Dialogue with Prof. Laura Veldkamp

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Main Message of Key Note Speech

1. I am honored and pleased to have an occasion to engage in a dialogue with Prof. Laura Veldkamp

2. After observing and hearing her excellent speech, I would like to make four comments on following points:

(1) Long-run changes in output and productivity by data revolution

(2) Value of data and data sharing

(3) Decline of labor share of income for knowledge production in investment management firms by 5%

(4) Policy agenda on global data economy

First Comment: Difference between changes in long-run output and productivity and growth rate

1. My first comment is to what extent the long-

run growth rate is affected by data revolution

- It is clear that new data technology significantly increases productivity as shown in the rising trend of financial analysis parameters combined with the value of data increasing by 25% in four years.

-It is noted that the AI analysis productivity parameters jumped after 2018

First Comment: Long-run output and productivity level and growth rate

2. In my understanding AI technology has two functions; namely prediction algorithm and invention algorithm

-Invention algorithm is assumed to affect total factor productivity directly, leading to higher growth rate in the long-run.

-Prediction algorithm works to improve the efficiency in choosing optimal technology and production process. But it will not lead to the long-run steady state growth rate because of the upper limit on accuracy of forecast, in addition to diminishing returns on data.

First Comment: Long-run output and productivity level and growth rate

3. Investment management firms become more productive at use of data in producing knowledge.

4. Does this fact lead to higher growth rate in the long-run?

- In other words does AI prediction algorithm turns out to become invention algorithm in the production of knowledge?
- How about the productivity growth rate of knowledge production in comparison with past industrial revolution?
- Do you recommend the estimated productivity parameters as a new measurement of productivity in data economy?

First Comment: Long-run output and productivity level and growth rate

5. At the JCER, we once argued that selected companies with intensive AI-IOT use significantly outperform those of less intensive AI-IOT use, based on survey on selected 286 companies (Chart 1 (JCER, 2017)).

-Japan's growth rate will be up from 1% to 5%, if all the companies in Japan become AI-IOT intensive companies.

-However, we noted that the Baumol's cost disease will lower the aggregate growth rate, given the large share of workers remaining in low productivity sectors.

First Comment: Long-run output and productivity level and growth rate

6. Last year I had the occasion to talk with Professor Gordon on the impact of AI-revolution.

-Prof. Gordon argued that the AI revolution is at its end.

- According to his forecast in his famous book on American economic history(Gordon(2016), the output per person in the US from 2015 to 2040 will growth at 0.8%.

-In contrast the US recorded high average growth rate of output per person by 2.4% in the golden age of American growth (1920-70).

