



**WP/19/4**

# **IMF Working Paper**

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by Bernardin Akitoby, Jiro Honda, and Hiroaki Miyamoto

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Fiscal Affairs Department

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Prepared by Bernardin Akitoby, Jiro Honda, and Hiroaki Miyamoto

Authorized for distribution by Nikolay Gueorguiev

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#### ABSTRACT

Would countercyclical fiscal policy during recessions improve or worsen the gender employment gap? We give an answer to this question by exploring the state-dependent impact of fiscal spending shocks on employment by gender in the G-7 countries. Using the local projection method, we find that, during recessions, a positive spending shock of 1 percent of GDP would, on average, lift female employment by 1 percent, while increasing male employment by 0.6 percent. Consequently such a shock would improve the female share of employment by 0.28 percentage point during recessions. Our findings are driven by disproportionate employment changes in female-friendly industries, occupations, and part-time jobs in response to fiscal spending shocks. The analysis suggests that fiscal stimulus, particularly during recessions, could achieve the twin objectives of supporting aggregate demand and improving gender gaps.

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## I. INTRODUCTION

**1. Significant gender employment gap remains in the G-7 countries, leading to sizable loss of output.** On average, women's labor market participation rate is about 17 percentage points lower than men's, and the wage gap between women and men amounts to about 14 percent (IMF, 2017a). These labor market divides have important economic implications. For instance, if the female labor participation rate were raised to the country-specific male rate, output could increase by 5 percent in the United States (Aguirre et al., 2012). As the G-7 economies are ageing, higher female employment could also boost potential growth and total factor productivity (Elborgh-Woytek et al., 2013; Steinberg and Nakane, 2012; and Barsh and Yee, 2012).

**2. To increase female labor force participation, the G-7 countries have implemented a range of structural fiscal policies.** Taxation is often used to eliminate disincentives for the secondary earners (mostly female) to work. For instance, most G-7 countries now implement individual taxation rather family-income-based taxation.<sup>2</sup> All G-7 countries have spending policies to support childcare facilities and gender-responsive public employment (IMF, 2017a). For example, the Canada Child Benefit provides for a tax-free, income-tested benefit to alleviate the cost of child care for female workers (IMF, 2017a). Other spending measures include quotas in managerial positions (France, Germany), public sector equal pay (e.g., Canada, France).

**3. The cyclical component of gender unemployment also deserves attention because of "hysteresis."** A process of "hysteresis" could link the short-term cycle to the long-term trend, so that a temporary change in unemployment may become permanent (DeLong and Summers, 2012). According to this view, in a depressed economy, low rates of investment imply a deterioration of physical capital, human capital declines as workers without employment lose their skills, and the long-term unemployed face a declining likelihood of being rehired. All of these factors influence potential output. Thus, if hysteresis effects are stronger during slumps, then fiscal policy is likely to have more persistent effects on gender employment.

**4. Fiscal spending shocks could influence gender employment equality through several channels.** First, the spending shocks may create larger labor demand for female-friendly occupations. Bredemeier et al. (2017) show that "pink-collar job" booms are the drivers of the female-biased employment effects of fiscal policy. Second, the shocks may stimulate larger demand for part-time employment (which female workers generally occupy), often hired to meet temporary labor demand. Third, the shocks may stimulate female labor supply more in response to the loss in household income, particularly during recessions (household income effect). The positive impacts of fiscal spending shocks on gender equality during recessions would be basically consistent with the long-standing theory of wages (Douglas, 1934). Finally, fiscal spending shocks, if associated with the

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<sup>2</sup> Some countries such as Japan, continue to have disincentives for dual earner households, including secondary earner tax deduction and waiving of social security premiums, disincentivizing women from working over certain income threshold (IMF, 2017b).

implementation of properly designed gender-oriented measures, could directly influence gender equality.

**5. This paper examines whether countercyclical fiscal policy during recessions improves or worsens the gender employment gap.** We give an answer to this question by exploring the state-dependent impact of fiscal spending shocks on gender employment in the G-7 countries. Using the local projection method (Jordà, 2005), we find that an expansionary fiscal spending shock would generally improve the gender employment gap during recessions (increasing female employment more than male). Notably a positive spending shock of 1 percent of GDP during recessions would, on average, lift female employment by 1 percent, while increasing male employment by 0.6 percent. This impact varies across countries, owing to labor market institutions and social preferences. The impacts during booms, however, are largely statistically insignificant and generally smaller. We confirm that these results are robust in several directions (e.g. sample periods, control variables). Our findings are driven by disproportionate employment changes in female-friendly industries, occupations, and part-time jobs in response to fiscal spending shocks. The analysis suggests that fiscal stimulus, particularly during recessions, could achieve the twin objectives of supporting aggregate demand and improving gender gaps.

**6. Our study builds on the literature on how fiscal policy shocks affect growth and employment outcomes over the business cycle.** It makes two main contributions to the literature. First, it estimates the state-dependent impact of fiscal policy shocks on the gender employment gap. Recent empirical studies show that the impact of fiscal policy shocks on growth or employment differs between booms and recessions (Auerbach and Gorodnichenko, 2012, 2013; Baum et al., 2012; and Ramey and Zubairy, 2017). Second, the econometric analysis covers all G-7 countries, in contrast to Bredemeier et al. (2017) who only focused on the U.S.

**7. The rest of the paper is organized as follows:** Section II briefly reviews the existing literature. Section III presents key stylized facts on the gender employment gap, the business cycles, and fiscal spending shocks. Section IV describes the data and discusses the empirical strategy. Section V discusses the findings, and Section VI concludes and draws policy implications.

## II. LITERATURE REVIEW

**8. Fiscal policy instruments can promote gender equality.** Keane (2011) and Bick and Fuchs-Schündeln (2017) found that female labor supply is sensitive to taxation. Jaumotte (2003) and Blau et. al. (2013) showed that female labor force participation would increase with childcare costs and parental leave policies. Part-time work opportunities and incentives also affect women's labor participation choice (Kinoshita and Guo, 2015; Steinberg and Nakane, 2012). IMF (2017a, b) argue that well-structured fiscal policies and sound PFM systems have the potential to contribute to gender equality.

**9. Recent literature recognizes that the impact of fiscal policy shocks on growth or employment depends on the state of the economy.** The impact of fiscal contractions on GDP

growth is more adverse when multipliers are larger, which is typically the case when an economy is in recession (Barro and Redlick, 2011; Auerbach and Gorodnichenko, 2012).<sup>3</sup> Dell’Erba et al. (2014) identified asymmetric effects of fiscal consolidation on employment during protracted recessions, using annual data of 17 OECD countries. Using the quarterly data for the U.S., Fazzari et al. (2015) showed that, while a positive spending shock reduces the unemployment rate, its impact is weaker and less persistent when the economy is in the high-utilization regime. Indeed, other studies confirm that the responses of employment and unemployment vary over the cycle in OECD countries (Auerbach and Gorodnichenko, 2013).

**10. The literature, however, has yet to explore the state-dependent impact of fiscal policy shocks on gender employment.** Using structural VAR models—which do not control for the state of the economy—, Bredemeier et al. (2017) find that fiscal expansion stimulates predominantly female employment in the U.S. In investigating the impact of fiscal policy shocks on gender gaps in labor markets of the G-7 countries, Akitoby et al. (2018) find that an expansionary fiscal policy shock generally increases female employment more than male, thus reducing the gender employment gap.

### III. STYLIZED FACTS

**11. We look at the recent developments associated with the gender gap in labor markets of the G-7 countries and its correlation with the business cycle and government spending.** As a measure of gender employment equality, we use the female share of total employment. We highlight four stylized facts:

- ***Stylized fact 1.*** *The share of female in total employment has been on an increasing trend in the G-7 countries, but the gender gap remains (Figure 1).*<sup>4</sup>

For the last few decades, the gaps have generally declined (i.e., female employment grew faster than male), leading to steady increase in the female share of total employment. On average, for the G-7 countries as a whole, the number of female workers is about 18 percent lower than that of male workers.

- ***Stylized fact 2.*** *After the global financial crisis, the increasing trend of the female share in total employment has been reversed in some countries (e.g. Canada and the U.S.). (Figure 2).*

This reversal could possibly be explained by the process of “hysteresis,” including in the female-friendly sectors. For instance, for the U.S., Kochlar (2011) shows that in two years of economic recovery after the great recession, the sluggish recovery has favored men over women in all but 1 of the 16 major sectors of the economy reviewed. Moreover, he finds that this gender employment pattern contrasts with all other economic recoveries since 1970. Under these

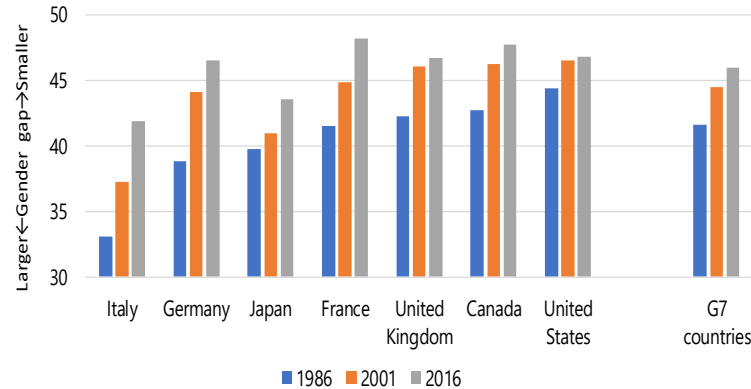
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<sup>3</sup> Other studies include Jordà and Taylor (2013), Baum et al. (2012), Dell’Erba et al. (2014), and Ramey and Zubairy (2017).

<sup>4</sup> IMF (2017) summarizes recent trends in gender equality in the G-7 countries, noting that while equality has improved overall, exceptions and gaps remain. Specifically, it notes that there remain significant gaps in pay, and the main burden of unpaid work is on women.

