

*RIETI-IWEP-CESSA Joint seminar 12/1*

# Determinants of Invoicing Currency Choice by Japanese Firms

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# Introduction

# Motivation

## Japanese Trade Balance and Nominal Yen/Dollar Exchange Rate

Jan. 2006 to Feb. 2018

Source: Website of the Bank of Japan, Ministry of Finance

□ 2007-2012

Japanese yen: **drastically appreciated.**

Trade Balance: experienced **trade deficit.**

□ 2012-2015

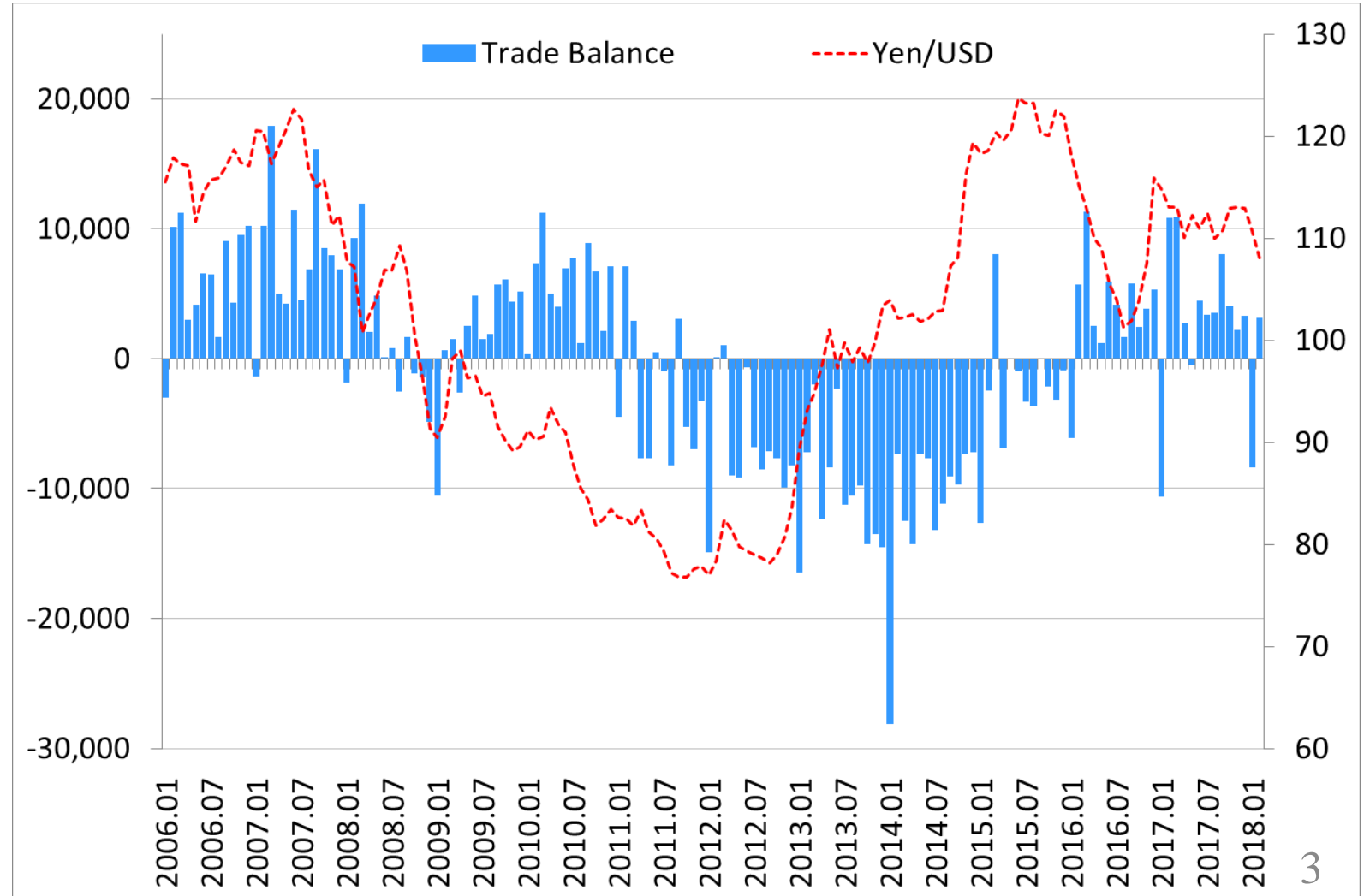
Japanese yen: **rapidly depreciated.**

Trade Balance: didn't improve.

✓ After 2014, TB started to improve.

⇒ Decrease of oil price.

100 million yen



# Motivation

## Real Exports and Nominal Yen/Dollar Exchange Rate

(Jan. 2000 to Feb. 2018: Real Exports 2010=100)