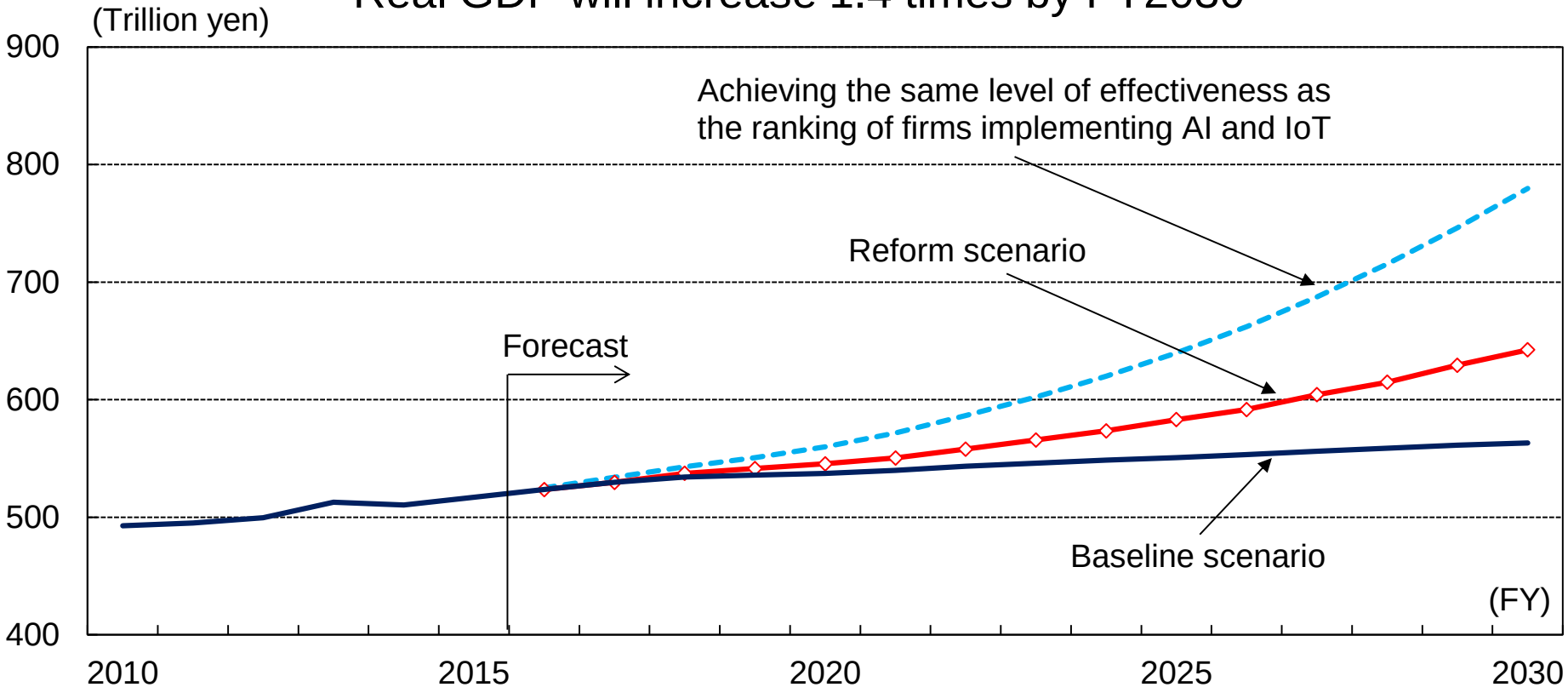
First Comment: Long-run output and productivity level and growth rate

7. In our forecast by Iwata-Maeda-Takano it will grow by 1.2%, due to the increase in intangible assets which exerts positive spillover effect on other sectors to raise total factor productivity (and thus the labor augmenting technological progress) (Chart 3).

8. There is wide difference in view on impact of AI-data revolution on future growth rate between optimists and pessimists. How about your view?

Chart 1a. JCER: AI impact on firm's performance

Boosting economic growth through the use of AI and IoT
-Real GDP will increase 1.4 times by FY2030-



Notes: "Achieving the same level of effectiveness as the ranking of companies implementing AI and IoT" is the case in which the growth rate is gradually added to the growth rate in each year so that the growth rate in Baseline scenario is increased by 4.1 percentage points by FY2030.
Source: Cabinet Office "System of National Accounts", JCER (2017) "43th Mid-Term Economic Forecast"

Chart 1b. JCER: AI impact on firm's performance

Ranking of companies implementing AI and IoT

	IoT: Top10 companies		AI: Top 10 companies
1	AMADA CO.,LTD.	1	KONICA MINOLTA, INC.
2	Daiwa House Industry Co., Ltd.	2	NTT DATA Corporation
3	Not open to the public (Major electric power equipment)	3	Not open to the public (Major automaker)
4	Not open to the public (Major sanitary materials)	4	Nomura Research Institute, Ltd.
5	SUMITOMO CORPORATION	5	Mitsubishi UFJ Financial Group, Inc.
6	KONICA MINOLTA, INC.	6	Hitachi, Ltd.
7	Suntory Holdings Limited	7	Chugai Pharmaceutical Co., Ltd.
8	Tokyo Century Corporation	8	Ajinomoto Co., Inc.
9	Not open to the public (Major automaker)	9	Fujitsu Limited
10	Not open to the public (Major general chemistry)	10	Not available

