# Macroeconomic Impact of Tax Shocks:
## Evidence from Japan Using a Narrative Approach※

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**Abstract**
This paper analyzes the effects of tax shocks on the economic activity. Following David and Christina Romer's narrative approach, we identify, from scratch, 486 tax changes enacted in Japan into endogenous tax changes motivated by the state of the economy and more exogenous tax changes . These provide new datasets following those for the US and UK. We found that exogenous tax changes have a large and long-term impact on the economic activity in Japan as well. Exogenous tax shocks negatively impact the GDP trajectory, with consumption as the main transmission channels. In other words, tax cuts motivated by a desire to raise long-term growth have a positive effect on consumption, thereby increasing GDP. Deficit-driven tax changes have a negative effect on residential investment but has a positive effect on corporate investment, thereby increasing GDP.

**Keywords:** exogenous tax change, narrative approach, distributed lag model, GDP growth, dynamic multiplier, Japan

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# 1. Introduction

Japan's fiscal health is extremely serious when comparing government debt with other developed countries. According to OECD definition, debt-to-GDP ratio is as high as 250 percent resembling to a situation in which the debt of a nation exceeds its future capacity to repay it. A debt overhang can lead to stagnant growth and a degradation of living standards from reduced funds to spending in critical areas such as healthcare, education, and infrastructure. However, the sense of crisis is weak so far. This is because Japan has not heard any warnings from the capital market. If the confidence of debt is deteriorated, bond yields should rise reflecting the risk premium, but the yield of 10-year JGB has been hovering around zero percent for a decade. One reason for this paradox is that the balance between Japan's savings and investment was in a large excess of savings. But more crucial factor is the Bank of Japan's unconventional monetary easing. Since September 2016, the Bank has been implementing yield curve control by purchasing long-term government bonds so that the yield on 10-year JGB remains around zero percent. However, the macroeconomic condition is undergoing changes. Prices are soaring due to the global rise in resource prices and the depreciation of the yen. Wages, which have been sluggish until now, are also gaining momentum.

Under these circumstances, it is unlikely that yields of JGB will surge any time soon. However, once yields rise sharply, various side effects will hit the Japanese economy. Considering the current situation in Japan, any austerity fiscal policy that across-the-board cuts government spending is not desirable. However, when making spending decisions, it is important to clarify policy goals and verify their effectiveness. It is often pointed out that wasteful spending should be cut, as majority of citizens oppose easy tax hike. However, it is also necessary to have a sense of crisis that Japan's government debt has reached a level that cannot be eliminated by reducing wasteful spending alone. It is imperative to present a concrete timetable for raising taxes and social contribution to prevent crises and reduce the burden on future generations.

In this context, the question of how taxes affect economic growth has become a topic that deserves renewed discussion. The impact of taxes on economic growth is a controversial topic of debate among researchers. This is partly due to competing economic theories about the driving factors of economic growth. Keynesian economics focus on demand-side factors, whereas neoclassical economics focus on supply-side aspects, discussing the impact of taxes on the economic activity. The empirical research should shed light on these disputes and provide evidence for judging the validity of them. It is difficult, however, to conduct an empirical analysis of the impact of tax changes on economic activity, such as the effect measured by the rate of change in real GDP. This is derived from to the issues of simultaneous causality, as we will discuss in Section 2. Discretionary tax changes affect output but changes in output should also have a contemporaneous effect on tax

changes. This simultaneous causality leads to lack of consensus on the macroeconomic impact of tax changes.

The earlier literature has tackled the identification problem by using structural vector autoregression to identify tax shock which is uncorrelated with macroeconomic fluctuation. Blanchard & Perotti (2002) resolved the issue of simultaneous causality and analyzed the impact of taxes on the economy, focusing on the actions of the U.S. federal government in the postwar period[1]. Decision and implementation lags in fiscal policy imply that, at high enough frequency—say, within a quarter—there is little or no discretionary response of fiscal policy to unexpected contemporaneous movements in activity. Thus, with enough institutional information about the tax and transfer systems, they constructed estimates of the automatic effects of unexpected movements in activity on fiscal variables, and, by implication, obtain estimates of fiscal policy shocks. Having identified these shocks, they then estimated a VAR comprising three variables: output, government spending, and tax changes. They applied a non-recursive identification constraint to estimate structural VAR. The results consistently show positive government spending shocks as having a positive effect on output, and the effect of a tax shock on GDP is typically around 1 percent. It is essential to constrain several parameters when estimating structural VAR, especially the tax revenue elasticity calculated from institutional information and assigned to the model externally. However, there are difficulties in conducting empirical research, as the tax revenue elasticity values used in previous studies employing Blanchard & Perotti-type identification constraints vary considerably and have different sample[2].

More recent literature uses the narrative records to construct a direct measure of the policy changes that are uncorrelated with macroeconomic fluctuation. A notable epoch-making study is the research by David and Christina Romer (2010)[3]. After taking an overhead view of the post-World War II U.S. federal tax share of GDP, they analyzed the legislative records, such as presidential speeches and congressional reports, to identify the tax shocks that were legislated. These included motives such as dealing with inherited budget deficits and raise long-run growth. This identification method resolves the statistical problem of simultaneous causality by removing endogenous tax changes from the data in response to the state of the economy, such as countercyclical tax changes

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[1] Blanchard and Perotti found that the impact of tax changes on output is small. Watanabe, Yabu, and Ito (2008) use Blanchard & Perotti type identification. They estimate elasticity of tax revenues on a quarterly basis using institutional information on the tax and transfer system.

[2] There are challenges in assigning tax revenue elasticity calculated from institutional information into the model from the outside. If the elasticity is too low, there will be a bias for the impact of tax changes on output to be too small. Mertens and Ravn (2012) revealed that tax revenue elasticity is usually higher than typical assumptions.

[3] Ramey and Shapiro (1998) used a narrative approach to determine the impact of economic shocks on government spending.

or tax changes associated with increased government spending. They found that the impact of taxes is more negative than that argued in previous studies. They reported that a 1 percent tax increase lowers real GDP by 3 percent over two years[4]. The most significant impact is from tax changes that raise long-run growth, with investment as the primary transmission channels. The estimated results are robust even when controlling for changes in economic conditions, monetary policy, and government spending. Cloyne (2013) used an approach like that of David and Christina Romer, estimating the impact of tax changes on the economy in the United Kingdom[5].

Of course, different taxes may have different effect on economic activity. Another trend of the recent research is its focus on the differing impacts of different taxes on the economic activity. Corporate income taxes affect investment and capital accumulation, and income taxes affect labor supply and personal savings. Consumption taxes affect the supply of labor and capital but are considered more neutral. Arnold et al. (2011) analyzed panel data for 21 OECD countries from 1971 to 2004 to rank taxes that were the most harmful to economic growth. They reported that corporate income taxes caused the most damage, followed by personal income taxes, consumption taxes, and property taxes.

This paper analyzes, from scratch, ninety-five tax reforms enacted in postwar Japan between 1955 and 2014 in detail, following David and Christina Romer's narrative approach. Exogenous tax changes include tax changes motivated by a desire to raise long-run growth, tax changes to deal with inherited budget deficits, and tax changes motivated by beliefs in fairness. Similarly, endogenous tax changes include countercyclical tax changes motivated by the state of the economy and spending driven changes in social security contributions. Of the ninety-five tax reforms, we identify 486 individual tax changes. Of these, 302 were found to be exogenous tax changes and 184 were endogenous. We use a distributed lag model to estimate cumulative dynamic multiplier of exogenous tax changes on output. The primary results suggested that a tax increase of 1 percent relative to GDP reduced GDP by 1 percent on impact, cumulatively reaching to a 2.66 percent drop over three years. These estimates closely resemble Romer and Romer's (2010) empirical results for the United States and results for the United Kingdom in the study by Cloyne (2013), both of which are based on documentation on policy-making processes.

We organize this paper as follows. Section 2 discusses the issue of simultaneous causality and identification strategies for tax changes based on documentation of the policy-making processes. Section 3 provides an overview of the new quarterly datasets for Japan. In Section 4, we use the new

[4]The effect is higher than those in the previous study by Blanchard and Perotti (2002).

[5] Cloyne (2013) found that a 1 percent tax cut relative to GDP increased GDP by 0.6 percent, cumulatively amounting to 2.5 percent over three years.

datasets to estimate CDM of exogenous tax changes using a distributed lag model. We also conduct robustness tests by considering the effects of outliers and controlling for government spending changes, economic performance, and other economic variables. Section 5 expands the estimation specification. We examine whether expectations of future tax changes could affect the economic activity and the transmission channels through which exogenous tax changes affect output.

# 2 Motives for Tax changes

## 2.1 Simultaneous Causality

Discretionary tax changes affect output but changes in output should also have a contemporaneous effect on tax changes. This simultaneous causality means there is lack of consensus on the macroeconomic impact of tax changes [6]. Denote the GDP growth rate as $\Delta y_t$ ( $y = log\text{GDP}$), the relation between the tax changes and the GDP growth rate is as follows.

$$\Delta y_t = \alpha_0 + \varphi \Delta \tau_t + u_t \qquad (1)$$

$\alpha_0$ is a constant, and $\Delta \tau_t$ is a variable denoting the tax changes. If the error term and the explanatory variable are correlated ($\Delta \tau_t = \tau(u_t)$), $\Delta \tau_t$ is an endogenous variable. Therefore, the OLS estimator in Equation (1) is not consistent and does not result in BLUE. To estimate the parameter $\varphi$ in Equation (1), we identify an exogenous tax shock uncorrelated with other macroeconomic shocks. Once one has identified the exogenous tax shock, one can estimate the parameters using a distributed lag model such as the one described below.

$$\Delta y_t = \mu + \sum_{j=0}^{\infty} \gamma_j d_{t-j} + v_t \qquad (2)$$

Estimating Equation (2) enables us to examine the dynamic effects of exogenous tax shocks on GDP, where $d_{tj}$ denotes the identified exogenous tax shocks, and the identification condition for exogeneity is $E\left(v_t \middle| d_t, \ d_{t-1}, \ \ldots\right) = 0$. In the following, we refer to $d_{tj}$ as the exogenous tax change as per Romer and Romer (2010).

