Characteristics of Firms Transmitting Data Across Borders:
Evidence from Japanese Firm-level Data

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Background

- Cross-border data flows are increasing at an accelerating pace
- However, it is difficult to measure the economic value of such transmitted data.

➔An academic survey on cross-border data flows of Japanese firms, asking simple yes/no questions regarding data flows

➔Infer the extent, depth, and intensity of the data flow by asking about the impact of the newly imposed regulations

Tomiura, Ito and Kang (2019) [RIETI Discussion Paper Series 19-E-088](#)

"Only a limited fraction of firms are active in data collection overseas"

Research question

- What firm-level attributes determine the cross-border data flows?

- How much of the productivity premium can be attributed to cross-border data flows?

➔ Combine the survey result on data flows with official firm-level data to investigate the relations btw firm-specific factors and data flows

Design of our survey

- **Sent to 19,790** large- and mid-sized firms (50 or more employees and capital of 30 million yen or more) in manufacturing, wholesale, and information-related service industries

- Collected responses from the beginning of April 2019 ~ April 22, but we accepted responses until August

- The firms could choose to respond using the following two options:

(i) fill in the survey form directly and return it in the enclosed return envelope;

(ii) access the URL and answer the questions using provided ID and password.

➔ **Received from 4,227 firms (21%)** (2,628 were via (i) & 1,599 were via (ii))

Official statistics at the firm-level

- *Basis Survey of Japanese Business Structure & Activities*, which METI conducts annually by imposing legal reporting obligation (50 or more employees and capital of 30 million yen or more)

- Link our survey on cross-border data transfer with the official statistics in 2017 (2 years two years prior to our survey)

- Firm size (number of employees), sales, capital (tangible fixed assets),
- R&D and ICT expenditures,
- exports, imports, and the status of multinational enterprise
- The labor productivity. The total factor productivity (TFP) is defined as residuals of Cobb-Douglas production function

"For the collection of data in Japan and overseas through business in your company, choose the most appropriate option."

Table 1. Data collection activities of firms (%)

Reponses to the question	Domestic	Overseas
Our company is continuously collecting digital data through IoT.	7.81	2.31
Although IoT has not been introduced, our company is regularly collecting digital data.	21.62	8.73
Our company is not particularly conscious of data, or not collecting data consciously.	55.66	70.7
I do not know whether IoT is introduced, or do not know IoT.	14.91	18.26
Total	100	100