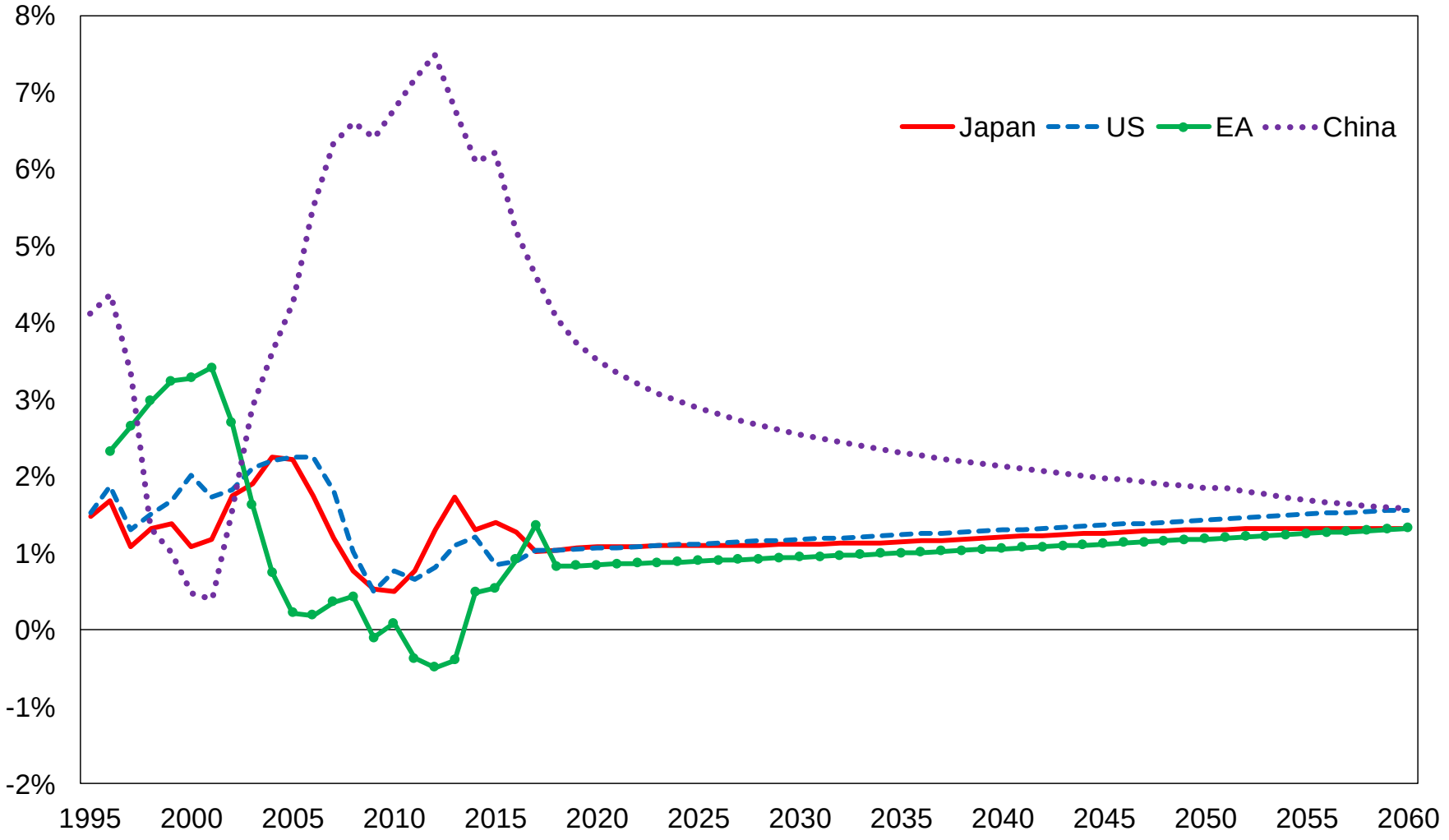
Source: JCER (2017) "Economic growth rate will be boosted by 4% through using ICT at the same level as the best companies"

Chart 2. Difference of Future Labor Productivity Growth between Prof. Gordon and Iwata, Maeda, and Takano

	Country	Productivity	2015-2040	2015-2060
Prof. Gordon	U.S.	Output per Hour	1.20	N.A.
		Output per Person	0.80	N.A.
Iwata, Maeda, and Takano	U.S.	Output per Person	1.20	1.35
		Labor Augmenting Technological Growth	1.11	1.25
	Japan	Output per Person	1.40	1.40
		Labor Augmenting Technological Growth	1.08	1.17

Source: Gordon (2016), Iwata, Maeda, and Takano (2019), “Global Imbalances and Demographic Changes”

Chart 3. Labor Augmenting Technological Progress in Japan, US, EA, and China



Source: Iwata, Maeda, and Takano (2019), “Global Imbalances and Demographic Changes”

Second Comment: Value of data

1. In her presentation, knowledge is produced by the combination of non-rival, processed data and human labor with AI skills and old skills.