To clarify the meaning of exogenous tax change, it is necessary to explain the correlation between the explanatory variables and the error term. Assume that $p_t$ denotes observational data of tax changes. In addition to exogenous tax changes $x_t$, $p_t$ includes changes to tax revenues $f(\cdot)$ as

[6] On the issue of simultaneous causality, we owe much on Romer and Romer (2010), pp.765-767 and Cloyne (2013), pp.1509-1510.

policymakers react to changes in GDP $y_t$, the inflation rate $\pi_t$, unemployment$u_t$, and government spending $b_t$, as seen in Equation (3).

$$f(y_t,\ \pi_t,\ u_t,\ b_t) \qquad (3)$$

$$p_t = x_t + f\left(y_t,\ \pi_t,\ u_t,\ b_t\right) \qquad (4)$$

If we use $p_t$ as the observational data of $d_t$, then $f(\cdot)$ is correlated with the error term$v_t$. This means that the estimators in Equation (2) are not consistent and do not result in BLUE. When we identify exogenous tax change $x_t$ using documentary evidence of the policymaking process, then the estimate is consistent because $x_t$ and the error term are uncorrelated. For the same reason, using the broad measure of tax changes derived from statistical data are not a proxy variable for $d_t$. This is because of that the broad measure of tax change does not meet condition $E\left(v_t \middle| d_t,\ \ d_{t-1},\ \ \ldots\right) = 0$ as change in output also affect tax revenues.

## 2.2 Strategies for the identification

The Japanese case is a good fit for applying David and Cristina Romer's narrative approach. Policy making processes is centralized in the Government Tax Commission, and tax reform is a major annual event. Most of tax reform bills take the form of cabinet bills. In the case of the Income Tax Law and the Corporation Tax Law, the Taxation Bureau of the Ministry of Finance prepares the drafts, and the government's Tax Reform Proposal is publicly announced. The reports of the Government Tax Commission provide an outline and motivation of the tax reform[7]. Tax reform proposals are ultimately approved by the ruling party and the Diet and implemented throughout the year. In January of the following year, the Cabinet decides on the outline of the draft law and submits the bill to the Diet. Amendments to the bill are rare, and the Diet usually passes the bill at the end of March. The estimated revenue effect of tax changes is publicly announced. Japan's budget process is well-suited to a narrative approach, i.e., constructing a dataset based on documentary records of the policy-making process.

Considering these processes, we use documentation on the policy-making process as a source for identifying exogenous tax changes. The main sources are such as Report of Government Tax Commission, Tax reform proposal of ruling parties, Interview with the Director of Taxation Bureau,

[7] Ishi (2008) characterizes the management procedure of the Government Tax Commission as a "Japanese-style council". It is a procedure in which interested groups representing each industry become members of the council and obtain consensus from them. This procedure has the advantage that the recommendations are almost certainly implemented. These reports and recommendations are valuable documentation on policy-making processes for understanding the motivation of tax reforms. See, Ishi(2008)p.301.

and the Deputy Secretary etc. MOF compiles them into "History of Fiscal and Monetary Policies in Japan" since 1952[8]. These histories compiled by MOF are accurate descriptions of fiscal and monetary policies based on the original documents. They are not only history of the fiscal policies implemented but also a rich record on policy-making processes. The compilation of records on tax changes from 2000 onward is still being compiled. Therefore, for periods not covered in the existing volumes, we have supplemented the literature by using the Government Tax Commission Report, the Tax Reform Proposals of the ruling parties, the Commentary on Tax Reform of the Taxation Bureau, newspaper articles, and other sources. It is possible to use such institutional information to classify all legislated tax changes into exogenous shocks and endogenous changes.

We broadly classify tax changes into two categories: those motivated by the state of the economy and those that are not. Following Romer and Romer (2010), refer to the former as endogenous tax changes and the latter as exogenous tax changes. One type of endogenous tax change is countercyclical tax policy[9]. If the economy is predicted to decline and governments decides a tax cut to mitigate the downturn, this is an action motivated by a desire to return growth to the normal. When the economy is in recession, the income tax and corporate tax bases decline in tandem. Thus, inclusion of countercyclical tax changes bias estimates of the impact of tax changes on output. There is now one other category of endogenous tax changes, those linked to increases in government spending[10]. In this case, since government spending is included in the error term, it correlates with tax changes, which makes explanatory variable endogenous. Previous studies have identified two types of spending driven tax changes: tax increases to cover increased military spending and social contributions associated with expanding social security benefits. We focus exclusively on social security contributions hikes, which are clearly linked to social security benefits, as a tax revenue change related to spendings.

Exogenous tax changes are not motivated by a desire to return output growth to the normal. Exogenous tax changes are either changes designed to move growth away from normal or changes taken irrespective of their effects on growth. In other words, they are tax changes not taken in response to information about future economic developments. Since these are considered exogenous shocks rather than endogenous tax changes, we use then to estimate macroeconomic impact of tax

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[8] For reference see, Fiscal History Office, Ministry of Finance (1990) and (1998), and Fiscal History Office, Ministry of Finance Policy Research Institute (2003), (2005), (2013), and (2017). See H. Ishi (2008) for chapters on the history of tax reform from the post-World War II period to the collapse of the bubble economy.

[9] See Romer and Romer (2010), p. 769 for a definition of countercyclical tax changes. Cloyne (2013) classified countercyclical tax policies into two categories: demand-managed and supply-side.

[10] See Romer and Romer (2010), p. 769 for a definition of spending-driven tax changes. Note that Cloyne (2013) referred to tax reforms in response to rapid fiscal deterioration through rating downgrades as deficit-reducing and described it as the third type of endogenous tax change.

changes. First, inherited budget deficits reflect past state of economy and fiscal policy but are not simultaneously affected by current state of the economy. If governments decide to raise taxes to deal with such a deficit, this is not a change motivated by a desire to return growth to the normal. Therefore, tax changes dealing with inherited budget deficits are classified as exogenous tax changes[11].

Another type of exogenous tax changes is motivated by a desire to raise long-run growth[12]. A typical example would be a growth-oriented tax cut in which policymakers say that economy is doing fine, but they want output to grow faster than normal. These types of tax changes are not motivated by a desire to return growth to the normal but raise the growth rate of potential output, regardless of boom-and-bust cycles. In addition, tax changes based on tax principles such as fairness, neutrality, and simplicity, such as those that emphasize small government and fairness, may also be based on the belief that such reforms will raise long-run growth. Since a detailed categorization of these motives and objectives would unnecessarily complicate the analysis, we will lump them together as tax changes with the objective of raising growth over the long term.

We construct quarterly time series data of exogenous tax changes from 1955 to 2014. These data are expressed as the change in projected revenue normalized by GDP. We date the tax changes according to when tax liability changed, not according to when firms and households recognize changes in tax[13]. This is consistent with literature that finds consumers are reactive to their current disposable income. To convert this specific date to the quarterly time series data, if the effective date is on or before the midpoint of the quarter, we assigned it to the quarter in question, and if it is after the midpoint, we assigned it to the next quarter [14]. In section 5, we will convert specific effective date to the quarter when consumers recognized tax changes, rather than to when liability changed.

This study expresses all revenue projection at an annual rate. In other words, we use estimated impact in the first full fiscal year after the change. This is because change in full year tax liabilities is more appropriate than quarterly tax collections reaching to exchequer. The projection of tax changes usually assumes that tax revenues do not affect levels of output. The change in projected revenue

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[11] For a definition of tax changes dealing with budget deficits, see Romer and Romer (2010), p. 770. Cloyne defined this kind of tax changes more restrictively. See Cloyne (2013), p.1512 for more on this point.

[12] For a definition of tax changes motivated by a desire to raise long-run growth, see Romer and Romer (2010), p. 770. Cloyne (2013) added two further types to Romer and Romer's definition of long-run growth: those based on political and philosophical ideologies, and those imposed by external parties such as the judiciary and international organizations.

[13] Romer and Romer (2010) assigned data on tax changes to the effective date of tax changes. This is consistent with the empirical work of Shapiro and Slemrod (1995), who investigated the response to the Bush administration's tax cuts. They found that consumers responded to changes in disposable income.

[14] See Romer and Romer (2010), pp. 770-771 and Cloyne (2013) p. 1513 for information on the methodology used to convert tax changes into quarterly data.

may not necessarily equal the effect of 1 percentage point change in actual, ex post, revenues to GDP. This is an unavoidable limitation of this type of research.

Retroactive component of tax changes is rare in Japan. Romer and Romer (2010) and Cloyne (2013) treat these components as one-time levies or rebate in the quarter the bill that included them were passed. While this treatment makes the shock data more volatile, they report that retroactive components have little effect on estimating the impact of tax changes on output. Japan's Supreme Court has often reviewed whether it is unconstitutional to change tax laws in the middle of a calendar year and apply the new rules from the beginning. They stated that the purpose of Article 84 of the Constitution, which stipulates the tax statutory principle, means that legal stability should be maintained[15]. Retroactive measures resulting from tax changes in Japan are rare in impact.

## 2.3 Result of the Narrative Analysis

To give a sense of how we classify tax changes, exhibits 1 and 2 reproduce two of our narrative summaries. Exhibit 1 illustrates an endogenous, countercyclical action, and Exhibit 2 illustrates an exogenous change to encourage long-run growth.

**Exhibit 1**

Narrative Analysis of a countercyclical Tax Change

**'Permanent tax cut' of 1999**

1999 Tax Reform "Law Concerning Measures to Reduce Burden of Income Tax and Corporate Tax that should be taken immediately in response to Changes in Economy and Society" (Law No. 8 of March 31, 1999)

1999Q2 -2.6 trillion yen (endogenous: countercyclical)
2006Q1 +1.25 trillion yen (endogenous: countercyclical)
2007Q1 +1.25 trillion yen (endogenous: countercyclical)

The 'permanent tax cuts' of 1999 tax reform intended to stop the recession and return economic growth to normal. In 1998, the Japanese economy recorded its first negative growth rate since the end of World War II, but in 1999, there was concern that negative growth would continue for two years. Prime Minister Hashimoto mentioned a permanent tax cut, not a temporary tax cut (press conference in Kumamoto city). After Hashimoto resigned, during the LDP presidential election, Keizo Obuchi said, "In order to restore the real economy, we must implement various policies. One of them is a permanent tax cut. I have given you 6 trillion yen as a pledge" (Tax Bureau memo). Prime Minister Obuchi made the following statement in his policy speech at the extraordinary session of the Diet (August 8, 1999). "We will consider restoring the economy as much as possible and implement a permanent tax cut that considerably exceeds 6 trillion yen." This policy statement was realized with the 1999 tax reform. At that time, the House of Representatives passed the "Law Concerning Measures to Reduce the Burden of Income Taxes and Corporate Taxes that Should Be Taken Immediately in Response to Changes in the Economy and Society" (Law No. 8 of March 31, 1999). It is defined as follows. To "contribute to the recovery of the current remarkably stagnant economic activity," tax cuts will be implemented "until a drastic review of the individual income tax is carried out." From this wording, it is a temporary tax cut that clearly considers the state of the economy and is not the 'permanent' tax cut that Obuchi made in his pledge. Therefore, this study classifies it as an endogenous, countercyclical tax cut.