n=93

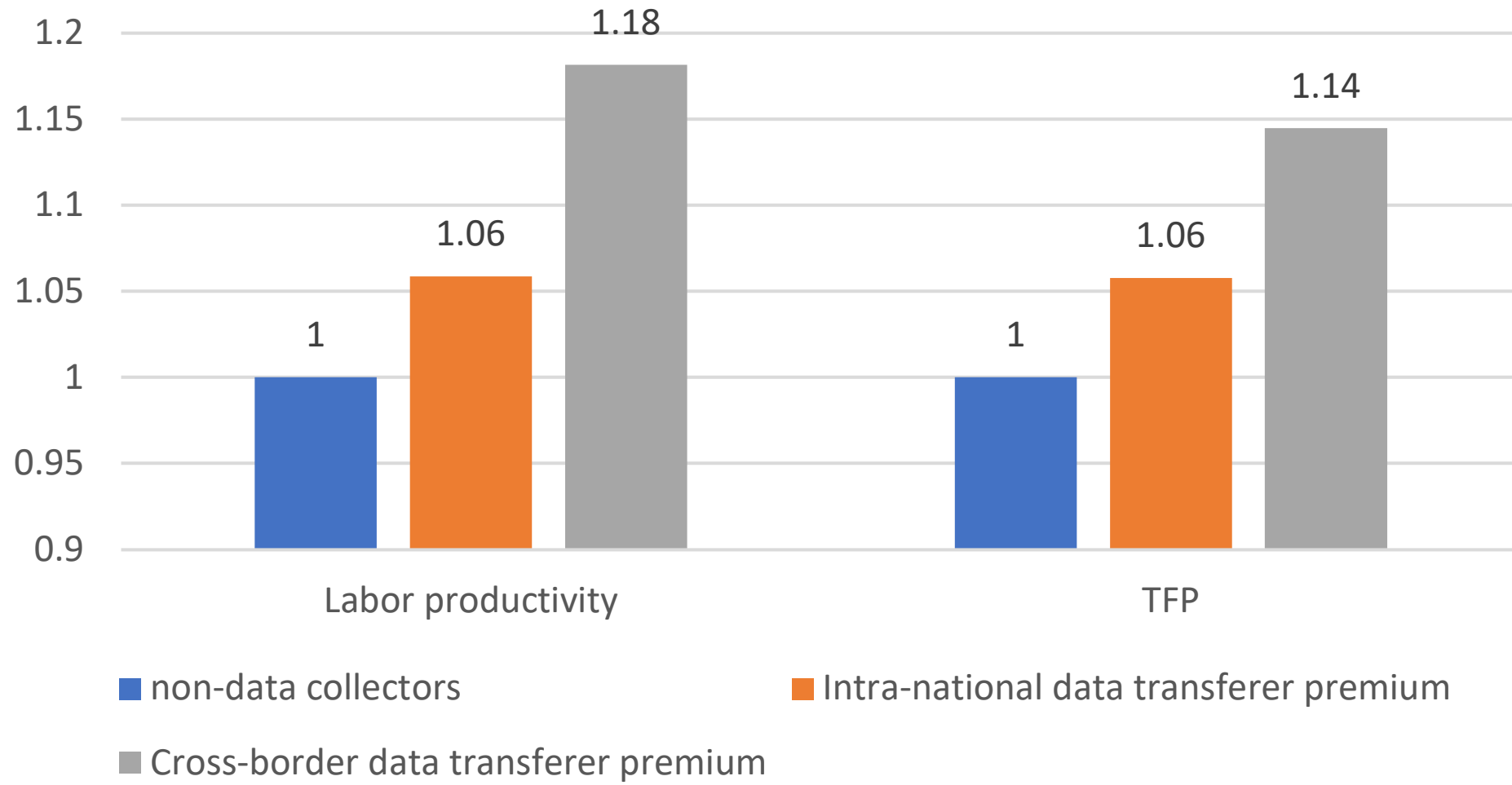n=350

Basic firm attributes across different types of firms

(1) not collecting data,

(2) collecting data in Japan,

(3) collecting data overseas and in Japan

- Firms decisively differ according to their data activities.

- Firms actively collecting data overseas tend to be substantially larger in size, and more productive

Table 2. Basic characteristics of firms grouped by data collection activities

Firm type	Not collecting data	Collecting data in Japan	Collecting data overseas	Total
N of firms	2,891	691	443	4,025
Total sales*	7504.4	12240.7	46133.6	12588.3
Fixed tangible asset*	1359.3	1904.8	8206.5	2212.8
N of employees (L)	174.7	233.0	833.7	257.5
Value added (VA)*	1157.7	1632.4	8581.3	2059.9
VA/L	6.30	6.67	7.45	6.49
TFP	0.96	1.01	1.10	0.98
Exporter share	0.22	0.24	0.58	0.27
MNEs share	0.15	0.13	0.43	0.18
R&D intensity	0.0124	0.0140	0.0211	0.0142
ICT intensity	0.0035	0.0061	0.0047	0.0041
Firm age	48.1	46.2	50.8	48.0

Pecking order of productivity

- non-data collectors
- Intra-national data transferer premium
- Cross-border data transferer premium

Productivity premium

- Firms are likely to incur fixed costs for cross-border data transmissions

- The fixed costs are expected to be higher for transmitting data across borders than those within the home country.

- Additional costs for cross-border data transfers include compliance with foreign regulations and installation of required servers and networks.

➔Only a limited number of productive firms are supposed to be able to cover these non-negligible fixed costs

Estimating productivity premium of data transfer

$$\ln y_i = \alpha_0 + \beta_1 DD_i + \beta_2 DO_i + \beta_3 EXP_i + \beta_4 MNE_i + u_i$$

$\ln y_i$: Labor productivity or TFP

DD_i : Dummy for firms collecting data in Japan,

DO_i : Dummy for firms collecting data overseas and in Japan

EXP_i : Exporter dummy

MNE_i: MNE dummy

Table 3. Productivity premiums of firms collecting data

	(1)	(2)	(3)	(4)	(5)	(6)
Panel (a). lnTFP	OLS	q10	q25	q50	q75	q90
Collecting data in Japan	0.042**	0.041	0.041*	0.027**	0.036*	0.066**
	[0.018]	[0.032]	[0.023]	[0.012]	[0.021]	[0.030]
Collecting data overseas	0.059**	-0.037	0.082*	0.084***	0.071**	0.111***
	[0.027]	[0.048]	[0.046]	[0.031]	[0.036]	[0.041]
Exporter	0.134***	0.049*	0.074***	0.164***	0.190***	0.171***
	[0.021]	[0.026]	[0.027]	[0.035]	[0.027]	[0.037]
MNE	0.078***	0.117***	0.058*	0.03	0.026	0.03
	[0.023]	[0.032]	[0.030]	[0.029]	[0.023]	[0.027]
Panel (b). ln(VA/L)	OLS	q10	q25	q50	q75	q90
Collecting data in Japan	0.052***	0.050**	0.055***	0.048**	0.065***	0.093***
	[0.019]	[0.024]	[0.015]	[0.019]	[0.022]	[0.026]
Collecting data overseas	0.055*	-0.028	0.106***	0.078**	0.070**	0.095**
	[0.028]	[0.041]	[0.025]	[0.037]	[0.032]	[0.047]
Exporter	0.146***	0.065**	0.103***	0.177***	0.219***	0.190***
	[0.022]	[0.033]	[0.019]	[0.018]	[0.025]	[0.030]
MNE	0.101***	0.134***	0.087***	0.080***	0.052*	0.083**
	[0.023]	[0.041]	[0.022]	[0.024]	[0.026]	[0.037]