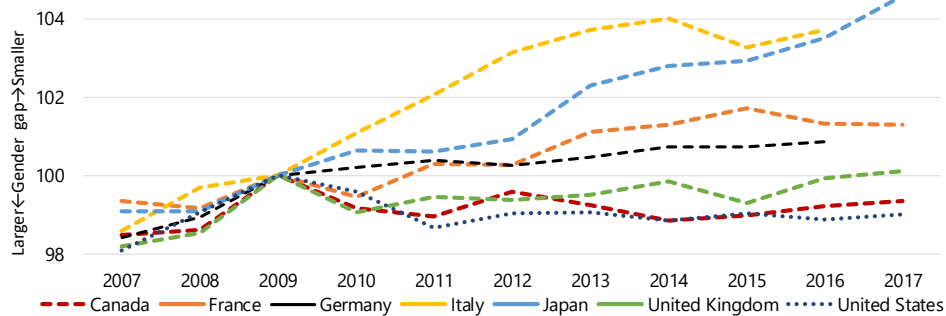
circumstances a cyclical decline in female unemployment could become permanent, thus leading to loss of skills and reducing the likelihood of female workers being rehired.

**Figure 1. Female Share of Total Employment: 1986–2016**  
(Percent)



Source: OECD.

**Figure 2. Female Share of Total Employment: 2007–2017**  
(2009=100)



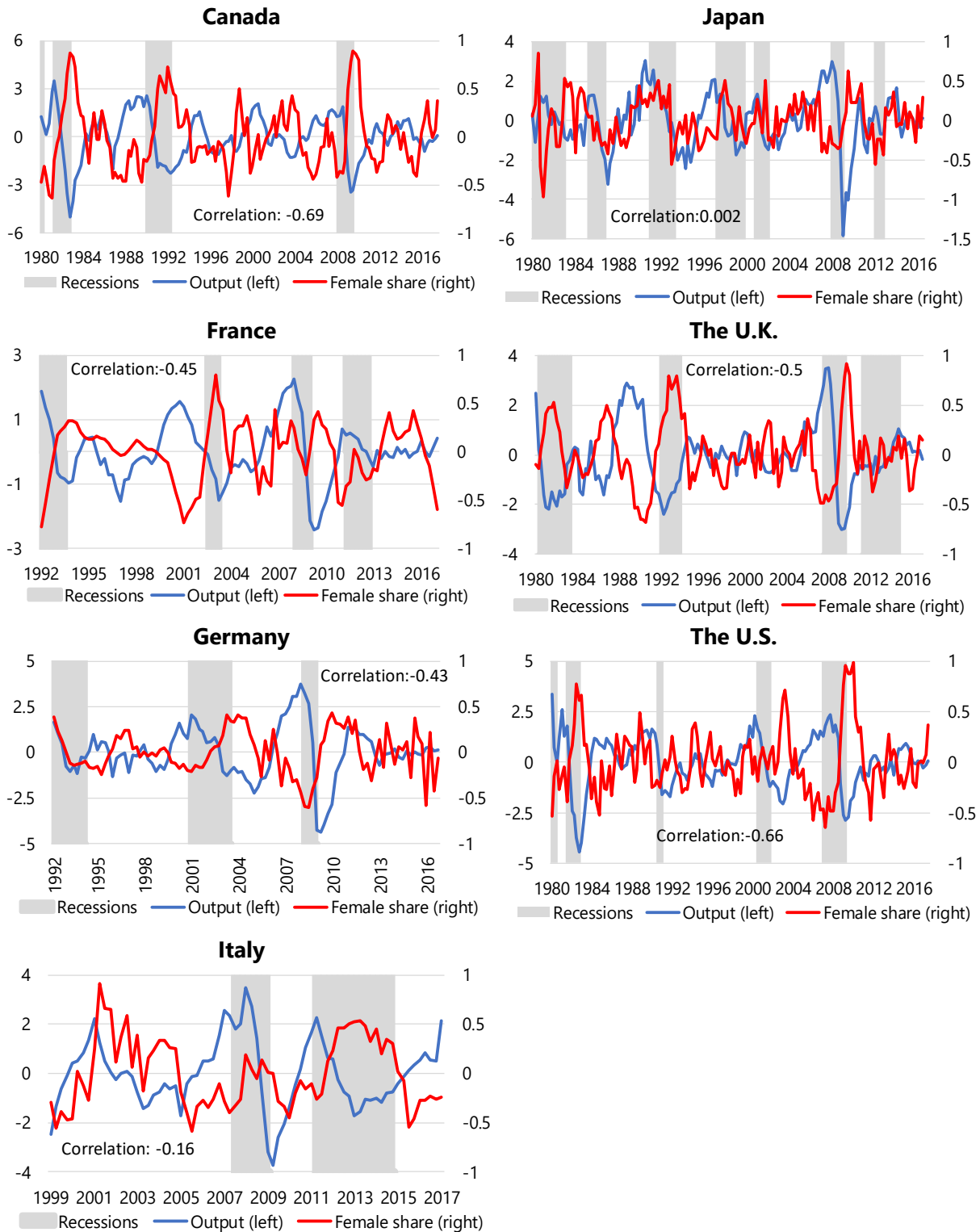
Source: OECD.

- **Stylized fact 3.** *The female share of total employment tends to be countercyclical* (Figure 3).

To examine the relationships between the gender employment gap and the business cycles, we first look at the cyclical component of the output gap and the female share of total employment. These series are computed by applying the HP filter to extract the cyclical components of real GDP and the female share of total employment. In all the G-7 countries except Japan, the female share of total employment tends to increase during recessions, thus leading to a narrowing of the gender employment gap during recessions (Figure 3). What explains this pattern? One plausible explanation is the higher cyclical exposure of male-friendly industries. For example, for the U.S, Hoynes et al. (2012) document that across recessions, men experience more cyclical employment fluctuations than women because the former group exhibits higher propensity to be employed in highly cyclical industries such as manufacturing and construction.



**Figure 3. Output and Female Share of Total Employment**  
(Percent, deviation from trend)

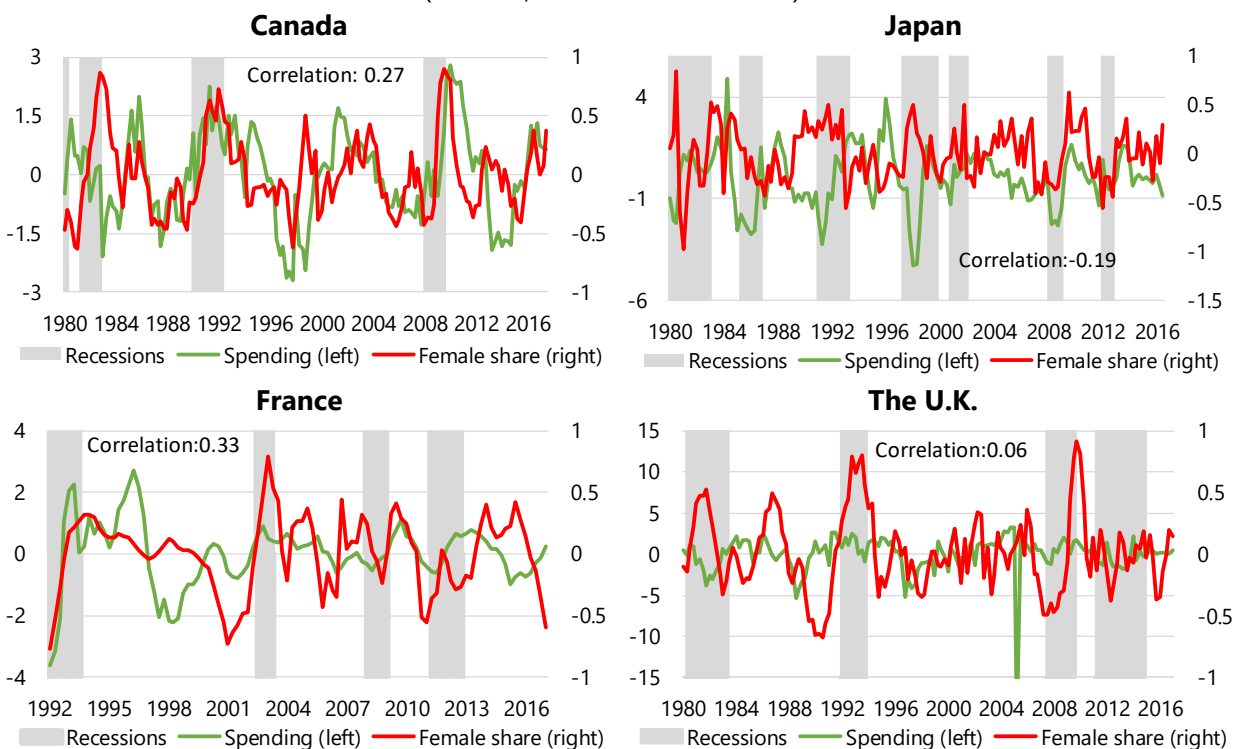


Source: Authors' calculations.

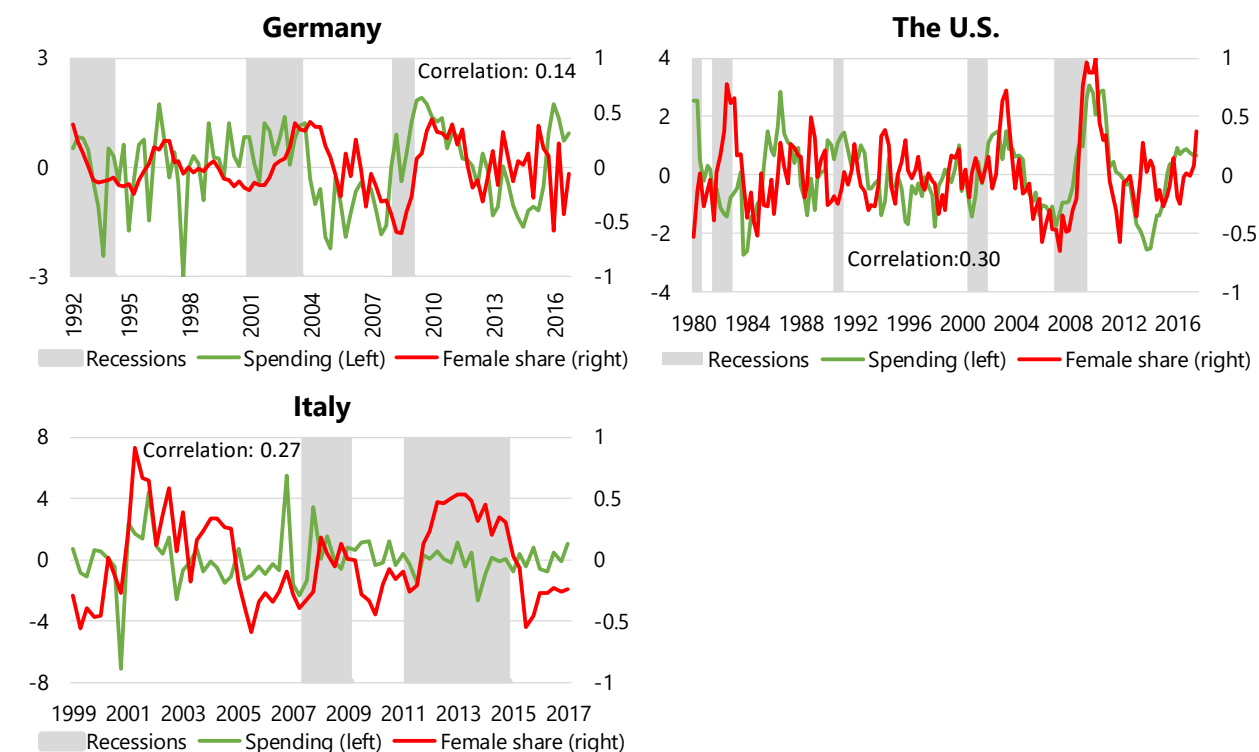
- **Stylized fact 4.** *The female share of total employment is positively correlated with government spending* (Figure 4).

