

Dialogue with Prof. Robert J. GORDON

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Main Message of keynote speech by Prof. Robert Gordon

1. I am honored and pleased to have an occasion to engage in a dialogue with Prof. Robert Gordon.
2. After observing and hearing his excellent speech, I find two main points as below;
 - (1) Limited role of AI and Robots in terms of productivity growth, employment and investment over the future.
 - (2) The fourth industrial revolution is now at its end, not the beginning.

First Comment: when has the fourth IR got started?

1. According to his famous book on the history of US standard of living since the Civil War, Prof. Gordon identified the following three phases of industrial revolutions:

(1)The First IR:1750-:Steam engine

(2)The Second IR:1870-:Electricity

(3)The Third IR:1960-:Information and communication

It is not clear whether he uses the word in the same way as the German government and business circle who started to propagate the fourth IR since 2011.

First Comment: when has the fourth IR got started?

2. The German way of defining the fourth IR is based on the following periodization:

(1)Mechanization: Steam power

(2)Massproduction: Electricity

(3)Computer and Automation

(4)Cyber-Physical Systems: Smart factory

The World Economic Forum integrated the Cyber-Physical Systems with human activity as a whole.

First Comment: when has the fourth IR got started?

3. In Japan we started to talk about the Society 5.0 since the publication of the Basic Plan on the Fifth Science and Technology(2016-2020) as a concept of future society. It is based on the periodization of the past history of human society.

(1)Society 1: Hunting Age

(2)Society 2: Agricultural Age

(3)Society 3: Industrial Age

(4)Society 4: Information Age

(5)Society 5: Human-Centered Cyber-Physical Age

First Comment: when has the fourth IR got started?

4. Prof. Gordon also noted in his book that the period between 1994 and 2004 was marked by temporary upswing of output per hour (2.26%).

-But he argued that it might imply the end of AI revolution, in contrast to the techno-optimist's view. I was wondering whether the AI revolution was the same as the Fourth IR.

-It may be noted that in Japan we have not seen any temporary upswing of productivity in the information revolution because of the "Lost Decades" since the bubble burst in 1990, in contrast to electricity revolution (Figure 6).

Second Comment: Future Growth Prospect

1. Although he did not mention the future growth prospect, I find it to be interesting to make comparison of the US future growth prospect between the estimate by Prof. Gordon's book and the JCER's forecast to 2060 global economy (Figure 1, 2)

-In the JCER forecast, the US will maintain the first ranking in terms of per capita GDP.

-Yet, China will exceed the size of real GDP of US in the early-2030s. Corona crisis will frontload the timing to the end-2020s.

Second Comment: Future Growth Prospect

2. Figure 4 presents the difference of labor productivity growth between the estimate by Prof. Gordon and that calculated by Iwata-Maeda-Takano (2019) employing the labor augmenting technological progress (Figure 3, 5).

-The output per person in the US from 2015 to 2040 will grow at 0.8% in Prof. Gordon's estimate, while that of Iwata-Maeda-Takano will increase by 1.2%, marginally larger by the size of decline of labor hours (negative 0.4%).

3. Prof. Gordon took the average growth rate of those of 1974-1994 (1.54%) and 2004-2015 (1%), thereby taking into account the diminishing role of education (negative 0.3%).

Second Comment: Future Growth Prospect

4. In the JCER estimate we put emphasis on the role of intangible assets such as R&D, Data and AI, focusing on the non-rivalry and spillover effects to other sectors.

-Data accumulation coupled with AI and IoT may enhance our knowledge and ideas which may directly contribute to the increase of total factor productivity in addition to accumulation of intangible assets(Jones). Moreover the data accumulation will help to choose the best-fit technology in the manager's decision making (Veldkamp).

Third Comment: Future Obstacles to Growth

1. Prof. Gordon indicated the adverse effect of AI application on widening inequality.

-We have observed the declining tendency of labor income share and diminishing share of middle-skill workers of the GAFA economy since 2000's.

-Prof. Gordon mentioned in his book the four headwind problems such as:

(1)increasing inequality

(2)education

(3)demography

(4)debt

Third Comment: Future Obstacles to Growth

2. They are common problems to Japan, to be worse in (3) and (4).

-We may add health problem in the US (=shortening life expectancy of white people) and racial/social injustice.

-The latter may erode the American democracy and deepen the divide between the state and the society as pointed out by Acemoglu and Posner.

