adult passenger
Distance	5 - 15 Km	Not relevant	50 km	150 km	350 km
Time	Working day	Not relevant	Working day	Working day	Working day
Starting point	Survey city center	Not relevant	Survey city center	Survey city center	Survey city center
Price includes					
Exclude	Price reductions (such as discount or special offer only for best customers)	Extended services outside of urban area	Price reductions (such as discount or special offer only for best customers)	Price reductions (such as discount or special offer only for best customers)	Price reductions (such as discount or special offer only for best customers)
Reference quantity	1	1	1	1	1
Reference unit of measurement	Ticket	Ticket	Ticket	Ticket	Ticket

Restaurants Awarded in Michelin Guide 2018

Area	City	3 stars	2 stars	1 stars	Bib Gourmand
Japan	Tokyo	12	56	166	278
	Kyoto	8	23	64	90
	Osaka	4	17	75	131
USA	New York City	5	11	55	116
	Washington DC	1	2	13	39
	San Francisco	7	7	40	66
Europe	Paris	10	15	79	62
	Great Britain and Ireland	5	20	150	145
Asian	Hong Kong Macau	8	16	57	82
	Taipei	1	2	17	36
	Seul	2	4	17	48
	China	1	8	33	46

Bib Gourmand restaurants are selected by Michelin's famously anonymous food inspectors, who choose restaurants serving high quality food on their menus and make it possible to order two courses and a glass of wine or dessert **for \$40 or less** (tax and gratuity not included).

Japan, under ¥5000.

Sources: Guide Michelin (<https://guide.michelin.com>) for NYC, Washington DC., San Francisco, Hong Kong, and Taipei, Guide Michelin (<https://guide.michelin.com>) for NYC, Washington DC., San Francisco, Hong Kong, and Taipei, Guide Michelin (<https://guide.michelin.co.kr>) for Seoul, Le Guide Michelin, Tokyo, 2018 for Tokyo, Le Guide Michelin, Kyoto and Osaka 2018 for Kyoto and Osaka, MICHELIN Guide Great Britain and Ireland 2018, <https://restaurant.michelin.fr> for Paris

Bullet Train



- 323 shinkansen bullet trains depart Tokyo Station daily, transporting nearly 400,000 passengers every day.
- Since its inception in 1964, the Tokaido Shinkansen has never experienced any fatal accidents due to derailments or collisions.
- The average delay of the nation's fleet of bullet train, known locally as the Shinkansen, is less than 60 seconds (eat your heart out Metro Trains). Believe or not, this statistic also includes unavoidable, major delays such as typhoons and earthquakes.
(<http://www.traveller.com.au/>)

Difficulties in Measuring PPPs for Services

- Most services are not traded over borders. The law of one price generally does not hold.
- It is very hard to find “identical” service in two different countries. When we use transportation service by railroad, the “quality” of train travel might reflect not only the speed to reach the destination, but also reflect: 1) cleanliness; 2) punctuality; 3) safety; 4) frequency of trains; 5) customer service; 6) congestions; and 7) terminal services.

This paper

- To compare the service quality between Japan and the United States, we obtain information on the quality of each country's services by asking people who have used services in both countries about their marginal willingness to pay for the service from the other country.
- Finding: difference in quality in services in the US and Japan causes undervaluation of Japanese Yen by 9%. The quality adjusted PPP of service industries of Japan/US is 104 JPY, while without adjustment, it is 113JPY.

Outline

- Main Questions
- Background
- Analytical Framework and Index Number Approach
- Survey Design
- Data and Estimation Procedures
- Estimation Results
- Conclusion

Analytical Framework and Index Number Approach

The quality adjustment factor 1

- The Budget constraint for the representative consumers in country j and k .
- $\sum_{i=1}^N p_{il} q_{il} = I_l, l = j \text{ or } k,$
- Assume q_{ij} and q_{ik} are **different** products!
- Also assume that by using **the quality adjustment factor** $(1 + a_{ik})$, we can make the two commodities to be identical for consumers.
- $1 + a_{ij}$ unit of q_{ij} is identical to $1 + a_{ik}$ unit of the commodity i in country k , q_{ik}

The quality adjustment factor 2

- $\sum_{i=1}^N \frac{(1+a_{il})}{(1+a_{il})} p_{il} q_{il} = \sum_{i=1}^N p_{il}^* q_{il} (1 + a_{il}) = I_l,$

$l = j \text{ or } k, \text{ where } p_{il}^* = \frac{p_{il}}{(1+a_{il})}.$

- p_{il}^* is can be regarded as the quality adjusted price.

The quality adjusted quantity, q_{il}^* , is defined as

$$q_{il}^* = (1 + a_{il}) q_{il}, l = j \text{ or } k$$

Consumers' Problem

$$\begin{aligned} &\text{Max: } U(q_{1l}^*, q_{2l}^*, q_{3l}^*, \dots, q_{Nl}^*) \\ &\text{s.t. } \sum_{i=1}^N p_{il}^* q_{il}^* = I_l \end{aligned}$$

- The following expenditure function can be derived,

$$\begin{aligned} E_l(p_{1l}^*, p_{2l}^*, p_{3l}^*, \dots, p_{Nl}^*; U_l) &= \text{Min } \sum_{i=1}^N p_{il}^* q_{il}^* \\ &\text{s.t. } U(q_{1l}^*, q_{2l}^*, q_{3l}^*, \dots, q_{Nl}^*) \geq U_l \end{aligned}$$

- We can define the cost of living index (COLI) between countries j and k as,

$$\bullet \text{ } COLI = \frac{E(p_{1j}^*, p_{2j}^*, p_{3j}^*, \dots, p_{Nj}^*; U)}{E(p_{1k}^*, p_{2k}^*, p_{3k}^*, \dots, p_{Nk}^*; U)}$$

Sato-Vartia Index

We use the Sato-Vartia Price Index as the COLI,

Sato-Vartia index is commonly used in the literature focusing on quality (or the number of products) differences in cross-country welfare comparison (Feenstra 1994), and business cycles (Broda and Weinstein 2010).

Sato-Vartia has several useful properties: (1) the S-V index is exact for CES utility function; (2) satisfies factor reversal test; and (3) the index is multiplicative.

