PROGRAM ON U.S.-JAPAN RELATIONS
Weatherhead Center FOR INTERNATIONAL AFFAIRS
HARVARD UNIVERSITY

HARVARD UNIVERSITY

JAPAN AND EMERGING TECHNOLOGIES: WHY AND HOW IS JAPAN RESPONDING TO ARTIFICIAL INTELLIGENCE?

Aki Nakai

Harvard Program on U.S.-Japan Relations
Occasional Paper Series
22-NA

https://programs.wcfia.harvard.edu/us-japan/research

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

Introduction

From the time of the Meiji Restoration of 1868, as Japan experienced many domestic and international challenges, it decidedly changed its external behaviors through internal developments of redefining concepts such as power, interests, norms and updating domestic institutions. These adaptations sometimes have resulted in success, and sometimes have not. Japan is now facing various domestic and international policy crises which include growing public debt, a super-aging society along with a decreasing population, the U.S.-China competition, and emerging technologies to name a few. How is Japan addressing these internal and external challenges? Is Japan persisting as a key regional power? This study focuses on Japan and emerging technologies, and explore the question of why and how Japan is responding to artificial intelligence, in particular?

This research possesses both policy and academic significance. First, in Japan the domain of technology is regarded as a significant source of national wealth and autonomy, and since the establishment of the Science and Technology Agency in 1956, technology policy has been a major part of public policy areas. An intense interest in technological research, acquisition and adaptation contributed to the postwar Japanese economic miracle, which to a great extent has encouraged scholars and policy experts to study the Japanese political economy.[1] Japan was the crucial case used in order to test general theories and became a key subject of academic and policy debates. Therefore, it is fair to say that Japan's "Two Lost Decades" has raised the question of whether Japan will still matter. We now live in a digital world, and this fact means

[1] For example, Chalmers Johnson, *MITI and the Japanese Miracle: The Growth of Industrial Policy, 1925-1975* (Stanford, CA: Stanford University Press, 1982); Edward J. Lincoln, *Japan's Industrial Policies: What Are They, Do They Matter and Are They Different from Those in the United States?* (Washington, D.C.: Japan Economic Institute of America, 1984); Daniel I. Okimoto, *Between MITI and the Market: Japanese Industrial Policy for High Technology* (Stanford, CA: Stanford University Press, 1989); Kent E. Calder, "Japanese Foreign Economic Policy Formation: Explaining the Reactive State." *World Politics* 40, 4 (1988): 517-541.; Gerald L. Curtis, *The Japanese Way of Politics* (New York, NY: Columbia University Press, 1988)

that emerging technologies such as artificial intelligence, big data analytics, and robotics have significant consequences for a nation's wealth and security. Does the Japanese government of today possess the unrelenting interest in emerging technologies such as artificial intelligence, as it previously did for various advanced technologies during Japan's postwar industrial and economic development? Is Japan catching up with top runners such as the United States and China in the field of artificial intelligence, as it did during the postwar economic miracle? What factors are motivating the Japanese approach to artificial intelligence? What is the logic of Japanese policy toward artificial intelligence?

Second, prominent leaders on both sides of the Pacific have often suggested and pointed out that artificial intelligence should be a major field for U.S.-Japan collaboration. For example, at the U.S.-Japan summit in April 2021, the two countries collectively stated that they recognized that "digital economy and emerging technologies have the potential to transform societies and bring about tremendous economic opportunities" and committed that the U.S. and Japan will collaborate to enhance their "competitiveness, individually and together, by deepening cooperation in research and technology development in life sciences and biotechnology, artificial intelligence, quantum information sciences, and civil space."[2] Five months later, the U.S., Japan, Australia, and India held the very first in-person summit in Washington, D.C., and the Quad leaders jointly emphasized their "cooperation on critical and emerging technologies."[3] Is the current Japanese policy toward artificial intelligence designed to strengthen the U.S.-Japan

[2] White House, *U.S.- Japan Joint Leaders' Statement: "U.S. – JAPAN GLOBAL PARTNERSHIP FOR A NEW ERA"* (April 16, 2021): https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/16/u-s-japan-joint-leaders-statement-u-s-japan-global-partnership-for-a-new-era/

[3] White House, *Joint Statement from Quad Leaders* (September 24, 2021): https://www.whitehouse.gov/briefing-room/statements-releases/2021/09/24/joint-statement-from-quad-leaders/

alliance and the Quad or merely focus on its own economic gains? This study will explore these questions and provide academic and policy implications.

Literature Review

Why and how is Japan responding to artificial intelligence? Is there a theoretical logic behind Japanese policies toward artificial intelligence? There are two major pieces of political science literature: (1) developmental state, and (2) electoral politics which provide two competing explanations for Japanese government policy-making.[4]

First, some scholars assume that in general, governments make policies in order to seek the economic welfare of an entire nation and to improve the position of their own domestic industries in competition with foreign competitors. In the literature of Japan's developmental state model, it has been considered that the primary agent in the making of government policies has been identified as the state bureaucracy, especially the Ministry of International Trade and Industry (MITI) and the Ministry of Finance (MOF), not Diet members in the long-term ruling Liberal Democratic Party (LDP).[5] If this conventional wisdom in the developmental state model literature still holds true, it can be expected that Japanese government policies toward artificial intelligence are determined by economic considerations (e.g., high economic growth) for the most part.

Second, other political economists disagree however with the above assumption, and contrastingly argue that all actors in policy-making will seek their narrow self-interest, and politicians in democracies will be motivated to influence government policies out of an electoral

[4] Saadia M. Pekkanen, *Picking Winners? From Technology Catch-Up to the Space Race in Japan* (Stanford, CA: Stanford University Press, 2003)
[5] Chalmers Johnson, *Japan: Who Governs? The Rise of the Developmental State* (New York, NY: W.W. Norton, 1995)

political interest in self-preservation.[6] If this insight in the literature of electoral politics is true, we can expect that Japanese government policies toward artificial intelligence are determined by political considerations (e.g., size of voters) more often than not.

Hypotheses

Dependent Variable

Based on the two competing explanations for Japanese government policy-making, this study operationalizes specific factors as the dependent and independent variables and generates two rival hypotheses. The dependent variable is Japanese government policies toward artificial intelligence which is measured by an AI-related budget figure by ministry/agency at year *y*. Upon Prime Minister Shinzo Abe's direction in April 2016, the Japanese government established the Artificial Intelligence Technology Strategy Council (AITSC) in coordination with the Ministry of Internal Affairs and Communications (MIC), the Ministry of Education, Culture, Sports, Science and Technology (MEXT), and the Ministry of Economy, Trade and Industry (METI), and in March 2017 the AITSC issued the Artificial Intelligence Technology Strategy.[7]

In March 2018, the Cabinet Office which is in charge of collecting information regarding each ministry's science and technology-related budget, reported that the AI-related budget (including supplementary budgets) decreased from 77.2 billion yen in 2016 to 72.2 billion yen in 2017, and the regular 2018 AI-related budget would bounce back to the 2016 level (77.0 billion

[6] Jagdish N. Bhagwati, "Lobbying and Welfare." *Journal of Public Economics* (December 1980): 355-363.
[7] Artificial Intelligence Technology Strategy Council, Cabinet Office website: https://www8.cao.go.jp/cstp/tyousakai/jinkochino/index.html; *Artificial Intelligence Technology Strategy* (March 2017): https://www.ai-japan.go.jp/menu/learn/ai-strategy-1/Artificial%20Intelligence%20Technology%20Strategy%28March%2C2017%29.pdf

yen in 2018).[8] These figures were cited by the media and researchers,[9] but the official AI-related budget, by ministry, for the subsequent years are not available.

