Exchange rate fluctuations and firm performance

Evidence from the historic depreciation period of Japanese yen

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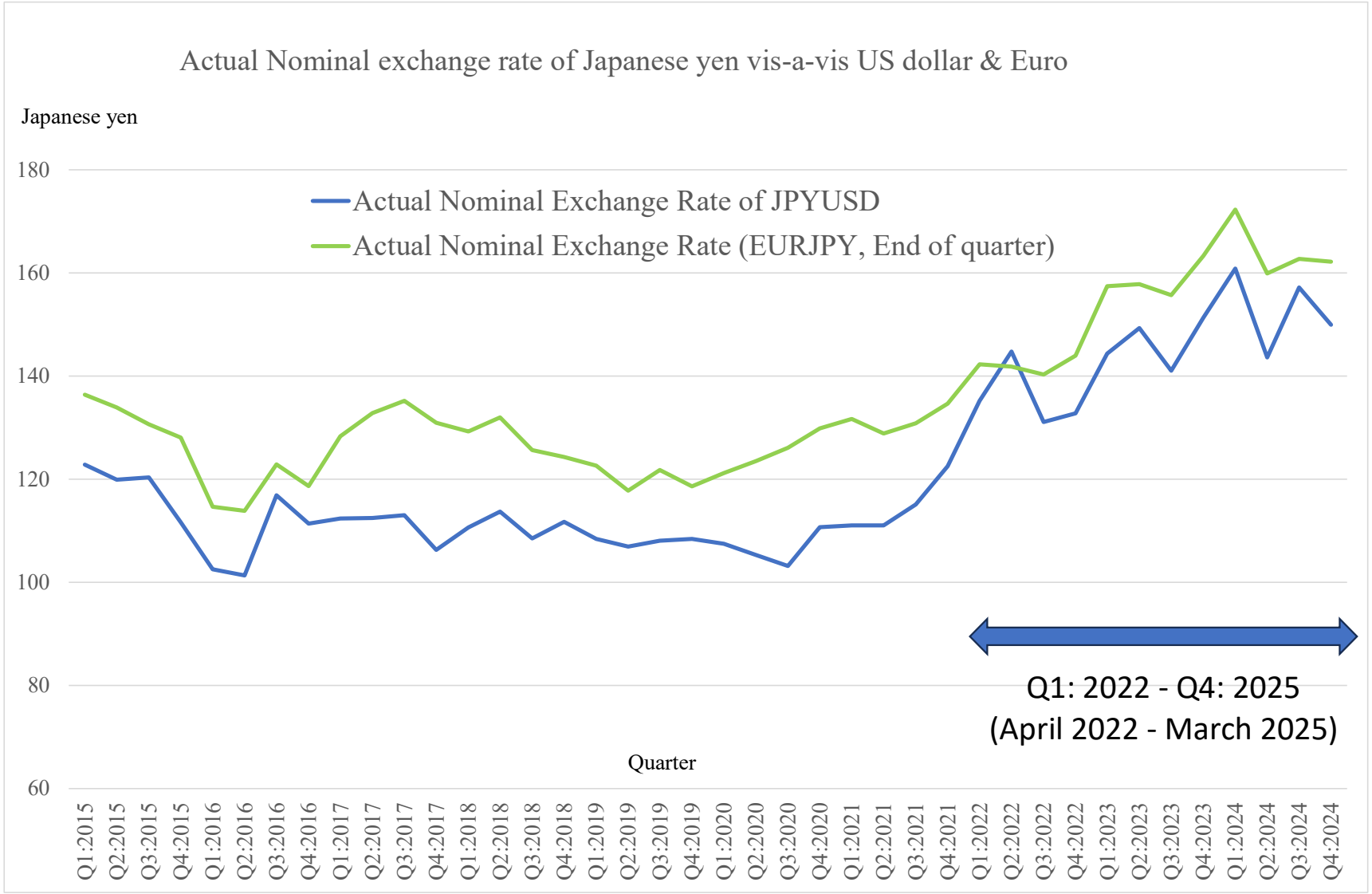
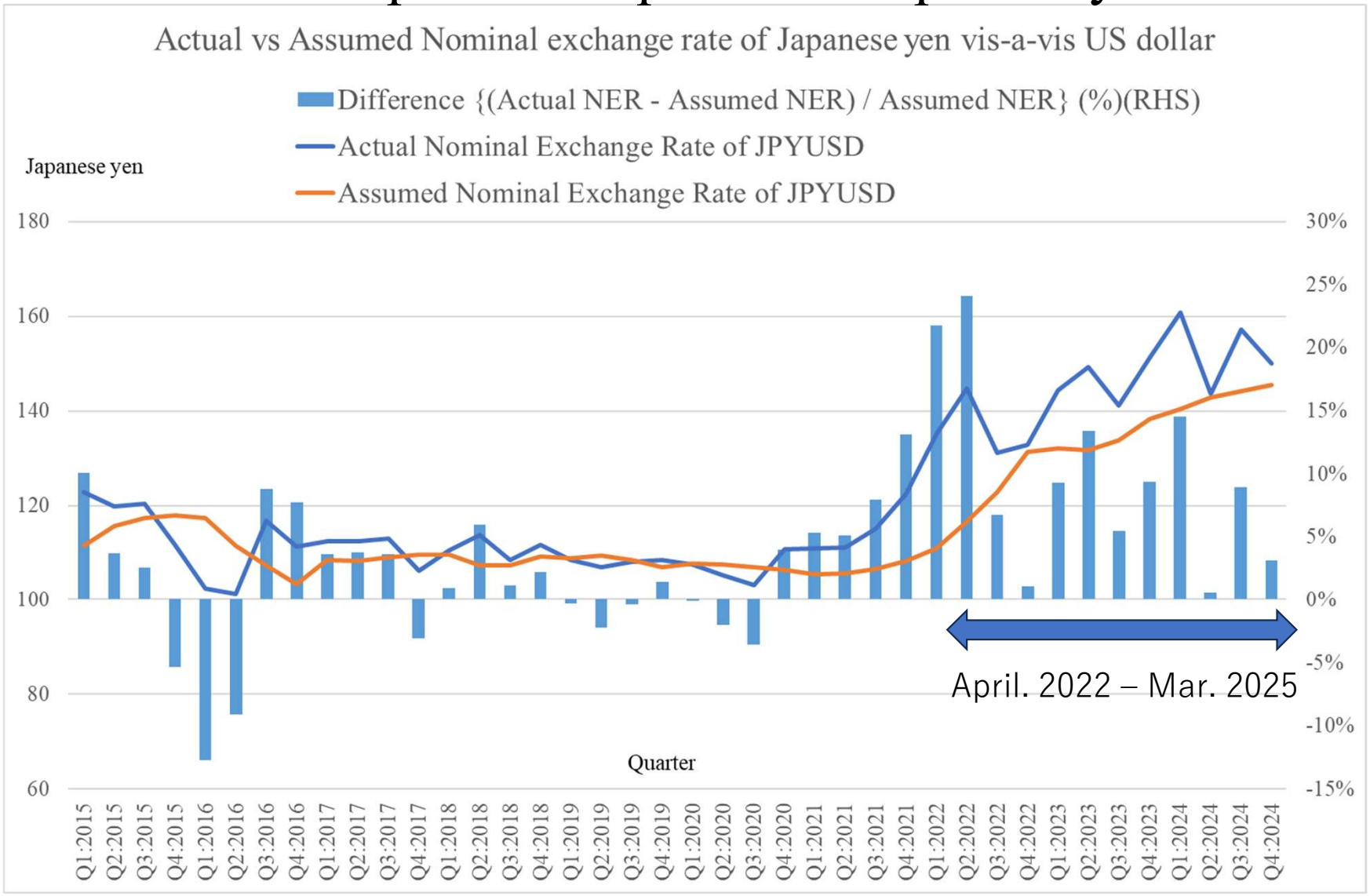
Observations during the historic depreciation period of Japanese yen

Historic depreciation period of Japanese yen vis-à-vis USD & EUR



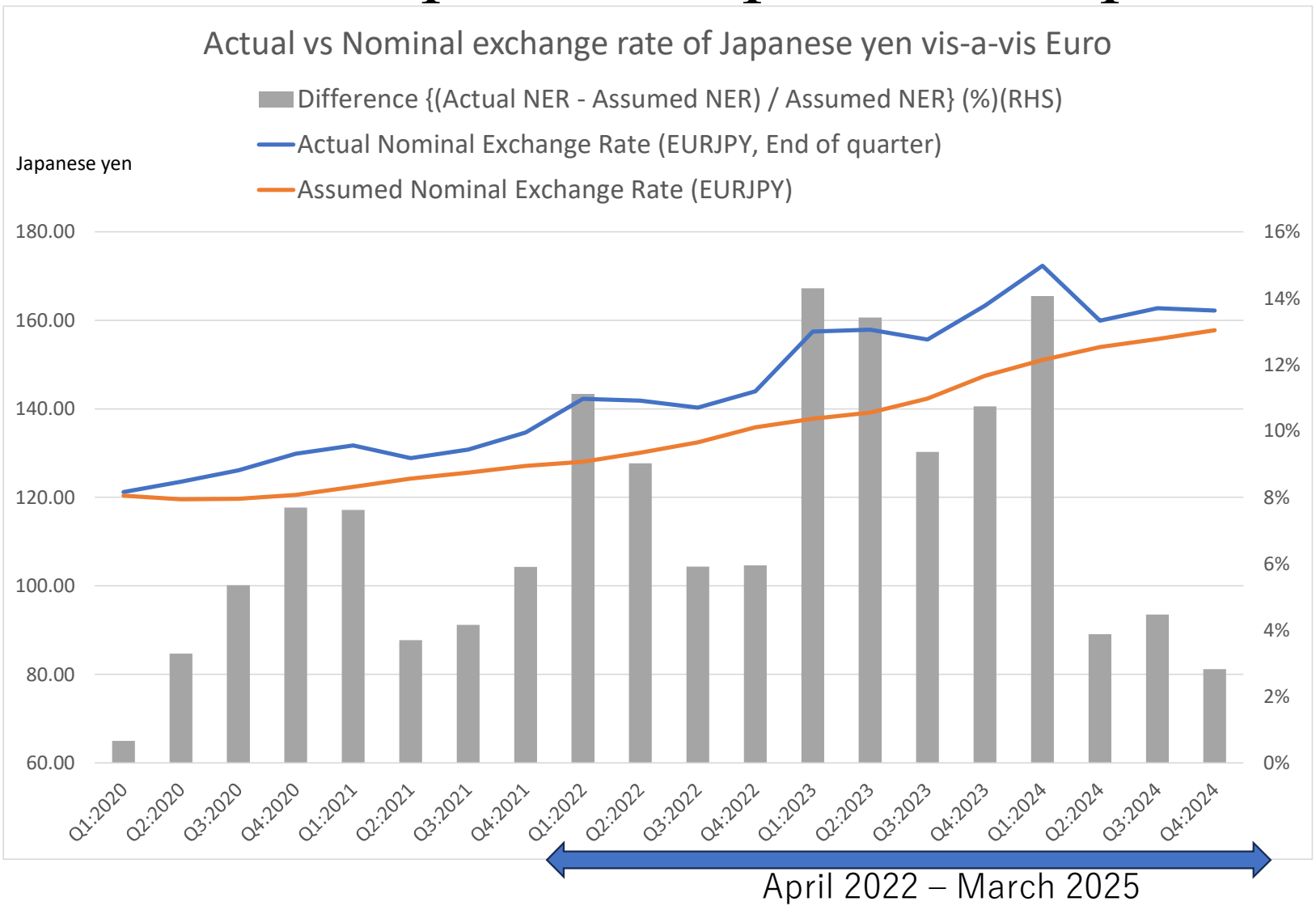
Historic depreciation period of Japanese yen