Fourth Comment: How to Cope with the Rise of China

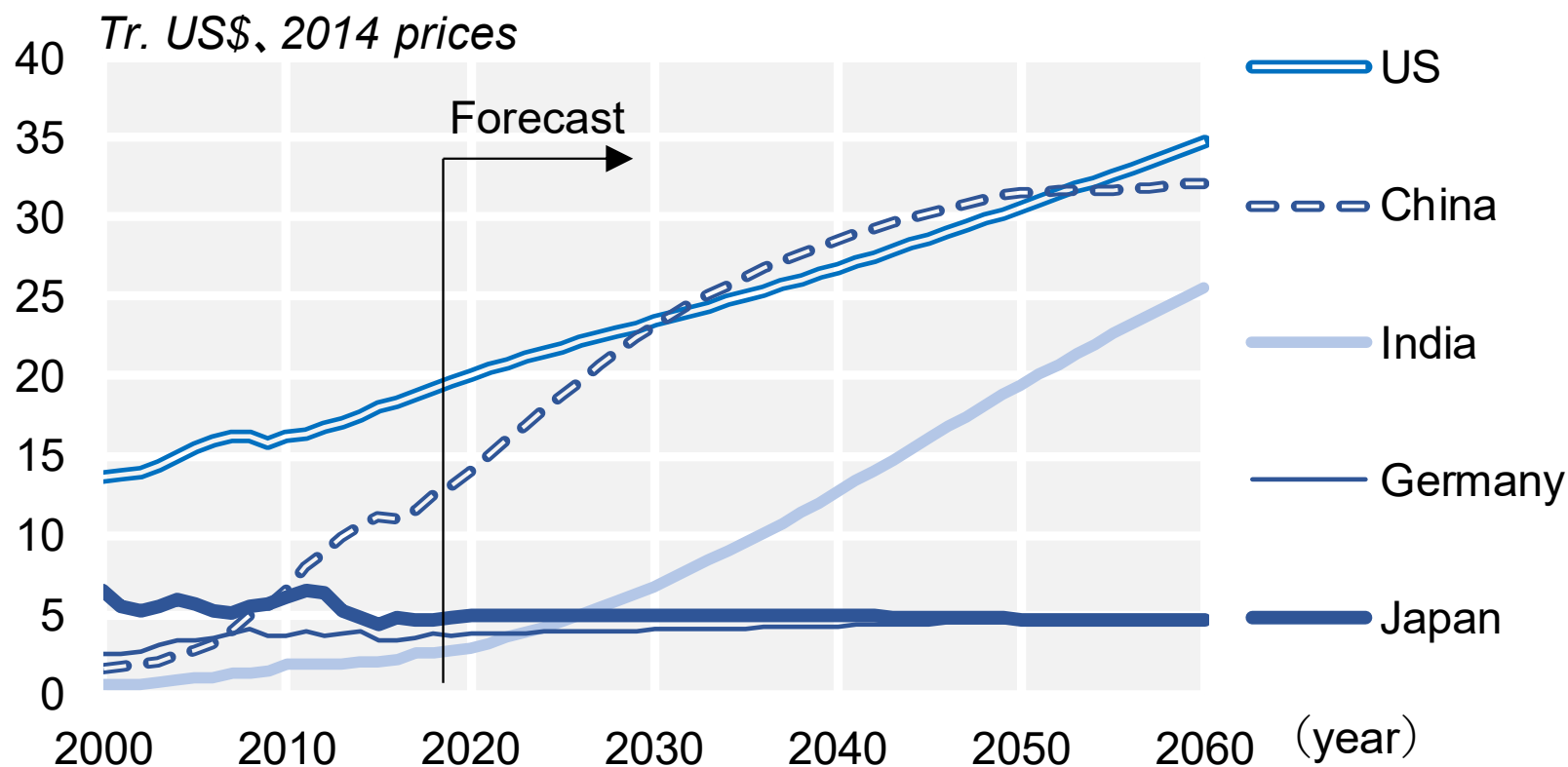
1. China has advanced rapidly the AI technology in recent ten years and caught up with the US, notably with respect to “perception AI”(Figure7).

2. China is strong in AI applications and the establishment of AI-venture eco-system. Business AI application is now the top class in the world economy(Figure 8).

3. China develops not only the technologies of autonomous vehicles but also the autonomous weapons.

- This will increase the risk of “hyper-war” when China recognizes the equivalent economic and military power with the US.