Several government sources give information on the size of tax cuts. According to documents submitted by the government to the Tax Commission, tax cuts on income tax and inhabitant tax consist of two pillars: (1) a reduction in the maximum tax rate of 0.5 trillion yen, and (2) a fixed-rate tax cut of 3.5 trillion yen (national

[15] For an interpretation of the tax jurisprudence in Article 84 of the Constitution, see Yoshihiro Masui(2014).

tax of 2.6 trillion yen and local tax of 0.9 trillion yen). It was decided to be implemented in of these, the fixed-rate tax cut was implemented with a 20percent tax credit for income tax and a 15percent tax credit for inhabitant tax. The fixed-rate tax cut started in 1999Q2, but the timing of its abolition was decided in consideration of the economic situation. In its November 2004 report, the Tax Commission stated, "The current economic situation is markedly turned around than in 1999, when the fixed-rate tax cuts were implemented, as structural reform progressed, and the strength of the private sector economy was being strengthened. Under these circumstances, the need to continue the fixed-rate tax cut has decreased significantly. The fixed-rate tax cut should be abolished by fiscal 2006." Actual progress has been made according to this proposal. From January 2006, the fixed-rate tax cut was halved to one-half, and in January 2007 it was abolished. Each of these amounts to a substantial tax increase of 1.5 trillion yen.

Several sources of the tax reform stipulate that tax cuts are temporary measures "until a drastic review of the individual income tax" is carried out. Income tax and inhabitant tax cuts took the form of fixed rate across the board tax breaks. The Government Tax Commission gave a positive evaluation to the fact that it took the form of a fixed-rate tax cut as follows, "fixed-rate tax cuts can reduce the tax burden smoothly for all income classes and maintain the equity among taxpayers ("Report on the tax reform in 1999" pp.6-7).

**Exhibit 2**

Narrative Analysis of a Long-Run Tax Change

**Annual tax cuts in 1950s and 1960s**

1953Q2 -86.5billion yen (exogenous, long-run growth)
1954Q2 -23.3 billion yen (id.)
1955Q2 -23.4 billion yen (id.)
1956Q2 -15.1 billion yen (id.)
1957Q2 -109.2 billion yen (id.)
1959Q2 -37.2 billion yen (id.)
1961Q2 -63.1 billion yen (id.)
1962Q2 -41.4 billion yen (id.)
1963Q2 -27.7 billion yen (id.)
1964Q2 -62.0 billion yen (id.)
1965Q2-80.2 billion yen (id.)
1966Q2-132.0 billion yen (id.)
1967Q2-108.4 billion yen (id.)
1968Q2-105.0 billion yen (id.)
1969Q2-150.3 billion yen (id.)
1970Q2-246.1 billion yen (id.)
1971Q2-166.6 billion yen (id.)
1972Q2-253.0 billion yen (id.)
1973Q2-315.0 billion yen (id.)

The annual income tax cuts during the double-digit growth period were exogenous tax changes motivated by a desire to raise long-run growth. In the 1950s and 60s, the Japanese economy achieved a growth rate of more than 15percent. The annual tax cuts were not motivated by a desire to return output growth to the normal. The rationale for the tax cut was the need to eliminate fiscal drag, so the economy could growth faster than the normal. The tax bureau of ministry of finance's documents states the evidence of fiscal drag. "Comparing the income tax burden with the prewar period, it increased 6.25 times in 1956. This is explained by the fact that the number of taxpayers, who were only 940,000 before the war, increased 11 times to 11.01 million. Before the war, the amount of tax paid was concentrated among the highest-income earners, but in 1956 it became skewed toward the low- and middle-income earners, increasing the sense of heavy taxation" (Explanation Concerning Income Tax Deductions and Tax Rates, 1956. September 10, 2010").

If this tax revenue increase was not return to taxpayers, the largest barrier to high growth is a heavy drag of tax on private purchasing power, initiatives, and incentives. The report of the Extraordinary Tax Commission in 1956 states the harmful effects of excessive income tax burden. "Individual income tax undermines the risk-bearing preparedness of life. …The high tax burden and its progressive rate schedule hinder the willingness of the people to work, start a business, and increase productivity. …There is a general tendency to try to avoid income tax by various means."

The idea of excessive income tax has been consistently maintained since then, and was firmly removed through annual tax cuts in the 1960s. A long-term report issued by the Tax Commission in 1968 states, "If the rapid rise in income levels continues, it cannot be overlooked that more income is taxed at a higher rate" and proposes "raising the thresholds for taxable income to 1 million yen for family with three children, expansion of income deduction for salaried workers". It also states, "If the public sector expands too rapidly, it will increase the tax burden, unduly suppress the activities of the private sector, and adversely affect economic development." Fiscal drag also occurs when tax thresholds and allowances do not keep up with inflation. Since 1962 to 1971,these thresholds were uprated each year in line with the previous CPI inflation rate.

Because the annual tax cut was motivated by a desire to raise long-run growth and not by concern about current cyclical conditions, we classify it as exogenous tax changes, long-run changes.

Several government sources give information about the size of tax cuts. Estimates on the size of tax cuts in the document by the Tax Commission (May 1972) are given at the beginning of this exhibit. Income tax cuts have been implemented in all years except 1958 and 1960. It was implemented almost every year using about one-third of the total natural tax increase. As a numerical target for tax reduction, the Tax Commission set a target of lowering the ratio of taxpayers to 50percent of the working population ("Report on Tax Reform in 1966"). This implies that the tax-GDP ratio would be kept at around 20percent over the long term.

Income tax cuts took the form of raising the threshold for taxable income and reducing the burden on low-income earners. Apart from two years in which no income tax cuts were made at all, the income deductions have been increased each year. The only exception to this was the '100-billion-yen income tax cut' in 1957. The tax cuts at this time focused on lowering the marginal tax rate, easing the tax rate for low- and middle-income earners.

# 3 Overview of the new dataset

## 3.1 Exogenous tax changes

Following the David and Christina Romer-type of narrative approach, we analyzed ninety-five tax reforms enacted between 1955 and 2014 using documentation of the policy-making process. Of these, we identified 486 individual tax changes items; 302 were exogenous tax changes and 184 were endogenous tax changes. In addition, 129 of the endogenous changes were countercyclical and fifty-five were spending-driven. Exogenous changes include 219 tax actions motivated by a desire to raise long-run growth and 83 deficit-driven tax changes.

The first step in using new data set is to discuss some of its properties. Our estimate of the revenue effect of exogenous tax changes are in nominal term. To put the value on consistent basis, we express each revenue effect as a percentage of nominal GDP in the quarter the change took effect. Figure 1A shows new dataset of exogenous tax changes since 1955. The graph shows that there have been both positive and negative tax changes throughout the postwar era. Certain eras, however, have seen frequent changes. The 1950s to early 1970s, and the later 1970s. Quarterly changes of 0.2 to 0.3 percent of GDP have been common. The largest quarterly exogenous tax change was a cut in taxes of nearly 0.8 percent of GDP in 1974Q2[16].

Figure1B shows the two types of exogenous tax changes, those for deficit reduction and those for long-run growth, separately. As expected, most tax changes of long-run growth were tax cuts. The 1950s to early 1970s have seen annual income tax cuts keeping tax-to-GDP ratio at 20 percent[17]. The most significant tax cuts to raise long-run growth are well known: the 1957 Ishibashi tax cut[18],

[16] See, Office of Fiscal History, Policy Research Institute, Ministry of Finance (2003),pp.153-159.
[17] See, OFHPRI (1990),pp.125-135 for the overview.
[18] See, OFHPRI (1998),pp.110-111 for the overview.

the 1974 Tanaka tax cut[19], and the 1989 Takeshita tax cut as a part of full-scale reform since the Report on Japanese Taxation by C. Shoup Mission[20].

**Figure 1A. All exogenous tax change**

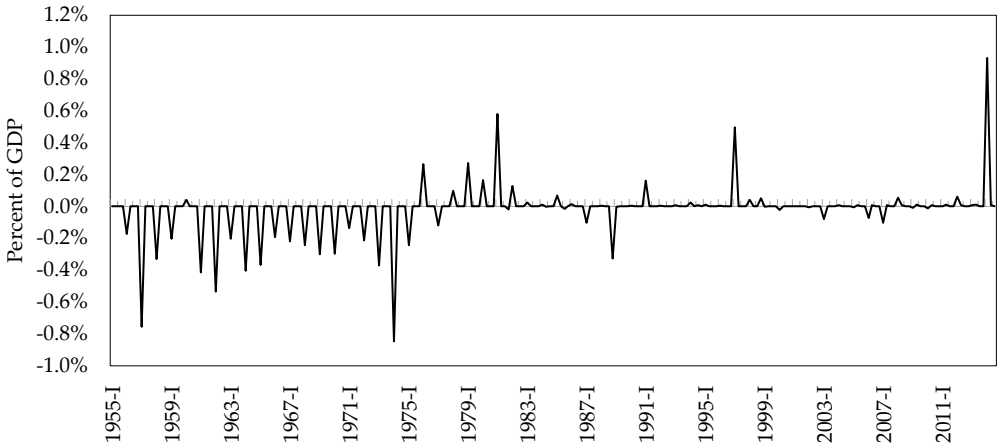
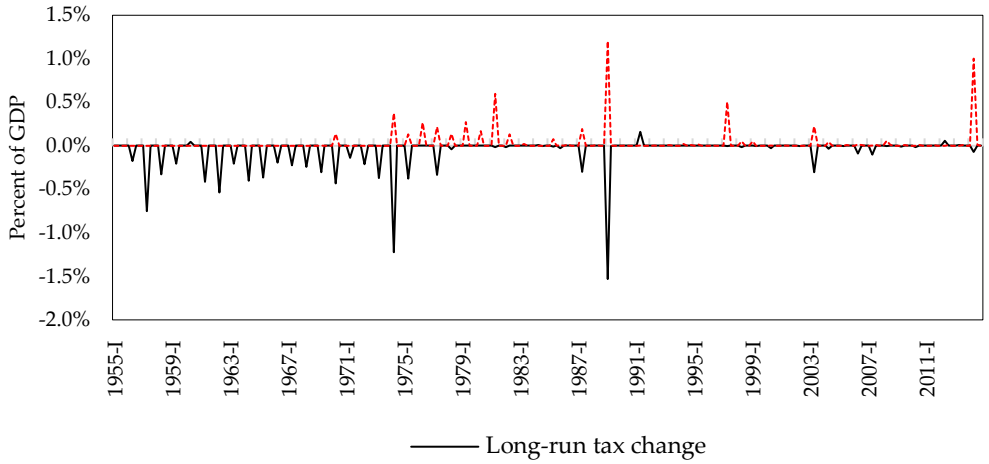



**Figure 1B. Long-run and deficit-driven tax change**




It is necessary to state here why we classify the annual income tax cuts as exogenous tax changes for long-run growth. Fiscal drag occurs when tax thresholds and allowances do not keep up with inflation or wage growth, resulting in more of a taxpayers' income being taxable[21]. This can also mean that more income is taxed at a higher rate or more taxpayers are 'dragged' into paying tax at a higher rate. This was a case for Japan in high growth era. Tax revenues tend to increase over time as tax allowances and thresholds are not indexed to prices, and earnings have historically increased by more than prices. The number of taxpayers, which was only 940,000 before the war, increased eleven times to 11 million. If this tax revenue increase was not return to taxpayers, the largest barrier

[19] See, OFHPRI (2003),pp.153-159 for the overview.
[20] See, OFHPRI (2003),ch.3 for the overview.
[21] For definition of fiscal drag, see Masala (2022).

to high growth is heavy drag of tax on private purchasing power, initiative, and incentive. Postwar Japan's policy of annual income tax cuts can be regarded as a kind of fiscal dividend, which remove from private economy heavy drag of tax[22].