Looking at the historical developments of the female share of total employment and government spending in the G-7 countries, we find that both the female share of total employment and government spending tend to increase during recessions, while they decline during economic booms. In all the G-7 countries except Japan, they are positively correlated. This stylized fact, however, does not suggest by itself any causality between government spending and the female share of total employment. For instance, one could argue that what is behind the correlation between these two variables is the stylized fact 3, mostly driven by greater male-friendly industries' exposure to the business cycle. Any empirical analysis to identify the impact of fiscal policies on the cyclical gender employment gap should, therefore, control for industry cycles for robustness checks. For the U.S., industry effects alone cannot account for the female employment share over the business cycle (Bredemeier et al., 2017). In the next section, we econometrically examine the causality between fiscal spending shocks and the female share of employment.

**Figure 4. Fiscal Spending and Female Share of Total Employment**  
(Percent, deviation from trend)



**Figure 4. Fiscal Spending and Female Share of Total Employment (end)**  
(Percent, deviation from trend)



Source: Authors' calculations.

#### IV. DATA AND METHODOLOGY

**12. We use two econometric models to investigate whether countercyclical fiscal policy improves the gender employment composition over the business cycles.** First, we estimate a structural vector autoregressive (SVAR) model, as in the previous studies.<sup>5</sup> Second, we use the local projection method of Jordà (2005) to allow for a state-dependent impact of fiscal spending shocks on the female share of employment.

**13. Quarterly data from the 1980s to 2017 for the G-7 countries (Canada, France, Germany, Italy, Japan, the U.K., and the U.S.) is used for both the SVAR model and the local projection method** (see Appendix I for a detailed description of the data). Data on GDP, government spending, and tax revenue, is derived from the OECD Economic Outlook and Eurostat, and total employment and the female share of total employment are taken from ILO database of labor statistics and national statistics offices. We use a GDP deflator to convert nominal tax revenue to real values. The sample period varies across countries and spans the longest timeframe for which data is available.<sup>6</sup>

<sup>5</sup> See also our companion paper Akitoby et al. (2018) and Bredemeier et al. (2017).

<sup>6</sup> Data are seasonally adjusted by using the Census Bureau's X12 filter.

### **SVAR: Estimation and Inference of Impulse Response Functions**

**14. We estimate the SVAR model to examine the effects of government spending shocks on the gender employment gap.** Our model consists of five variables: GDP ( $y$ ), government spending ( $g$ ), tax revenues ( $t$ ), employment ( $e$ ), and the female share of total employment ( $f$ ). Our choice of the variables is standard in the literature. Following Ramey (2016), our model includes output and fiscal policy variables. To examine the effect of fiscal policy shocks on the gender employment gap, we incorporate a measure of gender employment equality and aggregate employment into our empirical analysis. This setup is similar to that of Bredemeier et al (2017). While they used the male share of total employment, we use the female share of total employment as the measure of gender employment equality. A change in the female share of total employment (in response to fiscal policy shocks) means that male and female employment respond differently to the shocks.

**15. We estimate the following reduced form VAR model:**

$$X_t = B(L)X_{t-1} + \varepsilon_t,$$

where  $X_t = [g_t, t_t, y_t, e_t, f_t]'$  is a vector of the endogenous variables described above,  $B(L)$  is a polynomial of lag operators and  $\varepsilon_t \sim N(0, \Sigma)$  is the vector of reduced form residuals. Our benchmark specification also includes a constant and deterministic time trend up to the second order, which we omit from the notation for convenience. All variables are log-transformed and the lag length of the VAR model is set based on information criteria.

**16. The structural representation of the VAR model is:**

$$AX_t = AB(L)X_{t-1} + v_t,$$

where  $v_t$  is the vector of structural shocks which are uncorrelated and identically normally distributed. Then, the objective is to uncover the structural shocks  $v_t$  defined by an orthogonal rotation of the reduced-form residual:

$$A\varepsilon_t = v_t,$$

where  $A^{-1}\Omega A^{-1'} = \Sigma$ ,  $v_t \sim N(0, \Omega)$ , and the covariance matrix  $\Omega$  of the structural shocks is diagonal. However, it is well known that  $A^{-1}\Omega A^{-1'} = \Sigma$  does not define a unique rotation and we need additional information to identify the full components of  $A$ . Once the VAR is estimated and structural shocks are identified, structural impulse response functions are computed by:

$$X_t = [1 - B(L)]^{-1}A^{-1}v_t.$$

**17. We use Blanchard and Perotti (2002)'s method to identify the fiscal spending shock.** Specifically, we assume that government spending is not contemporaneously affected by all variables in the model. This is accomplished by ordering government spending first in the VAR model and identifying the matrix  $A^{-1}$  as the Choleski decomposition of  $\Sigma$ . Then, the first row of the rotation matrix represents the government spending shock. An alternative method of shock identification is

the narrative approach. Due to the lack of quarterly data of comparable quality for our sample countries, this paper adopts Blanchard and Perotti's identification method.<sup>7</sup>

### **Local Projections: Estimation and Impulse Response Functions**

**18. To estimate a state-dependent impact of the government spending shock on the gender employment gap, we use the local projection method (Jordà, 2005).<sup>8</sup>** This method is more robust to omitted variables and misspecification and easily handles nonlinearity. As discussed in Auerbach and Gorodnichenko (2013) and Jordà (2005), the local projection technique can easily adapt non-linearly and thus estimate state-dependent models and compute impulse response functions. Moreover, the method does not constrain the shape of the impulse response function, so it is less sensitive to misspecification of the standard VAR models.<sup>9</sup> The method conducive a more parsimonious specification because it does not require that all variables enter all equations.

**19. The model that allows state dependence can be written as follows:**

$$x_{t+h} = I_{t-1}[\alpha_{E,h} + \Psi_{E,h}(L)z_{t-1} + \beta_{E,h}shock_t] + (1 - I_{t-1})[\alpha_{R,h} + \Psi_{R,h}(L)z_{t-1} + \beta_{R,h}shock_t] + Trends + \varepsilon_{t+h} \dots (1)$$

$x$  is the dependent variable,  $z$  is a vector of control variables,  $\Psi(L)$  is a polynomial in the lag operator, and  $shock$  is the identified fiscal spending shock. Similar to our SVAR model, we identify the fiscal spending shock by employing the Blanchard and Perotti (2002) method.  $I$  is a dummy variable that indicates the state of the economy, namely expansion ( $E$ ) and recession ( $R$ ), when the shock hits. We use output gaps as our indicator of slack.<sup>10</sup> The model also includes constant and time trends up to the second order. Following Ramey and Zubairy (2017), we use the Newey-West correction for standard errors to eliminate the possibility of serial correlation in the error terms.

**20. All coefficients of the model other than deterministic trends vary according to the state of the economy.** This means that the forecast of  $x_{t+h}$  is also allowed to be different according to the state of the economy when the shock hits. The coefficient  $\beta$  gives the response of  $y$  at time  $t+h$  to the shock occurred at time  $t$ . Thus, we can construct the impulse responses by estimating a set of  $\beta$  for each horizon  $h$ . In our baseline specification,  $x$  is the female share of total employment  $f$ , with

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<sup>7</sup> Ramey (2011), for example, argues that, as fiscal policy shocks are often anticipated, the narrative approach based on news about future defense spending and forecast errors of professional forecasters helps predict VAR shocks. Romer and Romer (2010) and IMF (2010) use information from budget documents to directly identify exogenous policy changes.

<sup>8</sup>See, for example, Auerbach and Gorodnichenko (2013), Dell'Erba et al. (2014), and Ramey and Zubairy (2017).

<sup>9</sup> The standard VAR are sensitive to misspecification of the data-generating process (DGP). If the underlying DGP cannot be well approximated by the VAR model, impulse response functions derived from the model will be biased and misleading. Furthermore, the VAR is not flexible enough to accommodate state-dependent impacts easily.

<sup>10</sup> In addition to output gaps, various variables, such as the growth rate and the unemployment rate, are used as a measure of economic slack. Our main results remain unchanged for a different measure of economic slack.

four control variables: real GDP, real government spending, real tax revenue, and the female share of total employment ( $z = [g, t, y, f]'$ ).

**21. We use this parsimonious model as our benchmark model.** Although the local projection method has proven to be robust to misspecification and omitted variables, we conduct extensive robustness checks (see section V below).