Figure 1. Economic Growth Prospects of Leading Countries



Source: Japan Center for Economic Research, Long-term Forecast, December 2019
 Note: Five countries are displayed from 65 countries estimated in the forecast.

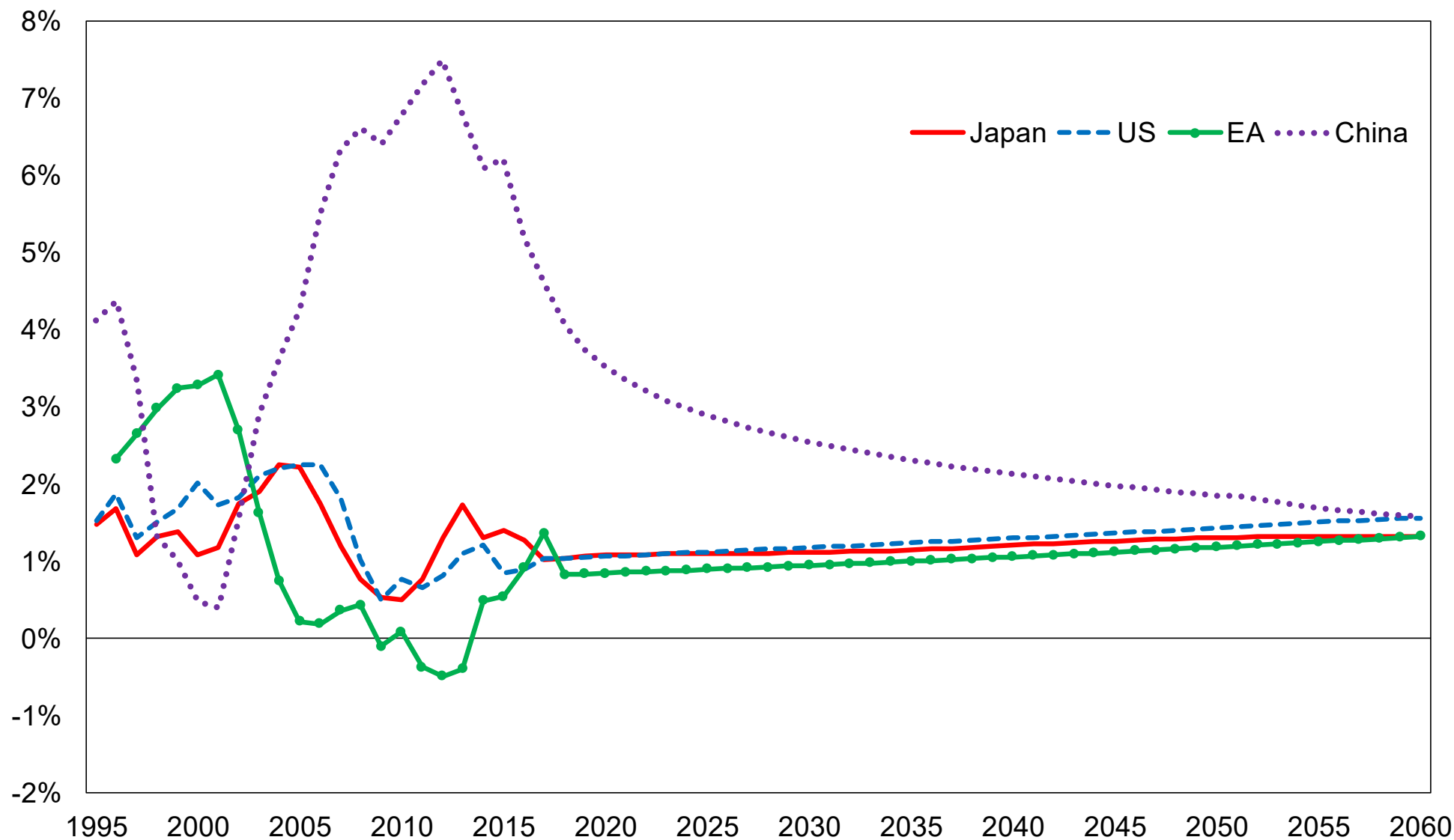
Figure 2. The World Top Countries in GDP

(US\$ trillion, 2014 prices)