All deficit driven tax changes were tax increases. The figure1B makes clear that they were most prevalent in the late 1970s to early 1980s. Both the personal allowance and the basic rate of income tax were indexed to CPI inflation in these eras, the government raised corporate income tax and liquor tax almost every year to finance tax cut[23]. We find no action in 1950s and 1960s for which primary motivation was dealing with inherited budget deficit. The largest deficit driven tax increases were those contained in the Tax Bills of 1989, and Tax Bills of 1994, and Tax and Social security Act of 2012. The first was Takeshita-era measure which introduced a full-scale value-added tax for the first time after the war[24]; the second was 1997 Hashimoto VAT hike that was announced 30 months earlier in September 1994[25]; the third was 2014 Abe VAT increase, announced in 2012 by DPJ-led government but had been postponed twice[26].

## 3.2 Endogenous tax changes

Figure2A shows our series of endogenous tax changes. The graph shows that while endogenous tax changes occur throughout the postwar era, there were major tax actions after 1990 and almost rare before them. Figure2B shows two subcategory of endogenous tax changes, countercyclical and spending-driven, separately. Heyday of countercyclical tax changes was 1990s. There were only two actions before them for which the primary motivation was a desire to return growth to the normal. The largest countercyclical tax changes were the 1994-96 Murayama tax cuts[27] and 1998-1999 Hashimoto-Obuchi tax cuts[28]. We find, however, that countercyclical motives were present for 1965 tax cut[29] and 1971 tax cut[30]. The former tax cut was implemented in the year following the issuance of government bonds for the first time after the war. The latter is related to the 1971 'Nixon Shock' and the adoption of the floating exchange rate system.

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[22] Ishi points out that 'year after year income tax cut' was a kind of fiscal dividend. See, Ishi(1976)pp.368-369. Ihori also points out that 'year after year income tax cut' had significant effect of increasing the warranted rate of growth stimulating economic activity from the supply side. See, Ihori(2001)pp.63-64.
[23] See, Ishi (2008)ch.11 for the overview.
[24] See, OFHPRI (2003)ch.3 for the overview.
[25] See, Ishi, op.cit.,ch.16 for the overview.
[26] See, Mochida (2019)pp.24-41 for the overview.
[27] See,Ishi,op.cit.,pp.611-613 for the overview.
[28] See,Ibid.,pp.631-638 for the overview.
[29] See, OFHPRI(1990)pp.309-329 for the overview.
[30] See, Ibid.

**Figure2A. Endogenous and all legisrated tax change**

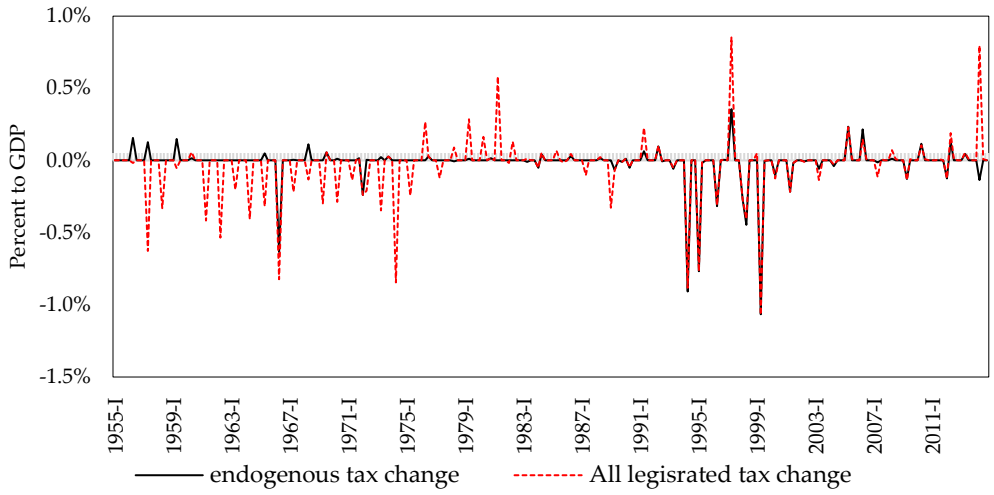
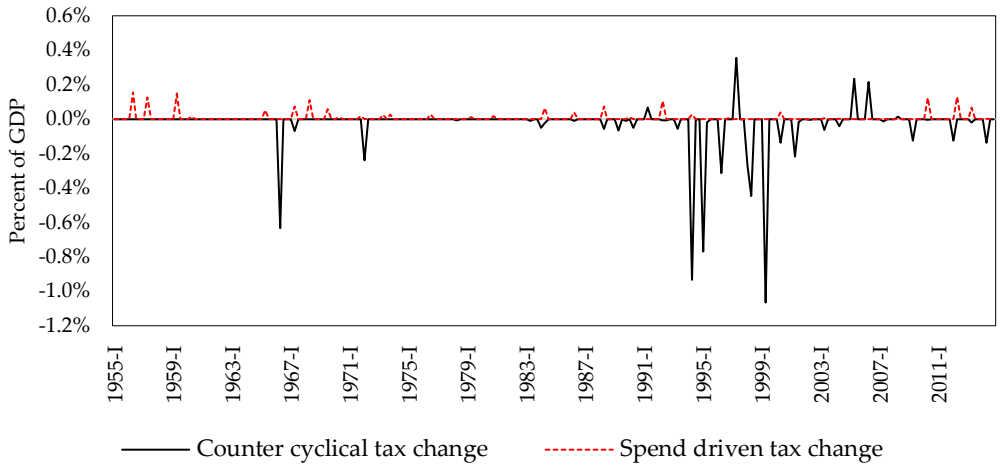



**Figure2B. Countercyclical and spending driven tax change**




Spending driven tax changes were always tax increase, but its size was small. A large fraction of the spending driven tax changes were related to Social Security benefits. Those were tax increase specifically tied to contemporaneous increase in benefits that were indexed to wage increase. The starting point of indexation was 1973 Tanaka cabinet's Pension Reform. However, there were numerous tax increase uncorrelated with social security benefit[31]. These were taxes for specific purpose such as construction of loads, airports.

[31] See, OFHPRI(2003)ch.1-2.

# 4. The impact of tax changes on output

## 4.1 Distributed lag model

We use the distributed lag model to estimate CDM of exogenous tax changes on GDP growth[32]. We focus on reduced-form of relationship between tax changes and output. Starting specification is quite simple. Following specification (5) is the same as specification (2), but the order of the lag is truncated at 12.

$$\Delta y_t = \mu + \sum_{j=0}^{12} \gamma_j d_{t-j} + v_t \qquad (5)$$

We take three steps in preparation for estimating distributed lag model. First, change in output is not a useful predictor of exogenous tax change, controlling for other variables. Given current and past values of $d_t$, the estimator is consistent only if the conditional mean of the error terms is zero. In other words, $d_t$ must be uncorrelated with the error term.

$$E\left(v_t \middle| d_t, d_{t-1}, d_{t-2,\ldots.}\right) = 0 \quad (6)$$

For the OLS estimator of distributed lags to be consistent, the tax change must be an exogenous variable. This assumption is valid because we identified exogenous tax changes using documentary evidence of the policymaking process in Section 3.2. However, one cannot completely deny the possibility that exogenous tax changes are influenced by prospective of the state of the economy. To confirm that the exogenous tax changes newly identified are not endogenous variables, it is prudent to estimate a vector autoregressive model (VAR) and perform Granger's causality test. The VAR was estimated with two variables: exogenous tax change and GDP growth. We then statistically tested the null hypothesis that 'output change is not a useful predictor of exogenous tax change, controlling for other variables' (Granger's causality test). The null hypothesis could not be rejected even at the 10percent level with a p-value of 0.107. In other words, we found no evidence that the exogenous tax shocks we identified in the documented policy-making process are reactive to prospective of the state of the economy. Using these exogenous tax changes, we can estimate the OLS coefficients in the distributed lag model and approximate the effect of dynamic causality.

Second, to obtain confidence interval, we estimate standard error that takes account of heteroscedasticity and autocorrelation. The error term in a distributed lag model is suspicious of serial correlation, as discussed in section 2.1. The OLS standard errors are not guaranteed to be consistent and make hypothesis tests and confidence intervals imprecise. One should use HAC

[32]Dynamic multiplier implies that different treatments (randomly assigned tax changes) have been applied to the same entity (the Japanese economy) at different points in time (one quarter, two quarters, etc.) and then performing OLS estimation to see how the effects of each treatment change over time. For more information on this point, see Stock and Watson(2007).

standard errors that take account of heteroscedasticity and autocorrelation. The truncation parameter for the Newey West standard errors was selected using the rule $m = 0.75T^{1/3}$. Since we now have acquired 245 quarterly observations, the rule becomes $m = 4.695$. $m$ is an integer, the fraction is rounded to $m = 5$. The effect of changing the truncation parameter on the results will be discussed in section 4.3.

Third, we regard 1973Q2 as the period of structural break. To assess the stability of the dynamic multiplier, we check beforehand whether the coefficients of the distributed lags are constant over time. Since there are no specific candidates for the timing of structural break, we used the Quandt Likelihood Ratio (QLR) statistic to test for changes in the regression coefficients. The QLR statistic (cutting the sample ends by 15percent and using the HAC variance estimator) was calculated for all coefficients of the model in column (1) and gave a maximum value of 85.6 with q = 14 degrees of freedom. Since the critical value of the QLR statistic is 40.68 at the 1percent level, we rejected the null hypothesis that these QLR statistics show no structural break at the 1percent level. For this reason, the second quarter of 1973, when the F-statistic is at its maximum value, was regarded as the period of structural break. For the following estimations, we created a dummy that takes 1 for the 1st quarter of 1955 to the 2nd quarter of 1973 and 0 otherwise and combined the specifications into one.