Sato-Vartia Index

Expenditure share: $w_{il} = \frac{p_{il}q_{il}}{\sum_{i=1}^N p_{il}q_{il}}$ for $l = j$ or k

j, k : countries, i : item. Then the S-V price comparison is given by

$$PPP_{jk}^{SV} = \prod_{i=1}^N \left(\frac{p_{ij}^*}{p_{ik}^*} \right)^{\phi_i}$$

$$\text{where } \phi_i = \left(\frac{w_{ij} - w_{ik}}{\ln(w_{ij}) - \ln(w_{ik})} \right) / \left(\sum_{i \in g} \left(\frac{w_{ij} - w_{ik}}{\ln(w_{ij}) - \ln(w_{ik})} \right) \right)$$

Decomposition of Expenditure Ratio

Thanks to the factor reversal and multiplicity of the Sato-Varita's price index,

$$\frac{\text{Total Expenditure in Japan}}{\text{Total Expenditure in US}} = \frac{\sum_{i=1}^N p_{ij} q_{ij}}{\sum_{i=1}^N p_{ik} q_{ik}}$$

$$\begin{aligned} &= \prod_{i=1}^N \left(\frac{p_{ij}}{p_{ik}} \right)^{\phi_i} \prod_{i=1}^N \left(\frac{q_{ij}}{q_{ik}} \right)^{\phi_i} \\ &= \prod_{i=1}^N \left(\frac{p_{ij}^*}{p_{ik}^*} \right)^{\phi_i} \prod_{i=1}^N \left(\frac{q_{ij}}{q_{ik}} \right)^{\phi_i} \prod_{i=1}^N \left(\frac{(1+a_{ik})}{(1+a_{ij})} \right)^{-\phi_i} \\ &= \prod_{i=1}^N \left(\frac{p_{ij}^*}{p_{ik}^*} \right)^{\phi_i} \prod_{i=1}^N \left(\frac{(1+a_{ij})q_{ij}}{(1+a_{ik})q_{ik}} \right)^{\phi_i} = \prod_{i=1}^N \left(\frac{p_{ij}^*}{p_{ik}^*} \right)^{\phi_i} \prod_{i=1}^N \left(\frac{q_{ij}^*}{q_{ik}^*} \right)^{\phi_i} \end{aligned}$$

= Quality Adjusted Price Index $\times$ Quality Adjusted Volume index

Premium for quality

- Define b_{ik} as **the premium** felt by the household in country k for the commodity i in country j . This implies, if the price of q_{ik} is discounted by $(1 + b_{ik})$, the two commodities become identical. That is, the followings hold:

$$(1 + b_{ik}) = \frac{(1 + a_{ik})}{(1 + a_{ij})}$$

$$\frac{p_{ij}^*}{p_{ik}^*} = (1 + b_{ik}) \left(\frac{p_{ij}}{p_{ik}} \right).$$

Identifications of Quality Adjustment Factor 2

- The cost of living index based on the willingness to pay by consumers in countries j and k are respectively given by

$$COLI_k = \prod_{i=1}^N \left(\frac{p_{ij}^*}{p_{ik}^*} \right)^{\phi_i} = \prod_{i=1}^N \left(\frac{p_{ij}}{p_{ik}} \right)^{\phi_i} \left(\frac{1}{(1 + b_{ik})} \right)^{\phi_i}$$

$$COLI_j = \prod_{i=1}^N \left(\frac{p_{ij}}{p_{ik}} \right)^{\phi_i} (1 + b_{ij})^{\phi_i}$$

- Here, we **use the geometric mean** of the two cost of living indexes as the cost of living index of the two countries,

- $COLI = \prod_{i=1}^N \left(\frac{p_{ij}}{p_{ik}} \right)^{\phi_i} \left(\sqrt{\frac{(1+b_{ij})}{(1+b_{ik})}} \right)^{\phi_i}$

Survey Design

US-Japan Survey: Quality differences and willingness to pay

- Survey was supported by funding from the Japan Productivity Center
- Internet surveys were conducted both in Japan and the United States in February-April, 2017.
- Sampling persons aged 20-60, reflecting the age-gender distribution in the census.
- Japanese Sample: From individuals who stayed in the United States at least for a period of **three months** since April, 2012.
Sample size: 519 (479 valid responses)
- US Sample: Individuals who stayed in Japan for at least **one month** since April, 2012. (initially imposing staying for three months or longer, but it was very hard to collect enough sample size)
Sample size: 517 (404 valid responses)

Asking $(1 + b_{ik})$:Relative Marginal Willingness to Pay

- Rather than obtaining the information on the marginal willingness to pay for a specific item, we try to get the “**relative**” marginal willingness to pay, (marginal substitution rate).
- We try to find consumers who experienced service both in the US and Japan in some specific periods. Such persons are expected to know the differences in the quality between the two countries.
- After finding such persons, we ask:

“Suppose services of the average Japanese quality were offered in the US in English. If the Japanese service was better in quality than the corresponding US service, how much more would you be willing to pay for the Japanese service?”

Q3

Suppose services of average Japanese quality were offered in the US in English.

If the Japanese service was better in quality than the corresponding US service, how much more would you be willing to pay for the Japanese service?

Conversely, if the Japanese service was worse in quality, how much cheaper would it have to be for you to choose it over the corresponding US service?

* Please note that the numbers in the list below do not necessarily match the numbers in the explanation of service categories.