Vis-à-vis US dollar

Data of assumed exchange rate for Large-size firms In manufacturing sector Is obtained from the BOJ's Tankan survey

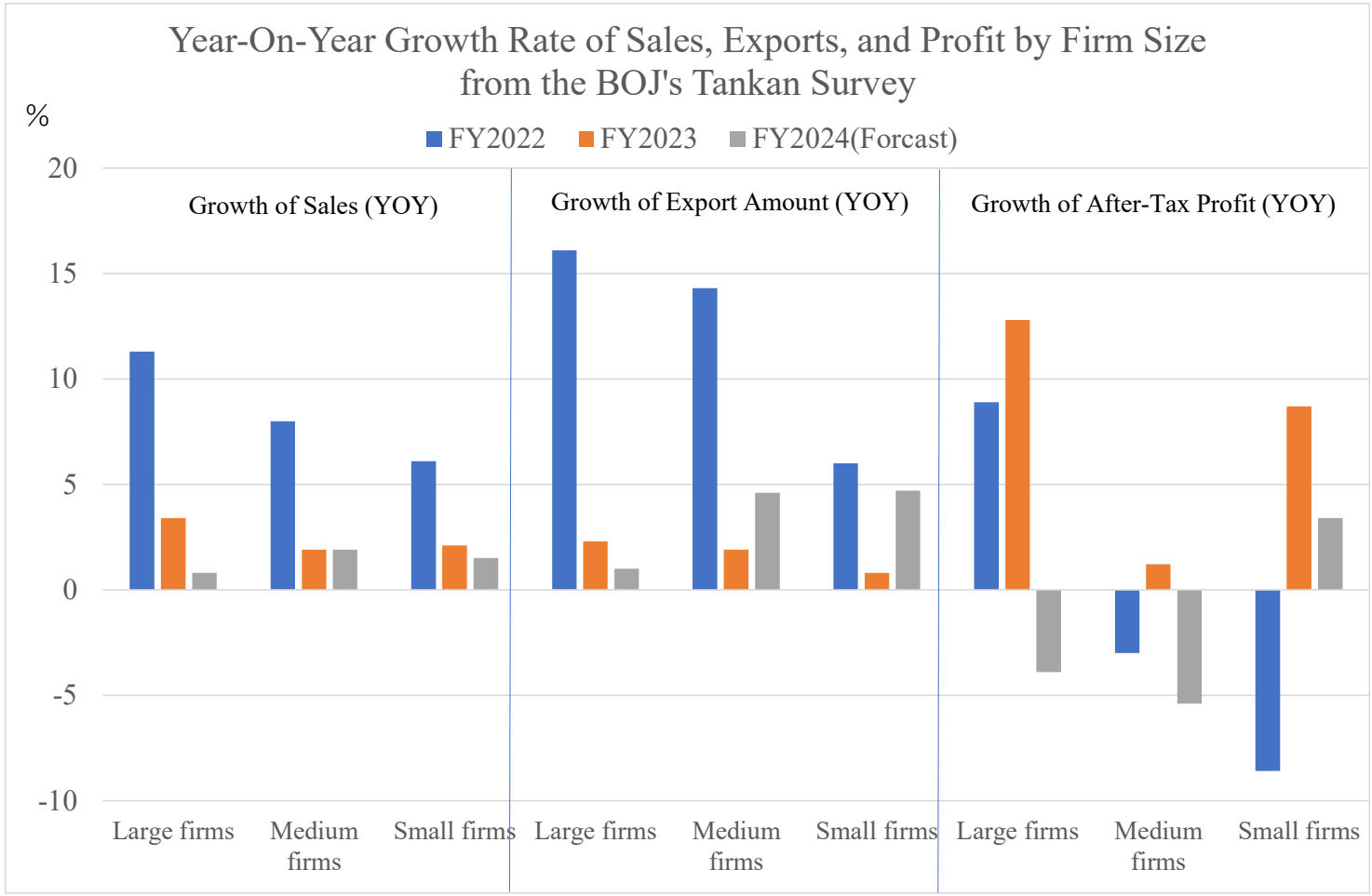
Historic depreciation period of Japanese yen



Vis-à-vis Euro

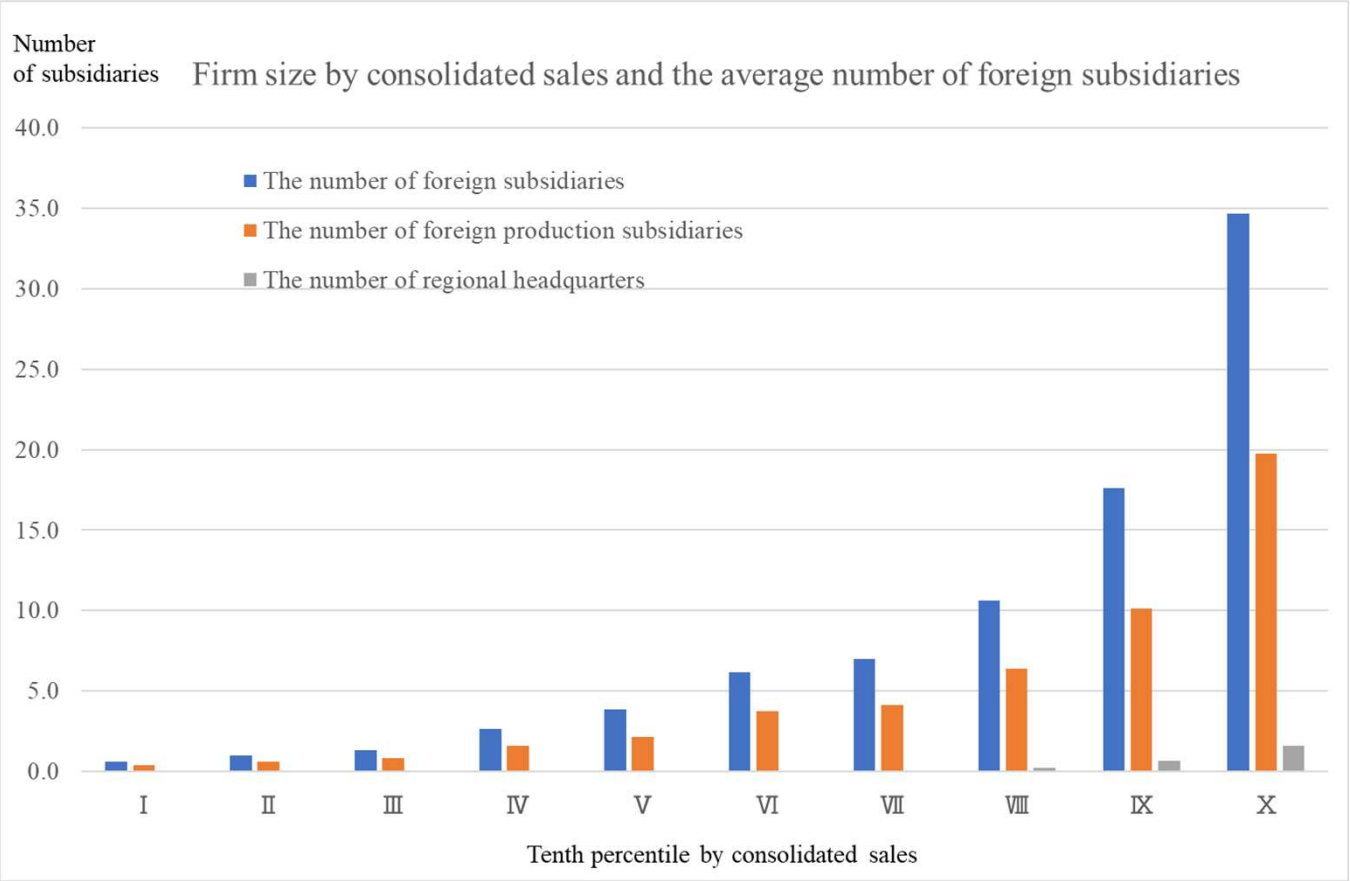
Data of assumed exchange rate for Large-size firms In manufacturing sector Is obtained from the BOJ's Tankan survey

Performance of corporate sector by firm size in FY2022-2024: the BOJ's Tankan Survey



Firm size by sales and percentage of firms with upward revision – downward revision

Firm size by sales and the average number of foreign subsidiaries



Purpose of this presentation

- (1) Formulate the theoretical and practical relationship among invoice currencies, expected exchange rates by firms (assumed exchange rates), operational and financial hedges, and foreign exchange exposures
- (2) Provide novel method to estimate *direct foreign exchange exposure* at firm level by using the earning forecast revision data
- (3) Examine what factors affected *direct exposure* during the period of historic depreciation of Japanese yen

Summary of today's presentation

- Purified earnings forecast data caused by exchange rate fluctuation factors by Japanese listed manufacturers from Q1:FY2022 – Q4:FY2024 (12 quarters)

- Firms with more intra-firm exports tend to improve their financial performance more swiftly as Japanese yen depreciates.

- Financial performance of firms with production foreign subsidiaries in foreign countries are less likely to fluctuate during the period of massive depreciation of home currency.

- Financial performance of firms with local headquarters in foreign countries are also less likely to fluctuate due to the operational hedging working through the local headquarters.