## V. EMPIRICAL FINDINGS

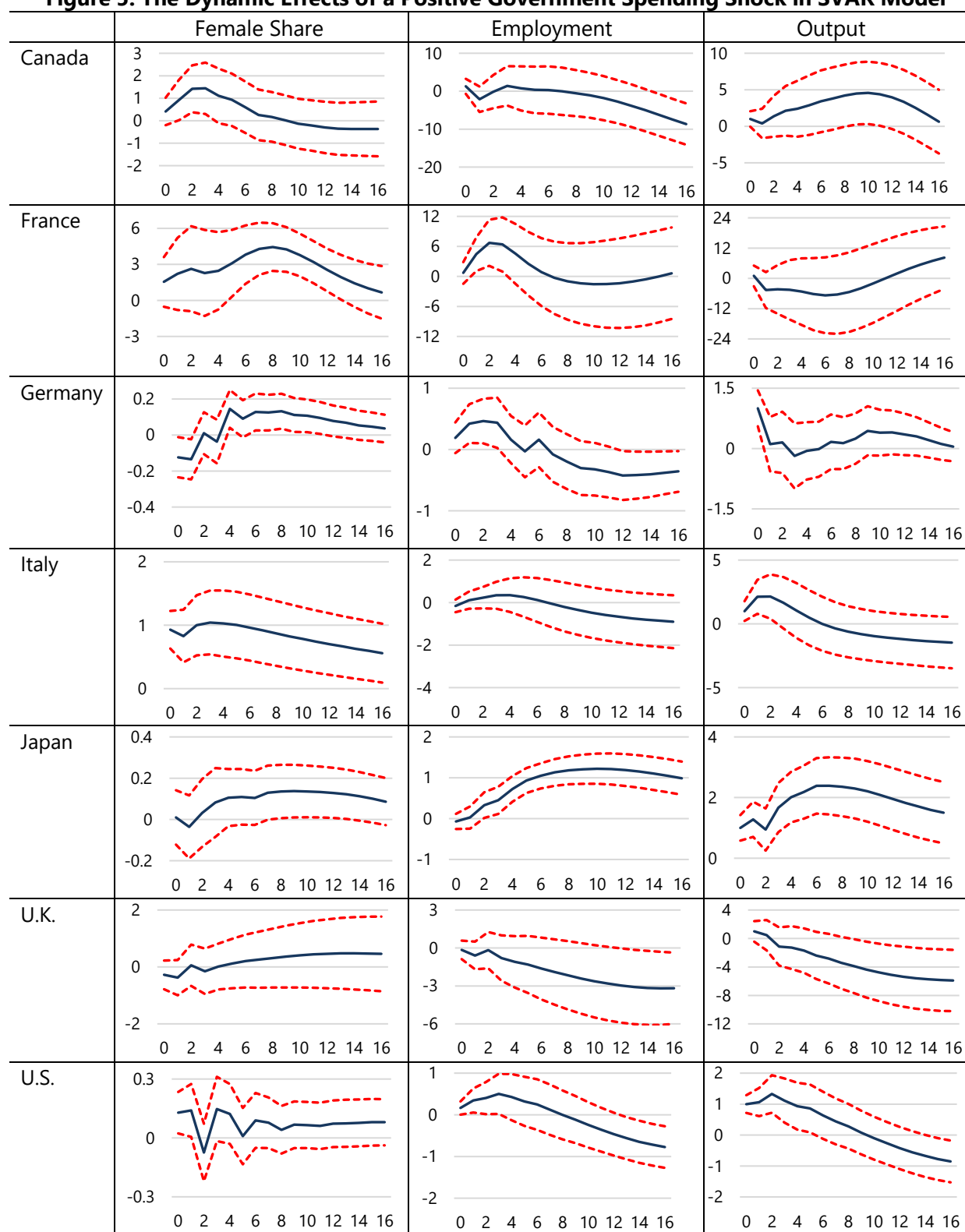
### *Impacts on Gender Employment Gap—SVAR Results*

**22. Consistent with the existing studies, the SVAR results confirm the robust impact of fiscal spending shocks on the gender employment gap.** Figure 5 shows the impulse response functions for a positive government spending shock in our SVAR model. Except for the U.K., an expansionary government spending shock increases the female share of total employment. These responses are statistically significant at peak. As aggregate employment increases in response to the positive government spending shock, this result suggests that female employment rises more strongly than male employment in response to the positive fiscal spending shock. Our results for the U.S. are consistent with those of Bredemeier et al. (2017). Their baseline model results show that an expansionary fiscal shock (normalized such that output changes by 1 percent on impact) increases female employment by 0.5 percent and male employment by 0.07 percent, one year after the shock. Our results indicate that a positive government spending shock of 1 percent of GDP increases female employment by 0.17 percent, relative to the increase in male employment by 0.14 percent.<sup>11</sup>

**23. The spending shock has an independent and statistically significant impact on gender employment.** We conduct a variance decomposition analysis to disentangle the direct and independent impact of the spending shock on gender employment. We find that the impact of spending shocks—though smaller than that of output shocks—is statistically significant in most of the G-7 countries. This further confirms the impact of spending shocks independent from business cycles. In the case of the U.S., for instance, the fiscal spending and output shocks account for 6.1 percent and 36.2 percent of the change in the female share of total employment, respectively. The impact of the spending shock could be even larger, if we were to include its indirect effect on growth via the spending multiplier.

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<sup>11</sup> The different magnitude of the impacts on female employment may reflect the use of different sample periods, detrending methods, and identification methods.

**Figure 5. The Dynamic Effects of a Positive Government Spending Shock in SVAR Model**

Note: The horizontal axis represents quarters after the shock. Shaded area indicates the 16<sup>th</sup>-84<sup>th</sup> percentile of empirical distribution, constructed by the bootstrap method.

Source: Authors' calculations.

### **Impacts on Gender Employment Gap Over Business Cycles**

**24. We find supportive evidence for state-dependent impacts of fiscal spending shocks on gender equality in labor markets.** Figure 6 presents the resulting impulse response functions for an expansionary fiscal spending shock on the female share of total employment, during recessions and booms. Table 1 summarizes the impact at the peak and 8 quarters after the shock.

**Table 1. Effects of Government Spending Shock on Gender Employment**  
(Changes in the female share of total employment, in percentage points)

	Boom		Recession	
	Peak	8th quarter	Peak	8th quarter
<b>Canada</b>	0.26 *	0.14 *	0.27 *	-0.08
<b>France</b>	0.21	-0.01	0.36 *	0.03
<b>Germany</b>	0.18 *	-0.01	0.27 *	0.16 *
<b>Italy</b>	0.09 *	0.09 *	0.52 *	0.39 *
<b>Japan</b>	0.18	0.18	0.09 *	0.09 *
<b>UK</b>	0.05 *	0.01	0.11 *	0.08 *
<b>US</b>	0.17	0.05	0.31 *	0.14 *
<i>Average</i>	0.16	0.06	0.28	0.12
<i>Median</i>	0.18	0.05	0.27	0.09

Source: Authors' calculations.

Note: The figures present estimated impacts of an expansionary spending shock (equivalent to 1 percent of GDP) on the female share of employment (i) at its peak during 8 quarters after the shock and (ii) at the eighth quarter after the shock. The sign "\*" (highlighted in blue) indicates significance at 5 percent level.

**25. During recessions, government spending shocks have positive impacts on gender equality.**

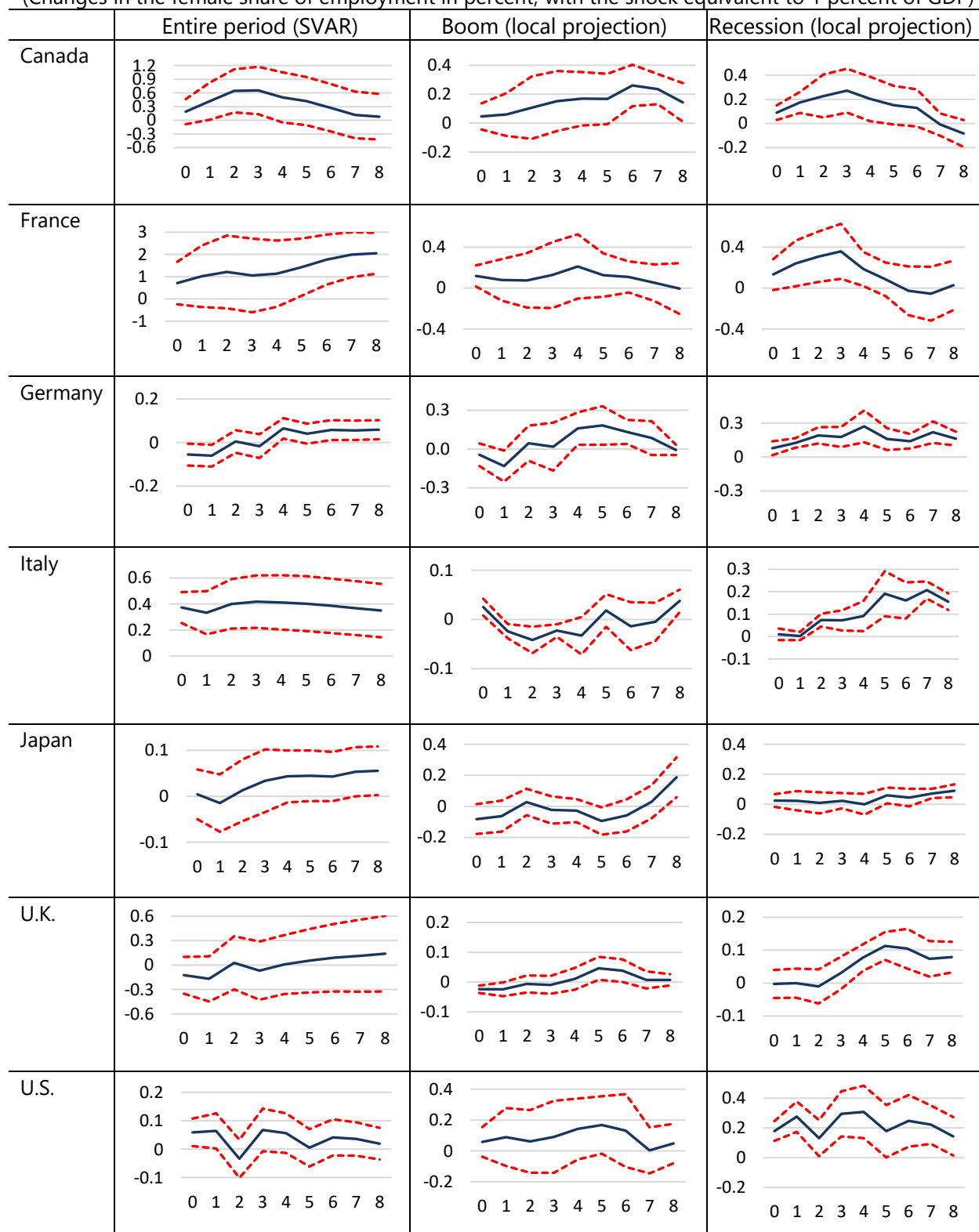
- In all seven cases, the impacts at peak are statistically significant and in favor of female employment, possibly reflecting the added worker effect (for inactive spouses to newly enter the labor market in response to job losses by other spouses).<sup>12</sup>

<sup>12</sup> When a married male worker involuntarily loses his job during a recession, the nonparticipating wife may enter the labor force to make up for the loss in family income. Though this effect is well-known in theoretical models, the existing empirical studies do not reach consensus on this effect (Tano, 1993; Maloney, 1991; Lundberg, 1985, Juhn and Potter, 2007). Most recently, Bredtmann et al. (2017) find supportive evidence for an added worker effect, using data covering 28 European countries from 2004 to 2013. They reveal that wives' likelihood of increasing their labor supply as a response to their husband's job loss increases with the country's unemployment rate, while the probability of increasing female labor supply decreases with the country's female labor force participation rate.