Table 4. Productivity premiums of firms grouped by regulatory impacts

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	lnTFP	lnTFP	lnTFP	lnTFP	lnTFP	lnTFP	lnY/L	lnY/L	lnY/L	lnY/L	lnY/L	lnY/L
(a). Impacts from GDPR	OLS	q10	q25	q50	q75	q90	OLS	q10	q25	q50	q75	q90
Collecting data in Japan	0.041**	0.042	0.042	0.030*	0.026	0.065**	0.052***	0.043	0.060**	0.044*	0.065**	0.098**
	[0.018]	[0.038]	[0.031]	[0.017]	[0.024]	[0.030]	[0.019]	[0.042]	[0.027]	[0.026]	[0.031]	[0.048]
Transmitting data across borders but unaffected by regulations	0.011	-0.1	0.044	0.047**	0.032	0.073*	0.004	-0.098**	0.038	0.033	0.011	0.049
	[0.029]	[0.066]	[0.045]	[0.024]	[0.030]	[0.041]	[0.030]	[0.039]	[0.046]	[0.024]	[0.016]	[0.039]
Transmitting data across borders and affected by regulations	0.309***	0.385***	0.334***	0.272***	0.201***	0.489***	0.326***	0.315***	0.314***	0.325***	0.276***	0.395***
	[0.054]	[0.085]	[0.056]	[0.031]	[0.062]	[0.143]	[0.055]	[0.116]	[0.078]	[0.049]	[0.069]	[0.124]
Exporter	0.134***	0.054	0.081**	0.156***	0.189***	0.166***	0.145***	0.09	0.098***	0.167***	0.205***	0.194***
	[0.021]	[0.037]	[0.032]	[0.025]	[0.030]	[0.042]	[0.022]	[0.062]	[0.033]	[0.031]	[0.041]	[0.029]
MNE	0.069***	0.117***	0.059***	0.027	0.01	0.03	0.091***	0.119***	0.084***	0.063***	0.049*	0.064
	[0.023]	[0.024]	[0.021]	[0.023]	[0.019]	[0.041]	[0.023]	[0.033]	[0.029]	[0.019]	[0.029]	[0.050]

Table 6. Productivity of firm collecting data and affected by cross-border data transfer regulations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	lnTFP	lnTFP	lnTFP	lnTFP	lnTFP	lnTFP	lnY/L	lnY/L	lnY/L	lnY/L	lnY/L	lnY/L
(a). Impacts of GDPR	OLS	q10	q25	q50	q75	q90	OLS	q10	q25	q50	q75	q90
Collecting data in Japan	0.040**	0.04	0.042**	0.031*	0.025	0.067***	0.051***	0.045**	0.057***	0.041***	0.065***	0.098***
	[0.018]	[0.026]	[0.021]	[0.017]	[0.018]	[0.023]	[0.019]	[0.021]	[0.016]	[0.015]	[0.015]	[0.025]
Collecting data overseas but unaffected by regulations	0.01	-0.098*	0.043	0.044*	0.031	0.068	0.002	-0.098**	0.033	0.033	0.012	0.048
	[0.029]	[0.052]	[0.035]	[0.025]	[0.032]	[0.049]	[0.030]	[0.050]	[0.036]	[0.024]	[0.034]	[0.051]
Collecting data overseas and affected by regulations but taking no measures	0.192***	0.541***	0.491***	0.241***	0.027	-0.176**	0.173***	0.555***	0.376**	0.132	-0.017	-0.193***
	[0.044]	[0.071]	[0.107]	[0.047]	[0.054]	[0.070]	[0.057]	[0.198]	[0.169]	[0.093]	[0.052]	[0.051]
Collecting data overseas, affected by regulations, and taking some measures	0.318***	0.378***	0.334***	0.272***	0.208*	0.514**	0.334***	0.296**	0.311**	0.349***	0.279**	0.393**
	[0.062]	[0.102]	[0.080]	[0.032]	[0.122]	[0.232]	[0.062]	[0.146]	[0.124]	[0.064]	[0.139]	[0.156]
Exporter	0.135***	0.058**	0.081***	0.159***	0.188***	0.187***	0.147***	0.089***	0.102***	0.169***	0.210***	0.197***
	[0.021]	[0.026]	[0.029]	[0.023]	[0.030]	[0.040]	[0.022]	[0.018]	[0.031]	[0.015]	[0.013]	[0.034]
MNE	0.070***	0.114***	0.059***	0.028	0.011	0.014	0.092***	0.123***	0.080***	0.063*	0.046	0.066**
	[0.023]	[0.024]	[0.017]	[0.020]	[0.028]	[0.053]	[0.023]	[0.036]	[0.030]	[0.033]	[0.030]	[0.030]

Concluding remarks

- Firms actively collecting data overseas tend to be significantly more productive than those only within the home country, which in turn are more productive than those not involved in data collection.

- The productivity premium is particularly noticeable for firms collecting data overseas and affected by the regulations on cross-border data transfers with taking some measures.

- Only a small fraction of the firms involve in data transfer, but we should not underestimate them because the handful firms are superstars.