-Raw data is processed by data managers. They play a critical role in measuring the value of data.

-The imputed value of firm's data is then described by wage payments and hiring choices.

2. This ingenious formulation of value of data in the absence of capital stock reminds me of the argument on "data as labor" (Arrieta-Ibarra=Imanol=Goff=Jiménez-Hernández=Lanier=Weyl (2018)).

-However, there may exist difference with respect to ownership of data. The proponents of "data as labor" may argue that the personal data belong to the ownership of data providers (consumers of digital services), instead of digital service providers.

Second Comment: Value of data

3. AI Study Group at the Council of AI Network Promotion estimated the production function with three factors (capital, labor and data measured in terms of terabyte, thus digitized) based on 1417 firms survey (AI Study Group Report 2021(2021)).

$Y=A\ f(K,L,D)$

-The results exhibit the constant returns to scale with the sum of exponents equal virtually to one and the diminishing returns on data. The data share of income ranges from 3% to 8%(Chart 4).

Second Comment: Value of data

4. It is interesting to note that the sharing data with other firms raise the productivity of data. The data exponent increases from 3% to 8%, if the data is derived from outside of companies (Chart 4).

5. If we add dummy variable indicating the use of AI and the collaboration with other companies, we get significant result on its contribution to output (Chart 5).

Second Comment: Value of data

6. The non-rivalry of data is assumed in the knowledge production within the firm.

-My question is what would be the impact of free flow of data across different sectors and industries on firm's productivity.

-It may be noted that the automobile companies move to provide not only the platform on the MaaS, but also connect the EV to infrastructure or everything (smart city).

Chart 4. Importance of Data Sharing

Estimation Results (no restriction)

Variable	Adj R^2	α (K)	β (L)	γ ($Data$)
All available data	0.5330	0.39 ***	0.50***	0.04***
Internally obtained data	0.5327	0.39***	0.50***	0.03**
Externally obtained data	0.5338	0.39***	0.52***	0.08***

Estimation Results (restriction: $\alpha + \beta = 1$)

Variable	Adj R^2	α (K)	β (L)	γ ($Data$)
All available data	0.2554	0.39 ***	(0.61)	0.03**
Internally obtained data	0.2550	0.39***	(0.61)	0.02*
Externally obtained data	0.2573	0.39***	(0.61)	0.08***

Notes: Sample size is 1417. ***, ** and * represent significance level of 1%, 5% and 10%, respectively.
Dummy variables are used to control manufacturing sectors and large companies.
Source: Ministry of Internal Affairs and Communications “AI Study Group Report 2021.”

Chart 5. Empirical analysis for utilization of AI

Variable	Estimates
log(tangible assets + non-tangible assets)	0.37***
log(number of regular employees)	0.52***
log(volume of data utilized)	0.02
Use of paid external data	0.25***
Use of free external data	0.03
There is a full-time manger	-0.01
There is a concurrent manager	0.07
Establishing an environment for company-wide data utilization	0.12*
Establishing an environment for data utilization in multiple departments	-0.03
Persons in charge of specialized departments that perform data analysis	0.14*
Persons specializing in data analysis in each business unit	0.04
Joint analysis with other companies, such as alliances and consortiums	0.33*
Dummy_manufacturing companies	0.23***
Dummy_large companies	-0.22**
Adjusted R^2	0.5399
Sample size	1300

Variable	Estimates	Estimates (adding interaction term)
log(tangible assets + non-tangible assets)	0.39***	0.38***
log(number of regular employees)	0.50***	0.50***
log(volume of data utilized)	0.03**	0.02
Utilization of AI	0.22**	0.05
Utilization of AI * log(volume of data utilized)	-	0.07*
Dummy_manufacturing companies	0.20***	0.20***
Dummy_large companies	-0.19**	-0.18**
Adjusted R^2	0.5347	0.5355
Sample size	1417	1417

Notes: ***, ** and * represent significance level of 1%, 5% and 10%, respectively.