Japan's AI-related policy includes research and development (R&D), school education reform, development of data infrastructure, social implementation, digital transformation of government, and support for small, medium-sized, and venture companies.[10] Therefore, this study used two public open documents: (1) Progress Report of the AI Strategy 2021 (Cabinet Office);[11] and (2) Science and Technology-related Budget Assessment Results (Cabinet Office).[12] The former listed the AI-related policy items by ministry without the budget figures, and the latter includes the science and technology-related budget figures (including AI). For example, the Progress Report of the AI Strategy 2021 described that a major policy in the area of school education reform is the MEXT's Global and Innovation Gateway for All (GIGA) school initiative. The GIGA school initiative aims to provide a computer with a high speed network to all students in primary, junior high, and high schools.[13] This study checked the Science and Technology-related Budget Assessment Results, then identified 231.8 billion yen in the 2019 supplementary budget and 229.2 billion yen in the 2020 supplementary budget respectively for

[8] Artificial Intelligence Technology Strategy Council Meeting (March 23, 2018), Cabinet Office website: https://www8.cao.go.jp/cstp/tyousakai/jinkochino/6kai/siryo1.pdf

[9] For example, "Japan's budget for AI to be less than a fifth of that planned by U.S. and China," *The Japan Times*, February 25, 2018: https://www.japantimes.co.jp/news/2018/02/25/business/tech/japanese-government-spending-ai-less-20-u-s-china/; Policy Research Blog (October 28, 2020): https://ameblo.jp/seisakuresearch/entry-12634408732.html

[10] *AI Strategy 2019* (June 11, 2019), Cabinet Office website: https://www8.cao.go.jp/cstp/ai/aistratagy2019en.pdf

[11] *Progress Report of the AI Strategy 2021*, Cabinet Office website: https://www8.cao.go.jp/cstp/ai/aistrategy2021_bessi.pdf

[12] *Summary of the Science and Technology-related Government Budget Proposal in the Fiscal Year*, Cabinet Office website: https://www8.cao.go.jp/cstp/budget/index2.html

[13] *Implementation Plan for Education for Sustainable Development in Japan* (December 8, 2021), Ministry of Education, Culture, Sports, Science and Technology (MEXT) website: https://www.mext.go.jp/en/content/20211208-mxt_koktou01-1373244_1.pdf

the GIGA school initiative.[14] This research collected the AI-related budget items and figures by ministry through the examination of the above two documents.

Table 1 shows the AI-related budget (including supplementary budgets) by ministry in 2016-2021. The Japanese government spent the total 1.3 trillion yen (approximately $11.27 billion) in the last six fiscal years for the AI-related policy.[15] In March 2018, the Japanese media reported that Japan's AI-related budget (¥77.04 billion ($720 million)) for the fiscal 2018 year (initial budget) would be a fifth of that planned by the U.S. (¥500 billion) and China (¥450 billion),[16] but Table 1 demonstrated that the Japanese government allocated greater financial sources to the AI-related policy items in the supplementary budget in 2018, and the level of Japan's AI-related budgets in 2019 (¥388.6 billion) and 2020 (¥515.0 billion) reached close to the level of the U.S. and China's budget for 2018.

Independent Variables

For the independent variables, there are two categories of variables, one, developmental state model related and the other, electoral politics related. In addition, each Japanese industry is broadly categorized under the specific ministerial jurisdiction. In order to examine possible correlations with the dependent variable, for the category of developmental state, this study focuses on indicators such as the economic growth rate by industry, the monthly payroll by industry, the production inducement coefficient for each industry, and the number of the term of

[14] *Science and Technology-related Budget Assessment Results for the Supplementary Budget of FY 2019*, Cabinet Office: https://www8.cao.go.jp/cstp/budget/r2hoseizogen.pdf; *Science and Technology-related Budget Assessment Results for the First Supplementary Budget of FY 2020*, Cabinet Office: https://www8.cao.go.jp/cstp/budget/r2dai1ji_hosei_hantei.pdf

[15] The following exchange rate was used: US$ 1 = JPY 115.41.

[16] "Japan's budget for AI to be less than a fifth of that planned by U.S. and China," *The Japan Times*, February 25, 2018: https://www.japantimes.co.jp/news/2018/02/25/business/tech/japanese-government-spending-ai-less-20-u-s-china/

artificial intelligence (AI) in the documents formulated by the Council on Economic and Fiscal Policy.

First, the data of economic growth rate by industry was referred from the Gross Domestic Product (GDP) by Economic Activity (Real), the Annual Reports on National Accounts (Cabinet Office).[17] This data follows the categorization of economic activities based on the United Nations System of National Accounts,[18] therefore this study used the same categories and assigned each ministry to specific economic activities under the ministerial jurisdiction as follows:

If the assumption of developmental state model literature is correct, governments, in general, make policies in order to seek the economic welfare of an entire nation and to improve the position of their own domestic industries in competition with foreign competitors. When one economic activity experiences a relatively higher economic growth rate, the Japanese government is more likely to allocate financial resources to such an industry by budgeting the AI-related policy items.

H1: The higher the economic growth rate, the more favorable the AI-related budget

For the second indicator of monthly payroll by industry, this study collected the data of monthly cash earnings from the Monthly Labor Survey (Ministry of Health, Labor and

[17] Gross Domestic Product (GDP) by Economic Activity (Real), *the Annual Reports on National Accounts*, Cabinet Office website: https://www.esri.cao.go.jp/jp/sna/data/data_list/kakuhou/files/2020/tables/2020fcm3rn_jp.xlsx
[18] *Annual Reports on National Accounts Manual*, Cabinet Office website: https://www.esri.cao.go.jp/jp/sna/data/data_list/kakuhou/files/2020/sankou/pdf/usage.pdf; *Categorization of Economic Activities*, Cabinet Office website: https://www.esri.cao.go.jp/jp/sna/data/data_list/kakuhou/files/2020/sankou/pdf/katudo_bunrui.pdf

Welfare),[19] the National Civil Servants Payroll Survey (National Personnel Authority),[20] and the Firm Management Survey (Ministry of Agriculture, Forestry and Fisheries).[21] If the assumption of developmental state model literature is held and one economic activity enjoys relatively higher cash earnings than the others, the Japanese government is more likely to allocate financial resources to such an industry by budgeting the AI-related policy items.

H2: The higher the payroll level, the more favorable the AI-related budget

For the third variable of developmental state model, the data of production inducement coefficient was collected from the Input Output Table (Cabinet Office).[22] The production inducement coefficient is a measurement of interdependence among economic activities, and represents the economic impact of production from one economic activity to that of other economic activities. If governments, in general, make policies in order to seek the economic welfare of an entire nation, the Japanese government is more likely to allocate financial resources to an economic activity with a relatively higher production inducement coefficient.

H3: The higher the production inducement coefficient, the more favorable the AI-related budget

[19] *Monthly Labor Survey*, Ministry of Health, Labor and Welfare website: https://www.mhlw.go.jp/toukei/list/30-1.html;
[20] *National Civil Servants Payroll Survey*, National Personnel Authority website: https://www.jinji.go.jp/kankoku/kokkou/02kokkou.html
[21] *Farm Management Survey*, Ministry of Agriculture, Forestry and Fisheries website: https://www.maff.go.jp/j/tokei/kouhyou/noukei/einou/index.html
[22] *Input Output Table*, Cabinet Office website: https://www.esri.cao.go.jp/jp/sna/data/data_list/sangyou/files/files_sangyou.html

For the last and fourth indicator of developmental state model, this study used a document of the Basic Policies for Economic and Fiscal Management and Reform (Council on Economic and Fiscal Policy, Cabinet Office).[23] The Council on Economic and Fiscal Policy (CEFP) was established in 2001, and is chaired by the Prime Minister. The CEFP plays a role in examining and ensuring consistency among important economic policies in response to inquiries from the Prime Minister and/or responsible ministers, and issues the Basic Policies for Economic and Fiscal Management and Reform ("*Honebuto no houshin*") in the initial stage of the budget making process.[24] If the Prime Minister and responsible ministers in the CEFP make policies in order to seek the economic welfare of an entire nation, the Basic Policies are more likely to mention the terms such as artificial intelligence, AI, and *Jinkou Chinou* (人工知能), and the Japanese government would then allocate greater financial resources to the AI-related budgets in general.