Literature review and research questions

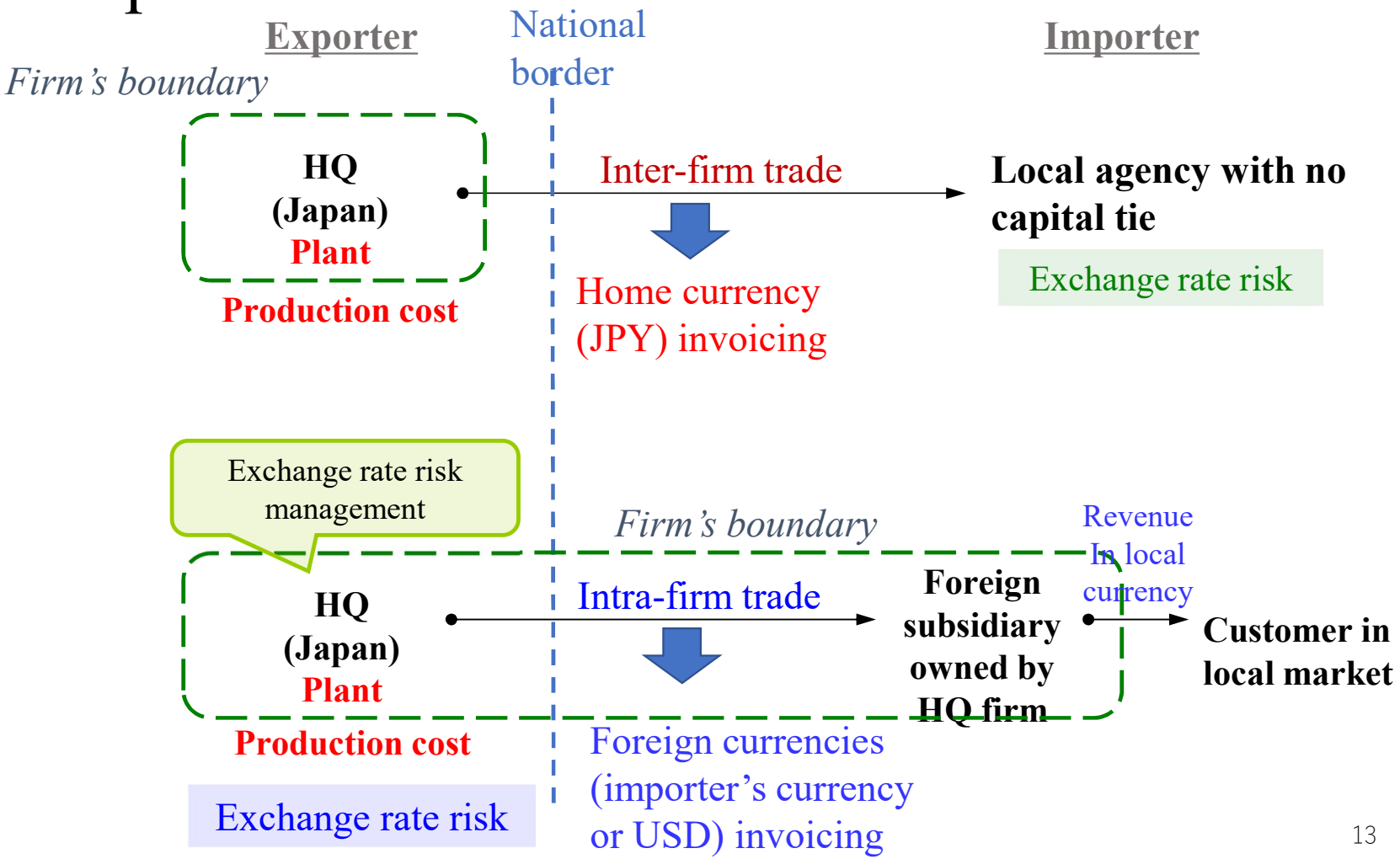
Difference in the invoice currency choice for listed firms by firm size

Status of Invoice Currency Choice by Firm Size: Listed Manufactures

Sample firms	Size of Consolitated Sales	Share of Japanese Yen in Total Exports	
		Average	Median
Listed Manufacturers	Large-size	29.8%	11%
	Medium-size	41.3%	34%
	Small-size	51.5%	47%

- Ito, et al (2018) argue significant scale effects in pattern of export invoice currency choice in Japanese listed manufacturers.
- Larger listed exporters tend to have larger share of *foreign currency invoicing* including importer's currency or US dollar (smaller share of home currency) especially in intra-firm exports.

Patterns of invoice currency choice in exports



Foreign exchange exposures

- *Foreign exchange exposure* is defined as the risk that a company's profitability or value will be affected by fluctuations in exchange rates.

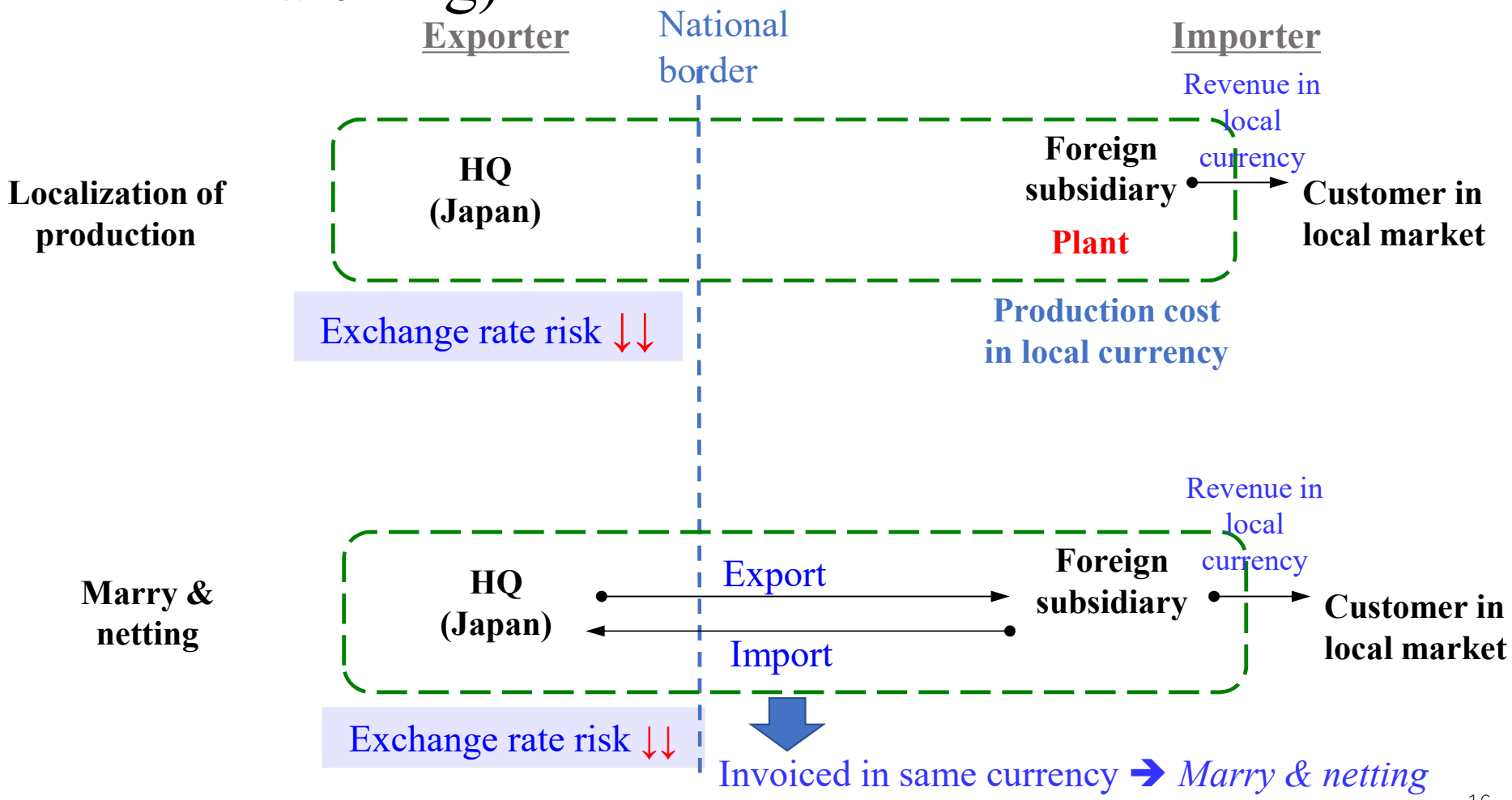
- *Direct exposure* arises from known and expected future foreign currency transactions

- *Indirect exposure* arises from the competitive environment in which the firm operates.

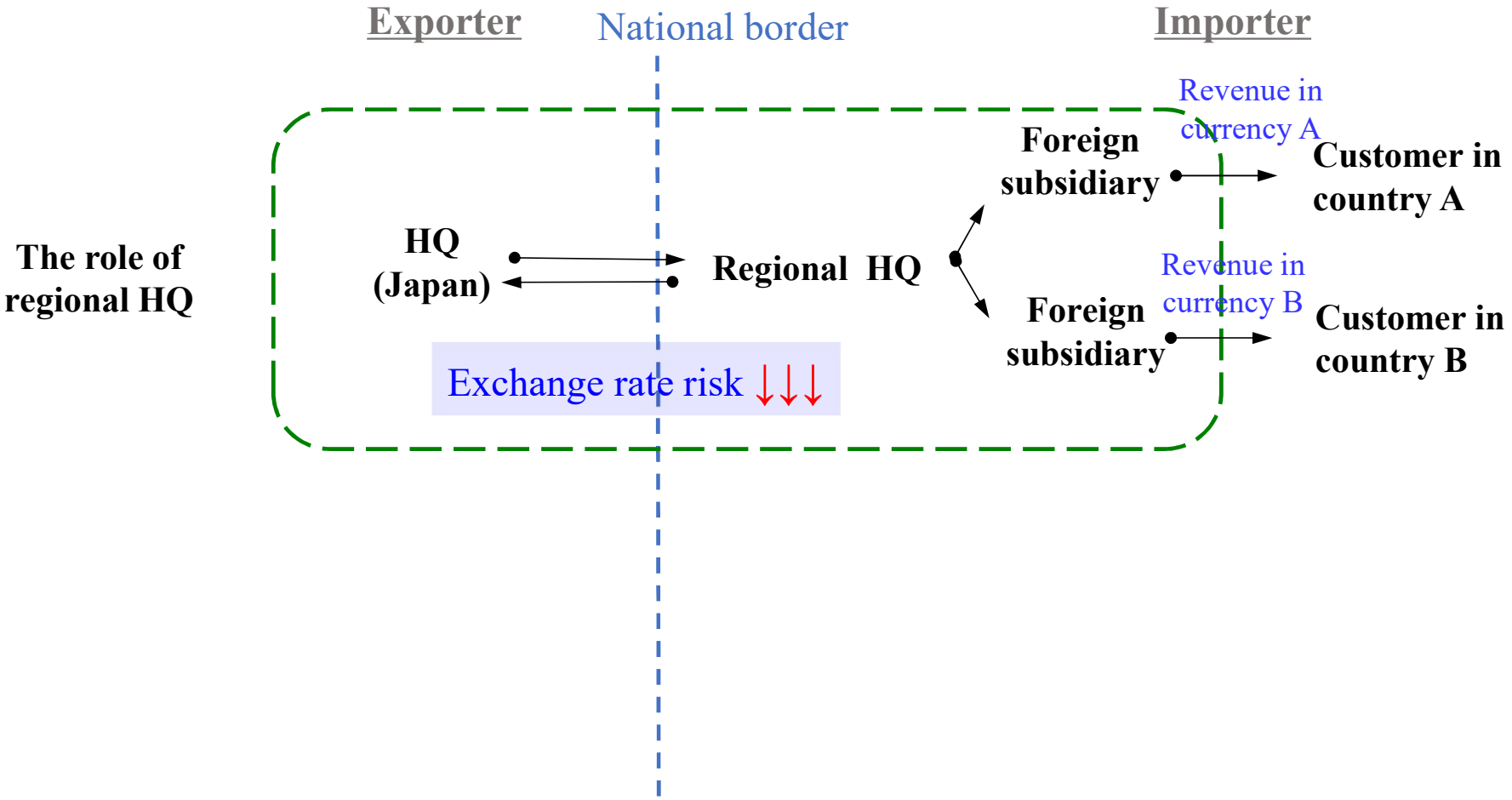
Operational vs financial hedging

- Financial hedging
  - Including forwards, options, swaps, and foreign currency debt
  - Most financial derivative contracts are *short-term*
- Operational hedging
  - Involves altering the firm's real operations to reduce overall foreign exchange exposure
  - Including *currency diversification*, *currency matching*, *and operational flexibility*
  - *Longer-term* hedging techniques
  - 'Natural hedge' of multinational companies via operational hedging
- Allyayanis, et al (2001) also argue the role of operational hedging strategies on exchange rate exposures
- Amiti, et al (2014) emphasize that large exporters are simultaneously large importers.

