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**Effects of Monetary and Fiscal Policy Interactions on Regional
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Effects of Monetary and Fiscal Policy Interactions on Regional Employment: Evidence from Japan^{*}

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This study examines the effects of the interaction between unconventional monetary policy and fiscal stimulus on regional employment in Japan. A mixed vector autoregressions (VARs)/event study approach is used. Our empirical findings first show that whereas employment recovery was salient in western Japan, it was not the case in Tokyo metropolitan areas, the country's main economic hub. Second, we confirm employment recovery on female employees in all regions. However, we do not observe this on male employees, implying the policy interaction did not necessarily increase the number of regular workers, which might suppress a wage hike in the entire country.

JEL classification: E24, E62, E63, R32,

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The ratio of active job openings to applicants for positions exceeds one in all 47 prefectures and the warm winds of economic recovery are now reaching Japan's local areas as well.¹

1. Introduction

Since the global financial crisis (GFC), many developed countries have employed both unconventional monetary policies and economic stimulus packages in order to pull the economy out of long-term economic downturn so called “secular stagnation.”² As is well known, one important objective of monetary policy is to support the goal of maximum employment. Also, fiscal policies can create jobs or reduce unemployment through various channels³. Therefore, the interaction between monetary and fiscal stimuli is assumed as strong ammunition to stimulate employment or to reduce the unemployment rate.⁴ Meanwhile, each region may react asymmetrically depending on

¹ Please see the website: https://japan.kantei.go.jp/98_abe/statement/201801/_00001.html.

² Overall, conventional monetary policy is defined as adjustment of short-term policy interest rate. In contrast, as summarized in Miyao and Okimoto (2020), roughly speaking, unconventional monetary policy can be defined as the central banks' various measures that employ unconventional policy instruments and pursue further monetary accommodation once the policy interest rate has plunged to approximately zero percent. Our study uses the term conventional or unconventional monetary policy following these definitions.

³ From theoretical perspective, the New Keynesian model with staggered price and wage setting has been developed like Galí (2010) to examine the relationship between unemployment and the design of monetary policy. Indeed, a recent paper by Nakamura et al. (2021) shows that the unemployment falls in response to monetary policy shocks. With respect to fiscal policy, some theoretical papers like Monacelli et al. (2010), Campolmi et al. (2011), and Faia et al. (2013) show that government expenditure or hiring subsidies can decrease unemployment.

⁴ We define employment recovery as decrease in unemployment rate or increase in employment and both

the different sensitivities of regional economic activities with respect to common macroeconomic shocks, as indicated by Clark (1998) and Campolieti et al. (2014). Thus, it is worthwhile to investigate whether the interaction between unconventional monetary policy and fiscal stimuli, a common macroeconomic policy shock, has different effects at the regional level. However, to the best of our knowledge, the effects of the aforementioned policy interaction on regional employment under long stagnation periods have yet to be explored.

The objective of our research is to examine the effects of the interaction between unconventional monetary policy and fiscal stimuli on regional employment under stagnation in Japan. A study in Japan has favorable characteristics. First, Japan is a harbinger of secular stagnation, as Ito (2014) argues. As a matter of fact, the short-term interest rate has been at the zero lower bound (ZLB) since the late 1990s. Second, following this, the Japanese government implemented a large size monetary and fiscal expansion as a part of the policy package called “Abenomics” in the 2010s.⁵ Some economists attribute the employment recovery to the interaction between unconventional monetary policy and fiscal stimuli.⁶ On top of that, as noted earlier,

of them.

⁵ For more details, please see Section 2.

⁶ For example, please see a dialogue named “The Japanese Economy in 2017 (1): Is Abenomics Working?” The link is as follows: <https://www.tkfd.or.jp/en/research/detail.php?id=399>.

former Prime Minister Shinzo Abe, who initiated Abenomics, reiterated that the employment recovery propagated to local areas. However, there is some criticism on the regional effects of the Abenomics policy. For example, Endo (2016) pointed out that although Abenomics led to employment recovery in the Tokyo metropolitan areas, it had not increased employment in rural areas up until 2016, when the government prioritized the policy interaction as mentioned in Section 2. From these points of view, the Japanese case is the most suitable for examining the effectiveness of the aforementioned monetary-fiscal policy interaction in increasing regional employment under secular stagnation.

We focus on both the employment gap and the cyclical unemployment rate because short-term policy measures affect cyclical components rather than the total employment or unemployment rates consisting of both cyclical and structural factors. To capture employment figures, we use the number of employees as an indicator of employment.

We also divide workers into men and women. Overall, the proportion of part-time female employees is larger than that of their male counterparts; indeed, part-time workers make up more than half of the female employees, even in recent years in Japan.

Dividing employees into females and males is also useful for distinguishing the different responses with respect to policy shocks.

We estimate a separate VAR for each region, following Owyang and Zubairy (2013) and Hayo and Uhl (2015). By doing this, we address the asymmetric regional-level responses to macroeconomic policy shocks. When it comes to the data on the number of employees and unemployment rate, we use the data from the Labor Force Survey published by the Statistics Bureau, Ministry of Internal Affairs and Communication (MIAC). Although prefectural-level data are also available in the Labor Force Survey, MIAC warns of the use of the prefectural data because they are less accurate than data for the entire country or regional level survey.⁷ As mentioned earlier, the effects of the policy interaction as a part of Abenomics seem to differ between the Tokyo metropolitan area and other rural areas in Japan. The use of regional data makes the comparison between the Tokyo metropolitan area and other areas more distinct than the use of prefectural-level data. Following these points, we use the quarterly data for nine regions, as shown in Section 4.

We examine the policy effects using VAR analysis in conjunction with an event study, as in the case of Blanchard and Perotti (2001), Miyazaki (2010), and Miyazaki (2016). Using this approach, we construct dummy variables based on when the policies are

⁷ Roughly speaking, “prefecture” in Japan is equivalent to “state” in the US. We use the word “region” to indicate a group of prefectures. For details, please see Figure 5.

announced or implemented. Using these dummies as variables in the VAR estimation, we can examine the size and persistence of specific stimulus packages.

Our results can be summarized as follows: First, we confirmed the improvement in both female and male workers in all regions of western Japan. However, this is not the case in Southern Kanto region (or Tokyo metropolitan areas), a core region of economic activities in Japan. This implies that when it comes to employment, rural regions reaped more benefit from the policy interaction than the country's major economic hub.

Second, we confirm an improvement in the female employment gap and a decrease in the cyclically-adjusted female unemployment rate in almost all regions thanks to the policy interaction. However, this policy interaction is less effective in increasing male employment than economic stimuli in the past. This implies that employment recovery in many regions can be attributed to an increase in female employees, most of whom are part-time workers. On the flipside, this alludes the policy interaction did not necessarily boost the number of regular workers, which might not lead to wage hikes in all regions.

This is consistent with the phenomenon observed in the entire country. Finally, the quantitative effects of the policy interaction are not necessarily larger than those of past fiscal stimuli for all regions. This means that the interaction of the aforementioned two policies is not necessarily a silver bullet for stimulating employment in the short run,

despite the combination of bulky buying of the Japanese government bonds (JGBs) by the Bank of Japan (BOJ) and the increase in public investment. We also confirmed these results by three robustness checks: adding the yen-dollar exchange rate to the basic VAR model, adding the female or male labor force participation ratio, and limiting the sample period to being after the first quarter of 1991.

This study is related to three bodies of literature. The first deals with the regional effects of macroeconomic stabilization policies. These include Garrison and Chang (1979), Mathur and Stein (1980), Carlino and Defina (1998) (1999), Di Giacinto (2003), Chodorow-Reich et al. (2012), Wilson (2012), Conley and Dupor (2013), Nakamura and Steinson (2014), Dupor and McCrory (2018), Beraja et al. (2019), Chodorow-Reich (2019), and Furceri et al. (2019). For example, Wilson (2012) and Dupor and McCrory (2018) examine the effects of the American Recovery and Reinvestment Act of 2009 on local employment and the local labor market. However, while recent studies focus on the effectiveness of either monetary or fiscal policy, to the best of our knowledge, surprisingly few recent studies examine the effects of the policy mix between unconventional monetary policy and fiscal stimuli on regional employment under secular stagnation. We do this.

Second, our study contributes to the research on the fiscal policy effectiveness in Japan. A significant body of research has already been conducted on this topic: Ihori et al. (2003), Miyazaki (2009) (2010), Rafiq (2012), Kato and Miyamoto (2013) (2014), Brückner and Tuladhar (2014), Kameda (2014), Morita (2015), Miyazaki (2016), Auerbach and Gorodnichenko (2017), Yoshino and Miyamoto (2017), Miyamoto et al. (2018), Miyazaki et al. (2018), Funashima and Ohtsuka (2019), Kameda et al. (2021), Bessho (2021), and Kanazawa (2021), etc. Above all, Miyazaki (2010), Kato and Miyamoto (2013) (2014), and Miyamoto et al. (2018) examine the effects of fiscal stimuli on employment and unemployment as well. However, to our knowledge, our study is the first to examine the regional effects of “Abenomics” on employment.

Finally, our research is also related to studies examining the effects of fiscal policy on employment. Recently, there have been a multitude of studies that address this topic: Pappa (2009), Mayer et al. (2010), Monacelli et al. (2010), Campolmi et al. (2011), Brückner and Pappa (2012), Faia and Merkl (2013), Owyang and Zubairy (2013), Hayo and Uhl (2015), Dupor and Saif Mehkari (2016), and Atems (2019), etc. In particular, Pappa (2009), Owyang and Zubairy (2013), Hayo and Uhl (2015), and Atems (2019) utilize state-level data from the U.S. While most of them address the effects of fiscal policy on employment without dividing the period into expansion and recession, we

address the regional effects of the fiscal stimulus accompanied by expansionary monetary policy under long-term stagnation. In this regard, we can differentiate ourselves from the previous studies.

The remainder of this paper proceeds as follows. Section 2 presents a brief explanation of the monetary and fiscal policy interactions under the Abe Cabinet. Section 3 discusses the empirical framework of the study. Section 4 presents the empirical results. Section 5 concludes the paper.

2. A brief description of “Abenomics”

2.1. An overview of Abenomics

Shortly after his second inauguration on December 26, 2012, then Prime Minister Shinzo Abe unveiled a policy package called “Abenomics.” This consists of “three policy arrows.”⁸ The first arrow is an aggressive monetary policy, which uses the unconventional measures of monetary policy, and the second is a flexible fiscal policy, which encompasses both short-term stimulus measures and fiscal consolidation in the

⁸ For some details on the “three policy arrows,” please see the website: https://www.japan.go.jp/abenomics/userdata/abenomics/pdf/170508_abenomics.pdf.

long run.⁹ The third arrow represents growth-enhancing strategies, including structural reforms.

As noted earlier, Japan has been in a protracted recession, where conventional monetary policy has proven less effective owing to the zero lower bound of short-term interest rates since the late 1990s. While structural reforms that increase competition and spur activities in the labor market are precise to accelerate economic growth in the long run, the reforms under the ZLB environment may have contractionary effects in the short run without the appropriate macroeconomic stabilization policy.¹⁰ The “three arrows” of Abenomics is consistent with this notion; policy makers in Japan prioritized the policy interaction over the structural reforms to stimulate the demand side of macroeconomy along the lines of Abenomics.¹¹ By way of the policy packages on the demand side (or the first and second arrows of Abenomics), the Abe Cabinet tried to achieve a 2% inflation target. On top of that, as indicated by Ito (2021), wage hikes were also expected in parallel with the achievement of the inflation target.

⁹ We define “flexible fiscal policy” based upon some arguments by relevant ministers and policy makers. Indeed, Doi (2018) reaffirms that flexible fiscal policy means fiscal consolidation as well as economic stimulus.

¹⁰ For instance, Eggertsson et al. (2014) show structural reforms have short-term contractionary effects in the short run under the ZLB environment using the open economy dynamic stochastic general equilibrium model.

¹¹ For this point, please see also Hayakawa (2016). As a matter of fact, the package of these three policies is often called as the “first phase” of Abenomics in comparison to the packages announced in late 2015, which laid more emphasis on the structural reforms. Please see also the link: https://www.rieti.go.jp/en/events/17080101/pdf/k-1_jorgenson.pdf.

Indeed, both the government and the central bank initially pursued the measures to spur short-term economic recovery. First, Figure 1 presents the share of JGB holdings by the BOJ. We highlight this because a large purchases of JGBs by the BOJ is one of the principal tools of unconventional monetary policy. As shown in Figure 1, the BOJ's holdings of the JGB have skyrocketed since 2013. Second, we show the movement of public investment, which has mainly been used as a measure of fiscal stimulus packages in Japan.¹² Figure 2 depicts the growth rate of capital formation by the general government (compared to the same quarter of the previous year). The government increased its investments in a couple of years after the start of the Abe Cabinet, in contrast to the period from FY 2001 to 2012.¹³

2.2. Abenomics and employment recovery

As argued in Section 1, the interaction between unconventional monetary policy and fiscal stimuli may be useful in attaining employment recovery. Furthermore, as also indicated in Section 1, Mr. Abe underscored that employment recovery was observed in all the regions.

¹² For more details, please see Miyazaki (2009), Miyazaki (2010), and Miyazaki et al. (2018).

¹³ Junichiro Koizumi's cabinet (2001-2006) initiated public investment cutbacks as part of the "structural reform of the government," a fiscal consolidation achieved by decreasing government expenditures and privatizing public corporations. Further, the Democratic party-led coalition government (2009-2012) reduced public investment while attempting to increase welfare expenditures.

However, the reality was that job recovery differed at the regional level. For example, Figures 3a and 3b show that employment (number of employees) increased between 2012 and 2017, and unemployment rate fell to 2.8 % in the fourth quarter of 2016 from 4.3% in the first quarter of 2013 in Southern Kanto area, which is equivalent to the Tokyo metropolitan area. Meanwhile, when it comes to Shikoku, a typical rural region in Japan, employment did not increase, whereas the unemployment rate decreased. These are confirmed in Figures 4a and 4b, respectively. These figures indicate that all regions did not necessarily benefit from Abenomics with respect to employment.

Here we have to consider two things to dig deeper into the effects of the interaction between unconventional monetary policy and fiscal stimulus on regional employment or unemployment. First, we should divide figures on employment into two components: trends and cyclical components. This is why stabilization policy particularly affects cyclical components. In this regard, when we discuss the effects of the interaction between unconventional monetary policy and fiscal stimulus, we have to purify the cyclical factor of employment or the unemployment rate. Second, we have to examine the differing effects on men and women. As stated in Section 1, the proportion of part-time female employees is larger than that of their male counterparts, which may lead to different reactions to policy shocks. With this in mind, we proceed to examine the

effects of the interaction between unconventional monetary policy and fiscal stimulus on regional employment in Japan, not only by focusing on cyclical factors, but also on the differing impacts on female and male workers.

3. Empirical framework

3.1. Empirical hypothesis

Our hypothesis is to check whether or not the interaction between unconventional monetary policy and fiscal stimuli increases employment and decreases unemployment in the short run. The frame work to confirm Okun (1962)'s law is useful for addressing the effects on employment figures in the short-run.

Usually, Okun's (1962) law is examined by the estimating the following equation.¹⁴

$$e_t = a + by_t + \varepsilon_t, \tag{1}$$

¹⁴ We follow the notation of Bova et al. (2015).

where e_t is the employment gap (the deviation of the logarithm of current employment from its trend) or the cyclical unemployment rate, y_t is the output gap, and ε_t is the disturbance.

3.2. Constructing dummy variables

In our empirical approach, we use dummy variables to identify fiscal policy shocks based on official documents. While selecting the dummy variables, we faced an identification problem. If we allow the dummy associated with each major policy change to have its own distributed lag effect, we cannot identify the effects of each individual fiscal policy because the time at which they were announced and/or implemented are too close. To deal with this, we constructed dummy variables that take the value of one throughout the time period for which the policy was in effect, as in the case of Blanchard and Perotti (2002), Miyazaki (2010), and Miyazaki (2016).

To construct dummy variables capturing the effects of the interaction between unconventional monetary policy and fiscal stimuli, we clarify the start and end dates of the policy's implementation periods as follows. The dummy variable specifying the policies take the value of one from 2013 Q1 to 2016 Q4, which can be written as " D_{13} "

within our sample period (from 1983 Q1 to 2016 Q4).¹⁵ The initial period is set as 2013 Q1 because Abenomics was announced on the heels of Prime Minister Abe's inauguration, as shown in Section 2.1. By doing so, we captured the duration of the monetary and fiscal policy interaction implemented by the Abe Cabinet.

What is more, we construct other two policy dummy variables to compare the policy effects with the past policies. One is " D_{90} ," which is equal to one from 1992 Q3 to 1996 Q3 and from 1998 Q2 to 2000 Q4. This captures the announcement and implementation periods of the fiscal stimulus packages in the 1990s. The other dummy is " D_{08} ," which takes one from 2008 Q4 to 2010 Q2. This captures the stimulus packages implemented by the coalition government of the Liberal Democratic Party and Komeito after the 2008 GFC. The durations for these two dummy variables follow Miyazaki (2010) and Miyazaki (2016), respectively.

3.3. Outline of VAR estimation

We included the aforementioned dummy variables into our empirical models with employment gap, cyclical unemployment rate, and output gap. We ran VARs for a separate region, as in the case of Owyang and Zubairy (2013) and Hayo and Uhl (2015).

¹⁵ We discuss the reason why we did not include more recent periods in Section 4.