Source: Website of the Bank of Japan,  
Ministry of Finance

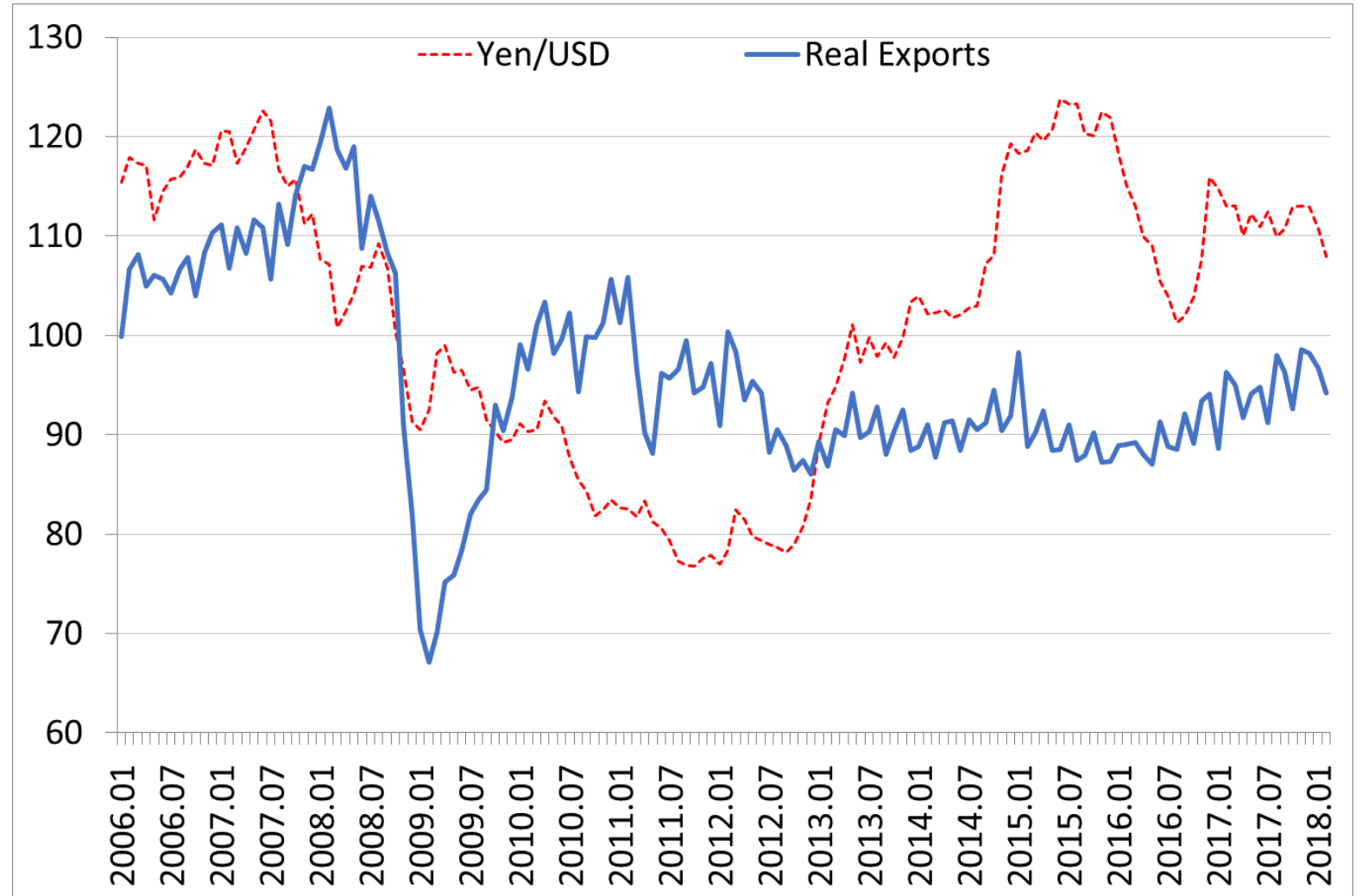
☐ 2007-2012

Japanese yen: **drastically appreciated.**  
Trade Balance: experienced **trade deficit.**

☐ 2012-2015

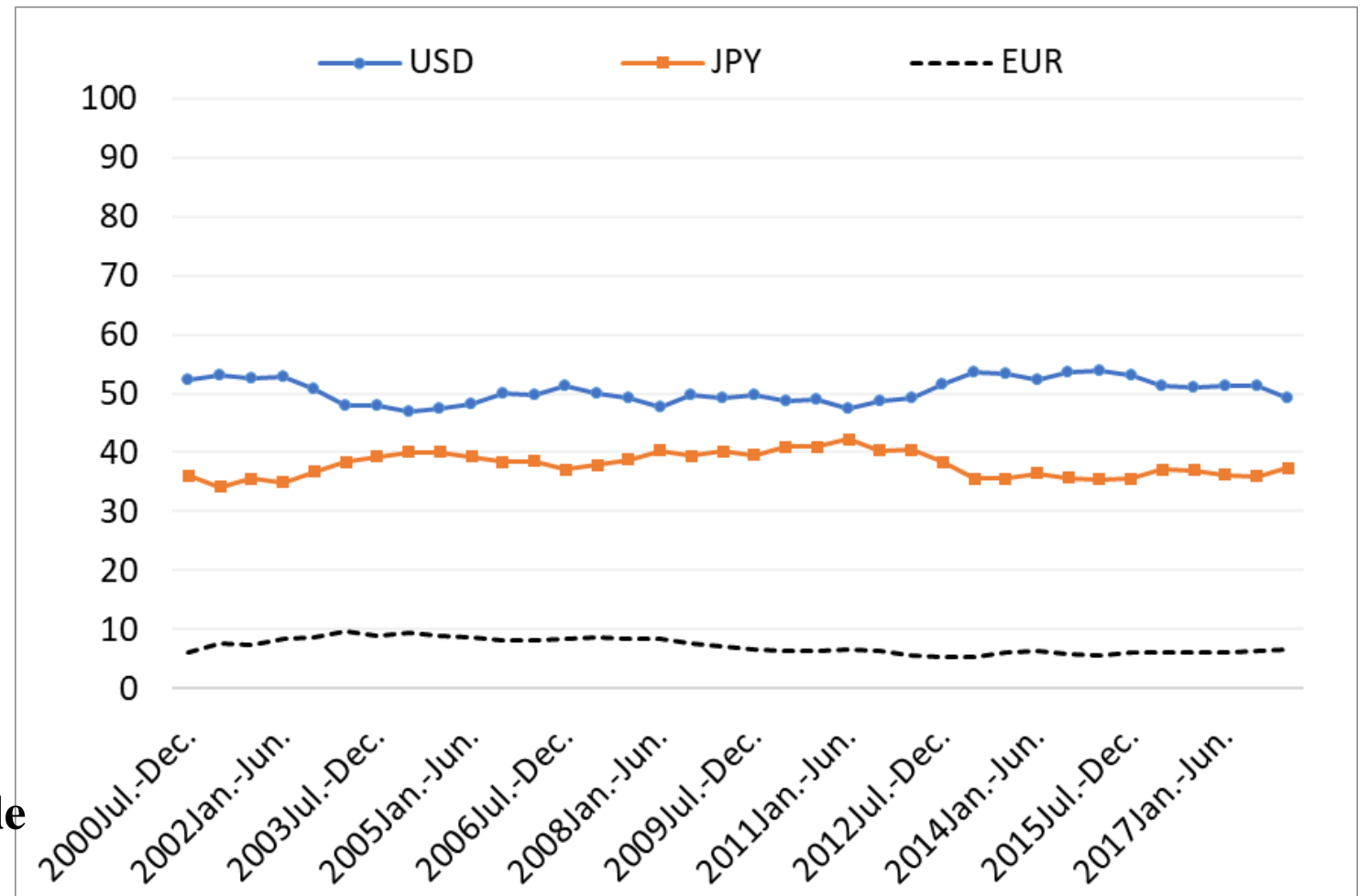
Japanese yen: **rapidly depreciated.**  
Trade Balance: didn't improve.  
✓ After 2014, TB started to improve.  
⇒ Decrease of oil price.

**Real Exports has not improved.**



# Motivation

## Half-Yearly Invoice Currency of Japanese Export 2000 H2 to 2017 H1



❑ 2007-2012

Japanese yen: **drastically appreciated.**

Trade Balance: experienced **trade deficit.**

❑ 2012-2015

Japanese yen: **rapidly depreciated.**

Trade Balance: didn't improve.

✓ After 2014, TB started to improve.

⇒ Decrease of oil price.

**Real Exports has not improved.**

⇒ Exporters use **USD** as an invoice currency

Invoice Currency: the influence of exchange rate fluctuation on trade.

⇒ Detail invoice currency data is **not available** (especially industry/commodity).

# Contribution

- Time-varying estimators of the share of invoicing currency
  - ❑ Followed the method of estimation developed by Ito *et al.* (2016, 2018)
  - ❑ Drastically different depending on industry / commodity
- Determinants of invoice currency share
  - ❑ Constructed commodity-level explanatory variables from **Japanese export firms data.**
  - ❑ We assume Export Competitiveness has an impact on that determinants.

**Export competitiveness plays a major role in invoicing currency.**

# Analysis

# Method of estimating invoice currency

- **Time-Varying** Parameter Model:

Observation Equation:

$$\begin{aligned} & \Delta \ln(P_{yen}^{EX} / P_c^{EX})_t \\ &= \beta_t \cdot \Delta \ln E_{yen/\$,t} + \gamma_t \cdot \Delta \ln E_{yen/euro,t} + \varepsilon_t \end{aligned}$$

State Equations:

$$\begin{aligned} \beta_t &= \beta_{t-1} + v_{\beta,t} \\ \gamma_t &= \gamma_{t-1} + v_{\gamma,t} \end{aligned}$$