**Figure 6. Effects of Government Spending Shocks on Gender Equality**

(Changes in the female share of employment in percent, with the shock equivalent to 1 percent of GDP)



Note: 95 percent confidence intervals are shown in all cases.

Source: Authors' calculations.

- With a positive spending shock equal to 1 percent of GDP, the female share of employment would improve, on average, by 0.28 percentage points at peak. After 8 quarters, this impact ranges from 0.08 percentage points in the U.K. to 0.39 percentages points in Italy, with a large variance across countries.
- In most countries, the impact of the shock is long-lasting. For instance, in Germany, Italy, Japan, the U.K., and the U.S., the impacts are long-lasting with increasingly positive impact through the projected period (8 quarters). In Canada and France, however, the positive impact is deemed short-lived and fades out two years after the spending shock, possibly reflecting the diminishing role of the added worker effect (following the improvement of general labor conditions over time).

### **Comparison Between SVAR and Local Projection Results**

#### **26. The two methodologies (SVAR and local projection) sometimes yield different results.**

For example, in the U.K., the results of the SVAR suggest no statistically significant impacts, while the local projection analyses point to robust impacts during recession, demonstrating the nonlinearity or the state-dependent impacts. In Canada, Germany, and Japan, the shocks have robust impacts on gender equality under the SVAR and the local projection (during recession and/or boom). In France, while the results of the SVAR point to robust results over eight quarters, the impacts are not statistically significant during recession (using the local projection).

**Table 2. Impacts of Spending Shocks on Female and Male Unemployment, Labor Force, and Employment During Recessions**

(Percent changes, peak after the shock)

	Male			Female		
	Unemployment rate	Labor force	Employment	Unemployment rate	Labor force	Employment
Canada	-0.2***	0.0	+0.7	-0.4***	+0.3***	+1.7***
France	-1.0***	0.1	+1.5***	-0.8***	+0.3***	+1.9***
Germany	-0.5***	0.0	0.0	-0.3	0.0	0.0
Italy	-0.1***	0.0	+0.0	-0.4***	+0.3***	+0.5***
Japan	-0.1***	+0.1***	+0.7***	-0.1***	+0.1***	+0.8***
UK	0.0	+0.1***	0.0	0.0	+0.1	+0.5***
US	-1.2***	+0.2***	+1.6***	-1.1***	+0.3***	+1.9***
Average	-0.4	0.1	0.6	-0.4	0.2	1.0

Note: \*\*\* indicates significance at 5 percent level.

Source: Authors' calculations.

### **Impacts on Unemployment, Labor Force and Employment by Gender**

**27. We find that the shock has a relatively stronger impact on female employment and labor force during recessions.** To make sure that the improvement in the share of female employment is not due to the mechanical effect of men losing jobs more than women, we estimate

the state-dependent impacts of the fiscal spending shock on female and male employment separately (Table 2). On average, the analysis suggests that, with the fiscal spending shock of 1 percent of GDP during recessions, female employment would increase by 1.0 percent at peak, while male employment may increase by 0.6 percent (with the results of four countries statistically not significant). We also estimate the impacts of the spending shocks on labor force and unemployment by gender during recessions. The impacts on female labor force are statistically significant in five countries (compared with three for male labor force). The analysis suggests that, with the fiscal spending shock of 1 percent of GDP during recessions, female labor force would increase by 0.2 percent at peak, while male labor force may increase by 0.1 percent (with the results of four countries statistically not significant). Though female employment increases more than male's, the impacts on unemployment rate are broadly the same between male and female, because of the base effect (female labor force increase more).

**28. During economic booms, the impacts on gender equality are less obvious (Figure 6).**

During booms, the results of the impacts on the female share of total employment are not statistically significant in two G-7 countries (France and the U.S.). In other countries, the impacts are positive and statistically significant, but are smaller than the impacts under recessions. For the G-7 countries as a whole, with a positive spending shock equal to 1 percent of GDP, the female share of employment would improve, on average, by 0.16 percentage points at peak. The impacts are not sustained over time in most cases, with the female share declining over two years.

***Effects of Different Fiscal Policy Instruments***

**29. Different fiscal policy instruments have different impacts on the gender employment gap.** In our companion paper, Akitoby et al. (forthcoming), we decompose the government spending shock into its components, consumption and investment shocks. Our analysis finds that fiscal consumption shocks tend to have larger and more robust impacts than fiscal investment shocks.

***Robustness Checks***

**30. These results are robust in several directions.** Although the local projection method is more robust to misspecification (Jordà, 2005), we conduct several robustness checks:

- *Sectoral composition and female-friendly sectors:* The structure of the economy may affect the movement of the female share of total employment during the business cycles. For example, if female-friendly sectors are countercyclical, female employment could thrive during recessions without a spending shock. Thus, the impact of fiscal spending shocks on the gender employment gap could be biased without taking into account structure variables. To assess the robustness of our findings, we re-estimate equation (1) to control for structural variables such as the share of sectoral GDP (agriculture, industries, services), and the share of female-friendly sectors (e.g.,

public services, health care, and education) in the total employment. We find that our results are robust to the structural variables.<sup>13</sup>

- *Sample periods*: to assess robustness of our results to our sample, we estimate the model with different sample periods. Instead of using the available longest sample period for each country, we use the two periods—(i) through 2008 (before the global financial crisis) and (ii) from 1990 (after structurally high unemployment rates for female labor force were removed in many G-7 countries) to the latest. The results are broadly the same, though with weaker significance.
- *Business cycles*: Given the uncertainty surrounding the output gap as a measure of the business cycle, we test a different measure of slack using the growth rate instead of output gap. For the growth rate, as in Auerbach and Goronichenko (2013), we use the deviation of a moving average (over 1.5 years) real GDP growth rate from the trend as a threshold variable to determine the state of the economy. The main results remain unchanged.
- *Control variables*: We also consider different combinations of control variables (unemployment, employment, the labor force participation rate, and real wages, private consumption, and the interest rate). Our main results broadly remain unchanged with the regressions using these variables. Furthermore, as the impacts of fiscal policy shocks may be affected by the behavior of the monetary authorities, following Monacelli et al. (2010) and Bruckner and Papp (2012), we also incorporate the short-term interest rate to take into account the reaction of monetary policy to fiscal spending shock. We find that our results remain unchanged.

### ***Impacts of Fiscal Contractions and Expansions***

**31. We find that the effects of positive and negative spending shocks on gender equality are broadly symmetric.** We have not considered possible asymmetry of fiscal spending shocks, while the impacts of fiscal contractions and expansions may not be symmetry. To test asymmetric effects of fiscal policy shocks on the female share of total employment, we use the following specification:

$$x_{t+h} = D_t [\alpha_{P,h} + \Psi_{P,h}(L)z_{t-1} + \beta_{P,h}shock_t] + (1 - D_t) [\alpha_{N,h} + \Psi_{N,h}(L)z_{t-1} + \beta_{N,h}shock_t] + Trends + \varepsilon_{t+h},$$

where  $D_t$  is a dummy variable that indicates whether the shocks are positive ( $P$ ) or negative ( $N$ ). The results (Appendix VI) show that, while there are variances across countries, the impacts of these two shocks are broadly symmetric. In all G7 countries, a positive shock tends to increase the female share of total employment, while a negative shock would reduce the female share. In some countries (e.g., The U.K, Canada), the impacts of negative spending shocks are relatively large.

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<sup>13</sup> The details are available upon request.

## **Possible Channels for Fiscal Policy to Influence Gender Employment Gap**

### **32. Fiscal spending shocks could influence gender employment equality through several channels.**

- a. *Fiscal spending shocks may stimulate female labor supply more in response to the loss in household income during recessions (household income effect).*<sup>14</sup> The positive impacts of fiscal spending shocks on gender equality during recessions would be basically consistent with the long-standing theory of wages. If a married male worker involuntarily loses his job, the nonparticipating wife may enter the labor force to make up for the family income loss. Thus, female labor supply may increase in response to lower husbands' income, leading to a negative correlation between husbands' income levels and wives' labor participation. The analytical results in the previous section (Table 2, Annex IV) are generally consistent with this theory, with female labor increase more than male's during recessions.
- b. *Fiscal spending shocks, if associated with gender-oriented measures, could directly influence gender equality.*<sup>15</sup> As discussed in IMF (2017a), there are many gender-oriented fiscal policies helping to improve gender equality (Appendix II). On the expenditure side, gender-related policies include improved family benefits, subsidized child-care, other social benefits that increase the net return to women's work, and incentives for businesses to encourage the hiring of women. While some of these policies could be undertaken in a budget-neutral manner, other policies would have budgetary implications. The fiscal spending shocks associated with those policies—if they are properly designed and executed—would contribute to gender equality.
- c. *Fiscal spending shocks may create larger labor demand for female-friendly occupations.* Bredemeier et al. (2017) show that “pink-collar job” booms are the drivers of the female-biased employment effects of fiscal policy.<sup>16</sup> Put differently, occupational dynamics explain the female-biased employment effects of fiscal policy. They argue that fiscal policy shocks

<sup>14</sup> Douglas (1934), in his old book on “The Theory of Wages”, pointed that “Where wages are low, they (women) will be driven into the market in much greater numbers in order to eke out the family income than where the earnings of their husbands are higher”. Since then, this theory has been studied in many literature, and one of the variance is the so-called “added worker effect”. The literature of the added workers effect can be dated to the 1940s (Woytinsky, 1940). Despite this effect is well-known in theoretical models, the existing empirical studies do not reach consensus on its magnitude or even its existence (see for example, Tano, 1993; Maloney, 1991; Lundberg, 1985). In the most recent literature, Bredtmann et al. (2017) find evidence for the existence of an added worker effect, using data covering 28 European countries from 2004 to 2013, while they also reveal that the added worker effect varies over both the business cycle and the different welfare regimes within Europe.