The estimating equations of our VAR models for E_{it} (the employment gap or cyclical unemployment of region i in quarter t) are as follows:

$$E_{it} = a_0 + a_{1i} \sum_{j=1}^T E_{it-j} + a_{2i} \sum_{j=1}^T \sum_{-i} E_{it-j} + a_{3i} \sum_{j=1}^T Y_{t-j} + a_{4i} \sum_{j=1}^T D_{90t-j} + a_{5i} \sum_{j=1}^T D_{08t-j} + a_{6i} \sum_{j=1}^T D_{13t-j} + \varepsilon_{it}^E, \quad (2)$$

where E_{it} is the employment gap (the deviation of the logarithm of current employment from its trend) or the cyclical unemployment rate for each region (i) in quarter t , Y_t is the output gap of the entire country in period t , and ε_{it}^E is the disturbance. Y_t is the difference between the logarithm of the current output and its trend, which is used to address the business cycle of the entire country.¹⁶

For E_{it} , we also added the indicator of other regions, $\sum_{-i} E_{it-j}$. We do so to address the effects employment in other regions. This follows Owyang and Zubairy (2013).

Meanwhile, as stated by Owyang and Zubairy (2013), this specification suppresses spatial error dependence. However, they also argue that spatial error dependence would

¹⁶ The Cabinet office's Report on Prefectural Account does not provide the data regarding the regional GDP and each item of private sector's demand (private consumption and capital formation, etc.) on a quarterly basis. Although the Ministry of Economy, Trade, and Industry offers quarterly level data on Industrial Production Index, the regional classification is different from ours. Therefore, we cannot add regional level output, consumption, and investment.

only influence the estimation of contemporaneous effects, such as one region's output shocks on the output of other regions. Since we focus on the impulse responses with respect to nationwide monetary and fiscal policy interactions, suppressing spatial error dependence does not seriously affect our results. Therefore, we do not use techniques such as spatial VAR or global VAR following Owyang and Zubairy (2013) and Hayo and Uhl (2017).¹⁷

The impulse response function of each economic variable is calculated using reduced-form residuals ε_t^{D90} , ε_t^{D08} , or ε_t^{D13} (or policy shocks). Meanwhile, there should be no feedback from the current endogenous variables on fiscal expansions, as indicated by Blanchard and Perotti (2002) and Miyazaki (2009). Thus, when we incorporated the contemporaneous dummy variables as regressors in Equation (2), an overidentification restriction test must be done for the contemporaneous dummy variables and each economic variable.¹⁸ However, since the p-value of the likelihood ratio (LR) test for overidentification is 0.00 for all cases, the null hypothesis is rejected at the 1% significance level, and the model is rejected. Therefore, certain identification strategies such as structural VAR or Cholesky decomposition are not used.

¹⁷ As mentioned in Owyang and Zubairy (2013), this specification assumes that the spatial weights determining the magnitudes of the coefficients are equal for all regions.

¹⁸ For this point, please see also Miyazaki (2010) and (2016). We follow the strategies of the two papers.

4. Empirical results

4.1. Data

The sample period is from 1983 Q1 to 2016 Q4. As stated earlier, Prime Minister Abe had put more emphasis on the third arrow (or growth-enhancing strategies) in the latter half of its tenure. On top of that, while the BOJ continued its unconventional monetary policy, the government gradually attempted to shift toward fiscal consolidation after 2016.¹⁹ In this regard, it is favorable for us to not include the recent data to examine the effects of the demand-side policies of Abenomics.

To capture the effects on employment, we use total unemployment ratio (= (*Number of unemployed*)/ (*Total labor force*), U3) and the employment (= the number of workers).²⁰ These data come from the Labor Force Survey by Statistics Bureau, MIAC. The data on GDP comes from the Cabinet Office, Government of Japan. The regional data of the Labor Force Survey consists of 10 regions as shown in Figure 5: Hokkaido, Tohoku, Southern Kanto, Northern Kanto and Koshin, Hokuriku, Tokai, Kansai,

¹⁹ For example, please see the link below:

https://www.jsda.or.jp/en/activities/international-events/jss2016/01MrIchikawa_presentation.pdf.

²⁰ Since U3 is available at a regional level on the Labor Force Survey, we have to use the U3 data to capture unemployment.

Chugoku, Shikoku, and Kyushu and Okinawa. Meanwhile, owing to the Great East Japan Earthquake, MIAC admits there are concerns about preciseness with regard to the data on Tohoku. Therefore, we make $\sum_{-i} E_{it-j}$ except Tohoku and run VARs for nine regions.

We use Hamilton's (2018) filter to extract the cyclical components of the unemployment rate, potential employment, and underlying GDP. There are several advantages over the Hodrick and Prescott (1997) filter; for example, Hamilton's (2018) filter is robust to seasonal adjustment. Since we have to take several lags while filtering, the initial quarter in our VAR estimation is set as 1986 Q1.

4.2. Estimation results

Throughout the analysis, we follow the recent convention in the VAR literature and use the levels for all series. As Hamilton (1994) argues, a level specification yields consistent estimates, regardless of whether or not cointegration exists, whereas a difference specification is inconsistent if some variables are cointegrated. The upper limit of the lag length is set to four in all cases to maintain sufficient degrees of freedom, and the lag length is set as one for all cases according to the LR test in Sims (1980).

Figures 6a–14f report the estimation results of impulse response functions with respect to dummy variables that capture each fiscal stimulus package (D_{90} , D_{08} , and D_{13}) for the nine regions. The solid line depicts the estimated response, and the dotted lines represent the one standard error band following Perotti (2007) and Ramey (2011). The one standard error band is based on asymptotic distributions for all cases.²¹ Tables 1a–1d summarize the estimated responses shown in Figures 6a–14f.

The subscripts a, b, and c are used to represent the response functions on the female employment gap and the female cyclically-adjusted unemployment rate with respect to D_{90} , D_{08} , or D_{13} . Likewise, the subscripts d, e, and f are used for the response functions on the male employment gap and the male cyclically-adjusted unemployment rate with respect to D_{90} , D_{08} , or D_{13} .

The results of policy interaction after 2013 can be summarized as follows. First, improvements in both female and male workers were salient in western Japan. Second, most figures demonstrate that the monetary and fiscal policy interaction after 2013 (D_{13} in each Figure) improved the figures for female workers. Finally, the quantitative effects

²¹ Other methods, such as Monte Carlo integration and bootstrap replications, could also be considered to calculate the confidence intervals of the impulse response functions. However, since there is no established method for calculation, we report the results based on asymptotic distributions. For confirmation, we also calculate the confidence intervals with 500 bootstrap replications, but the results and implications are not fundamentally changed.

of Abenomics are not necessarily larger than those of the fiscal stimuli in the 1990s and after the GFC. We provided a detailed interpretation as follows.

4.2.1. Comparison among regions

First, by comparing the policy effects across regions, non-Tokyo metropolitan areas reaped larger benefits from the policy interaction with respect to both female and male workers. This is especially true for regions in western Japan, such as Kansai, Chugoku, Shikoku, and Kyushu and Okinawa (as shown in Figures 11a–14f). The Kansai region might have benefited from the increase in the number of tourists traveling to Kyoto, which led to the recovery of employment in that region.²² The economic activities within the Setouchi Industrial Area (Chugoku and Shikoku) may have been revitalized because there are many factories and subsidiaries of famous auto manufactures and shipbuilding makers. The economic recovery of these regions could be attributed to the depreciation of the yen, which the unconventional monetary policy mainly contributed.²³ Furthermore, since Kansai, Chugoku, Shikoku, and Kyushu are

²² For this point, please see also Nguyen (2020).

²³ This is because the effects of the unconventional monetary policy, which depreciates the yen, dominate the appreciation of the yen caused by fiscal expansion. Indeed, Shirai (2018) underscores the monetary policy under Abenomics contributed to the depreciation of the yen. In fact, we also confirmed the policy interaction depreciated the yen in our robustness check. Although we omit these results for the sake of brevity in Section 4.3, please see the online appendix of this paper, which is downloadable from the website: <https://sites.google.com/view/tomomosite2/home/research/dpwp>.

geographically close, as can be seen from Figure 5, the recovery of one area may propagate to other areas. In this respect, the policy interaction depreciated the yen, and rejuvenated not only economic activities but also the employment of Kansai, Chugoku, and Shikoku, which benefited each other.

4.2.2 Comparing policy effects between female and male employees

Second, we compared the differential effects of Abenomics on female and male employees. Regarding female workers, we observe a positive response in the employment gap and a decrease in the cyclically-adjusted unemployment rate in almost all the regions. We show positive and statistically significant responses to the female employment gap in Southern Kanto (Figure 7a), Hokuriku (Figure 9a), Tokai (Figure 10a), Kansai (Figure 11a), Chugoku (Figure 12a), Shikoku (Figure 13a), and Kyushu and Okinawa (Figure 14a). Furthermore, negative and statistically significant responses were observed for the cyclically-adjusted female unemployment rate in Hokkaido (Figure 6a), Hokuriku (Figure 9a), Tokai (Figure 10a), Shikoku (Figure 13a), and Kyushu and Okinawa (Figure 14a).

Although we confirmed the employment recovery of male workers in some regions, the effects of the policy interaction are less effective than in the case of female workers

in certain regions such as Kansai (Figure 11d), and Kyushu and Okinawa (Figure 14d). For example, it takes about a year for the male employment gap to become positive in Kansai. Although negative and significant results for the cyclically-adjusted male unemployment rate are shown in Hokkaido (Figure 6d), Southern Kanto (Figure 7d), and Kyushu and Okinawa (Figure 14d), the confidence intervals soon include zero, as shown in Figures 7d and 14d.

It is often said that there has been a steady increase in the number of part-time employees under Abenomics.²⁴ This can be attributed to the change in the job market structure in Japan, which has gradually increased the number of part-time workers, while reducing regular employees. Generally speaking, the proportion of female part-time workers is higher than that of male part-time employees. In this regard, even if the policy interaction between the unconventional monetary policy and fiscal stimulus after 2013 contributed to job recovery, our results suggest that this improvement might be attributed to the increase in female part-time employees in most regions. On the flipside, this implies that the policy interaction did not substantially boost the number of regular workers, which might not lead to wage hikes for all regions. This is consistent with the observation in the entire country, as pointed out by many economists.²⁵

²⁴ For example, please see Hoshi and Kashyap (2020) and Lincoln (2020).

²⁵ For instance, Kawaguchi et al. (2021) point out that the real wage declined by 1.8 % from 2012 to

In the meantime, unlike the stimulus after 2013, both female and male labor gaps increased in response to the stimulus in the 1990s and the one after the GFC in some cases such as Hokkaido (Figure 6b, 6c, 6e, and 6f), Northern Kanto, and Tokai (Figures 8b and 8e, 10b and 10e). Furthermore, regarding male cyclically-adjusted unemployment rates, negative and statistically significant responses were observed in some cases like Hokkaido (Figure 6f), Southern Kanto (Figure 7e), Hokuriku (Figure 9e), Shikoku (Figure 13e), and Kyushu and Okinawa (Figure 14e). Especially with respect to the 1990s, the proportion of male regular employees was larger in the 1990s and the 2000s than in the 2010s. Therefore, it is quite natural that we observe more cases of employment recovery for male workers in the 1990s.²⁶

4.2.3. Quantitative evaluation of Abenomics and the past economic stimuli

Finally, in comparison to the fiscal stimuli in the 1990s and after the GFC, the quantitative effects of Abenomics are not necessarily large. For example, in any case, the improvement in the employment gap is approximately 2 percentage points at the largest (for example, Figure 7a, 9a, 10a, 11a, 12a, 12d, 13a, 13d, and 14a on D_{13} , and

2017, of which 1.4 % is explained by changes in the increase in female workers.

²⁶ In Appendix 1, we also discuss the reason why cyclically-adjusted unemployment rate is estimated to be positive and statistically significant to the fiscal stimulus after the GFC (D_{08}).

Figure 6c, 8b, and 12c on D_{90} , or D_{08}). For male employees, the size is less than one percentage point, except for Figures 12d and 13d, regardless of D_{90} , D_{08} , or D_{13} .

From the viewpoint of quantitative evaluation of employment, the interaction between unconventional monetary policy (which includes large purchases of the JGB by the BOJ) and fiscal stimuli after 2013 did not necessarily have a larger impact than the past simple economic stimuli without intervention by the monetary authority.

4.3. Robustness check

To check the robustness of the results, we performed the VAR analysis under alternative specifications. First, we included the yen-dollar exchange rate to our VAR system because the policy interaction between unconventional monetary policy and fiscal stimulus might have led to the depreciation of the yen and, hence, had positive impacts on the economy. Second, we added the female or male labor force participation ratio to control for the supply side effects of the labor market. Finally, we limited the sample period to being after the first quarter of 1991, following Christiano (1986) and Cecchetti and Karras (1994). We note a structural change in the data after this quarter.

The results are summarized in Tables 2a–2d for comparison with the results of the basic framework. As our robustness check yielded so many figures, we summarized the

results in these tables by concentrating on the results of the fiscal stimulus after 2013 (D_{13}) for brevity.²⁷ Overall, these robustness checks confirm the principal results reported in Section 4.2.

First, Table 1 shows that we confirm the positive and statistically significant results on the female labor gap in all regions when we added the yen-dollar exchange rate and limited the sample period to after the first quarter of 1991. In addition, once we controlled for the yen-dollar exchange rate, the responses of female cyclically-adjusted unemployment rates became statistically significant in all regions. Second, the responses to the male labor gap were robust in western Japan, regardless of alternative frameworks. Third, when it comes to the male cyclically-adjusted unemployment rate, although we confirm negative and statistically significant responses after adding the yen-dollar exchange rate for all regions, we do not always observe statistically significant results for the other two alternative frameworks for most regions.

²⁷ For the figures of the impulse response functions, please check the online appendix of this paper.

5. Conclusion

This study examines policy effectiveness with regard to the interaction between unconventional monetary policy and fiscal stimuli in Japan. Especially, we focus on regional employment with respect to female and male workers.

We first confirm that whereas the policy interaction contributed to job recovery on both female and male employment in western Japan including some rural areas like Chugoku and Shikoku, this was not the case in Southern Kanto region. Although there is some criticism that the benefit generated from a large size monetary and economic stimulus does not spread to rural areas, our results impugn this argument.

Second, while the policy interaction contributed to the increase in female employment and decrease in female unemployment in all regions, this is not the case for male workers. As stated in Section 4.2.2, this is different from the results of the policy responses in the 1990s. Following the fact that the proportion of non-regular employees is larger in the case of female employees than male employees, the results imply that the job recovery by the policy interaction might be mainly attributed to the increase in female non-regular employees. This is also consistent with an evaluation of Abenomics by some economists such as Lincoln (2020). This might not lead to a pay rise and, hence, curb price hikes in the entire country, both of which are the policy goals of the

Abe Cabinet, as mentioned in Section 2.1. Our results suggest that a change in the structure of the labor force in Japan might prevent the government from attaining its policy goals.

Finally, the effects of the policy interaction are not quantitatively larger than the past economic stimuli, which lack intervention by the monetary authority. This means that the policy interaction was not necessarily a powerful ammunition to stimulate employment in the short run, despite its scale and government propaganda.

Our results can also be generalized to other countries. In addition to several developed countries that have been suffering secular stagnation since the GFC, it is also likely that Asian countries will face such long-term economic downturns in the near future, as pointed out by Cohen-Setton et al. eds (2018). Our results have some implications for both developed and emerging countries. For example, we reveal that the transmission paths of the policy interaction are related to the industrial structure of each region, following the results of western Japan. This suggests that even when the government plans a macro stabilization policy, the characteristics of each region should be considered. On top of that, since the quantitative effects may not be large according to our results, policymakers should not have high expectations regarding the effects of the policy interaction. Our results reaffirm that monetary and fiscal policies are justifiable

as short-term measures; however, these policies are not sufficient to assure employment recovery. This establishes that structural policies would also be indispensable to labor market resilience.²⁸

This study's analysis can be fruitfully extended in three ways. First, due to the inaccuracy of the data, we avoided using prefectural-level data from the Labor Force Survey. However, if more accurate data are available in the future, we will be able to examine the effects of the policy interaction at the prefectural level. Second, although we focused on empirical analyses, it is necessary to construct a theoretical model to support our results. Finally, more recent econometric techniques, such as factor-augmented or time-varying VAR models, could also be employed in our approach.

Appendix 1. The interpretation on cyclically-adjusted unemployment rate after the GFC

The responses of the cyclically-adjusted unemployment rate with respect to the stimulus packages after the GFC are estimated to be positive and statistically significant in most regions such as Hokkaido, Southern and Northern Kanto, Hokuriku, Tokai,

²⁸ For this point, please see also Hijzen et al. (2017).

Kansai, Chugoku, Shikoku, Kyushu and Okinawa to the stimulus (Figures 7c, 7f, 8c, 8f, 9f, 10c, 10f, 11c, 11f, 13c, 13f, 14c, and 14f). In most regions, unemployment increased after the fiscal stimulus packages following the GFC. We can interpret the positive effects of fiscal stimulus on unemployment based upon Brückner and Pappa (2012): once the fiscal stimulus is announced or implemented, people expect the economic recovery. If that is the case, some people who dropped out of the job market would likely resume their job search. In other words, “discouraged” job seekers return to the market. As a result, total unemployment increases. This explains the effects of the economic stimulus on unemployment after the GFC.