*

	Japanese quality is worse and so I feel a discount is necessary	←How much cheaper would it have to be for you choose the Japanese service? How much more would you be willing to pay for the Japanese service? →												Japanese quality is better and so I would be willing to pay more
	60% or even more of a discount is necessary/will absolutely not use	-50%	-40%	-30%	-20%	-10%	0	+10%	+20%	+30%	+40%	+50%	Would be willing to pay 60% or even more	
1. Taxi Response to previous question: → (【Q2S1の選択内容】)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
2. Rental car Response to previous question: → (【Q2S2の選択内容】)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
3. Automobile repair Response to previous question: → (【Q2S3の選択内容】)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
4. Subway/urban commuter train Response to previous question: → (【Q2S4の選択内容】)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
5. Long-distance train Response to previous question: → (【Q2S5の選択内容】)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
6. Air travel Response to previous question: → (【Q2S6の選択内容】)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Service Industry in our Survey

1	Taxi	15	Hotel (mid-range)
2	Rental car	16	Hotel (economy)
3	Automobile repair	17	ATM, money wiring service
4	Subway	18	Real-estate agent
5	Long-distance train	19	Hospital
6	Air travel	20	Postal mail
7	Parcel delivery service	21	Provider with a mobile phone line
8	Convenience store	22	TV reception service using cable, satellite, Wi-Fi, etc.
9	General merchandise store	23	Hair dressing/ beauty services (including beauty salons)
10	Department store	24	Laundry
11	Coffee shop	25	Travel services
12	Hamburger restaurant	26	Electricity, gas, heat supply, sewerage and water distribution/pipe repairs & management
13	Casual dining restaurant	27	Museum/art gallery
14	Hotel (luxury)	28	University education

Table X: The List of Service Items and Their Explanations

1	Taxi	does not include Uber or limousine services
2	Rental car	Japan examples: TOYOTA Rent-A-Lease, ORIX Auto, Nippon Rent-A-Car, Nissan Rent-A-Car, etc. US examples: Hertz, Avis, Alamo, Budget, Enterprise, etc.
3	Automobile repair	does not include simple inspections/maintenance at gas stations
4	Subway/urban commuter train	Only close-range transport by subway is subject here. Doesn't include longrange transport using mutual connections between a subway and other trains
5	Long-distance train	Japan examples: JR East, JR Tokai, and others. US examples: Amtrak, etc
6	Air travel	domestic flight or international flight. Does not include low-cost carriers (LLC). Japan examples: JAL, ANA, etc. US examples: American, Delta, United, Continental, etc.
7	Parcel delivery service	also includes USPS parcel service. Japan examples: Yamato Transport, Nippon Express, Sagawa Express. US examples: FedEx, UPS, DHL, USPS parcel service, etc.
8	Convenience store	Explanation: also includes drugstores. Japan examples: 7-Eleven, FamilyMart, Lawson, etc. US examples: 7-Eleven, Sheetz, United Dairy Farmers, Mobile Mart, etc
9	General merchandise store	refers to supermarkets centered on a self-service system and selling various daily necessities such as food, clothes, and household commodities. Japan examples: Ito Yokado, Aeon, etc. US examples: Target, Walmart, Kmart, Sears, Safeway, etc.
10	Department store	refers to department stores centered on a customer servicing system and also handling luxury products besides daily necessities. Japan examples: Mitsukoshi, Isetan, Takashimaya, Matsuzakaya, etc. US examples: Macy's, Saks Fifth Avenue, Bloomingdale's, JCPenny, etc.

11	Coffee shop	refers to shops that mainly carry products such as coffee, tea, and soft drink type beverages. Japan examples: Doutor Coffee, Starbucks, etc. US examples: McDonald's, BURGER KING, Wendy's, etc.
12	Hamburger restaurant	refers to restaurant that mainly serve hamburgers and similar items. Japan examples: McDonald's, MOS Burger, Lotteria, etc. US examples: McDonald's, BURGER KING, Wendy's, etc.
13	Casual dining restaurant	Japan examples: Skylark, Denny's, Royal Host, etc. US examples: Denny's, Waffle House, Applebee's, Chilles, Olive Garden, etc.
14	Hotel (luxury)	Japan examples: Imperial Hotel, Four Seasons Hotels, Hotel Okura US examples: Hyatt, CONRAD, etc
15	Hotel (mid-range)	Japan examples: Keio Plaza Hotel, Prince Hotel, Mitsui Garden Hotel, etc. US examples: Hilton, Marriott, etc.
16	Hotel (economy)	Japan examples: Toyoko Inn, Apa Hotel, Hotel Sunroute, etc. US examples: Best Western, Holiday Inn, etc.
17	ATM, money wiring service	instances in which you used your own cash card at an ATM in Japan. Japan examples: Mizuho Bank, Sumitomo Mitsui Banking Corporation, The Bank of Tokyo-Mitsubishi UFJ, etc. US examples: Citibank, Chase, Bank of America, First Union, etc.
18	Real-estate agent	refers to everything from renting and matters related to the mediation of buying/selling of real estate. Does not include mediation services such as Airbnb that are provided through the Internet exclusively.
19	Hospital	includes dentists, medical offices, and clinics.
20	Postal mail	refers to postcards, letters, FedEx (does not include parcels). Japan examples: Japan Post (post office), Yamato Transport (document delivery), etc. US examples: USPS, FedEx (does not include parcels), etc.
21	Provider with a mobile phone line	refers to use of mobile phone only; excludes use of communication devices without call function such as WiMAX. Japan examples: NTT DoCoMo, au, Softbank, etc. US examples: AT&T, Vodafone, T-Mobile, etc.
22	TV reception service using cable, satellite, Wi-Fi, etc	refers to services in Japan like Sky Perfect. Does not include paid movie distribution services such as those offered by Amazon and Apple. Also does not include outlets such as Star Channel. Japan examples: Sky Perfect, Hikari TV. US examples: Verizon, Time Warner, etc.

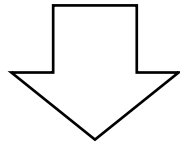
Data and Estimation Procedures

Sample versus Population characteristics

	Japan					US				
	N	mean	p50	sd	Nationwide Average	N	mean	p50	sd	Nationwide Average
Age	479	44.33	43	12.83	46.4	404	35.26	33	9.93	37.6
Household Income	479	977	751	787.33	546	404	105189.9	75074.46	107174.7	53889
Female Ratio	479	0.50	0	0.50	0.514	404	0.48	0	0.50	0.508
Married	479	0.70	1	0.46	0.589	404	0.33	0	0.47	0.524
Family Size	479	3.04	3	1.38	2.38	404	3.17	3	1.52	2.64
University Graduate	479	0.70	1	0.46	0.299	404	0.54	1	0.50	0.205
Exchange Rate	479	102.92	100	11.99		404	99.90	100	14.54	