<sup>15</sup> The benefits of specific policy instruments for female employment have been examined in the literature (see, for example, Jaumotte (2003) and Kinoshita and Guo (2015)).

<sup>16</sup> Bredemeier et al. (2017) argue that fiscal policy shocks cause employment in services, clerical, and retail sales occupations—the so-called “pink-collar” occupations—to grow disproportionately. It is also well known that labor supply elasticities differ between males and females. Most studies find that labor supply elasticities are usually large for married women, smaller and sometimes negative for men (see for example, Blundell and MaCurdy, 1999).

cause employment in services, clerical, and retail sales occupations—the so-called “pink-collar” occupations—to grow disproportionately.

- d. *Fiscal spending shocks may stimulate larger demand for part-time employment during recessions.* Fiscal spending shocks may facilitate part-time work, which female workers generally occupy. Part-time workers are often hired to meet temporary labor demand and tend to increase when full-time workers are reduced (employment buffers). The impact through this channel, however, may vary by country.

### **Testing Robustness of Potential Channels**

**33. To verify these potential channels (b and c above), we estimate additional impulse responses of the gender employment gap for the U.S. using the empirical approach in Bredemeier et al. (2017).<sup>17</sup>** Based on the understanding on the potential channels above, we investigate the effects of industry, occupation, and employment type (full time vis-a-vis part time).<sup>18</sup> To investigate the importance of industry effects, we estimate gender-specific regressions

$$e_{g,t} = \beta_g \cdot ind_t + \varepsilon_{g,t},$$

and, to investigate the combined effects of industries and occupations, we estimate

$$e_{g,t} = \gamma_g^i \cdot ind_t + \gamma_g^o \cdot occ_t + \eta_{g,t}$$

and, to investigate the combined effects of industries, occupations, and employment types, we estimate

$$e_{g,t} = \delta_g^i \cdot ind_t + \delta_g^o \cdot occ_t + \delta_g^t \cdot type_t + \nu_{g,t}$$

where  $e_{g,t}$  is gender-specific employment and  $ind_t$ ,  $occ_t$ , and  $type_t$  are vectors of industry-, occupational-, and type-specific employment level, respectively. The residuals,  $\varepsilon_{g,t}$ ,  $\eta_{g,t}$ , and  $\nu_{g,t}$  reflect fluctuations in gender-specific employment unrelated to industries, occupations and/or employment types. We use the predicted values of the regressions to calculate the female employment share implied by industry-specific and/or occupational employment.

**34. The analytical results underscore the importance of gender dynamics in industries, occupations, and employment types for individual workers' employment possibilities.** The results (Appendix VII) show the impulse responses estimated by using local projection methods where we replaced actual by predicted female employment shares. The differences between solid

<sup>17</sup> Bredemeier et al. (2017) find that fiscal expansions stimulate predominantly female employment and argue that, based on this empirical approach, the finding can be understood as a consequence of differences in the industry-occupation mix of employment by gender.

<sup>18</sup> For this analysis, we replace the actual female employment share by the share predicted by employment in 12 major industries (excluding agriculture), ten major occupation groups according to the 2002 Census classification, and/or two employment types (full time and part time).

and dashed lines reflect dynamics in the gender composition of employment unrelated to industries, occupations, and/or employment types.

- The result (Appendix VII A) suggests that, while industry effects have some influence over female-male employment development, the gender-specific effects of fiscal shocks cannot be fully understood by industry effects alone. The actual female employment share falls more strongly than predicted by industry dynamics.
- Taking into account occupations in addition to industries (Appendix VII B), the predicted decline in relative female employment is more pronounced. Hence, our results show that occupations play an important role for understanding gender-specific employment dynamics. These results are consistent with the findings by Bredemeier et al. (2017).
- Adding employment types (Appendix VII C), the predicted decline in relative male employment is further pronounced. Hence, our results show that, in particular for the fiscal spending shock, employment types (full-time, part-time) play an important role for understanding gender-specific employment dynamics.

## VI. CONCLUSION AND POLICY IMPLICATIONS

**35. Our analysis finds that expansionary fiscal spending shocks generally increase the female employment, notably during recessions.** In all G-7 countries, positive fiscal spending shocks contribute to gender equality during recessions, increasing female employment more than male. During booms, however, the impact on gender employment is less obvious and generally smaller than during recessions. During recessions, though female employment increases more than male's, the impacts on unemployment rate are broadly the same between male and female, because of the base effect (female labor force increase more). Such gender-specific employment dynamics can be largely explained by gender dynamics in industries, occupations, and employment types. Our finding also shows that the effects of positive and negative spending shocks on gender equality are broadly symmetric.

**36. The study leads to two main policy implications.** First, fiscal stimulus, particularly during recessions, can achieve the twin objectives of supporting aggregate demand and improving gender gaps. In contrast, given the symmetric nature of fiscal spending shocks, a fiscal contraction during recessions is bound to worsen the gender employment gap, thus calling for compensatory measures to protect female employment.

**37. More broadly, these findings also suggest the need for cautious assessment for specific gender-oriented policy instruments.** The outcome of policies to improve gender equality depends, at least in the short term, on whether the economy is in a recession or under a boom. Therefore, the assessment on the short-term impact of those measures should take into account the state of the economy.

**38. For future research, a number of open questions could be addressed.** First, government spending could be disaggregated to study the differentiated impact of each component (e.g., nonwage consumption, wages, transfers, investment) on the gender employment gap. Second tax shocks could also be considered to find out how their impact differs from that of spending. Third, it would be useful to examine the impacts of fiscal shocks on other gender gaps (e.g., gender wage gaps, managerial positions). Fourth, it would also be important to deepen our understanding of the transmission channels of the fiscal shocks, based on theoretical models. Finally, one could investigate how market institutions determine the outcomes of the fiscal shocks on gender gaps on labor markets.<sup>19</sup>

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<sup>19</sup> Labor market regulations (e.g., ease of firing and hiring) could affect the impact of the fiscal shocks on gender gaps in labor markets.



### Appendix I. Statistical Summary

We collect quarterly data on GDP, government spending, tax revenues, and the female share of total employment from various sources, such as the Eurostat, ILO, OECD, and national statistics offices. The sample period varies across countries and spans the longest timeframe for which data is available. Specifically, the sample periods are 1980:1-2016:3 for Canada, 1992:1-2017:1 for France, 1992:2-2016:4 for Germany, 1999:1-2017:1 for Italy, 1980:1-2016:3 for Japan, 1971:1-2017:1 for the United Kingdom, and 1964:1-2016:4 for the United States. All series are seasonally adjusted and logged. Except for the female share of total employment, all series are in real terms. GDP deflator is used to convert nominal values to real values. The following table summarizes statistics.

**Table AI.1. Summary Statistics**

Country	Sample period	Mean (standard deviation)			
		GDP	Government Spending	Tax revenues	Female Share of Total Employment Ratio
Canada	1980:1-	12.08	11.48	11.56	-0.79
	2016:3	(0.12)	(0.09)	(0.11)	(0.05)
France	1992:1-	5.66	5.04	5.31	-0.77
	2017:1	(0.05)	(0.10)	(0.11)	(0.03)
Germany	1992:2-	12.39	11.71	11.13	-0.81
	2016:4	(0.04)	(0.04)	(0.05)	(0.04)
Italy	1999:1-	5.60	5.28	5.11	-0.91
	2017:1	(0.01)	(0.02)	(0.02)	(0.03)
Japan	1980:1-	14.62	14.03	13.94	-0.89
	2016:3	(0.09)	(0.08)	(0.08)	(0.03)
The United Kingdom	1980:1-	12.12	11.48	11.50	-0.80
	2017:1	(0.11)	(0.09)	(0.11)	(0.05)
The United States	1980:1-	4.04	3.38	3.38	-0.78
	2016:4	(0.13)	(0.08)	(0.13)	(0.03)

Sources: Eurostat, ILO, OECD, and national statistics offices.

## Appendix II. Gender-Related Fiscal Policies<sup>20</sup>

As summarized in IMF (2017a), all the G-7 countries have implemented a range of tax and expenditure policies aimed at increasing female labor supply:

- *On the expenditure side*, all the G-7 countries have implemented various laws or regulations designed to increase women's workforce participation, provide enhanced support for child or dependent care, and achieve equal pay for equal work.
- *On the revenue side*, most countries have moved to individual income taxation. Some countries have retained a system of joint taxation, but adapted it through tax credits, or deductions, or other tax preferences for households with two earners, or by leaving an option for individual taxation.<sup>21</sup> For low-income families, there are various tax reliefs, such as the earned income tax credit, for example in the U.S., or a combination of tax and transfers in the U.K. and other G-7 countries.