**Yen** invoicing share:

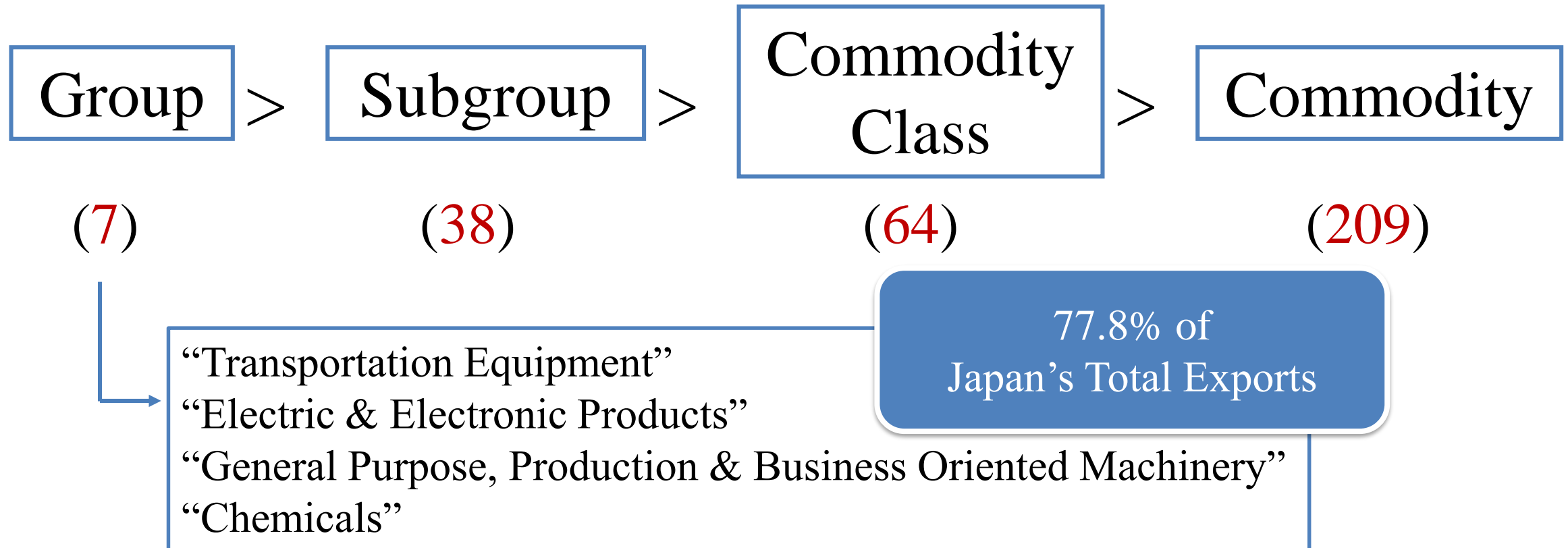
$$\alpha_t = 1 - \beta_t - \gamma_t$$



# BOJ Export Price Index 1

—2015 Base Price Data—

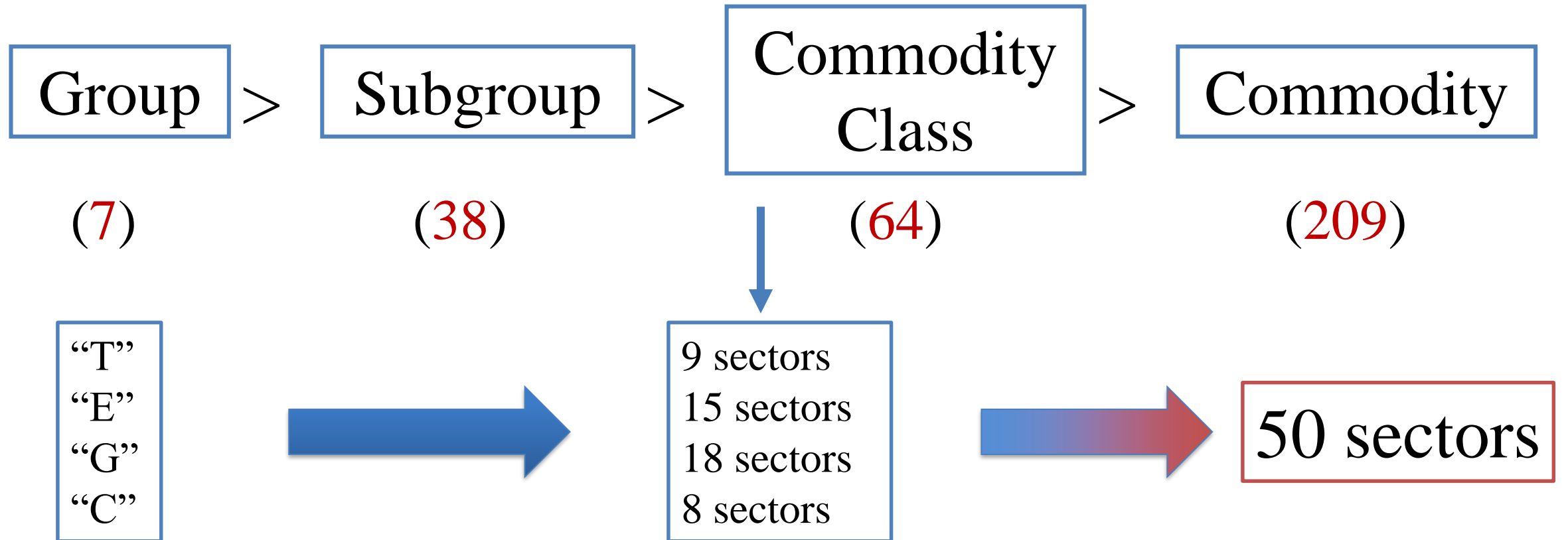
- Industry Classification of Export Price Index