	1990		2018		2060	
1	U.S.	9.7	U.S.	19.2	U.S.	34.7
2	Japan	5.1	China	12.6	China	32.2
3	Germany	2.6	Japan	4.7	India	25.5
4	France	2.1	Germany	3.8	Germany	4.9
5	U.K.	1.9	U.K.	2.7	Japan	4.6
6	Italy	1.9	France	2.6	U.K.	3.9
7	Canada	1.0	India	2.6	Indonesia	3.9
8	Iran	0.9	Italy	1.9	France	3.6
9	Spain	0.9	Brazil	1.8	Canada	3.1
10	Brazil	0.7	Canada	1.6	Australia	2.8
11	China	0.6	Russia	1.5	Mexico	2.5
12	India	0.5	Korea	1.5	Nigeria	2.3
13	Australia	0.5	Spain	1.3	Brazil	2.3
14	Netherlands	0.5	Australia	1.3	Russia	2.1
15	Mexico	0.5	Mexico	1.1	Philippines	1.8
16	Korea	0.5	Indonesia	1.0	Korea	1.8
17	Switzerland	0.4	Netherlands	0.9	Turkey	1.7
18	Sweden	0.4	Saudi Arabia	0.7	Italy	1.6
19	Turkey	0.3	Turkey	0.7	Egypt	1.6
20	Belgium	0.3	Switzerland	0.7	Spain	1.5

Source: Japan Center for Economic Research, Long-term Forecast, December 2019.

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



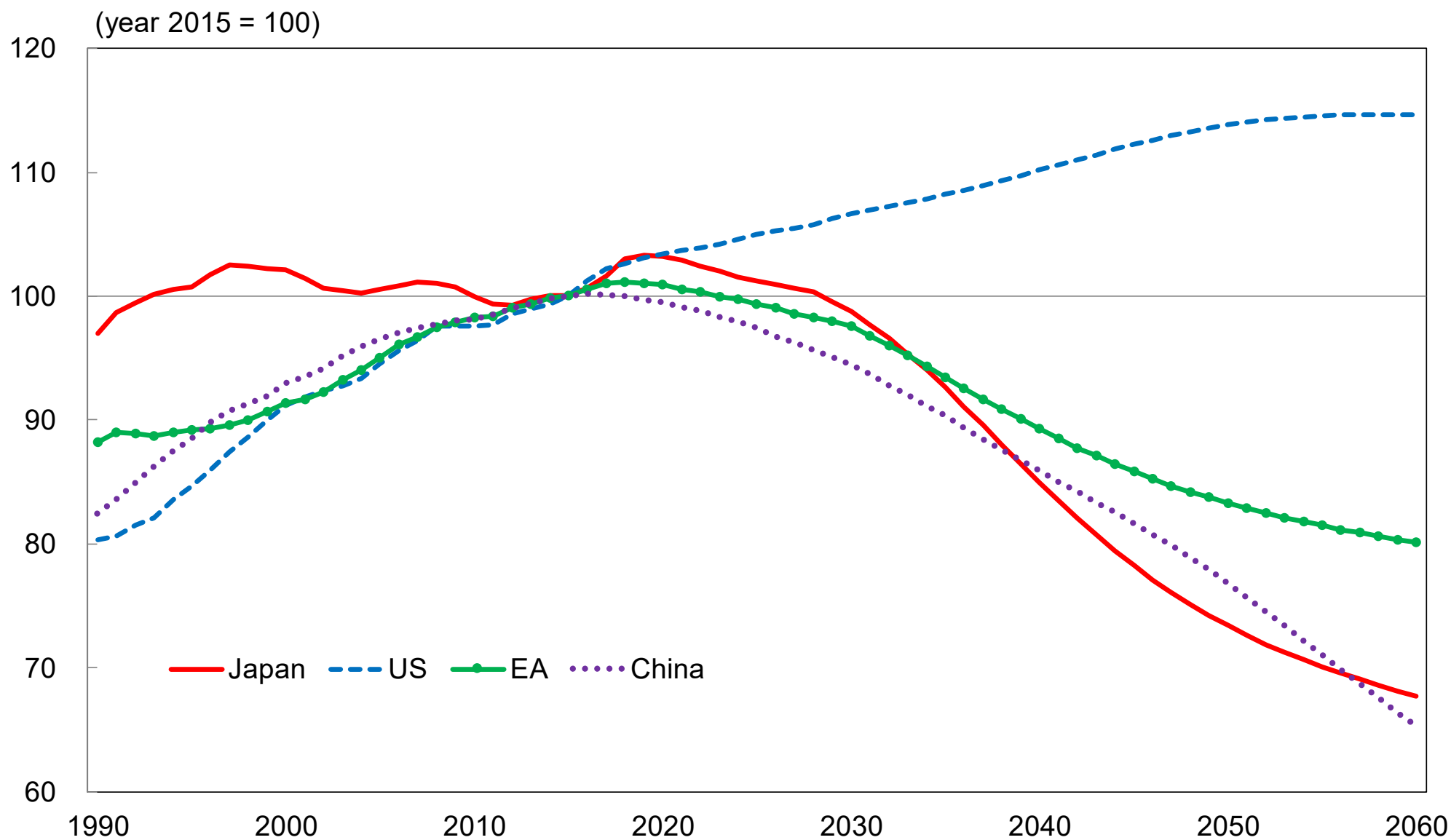
Source: Iwata, Maeda, and Takano (2019), "Global Imbalances and Demographic Changes"