Source: Ministry of Internal Affairs and Communications “AI Study Group Report 2021.”

Third Comment: Labor share of income

1. We observe the declining tendency of labor share of income coupled with rising income share of intangible assets after 2000 in advanced economies (Chart 6).

- This fact corresponds well to the conclusion of her speech on the increase in data owner's share of income, if we interpret the AI and big data as intangible assets.

Third Comment: Labor share of income

2. We are puzzled to observe the non-declining tendency of labor share of income in the case of Japan (Chart 7).

3. Is this due to the delay in Japan's AI-data revolution?

-Apparently, Japan is lagging behind the use and

application of AI technology in business sectors, in sharp

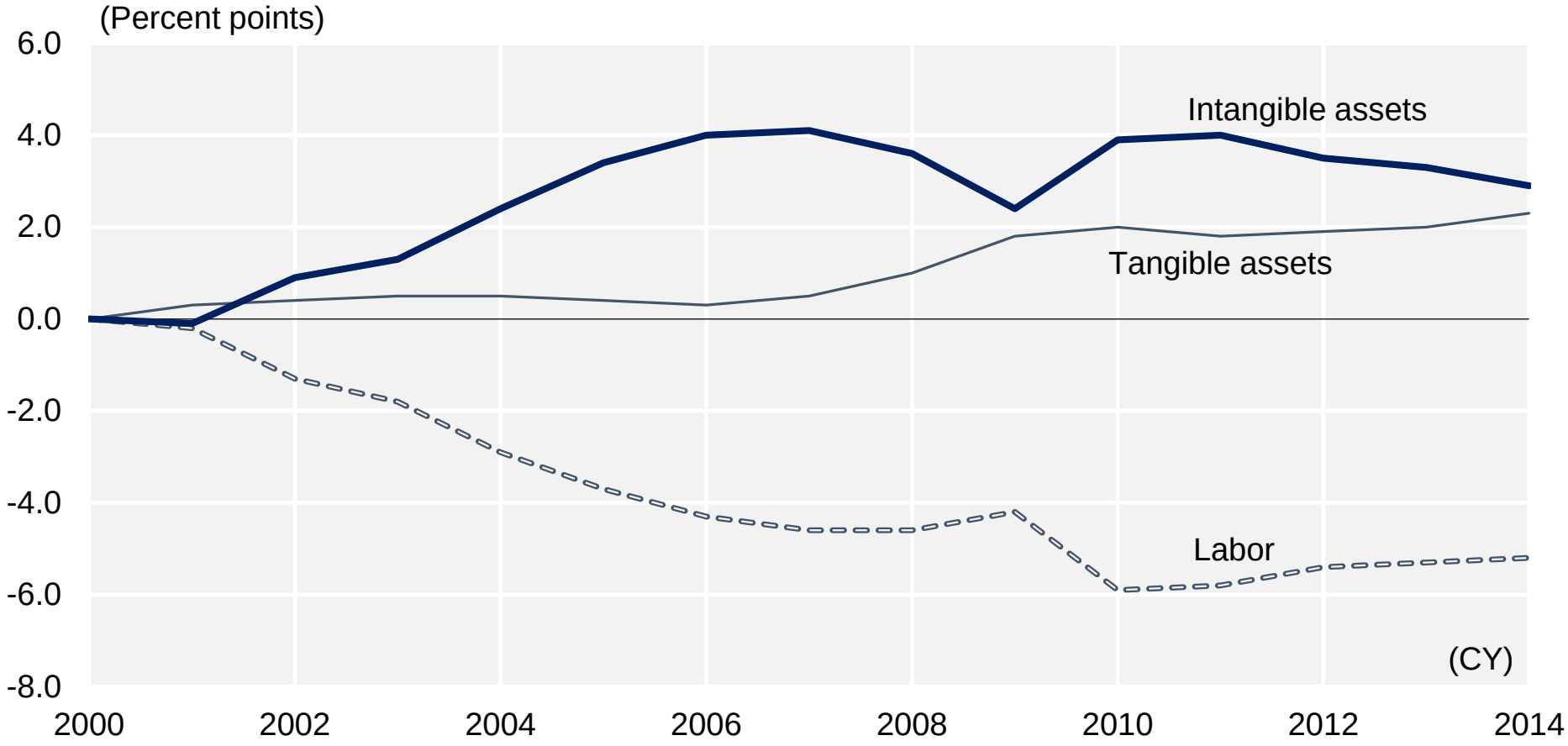
contrast to China (Chart 8).