# BOJ Export Price Index 2

—2015 Base Price Data—

- Industry Classification of Export Price Index



# Result of invoicing currency share

	Weight	U.S. Dollar						Yen					
<b>Chemicals &amp; Related Products</b>	<b>(9.84)</b>	<b>1995</b>	<b>2000</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2017</b>	<b>1995</b>	<b>2000</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2017</b>
Industrial inorganic chemicals	(0.94)	58.3	79.4	82.2	82.5	86.5	82.8	33.4	26.1	17.6	17.3	14.3	19.0
Basic petrochemicals	(0.95)	n.a.	102.5	102.9	99.8	100.8	100.2	n.a.	-2.0	-1.4	-1.2	0.0	2.4
Aliphatic intermediates	(0.64)	101.3	104.7	102.2	100.2	100.6	100.8	-0.9	-2.8	-4.0	-1.6	-0.4	2.8
Cyclic intermediates	(1.91)	98.7	102.7	103.6	100.9	101.6	102.1	0.7	-2.4	-3.7	-1.6	-0.6	1.3
Plastic resins & materials	(2.26)	92.0	89.4	77.6	75.6	73.8	65.5	11.8	9.5	18.1	23.3	28.7	36.3
Other industrial organic chemicals	(0.55)	95.8	98.0	91.5	89.7	52.0	65.3	1.5	3.2	8.8	10.6	40.1	30.2
Pharmaceutical products	(0.74)	19.0	14.9	6.8	15.8	24.2	21.0	57.0	84.4	88.8	81.1	61.2	67.7
Other chemical products	(1.85)	14.8	28.4	29.9	31.6	30.8	35.0	84.0	66.1	59.5	65.0	67.5	66.2
<b>General Machinery</b>	<b>(18.94)</b>	<b>1995</b>	<b>2000</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2017</b>	<b>1995</b>	<b>2000</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2017</b>
Engines	(1.07)	8.8	9.2	11.3	21.4	25.9	25.9	90.9	88.7	69.2	45.2	51.0	53.3
Pumps & compressors	(1.60)	65.4	66.8	55.1	36.0	28.3	26.4	33.7	31.3	41.3	64.3	70.8	74.9
Power transmission equipment & bearings	(1.69)	49.6	50.2	51.9	46.5	25.9	32.0	41.5	40.1	34.3	39.0	49.7	40.1
Refrigerating appliances	(0.32)	91.5	91.1	40.4	30.3	34.9	34.5	4.9	-10.0	16.3	-2.1	2.9	1.3
Other general purpose machinery	(0.59)	0.1	7.6	27.7	37.8	43.4	39.4	100.1	94.0	69.3	59.5	56.4	62.3
Agricultural machinery	(0.44)	95.6	62.0	17.3	38.8	63.4	59.7	8.7	37.9	74.7	61.7	36.7	41.8
Machinery & equipment for construction and mining	(2.08)	n.a.	32.6	37.0	57.0	43.6	37.9	n.a.	55.3	48.1	21.0	45.6	49.5
Textile machinery	(0.51)	0.0	0.2	4.4	13.1	21.3	22.7	100.0	99.7	92.3	72.7	57.2	56.2
Dairy lives industry machinery	(0.64)	n.a.	68.7	52.3	7.3	14.7	2.4	n.a.	31.1	46.6	87.9	86.0	100.2
Semiconductor and flat panel & display manufacturing equipment	(3.34)	n.a.	11.2	8.4	1.7	0.0	0.0	n.a.	70.7	90.6	97.9	100.0	100.0
Basic material industry machinery	(0.53)	31.2	64.3	43.0	28.9	23.8	25.2	50.6	37.5	56.4	70.2	74.4	75.6
Metal cutting machine tools	(1.92)	53.3	47.7	45.6	39.9	25.0	25.4	40.0	54.2	35.6	39.1	65.8	64.4
Metal forming machinery	(0.51)	n.a.	34.0	38.9	40.3	41.9	57.1	n.a.	30.8	35.6	59.7	56.6	31.3
Tools for machines and pneumatic & electric tools	(0.66)	22.3	3.3	3.4	19.7	41.0	29.7	61.0	75.3	69.4	54.5	35.3	37.0
Robots	(0.34)	n.a.	36.7	35.6	32.6	32.0	30.6	n.a.	23.6	23.6	40.9	64.8	67.1
Instruments & appliances for measuring, checking & testing	(1.13)	38.7	39.6	38.3	21.7	0.3	0.7	61.7	61.1	62.1	80.2	87.9	84.6
Medical appliances	(0.89)	58.9	62.0	65.2	70.7	83.8	65.0	29.7	38.3	35.1	6.7	6.2	25.0
Optical instruments & lenses	(0.68)	47.0	52.7	51.8	47.3	82.6	80.3	54.1	41.3	18.9	20.4	1.7	4.0

# Result of invoicing currency share

	Weight	U.S. Dollar						Yen					
<b>Electric &amp; Electronic Products</b>	<b>(20.55)</b>	<b>1995</b>	<b>2000</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2017</b>	<b>1995</b>	<b>2000</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2017</b>
Photoelectric converter devices	(0.58)	-0.2	-0.2	2.2	9.9	15.0	17.5	100.0	100.0	97.0	83.3	72.7	68.7
Semiconductor devices	(0.44)	79.6	85.3	61.3	42.2	44.1	59.3	19.9	16.2	40.7	55.5	59.4	34.0
Integrated circuits	(4.59)	n.a.	73.5	55.0	70.3	74.1	74.5	n.a.	26.1	42.8	27.1	21.8	22.1
Display devices	(1.14)	n.a.	n.a.	53.7	40.7	33.5	41.0	n.a.	n.a.	48.8	59.6	66.3	58.8
Passive components	(1.72)	62.9	54.3	58.2	40.3	48.8	41.4	37.1	43.9	42.8	58.4	50.0	59.6
Connecting components	(1.45)	12.6	11.4	13.2	17.8	41.1	44.0	87.9	89.4	87.4	81.3	54.9	55.6
Other electronic components	(1.66)	78.9	80.0	72.1	67.8	80.8	72.9	15.8	7.1	20.1	31.8	20.8	28.4
Heavy electrical apparatus	(1.79)	n.a.	n.a.	50.4	50.6	37.9	28.3	n.a.	n.a.	50.3	41.7	57.7	66.6
Electric bulbs and lighting & wiring devices	(0.45)	0.0	0.0	0.0	0.5	1.5	2.4	100.0	100.0	100.0	99.0	96.7	95.2
Electronic equipment	(0.86)	53.1	44.3	24.0	31.3	43.9	42.0	46.9	58.0	73.4	49.3	38.2	44.9
Electrical meters & measuring instruments	(1.61)	66.5	64.4	52.3	41.2	36.4	41.3	32.3	37.7	46.4	57.6	63.4	59.8
Other electrical machinery & equipment	(2.03)	60.7	58.0	58.8	61.6	65.0	53.3	11.2	28.0	21.5	20.1	16.0	34.5
Communications equipment	(0.68)	0.0	0.0	1.4	13.8	19.5	22.4	100.0	100.1	98.3	80.5	69.9	68.2
Audio & visual equipment	(0.86)	24.2	88.0	84.2	65.8	75.2	69.0	37.8	9.0	-7.4	4.3	-4.6	0.2
Electronic computers & computer equipment	(0.69)	48.2	83.9	63.1	65.7	71.3	75.4	52.9	11.4	7.9	17.6	10.3	10.1
<b>Transport Equipment</b>	<b>(28.52)</b>	<b>1995</b>	<b>2000</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2017</b>	<b>1995</b>	<b>2000</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2017</b>
Passenger cars	(14.30)	80.7	84.6	59.0	61.1	71.5	66.4	1.0	-8.8	0.0	15.4	13.7	22.1
Buses	(0.54)	28.2	18.9	7.1	3.7	10.7	10.6	74.5	73.3	79.6	70.9	77.2	83.3
Trucks	(1.50)	36.0	40.0	42.5	38.0	24.4	21.0	63.2	57.9	47.5	25.2	58.0	64.6
Motorcycles	(0.40)	48.0	54.0	50.5	65.1	53.8	46.1	8.1	-1.1	17.6	6.7	12.1	16.7
Motor vehicle parts	(7.26)	n.a.	49.5	43.0	39.8	41.3	40.7	n.a.	31.5	34.0	46.8	48.9	51.1
Vessels & parts	(2.72)	0.1	22.9	87.3	64.7	40.2	10.8	100.1	79.3	12.4	29.3	37.4	85.7
Aircraft parts	(1.41)	n.a.	86.9	87.8	99.7	100.9	100.4	n.a.	13.3	9.9	-0.2	0.6	1.7
Industrial trucks & parts	(0.21)	32.6	51.7	47.8	21.2	18.9	22.6	34.9	50.2	55.6	66.7	78.5	78.3
Bicycle parts	(0.18)	38.5	63.5	3.1	0.0	0.0	0.0	46.3	38.8	95.7	100.0	100.0	100.0

# Summarize result of invoicing currency share

- **USD invoice share** decreased and **JPY invoice share** increased from 1998 to 2000 and after 2015.
  - ❑ **Drastically:** Chemical, Transport Equipment (1998 to 2000)
  - ❑ Chemical, Electric and Electronic Products, Transport Equipment(2014 to 2015)
- After 2007, JPY invoice share tend to increase steadily.
  - ❑ Chemical, Electric and Electronic Products

The share of invoice currency drastically **differs by industry.**

# Two Stage Analysis

## (1) Time-Varying Parameter of Invoice Share

$$\Delta \ln(P_{yen}^{EX}/P_c^{EX})_t = \beta_t \Delta \ln E_{yen/\$,t} + \gamma_t \Delta \ln E_{euro,t} + \varepsilon_t$$

$$\alpha = 1 - \beta - \gamma$$

Japanese Yen Invoice Share

## (2) Dynamic Panel

$$Invoice_{i,t} = \alpha_1 Invoice_{i,t-1} + \alpha_2 Invoice_{i,t-2} + \beta_1 R\&D_{i,t} + \beta_2 FSR_{i,t} + \beta_3 \Delta \ln NEER_{i,t} + \eta_i + \varepsilon_{i,t}$$

# Hypothesis for analysis of determinants

- **Export Competitiveness** has strong effect on determinants of invoice currency.