Patterns of operational hedging (currency matching)



Patterns of operational hedging (the role of regional headquarters)



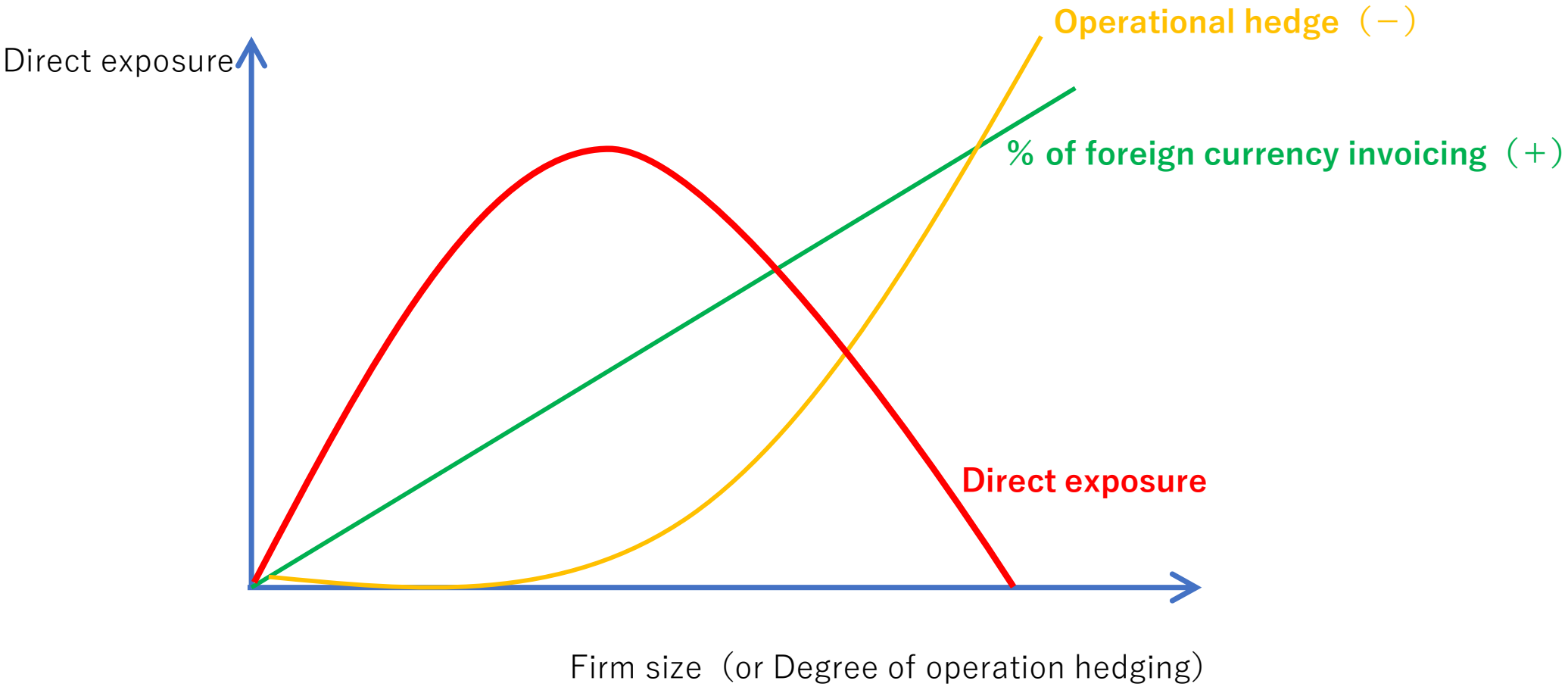
Financial hedging during the historic depreciation period of JPY

- The assumed nominal exchange rate (NER) of Japanese yen vis-à-vis USD and EUR by Japanese listed manufacturers was always below the actual NER (spot rate), which means they systematically overestimated the value of Japanese yen
- This evidence means many Japanese firms tended to fail to reduce the *direct exposure* by using *financial hedging*.
- Chowdhry & Howe's (1999) model suggests that *operational hedging* is particularly useful for firms that find it difficult to predict future foreign currency cash flows.

Non-linear effects of EXR exposure in the globalization of firm

- Hutson, E. and E. Laing (2014) "Foreign exchange exposure and multinationality"
- In terms of *direct exposure*, "if operational hedging (as proxied by the degree of multinationality) reduces direct foreign exchange exposure, in general direct exposure would fall with greater multinationality. … Purely domestic firms by definition have no direct exposure, so this theoretical relation therefore becomes **an inverse U-shape**."
- Reduction of (direct) exposure basically stems from the operational and financial hedging.

Non-linear effects of EXR exposure in the globalization of firm



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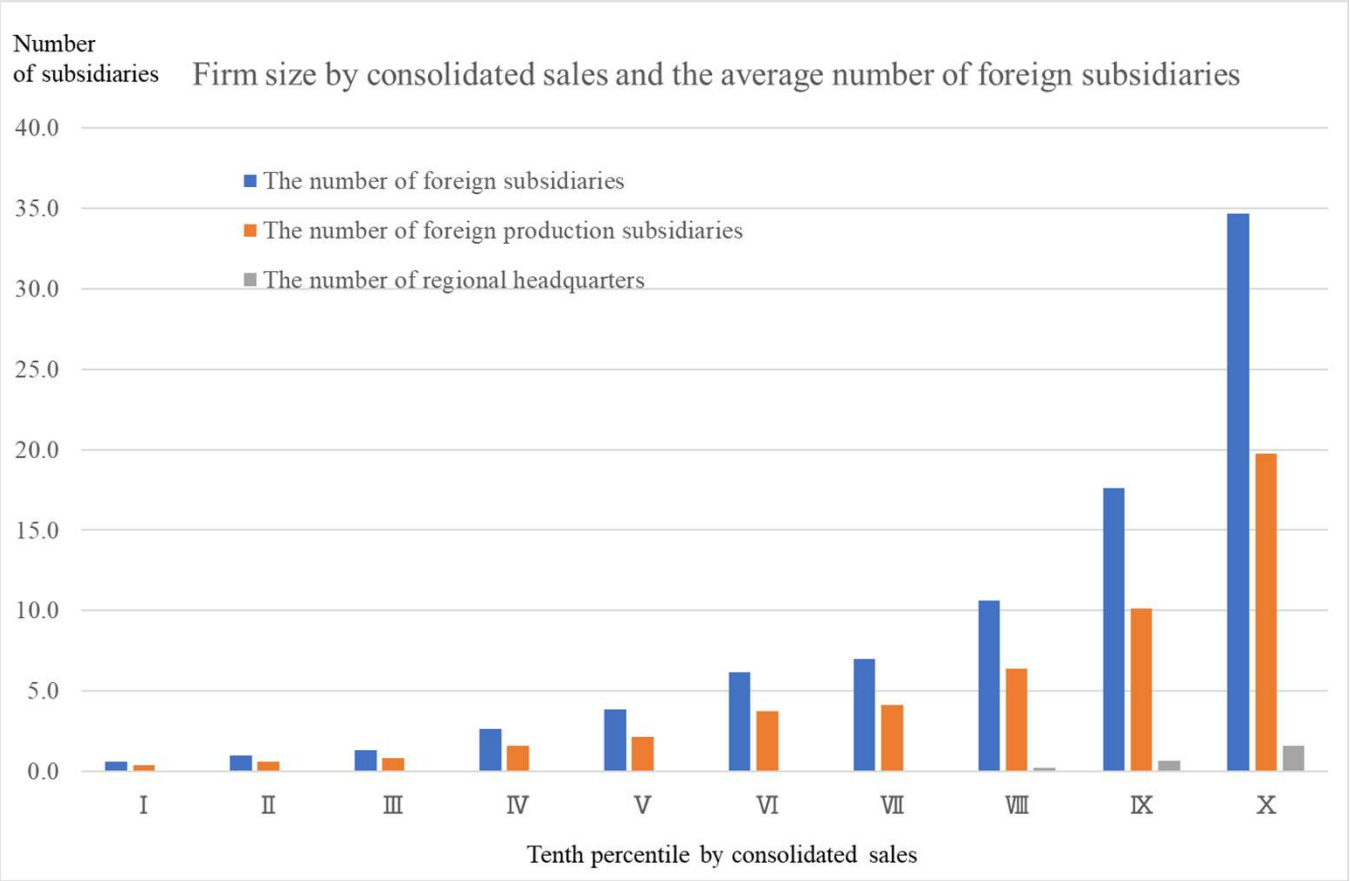
Firm size by sales and the average number of foreign subsidiaries



Sample average by firm size or foreign sales ratio

Consolidated sales	Obs.	Consolidated sales (million yen)	Foreign sales ratio	# of foreing subs.	Share of 100% owned foreign subsidiaries	# of foreign production subs.	# of foreign local headquarters
Large (Upper 1/3)	493	782,804	44%	19.6	43%	11.3	0.8
Medium (Middle 1/3)	493	40,845	28%	4.9	43%	2.9	0.0
Small (Lower 1/3)	494	8,832	16%	1.1	33%	0.7	0.0

Foreign sales ratio	Obs.	Consolidated sales (million yen)	Foreign sales ratio	# of foreing subs.	Share of 100% owned foreign subsidiaries	# of foreign production subs.	# of foreign local headquarters
Large (Upper 1/3)	493	583,105	65%	18.0	55%	10.2	0.6
Medium (Middle 1/3)	493	218,135	23%	6.4	46%	3.9	0.2
Small (Lower 1/3)	494	31,196	0%	1.2	18%	0.8	0.0

Research questions

- What factors are behind the difference of corporate performance by size as the exchange rate of home currency largely fluctuates

- How do the invoice currency choice and degree of operational hedging play important roles?

- To explore these questions, we need to estimate *direct exposure at firm level*.

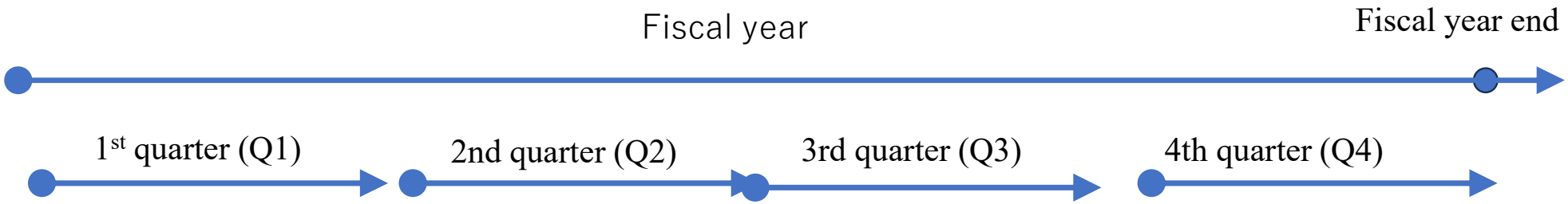
- How can we detect the direct exposure?