H4: The more frequently AI is mentioned in the Basic Policies (Honebuto no houshin), the more favorable the AI-related budget

For the electoral politics category, this research operationalizes the numbers of voters by industry, the numbers of interest groups' members by industry, the numbers of re-recruitment of former bureaucrats by industry and interest groups, and the existence of elections for both Houses of Representatives and Councilors.

[23] For example, *Basic Policy on Economic and Fiscal Management and Reform 2019: A New Era of Reiwa: Challenges toward Society 5.0* (June 21, 2019), Council on Economic and Fiscal Policy, Cabinet Office website: https://www5.cao.go.jp/keizai-shimon/kaigi/cabinet/2019/2019_basicpolicies_ja.pdf

[24] Gene Park, "The Politics of Budgeting in Japan: How Much Do Institutions Matter?," *Asian Survey*, Vol. 55, No. 5 (2010), pp. 965-989.

For the first variable of voters, this study has used the numbers of employees by industry as a proxy of voters, which is provided as a part of the Annual Reports on National Accounts (Cabinet Office).[25] If the literature of electoral politics is true, then Japanese politicians, in general, are more likely to focus on self-preservation, and Japanese government policies toward artificial intelligence are determined by political considerations (i.e., the size of voters) more often than not.

H5: The higher the number of potential votes, the more favorable the AI-related budget

The second indicator is the number of members of interest groups (*Rieki Dantai*), and this study used the data from the Public-Service Corporation Survey (Cabinet Office).[26] The jurisdiction of public-service corporations (*Koueki hojin*) belonged to specific ministries and agencies prior to 2008, and presently, the Prime Minister or Prefectural Governors are in charge of these public-service corporations. The Survey covers major interest groups such as the Japan Medical Association, and includes information of previous ministerial jurisdiction. Therefore, this research collected data of the number of members of public-service corporations as a proxy of interest groups. If the literature of electoral politics is true, then Japanese politicians are more likely to allocate an AI-related budget to the policy area where a relatively greater number of interest groups' members exist.

H6: The higher the number of interest groups (reiki dantai)' members, the more favorable the AI-related budget

[25] *The Numbers of Employees, Employers, and Working Hours by Economic Activity*, Cabinet Office website: https://www.esri.cao.go.jp/jp/sna/data/data_list/kakuhou/files/2020/tables/2020s3_jp.xlsx
[26] *Public-Service Cooperation Survey*, Cabinet Office: https://www.koeki-info.go.jp/outline/koueki_toukei_n4.html

For the third variable, this study used the Reports on the Re-Recruitment of Retired National Civil Servants (Cabinet Bureau of Personnel Affairs),[27] and collected the data of the number of re-recruitments of former bureaucrats, after retirement. When senior Japanese bureaucrats retire and are re-recruited to high-profile positions in the private and public sectors, the institutionalized practice is called *Amakudari* ("descent from heaven"). The *Amakudari* practice has provided an informal means of influence to the specific industries which have provided high-profile positions to former bureaucrats, but a reform to phase out *Amakudari* has been implemented since 2007. If a greater number of re-recruitments of former bureaucrats is approved by specific industries, then the AI-related budget is more likely to be allocated to these industries, to greater extent.

H7: The higher the number of re-recruitment of retired bureaucrats, the more favorable the AI-related budget

Lastly, this study also checked the existence of national elections of both the Houses of Representatives and Councilors during the years of 2016 to 2021. The elections of the House of Representatives were held in October 2017 and October 2021, and those of the House of Councilors were in July 2017 and July 2019. When politicians face and plan an election, they are more likely to use financial sources for the campaign. If this is the case, the AI-related budget, in general, would increase.

H8: When a national election is held, the AI-related budget is more likely to increase.

[27] *Reports on the Re-Recruitment of Retired National Civil Servants*, Cabinet Bureau of Personnel Affairs website: https://www.cas.go.jp/jp/gaiyou/jimu/jinjikyoku/nendokouhyo.html

Methodology

The format of data is a panel data (total number of observations: 84; 14 ministries in the six-year time period, 2016-2021),[28] and the test of multicollinearity did not identify that there is near-extreme multicollinearity (i.e., a highly, not perfect though, correlated relations) among the independent variables.[29] This study also tested the heteroskedasticity (Breusch-Pagan/Cook-Weisberg test), and identified the existence of heteroskedasticity,[30] which will report biased standard errors. In order to address this issue, this research uses robust standard errors that are available as an option in STATA.

After the data management phase, this study assessed which form of panel data analysis is most appropriate as per the requirement, fixed effect (FE) model, random effect (RE) model, or an ordinary least square (OLS) model. First, the Hausman test was conducted in order to determine which form of panel data analysis is more appropriate, FE model or RE model. If the p-value is significant at 5 percent, then the test has to reject the null hypothesis and accept the alternative hypothesis (i.e., the FE model is more appropriate). The Hausman test for this panel data showed as the p-value (0.2718), which means that the test failed to reject the null hypothesis (i.e., the RE model is more appropriate).[31] Second and last, the Breusch–Pagan Lagrange multiplier test for the RE model was conducted in order to determine which form of panel data analysis is most appropriate, a RE model, or an OLS model. The test failed to reject the null and

[28] See Appendix 1.
[29] See Appendix 2. If the VIF index is larger than 2.50, the index indicates an existence of near-extreme multicollinearity among independent variables. The VIF index for this panel data was: 1.19. For the multicollinearity diagnosis, see Paul David Allison, *Multiple Regression: A Primer* (Thousand Oaks, CA: Pine Forge Press, 1999): 141-142.
[30] See Appendix 3. If the probability value of the chi-square statistic is less than 0.05, the null hypothesis of constant variance can be rejected at 5% level of significance. It implies the presence of heteroscedasticity in the residuals. The probability value of the chi-square statistic was: 0.0000.
[31] See Appendix 4.

concludes that random effects is not appropriate.[32] This shows, no evidence of significant differences across ministries (i.e., no panel effect), therefore this study decided to run a simple OLS regression.

In sum, the statistical model of this study is as follows:

> Variable Y (*AI-related budget by ministry at year y*) = A + B^1*Variable X^1 (*developmental state-related variables by industry at year y)* + B^2*Variable X^2 (*electoral politics-related variables by industry at year y*) + e
>
> Where: A = the constant; B = the coefficient; and e = the standard error

Quantitative Results

The empirical results of the analysis appear in Table 3. The majority of my hypotheses were rejected with the exceptions of two variables (i.e., *Honebuto* and *Dantai*). As this study predicted, the frequency of the terms of AI in the Basic Policies of the CEFP and the number of interest groups' members are all associated with a greater number of AI-related budget statistically. Which literature provided a more convincing explanation to Japan's AI-related budget, developmental state model or electoral politics? A hypothesis of one variable derived from each literature was supported, therefore, the results of this study were inconclusive. In addition, the models in this study may not include confounders which might be associated with the variation in the AI-related budget (e.g., political donation to the Liberal Democratic Party by industry and interest group).