- Firms Productivity, Bargaining Power with import firms/countries.

- Friberg(1998) and Bacchetta and van Wincoop (2005) imply firms tend to choose the export's currency invoicing if they have **the strong export competitiveness**.

**But.** It is **difficult** to find commodity-specific variable of export competitiveness.

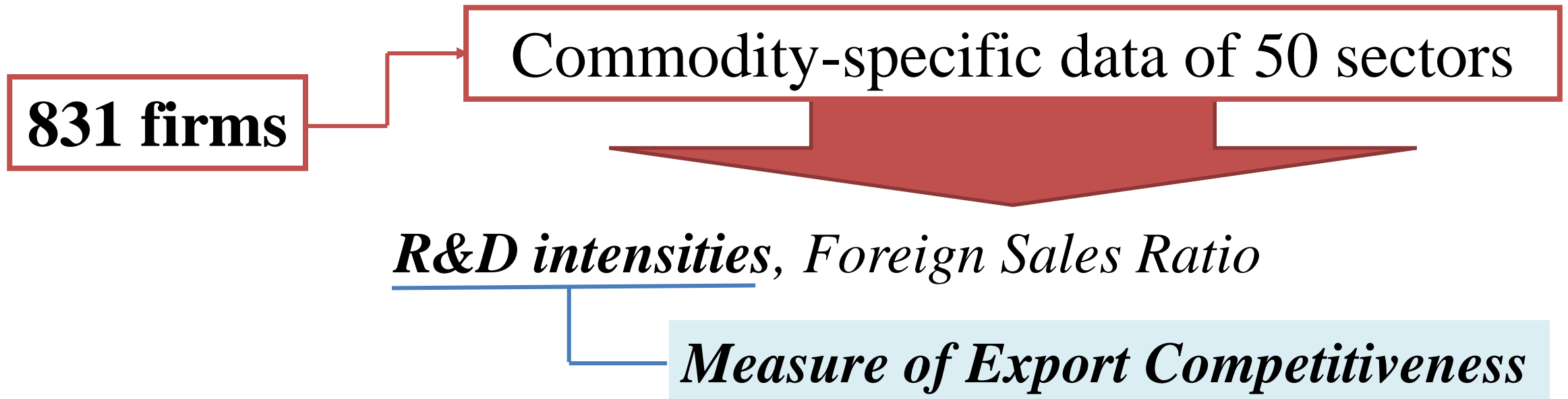
- Ito *et al.*(2012, 2018) pointed out that R&D investigation plays a key role of export competitiveness.

- Kwon *et al.*(2008) empirically showed relationship between R&D and productivity.

- The degree of price elasticity and product differentiation has a non-trivial relationship with R&D. (Berman *et al.* 2012 and Lie *et al.* 2012)

# Data Construction Method for Determinant Analysis

- We collect the data of R&D as an indicator of export competitiveness from annual report of Japanese export firms





# Equation of Panel Analysis

$$\begin{aligned} Invoice_{i,t} &= \alpha_1 Invoice_{i,t-1} + \alpha_2 Invoice_{i,t-2} \\ &+ \beta_1 R\&D_{i,t} + \beta_2 FSR_{i,t} + \beta_3 \Delta \ln NEER_{i,t} + \eta_i + \varepsilon_{i,t} \end{aligned}$$

《 $i$  denotes commodities (1 to 50) and  $t$  denotes time periods (2005 to 2016)》

*Invoice*: Time-Varying Parameter of JPY invoice currency share

- The annual average of estimated parameter on first step
- 50 sectors from 4 industries.
  - Transport Equipment, Electric & Electronic Machinery, General Machinery and Chemicals

# Equation of Panel Analysis

$$\begin{aligned} Invoice_{i,t} = & \alpha_1 Invoice_{i,t-1} + \alpha_2 Invoice_{i,t-2} \\ & + \beta_1 R\&D_{i,t} + \beta_2 FSR_{i,t} + \beta_3 \Delta \ln NEER_{i,t} + \eta_i + \varepsilon_{i,t} \end{aligned}$$

《 $i$  denotes commodities (1 to 50) and  $t$  denotes time periods (2005 to 2016)》

*R&D: Research & Development intensity, Export Competitiveness*

$$R\&D \text{ intensity} = \frac{R\&D \text{ Expenditure}}{Total \text{ Assets}}$$

- The average of R&D intensities of firm's data in 50 sectors
- Source: *Yu-ho* -Annual Securities Report of Japanese Firms (831)

# Equation of Panel Analysis

$$\begin{aligned} Invoice_{i,t} = & \alpha_1 Invoice_{i,t-1} + \alpha_2 Invoice_{i,t-2} \\ & + \beta_1 R\&D_{i,t} + \beta_2 FSR_{i,t} + \beta_3 \Delta \ln NEER_{i,t} + \eta_i + \varepsilon_{i,t} \end{aligned}$$

《 $i$  denotes commodities (1 to 50) and  $t$  denotes time periods (2005 to 2016)》

## *FSR*: Foreign Sales Ratio

- The average of foreign sales ratio of firm's data in 50 sectors
- Source: *Yu-ho* -Annual Securities Report of Japanese Firms (831)
- A measure of the industry-level exchange rate exposure

# Equation of Panel Analysis

$$\begin{aligned} Invoice_{i,t} = & \alpha_1 Invoice_{i,t-1} + \alpha_2 Invoice_{i,t-2} \\ & + \beta_1 R\&D_{i,t} + \beta_2 FSR_{i,t} + \beta_3 \Delta \ln NEER_{i,t} + \eta_i + \varepsilon_{i,t} \end{aligned}$$

《 $i$  denotes commodities (1 to 50) and  $t$  denotes time periods (2005 to 2016)》

## *NEER*: Nominal Effective Exchange Rate

- Commodity-specific nominal effective exchange rate in 50 sectors (Sato *et al.* 2013)
- Author's calculation by the data from BOJ
- $\Delta \ln NEER \uparrow$  means yen appreciation  
 $\Delta \ln NEER \downarrow$  means yen depreciation

# Expected Result

$$\begin{aligned} Invoice_{i,t} = & \alpha_1 Invoice_{i,t-1} + \alpha_2 Invoice_{i,t-2} \\ & + \beta_1 R\&D_{i,t} + \beta_2 FSR_{i,t} + \beta_3 \Delta \ln NEER_{i,t} + \eta_i + \varepsilon_{i,t} \end{aligned}$$

(+)(-)(+)

□ R&D intensity (Export Competitiveness): **positive**

Competitive exporter can use JPY as invoice and avoid exchange rate risk.