Earnings forecast revision data

Timely disclosure system

- Corporate Information Required for Timely Disclosure
- (iv) Amendments, etc. to Performance Estimates or Dividend Estimates of Listed Company
- Amendments to performance estimates, differences in estimates and earnings values
- Dividend estimate or amendment to dividend estimate

Earnings forecast disclosure system



Spot rate

120yen/$

Assumed EX rate (for budgeting)

115yen/$

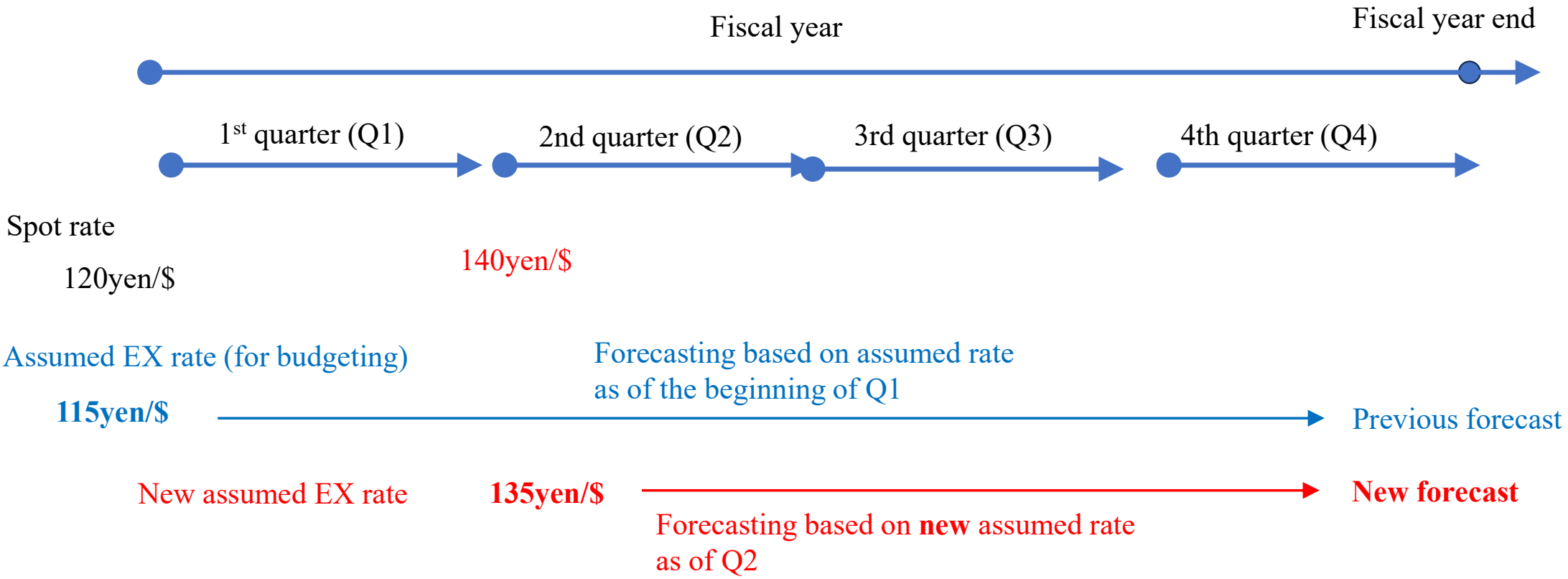
Forecasting based on assumed rate as of the beginning of Q1

Sales

Operating profit (Ordinary profit)

After-tax profit

Earnings forecast revision disclosure



- If there is a substantial discrepancy between old and new forecasts, **the firm release the revision of earnings forecast** as soon as possible for investors' appropriate decision making.

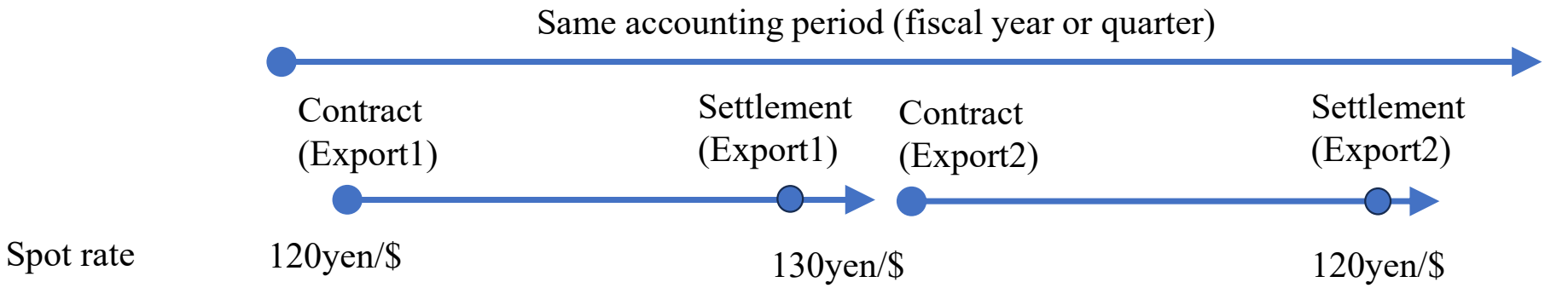
Earnings forecast revision disclosure

- JPX standard for the release of earnings forecast revision

- a. Consolidated sales: ±10%
- b. Consolidated operating profit: ±30%
- c. Consolidated ordinary profit: ±30%
- d. Consolidated after-tax profit (Net Income Attributable to Owners of the Parent): ±30%

- Percent is calculated as {(New forecast – previous forecast) / old forecast}

Case of standard fluctuation of USDJPY rate

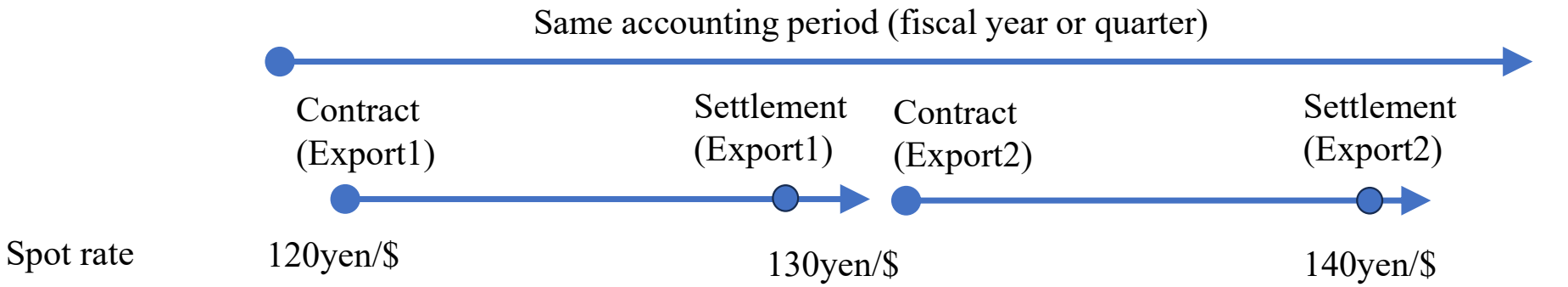


Foreign exchange gain (JPY)
10,000yen

Foreign exchange loss (JPY)
-10,000yen

Total profit or loss in I/S = 10,000yen – 10,000yen = 0 yen

Case of persistent depreciation of Japanese yen within an accounting period



Foreign exchange gain (JPY)
10,000yen

Foreign exchange gain (JPY)
10,000yen

Total profit in I/S = 10,000yen + 10,000yen = +20,000 yen

Invoice currency, bookkeeping and valuation & translation adjustments

Spot rate 120yen/$ 130yen/$

Receivable(USD) (1000 $)
(Invoice currency = USD)

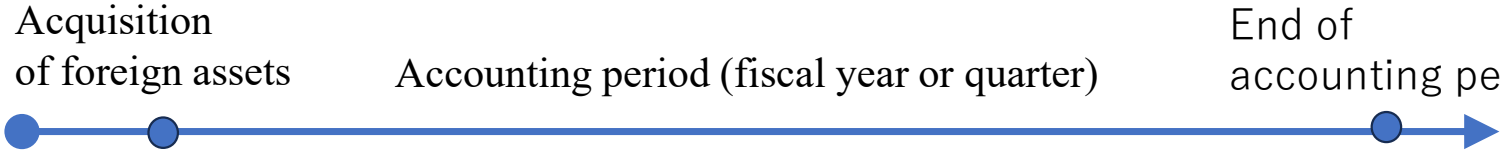
Cash(USD) 1,000 $

Receivable(JPY) (120,000yen)

Cash(JPY) 130,000yen

Foreign exchange gain(JPY) 10,000yen
= 10yen/$ * 1000 $

Evaluation of foreign assets (securities) by spot rate at the fiscal year end



Spot rate 120yen/$ 130yen/$

Acquired asset(USD) 10,000 $

Acquired asset(JPY) 1,200,000yen

Acquired asset(USD) 10,000 $

Acquired asset(JPY) 1,300,000yen

Foreign exchange gain (JPY) 100,000yen

Total profit in I/S = +100,000 yen

- Same type of translation in the end of accounting period will be applied to the evaluation of net worth of foreign subsidiaries, in which the **foreign currency translation adjustments (FCTA)**

Purifying the raw data

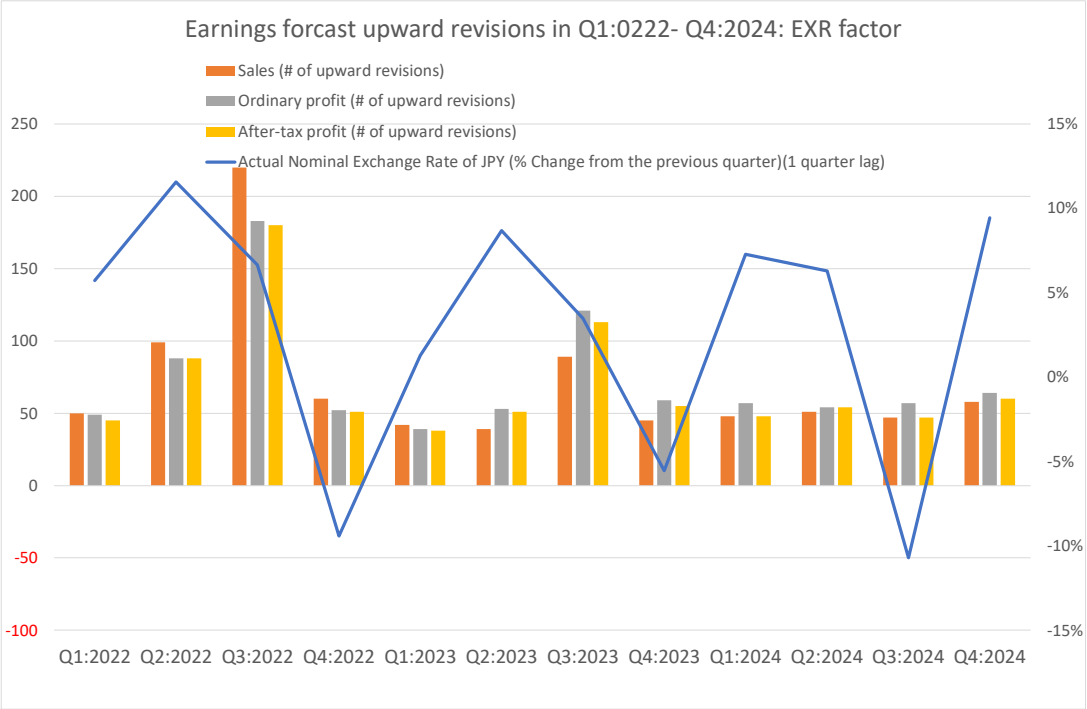
- Various factors other than EXR fluctuations affect the revision of earnings forecast by the CEO/CFO of firms