Figure 4. Difference of Future Labor Productivity Growth between Prof. Gordon and Iwata, Maeda, and Takano

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

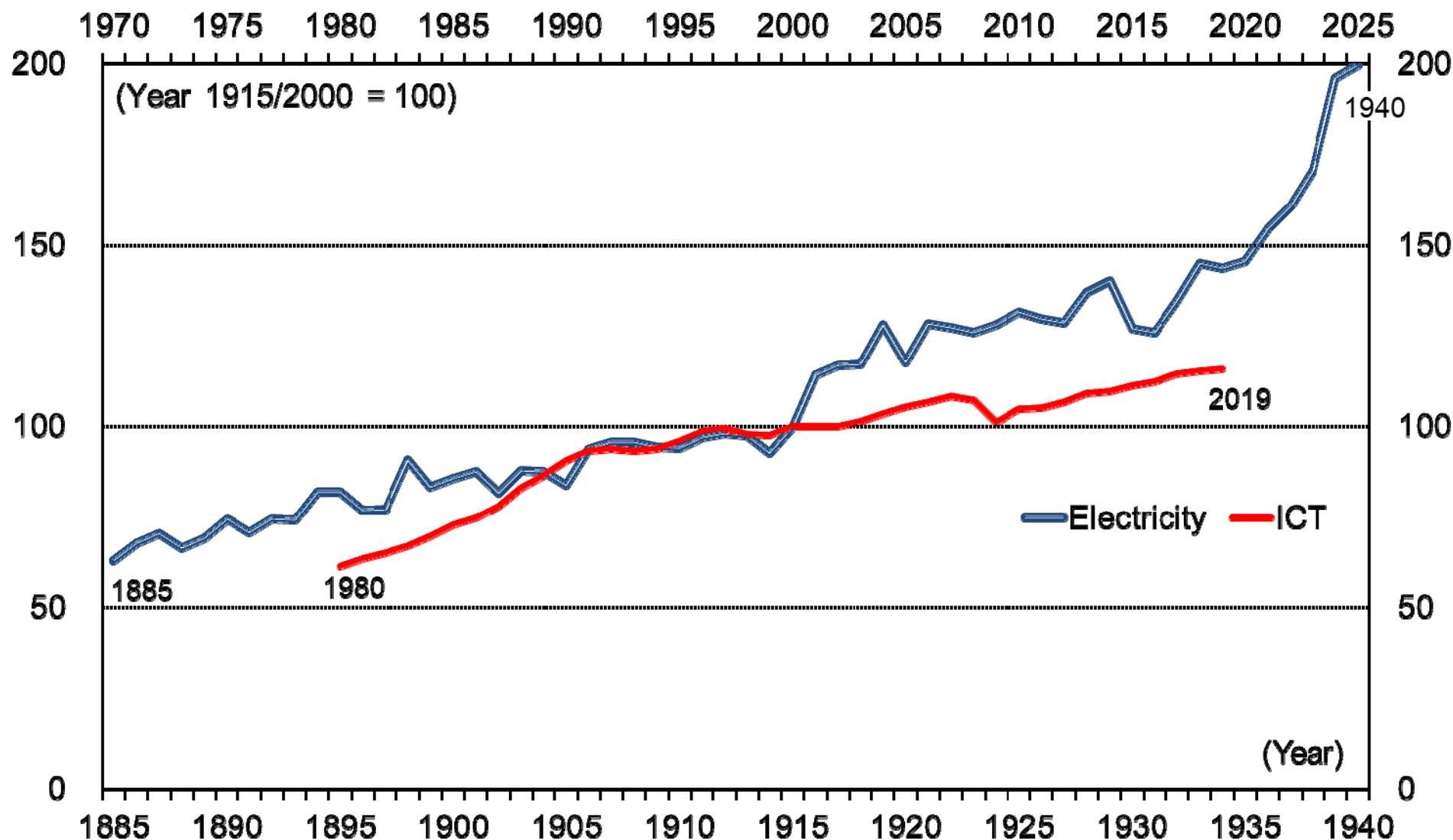
Source: Gordon (2016), Iwata, Maeda, and Takano (2019), "Global Imbalances and Demographic Changes"