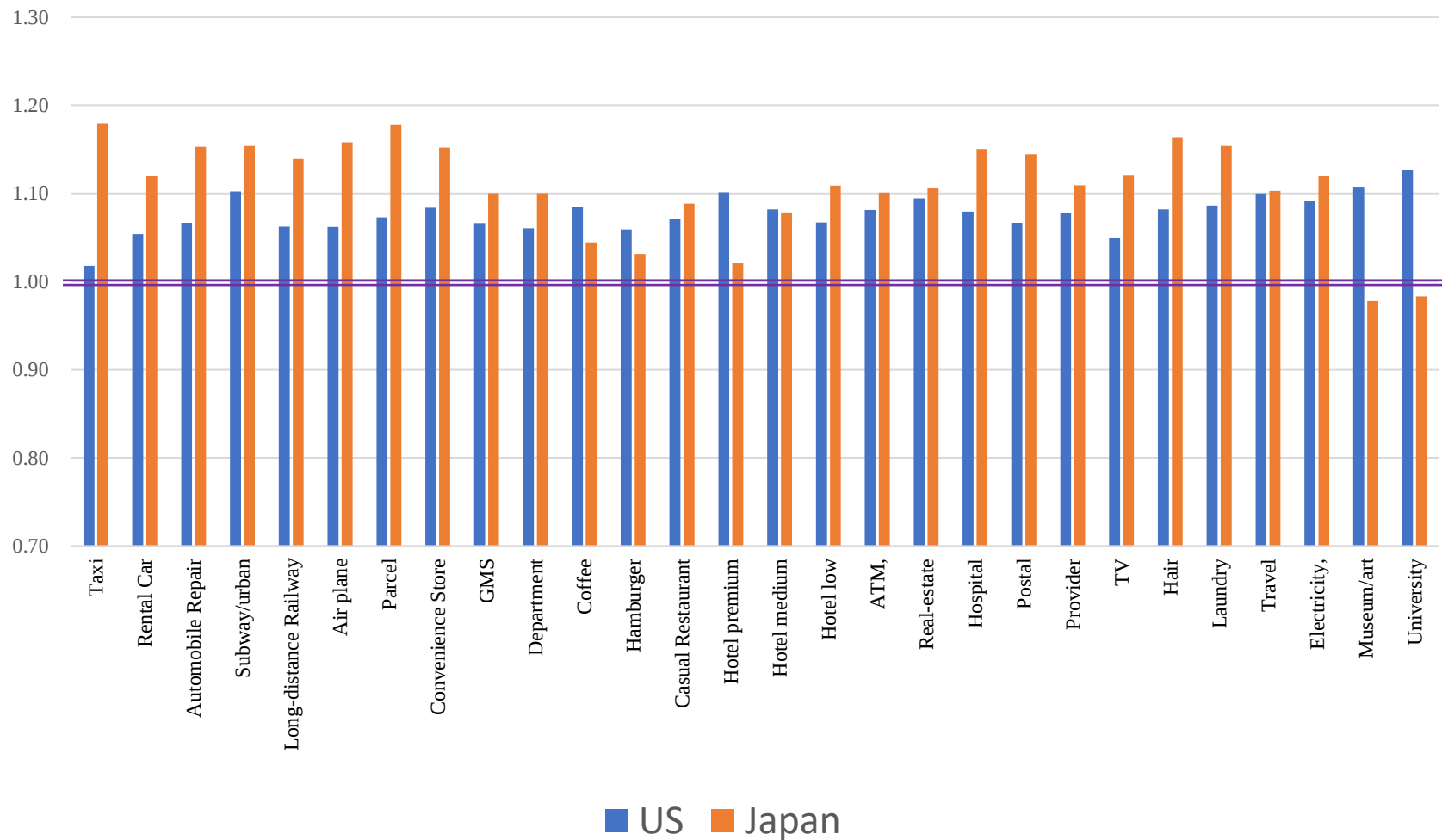
Estimation of Quality Difference and Willingness to Pay

Differences between population and sample characteristics indicates that self-selection could induce biases into estimates



Sample Selection Biases should be addressed
when we estimate the marginal willingness to pay

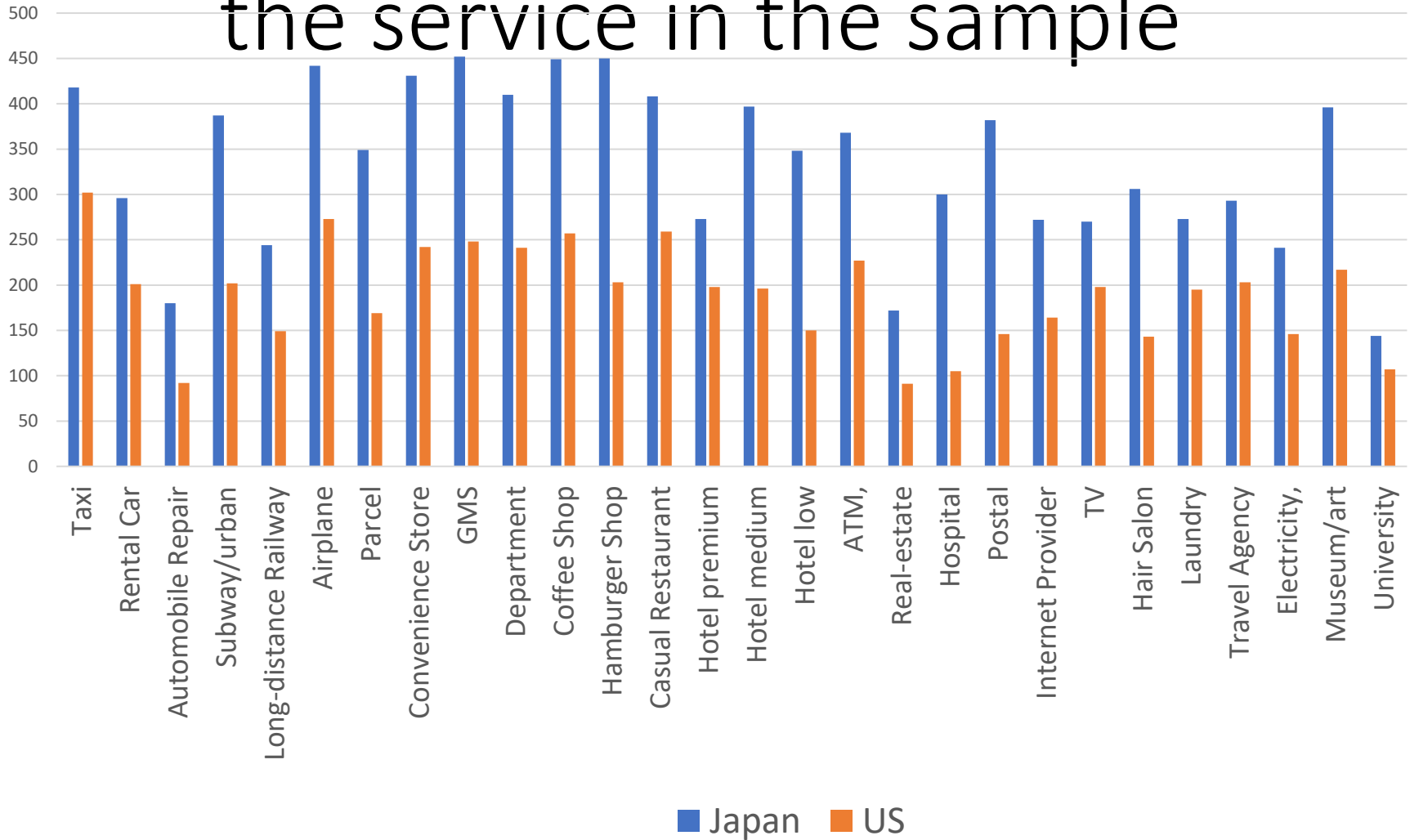
Results for relative MWP to Japanese Services in Japanese, $(1 + b_{JPN})$, and US Samples, $\left(\frac{1}{1+b_{US}}\right)$