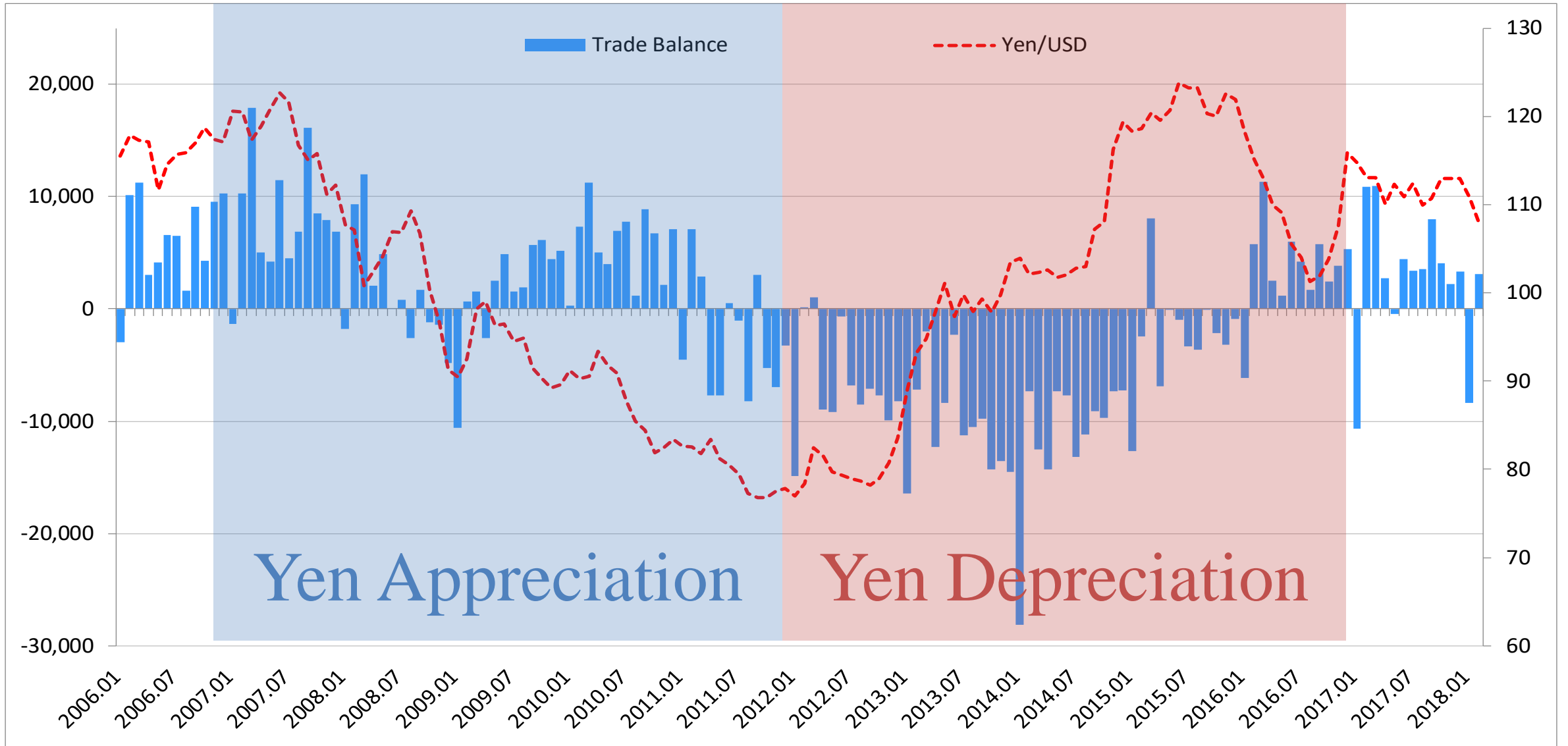
□ Foreign Sales Ratio: **negative**

Firms suffered from exchange rate exposure tend to decrease yen invoice share in order to avoid the change of local price.

□  $\Delta \ln NEER$ : **positive**

The week yen trend ( $\ln NEER \downarrow$ ) decrease JPY invoice to get ER gain.

# Sub-sample



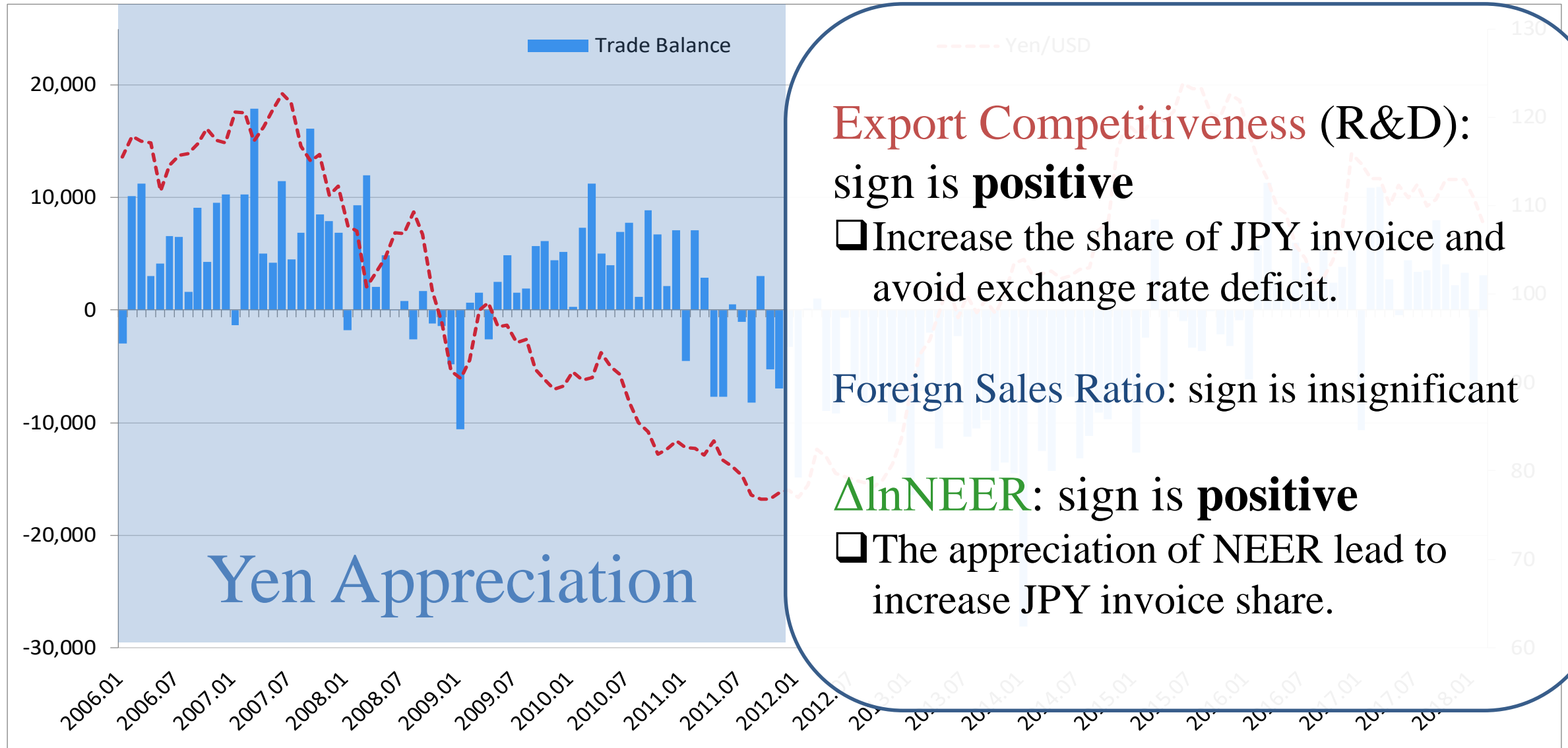
# Result of Dynamic Panel Analysis

Double asterisks (\*\*), a single asterisk (\*), and a sharp (#) denote 1%, 5%, and 10% significance, respectively.