Figure 5. Labor Force in Japan, US, EA, and China



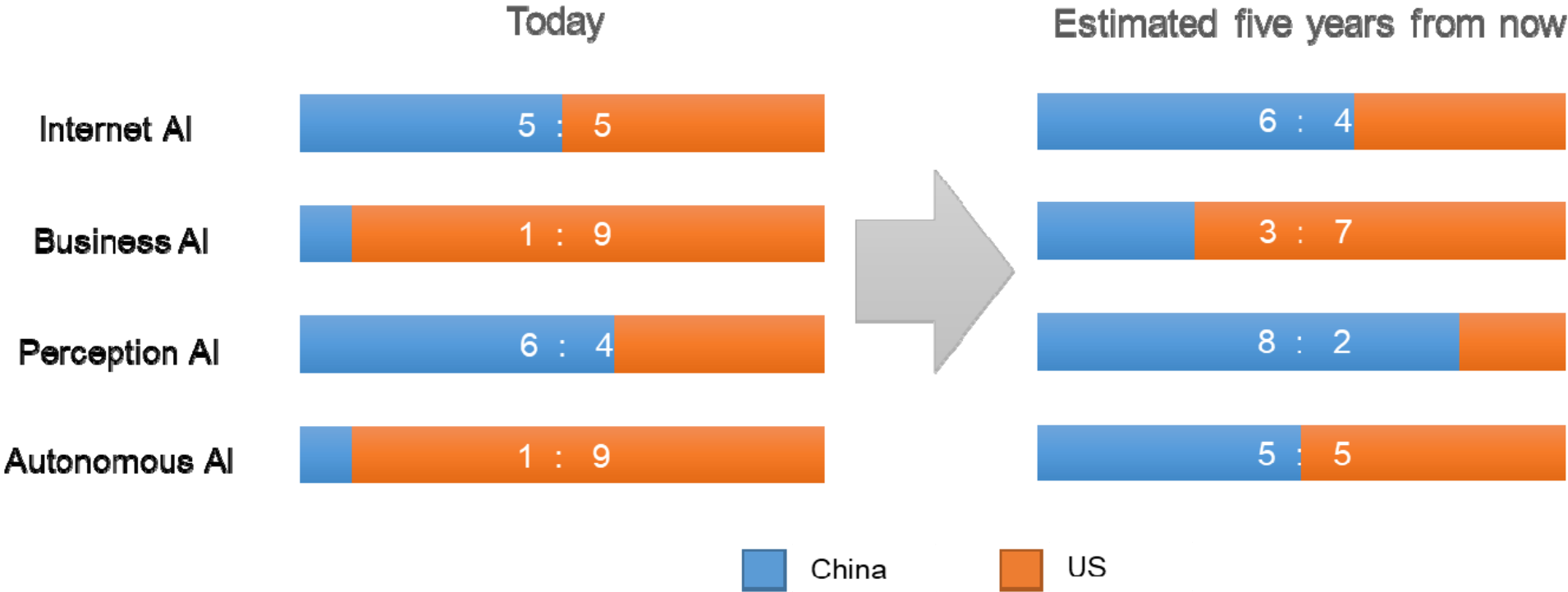
Source: Iwata, Maeda, and Takano (2019), "Global Imbalances and Demographic Changes"

Figure 6. Per-capita GDP for Two Periods When Electricity and ICT Become Widespread



Source: “Long-term Economic Statistics” edited by Kazushi Okawa for 1885-1940. Cabinet Office, “Annual Report on National Accounts” for 1980-2019.

Figure 7. The Balance of Capabilities between US and China across AI



(Source) Kai-Fu Lee, AI Superpowers: China, Silicon Valley, and the New World Order, Houghton Mifflin Harcourt, 2018

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"