Selection Biases

- The sample averages of income and other variables are different from those in the census and other survey.
- Two types of selection biases might exist
 - 1) Selection to visiting US or Japan
 - 2) Selection to utilizing particular service
- Unfortunately, 1) is very hard to deal with because of very tiny fraction of US people visit and stay in Japan for more than one month.
- We control for the second bias using Heckman's selection model.

The number of people who used the service in the sample



Heckman's Selection Model

- $E[y | D = 1] = x\beta + \rho\sigma\lambda(Z_m\gamma)$
- $Prob(D = 1, Z) = f(z\gamma)$

x : female dummy, age and age squared, family size, college graduate dummy

z (exclusion variables): purposes of visits, job classes, language fluency, and interaction terms

2Step procedures with Bootstrap standard errors

Sectors with Significant (10% level) Inverse Mills Ratio

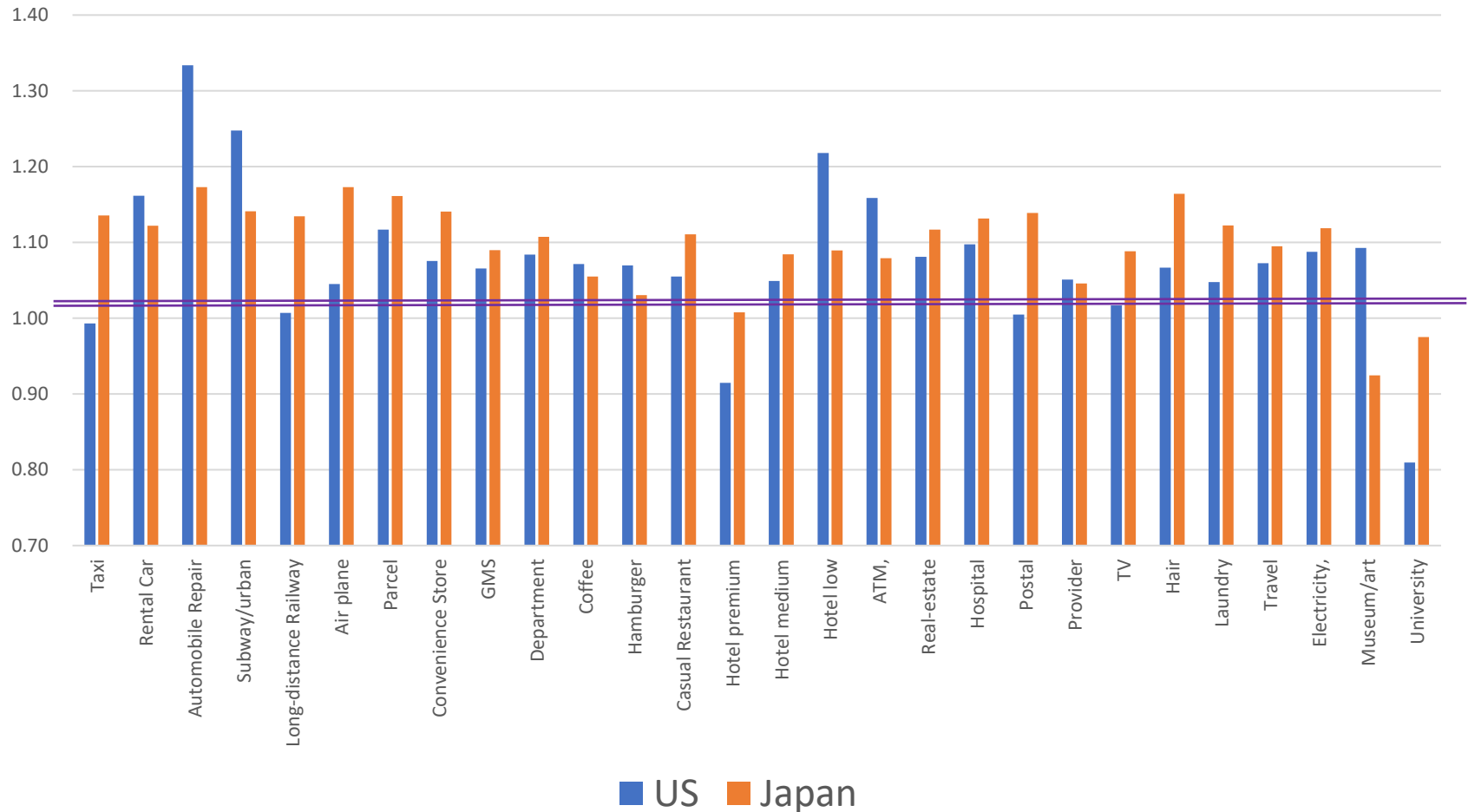
- US :Rental Car, Automobile Repair, Subway/urban, Hotel medium, Hotel low, ATM, Hospital, University
- Japan: Casual Restaurants