The founding of a correlational relationship does not fully explain the process of the AI-related budget. Therefore, it would be appropriate to conduct case study based on the statistical results as the next step. Figure 1 clearly demonstrates that when Basic Policies mentioned the

[32] See Appendix 5. The probability value of the chi-square statistic was: 1.0000.

term AI more frequently before the beginning of budget process at the ministerial level, a greater quantity of the AI-related budget has been approved by the Cabinet in the end. One possible key case study as an example would be the process of making the Basic Policies for Economic and Fiscal Management and Reform (Council on Economic and Fiscal Policy, Cabinet Office) of 2019 and 2020.

Case Study

In order to trace the process between the frequency of the term AI in the Basic Policies and the AI-related budget figures, this section first provides a background of the economic policymaking structure prior to the Shinzo Abe administration (2012-2020). The second section explains the continuity and changes of the economic policy making structure under the Abe administration. The last section explores the timing for the increase of AI-related budget in 2019 and 2020 through the examination of political and economic factors.

Economic Policy Making Structure Prior to the Shinzo Abe Administration

Prior to the establishment of the Council on Economic and Fiscal Policy (CEFP) in 2001, the budget making process usually began in June.[33] The Ministry of Finance (MOF) initially proposed to the Cabinet the overall size of the budget after considering the overall economic situation, expected tax revenues, and public debt levels. Then in July, the Cabinet issued the budget request guidelines in accordance with the MOF proposal. The MOF compiled the budget requests from ministries in August, and issued a MOF budget draft in December after the

[33] For more details of the Japanese budget making process prior to the establishment of the CEFP, see Maurice Wright. *Japan's Fiscal Crisis: The Ministry of Finance and the Politics of Public Spending, 1975-2000*. (Oxford: Oxford University Press, 2002); Aurelia George Mulgan. *Japan's Failed Revolution: Koizumi and the Politics of Economic Reform*. (Canberra: Asia Pacific Press at the Australian National University, 2002).

political negotiations with ministries and ruling party politicians who attempted to bring financial benefits to their constituents. In January, the Cabinet submitted a budget draft to the Diet, and the Diet under the rule of ruling party members typically approved the draft by the end of March without the draft revisions (the Japanese fiscal year in the government begins in April, and ends in March in the following year). Under this previous process, the MOF played a primary role in making the fiscal budget, and the negotiations among the MOF, ministries, and ruling LDP politicians determined the contents inside the budget.

In the early 1990s, Japan experienced the economic bubble burst, and economic hardship, as the so-called Lost Two Decades continued in the early 2010. The MOF and ruling LDP politicians implemented multiple large scale economic stimulus packages but failed to revitalize the economy, and even worse, the public debt levels significantly accumulated without the economic recovery. In the mid-1990s, the Japanese public lost strong confidence in the MOF's economic policy handling along with the MOF bureaucrats' corruption scandals.[34] In order to address the economic crisis, the public interest in strengthening the prime minister's power in the economic policy making grew and helped the passage of a government structure reform bill in 1998 under the Ryutaro Hashimoto administration. As the result of the Hashimoto government structure reform, the Council on Economic and Fiscal Policy (CEFP) was established in 2001, and is chaired by the Prime Minister. The CEFP plays a role in examining and ensuring consistency among important economic policies in response to inquiries from the Prime Minister and/or responsible ministers, and issues the Basic Policies for Economic and Fiscal Management

[34] Jennifer Ann Amyx. *Japan's Financial Crisis: Institutional Rigidity and Reluctant Change*. (Princeton: Princeton University Press, 2004).; *William M. Grimes. Unmaking the Japanese Miracle: Macroeconomic Politics, 1985-2000*. (Ithaca, NY: Cornell University Press, 2001).

and Reform ("*Honebuto no houshin*") in the initial stage of the budget making process, typically in June.[35]

The CEFP began to function very well under Prime Minister Junichiro Koizumi's strong leadership style. The *Honebuto no houshin* successfully sent a clear message to the public regarding the prime minister's focus on his economic policy during the initial stage of the budget making process. The *Honebuto no houshin* also provided a road map and time schedule for the implementation of structural reforms, and was used as a guiding document for the creation of MOF's budget request guidelines. This change made the making of *Honebuto no houshin* under the Koizumi administration a contested place for budget and policy negotiations. Ministries and ruling LDP politicians noticed that the insertion of specific words and figures in the *Honebuto no houshin* could be used for the subsequent budget requests to the MOF.[36] In addition, the CEFP meeting minutes became publicly available and the extent of transparency in policy making greatly increased. Under the budget making process prior to the establishment of the CEFP, the real policy negotiations inside the government and between the government and the ruling LDP were conducted behind the curtain. Now the public could know much more about policy debates in the initial stage of budget making through the meeting minutes.[37]

After the end of the Koizumi administration in 2006, the CEFP became defunct under the three short-term LDP administrations (Shinzo Abe, 2006-2007; Yasuo Fukuda, 2007-2008; Taro Aso, 2008-2009) and under three short-term Democratic Party of Japan (DPJ) administrations (Yukio Hatoyama, 2009-2010; Naoto Kan, 2010-2011; Yoshihiko Noda, 2011-2012). There

[35] Gene Park. "The Politics of Budgeting in Japan: How Much Do Institutions Matter?" *Asian Survey* 50:5 (2010): 965–89.
[36] Ibid.
[37] Hiroko Ohta. *Keizai Zaisei Shimon Kaigi no Tatakai* [Battles in the Council on Economic and Fiscal Policy] (Tokyo: Toyokeizaishinposha, 2006).

were two major reasons why the CEFP played a lesser role in the budget and policy negotiations in 2006-2012. Firstly, based on the law, the CEFP plays a role in examining and ensuring consistency among important economic policies "in response to inquiries" from the Prime Minister and/or responsible ministers, and issues the *Honebuto no houshin* in the initial stage of the budget making process. Therefore, whether the CEFP would function well or not depends on the prime minister. When a prime minister is weak in relation to the ruling party leadership and suffers from the low public approval rating, the CEFP will not enhance the prime minister's power in the budget and policy negotiations. In other words, a weak prime minister will make the CEFP weak, but the CEFP will not make a weak prime minister strong. Second, the DPJ administrations decided NOT to use the CEFP for the purpose of highlighting the differences from the LDP, and instead created alternative organizations such as the National Policy Unit (NPU, *Kottka Senryaku Shitsu*) in 2009 and the National Policy Council (NPC, *Kottka Senryaku Kaigi*) in 2011 inside the cabinet. These organizations were not established by the law, but solely through executive decision. In other words, there is no guarantee to the existence of these organizations after these prime ministers leave the office. The role of these organizations was also vague, and in the end, the DPJ administrations basically relied on the MOF for the budget making process.

Economic Policy Making Structure under the Shinzo Abe Administration

Following the electoral victory in December 2012, the LDP President Shinzo Abe declared that his highest policy agenda was to end deflation and recover the economy, and he would play a leading role in the economic policy making. A series of economic policies implemented by the Shinzo Abe administration (2012-2020) and the subsequent Yoshihide Suga

administration (2020-2021) was later referred to as Abenomics. Abenomics was based on three policy pillars called "Three Arrows" which included: (1) Monetary easing from the Bank of Japan; (2) Fiscal stimulus through government spending; and (3) Economic growth through private investment and innovation.