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Table 1a. Summary of the estimation results on response functions
(Female employment gap)

	Stimulus after 2013	1990's stimulus	Stimulus after the GFC
Hokkaido		+	+
Southern Kanto	+	—	+
Nouthern Kanto		+	+
Hokuriku	+		+
Tokai	+	+	
Kansai	+		+
Chugoku	+		+
Shikoku	+	+	—
Kyushu	+	—	+

Note: “+” means that the impulse response function of female employment gap with respect to the dummy variable capturing the fiscal stimulus after 2013 (D_{13}), the one in the 1990s (D_{90}), and the stimulus after the global financial crisis (GFC) (D_{08}) is estimated to be positive and statistically significant. “—” means that the impulse response function is estimated to be negative and statistically significant.

Table 1b. Summary of the estimation results on response functions
(Cyclically-adjusted female unemployment rate)

	Stimulus after 2013	1990's stimulus	Stimulus after the GFC
Hokkaido	—		—
Southern Kanto			—
Nouthern Kanto		—	+
Hokuriku	—	+	
Tokai	—		+
Kansai			+
Chugoku			
Shikoku	—	+	—
Kyushu	—		+

Note: “+” means that the impulse response function of cyclically-adjusted female unemployment rate with respect to the dummy variable capturing the fiscal stimulus after 2013 (D_{13}), the one in the 1990s (D_{90}), and the stimulus after the global financial crisis (GFC) (D_{08}) is estimated to be positive and statistically significant. “—” means that the impulse response function is estimated to be negative and statistically significant.

Table 1c. Summary of the estimation results on response functions
(Male employment gap)

	Stimulus after 2013	1990's stimulus	Stimulus after the GFC
Hokkaido		+	+
Southern Kanto			
Nouthern Kanto	—	+	
Hokuriku		+	
Tokai	—	+	—
Kansai	+		—
Chugoku	+	+	+
Shikoku	+	+	
Kyushu	+	+	—

Note: “+” means that the impulse response function of male employment gap with respect to the dummy variable capturing the fiscal stimulus after 2013 (D_{13}), the one in the 1990s (D_{90}), and the stimulus after the global financial crisis (GFC) (D_{08}) is estimated to be positive and statistically significant. “—” means that the impulse response function is estimated to be negative and statistically significant.

Table 1d. Summary of the estimation results on response functions
(Cyclically-adjusted male unemployment rate)

	Stimulus after 2013	1990's stimulus	Stimulus after the GFC
Hokkaido	—		—
Southern Kanto		—	
Nouthern Kanto			+
Hokuriku			+
Tokai			+
Kansai			+
Chugoku		—	+
Shikoku		—	+
Kyushu	—	—	+

Note: “+” means that the impulse response function of cyclically-adjusted male unemployment rate with respect to the dummy variable capturing the fiscal stimulus after 2013 (D_{13}), the one in the 1990s (D_{90}), and the stimulus after the global financial crisis (GFC) (D_{08}) is estimated to be positive and statistically significant. “—” means that the impulse response function is estimated to be negative and statistically significant.

Table 2a. Summary of the estimation results on the alternative frameworks in comparison to the basic framework (The response functions on female employment gap with respect to the fiscal stimulus after 2013 (D_{13}))

	Basic case	With exchange rate	With labor force	After 1991 Q1
Hokkaido		+		+
Southern Kanto	+	+	+	+
Nouthern Kanto		+	+	+
Hokuriku	+	+	+	+
Tokai	+	+	+	+
Kansai	+	+	+	+
Chugoku	+	+	+	+
Shikoku	+	+	+	+
Kyushu	+	+	+	+

Note: “+” means that the impulse response function of female employment gap with respect to the dummy variable capturing fiscal stimulus after 2013 (D_{13}) is estimated to be positive and statistically significant. “Basic case” is the estimation results of our basic framework, “with exchange rate,” which is the case adding yen-dollar exchange rate to the basic specification, “with labor force” indicates the specification adding female labor force participation ratio, and “after 1991 Q1” stands for the case that the sample period is limited after the first quarter of 1991.

Table 2b. Summary of the estimation results on the alternative frameworks in comparison to the basic framework (The response functions on cyclically-adjusted female unemployment rate with respect to the fiscal stimulus after 2013 (D_{13}))

	Basic case	With exchange rate	With labor force	After 1991 Q1
Hokkaido	—	—	—	—
Southern Kanto		—	—	
Nouthern Kanto		—		
Hokuriku	—	—	—	
Tokai	—	—	—	
Kansai		—		
Chugoku		—	—	
Shikoku	—	—	—	—
Kyushu	—	—	—	—

Note: “—” means that the impulse response function of female cyclically-adjusted unemployment rate with respect to the dummy variable capturing fiscal stimulus after 2013 (D_{13}) is estimated to be negative and statistically significant. “Basic case” is the estimation results of our basic framework, “with exchange rate,” which is the case adding yen-dollar exchange rate to the basic specification, “with labor force” indicates the specification adding female labor force participation ratio, and “after 1991 Q1” stands for the case that the sample period is limited after the first quarter of 1991.

Table 2c. Summary of the estimation results on the alternative frameworks in comparison to the basic framework (The response functions on male employment gap with respect to the fiscal stimulus after 2013 (D_{13}))

	Basic case	With exchange rate	With labor force	After 1991 Q1
Hokkaido		+	+	+
Southern Kanto		+		+
Nouthern Kanto	—		—	
Hokuriku		+		
Tokai	—	—	—	
Kansai	+	+	+	+
Chugoku	+	+	+	+
Shikoku	+	+	+	+
Kyushu	+	+	+	+

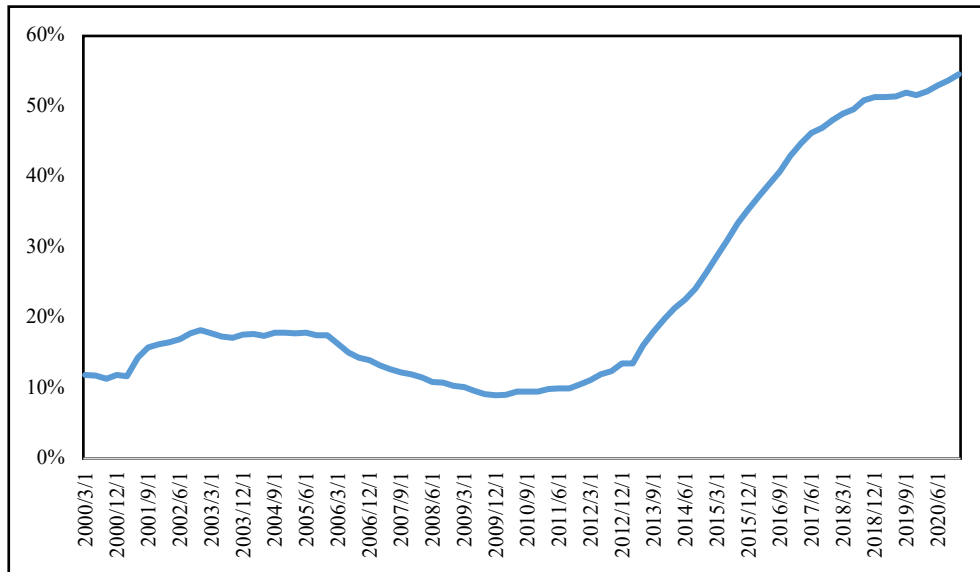
Note: “+” means that the impulse response function of male employment gap with respect to the dummy variable capturing fiscal stimulus after 2013 (D_{13}) is estimated to be positive and statistically significant, and “—” means the impulse response function is estimated to be negative and statistically significant. “Basic case” is the estimation results of our basic framework, “with exchange rate,” which is the case adding yen-dollar exchange rate to the basic specification, “with labor force” indicates the specification adding female labor force participation ratio, and “after 1991 Q1” stands for the case that the sample period is limited after the first quarter of 1991.

Table 2d. Summary of the estimation results on the alternative frameworks in comparison to the basic framework (The response functions on cyclically-adjusted male unemployment rate with respect to the fiscal stimulus after 2013 (D_{13}))

	Basic case	With exchange rate	With labor force	After 1991 Q1
Hokkaido	—	—	—	—
Southern Kanto	—	—		
Nouthern Kanto		—		
Hokuriku		—		
Tokai		—		
Kansai		—	—	
Chugoku		—		
Shikoku		—		
Kyushu	—	—	—	—

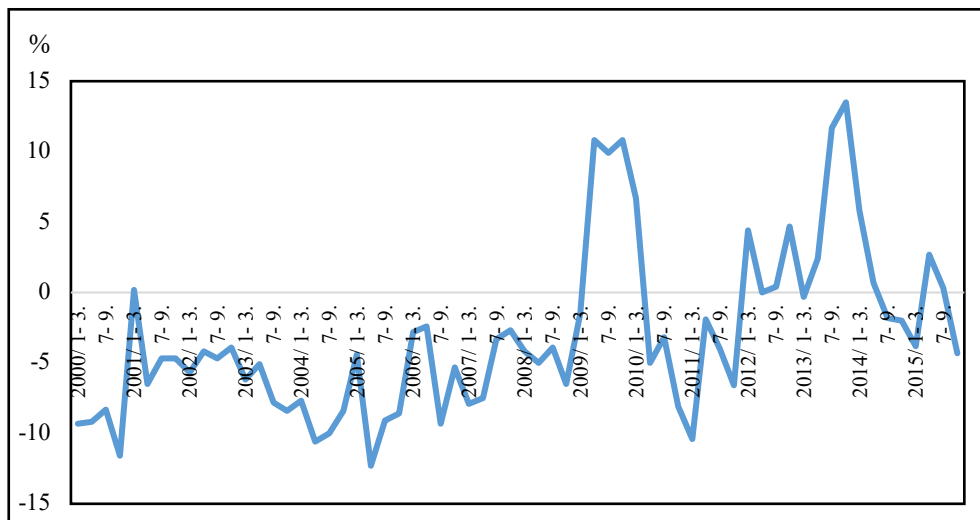
Note: “+” means that the impulse response function of cyclically-adjusted male unemployment with respect to the dummy variable capturing fiscal stimulus after 2013 (D_{13}) is estimated to be positive and statistically significant, and “-” means the impulse response function is estimated to be negative and statistically significant. “Basic case” is the estimation results of our basic framework, “with exchange rate,” which is the case adding yen-dollar exchange rate to the basic specification, “with labor force” indicates the specification adding female labor force participation ratio, and “after 1991 Q1” stands for the case that the sample period is limited after the first quarter of 1991.

Fig 1. The ratio of the Japanese Government Bonds holding by the Bank of Japan



Source: Flow of Funds Accounts, the Bank of Japan

Fig 2. The growth rate of capital formation by the government in Japan (compared to the same quarter of the previous year)