## 4.2 Baseline estimation

Baseline estimation suggest that changes in tax levels have a long and significant impact on economic activity. Table 1 of Appendix shows the estimation of equation(5), using our exogenous tax changes as well as all legislated tax changes and endogenous tax changes. A 1percent of exogenous tax changes cause a 1percent decline in GDP growth on impact. The effect remains near zero until its sixth quarter but becomes negative from the seventh quarter onward[33]. The information of table 1 is conveyed more effectively when they are shown in a graph. Figure 3A shows cumulative dynamic multiplier with one HAC standard error band [34]. Following exogenous tax changes, CDM remains near zero until the sixth quarter but becomes negative after the 7th quarter, peaking at -2.66 percent. The CDM is significantly different from zero. The baseline results of this study are surprisingly close to Romer and Romer's (2010) results for the US (-3 percent) and Cloyne's (2013) results for the UK (-2.5 percent). Since most of our exogenous tax changes are in fact reduction, the

[33] The effect of a one-unit change in X on Y after period h implies the dynamic multiplier of period h. Simultaneous dynamic multipliers means impact effects.

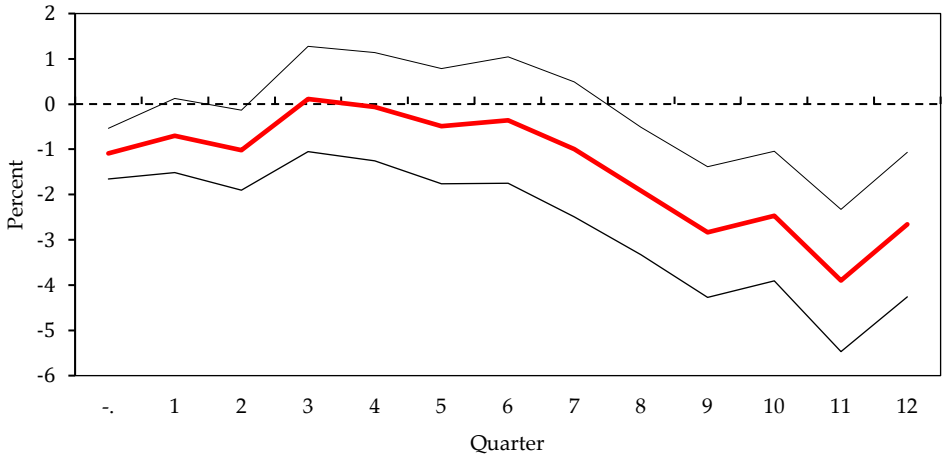
[34] CDM measures the cumulative effect of $d_t$ on $\Delta y_t$ over a period of h. In equation (7) and (8), $\gamma_1 + \gamma_2 + \cdots + \gamma_{h+1}$ is the CDM of $d_t$ on $\Delta y_t$.

$\Delta y_t = \delta_0 + \delta_1 \Delta d_t + \delta_2 \Delta d_{t-1} + \delta_3 \Delta d_{t-2} + \cdots \delta_r \Delta d_{t-r+1} + \delta_{r+1} X_{t-r} + u_t$ (7)

$\delta_0 = \mu, \delta_1 = \gamma_1, \delta_2 = \gamma_1 + \gamma_2$ (8)

more intuitive way to express this result is that tax cuts have very large and persistent positive output effects.

**Figure3A. Estimated Impact of an exogenous tax increse of 1 percent of GDP on GDP (single equation, no controls)**




Definition of tax changes matters. Using endogenous tax changes or all legislated tax changes obscures the effects of tax changes on the economic activity. Figure 3B shows CDM using alternative measure of tax changes caused by changes in policy: all legislated tax changes (sum of endogenous and exogenous tax changes) . The behavior of output following all legislated tax changes is smaller than following exogenous tax changes and not significant. For exogenous tax changes, the point estimate of largest drop was a -2.66 percent, while for all legislated tax changes was only -1.22percent ($t = 0.1$). It is easy to assume that this bias stem from inclusion of endogenous tax changes. Consider the behavior of output following an endogenous tax change. Figure 3C shows that the effect of endogenous tax changes on the path of GDP is small and not significant. The point estimate of the largest drop is only -0.48percent (t=0.33). The tentative estimation results so far suggest the following two points. First, changes in tax levels have a long and significant impact on economic activity. Exogenous tax changes, which are not motivated by the state of the economy, have a large and significant impact on economic activity. Second, definition of tax changes matters. Using endogenous tax changes or all legislated tax changes obscures the effects of tax changes on the economic activity.

## 4.3 Robustness

Next, we check the robustness of the estimate from three perspectives: identification of HAC standard errors, the effect of outliers, and controlling of omitted variables (the state of the economy, government spending).

**Figure4A Esimated impact of an exogenous increase of 1 percent of GDP on GDP (number of trancation parameter=10)**

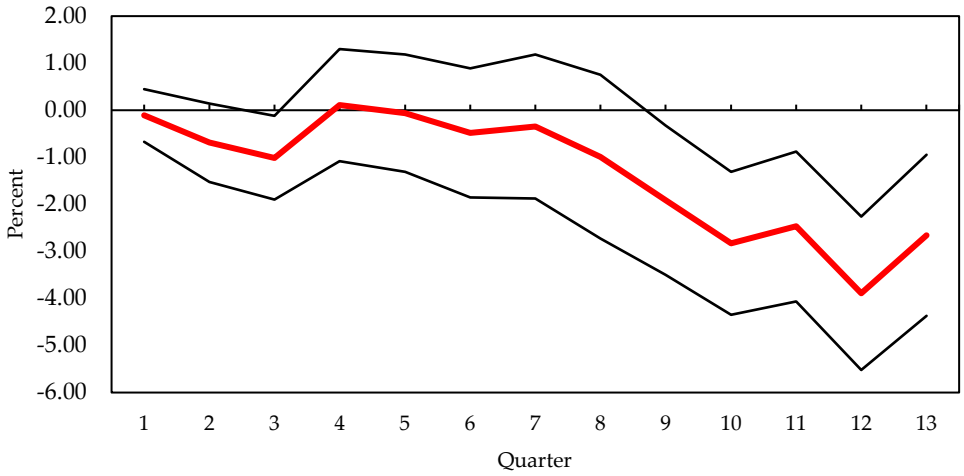
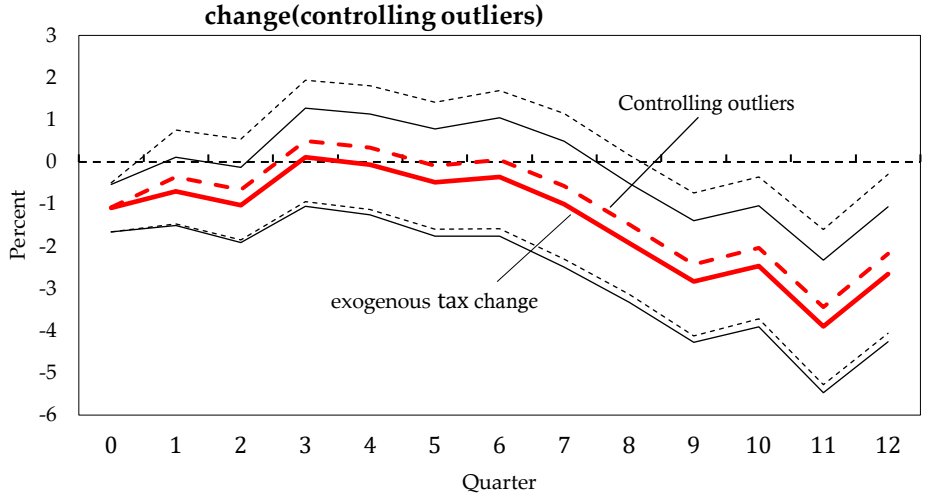



**Figure4B Using the change in exogenous tax change(controlling outliers)**




First, Newey West standard errors does not depend on the choice of HAC truncation parameter. Figure 4A shows the results when we used $m = 10$, i.e., double the value shown in Table 1 colum2. Since the regression model itself is same, the estimated coefficients and dynamic multipliers are identical. The estimated coefficients and dynamic multipliers are the same, i.e., only the standard errors are different, but not significantly so. Accordingly, the estimated results are not affected by changes in the HAC truncation parameter.

Second, outliers of exogenous tax changes do not affect the baseline estimation. Here, we estimate a model with a dummy variable for each of the four samples. Dummies are attached in the data for 1957Q2, 1974Q2, 1981Q2, and 1997Q2, all of which capture large-scale changes. The estimation results, shown in Figure 4B, show that these outliers do not affect them. Initially, CDM

for output hovers around zero, but GDP growth declines after the 7th quarter, with the largest decline occurring in the 11th quarter. The largest CDM is -3.44percent ($t = 1.87$). This is about 0.4percent lower than the baseline estimation, but the impact is similar over time.

**Figure4C. Estinmated Impact of an exogenous tax increase of 1 percent of GDP on GDP (single equation, controlling for lagged GDP growth)**

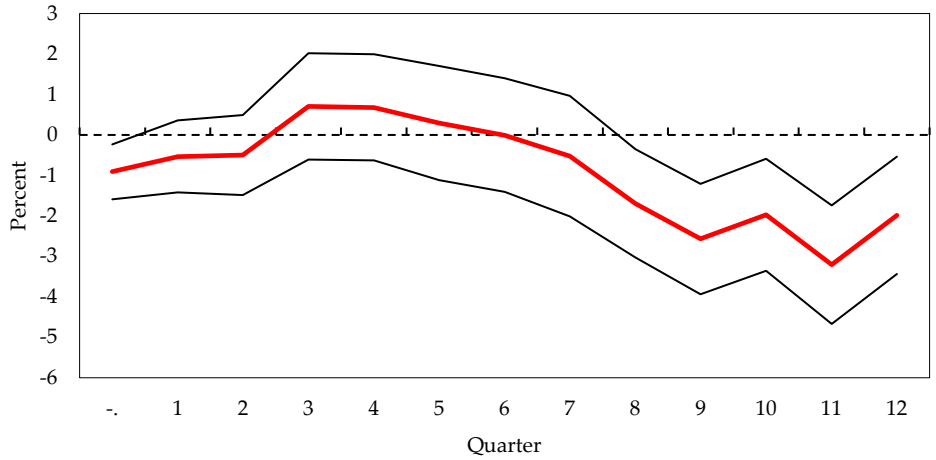
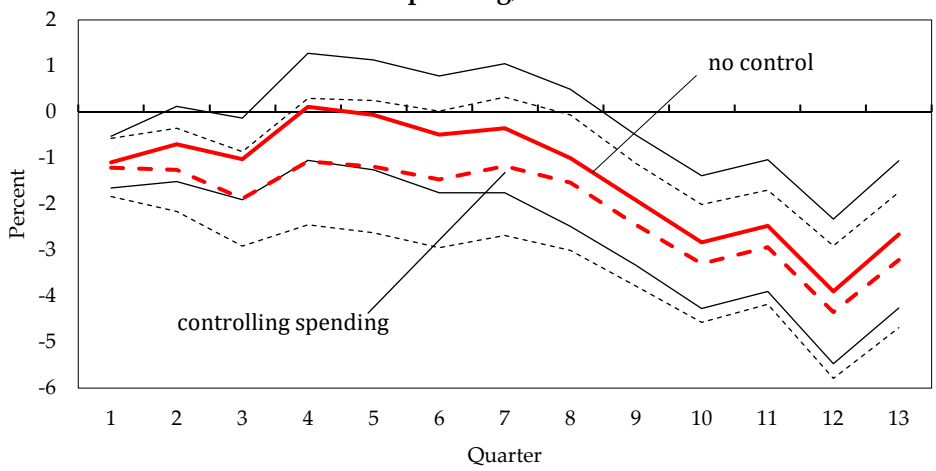