For the first and second arrows, Prime Minister Abe decided to restart the CEFP as a macro-economic policy headquarters in charge of the budget making process and to coordinate with the Bank of Japan because the President of the Bank of Japan is an official CEFP member. For the third arrow, Prime Minister Abe newly established the Headquarters for Japan's Economic Revitalization (HJER, *Nihon Keizai Saisei Honbu*) as a micro-economic policy headquarters in charge of the strengthening of international competitiveness of Japanese companies. In order to ensure a close collaboration between the CEFP and the HJER, Prime Minister Abe appointed Akira Amari as a Minister in charge of both the CEFP and the HJER.

Timing of Focus on the Artificial Intelligence Under the Abe Administration

A) 2012-2015

In 2012-2014, the Abe administration made progress in monetary policy and government spending in order to revitalize the economy, but the economic growth strategy was not yet meeting expectations. Dr. Koichi Hamada, Economics Professor at Yale University and Economic Advisor to Prime Minister Abe, even mentioned that he would give a grade A to the first arrow (monetary policy), a B to the second arrow (fiscal policy), and a E to the third arrow (growth strategy) in his speech in Japan in 2013.[38] The year of 2015 was a turning point. Minister Amari in charge of both CEFP and HJER admitted that Abenomics focused on the lack

[38] Reuters, November 15, 2013, https://jp.reuters.com/article/topNews/idJPTYE9AE06J20131115

of gross demand in the economy as a result of the monetary and fiscal policies of the last two and half years, and it was now time to focus on the improvement of companies' productivity and international competitiveness on the side of gross supply. As a response, the CEFP issued the *Honebuto no hoshin* 2015 for the Fiscal Year 2016 Budget on June 30, 2015, and the HJER also published the Revised Japan Revitalization Strategy (*Nihon Saiko Senryaku Kaitei*) 2015 at the exact same date.[39] The Fourth Industrial Revolution (*Dai Yon Ji Sangyo Kakumei*), which meant a big change that would shake the very ways of business and society from their foundations in the era of IoT (Internet of Things), Robot technologies, Big Date, and artificial intelligence, was the key term of these documents. The third arrow of Abenomics now focused on the use of emerging technologies such as artificial intelligence in order to achieve economic growth through the industrial and social structural reforms.

B) 2016

In the year of 2016, the Abe administration continued to prepare for the formulation of a growth policy for the Fourth Industrial Revolution. In April, on the side of the development of AI technology, Prime Minister Abe established the Artificial Intelligence Technology Strategy Council (AITSC, *Jinkou Chinou Gijyutu Senryaku Kaigi*) in coordination with the Ministry of Internal Affairs and Communications (MIC), the Ministry of Education, Culture, Sports, Science and Technology (MEXT), and the Ministry of Economy, Trade and Industry (METI).[40] In June, the Industrial Competitiveness Council (ICC, *Sangyou Kyousouryoku Kaigi*) under the HJER

[39] Council on Economic and Fiscal Policy, Basic Policy on Economic and Fiscal Management and Reform (*Keizai Zaisei Unei to Kaikaku no Kihonhoushin*) 2015: Without Economic Revitalization, There Can be No Fiscal Consolidation, June 30, 2015, https://www5.cao.go.jp/keizai-shimon/kaigi/cabinet/2015/2015_basicpolicies_ja.pdf ; Headquarters for Japan's Economic Revitalization, the Revised Japan Revitalization Strategy (*Nihon Saiko Senryaku Kaitei*) 2015, June 30, 2015, http://www.kantei.go.jp/jp/singi/keizaisaisei/pdf/dai1jp.pdf

[40] Artificial Intelligence Technology Strategy Council, Cabinet Office website: https://www8.cao.go.jp/cstp/tyousakai/jinkochino/index.html

issued a new growth strategy called *Japan Revitalization Strategy 2016: Toward the Fourth Industrial Revolution*.[41] This new strategy of 2016 clarified the overall goal of the economic growth strategy which was to achieve the "highest nominal GDP of 600 trillion yen" in the postwar period, and one of the major pillars for this ambitious goal was the new market creation of 30 trillion yen related to the Fourth Industrial Revolution (e.g., AI, IoT, Automated Vehicle). In September, the government compiled the figures of current AI-related budgets for the very first time.[42] According to the media report, the total figures of ministries' AI-related budget requests for the FY 2017 initial budget were 92.4 billion yen which was approximately nine times larger than the FY 2016 initial budget. The government was also planning to add 35.8 billion yen to the FY 2016 supplementary budget. During the same month, Prime Minister Abe created a new organization called the Future Investment Council (FIC, *Mirai Toushi Kaigi*) under the HJER through the merger of the ICC and an existing dialogue between the government and the businesses for investment.[43] Abe's intent was to strengthen the government's efforts to promote emerging technologies, especially artificial intelligence, for economic growth, through the consolidation of similar organizations inside the government. The FIC began to explore the challenges associated with the promotion of artificial intelligence and decided to focus on AI application to the four major areas of health, transportation, productivity, and security in November.[44]

[41] Headquarters for Japan's Economic Revitalization, the Japan Revitalization Strategy (*Nihon Saiko Senryaku*) 2016, June 2, 2016, http://www.kantei.go.jp/jp/singi/keizaisaisei/pdf/zentaihombun_160602.pdf
[42] *Nihon Keizai Shimbun*, September 29, 2016, https://www.nikkei.com/article/DGXLASFS29H4C_Z20C16A9EE8000/
[43] Future Investment Council (*Mirai Toushi Kaigi*) website, http://www.kantei.go.jp/jp/singi/keizaisaisei/miraitoshikaigi/index.html
[44] *Nihon Keizai Shimbun*, November 2, 2016, https://www.nikkei.com/article/DGXLASFS01H5R_R01C16A1PP8000/

In 2016, the ruling LDP politicians also grew more involved with AI-related policy making. In February, a group of young LDP politicians formed the Young Diet Members' Association for the Use of Promotion of AI, Big Data, and IoT (*AI, Big Data, IoT Rikatsuyo Sokushin Wakate Giin Renmei*), headed by the LDP Representative Daishiro Yamagiwa.[45] He authored the book titled, *AI, Industry, and Society* in 2015, and shared a close political relationship with Minister Amari in charge of economic revitalization. In March, the LDP also established the Headquarter for the Economic Strategy Toward the Future AI Society (*Jinko Chinou Mirai Shakai Keizai Senryaku Honbu*) as an official party policy research organization directly under the LDP President Shinzo Abe.[46] This Headquarter was chaired by the former Education Minister Ryu Shionoya, who had an interest in the application of AI for school through education and was politically close to Prime Minister Abe.

There are two major reasons why the ruling LDP politicians became interested in AI-related policy. Firstly, a new industry such as the AI-related industry does not belong exclusively to the jurisdiction of a specific ministry, and the government tends to have difficulty in implementing policies related to new industries. But the LDP in this case had experience in addressing the needs of new industries in the past, and successfully expanded the size of pro-LDP constituents (e.g., information communication industry). Secondly, the LDP understood that the reliance of old traditional industries would not be enough to secure votes and political financial contributions, in the future. The LDP party leaders recognized that what the voters wanted was economic growth and that AI was at the center of their focus. In fact, the LDP party platform for the 2016 House of Councilors stated that the LDP would achieve the creation of

[45] Official Facebook of Representative Daishiro Yamagiwa, February 25, 2016, https://m.facebook.com/yamagiwadaishiro.office/photos/a.375277219150483/1172141079464089/?type=3
[46] *Sankei Shimbun*, March 29, 2016, https://www.sankei.com/article/20160329-OAEPH2MSOZMHRPXNUFGSSU2GYM/

new growth markets such as AI and the productivity revolution. In order to promote the AI application to industries, it was critical to sway the central and local governments and the businesses to share the data. In addition, the ruling LDP and the Komeito, but not the Cabinet, submitted a bill for the Promotion of Public and Private Data Usage in corporation with the two opposition parties in December, and the bill passed only after the ten-day discussion. The Basic Law for the Promotion of Public and Private Data Usage urged the government to create common rules and principles for the data sharing inside ministries and across ministries, and obligated the government to create a roadmap for the data sharing promotion.[47]

C) 2017-2020

In 2017, the Abe administration continued to discuss the development of AI technology in the AITSC and AI application for industries in the FIC. But in early 2018, there was a growing perception that the Abe administration's approach to AI was not effective and energetic enough for two reasons. Firstly, the AITSC created a roadmap for AI technology development which relied mainly on research conducted by universities. But the universities could not afford to spend an enormous amount of AI research funds by themselves.[48] Secondly, the FIC designated AI as a major pillar of annual economic growth policies, but Japan still did not have a long-term and focused AI strategy like many other countries including the U.S., China, Germany, France, and Singapore.[49] In response, the Abe administration envisioned the drastic increase in the AI-related budget, based on a newly formed long-term AI strategy.