**Table AII.1. Key Gender-Related Fiscal Policies Implemented by the G-7 Countries**

Policy Measure	Country Practices
<b>Tax Policies</b>	
Individual income tax	Canada, Italy, Japan, and UK
Tax relief for single or working parents	Most or all G7
Targeted in-work tax credits or benefits	France, Japan
<b>Expenditure Policies</b>	
Work-life balance	Canada, France, Italy, Japan
Paid parental leave	Canada, France, Germany, Italy, Japan
Gender-related social security reforms	Canada, France, Italy, UK
Pensions linked to the number of children	Germany
Women in low-income support	France, Germany, Italy, Japan
Educations, STEM, elimination of stereotypes	All G7
Health prevention and age-related issues	All G7
Child care support	Canada, Japan, UK, Italy, Germany
Programs to counter domestic violence	All G7
Gender-responsive foreign aid and corporation	Canada, France, Japan
Gender-responsive public employment	All G7
Quotas in managerial positions	France, Germany
Public sector equal pay	Canada, France, Germany-Laender, Italy

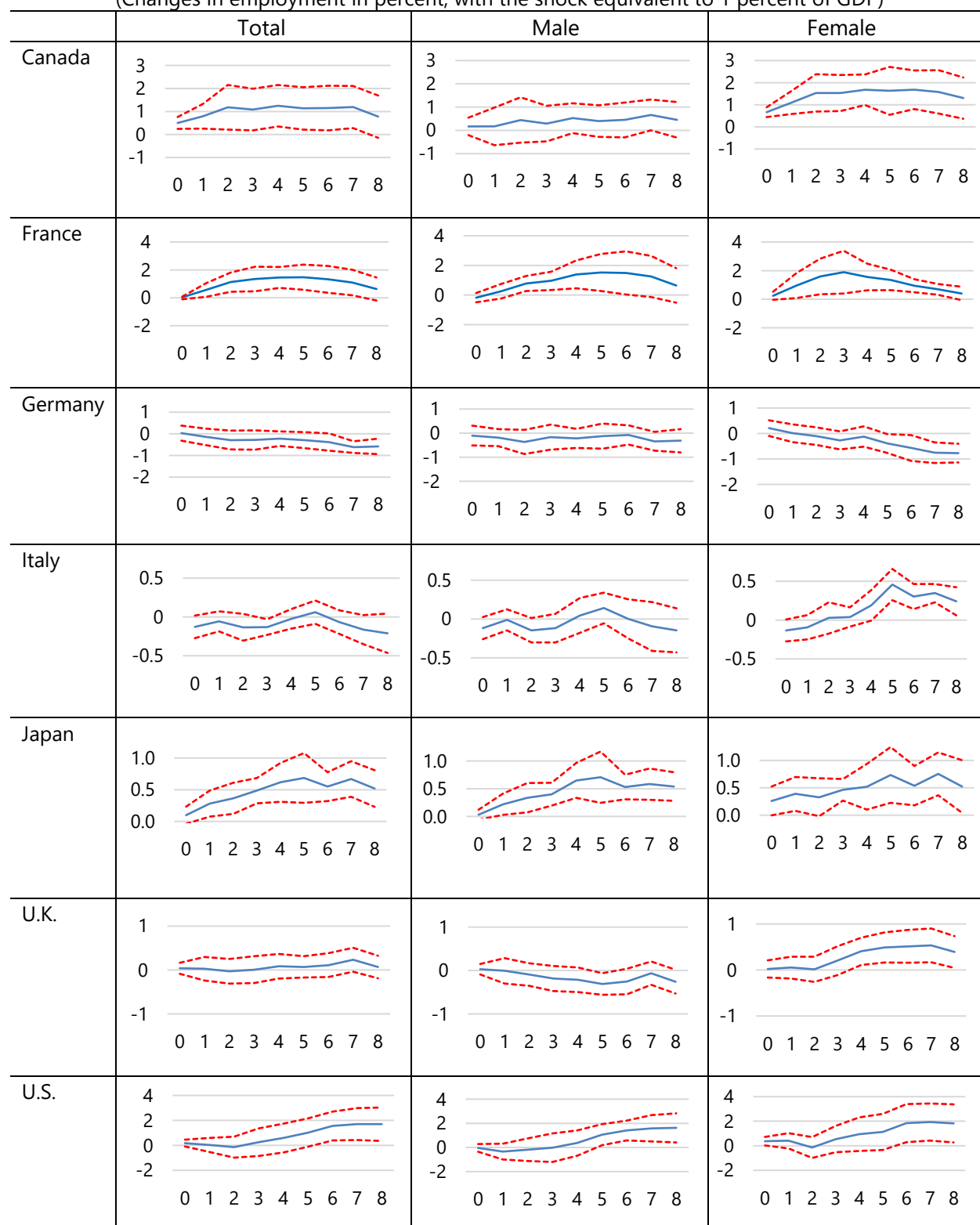
Sources: Beijing reports, OECD (2016), IMF (2017).

<sup>20</sup> This appendix is based on the assessments in IMF (2017).

<sup>21</sup> Taxation based on the family rather than individuals can create a disincentive for the second earner to work, as he/she is taxed at a higher marginal rate (IMF, 2017).

### Appendix III. Effects of Government Spending Shocks on Employment during Recessions

(Changes in employment in percent, with the shock equivalent to 1 percent of GDP)

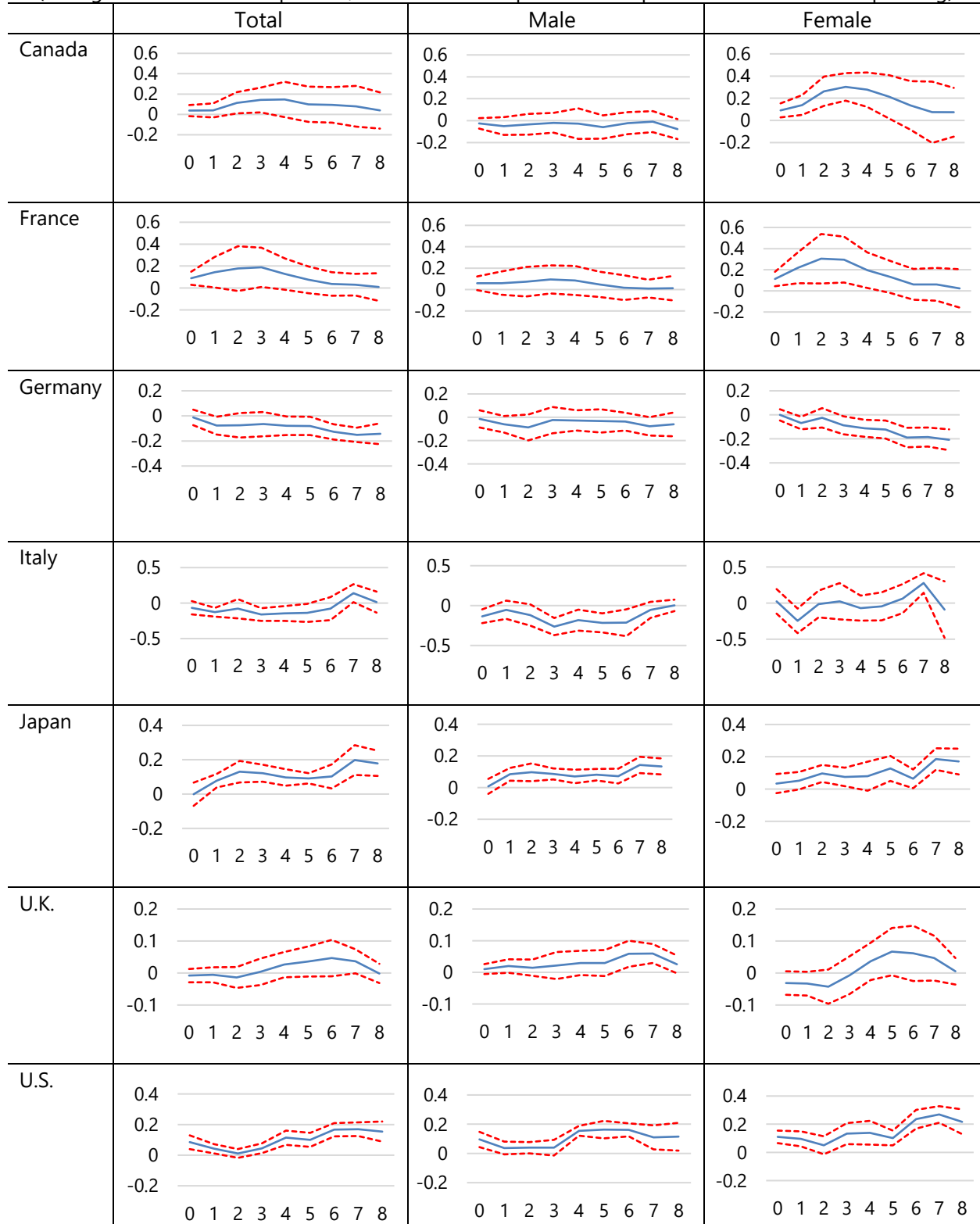


Note: 95 percent confidence intervals are shown in all cases.

Source: Authors' calculations.

### Appendix IV. Effects of Government Spending Shocks on Labor Force during Recessions

(Changes in labor force in percent, with the shock equivalent to 1 percent of Government Spending)