Estimation of Quality Difference and Willingness to Pay

- 1) Estimate both OLS and Heckman for each country and sector
- 2) Use the national average values for the covariates, construct the predicted values
- 3) If the inverse Mills ratio is significantly different from zero, use the predicted values from Heckman's model, otherwise, use estimates of OLS

Estimation Results

Predicted National Average MWP service sectors - Japan/US



Aggregation – Retail Sector PPP

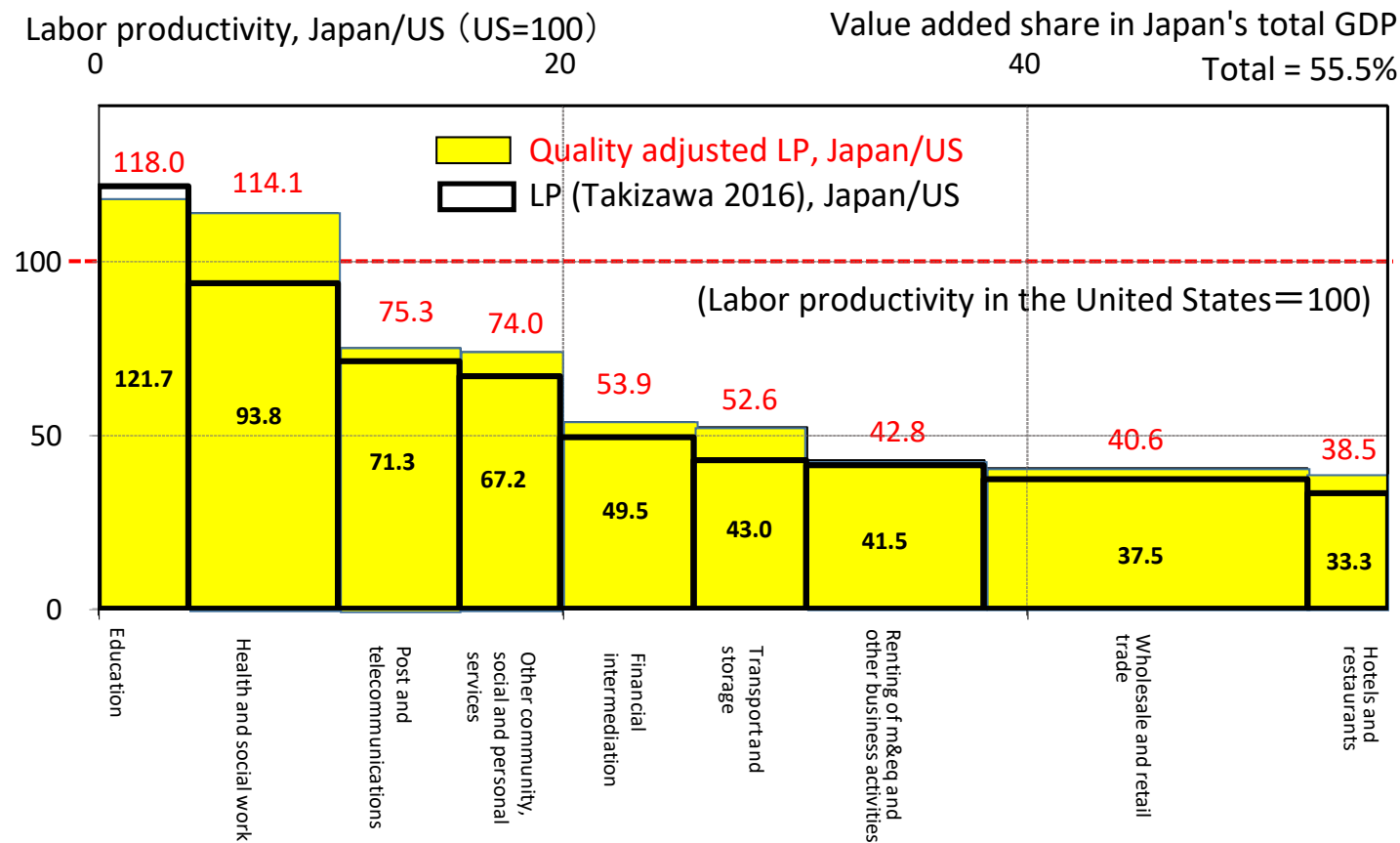
- We need weights to construct Sato-Vartia index.
- We use expenditure data by OECD BH 2014 for each service.
- In the OECD BH 2014 data, household payment to retail services (a part of commerce margin) is included in consumption expenditure of goods. As the weights for retail services, we use the [commerce margins based on Input-Output tables for retail industry](#) in both countries.

Service Sector Comparisons

Main Results

	with real estate	w.o. real estate
Sato_Vartia_PPP_w/o adjustment (US/JPN)	113	95
RMWTP_Japn_SV	1.10	1.09
RMWTP_US_SV	1.07	1.06
Geometric Mean of RMWTP (JPN/US)	1.08	1.09
PPP Quality Adjusted (US/JPN)	104	88
Per Capita Quantity Index Based on ICP (JPN/US)	0.46	0.33
Per Capita Quantity Index Quality Adjusted (JPN/US)	0.50	0.36
Total Value Added of Japan (trillion yen)	113	53.1
Total Value Added of the US (trillion \$)	5.44	4.27
Note: Data of PPP and Total Value Added are taken from ICP's tables of Basic Heading 2014.		
SV stands for Sato-Vartia Index		

Implication for Japan-US Labor Productivity Gap



We did not make quality adjustment of

- intermediate inputs and capital stock,
- output not used for household consumption.