[47] SciREX Center, National Graduate Institute for Policy Studies, December 2016, https://scirex.grips.ac.jp/newsletter/4-2017-02/02.html
[48] *Nihon Keizai Shimbun*, June 18, 2018, https://www.nikkei.com/article/DGXMZO30862870T20C18A5000000/
[49] *Nihon Keizai Shimbun*, September 28, 2018, https://www.nikkei.com/article/DGXMZO35848570X20C18A9PP8000/

Clear evidence of the Abe administration's intent to increase the AI-related budget was seen in the frequency of the term in the *Honebuto no hoshin* 2018 for the FY 2019 budget issued by the CEFP and the *Future Investment Strategy* (*Mirai Toushi Senryaku*) 2018 drafted by the FIC under the HJER. For the former, the *Honebuto no hoshin* 2018 mentioned the term AI eighteen times in comparison with nine times in the *Honebuto no hoshin* 2017. For the latter, the *Future Investment Strategy* 2018 mentioned the term AI 137 times, while in 2017 it was only mentioned 106 times. As a result, the initial AI-related budget for the FY 2019 was 128 billion yen in comparison with 77 billion yen for the initial AI-related budget for the FY 2018 (an over 66 percent increase).

After the beginning of FY 2019 in April, the Abe administration issued a long-term AI strategy 2019 in June.[50] Based on this new AI strategy, the Abe administration requested additional 261 billion yen in the supplementary budget for the FY 2019 in December 2019, and this supplementary budget was approved in the Diet in January 2020. In the FY 2020, the Abe administration continued to commit the budgetary support to AI development, and budgeted 119 billion yen in the initial budget and 396 billion yen in multiple supplementary budgets for the implementation of AI strategy in the end. As previously demonstrated in Table 1, the level of Japan's total AI-related budgets (combined initial and supplementary budgets) in FY 2019 was 388.6 billion yen and in FY 2020 reached 515.0 billion yen which was equivalent to the U.S. AI-related budget in the FY 2018 (500 billion yen) as well as the Chinese AI-related budget in the same fiscal year (450 billion yen).[51]

[50] *AI Strategy 2019* (June 11, 2019), Cabinet Office website: https://www8.cao.go.jp/cstp/ai/aistratagy2019en.pdf
[51] "Japan's budget for AI to be less than a fifth of that planned by U.S. and China," *The Japan Times*, February 25, 2018: https://www.japantimes.co.jp/news/2018/02/25/business/tech/japanese-government-spending-ai-less-20-u-s-china/

Conclusion

The results of this study have empirically demonstrated that the Japanese government of today possess the unrelenting interest in artificial intelligence, as it previously did for various advanced technologies during Japan's postwar industrial and economic development. The size of Japan's AI-related budget has nearly and/or already caught up with top runners such as China and the United States. The Basic Policies of 2019 and 2020 have recognized that there is grave concern related to the shrinking growth of the labor force population for the mid- and long-term, and emphasized the importance of boosting the potential growth rate by further stimulating human/physical investment. In order to achieve this goal, the Basic Policies of 2019 explained that it is imperative to commit to the social implementation of advanced technologies (including artificial intelligence) such as digitalization, and an economic and social structural transformation which makes the social implementation feasible.[52]

Japan is also actively committed to solving global problems including international rule and standard setting in the area of emerging technologies.[53] But Japan recognizes the lack of highly skilled system engineers and experience, therefore, the AI Strategy 2019 promotes cooperation with foreign countries, especially the United States.[54] Presently, Japan envisions a growing AI market in Asia. For example, one of the ongoing Japanese policy initiatives is the Asia Health and Wellbeing Initiative (AHWIN) which promotes the construction of health data infrastructure and the cooperation of AI medical practices in the Philippines, Vietnam, Indonesia,

[52] *Basic Policy on Economic and Fiscal Management and Reform 2019: A New Era of Reiwa: Challenges toward Society 5.0* (June 21, 2019), Council on Economic and Fiscal Policy, Cabinet Office website: https://www5.cao.go.jp/keizai-shimon/kaigi/cabinet/2019/2019_basicpolicies_ja.pdf
[53] Ibid.
[54] *AI Strategy 2019* (June 11, 2019), Cabinet Office website: https://www8.cao.go.jp/cstp/ai/aistratagy2019en.pdf

Laos, and India.[55] Japan also constructed the Southeast Asian linguistic data infrastructure in cooperation with the Association of Southeast Asian Nations (ASEAN) in order to support researchers.[56] In similar context, Japan's Innovative Asia project is currently promoting AI-related research cooperation with universities and institutes in Southeast Asia and South Asia.[57] The deeper diplomatic ties become, with the countries of Southeast Asia, the greater the geopolitical implications are, within the context of the recent U.S.-China competition.

Would Japan maintain its interest in artificial intelligence for economic growth? After the resignation of Prime Minister Abe due to his health condition in September 2020, new Prime Minister Yoshihide Suga committed that his administration would carry over Abenomics for his economic policies. But Prime Minister Suga abolished the HJER and the FIC, both chaired by Prime Minister Abe, which were in charge of economic growth, and instead created the Growth Strategy Council (GSC, *Seicho Senryaku Kaigi*), chaired by Chief Cabinet Secretary, as a subordinate organization under the CEFP. It appeared that Prime Minister Suga's focus was de-regulation for economic growth, as opposed to industrial policy toward new industries such as AI for economic growth.[58] Prime Minister Suga decided not to seek a new term as the LDP President due to unpopularity associated with his COVID-19 response, and in October 2021, Fumio Kishida assumed the office. It has been less than one year since Kishida's inauguration. Prime Minister Kishida's economic policies called "New Capitalism" appear to place emphasis

[55] The Asia Health and Wellbeing Initiative (AHWIN) website: https://www.ahwin.org/; *Progress Report of the AI Strategy 2019*, Cabinet Office website: https://www8.cao.go.jp/cstp/ai/aistrategy2019_fu_bessi.pdf; *Progress Report of the AI Strategy 2021*, Cabinet Office website: https://www8.cao.go.jp/cstp/ai/aistrategy2021_bessi.pdf
[56] *Progress Report of the AI Strategy 2021*, Cabinet Office website: https://www8.cao.go.jp/cstp/ai/aistrategy2021_bessi.pdf
[57] Innovative Asia Project, Japan International Cooperation Agency (JICA) website: https://www.jica.go.jp/regions/asia/innovative_asia.html; *Progress Report of the AI Strategy 2021*, Cabinet Office website: https://www8.cao.go.jp/cstp/ai/aistrategy2021_bessi.pdf
[58] *Nihon Keizai Shimbun*, October 27, 2020, https://www.nikkei.com/article/DGXMZO65448190W0A021C2000000/

on the issue of economic inequality, but not economic growth. But Prime Minister Kishida recently declared that his Cabinet will create a new AI strategy for economic growth, so it should be important to keep an eye on the development of this new AI strategy in the near future.