- Noise reduction is necessary though the cleansing of raw revision data

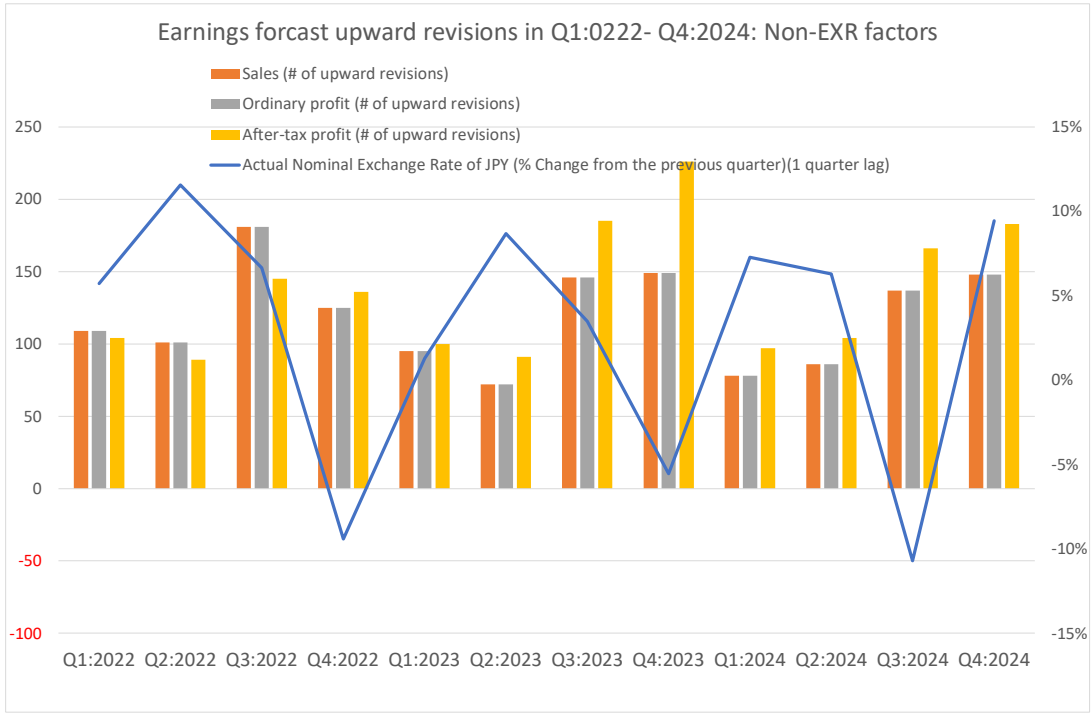
- We go through the “reason of revision” and pick up only the case that the article mentions a factor relating to exchange rate fluctuation (“EXR factor”) by distinguishing from others (“Non-EXR factors”)