Conclusions

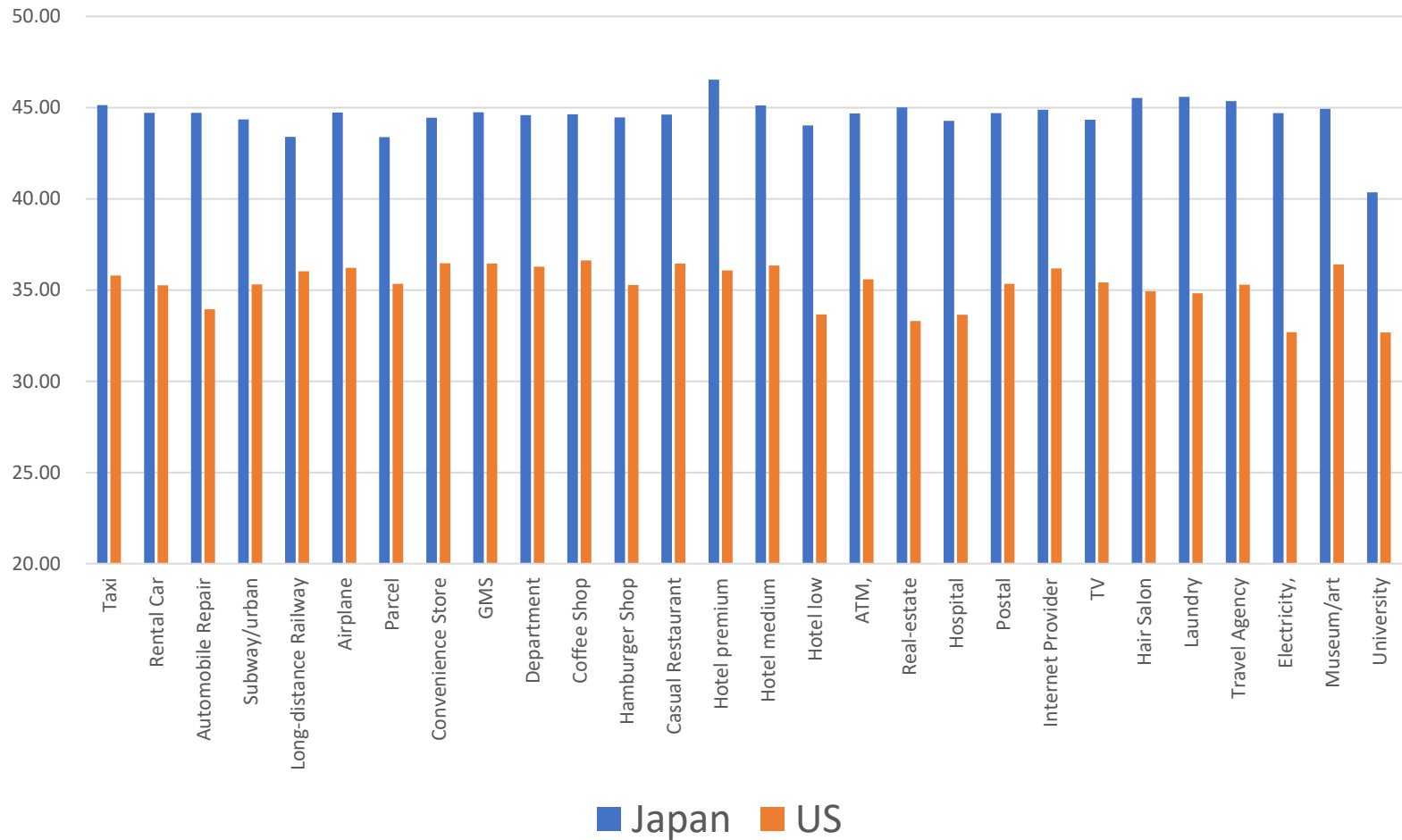
- PPPs from ICP are used to convert service sector expenditures as well as outputs for international comparisons.
- While ICP uses Structured Product Descriptions to specify items for price surveys, these surveys do not adequately account for quality differences.
- To the extent quality differences are not captured, PPPs reflect both price as well as quality differences in the items priced.
- Quality differences are likely to be significant in service sector products (transport etc.) – at least anecdotal evidence suggests this.
- This paper represents first ever attempt to estimate PPPs for the services sector after adjustment for quality differences.

Conclusions

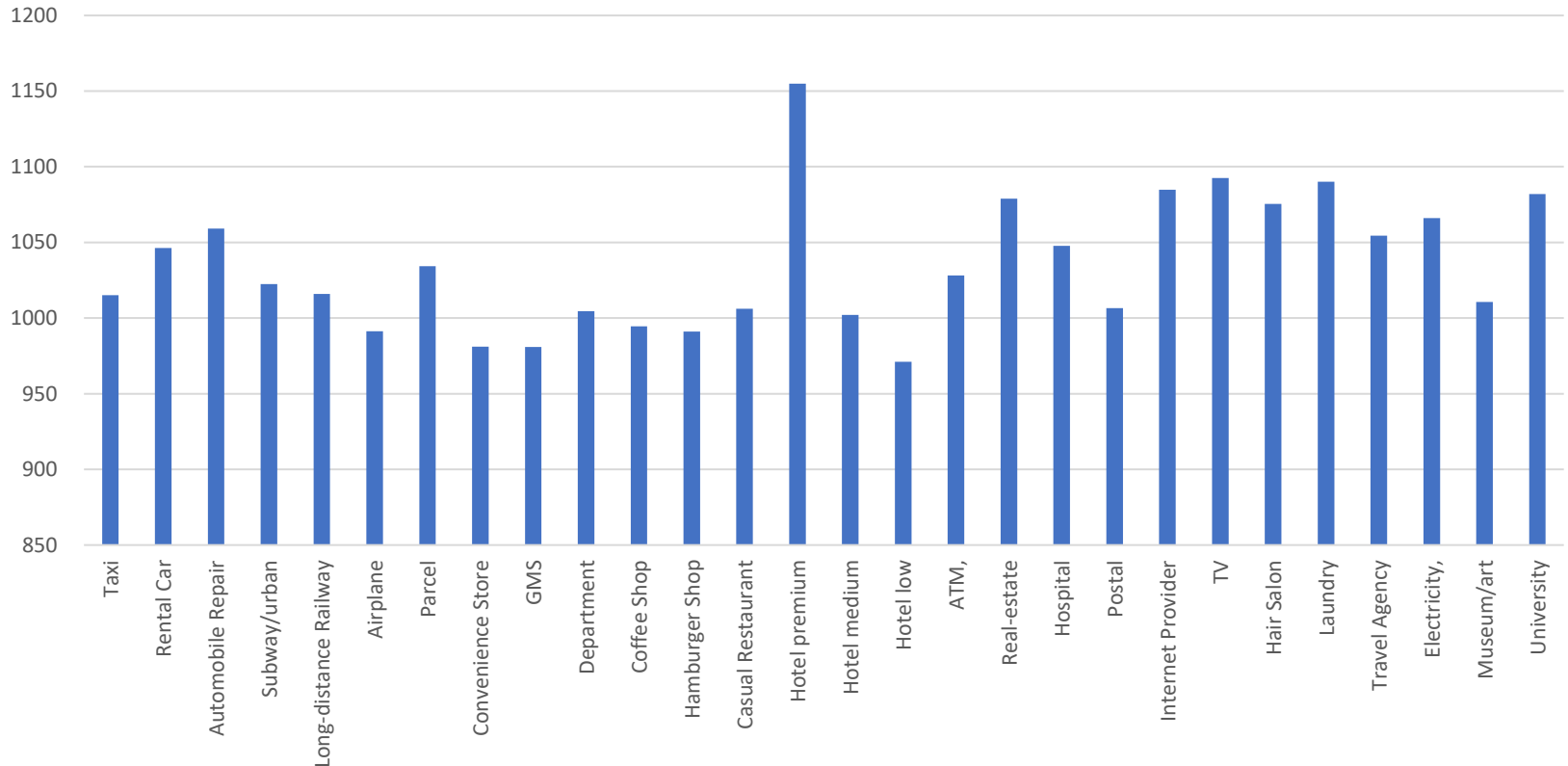
- Conducted a special survey of consumers in Japan and USA who have spent a reasonable length of time in visitor countries
- The survey is facilitated by funding from the Japan Productivity Center.
- Based on the analysis of data on differences in quality as perceived by consumers, a quality adjusted PPP is constructed.
- Econometric analysis is used for correcting sample selection bias.
- We make use of Sato-Vartia index as it allows for a simple multiplicative decomposition of quality effects.
- Our estimated effect of quality difference is about 9%.
- We are currently revising the results using ICP PPP 2017.