-The delay in developing the Medical IT of health record system due to the privacy protection works to constrain the efficient use of medical resources in dealing with corona virus (Chart 9).

4. Do you have any view on the non-decreasing labor share of income in Japan?

Chart 6. Labor Income Share

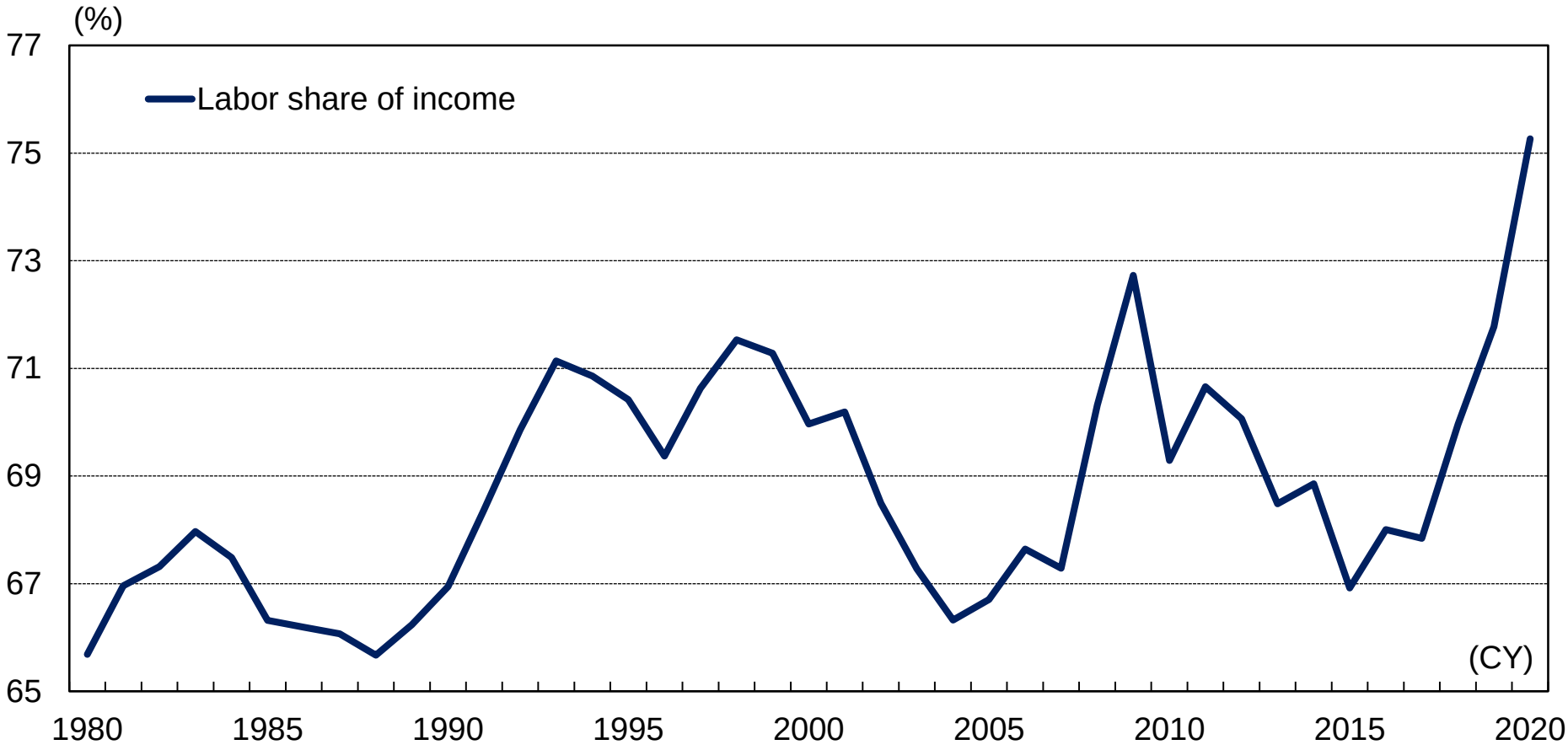
Factor income shares: Intangible assets, tangible assets and labor