Dependent variable: JPY Invoice<sub>t</sub>

	(1)	(2)	(3)	(4)	(5)	(6)
	2005-2016	2007-2012	2012-2016	2005-2015	2007-2012	2012-2016
JPY Invoice <sub>t-1</sub>	1.146 ** (0.073)	1.101 ** (0.065)	1.267 ** (0.063)	1.128 ** (0.072)	1.109 ** (0.067)	1.230 ** (0.063)
JPY Invoice <sub>t-2</sub>	-0.170 * (0.046)	-0.154 * (0.073)	-0.277 ** (0.064)	-0.154 (0.073)	-0.145 (0.083)	-0.242 ** (0.063)
R&D Intensity	-0.020 (0.019)	0.060 * (0.029)	-0.054 (0.030)	-0.017 (0.031)	0.055 * (0.031)	-0.067 * (0.032)
Foreign Sales Ratio	0.037 (0.043)	-0.102 (0.061)	0.150 ** (0.041)	0.008 (0.046)	-0.099 (0.046)	0.130 * (0.040)
ΔlnNEER				0.863 ** (0.218)	1.040 ** (0.246)	0.889# (0.474)
Wald test	1140.2 **	800.3 **	1312.3 **	1174.3 **	657.9 **	1071.7 **
(p-value)	0.000	0.000	0.000	0.000	0.000	0.000
NOBS	579	292	250	579	292	250
AR(1)	-3.12 **	-3.62 **	-2.48 *	-3.03 **	-3.47 **	-2.47 *
AR(2)	-1.50	-1.16	0.00	-1.90	-1.78	-0.18

# Sub-sample



**Export Competitiveness (R&D):**

sign is **positive**

□ Increase the share of JPY invoice and avoid exchange rate deficit.

Foreign Sales Ratio: sign is insignificant

$\Delta \ln \text{NEER}$ : sign is **positive**

□ The appreciation of NEER lead to increase JPY invoice share.



# Sub-sample

## Export Competitiveness (R&D): **negative**

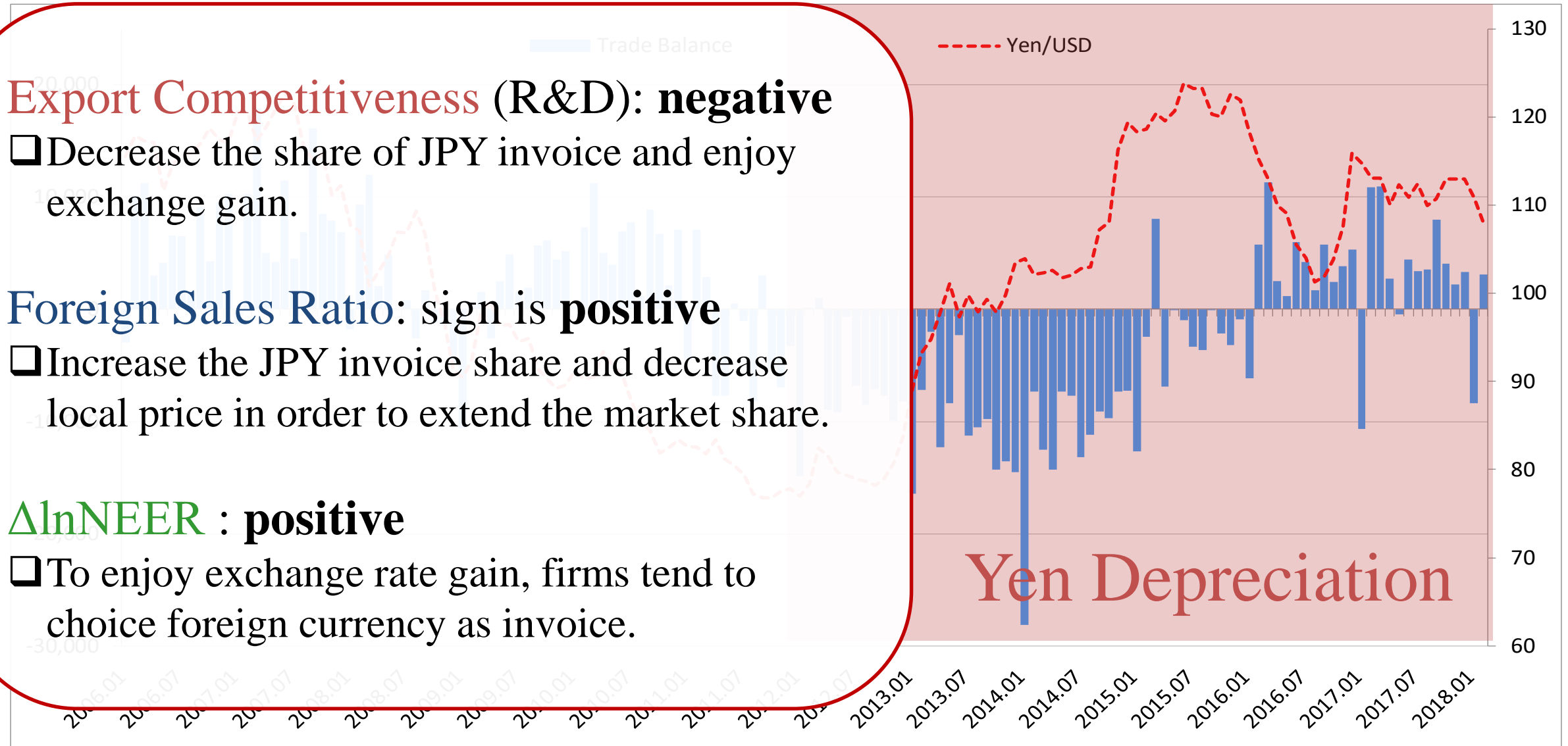
- ❑ Decrease the share of JPY invoice and enjoy exchange gain.

## Foreign Sales Ratio: sign is **positive**

- ❑ Increase the JPY invoice share and decrease local price in order to extend the market share.

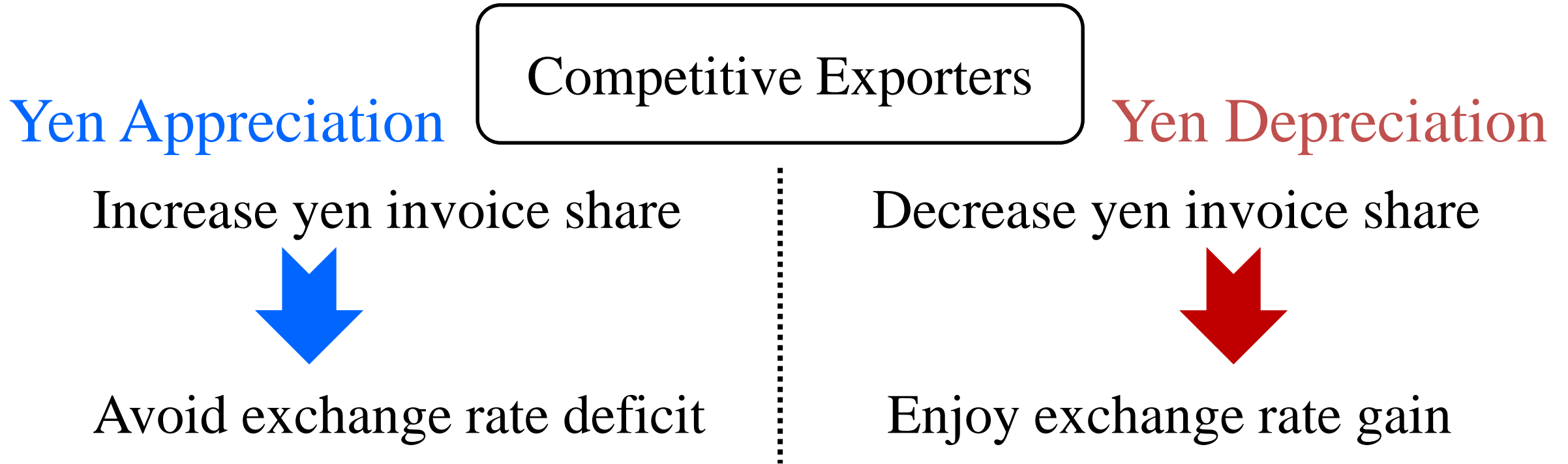
## $\Delta \ln \text{NEER}$ : **positive**

- ❑ To enjoy exchange rate gain, firms tend to choice foreign currency as invoice.