Source: The Cabinet Office, Government of Japan

Fig 3a. The logarithm of employment (number of employees) in Southern

Kanto

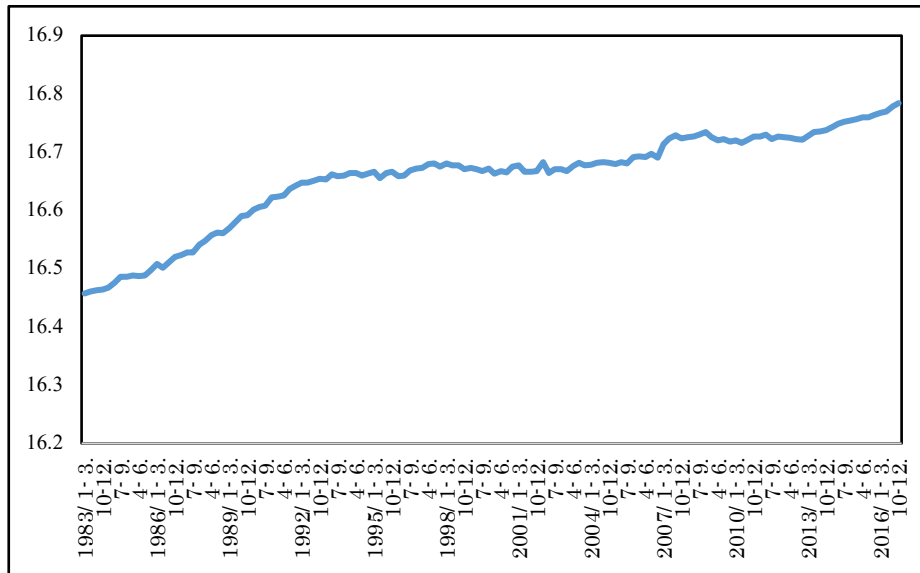


Fig 3b. Unemployment rate in Southern Kanto

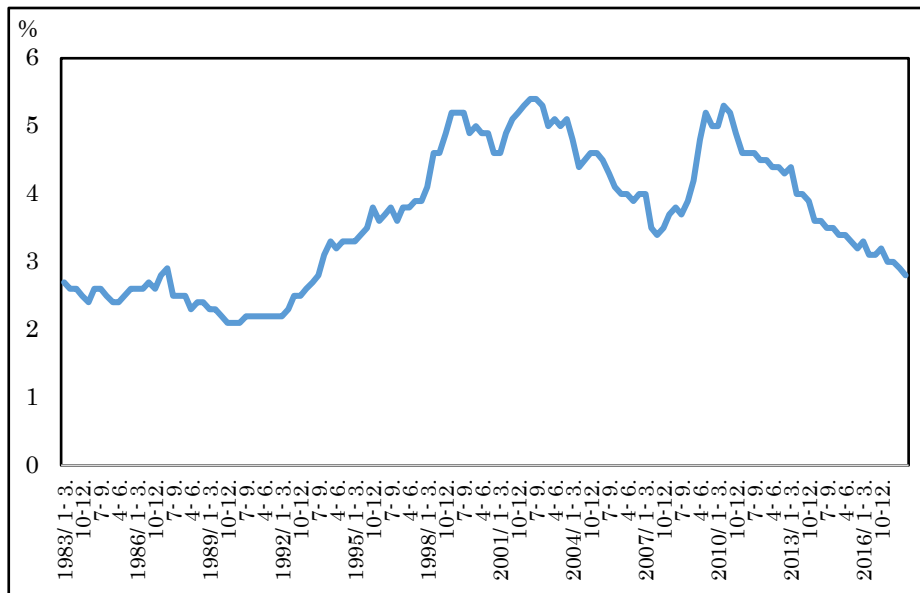


Fig 4a. The logarithm of employment (number of employees) in Shikoku

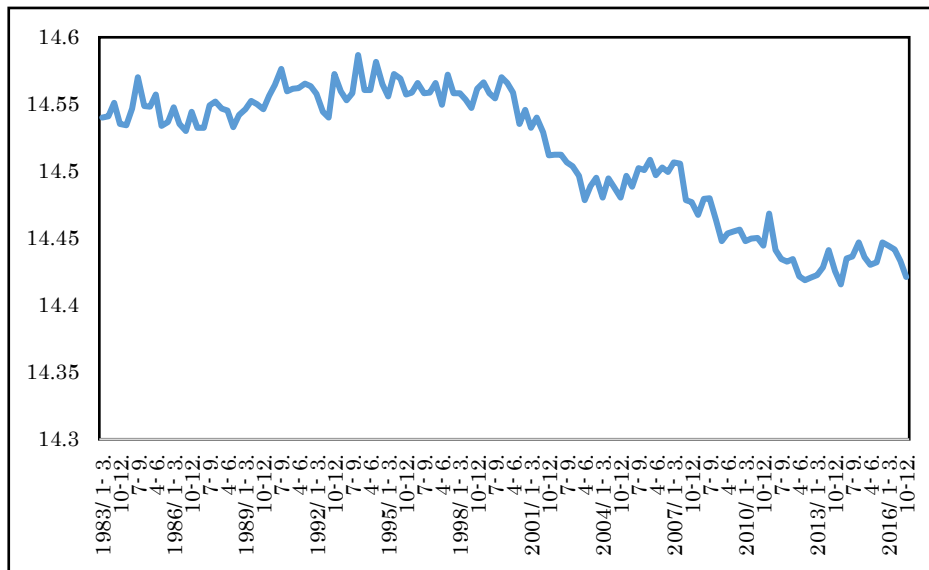


Fig 4b. Unemployment rate in Shikoku

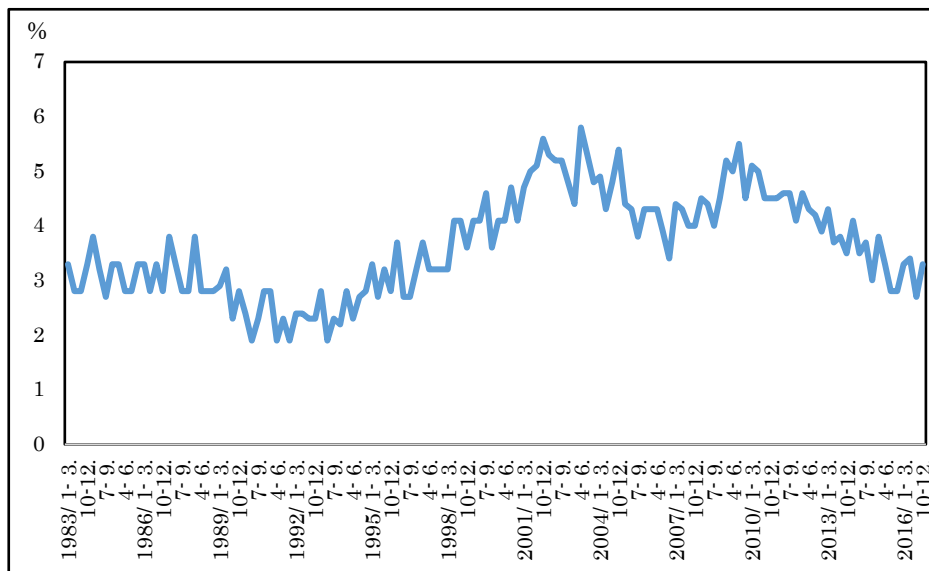
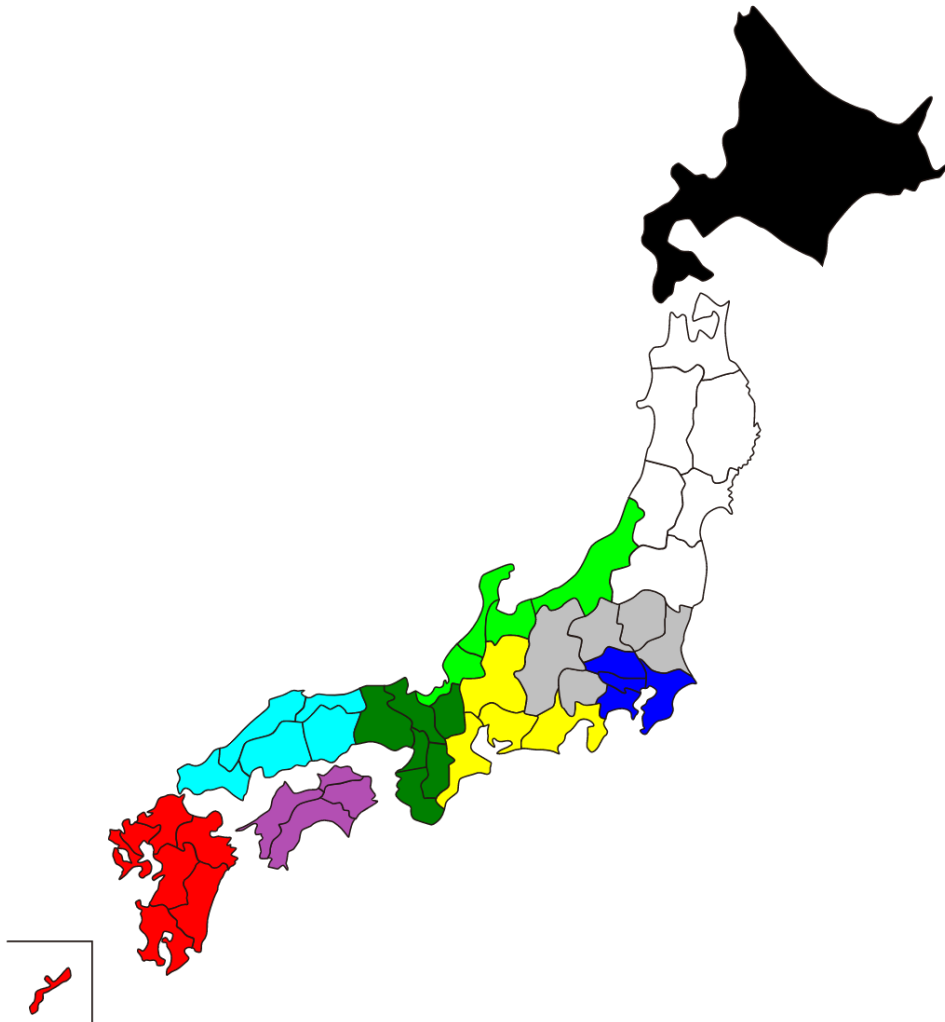
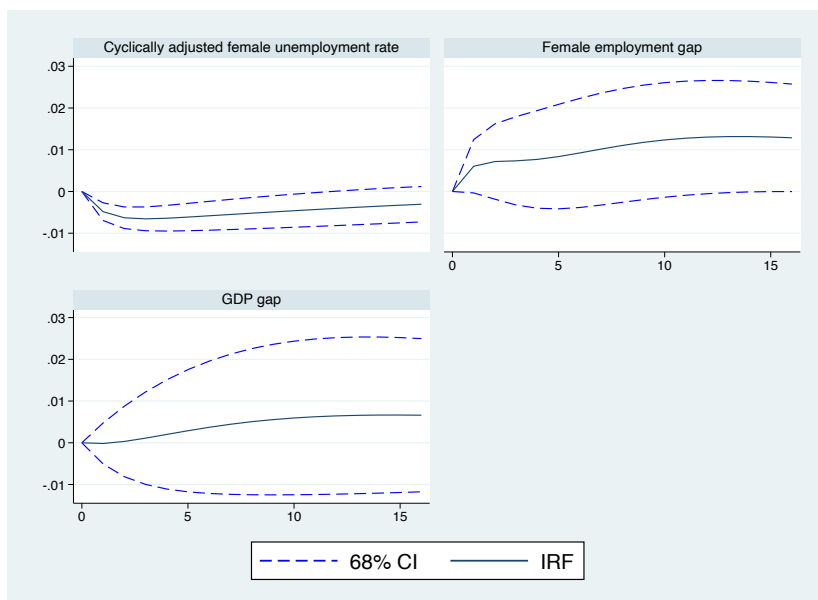


Fig 5. The map of the 10 regions of the Labor Force Survey



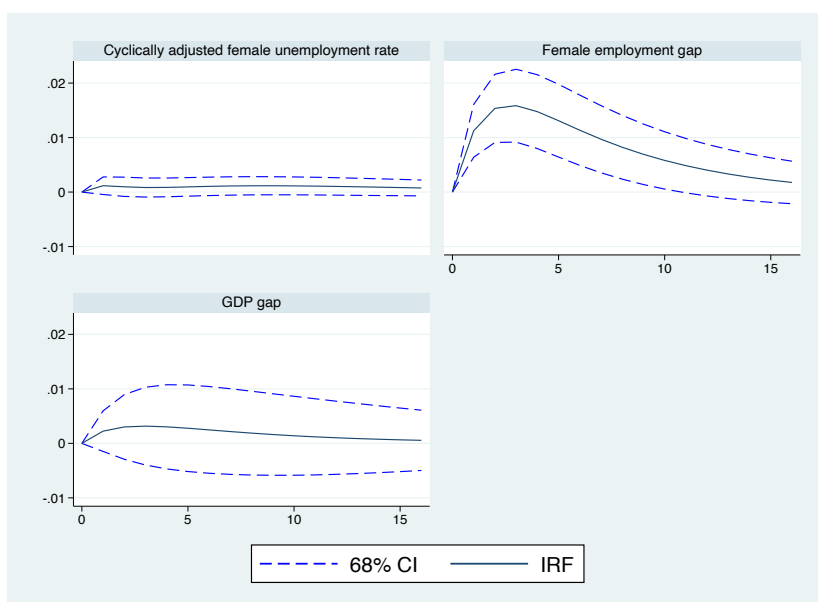
Note: The black area is Hokkaido, the white areas are Tohoku, the area of the four prefectures marked in blue is equivalent to Southern Kanto, and the grey areas are Northern Kanto and Koshin (we shorten this to Northern Kanto). Likewise, the light-green areas are Hokuriku, the prefectures group in yellow is Tokai, the group of prefectures marked in green is Kinki (we describe as Kansai), the light-blue areas are Chugoku, the purple areas are Shikoku, and the group of the islands in red is equivalent to Kyushu and Okinawa.

Fig 6a. Results of response functions on Hokkaido with respect to the stimulus after 2013 (D_{13}) (Female employment gap and cyclically-adjusted unemployment rate)



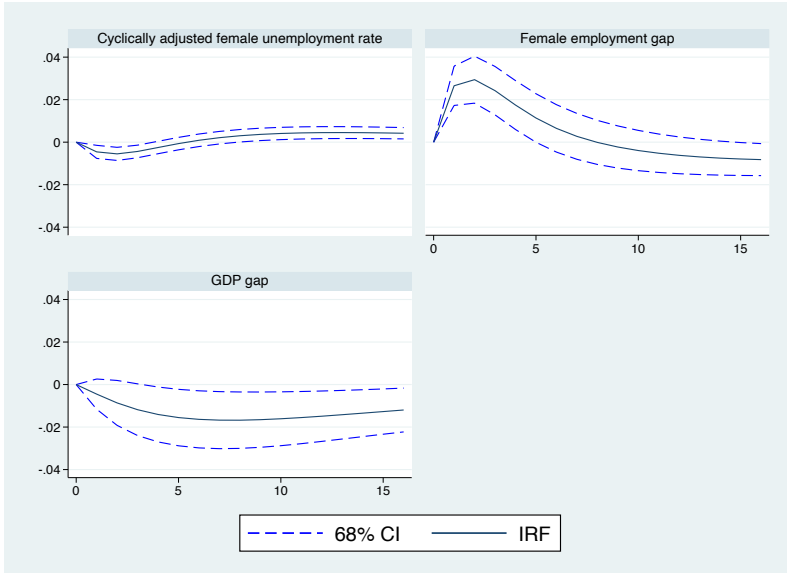
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 6b. Results of response functions on Hokkaido with respect to the stimulus in the 1990s (D_{90}) (Female employment gap and cyclically-adjusted unemployment rate)



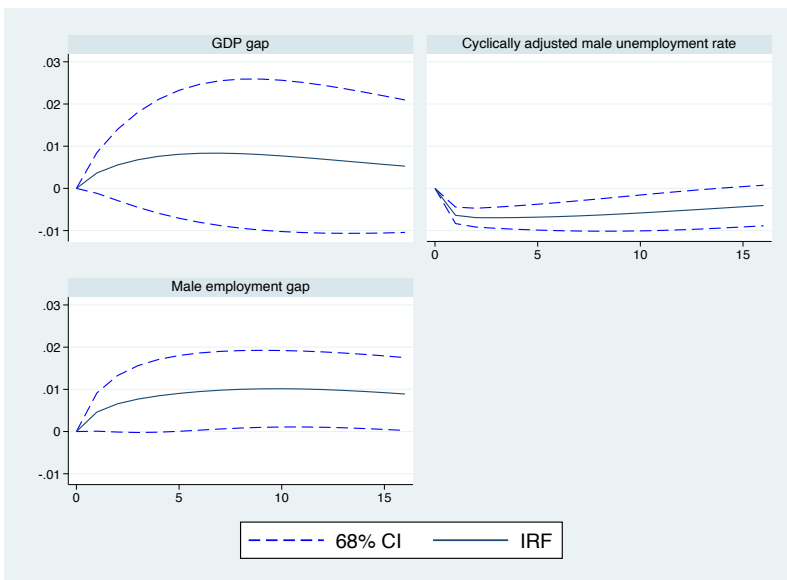
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 6c. Results of response functions on Hokkaido with respect to the stimulus after the global financial crisis (D_{08}) (Female employment gap and cyclically-adjusted unemployment rate)



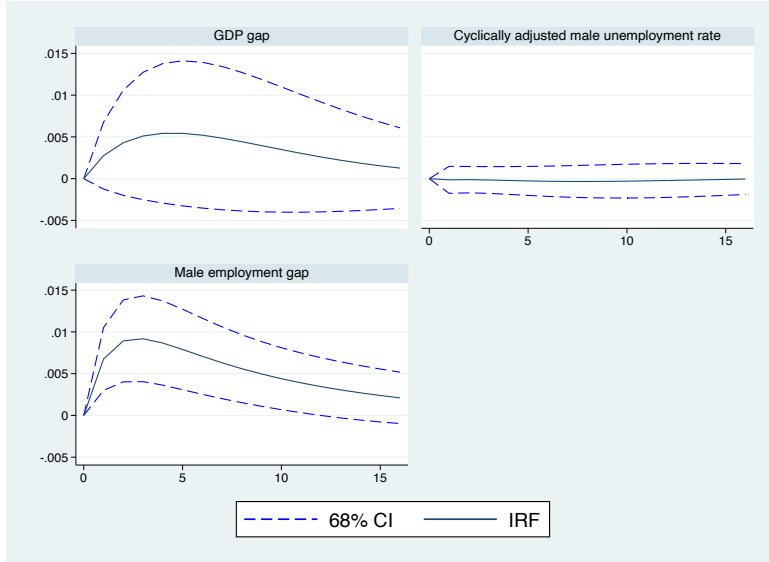
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 6d. Results of response functions on Hokkaido with respect to the stimulus after 2013 (D_{13}) (Male employment gap and cyclically-adjusted unemployment rate)



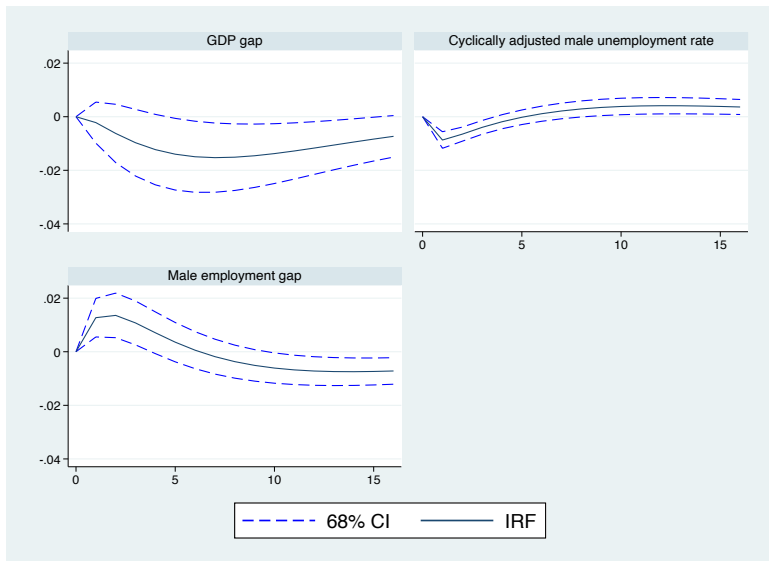
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 6e. Results of response functions on Hokkaido with respect to the stimulus in the 1990s (D_{90}) (Male employment gap and cyclically-adjusted unemployment rate,)



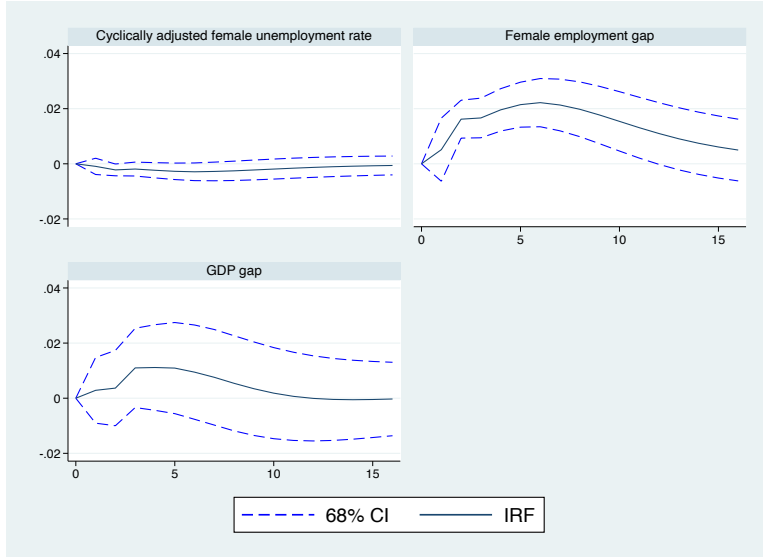
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 6f. Results of response functions on Hokkaido with respect to the stimulus after the global financial crisis (D_{08}) (Male employment gap and cyclically-adjusted unemployment rate)



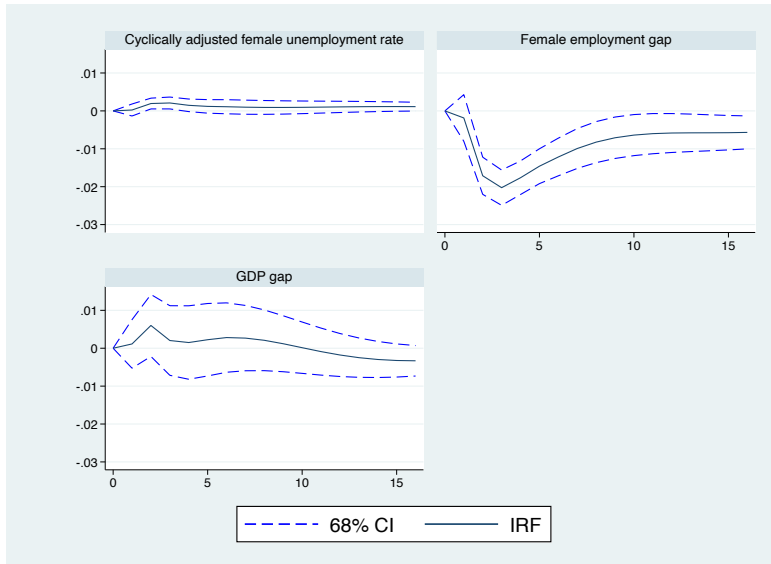
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 7a. Results of response functions on Southern Kanto with respect to the stimulus after 2013 (D_{13}) (Female employment gap and cyclically-adjusted unemployment rate)