**Figure 4D using Exogenous tax change(controlling government spending)**




Third, baseline result does not change significantly with controlling omitted variables. Since omitted variables are suspected to be included in error term, and the error term will have a positive autocorrelation. The first candidate for an omitted variable would be the lagged term of the GDP growth rate. Figure4C shows the results of the autocorrelation-distributed lag model (ADL(12,12) ): CDM when the lag term of the GDP growth rate is included as an explanatory variable are broadly like those obtained otherwise. Initially, the effect on output is small and fluctuates around zero. Then, the GDP growth rate declines from the second half of the second year, and the largest drop is

recorded in the third year. Controlling for the state of the economy does not significantly affect the estimation results.

Another potential omitted variable is government spending changes. Since we identified exogenous tax changes using documentation of the policymaking process, there is no need to control for government spending. However, if the government spending is included in the error term, the correlation between the two cannot be eliminated. For example, deficit driven tax changes are only sometimes implemented in isolation but are often combined with spending cuts. Here, we define changes in government spending as the actual change in spending minus interest payments divided by real GDP and including a lag term up to period 11. Figure 4D shows the effect of an exogenous tax changes on GDP when controlling for government spending. The dynamic multiplier was not significant in the first two years, but the cumulative effect became significantly negative after the third year, peaking at -3.3percent in the 11th quarter (t=-2.57). It is significantly different from zero. Controlling for government spending and its lag term does not significantly affect CDM.

# 5. Extending the model

So far, our results suggest that exogenous tax increases have a strong negative effect on output. An obvious question is whether we can go beyond the reduced-form results and shed light on how or why tax changes have such pronounced effects. Does tax changes for long-run growth and deficit-driven has different impact on the trajectory of GDP growth? What is transmission channel in which exogenous tax change affect components of GDP, such as consumption, and investment[35]. Do consumers respond to tax changes at the time of announcement or at the time of implementation? To answer these questions, this section extends previous starting specifications in three directions.: dividing tax changes into subcategories, the effect of expectation and transmission channels through which tax changes affect GDP growth.

## 5.1 Dividing into subcategories

We found that countercyclical tax changes have little or no effect of returning the economy to the normal. Endogenous and exogenous tax changes encompass multiple types of tax changes. First, divide endogenous tax changes into two types: countercyclical tax changes and spending-driven tax

[35] To understand the impact of tax changes on economic growth, one should consider the distortions arising from them. The distortion in labor supply caused by income taxes constrains growth. Bessyo and Hayashi (2015) estimated the Social Marginal Cost of Public Funding (SMCF) using micro data on Japanese households for 1997. They found that the SMCF associated with a 1 percent increase in the marginal tax rate becomes smaller as one moves from lower to higher income brackets. They argued that the Japanese government's 1999 tax reforms should have made the tax system more progressive.

changes and trace the impact of each on trajectories of output.

**Figure 5A: Using countercyclical tax change**

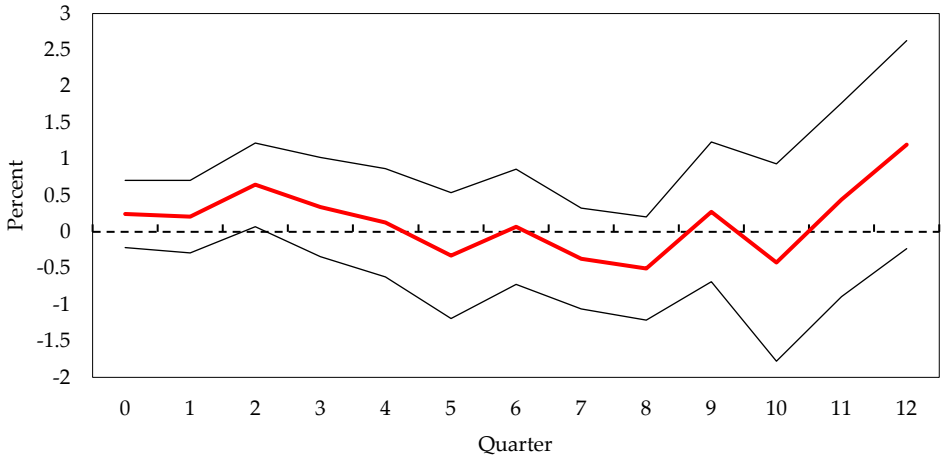
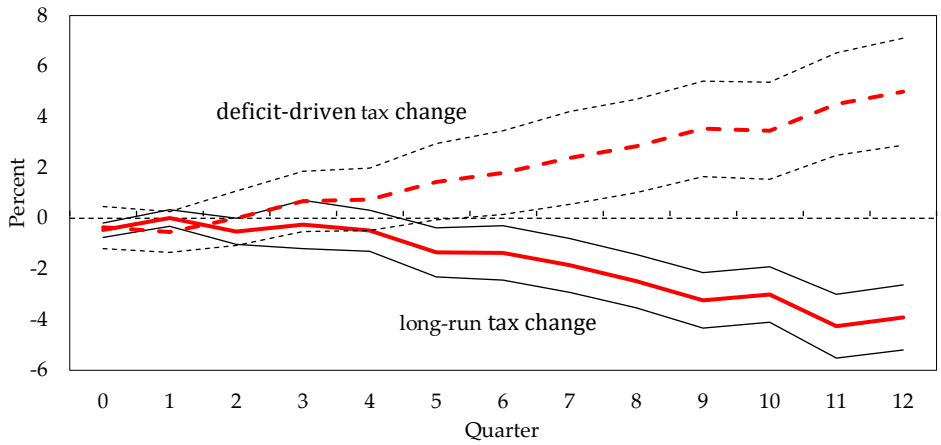



**Figure 5B:Using long-run and deficit driven tax change**




Looking at CDM of countercyclical tax changes on GDP, figure5A shows that the effect is quite different from that of exogenous tax changes. CDM consistently fluctuates around zero and is not statistically significant. There is discretionary response of countercyclical tax policy to unexpected contemporaneous movement in economic activity. Response of government leads to simultaneous causality, but even with that in mind, there is little evidence that countercyclical tax changes have had a positive effect on returning economy to the normal[36]. This is consistent with literature that find the impact of temporary tax changes on Japanese consumer is significantly smaller than the impact

[36]The impact on consumption differs between temporary and permanent tax cuts. According to the permanent income hypothesis, the impact of temporary tax cuts is small. This is consistent with Japan's experience: the temporary tax cuts of 1994-1998 were large but had insignificant impact on consumption. Therefore, in 1998, the Obuchi administration implemented a permanent tax cut. For more information, see Watanabe et al. (2001).

of permanent changes[37]. The effect of spending-driven tax changes is not reported here because they are not statistically significant.

Tax changes for long-run growth and deficit-driven has different impact on the trajectory of GDP growth. We divide the exogenous tax changes into two categories: tax changes for long-run growth and tax changes for dealing with inherited budget deficit. Figure 5B shows the estimation results. Following tax changes motivated by a desire to raise long-run growth, GDP growth remains near zero until first year, then starts to decline with largest drop recorded in third year. The point estimate of largest drop is -4.25 percent and significant (t=-3.38). This result suggests that tax cuts(increases) for long-run growth have a large, persistent positive(negative) impact on output. For tax increase to deal with an inherited budget deficit, the results are quite interesting. Following tax changes motivated by dealing with inherited budget deficit, output initially falls slightly, then a long-lasting upward trend continues, with the largest increase of 4.9percent (t=2.36) recorded in the third year (see Figure 5B). This analysis implies that tax changes for dealing with budget deficit will initially restrain economic activity, but GDP turns to increase after second year. See Section 5.3 for the detail reason of this interesting facts.

## 5.2 The transmission channels

The induced form results so far suggest that tax changes for long-run growth and deficit-driven has different impact on trajectory of GDP growth respectively. Tax changes for long-run growth have negative CDM, while deficit-driven tax changes have positive CDM on output. To understand these differences, now we focus on transmission channels through which exogenous tax changes affect component of GDP, such as consumption and investment.

Figure 6A shows that exogenous tax shock depresses consumption consistently with largest drop of -5.62percent. The point estimate is significantly different from zero (t=-2.73)[38]. Figure 6B suggests difference among CDMs on corporate investment and residential investment. Inventory investment is not reported here. Following exogenous tax changes, corporate investment increases on impact, but then weakens rapidly, dropping to around 1percent. The point estimate is not significantly

[37] Watanabe et al.(2001),pp.270-275.

[38] To demonstrate the impact of tax changes on investment, it is necessary to consider the cost of capital including tax(the marginal effective tax rate).The tax wedge is the deviation between the cost of capital including taxes and the cost of capital excluding taxes. Many studies have been conducted in Japan on the marginal effective tax rate, including Iwata, Suzuki, and Yoshida (1987) and Tajika and Yui (1998). Notably, Hayashida and Uemura (2010) measured the marginal effective tax rate using micro data and estimates impact on investment. They found that since the beginning of the 2000s, its impact on the marginal effective tax rate has become largely insignificant. Empirical analyses of capital investment and corporate taxation include studies based on the tax-adjusted Tobin's Q. See, Iwamoto (1992).

far from zero (t=0.3). Residential investment decline consistently, dropping to -7.8percent, which is not significantly far from zero (t=-0.94). Estimate using new exogenous tax series suggests that the adverse effect of tax on investment is not significant. These findings suggest that exogenous tax changes have a negative CDM on output with the transmission channels of consumption rather than investment. Since most of our exogenous tax changes are in fact reduction, this result suggests that post war Japan's annual income tax cuts removes from private economy heavy fiscal drag on private purchasing power.