LIST OF TABLES AND FIGURES

Table 1: AI-related Budget (Regular and Supplementary Budgets) by Ministry, 2016-2021 (Unit: JPY 100 million)

Ministry	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2016-21	FY 2016-2
CS	-	-	-	3.4	33.2	8.0	44.6	0.3%
CO	-	-	26.9	455.0	431.7	307.0	1,220.6	9.4%
PIPC	-	-	-	-	2.3	1.7	4.0	0.0%
NPA	-	-	-	1.4	2.1	3.0	6.5	0.0%
MIC	54.3	82.2	64.2	58.0	671.7	42.7	973.1	7.5%
MOJ	-	-	-	-	0.2	1.0	1.2	0.0%
MOF	-	-	-	-	0.6	4.4	5.0	0.0%
MEXT	65.0	104.8	115.2	2,505.5	3,067.8	344.6	6,202.9	47.7%
MHLW	223.0	201.8	196.5	38.6	274.5	146.1	1,080.5	8.3%
MAFF	-	-	62.0	127.6	89.5	100.3	379.4	2.9%
METI	426.2	322.2	440.7	484.0	344.4	439.4	2,456.9	18.9%
MLIT	3.3	10.7	25.7	29.3	165.2	77.7	311.9	2.4%
MOE	-	-	-	182.9	60.1	43.4	286.4	2.2%
MOD	-	-	-	0.8	7.3	27.0	35.1	0.3%
	771.8	721.7	931.2	3,886.5	5,150.6	1,546.3	13,008.1	100.0%

CS: Cabinet Secretariat	MEXT: Ministry of Education, Culture, Sports, Science
CO: Cabinet Office	MHLW: Ministry of Health, Labour and Welfare
PIPC: Personal Information Protection Commission	MAFF: Ministry of Agriculture, Forestry and Fisheries
NPA: National Police Agency	METI: Ministry of Economy, Trade and Industry
MIC: Ministry of Internal Affairs and Communications	MLIT: Ministry of Land, Infrastructure, Transport and
MOJ: Ministry of Justice	MOE: Ministry of the Environment
MOF: Ministry of Finance	MOD: Ministry of Defense

Table 2: Economic Activities and Ministerial Jurisdiction

Ministry	Economic Activities
Cabinet Secretariat	Public administration
Cabinet Office	Professional, scientific and technical activities
Personal Information Protection Commission	Public administration
National Police Agency	Public administration
Ministry of Internal Affairs and Communications	Information and communications
Ministry of Justice	Public administration
Ministry of Finance	Finance and insurance
Ministry of Education, Culture, Sports, Science and Technology	Education
Ministry of Health, Labour and Welfare	Human health and social work activities
Ministry of Agriculture, Forestry and Fisheries	Agriculture, forestry and fishing
Ministry of Economy, Trade and Industry	Manufacturing
Ministry of Land, Infrastructure, Transport and Tourism	Construction
Ministry of the Environment	Public administration
Ministry of Defense	Manufacturing

Table 3: OLS Regression Analysis

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Growth	-5.595								-0.477
	(7.096)								(10.054)
Payroll		-0.000							0.000
		(0.000)							(0.000)
Pro Inducement			-102.784						-131.724
			(74.061)						(89.409)
Honebuto				13.321^{+}					13.843*
				(7.157)					(6.026)
Voters					0.077				0.095
					(0.107)				(0.102)
Dantai						0.000^{+}			0.000^{+}
						(0.000)			(0.000)
Re-Recruite							-0.280		-0.363
							(0.181)		(0.248)
Election								-93.523	29.771
								(119.390)	(95.572)
Constant	158.288**	232.950^{+}	227.126*	-2.775	121.781	24.666	183.214**	217.207^{+}	-161.808
	(49.796)	(121.043)	(94.122)	(48.604)	(87.885)	(37.673)	(64.722)	(109.744)	(121.353)
Observations	84	84	84	84	84	84	84	84	84

Standard errors in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

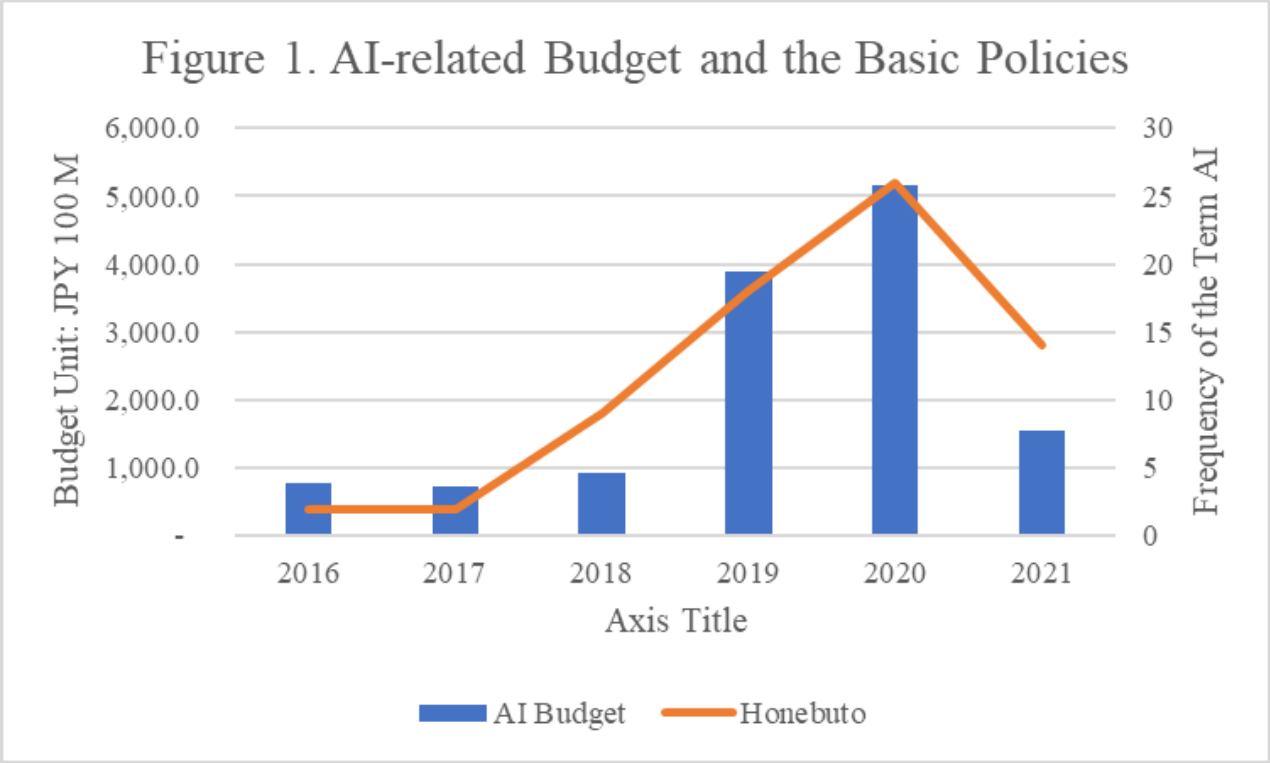
Figure 1. AI-related Budget and the Basic Policies
Budget Unit: JPY 100 M
6,000.0
5,000.0
4,000.0
3,000.0
2,000.0
1,000.0
-
30
25
20
15
10
5
0
Frequency of the Term AI
2016
2017
2018
2019
2020
2021
Axis Title
AI Budget
Honebuto

BIBLIOGRAPHY

Books and Articles

Allison, Paul David. *Multiple Regression: A Primer*. Thousand Oaks, CA: Pine Forge Press, 1999.