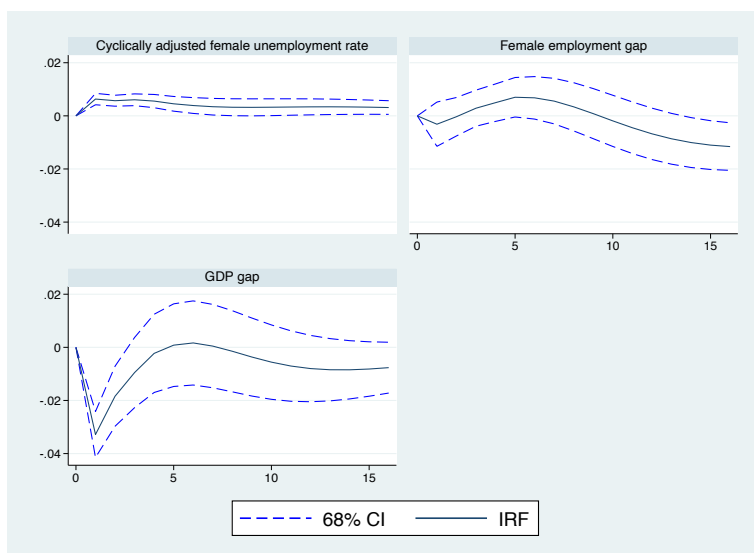
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 7b. Results of response functions on Southern Kanto with respect to the stimulus in the 1990s (D_{90}) (Female employment gap and cyclically-adjusted unemployment rate)



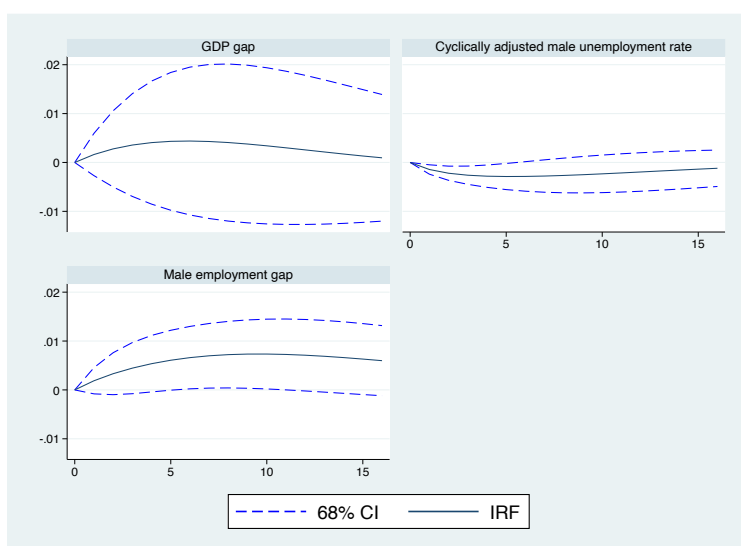
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 7c. Results of response functions on Southern Kanto with respect to the stimulus after the global financial crisis (D_{08}) (Female employment gap and cyclically-adjusted unemployment rate)



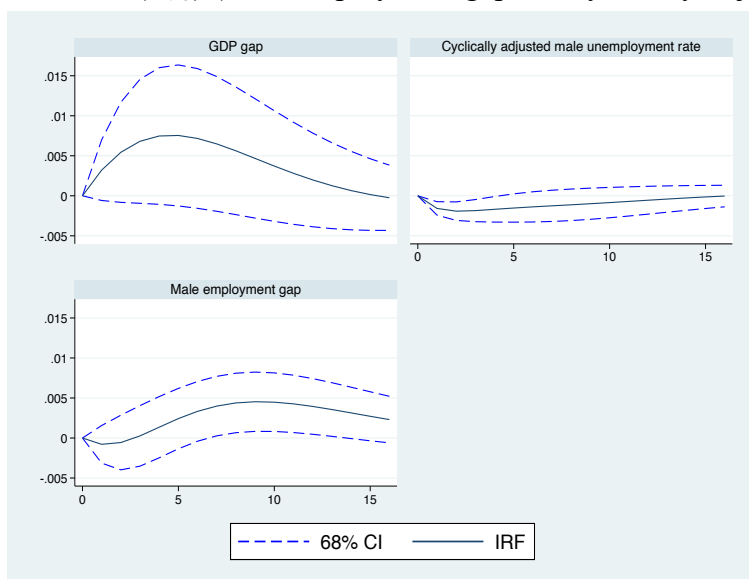
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 7d. Results of response functions on Southern Kanto with respect to the stimulus after 2013 (D_{13}) (Male employment gap and cyclically-adjusted unemployment rate)



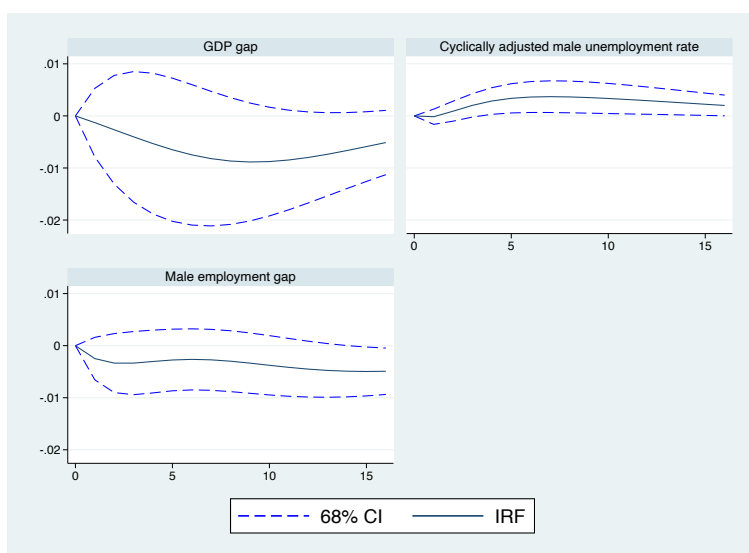
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 7e. Results of response functions on Southern Kanto with respect to the stimulus in the 1990s (D_{90}) (Male employment gap and cyclically-adjusted unemployment rate)



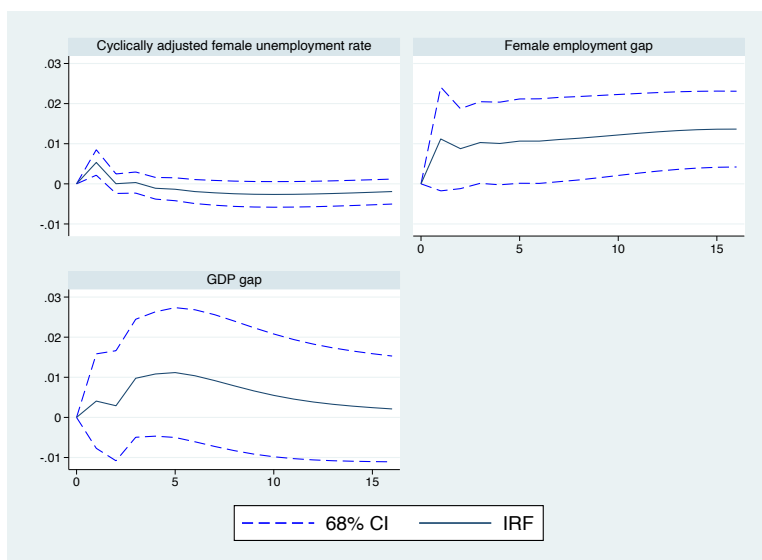
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 7f. Results of response functions on Southern Kanto with respect to the stimulus after the global financial crisis (D_{08}) (Male employment gap and cyclically-adjusted unemployment rate)



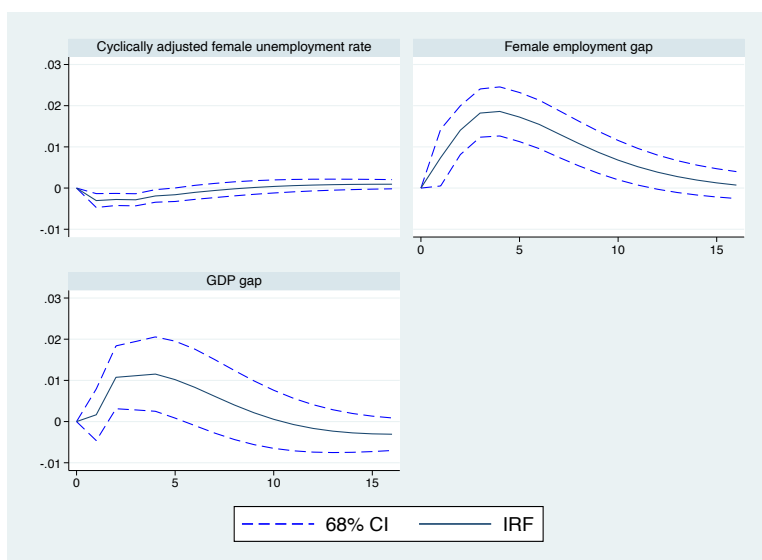
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 8a. Results of response functions on Northern Kanto with respect to the stimulus after 2013 (D_{13}) (Female employment gap and cyclically-adjusted unemployment rate)



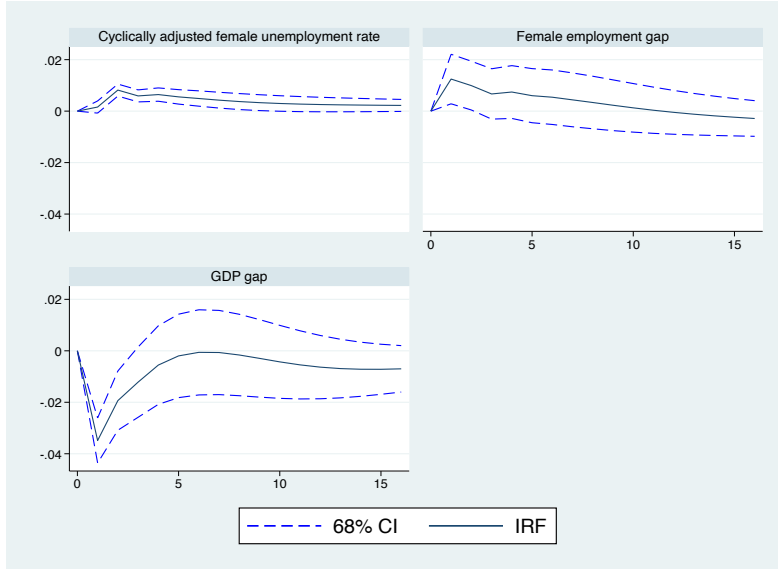
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 8b. Results of response functions on Northern Kanto with respect to the stimulus in the 1990s (D_{90}) (Female employment gap and cyclically-adjusted unemployment rate)



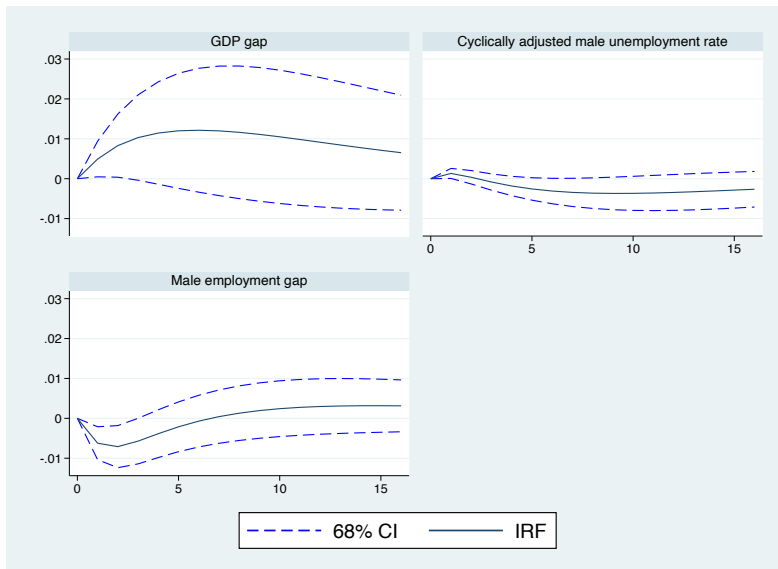
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 8c. Results of response functions on Northern Kanto with respect to the stimulus after the global financial crisis (D_{08}) (Female employment gap and cyclically-adjusted unemployment rate)



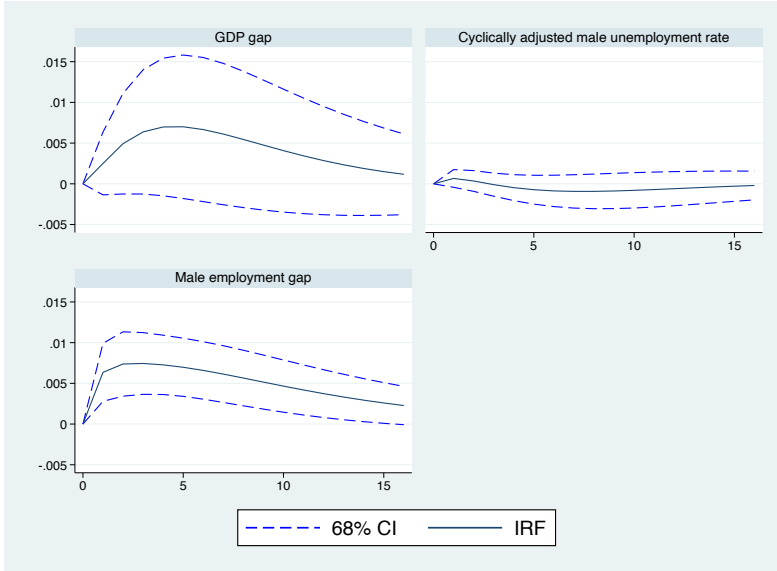
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 8d. Results of response functions on Northern Kanto with respect to the stimulus after 2013 (D_{13}) (Male employment gap and cyclically-adjusted unemployment rate)



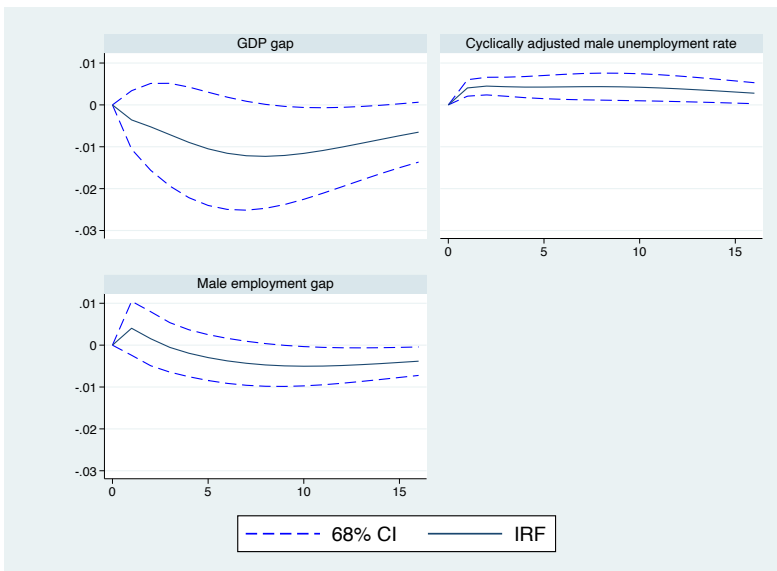
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 8e. Results of response functions on Northern Kanto with respect to the stimulus in the 1990s (D_{90}) (Male employment gap and cyclically-adjusted unemployment rate)



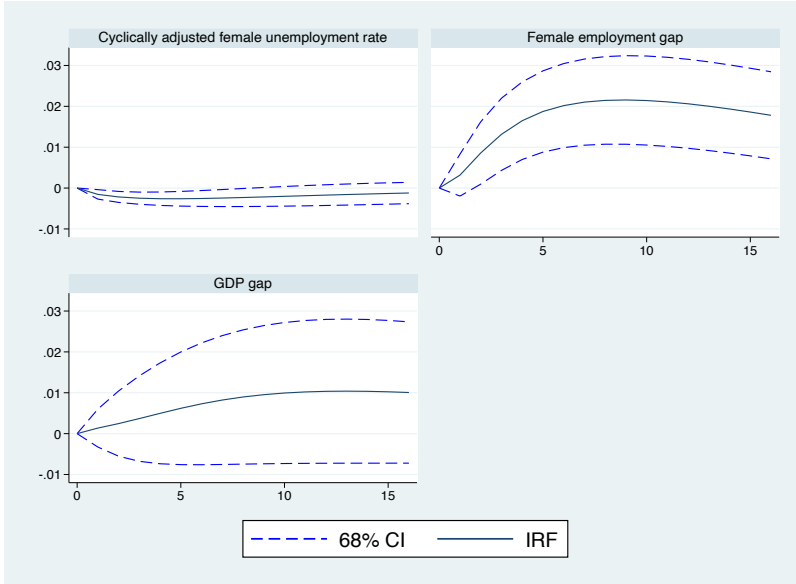
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 8f. Results of response functions on Northern Kanto with respect to the stimulus after the global financial crisis (D_{08}) (Male employment gap and cyclically-adjusted unemployment rate)



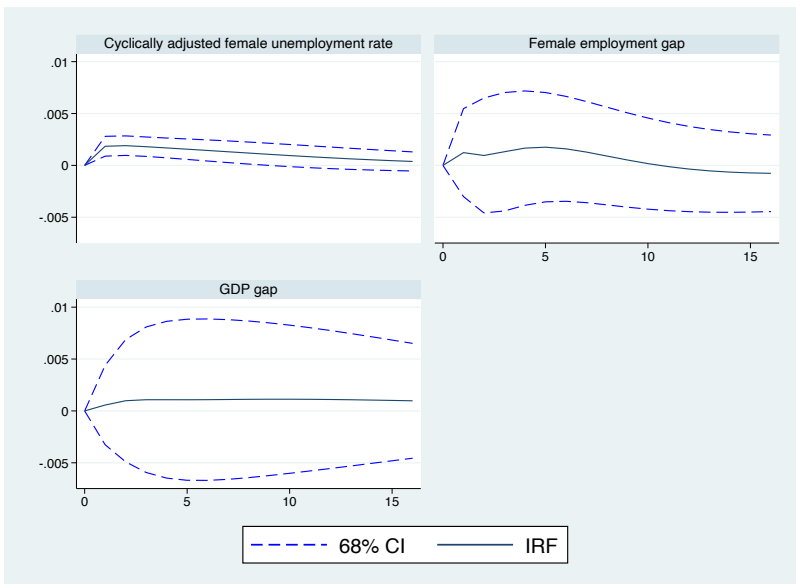
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 9a. Results of response functions on Hokuriku with respect to the stimulus after 2013 (D_{13}) (Female employment gap and cyclically-adjusted unemployment rate)