**Figure6A: Consumption**

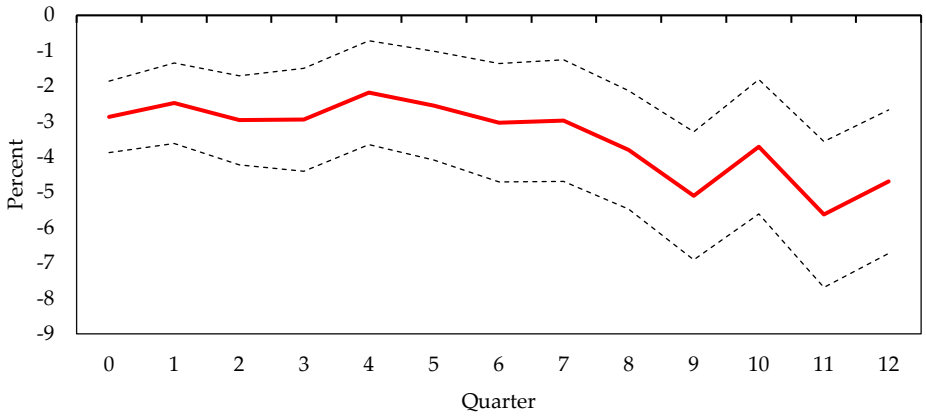
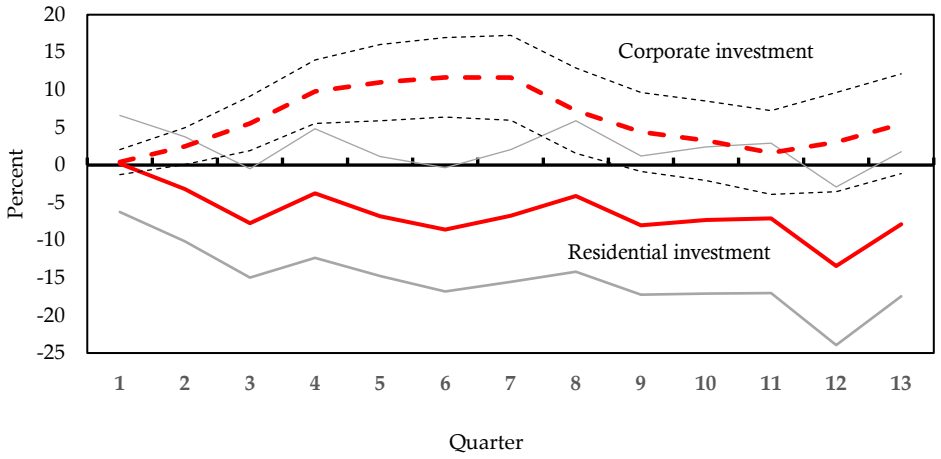



**Figure 6B: Corporate and Residential Investment**




The transmission channels where deficit driven tax changes affect output differ from those of exogenous tax changes. Section 5.1 suggested that following deficit driven tax changes, output initially falls slightly, but then a long-lasting upward trend continues for more than a year, reaching a peak of 4.5percent. Figure 7A shows that consumption declines initially following deficit driven tax changes, but then a long-lasting upward trend continues, reaching a peak of 3.45 percent. But the estimator is not statistically significant (t=1.21). Figure 7B suggests that CDM on corporate

investment and residential investment is quite different. Corporate investment increases cumulatively by 11.3 percent (t=1.9) , while residential investment falls sharply over the long run, with the largest drop of -21.8 percent (t=-2.18). These findings suggest that deficit driven tax changes have positive impact on corporate investment, but negative impact on residential investment.

**Figure7A: Consumption**

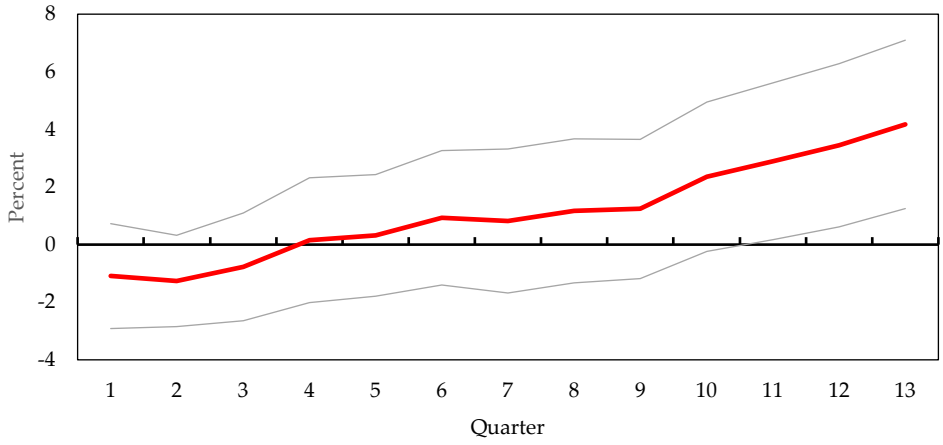
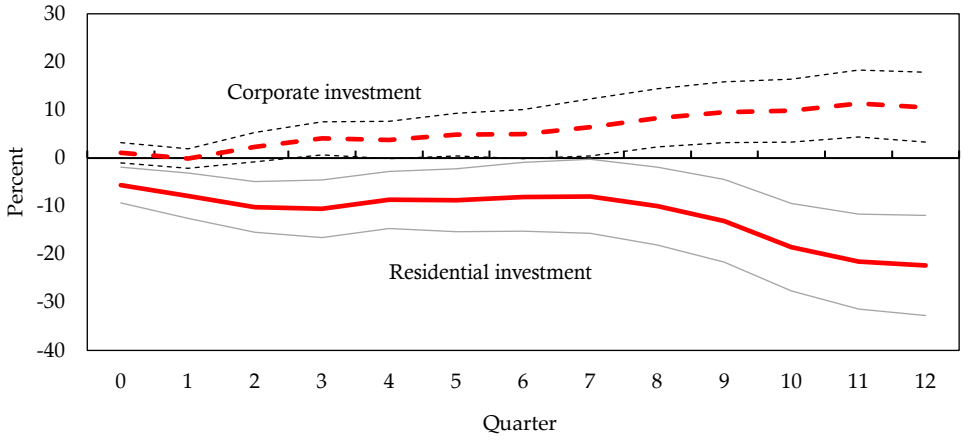



**Figure7.B Corporate and Residential Investment**




This section analyzed how exogenous tax changes affect GDP through which transmission channels, but the results are rich in nuances. In short, exogenous tax shocks have negative impact the GDP trajectory, with consumption as the main transmission channels. In other words, tax cuts motivated by a desire to raise long-term growth have a positive effect on consumption, thereby increasing GDP. On the other hand, deficit-driven tax changes have a negative effect on residential investment but has a positive effect on corporate investment, thereby increasing GDP.

## 5.3 The effects of expectation

So far, we regress change in output to exogenous tax changes dated in the quarter they took effect. This strategy is appropriate, as consumer decide consumption considering current income. Several empirical analyses have been conducted on this point[39]. This does not imply, however, that expectation effects are entirely absent. Under the permanent income hypothesis, consumer react to the announcement of tax bill, but they do not react to tax changes dated in the quarter they took effect. Japan's 1993-1998 experience is an experiment assessing the prophecies of the permanent income hypothesis: the consumption tax was increased in April 1997, but the tax hike was announced 30 months earlier, in September 1994. If the permanent income hypothesis is correct, consumption should have declined in September 1994 and must remain unchanged in April 1997[40]. The expectation effect may have the opposite impact on output. The passing of a tax increase bill may improve people's expectations about the fiscal health of the economy, increasing confidence and stimulating consumption. News of changing marginal tax rate could stimulate consumption through the intertemporal substitution effect of labor supply. These factors have an opposite, i.e., positive impact on output to that of the permanent income hypothesis.

Concerning to the expectation effect of future tax changes on output, we use the present discounted value of tax changes in the quarter of announcement. The discount rate used is 3percent, but the challenge is the timing at which consumer recognizes future tax changes. In Japan, most tax reform bills take the form of cabinet bills. In the case of the Income Tax Law and the Corporation Tax Law, the Taxation Bureau of the Ministry of Finance prepares the drafts, and the government's Tax Reform Proposal is officially announced. In January of the following year, the Cabinet decides on the outline of the draft law and submits the bill to the Diet. Amendments to the bill are rare, and the Diet usually passes the bill at the end of March. Here, we use the present discounted value of the tax changes in the quarter when the Tax Reform Proposal is officially announced.

$$\Delta y_t = \mu + \sum_{j=0}^{12} \gamma_j d_{t-j} + \sum_{j=0}^{12} \delta_j d^e_{t-j} + v_t \qquad (6)$$

Expanded specification(6) includes not only the exogenous tax changes in the quarter tax changes took effect ($d_t$), but also discounted present value of tax changes ($d^e_t$) in the quarter of announcement and its twelve lags. Using this expanded specification, we test for expectation effect.

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[39] In this regard, see Shapiro and Slemrod (1995). They found that consumers respond to their current disposable income.

[40] Consumption fell sharply in April 1997, and the consumption tax hike was one of the factors that caused Japan's economy to fall into a serious recession. See Watanabe et al. (2001) on this point.

The results of this analysis confirm that investments respond to deficit driven tax changes at the time of announcement, while consumers respond to tax changes for long-run growth at the timing of their implementation.