Appendix

Mean Age Differences

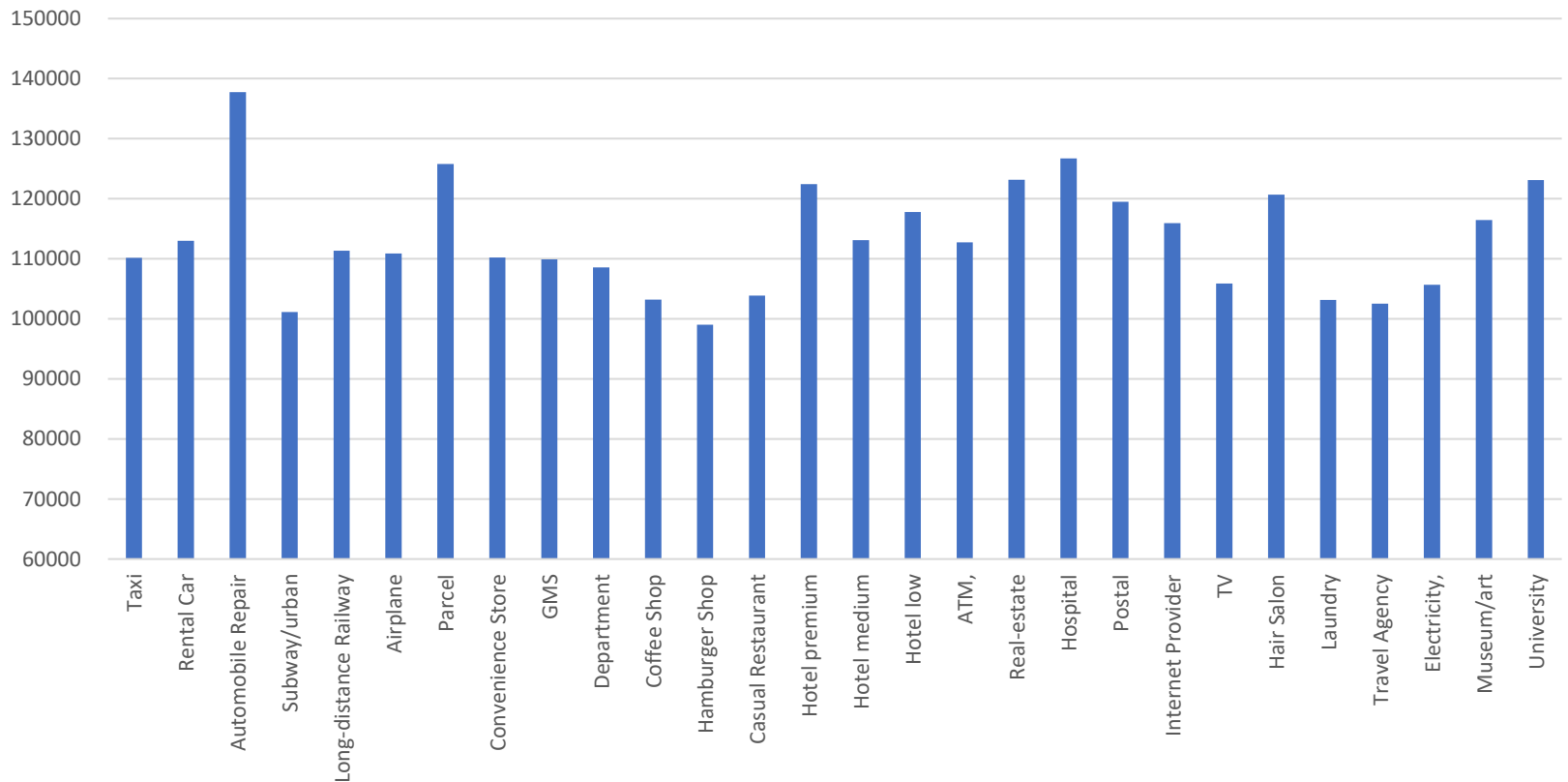


Mean Income Differences (Japan)



The Average Income of Japanese who experienced US services.

Mean Income Differences (US)



The Average Income of US people who experienced Japanese services.