Notes: The figure represents cumulative changes in factor income shares in the world production of final goods.

Source: Chen, W., Los, B., and Timmer, M. P., 2018. “Factor incomes in global value chains: The role of intangibles,” NBER Working Paper No. w25242, National Bureau of Economic Research.

Chart 7. Labor share of income in Japan



Notes: Labor share of income = compensation of employees/national income. The values prior to 1993 are calculated retrospectively using the growth rate of the old series in a simplified manner.
Source: Cabinet Office, Ministry of Internal Affairs and Communications

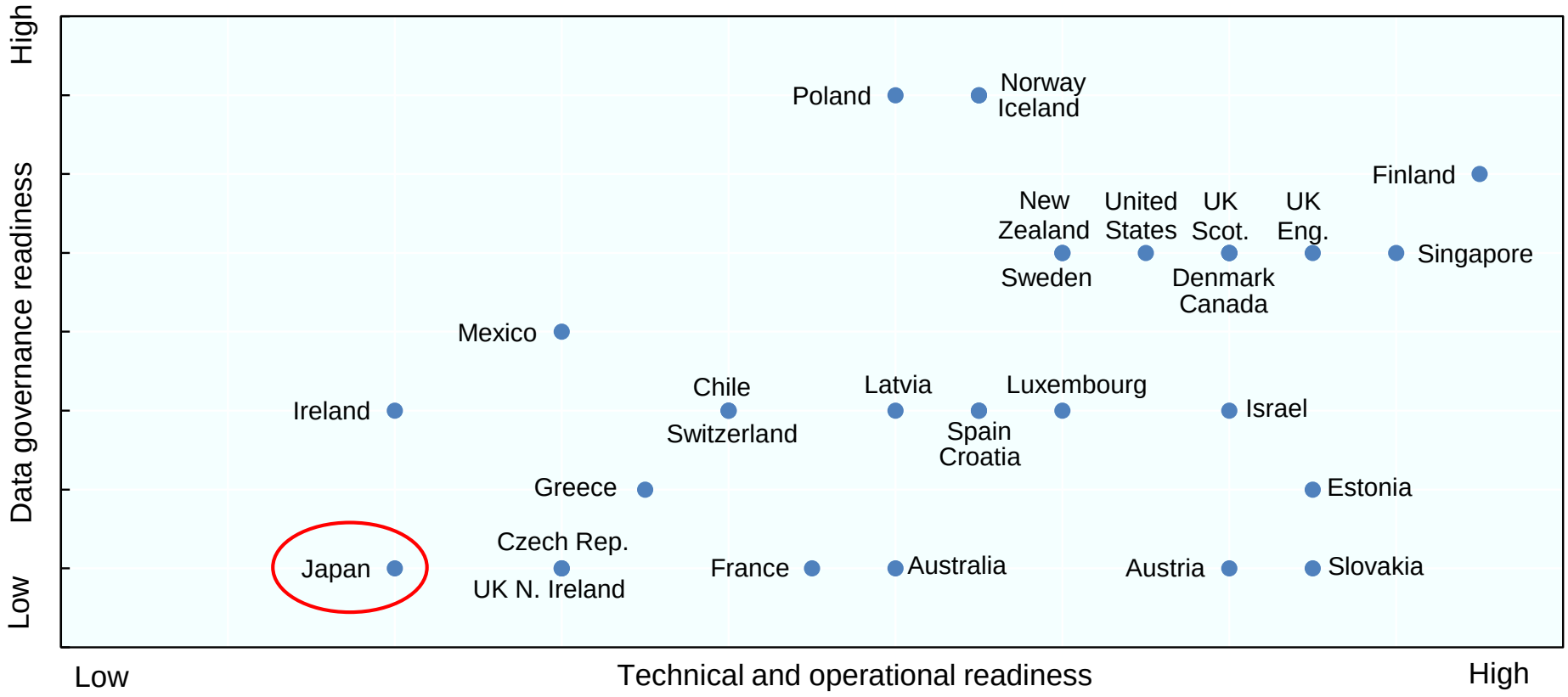
Figure 8. Share of active players in AI by country/industry