**Figure8.A Using Exogenous Tax Changes**

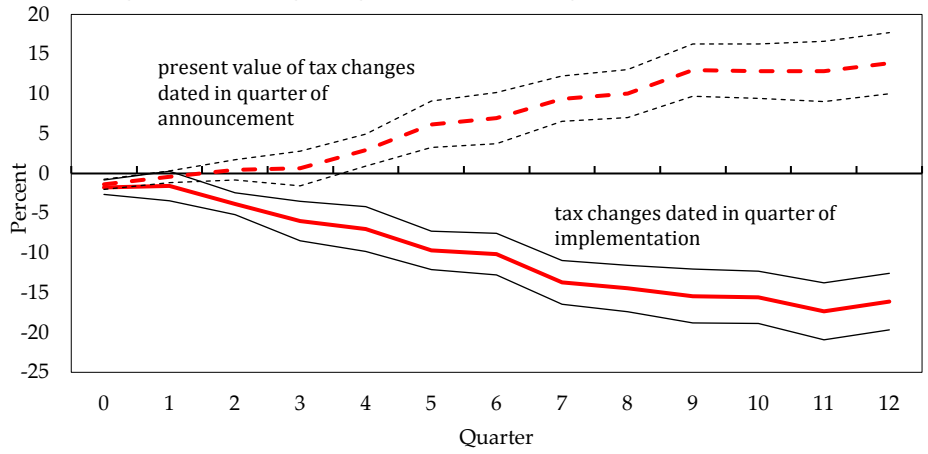


**Figure8.B Using Deficit-Driven Tax Changes**

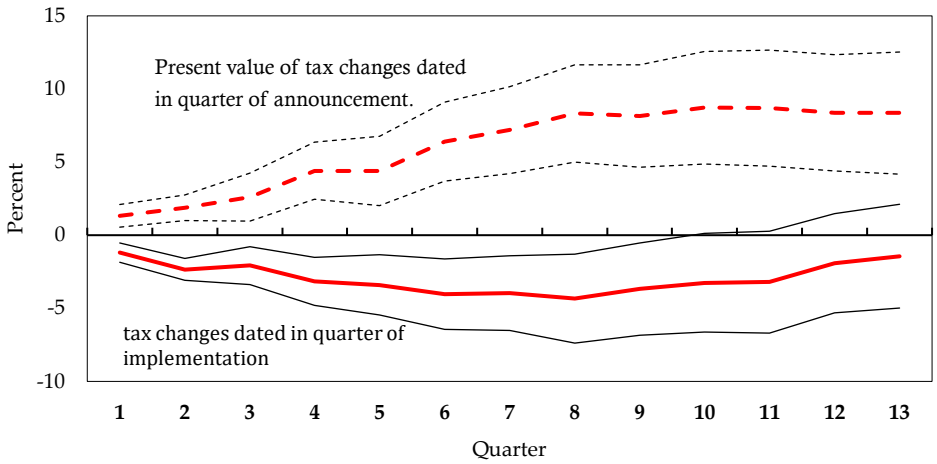


Figure8 shows the estimation results for cumulative dynamic effect of exogenous tax changes, taking into account expectation effect. First, exogenous tax changes have a negative impact on output because the negative effects of tax changes offset the positive effects of announcement. The dashed line in Figure8A shows the CDM of tax changes in the quarter of announcement, holding constant tax changes. The CDM is initially small, but thereafter consistently took a positive value, peaking to 12.8percent ( t =2.79). These positive effects are offset by the negative effect of actual tax changes. The solid line in Figure8A represents the CDM of actual tax changes, holding constant the present value of tax changes in the quarter of announcement. Following exogenous tax changes, output initially falls slightly, then a long-lasting downward trend continues, with the largest drop of -15.5percent (t=-4.74). These findings are consistent with a literature that find more than 80 percent

of Japanese consumers, including those who distinguish between temporary and permanent tax changes, respond to tax changes at the time of their implementation and not to at the time of a policy announcement[41].

Second, in the case of tax changes dealing with inherited budget deficit, the relationship between announcement and implementation is reversed. The solid line in Figure8B shows the CDM of deficit driven tax changes on output, holding constant the present value of tax changes in the quarter of announcement. The CDM is negative but not significant and smaller than that of present value of future tax changes. The largest drop is -3.9 percent (t=-0.27). These negative effects are offset by the positive CDM of announcement. The dashed line in Figure8B shows that following deficit driven tax changes, long-lasting upward trend continues, with the largest increase 8.6 percent (t=2.2). Tax increase dealing with fiscal deficit has a positive CDM on output, because positive effect of expectation offsets negative effect of actual tax changes .[42] These finding suggests that the announcement of tax increase may improve people's expectations about the fiscal health of the economy, increasing confidence of businesses.

The results of this analysis suggest that expectations of future tax changes matters. First, Exogenous tax changes have a negative impact on output because the negative effects of actual tax changes offset positive effects of expectation. Second, a tax increase dealing with fiscal deficit has a positive effect on output because positive effect of announcement outweighs negative effect of tax changes.

# 6. Conclusion

We analyzed the effects of tax shocks on the economic activity of post war Japan. Following David and Christina Romer's narrative approach, this analysis classified, from scratch, the 486 tax changes enacted in post war Japan into endogenous tax changes and more exogenous tax changes. These provide new datasets following those for the US and UK. Exogenous tax changes include tax changes motivated by a desire to raise long-run growth, dealing with inherited budget deficits. Endogenous tax changes include countercyclical tax changes motivated by a desire to return growth to the normal and spending-driven tax changes. Of ninety-five tax reforms, we identified 486 items as individual changes, of which 302 were exogenous tax changes and 184 were endogenous tax

[41] Watanabe et al.(2001)pp. 268-270.

[42] Watanabe et al. (2001) distinguished between temporary and permanent revisions, announcements and enforcement based on a sample of 43 tax reforms from 1975-1998. They found that less than a quarter of Keynsian-type consumers will respond to a temporary tax cut, while the remaining three-quarters will react only to a permanent tax cut. They also found that 80 percent of Japanese consumers respond at the date of enactment rather than the time of the policy announcement. They named this 'the near-rational decision rule.'

changes.

The motivations for tax changes have changed during development of the Japanese economy over the past 60 years. Heyday of countercyclical tax changes was 1990s but were rare before that time except both 1965 and 1971 tax cut. Large fraction of tax changes motivated by spending were related to Social Security benefits but small. Spending driven tax changes uncorrelated to Social Security were taxes for infrastructure investment such as loads, harbor and local airport. Tax changes motivated by desire to deal with inherited budget deficit were initiated in the late 1970s to early 1980s, but no action before that time. The largest deficit driven tax changes were contained in Tax bills of 1989, 1994 and 2012. The core of tax changes motivated by long-run growth considerations was annual income tax cut as fiscal dividend that remove from private economy heavy drag of taxes.

We used a distributed lag model to estimate CDM of exogenous tax changes on output finding that exogenous tax change has a large and long-term impact on the economic activity in Japan as well. Following 1 percent of exogenous tax cuts, GDP would increase GDP by 1 percent on impact, reaching 2.66 percent cumulatively over three years. These baseline estimation results were robust after tests that accounted for HAC standard error specification, outlier control, and omitted variables bias. The baseline results of this study are surprisingly close to Romer and Romer's (2010) results for the US (-3 percent) and Cloyne's (2013) results for the UK (-2.5 percent).

We went beyond the reduced-form results and shed light on how or why tax changes have such pronounced effects. The countercyclical tax changes have little effect of returning the economy to the normal. This is consistent with a literature that find the impact of temporary tax changes on Japanese consumer is significantly smaller than the impact of permanent changes. Tax changes for long-run growth and deficit-driven has different impact on the trajectory of GDP growth. Tax changes for long-run growth have negative CDM, while deficit-driven tax changes have positive CDM on output. To understand these differences, we focused on transmission channels where exogenous tax changes affect component of GDP. Exogenous tax changes have a negative CDM on output with transmission channels of consumption. The transmission channels of deficit driven tax changes differ from those of exogenous tax changes. Deficit driven tax changes have positive impact on corporate investment but negative impact on residential investment, thereby increasing GDP. The role played by expectation differs between tax change for long-run growth and deficit driven tax changes. Investments respond to deficit driven tax changes at the time of announcement, suggesting that the announcement of tax increase may improve people’s expectations about the fiscal health of the economy, increasing confidence of businesses. Consumers respond to tax changes for long-run growth at the timing of their implementation. This is consistent with a literature that find Japanese consumers respond to tax changes at the time of their implementation and not to at the time of announcement.

When one derives the policy implications from these findings, note that the estimation results in this paper are not necessarily precise. The estimators are significant, but the confidence intervals are a bit wide. With these caveats in mind, the paper argues that the preferred option for future tax reform is a combination of tax changes for long-run growth and tax changes dealing with inherited budget deficits. We found no convincing evidence supporting the effect of countercyclical tax changes. Of course, the impact of tax on output depends not only on size of the changes, but distinct types of taxes have differing impacts of on output[43]. We should address these issues in future research.

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**[Appendix]**

**Table1 Dynamic effect of changes in exogenous tax revenue on GDP growth rate:**

| | exogenous tax change | | | endogenous tax change | all legistrated tax change |
|---|---|---|---|---|---|
| lags | (1) dynamic multiplier | (2) cummulative dynamic multiplier | (3) cummulative dynamic multiplier | (4) cummulative dynamic multiplier | (5) cummulative dynamic multiplier |
| 0 | -1.09 | -1.09 | -1.09 | 0.21 | -0.37 |
| | (0.56) | (0.56) | (0.56) | (0.46) | (0.38) |
| 1 | 0.39 | -0.69 | -0.69 | 0.29 | -0.2 |
| | (0.40) | (0.81) | (0.83) | (0.53) | (0.47) |
| 2 | -0.32 | -1.01 | -1.01 | 0.52 | -0.18 |
| | (0.45) | (0.88) | (0.89) | (0.61) | (0.51) |
| 3 | 1.13 | 0.11 | 0.11 | 0.33 | 0.26 |
| | (0.51) | (1.16) | (1.19) | (0.73) | (0.62) |
| 4 | -0.17 | -0.06 | -0.06 | 0.05 | -0.02 |
| | (0.40) | (1.19) | (1.25) | (0.76) | (0.66) |
| 5 | -0.42 | -0.48 | -0.48 | -0.23 | -0.43 |
| | (0.33) | (1.27) | (1.37) | (0.83) | (0.68) |
| 6 | 0.13 | -0.35 | -0.35 | 0.19 | 0.02 |
| | (0.46) | (1.39) | (1.53) | (0.79) | (0.73) |
| 7 | -0.64 | -0.99 | -0.99 | -0.28 | -0.64 |
| | (0.62) | (1.49) | (1.74) | (0.72) | (0.67) |
| 8 | -0.92 | -1.91 | -1.91 | -0.48 | -1.02 |
| | (0.38) | (1.41) | (1.59) | (0.73) | (0.77) |
| 9 | -0.91 | -2.83 | -2.83 | 0.31 | -0.97 |
| | (0.65) | (1.44) | (1.52) | (0.97) | (0.95) |
| 10 | 0.35 | -2.47 | -2.47 | -0.48 | -1.19 |
| | (0.64) | (1.43) | (1.59) | (1.31) | (1.09) |
| 11 | -1.42 | -3.89 | -3.89 | 0.48 | -1.22 |
| | (1.10) | (1.57) | (1.63) | (1.28) | (1.17) |
| 12 | 1.23 | -2.66 | -2.66 | 1.13 | -0.36 |
| | (0.60) | (1.59) | (1.71) | (1.38) | (1.18) |
| trancation parameter | 5 | 5 | 10 | 5 | 5 |

Note: All regressions are OLS estimates using quarterly data from 1955:1 to 2014:4. Quandt Likelihood Ratio (QLR) statistic was used to test for stability of estimates.1973Q2, the F-statistic is at its maximum value, is regarded as the structural break. The dependent variable is the rate of change in GDP. Column(1) expresses result of distribution lag model, and the explanatory variables are quarterly "exogenous" tax changes and its 12 lags. Coefficients reported are OLS estimates of dynamic multipliers. The cumulative multiplier is the cumulative sum of the dynamic multipliers. All regression equations include a constant term. Newey-West HAC standard errors are shown in parentheses (numberof the truncation parameters are at the bottom).