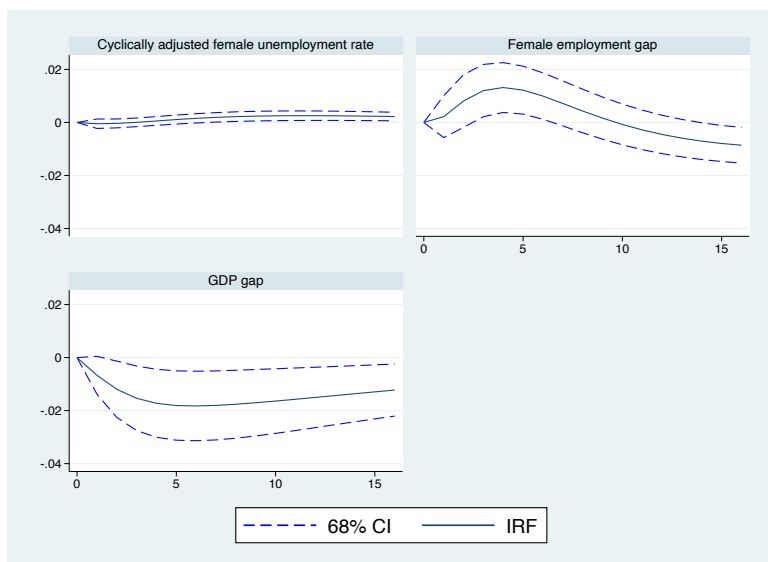
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 9b. Results of response functions on Hokuriku with respect to the stimulus in the 1990s (D_{90}) (Female employment gap and cyclically-adjusted unemployment rate)



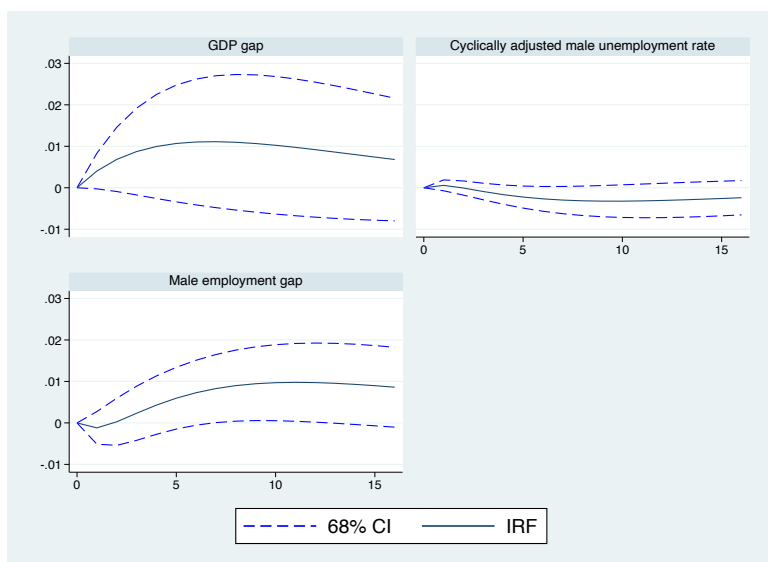
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 9c. Results of response functions on Hokuriku with respect to the stimulus after the global financial crisis (D_{08}) (Female employment gap and cyclically-adjusted unemployment rate)



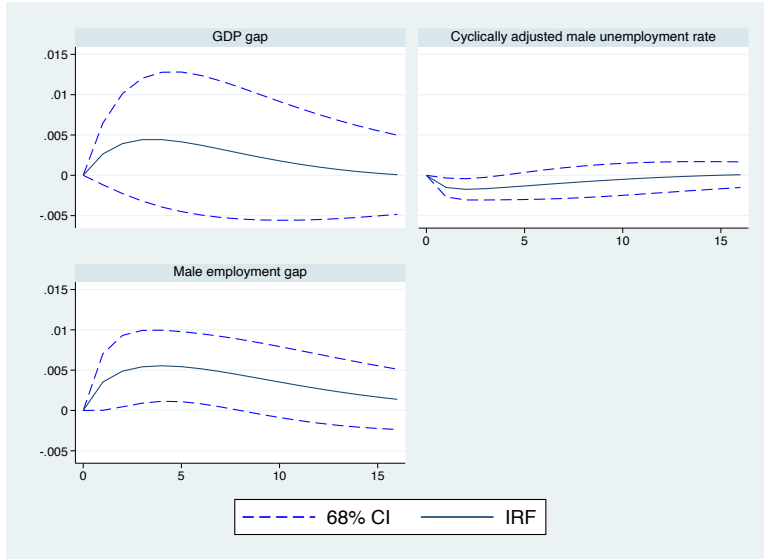
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 9d. Results of response functions on Hokuriku with respect to the stimulus after 2013 (D_{13}) (Male employment gap and cyclically-adjusted unemployment rate)



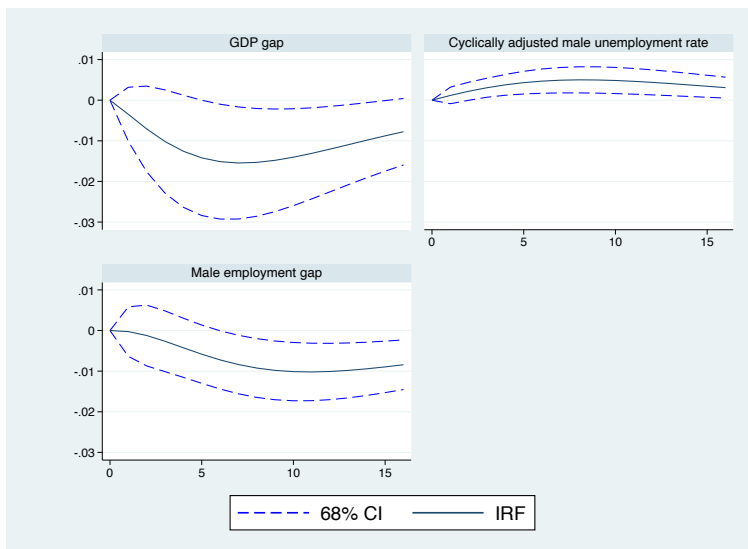
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 9e. Results of response functions on Hokuriku with respect to the stimulus in the 1990s (D_{90}) (Male employment gap and cyclically-adjusted unemployment rate)



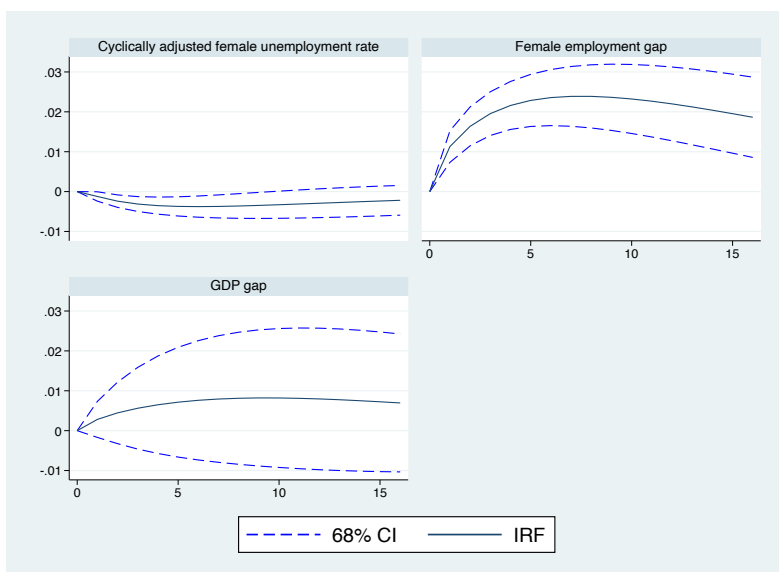
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 9f. Results of response functions on Hokuriku with respect to the stimulus after the global financial crisis (D_{08}) (Male employment gap and cyclically-adjusted unemployment rate)



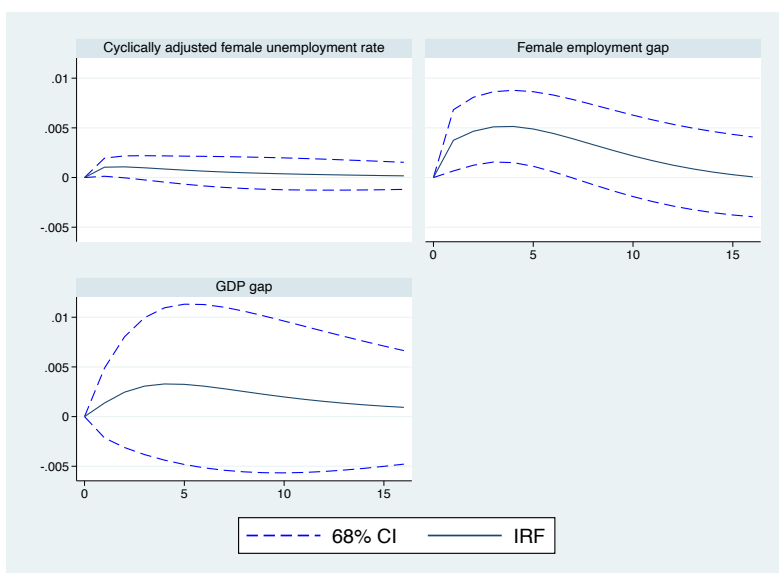
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 10a. Results of response functions on Tokai with respect to the stimulus after 2013 (D_{13}) (Female employment gap and cyclically-adjusted unemployment rate)



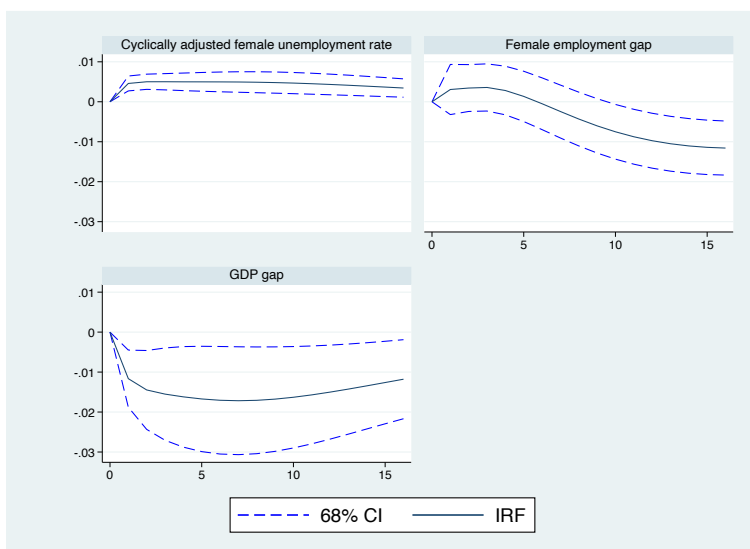
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 10b. Results of response functions on Tokai with respect to the stimulus in the 1990s (D_{90}) (Female employment gap and cyclically-adjusted unemployment rate)



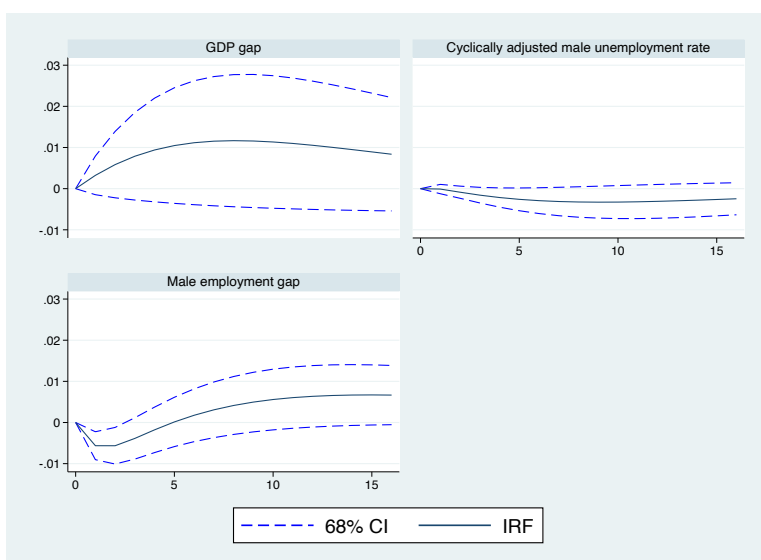
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 10c. Results of response functions on Tokai with respect to the stimulus after the global financial crisis (D_{08}) (Female employment gap and cyclically-adjusted unemployment rate)



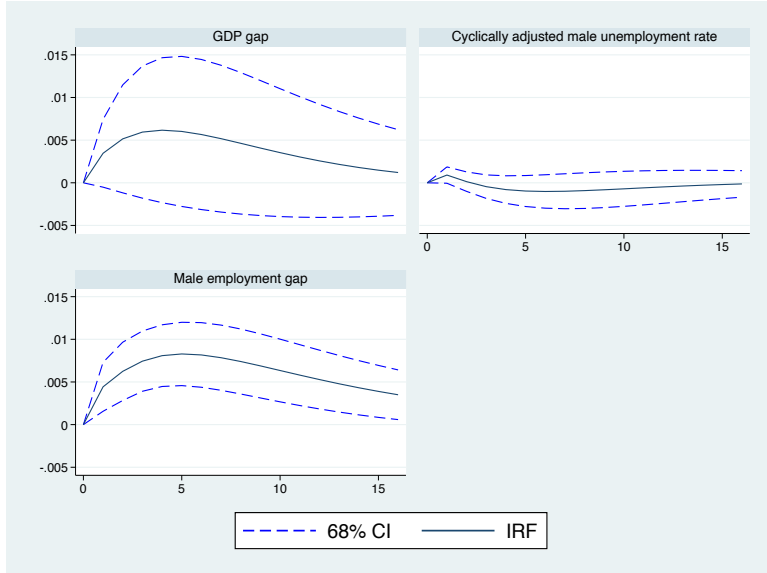
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 10d. Results of response functions on Tokai with respect to the stimulus after 2013 (D_{13}) (Male employment gap and cyclically-adjusted unemployment rate)



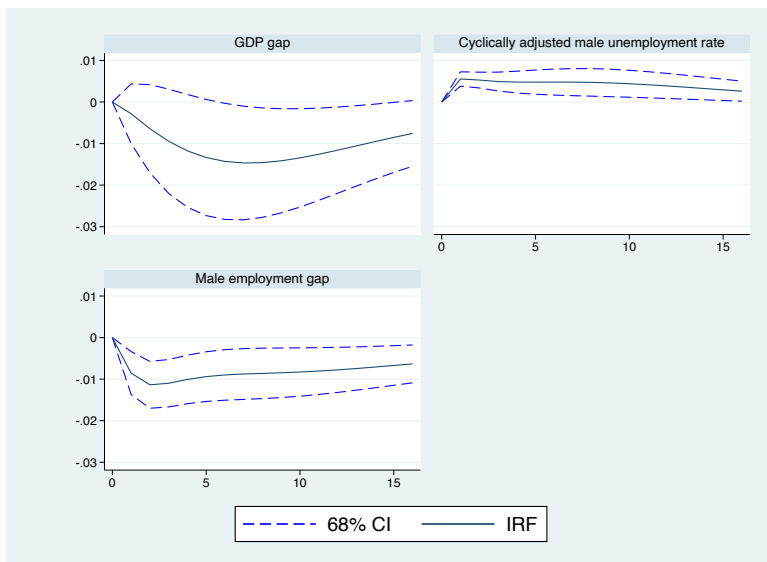
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 10e. Results of response functions on Tokai with respect to the stimulus in the 1990s (D_{90}) (Male employment gap and cyclically-adjusted unemployment rate)



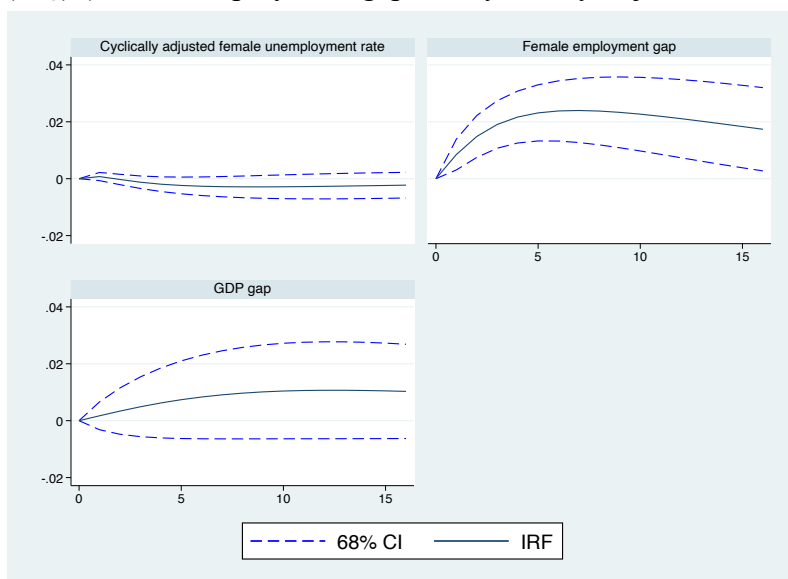
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 10f. Results of response functions on Tokai with respect to the stimulus after the global financial crisis (D_{08}) (Male employment gap and cyclically-adjusted unemployment rate)