(%)

Industry / Country	China	U.S.	France	Germany	Switzerland	Austria	Japan	Total
Consumer	84	41	57	39	65	32	35	50
Energy	86	73	48	50	n.a.	67	38	67
Financial services	86	61	45	34	67	22	42	52
Health care	83	49	51	43	38	33	23	49
Industrial	83	49	43	60	35	44	32	55
Technology, media, telecom	89	65	63	64	43	67	60	71
Total	85	51	49	49	46	42	39	55

Note 1: The survey was conducted from September to October 2018. The survey targeted managers with a basic understanding of AI working in small or large companies. The number of respondents was about 2,700.
Note 2: Active players in AI is defined as those companies making tangible progress in unlocking the value of AI in two dimensions: They are already moving to adopt AI into some existing processes or currently running pilot initiatives, and their efforts thus far have generally been successful.
Source: Boston Consulting Group, “Mind the (AI) Gap: Leadership Makes the Difference”

Chart 9. Medical IT: Technical and Operational Readiness: OECD HCQI survey of electronic health record system development and use



Source: OECD (2016) “HCQI Survey of Electronic Health Record System Development and Use”

Fourth Comment: Policy agenda on global data economy

1. Former Prime Minister Abe announced the principle of “free flow of data with trust” at Osaka G20 meeting.

-I find it important to establish the portability of personal data with privacy protection combined with interoperability of data and networks in fully flourishing the global data economy.

2. On privacy protection the EU has developed the legal framework (GDPR).

-The privacy shield arrangements between the US and EU is judged as violating the privacy protection by the EU court. There are frictions of system difference between the EU based on legal framework and the US based on private contract on the use of data.

- Some US big tech companies decided to leave the EU market due to the higher costs arising from strict regulations.

Fourth Comment: Policy agenda on global data economy

3. EU also moves to establish the data sharing scheme of “GAIA-X” covering twelve industries.

-I find it important to establish the linkage of cyber and physical digital twin with human knowledge production in data economy including the manufacturing sector.

4. On data sharing we observe the movement among Big Tech companies toward establishing the data transfer project.

- I am afraid of excessive market power concentration by big tech firms, due to the monopolization of global data among big tech companies.

Fourth Comment: Policy agenda on global data economy

5. On the other hand we see the rapid development of AI-autocracy in China under the different political regime. -China is likely to introduce the new central bank digital currency (CBDC) coupled with the RMB international payment system(CIPS) and the new digital settlement system among central banks of UAE, Hong Kong and Thailand and the BIS (mCBDC).

6. As a result we will observe the emergence of “three data areas” combined with three digital currencies in the global economy.

7. Do you expect any new arrangements on free flow of data with trust in Asia-Pacific (notably the US-Japan) or the Atlantic region?

Reference

[1] Abis, S. and Veldkamp, L. “The Changing Economics of Knowledge Production,” Working Paper, October 19, 2021.

[2] Arrieta-Ibarra, I., Goff, L., Jiménez-Hernández, D., Lanier, J., and Weyl, E. G. “Should we treat data as labor? moving beyond ”free”,” *AEA Papers and Proceedings*, 108:38-42, 2018.

[3] Gordon, R., Rise and Fall of American Growth, Princeton University Press, 2016.

[4] Iwata, K., Maeda, S., and Takano, T., “Global Imbalance and Demographic Changes,” JCER Discussion Paper, No.149 October 2019.

[5] AI Study Group Report, 2021, Council of AI Network Promotion, Ministry of Internal Affairs and Telecommunications, August 2021.