# Benchmark Result

Hypothesis: **Export Competitiveness** has strong effect on determinants of invoice currency.



Competitive firms **strategically** choose invoice currency

# Conclusion

- Japanese Exporter's choice of invoice currency:
  - ❑ Only a few studies empirically examine the share of invoice currency.
  - ❑ Differ across **commodity**.
- Determinants of invoice currency:
  - ❑ **Export competitiveness** variable is statistically significant.
  - ❑ But, its effect is conditional on **to which direction the yen strongly moves**.
  - ❑ Exporters with strong competitiveness can **advantageously choose the strategy of invoice currency**.

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# Appendix 1: Method of estimating invoice currency 1

- Two types of **BOJ export price index**:

(1) **Contract currency based** export price index ( $P_c^{EX}$ ):

$$P_c^{EX} = (P_{yen})^\alpha (P_{\$})^\beta (P_{euro})^\gamma \quad (\alpha + \beta + \gamma = 1)$$

More than 95% of export transaction use USD, JPY, EUR as an invoice currency

(2) **Yen based** export price index ( $P_{yen}^{EX}$ ):

$$P_{yen}^{EX} = (P_{yen})^\alpha (P_{\$} \cdot E_{yen/\$})^\beta (P_{euro} \cdot E_{yen/euro})^\gamma$$

$$= (P_{yen})^\alpha (P_{\$})^\beta (P_{euro})^\gamma \cdot (E_{yen/\$})^\beta \cdot (E_{yen/euro})^\gamma$$

$$= P_c^{EX} \cdot (E_{yen/\$})^\beta \cdot (E_{yen/euro})^\gamma$$

# Appendix 1: Method of estimating invoice currency 2

- Taking the ratio of two export prices:

$$P_{yen}^{EX} / P_c^{EX} = (E_{yen/\$})^\beta \cdot (E_{yen/euro})^\gamma$$

- Taking natural logarithm:

$$\ln(P_{yen}^{EX} / P_c^{EX}) = \beta \ln E_{yen/\$} + \gamma \ln E_{yen/euro}$$

- 1st-difference model:

$$\begin{aligned} \Delta \ln(P_{yen}^{EX} / P_c^{EX})_t \\ = \beta \cdot \Delta \ln E_{yen/\$,t} + \gamma \cdot \Delta \ln E_{yen/euro,t} + \varepsilon_t \end{aligned}$$

# Appendix 1: Method of estimating invoice currency 3

- Constant Parameter Model:

$$\Delta \ln(P_{yen}^{EX} / P_c^{EX})_t = \beta \cdot \Delta \ln E_{yen/\$,t} + \gamma \cdot \Delta \ln E_{yen/euro,t} + \varepsilon_t$$

USD invoicing share    Euro invoicing share

Yen invoicing share:

$$\alpha = 1 - \beta - \gamma$$



# Appendix 1: Method of estimating invoice currency 4

- **Time-Varying** Parameter Model:

Observation Equation:

$$\begin{aligned} & \Delta \ln(P_{yen}^{EX} / P_c^{EX})_t \\ &= \beta_t \cdot \Delta \ln E_{yen/\$,t} + \gamma_t \cdot \Delta \ln E_{yen/euro,t} + \varepsilon_t \end{aligned}$$

State Equations:

$$\begin{aligned} \beta_t &= \beta_{t-1} + v_{\beta,t} \\ \gamma_t &= \gamma_{t-1} + v_{\gamma,t} \end{aligned}$$

**Yen** invoicing share:

$$\alpha_t = 1 - \beta_t - \gamma_t$$

# Appendix2:Summary Statistics

stats	NOB	Mean	Median	Max	Min	Std.Dev
JPY Invoice	592	0.436456	0.427569	1.00148	-0.16408	0.307939
FSR	600	0.508359	0.514571	0.826871	0.252797	0.112307
RDTA	600	0.402854	0.390804	0.994189	0.118242	0.182226
REER	600	95.57768	94.23333	116.3417	74.3125	10.63446
NEER	600	100.9643	100.63	104.88	99.025	1.414436

stats	NOB	Mean	Median	Max	Min	Std.Dev
US sales/TS	600	0.193059	0.165625	0.485059	0.048416	0.089785
EURO sales/TS	600	0.122754	0.119826	0.257525	0.026972	0.041854
Asia sales/TS	600	0.192544	0.193259	0.400213	0.018257	0.05743

# Appendix 3: Robustness Check for Separation of Period

	2005-2016	2012-2016	2005-2016	2012-2016	2005-2016	2012-2016
FSR	0.037	0.150 **	0.039	0.152 **	0.008	0.130 *
p-value	0.392	0.001	0.410	0.003	0.870	0.035
RDTA	-0.020	-0.054 #	-0.018	-0.061 #	-0.017	-0.067 *
p-value	0.281	0.074	0.343	0.053	0.572	0.040
dlnREER			0.044	0.020		
p-value			0.239	0.462		
dlnNEER					0.863 **	0.889 #
p-value					0.000	0.066
	2005-2015	2012-2015	2005-2015	2012-2015	2005-2015	2012-2015
FSR	0.032	0.152 *	0.033	0.167 **	-0.008	0.099
p-value	0.434	0.014	0.466	0.001	0.842	0.085
RDTA	-0.004	-0.054	-0.001	-0.053	-0.005	-0.056
p-value	0.859	0.214	0.971	0.198	0.871	0.110
dlnREER			0.060	0.089 #		
p-value			0.152	0.059		
dlnNEER					0.918 **	1.008 **
p-value					0.000	0.069

# Appendix4: Area-Specific Foreign Sales Ratio

	2005-2016	2007-2012	2012-2016	2005-2016	2007-2012	2012-2016
R&D Intensity	-0.020	0.060 *	-0.054 #	-0.017	0.055 *	-0.067 *
Foreign Sales/TS	0.037	-0.102	0.150 **	0.008	-0.099	0.130 *
$\Delta \ln \text{NEER}$				0.863 **	1.040 **	0.889 #
R&D Intensity	-0.024	0.045 #	-0.057 *	-0.024	0.048 #	-0.061 *
U.S. Sales/TS	0.067 #	-0.069	0.155 **	0.071	-0.072	0.135 *
$\Delta \ln \text{NEER}$				0.878 **	0.985 **	1.045 **
R&D Intensity	-0.003	0.039	-0.050 *	-0.024	0.047 #	-0.051 #
EURO Sales/TS	0.123	0.142	0.175	0.111	0.100	0.153
$\Delta \ln \text{NEER}$				0.900 **	0.990 **	1.102 **
R&D Intensity	-0.015	0.014	-0.042 **	-0.021	0.027	-0.045 **
Asia Sales/TS	-0.009	-0.238 **	0.137	-0.038	-0.196 *	0.107
$\Delta \ln \text{NEER}$				0.875 **	1.023 **	1.044 **