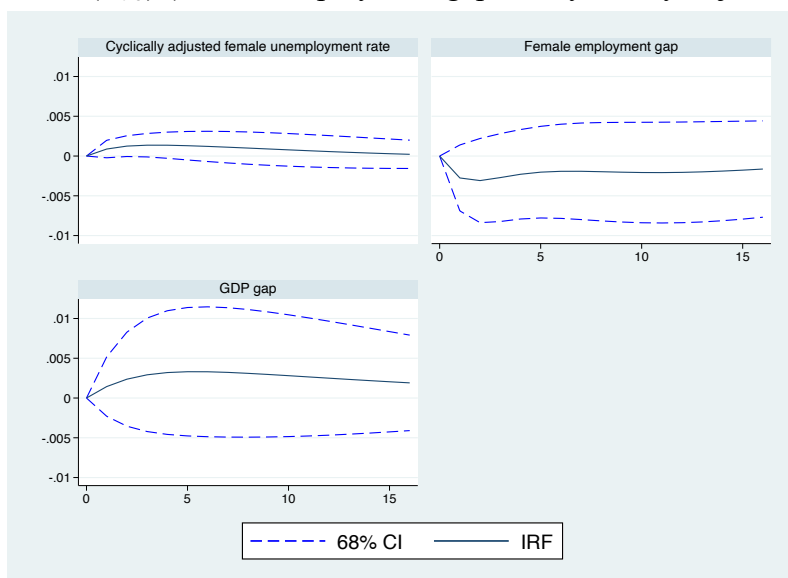
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 11a. Results of response functions on Kansai with respect to the stimulus after 2013 (D_{13}) (Female employment gap and cyclically-adjusted unemployment rate)



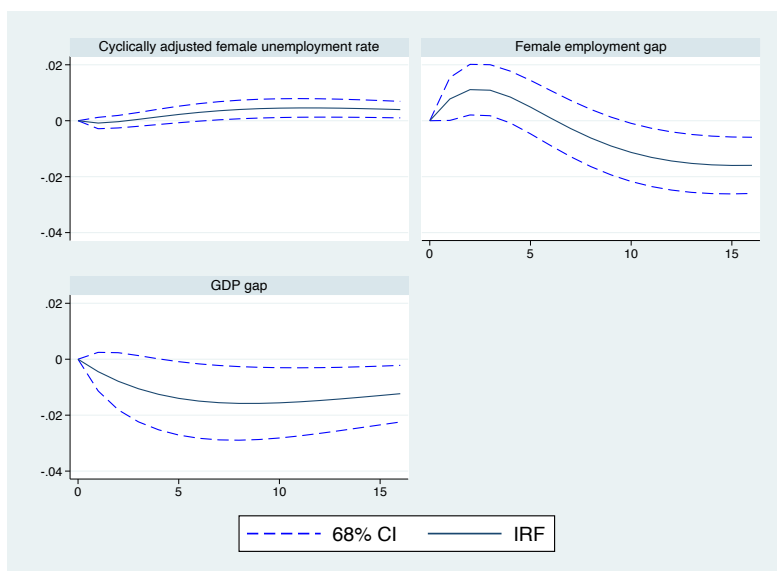
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 11b. Results of response functions on Kansai with respect to the stimulus in the 1990s (D_{90}) (Female employment gap and cyclically-adjusted unemployment rate)



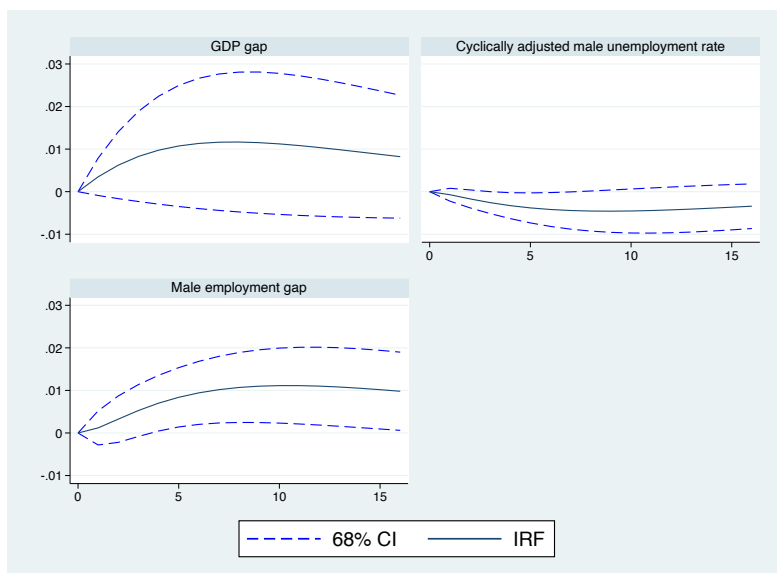
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 11c. Results of response functions on Kansai with respect to the stimulus after the global financial crisis (D_{08}) (Female employment gap and cyclically-adjusted unemployment rate)



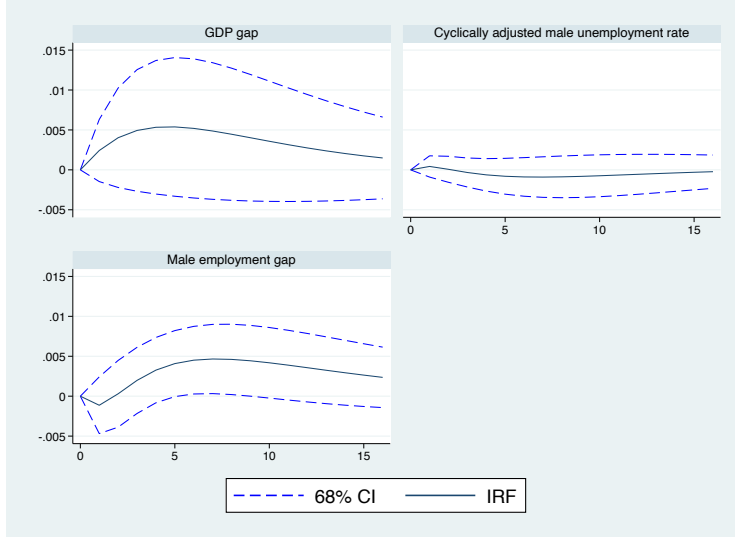
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 11d. Results of response functions on Kansai with respect to the stimulus after 2013 (D_{13}) (Male employment gap and cyclically-adjusted unemployment rate)



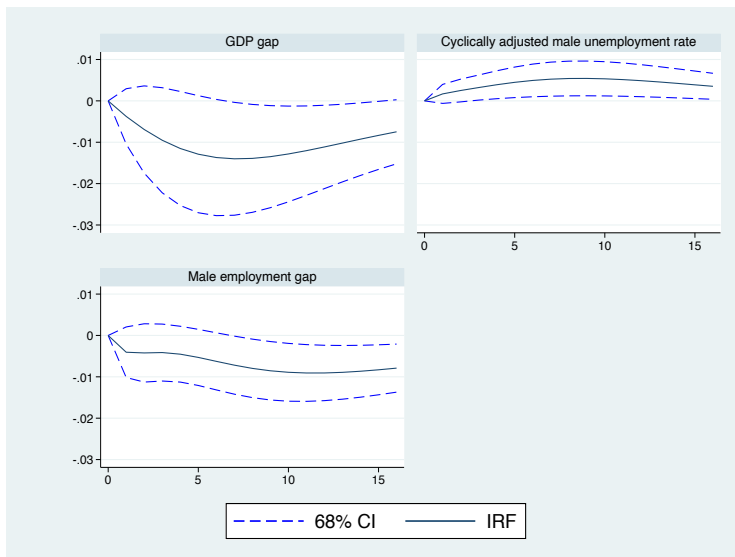
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 11e. Results of response functions on Kansai with respect to the stimulus in the 1990s (D_{90}) (Male employment gap and cyclically-adjusted unemployment rate)



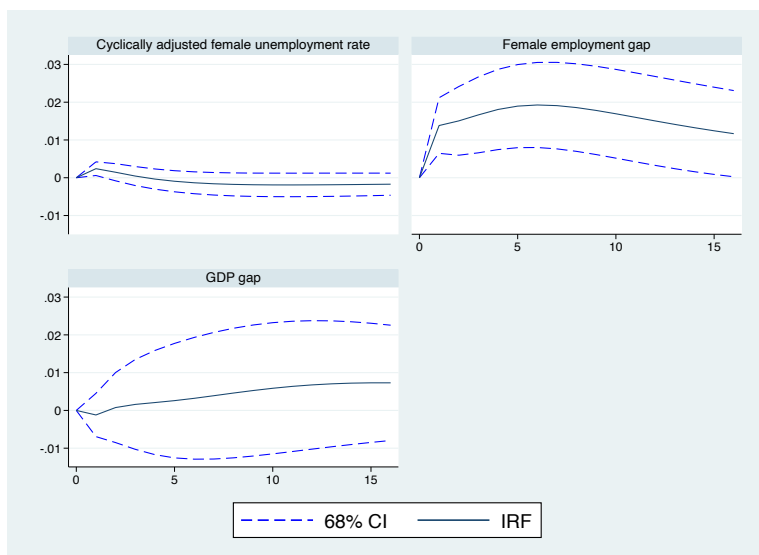
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 11f. Results of response functions on Kansai with respect to the stimulus after the global financial crisis (D_{08}) (Male employment gap and cyclically-adjusted unemployment rate)



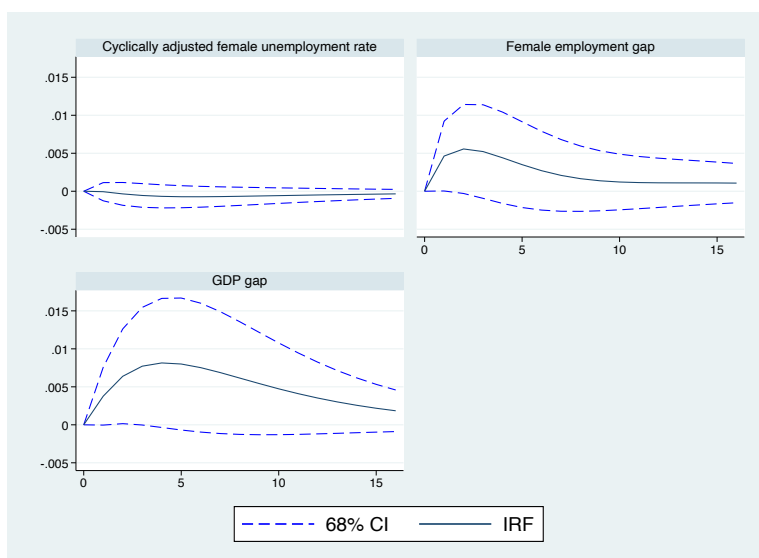
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 12a. Results of response functions on Chugoku with respect to the stimulus after 2013 (D_{13}) (Female employment gap and cyclically-adjusted unemployment rate)



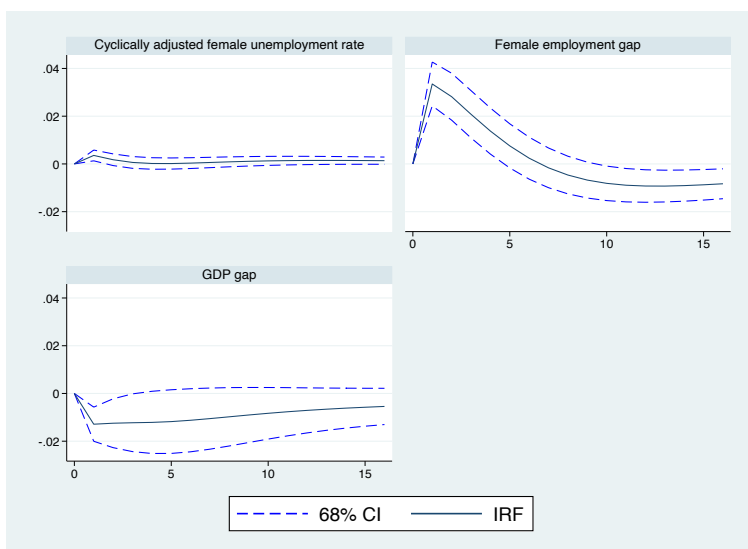
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 12b. Results of response functions on Chugoku with respect to the stimulus in the 1990s (D_{90}) (Female employment gap and cyclically-adjusted unemployment rate)



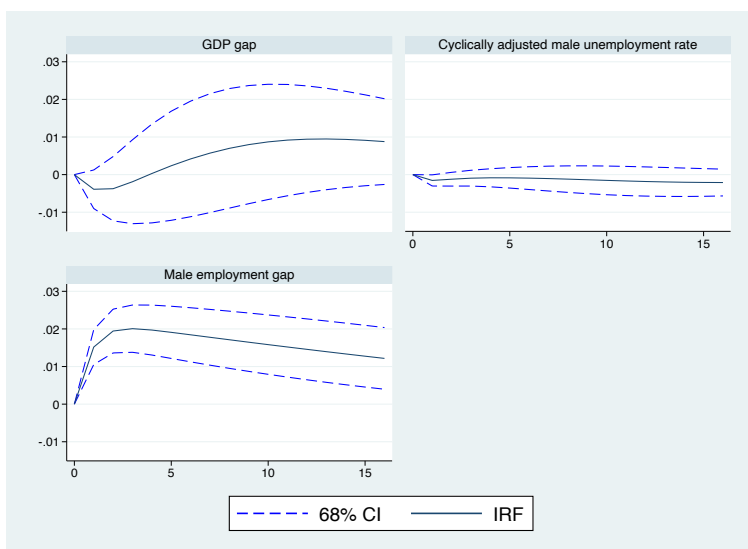
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 12c. Results of response functions on Chugoku with respect to the stimulus after the global financial crisis (D_{08}) (Female employment gap and cyclically-adjusted unemployment rate,)



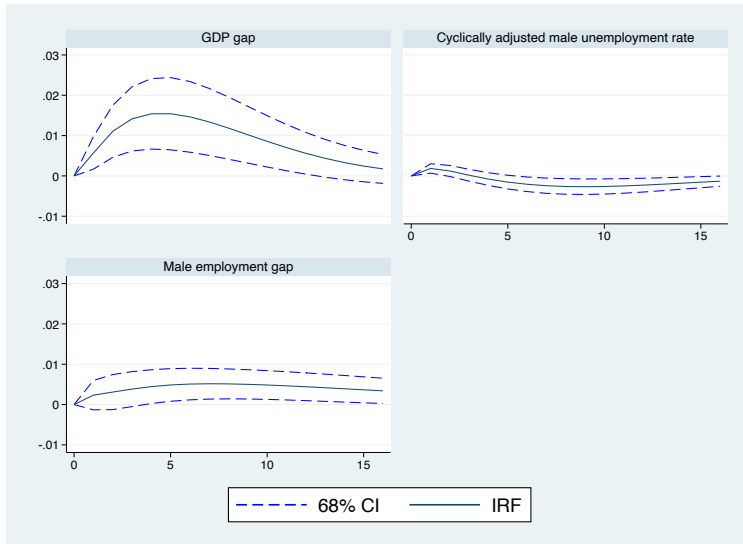
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 12d. Results of response functions on Chugoku with respect to the stimulus after 2013 (D_{13}) (Male employment gap and cyclically-adjusted unemployment rate)



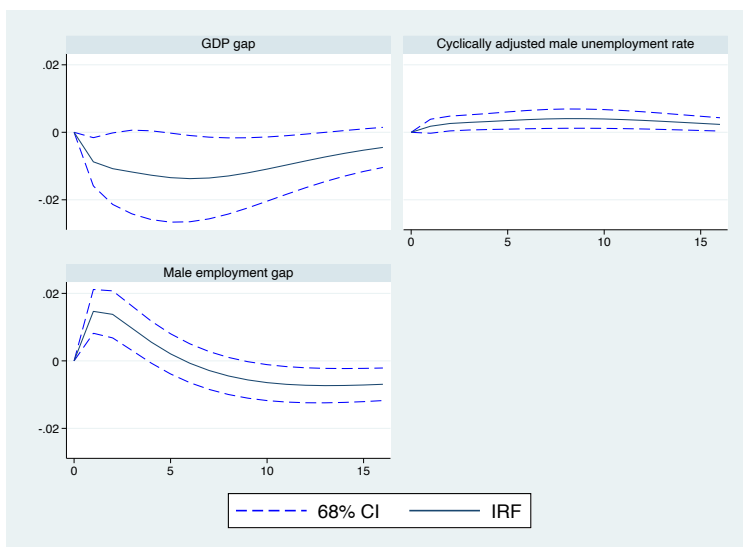
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 12e. Results of response functions on Chugoku with respect to the stimulus in the 1990s (D_{90}) (Male employment gap and cyclically-adjusted unemployment rate)