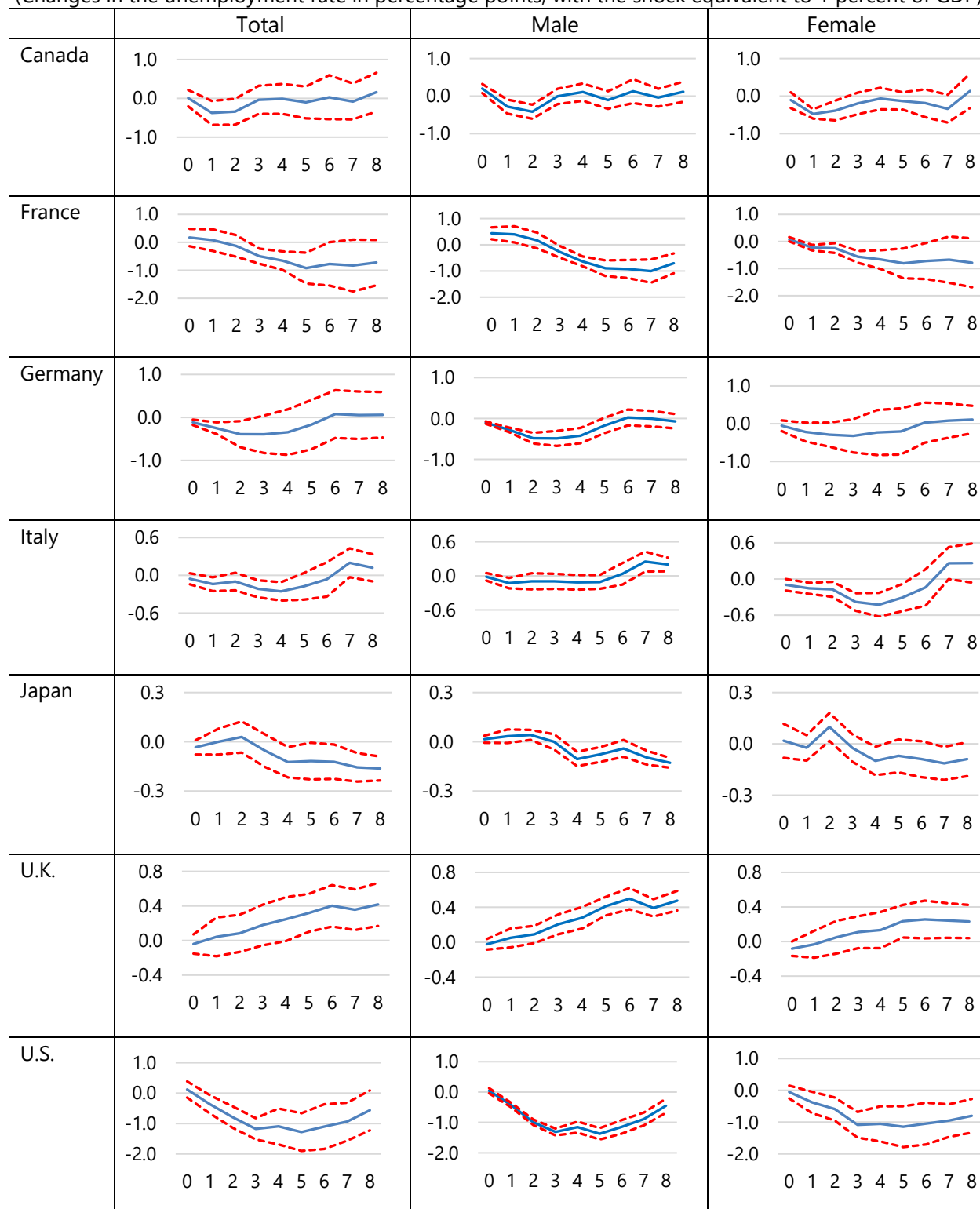


Note: 95 percent confidence intervals are shown in all cases.

Source: Authors' calculations.

### Appendix V. Effects of Government Spending Shocks on Unemployment Rates during Recessions

(Changes in the unemployment rate in percentage points, with the shock equivalent to 1 percent of GDP)

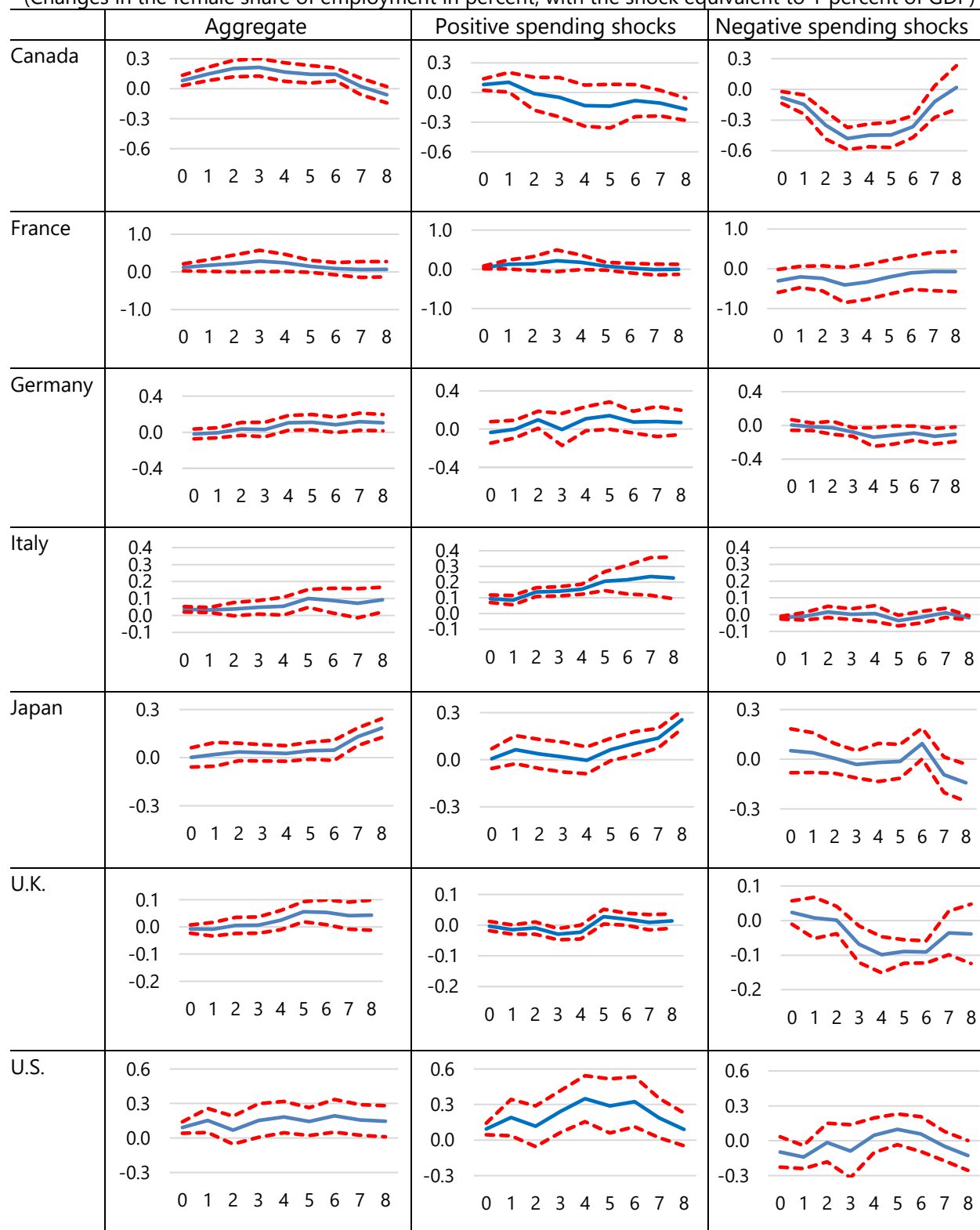


Note: 95 percent confidence intervals are shown in all cases.

Source: Authors' calculations.

### Appendix VI. Effects of Government Spending Shocks on Gender Equality

(Changes in the female share of employment in percent, with the shock equivalent to 1 percent of GDP)

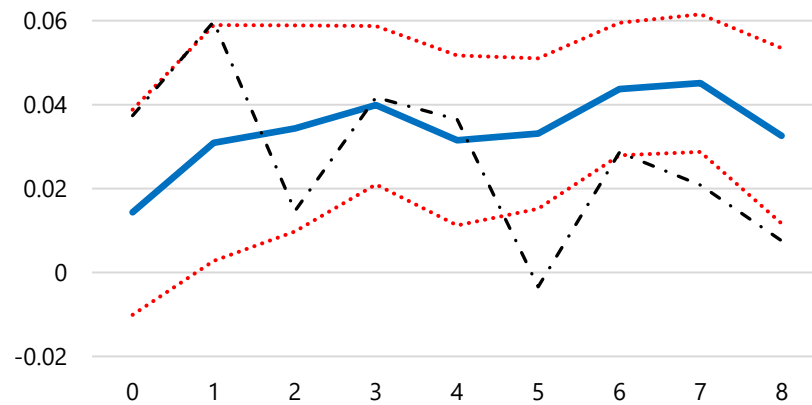


Note: 95 percent confidence intervals are shown in all cases.

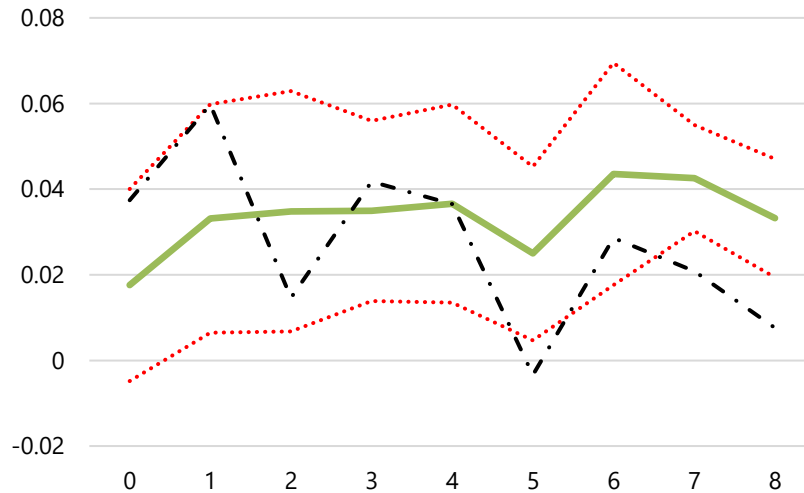
Source: Authors' calculations.

## Appendix VII. Response of Predicted Female Share of Employment During Recessions

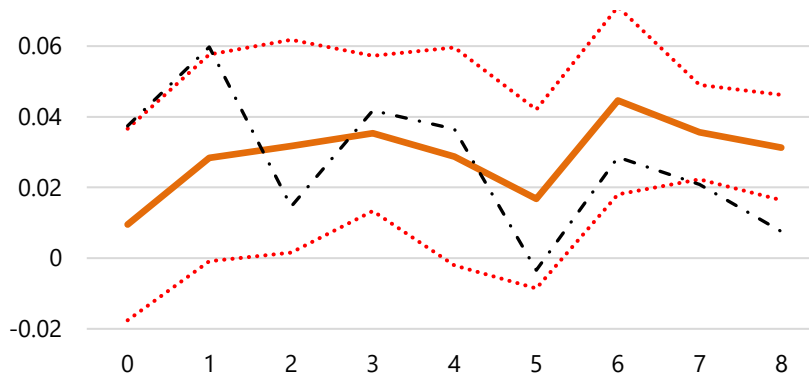
### A. Using prediction by industries



### B. Using prediction by industries and occupations



### C. Using prediction by industries, occupations, and employment types



Note: The solid lines plot impulse responses obtain by using predicted female employment shares. The dash-dotted lines plot impulse responses obtain by using the actual female employment share. The dash-lines denote 90 percent confidence bands. Correlations between impulse responses obtained by using predicted female employment shares and those obtained by using the actual female employment share are also presented.

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