Upward revisions due to EXR- & Non-EXR factors

EXR factor

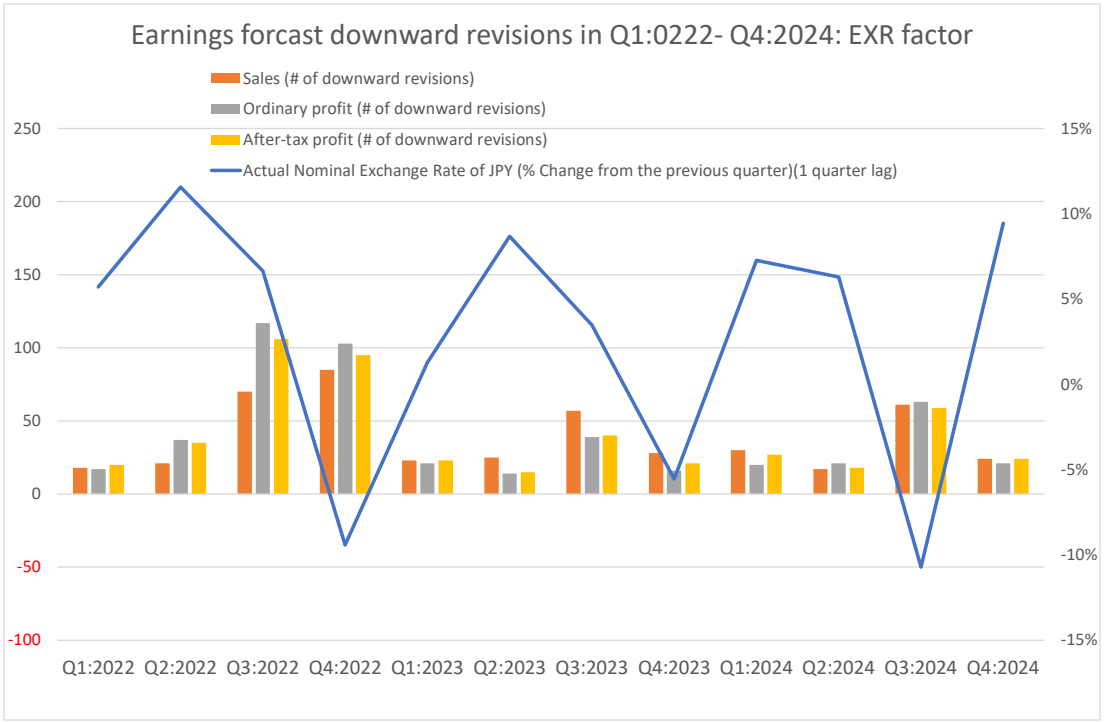


Non-EXR factors

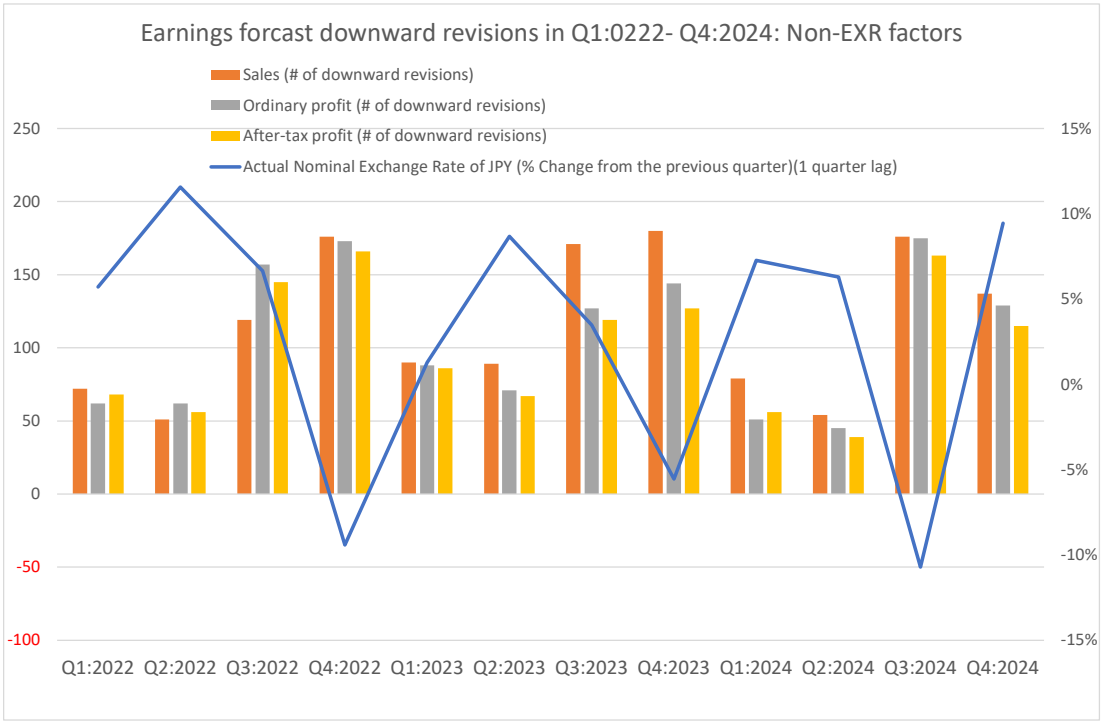


Downward revisions due to EXR- & Non-EXR factors

EXR factor

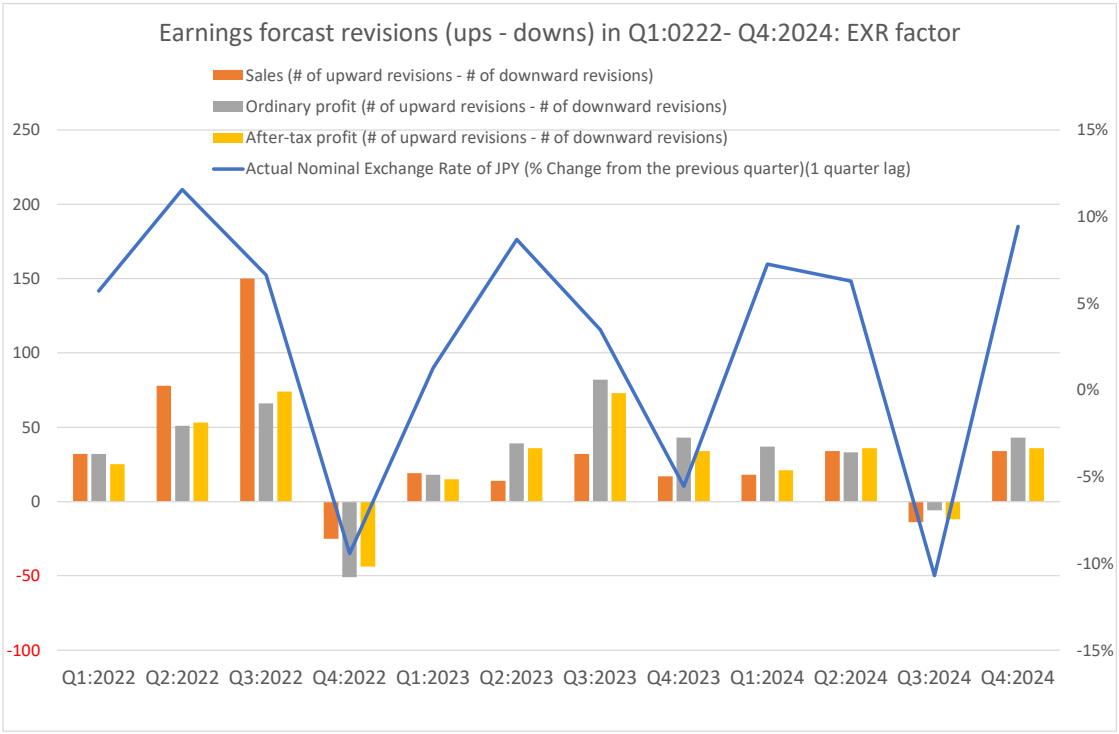


Non-EXR factors

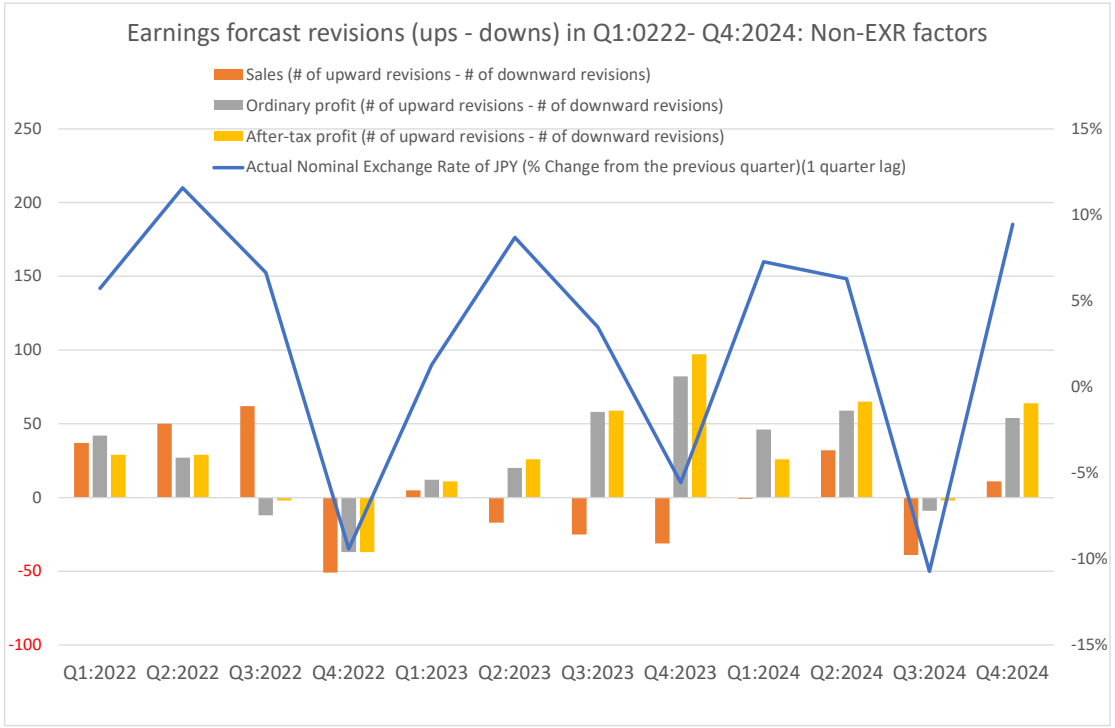


Forecast revisions (ups – downs) due to EXR- & Non-EXR factors

EXR factor



Non-EXR factors



Empirical Methodology

Data description

- Sample period: 12 quarters from Q1:2022 through Q4: 2024 (April 2022 – March 2025)
  - Covers the period of massive depreciation of Japanese yen

- Earnings forecast data of all manufacturing firms listed on Tokyo stock exchange (1,640 listed firms) as of March 2022

OLS regression

$$ForecastRevision_{t_i} = \alpha + \beta_1\, ForeignRatio_i + \beta_2\, Sales_i + \beta_3\, AssumedEXR_{t_i} + \gamma_1\, Intrafirm_i + \gamma_2\, Operational_i + \delta_1\, Quarter\ dummies + \delta_2\, Industry\ dummies + \varepsilon_{t_i}$$

- $ForecastRevision_{it}$: Percent change of the forecast revision from the previous forecast for firm *i* at quarter *t* (corporate performance are measured by *sales, ordinary profit,* and *after-tax profit*.)

Explanatory variables (1)

- Foreignratio$_i$: proxy for *dependency on foreign market*
  - Foreign sales ratio of firm *i* (defined as foreign sales / consolidated sales) as of FY2022

- *Sales*$_i$: proxy for *firm size*
  - Log of Consolidated sales of firm *i* as of FY2022

- *AssumedEXR*$_{ti}$: proxy for *unpredicted exchange rate fluctuation*
  - difference between actual and industry-averaged assumed exchange rate as of quarter *t* for industry *j* that firm *i* belongs to.

Explanatory variables (2)

- *Intrafirm*$_i$: (+) proxies for *foreign currency invoicing*
  - log of the number of foreign subsidiaries of firm *i*
  - the share of 100% owned subsidiaries of firm *i*.
    - Larger listed exporters tend to have larger share of foreign currency invoicing including importer's currency or US dollar (smaller share of home currency) especially in intra-firm exports.

- *Operational*$_i$: (-) proxy for *reduction of direct exposure*
  - log of the number of foreign plants
  - log of the number of (foreign) local headquarters of firm *i*.
    - Currency matching of foreign revenue and foreign cost in terms of same currency
    - Local HQ effectively manages foreign exchange exposure in the region

Explanatory variables (3)

- *Dummies* : include industry dummies (16 types of industry in manufacturing; the benchmark is chemical industry) and quarter dummies (Q1:FY2022 – Q4:FY2024; the benchmark is Q1:FY2022) representing fixed effect for industry *j* and quarter *t*

Results of OLS regression using the percent change of forecast revision data

Unpurified vs purified data: Percent change of forecast revisions

Unpurified data

All revised forecast data

Purified data

Revised forecast data based on exchange rate fluctuation

DATA	Percent change of forecast from the previous forecast						Percent change of forecast from the previous forecast					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	rev_sales	rev_ordinary profit	rev_after-tax profit	rev_sales	rev_ordinary profit	rev_after-tax profit	exr-rev_sales	exr-rev_ordinary profit	exr-rev_after-tax-profit	exr-rev_sales	exr-rev_ordinary profit	exr-rev_after-tax-profit
Foreign sales ratio	0.00177	-0.00414	-0.0143**	0.00343**	0.000764	-0.0120*	0.00530***	0.0275***	0.0230***	0.00626***	0.0294***	0.0240***
	(0.00151)	(0.00563)	(0.00575)	(0.00168)	(0.00625)	(0.00639)	(0.000574)	(0.00320)	(0.00332)	(0.000640)	(0.00358)	(0.00372)
log of sales	-0.00555***	0.00337	0.00320	-0.00384***	0.00721*	0.00632	0.000610	0.00464**	0.00417*	0.000522	0.00480**	0.00442*
	(0.00105)	(0.00387)	(0.00395)	(0.00112)	(0.00415)	(0.00424)	(0.000397)	(0.00221)	(0.00229)	(0.000424)	(0.00237)	(0.00246)
(log of sales)^2	0.000292***	-0.000260	-0.000230	0.000212***	-0.000462**	-0.000388*	-2.07e-05	-0.000285***	-0.000238**	-2.23e-05	-0.000318***	-0.000274**
	(5.01e-05)	(0.000185)	(0.000189)	(5.30e-05)	(0.000197)	(0.000201)	(1.90e-05)	(0.000106)	(0.000109)	(2.00e-05)	(0.000112)	(0.000116)
Constant	0.0248***	0.00984	0.0122	0.0155**	-0.0122	-0.0101	-0.00452**	-0.0169	-0.0162	-0.00471**	-0.0147	-0.0199
	(0.00558)	(0.0206)	(0.0210)	(0.00618)	(0.0229)	(0.0234)	(0.00211)	(0.0117)	(0.0122)	(0.00237)	(0.0132)	(0.0137)
Industry dummies	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Quarter dummies	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Observations	17,758	17,524	17,427	17,758	17,524	17,427	17,760	17,683	17,649	17,760	17,683	17,649
R-squared	0.003	0.001	0.001	0.012	0.007	0.007	0.007	0.004	0.003	0.022	0.011	0.009
	.	.	.	.	.	.	.	.	.	.	.	.

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Percent change of forecast revision from the previous forecast

Revised forecast data based on exchange rate fluctuation

DATA	Percent change of forecast from the previous forecast								
METHOD	Ordinary least square								
VARIABLES	(1) Sales	(2) Ordinary profit	(3) After-tax profit	(4) Sales	(5) Ordinary profit	(6) After-tax profit	(7) Sales	(8) Ordinary profit	(9) After-tax profit
Foreign sales ratio	0.0557***	0.0588***	0.0544***	0.0566***	0.0589***	0.0556***	0.00597***	0.0213***	0.0148***
	(0.00543)	(0.00567)	(0.00548)	(0.00548)	(0.00571)	(0.00553)	(0.000719)	(0.00468)	(0.00479)
Ln(sales)	0.000450	0.000669	0.000867	0.000298	0.000391	0.000524	4.08e-05	-0.00166**	-0.00225***
	(0.000999)	(0.00105)	(0.00101)	(0.000992)	(0.00103)	(0.00100)	(0.000114)	(0.000740)	(0.000757)
Actual - Asumed NER (t-1)	0.256***	0.205***	0.204***	0.174	0.120	0.0342			
	(0.0173)	(0.0184)	(0.0177)	(0.117)	(0.121)	(0.117)			
Ln(# of foreign subsidiaries)	0.0130***	0.0158***	0.0165***	0.0129***	0.0157***	0.0167***	0.000469	0.00710**	0.0102***
	(0.00315)	(0.00332)	(0.00318)	(0.00310)	(0.00326)	(0.00314)	(0.000446)	(0.00290)	(0.00297)
Share of 100% owned subsidiaries	0.00426***	0.00560***	0.00521***	0.00428***	0.00564***	0.00534***	-0.000109	0.00223	0.00256*
	(0.00147)	(0.00147)	(0.00142)	(0.00144)	(0.00144)	(0.00139)	(0.000210)	(0.00136)	(0.00139)
Ln(# of foreign plants)	-0.00133	-0.00458	-0.00712**	-0.00137	-0.00442	-0.00706**	-0.000346	-0.00661**	-0.0104***
	(0.00347)	(0.00367)	(0.00353)	(0.00340)	(0.00359)	(0.00347)	(0.000509)	(0.00331)	(0.00339)
Ln(# of local headquarters)	-0.0166***	-0.0223***	-0.0188***	-0.0162***	-0.0219***	-0.0184***	-0.000461	-0.00587*	0.000623
	(0.00370)	(0.00400)	(0.00385)	(0.00363)	(0.00392)	(0.00378)	(0.000499)	(0.00325)	(0.00332)
Constant	-0.00544***	0.000379	0.00357	-0.00187	0.0164	0.0163	-0.00228*	0.0177**	0.0197**
	(0.00104)	(0.00673)	(0.00689)	(0.00201)	(0.0131)	(0.0134)	(0.00124)	(0.00807)	(0.00826)
Quarter dummies	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No	No	No	Yes	Yes	Yes
Observations	17,760	17,719	17,689	17,760	17,719	17,689	17,760	17,719	17,689
R-squared	0.015	0.003	0.003	0.018	0.006	0.005	0.020	0.006	0.006
	.	.	.	.	.	.	.	.	.

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Results of probit estimation using upward and downward revisions data

Probit model regression

$$Prob(Upward_{ti} = 1) = \alpha + \beta_1\, ForeignRatio_i + \beta_2\, Sales_i + \beta_3\, AssumedEXR_{t_j} + \gamma_1\, Intrafirm_i + \gamma_2\, Operational_i + \delta_1\, Quarter\ dummies + \delta_2\, Industry\ dummies + \varepsilon_{t_i}$$

- Upward_Revision$_{it}$: a dummy variable that takes 1 if earnings forecast (for *sales*, *ordinary profit*, and *after-tax profit*, respectively) is revised upward comparing with the previous forecast for firm *i* at quarter *t,* otherwise zero.

- Dowwardn_Revision$_{it}$: a dummy variable that takes 1 if earnings forecast (for *sales*, *ordinary profit*, and *after-tax profit*, respectively) is revised downward comparing with the previous forecast for firm *i* at quarter *t,* otherwise zero.