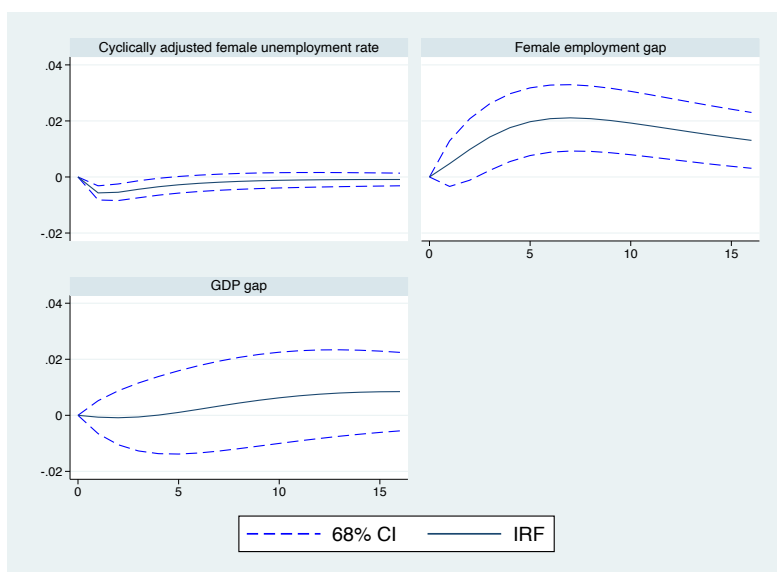
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 12f. Results of response functions on Chugoku with respect to the stimulus after the global financial crisis (D_{08}) (Male employment gap and cyclically-adjusted unemployment rate)



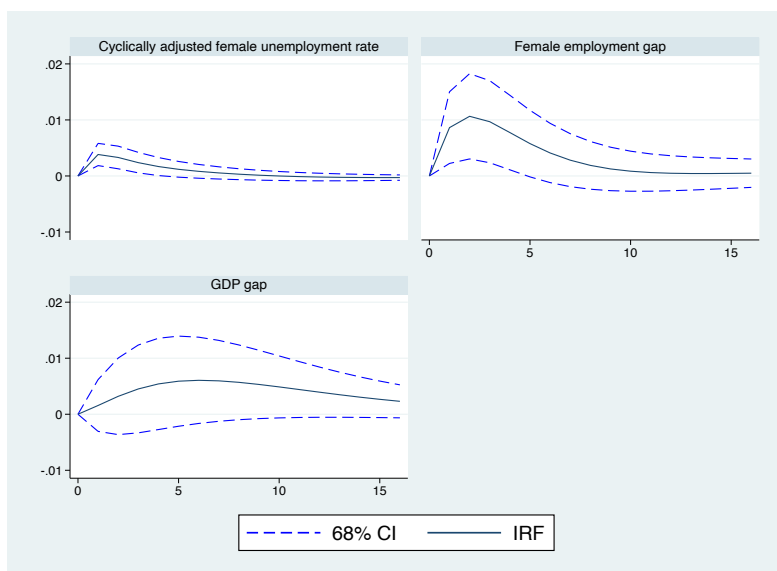
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 13a. Results of response functions on Shikoku with respect to the stimulus after 2013 (D_{13}) (Female employment gap and cyclically-adjusted unemployment rate)



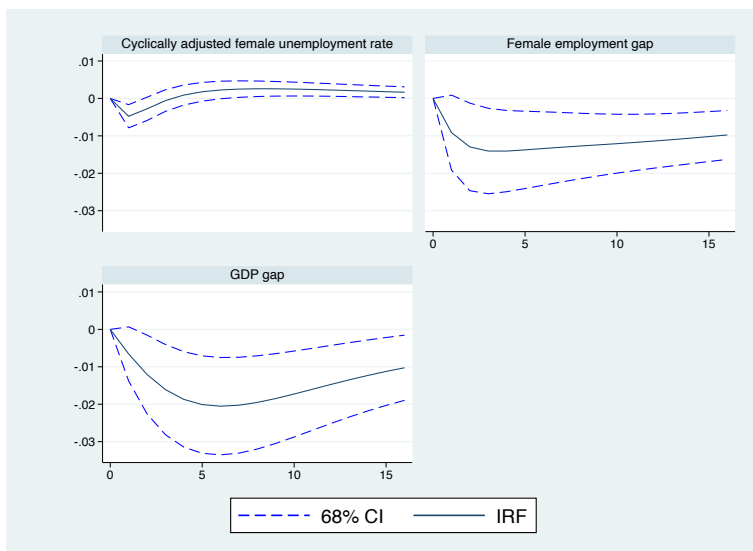
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 13b. Results of response functions on Shikoku with respect to the stimulus in the 1990s (D_{90}) (Female employment gap and cyclically-adjusted unemployment rate)



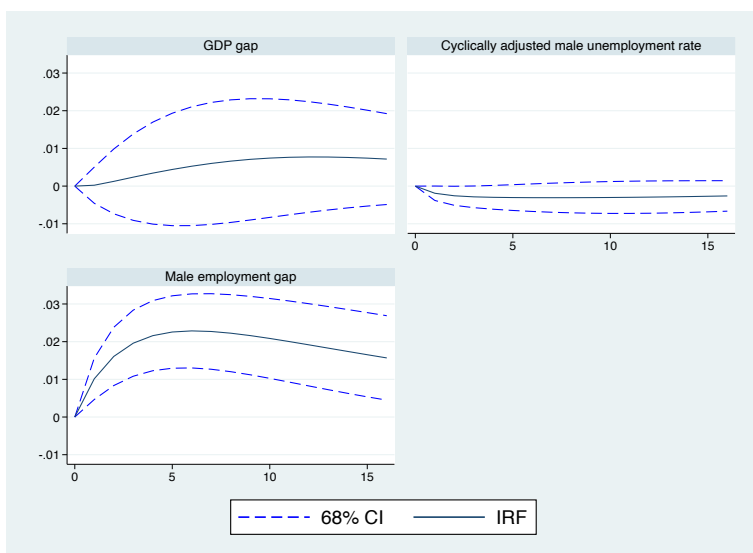
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 13c. Results of response functions on Shikoku with respect to the stimulus after the global financial crisis (D_{08}) (Female employment gap and cyclically-adjusted unemployment rate)



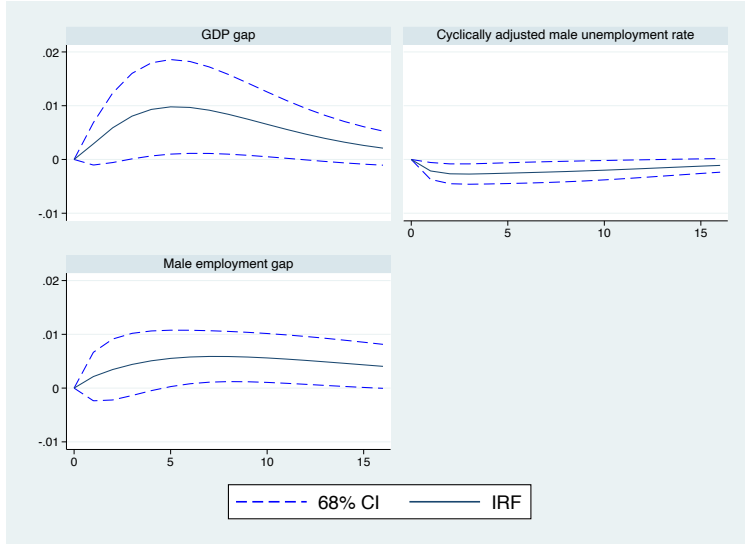
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 13d. Results of response functions on Shikoku with respect to the stimulus after 2013 (D_{13}) (Male employment gap and cyclically-adjusted unemployment rate)



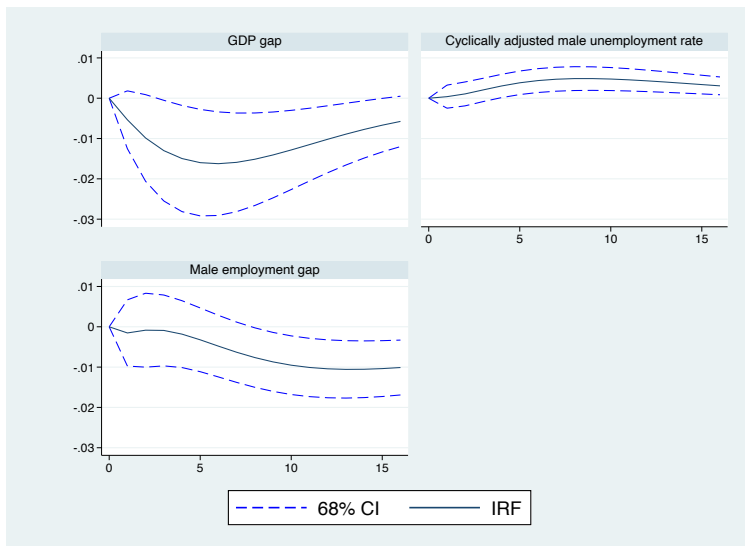
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 13e. Results of response functions on Shikoku with respect to the stimulus in the 1990s (D_{90}) (Male employment gap and cyclically-adjusted unemployment rate)



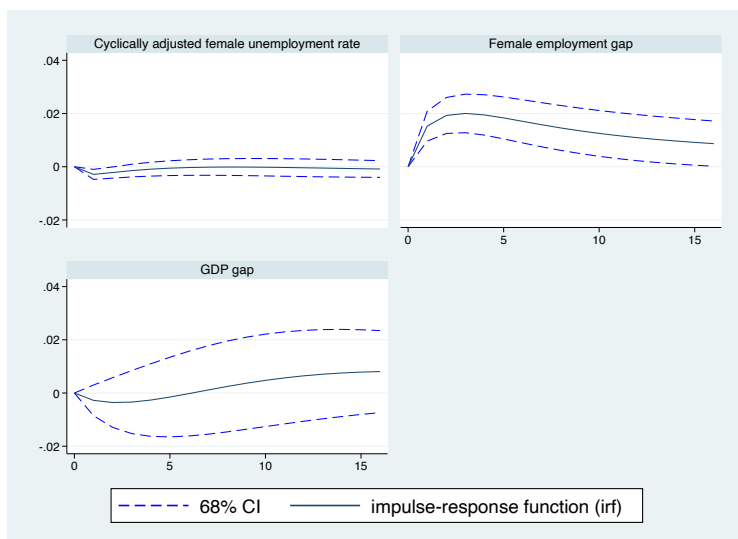
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 13f. Results of response functions on Shikoku with respect to the stimulus after the global financial crisis (D_{08}) (Male employment gap and cyclically-adjusted unemployment rate)



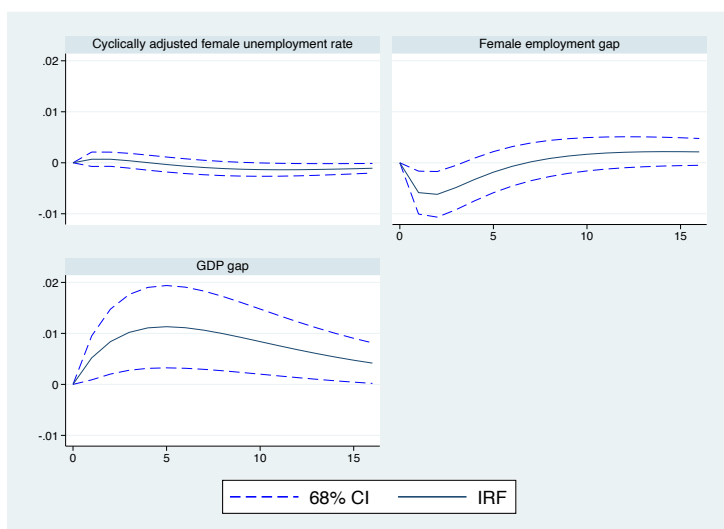
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 14a. Results of response functions on Kyushu and Okinawa with respect to the stimulus after 2013 (D_{13}) (Female employment gap and cyclically-adjusted unemployment rate)



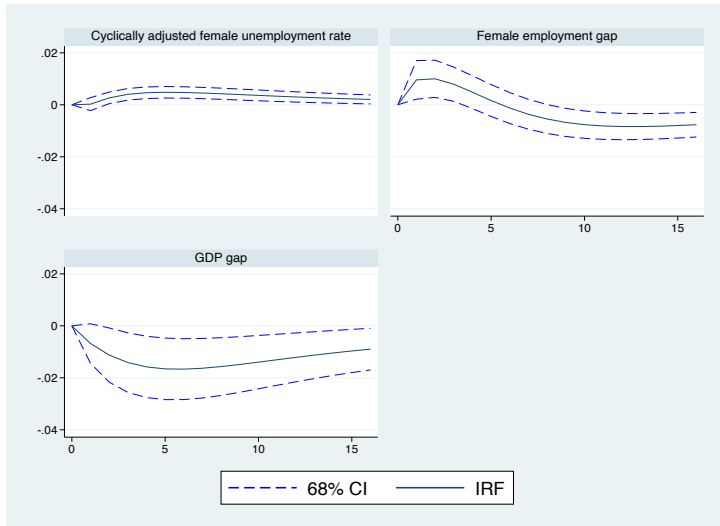
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 14b. Results of response functions on Kyushu and Okinawa with respect to the stimulus in the 1990s (D_{90}) (Female employment gap and cyclically-adjusted unemployment rate)



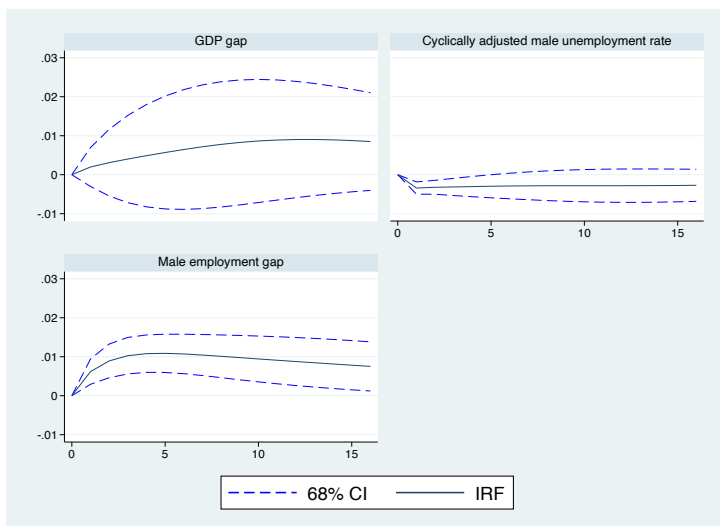
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 14c. Results of response functions on Kyushu and Okinawa with respect to the stimulus after the global financial crisis (D_{08}) (Female employment gap and cyclically-adjusted unemployment rate)



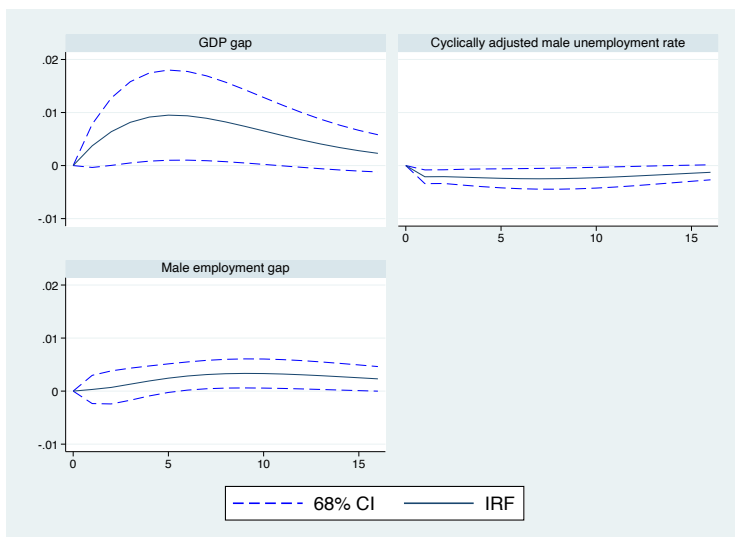
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 14d. Results of response functions on Kyushu and Okinawa with respect to the stimulus after 2013 (D_{13}) (Male employment gap and cyclically-adjusted unemployment rate)



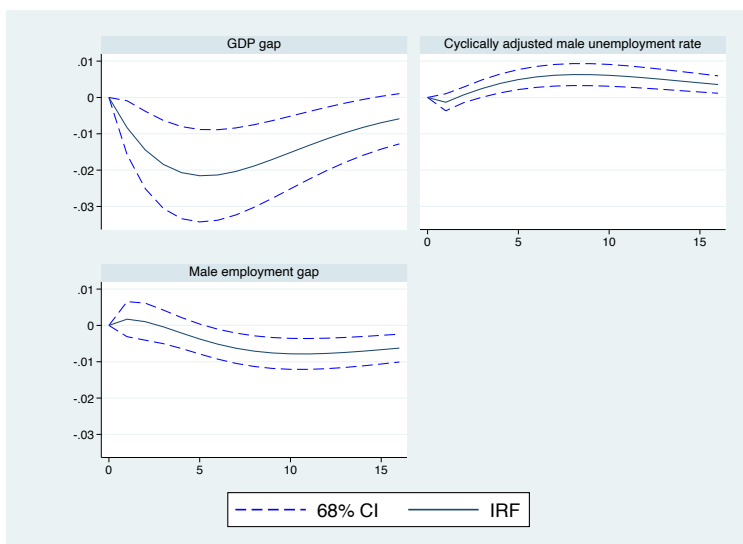
Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 14e. Results of response functions on Kyushu and Okinawa with respect to the stimulus in the 1990s (D_{90}) (Male employment gap and cyclically-adjusted unemployment rate)



Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.

Fig 14f. Results of response functions on Kyushu and Okinawa with respect to the stimulus after the global financial crisis (D_{09}) (Male employment gap and cyclically-adjusted unemployment rate)



Note: The solid line indicates the estimated response and the dotted lines represent the one standard error band.