Amyx, Jennifer Ann. *Japan's Financial Crisis: Institutional Rigidity and Reluctant Change*. Princeton: Princeton University Press, 2004.

Bhagwati, Jagdish N. "Lobbying and Welfare." *Journal of Public Economics*, December 1980, pp. 355-363.

Calder, Kent E. "Japanese Foreign Economic Policy Formation: Explaining the Reactive State." *World Politics* 40, 4, 1988, pp. 517-41.

Curtis, Gerald L. *The Japanese Way of Politics*. New York, NY: Columbia University Press, 1988.

Grimes, William M. *Unmaking the Japanese Miracle: Macroeconomic Politics, 1985-2000*. Ithaca, NY: Cornell University Press, 2001.

Johnson, Chalmers. *MITI and the Japanese Miracle: The Growth of Industrial Policy, 1925-1975*. Stanford, CA: Stanford University Press, 1982.

___. *Japan: Who Governs? The Rise of the Developmental State*. New York, NY: W.W. Norton, 1995.

Lincoln, Edward J. *Japan's Industrial Policies: What Are They, Do They Matter and Are They Different from Those in the United States?* Washington, D.C.: Japan Economic Institute of America, 1984.

Mulgan, Aurelia George. *Japan's Failed Revolution: Koizumi and the Politics of Economic Reform*. Canberra: Asia Pacific Press at the Australian National University, 2002.

Ohta, Hiroko. *Keizai Zaisei Shimon Kaigi no Tatakai* [Battles in the Council on Economic and Fiscal Policy]. Tokyo: Toyokeizaishinposha, 2006.

Okimoto, Daniel I. *Between MITI and the Market: Japanese Industrial Policy for High Technology*. Stanford, CA: Stanford University Press, 1989.

Park, Gene. "The Politics of Budgeting in Japan: How Much Do Institutions Matter?" *Asian Survey*, Vol. 55, No. 5, 2010, pp. 965-89.

Pekkanen, Saadia M. *Picking Winners? From Technology Catch-Up to the Space Race in Japan*. Stanford, CA: Stanford University Press, 2003.

Wright, Maurice. *Japan's Fiscal Crisis: The Ministry of Finance and the Politics of Public Spending, 1975-2000*. Oxford: Oxford University Press, 2002.

Official Government Websites

Artificial Intelligence Technology Strategy Council, Cabinet Office, Japan

Cabinet Office, Japan

Council on Economic and Fiscal Policy, Cabinet Office, Japan

Future Investment Council, Cabinet Office, Japan

Headquarters for Japan's Economic Revitalization, Cabinet Office, Japan

Japan International Cooperation Agency, Japan

Ministry of Agriculture, Forestry and Fisheries, Japan

Ministry of Education, Culture, Sports, Science and Technology, Japan

Ministry of Health, Labor and Welfare, Japan

National Personnel Authority, Japan

White House, the United States

Media Reports

Nihon Keizai Shimbun

Reuters

The Japan Times

APPENDIX

Appendix 1: Summary Statistics of Each Valuable

Variable		Mean	Std. Dev.	Min	Max	Observations	
aibudget	overall	154.8583	441.0733	0	3067.8	N =	84
	between		278.7207	.2	1033.817	n =	14
	within		348.6263	-813.9583	2188.842	T =	6
growth	overall	.6130952	2.673961	-8.1	7	N =	84
	between		1.360652	-3.416667	2.55	n =	14
	within		2.325988	-6.220238	8.029762	T =	6
payroll	overall	393994.6	81900.3	102750	498273	N =	84
	between		83950.56	153985.8	489969	n =	14
	within		9193.649	342758.8	421841.8	T =	6
proind~t	overall	.7031049	.3926457	-.355488	1.398125	N =	84
	between		.4017925	-.000452	1.351816	n =	14
	within		.0495841	.3480689	.8069059	T =	6
honebuto	overall	11.83333	8.662109	2	26	N =	84
	between		0	11.83333	11.83333	n =	14
	within		8.662109	2	26	T =	6
voters	overall	427.9369	335.0684	158.2	1076.7	N =	84
	between		345.4105	165.3333	1063.867	n =	14
	within		12.23629	379.2202	465.9369	T =	6
dantai	overall	734826.7	1250019	0	4882660	N =	84
	between		1286406	0	4582565	n =	14
	within		86006.31	292311.9	1034922	T =	6
rerecr~e	overall	101.3333	117.563	0	417	N =	84
	between		120.7048	.1666667	393.1667	n =	14
	within		11.36277	70.16667	129.1667	T =	6
election	overall	.6666667	.4742358	0	1	N =	84
	between		0	.6666667	.6666667	n =	14
	within		.4742358	0	1	T =	6

Appendix 2: VIF Test

Source	SS	df	MS	Number of obs =	84
				F(8, 75) =	4.92
Model	5561095.99	8	695136.998	Prob > F =	0.0001
Residual	10586191.8	75	141149.224	R-squared =	0.3444
				Adj R-squared =	0.2745
Total	16147287.8	83	194545.636	Root MSE =	375.7

aibudget	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
growth	-.4769663	17.59519	-0.03	0.978	-35.52839	34.57446
payroll	.0002279	.0005544	0.41	0.682	-.0008765	.0013322
proinducement	-131.7236	114.3665	-1.15	0.253	-359.5533	96.10609
honebuto	13.84347	5.517812	2.51	0.014	2.851426	24.83552
voters	.0953445	.1263768	0.75	0.453	-.156411	.3471
dantai	.0001797	.0000334	5.38	0.000	.0001132	.0002463
rerecruite	-.3625943	.3620178	-1.00	0.320	-1.083771	.3585821
election	29.77078	99.05619	0.30	0.765	-167.5593	227.1008
_cons	-161.8079	261.7116	-0.62	0.538	-683.1642	359.5484

```
. vif
```

Variable	VIF	1/VIF
honebuto	1.34	0.744422
growth	1.30	0.768249
election	1.30	0.770635
payroll	1.21	0.824962
proinducem~t	1.19	0.843337
rerecruite	1.07	0.938856
voters	1.05	0.948415
dantai	1.03	0.974663
Mean VIF	1.19	

Appendix 3: Breusch-Pagan / Cook-Weisberg Test for Heteroskedasticity

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of aibudget

         chi2(1)      =   264.48
         Prob > chi2  =   0.0000
```

Appendix 4: Hausman Test

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
growth	6.251958	-.4769663	6.728924	5.153295
payroll	-.0026406	.0002279	-.0028684	.0049464
proinducem~t	-325.3259	-131.7236	-193.6023	867.033
honebuto	16.05829	13.84347	2.214819	3.109583
voters	-.0403476	.0953445	-.1356921	4.482643
dantai	-.0003784	.0001797	-.0005581	.0005469
rerecruite	3.098538	-.3625943	3.461133	3.839742
election	5.866049	29.77078	-23.90473	23.3952

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 7.56
Prob>chi2 = 0.2718
(V_b-V_B is not positive definite)

Appendix 5: Breusch–Pagan Lagrange multiplier test for the Random Effect model

Breusch and Pagan Lagrangian multiplier test for random effects

aibudget[ministryid,t] = Xb + u[ministryid] + e[ministryid,t]

Estimated results:

	Var	sd = sqrt(Var)
aibudget	194545.6	441.0733
e	141061.4	375.5814
u	0	0

Test: Var(u) = 0
chibar2(01) = 0.00
Prob > chibar2 = 1.0000