Scale effects in unpurified vs purified data: Upward forecast revisions

Unpurified data | **Purified data**

DATA	All revised forecast data (only upward revision)						Revised forecast data based on exchange rate fluctuation (only upward revision)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	up_sales	up_ordinary-profit	up_after-tax-profit	up_sales	up_ordinary-profit	up_after-tax-profit	exr-up_sales	exr-up_ordinary-profit	exr-up_after-tax-profit	exr-up_sales	exr-up_ordinary-profit	exr-up_after-tax-profit
Foreign sales ratio	0.0719***	0.0467***	0.0448***	0.0779***	0.0557***	0.0517***	0.0827***	0.0857***	0.0804***	0.0818***	0.0812***	0.0773***
	(0.00918)	(0.00972)	(0.00953)	(0.0103)	(0.0108)	(0.0106)	(0.00492)	(0.00499)	(0.00485)	(0.00546)	(0.00550)	(0.00535)
log of sales	0.00332	0.00802	0.00534	0.00825	0.0135	0.0122	0.0418***	0.0524***	0.0493***	0.0434***	0.0531***	0.0503***
	(0.00770)	(0.00776)	(0.00753)	(0.00813)	(0.00832)	(0.00809)	(0.00724)	(0.00750)	(0.00728)	(0.00721)	(0.00745)	(0.00724)
(log of sales)^2	0.000465	0.000166	0.000281	0.000219	-0.000114	-5.51e-05	-0.00171***	-0.00222***	-0.00208***	-0.00182***	-0.00229***	-0.00217***
	(0.000352)	(0.000359)	(0.000349)	(0.000371)	(0.000383)	(0.000372)	(0.000316)	(0.000328)	(0.000318)	(0.000314)	(0.000325)	(0.000316)
Industry dummies	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Quarter dummies	No	No	No	No	No	No	No	No	No	No	No	No
Observations	17,760	17,760	17,760	17,760	17,760	17,760	17,760	17,760	17,760	17,760	17,760	17,760
Pseudo R^2	0.0193	0.00972	0.00987	0.0224	0.0123	0.0132	0.0646	0.0640	0.0623	0.0755	0.0757	0.0742

Standard errors in p*** p<0.01, ** p<0.05, * p<0.1

Introduction of the intra-firm trade variables & operational hedges: Upward forecast revisions

Revised forecast data based on exchange rate fluctuation

DATA	only upward revision due to exchange rate fluctuations								
METHOD	Probit estimation								
VARIABLES	(1) Sales	(2) Ordinary profit	(3) After-tax profit	(4) Sales	(5) Ordinary profit	(6) After-tax profit	(7) Sales	(8) Ordinary profit	(9) After-tax profit
Foreign sales ratio	0.0557***	0.0588***	0.0544***	0.0566***	0.0589***	0.0556***	0.0593***	0.0597***	0.0566***
	(0.00543)	(0.00567)	(0.00548)	(0.00548)	(0.00571)	(0.00553)	(0.00556)	(0.00577)	(0.00559)
Ln(sales)	0.000450	0.000669	0.000867	0.000298	0.000391	0.000524	-0.00120	-0.00117	-0.000943
	(0.000999)	(0.00105)	(0.00101)	(0.000992)	(0.00103)	(0.00100)	(0.00102)	(0.00107)	(0.00104)
Actual - Asumed NER (t-1)	0.256***	0.205***	0.204***	0.174	0.120	0.0342			
	(0.0173)	(0.0184)	(0.0177)	(0.117)	(0.121)	(0.117)			
Ln(# of foreign subsidiaries)	0.0130***	0.0158***	0.0165***	0.0129***	0.0157***	0.0167***	0.0171***	0.0188***	0.0193***
	(0.00315)	(0.00332)	(0.00318)	(0.00310)	(0.00326)	(0.00314)	(0.00319)	(0.00333)	(0.00320)
Share of 100% owned subsidiaries	0.00426***	0.00560***	0.00521***	0.00428***	0.00564***	0.00534***	0.00472***	0.00578***	0.00545***
	(0.00147)	(0.00147)	(0.00142)	(0.00144)	(0.00144)	(0.00139)	(0.00142)	(0.00142)	(0.00137)
Ln(# of foreign plants)	-0.00133	-0.00458	-0.00712**	-0.00137	-0.00442	-0.00706**	-0.00610*	-0.00826**	-0.0104***
	(0.00347)	(0.00367)	(0.00353)	(0.00340)	(0.00359)	(0.00347)	(0.00349)	(0.00367)	(0.00354)
Ln(# of local headquarters)	-0.0166***	-0.0223***	-0.0188***	-0.0162***	-0.0219***	-0.0184***	-0.0160***	-0.0204***	-0.0172***
	(0.00370)	(0.00400)	(0.00385)	(0.00363)	(0.00392)	(0.00378)	(0.00358)	(0.00387)	(0.00373)
Quarter dummies	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No	No	No	Yes	Yes	Yes
Observations	17,760	17,719	17,689	17,760	17,719	17,689	17,760	17,719	17,689
Pseudo R^2	0.101	0.0850	0.0856	0.116	0.0975	0.0967	0.127	0.109	0.109

Report the maeginal effect | Standard errors in parentheses | *** p<0.01, ** p<0.05, * p<0.1

Scale effects in unpurified vs purified data: Downward forecast revisions

Unpurified data — All revised forecast data (only downward revision)

Purified data — Revised forecast data based on exchange rate fluctuation (only dowward revision)

DATA	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	down_sales	down_ordinary-profit	down_after-tax-profit	down_sales	down_ordinary-profit	down_after-tax-profit	exr-down_sales	exr-down_ordinary-profit	exr-down_after-tax-profit	exr-down_sales	exr-down_ordinary-profit	exr-down_after-tax-profit
Foreign sales ratio	0.0192**	0.0412***	0.0464***	0.0166*	0.0417***	0.0489***	0.0198***	0.0195***	0.0237***	0.0149***	0.0165***	0.0210***
	(0.00868)	(0.00833)	(0.00812)	(0.00935)	(0.00899)	(0.00879)	(0.00422)	(0.00424)	(0.00417)	(0.00423)	(0.00401)	(0.00407)
log of sales	0.00259	-0.00205	0.00227	-0.00271	-0.00585	-0.000825	0.00996**	0.0143***	0.0124**	0.0103**	0.0126***	0.0116**
	(0.00668)	(0.00644)	(0.00649)	(0.00667)	(0.00635)	(0.00638)	(0.00485)	(0.00544)	(0.00522)	(0.00457)	(0.00454)	(0.00451)
(log of sales)^2	8.67e-05	0.000573*	0.000319	0.000254	0.000664**	0.000378	-0.000372*	-0.000468**	-0.000403*	-0.000405**	-0.000435**	-0.000409**
	(0.000312)	(0.000297)	(0.000298)	(0.000310)	(0.000291)	(0.000293)	(0.000217)	(0.000239)	(0.000230)	(0.000204)	(0.000199)	(0.000198)
Industry dummies	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Quarter dummies	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
Observations	17,760	17,760	17,760	17,760	17,760	17,760	17,760	17,760	17,760	17,760	17,760	17,760
Pseudo R^2	0.00233	0.0136	0.0135	0.0456	0.0579	0.0532	0.0114	0.0210	0.0224	0.0582	0.0925	0.0818

Standard errors in p*** p<0.01, ** p<0.05, * p<0.1

Introduction of the intra-firm trade variables & operational hedges: Downward forecast revisions

Revised forecast data based on exchange rate fluctuation

DATA	only downward revision due to exchange rate fluctuations								
METHOD	Probit estimation								
VARIABLES	(1) Sales	(2) Ordinary profit	(3) After-tax profit	(4) Sales	(5) Ordinary profit	(6) After-tax profit	(7) Sales	(8) Ordinary profit	(9) After-tax profit
Foreign sales ratio	0.0156***	0.0124**	0.0153***	0.0132***	0.0107**	0.0134***	0.0117**	0.0107**	0.0141***
	(0.00504)	(0.00487)	(0.00464)	(0.00472)	(0.00427)	(0.00417)	(0.00473)	(0.00436)	(0.00423)
Ln(sales)	0.00184**	0.00272***	0.00264***	0.00165**	0.00226***	0.00229***	0.00110	0.00180**	0.00181**
	(0.000854)	(0.000836)	(0.000803)	(0.000794)	(0.000728)	(0.000716)	(0.000809)	(0.000747)	(0.000729)
Actual - Asumed NER (t-1)	0.00318	0.0712***	0.0578***	0.0748	0.0666	0.0866			
	(0.0161)	(0.0148)	(0.0143)	(0.0885)	(0.0803)	(0.0799)			
Ln(# of foreign subsidiaries)	0.00267	0.000538	-0.00159	0.00207	0.000335	-0.00177	0.00145	-0.000144	-0.00184
	(0.00308)	(0.00296)	(0.00288)	(0.00284)	(0.00255)	(0.00254)	(0.00287)	(0.00263)	(0.00261)
Share of 100% owned subsidiaries	0.00162	0.000494	0.000789	0.00143	0.000421	0.000685	0.000951	7.61e-05	0.000476
	(0.00136)	(0.00149)	(0.00133)	(0.00125)	(0.00128)	(0.00117)	(0.00125)	(0.00130)	(0.00117)
Ln(# of foreign plants)	-7.77e-05	0.00552*	0.00736**	0.000349	0.00494*	0.00679**	0.00122	0.00572**	0.00702**
	(0.00347)	(0.00327)	(0.00318)	(0.00319)	(0.00281)	(0.00280)	(0.00322)	(0.00291)	(0.00288)
Ln(# of local headquarters)	-0.00955***	-0.0102***	-0.0120***	-0.00878***	-0.00860***	-0.0104***	-0.00638**	-0.00793***	-0.00934***
	(0.00360)	(0.00322)	(0.00314)	(0.00330)	(0.00276)	(0.00276)	(0.00322)	(0.00272)	(0.00272)
Quarter dummies	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No	No	No	Yes	Yes	Yes
Observations	17,760	17,719	17,689	17,760	17,719	17,689	17,760	17,719	17,689
Pseudo R^2	0.0129	0.0310	0.0321	0.0473	0.0886	0.0796	0.0586	0.0945	0.0861

Report the maeginal effect | Standard errors in parentheses | *** p<0.01, ** p<0.05, * p<0.1

Summary & Conclusions

Summary & Conclusion (1)

- Purified earnings forecast data caused by exchange rate fluctuation factors by Japanese listed manufacturers from Q1:FY2022 – Q4:FY2024 (12 quarters)

- Firms with more intra-firm exports tend to improve their financial performance more swiftly as Japanese yen depreciates.

- Financial performance of firms with production foreign subsidiaries in foreign countries are less likely to fluctuate during the period of massive depreciation of home currency.

- Financial performance of firms with local headquarters in foreign countries are also less likely to fluctuate due to the operational hedging working through the local headquarters.

Summary & Conclusion (2)

- The regression results generally indicate the inverse-U shape relation between the degree of operational hedging and firm's financial performance (direct exchange exposure) which is consistent with the prediction by Hutson and Laing (2014).

- The inverse U-shape relationship mainly comes from two distinct features: the *invoice currency choice by firm size* and the *degree of operational hedging by firm size*.

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