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An empirical investigation of tax policy in G-7 countries

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AN EMPIRICAL INVESTIGATION OF TAX POLICY IN G-7 COUNTRIES

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ABSTRACT

This dissertation consists of three essays on the effects of fiscal policy on the economic activity. The first and second chapters investigate the response of major macroeconomic variables to four different types of tax policy innovations within a VAR framework using contemporaneous restrictions and long-run restrictions, respectively. Although G-7 countries seem to react differently to tax policy innovations, we do not find any evidence for the existence of negative corporate tax multipliers (for output) or positive income tax multipliers (for output) with both identification schemes. The cross-country variation in the signs of indirect tax is considerably higher. The effects of social security tax innovations on output exhibit cross-country heterogeneity with contemporaneous restrictions. We do not find any significant effects of social security tax innovations on output with a SVAR approach that uses long-run restrictions. We conclude that the composition of the total tax response is even more important than the magnitude of the total tax response, and thus should be taken into consideration in explaining cross-country variation in the sign and magnitude of tax multipliers.

The third chapter of this dissertation uses an unbalanced panel data set that includes annual estimates of cyclically adjusted government expenditures, capital outlays, income tax revenues, indirect tax revenues, corporate tax revenues and social security tax revenues. The percentage share of these estimates in GDP is used to investigate the effects of fiscal policy on economic growth, and results are compared with regression results that use 5-year averages of cyclically unadjusted variables. The empirical results from both sets of regressions suggest that only taxes on household income have negative effects on per capita income growth. We also show that government expenditures that

include the government wage bill have significant negative effects on economic growth. These results are consistent with the recent literature that emphasizes the non-Keynesian effects of fiscal policy through labor market, firm profits and private investment. We consolidate our findings by showing that both government expenditures and income taxes have distortionary effects on private investment.

CHAPTER 1
ARE SOME TAXES DIFFERENT THAN OTHERS? AN EMPIRICAL INVESTIGATION OF TAX POLICY IN G-7 COUNTRIES

1.1. Introduction

Blanchard and Fischer (1989) argue that unlike monetary policy, fiscal policy has important effects on the macroeconomy, even in the absence of nominal rigidities. However, there is no strong consensus among economists of the dynamic effects of fiscal policy actions. Although the literature generally suggests small and positive spending multipliers, and small and negative tax multipliers, there is some evidence for negative spending multipliers and positive tax multipliers[1]. This chapter investigates the role of fiscal policy (tax policy in particular) in stimulating economic activity in G-7 countries by using vector autoregressive (VAR) models, and it sheds some light on the positive tax multipliers and negative spending multipliers found in previous studies.

VAR models have been extensively used in the literature to analyze the effects of monetary policy shocks. It is only recently, however, that more attention has been directed towards estimating the effects of fiscal policy within VAR models. Moreover, despite a number of studies that incorporate government spending into VAR models, few have attempted to investigate the effects of tax policy innovations. For instance, Edelberg, Eichenbaum and Fisher (1999*)* examine the effects of exogenous shocks to real government defense purchases in the U.S. within VAR models. These exogenous shocks are measured by a narrative based dummy created by Ramey and Shapiro (1997), that consists of four historical events that are associated with major increases in defense spending: World War II, the Korean War, the Vietnam War and the Carter-Reagan military spending build-up. However, World War II was omitted because patriotism then

[1] Please see Baldacci et.al (2001).

seemed to induce large supply shifts. They find that defense spending has a hump-shape effect on real GDP and a temporary effect on real interest rates. Fatas and Mihov (2000) examine the effects of exogenous shocks to real government purchases in a semi-structural VAR model, once again using U.S. data[2]. They find that following a positive expenditure shock, real GDP increases initially and then returns to its original level, the price level falls significantly, and there is a transitory positive effect on the T-Bill rate. Other studies that identify fiscal policy shocks (by using a Choleski decomposition) include Garcia -Mila (1989), which finds a multiplier effect of state and local government purchases on output. Military purchases, on the other hand, are found to be only slightly expansionary in the very short term.

Blanchard and Perotti (1999) is the first major study that incorporates an aggregate tax revenue variable into the VAR models. They estimate the effects of exogenous shocks to real government purchases and real net taxes within a semi-structural VAR model by computing impulse response functions (IRFs). They use institutional information about tax and transfer systems and the timing of tax collections to identify the automatic stabilizing aspects of fiscal policy and use this in deriving fiscal shocks[3]. The authors consider both a model with a deterministic trend (quadratic) and a model with stochastic trend (unit root with drift), since unit root tests prove to be in favor of neither. Their results consistently show that positive government spending shocks have

[2] Fatas and Mihov (2000) point out that spending and tax changes are usually announced in advance of the actual change. If these future changes vary systematically with the state of the macroeconomy, then a regular VAR can be estimated. Otherwise, a regular VAR will omit important information (the pre-announced changes) and hence will be misspecified. They use data from various issues of the Economic Report of the President to generate measures of past expectations of current fiscal variables and current expectations of future fiscal variables. Then they solve out their system by using these generated measures, and find results very similar to a standard VAR.

[3] Blanchard and Perotti (1999) use institutional information to construct some of the coefficients of the contemporaneous relations among the variables.

a positive effect on output, while positive tax shocks have a negative effect. They also find that persistence is stronger under stochastic trends.

Perotti (2002) studies the effects of fiscal policy on GDP, prices and interest rates in five OECD countries using a structural VAR approach. He argues that the effects of fiscal policy on GDP and its components have become substantially weaker in the last 20 years. He also contends that the tax multipliers tend to be negative but small, and there is some evidence on positive tax multipliers while the net tax shocks have very small effects on prices. Finally, he argues that the U.S. is an outlier in many dimensions, so the responses to fiscal shocks estimated on U.S. data are often not representative of the average OECD country.

In this chapter, we investigate the response of output and other macroeconomic variables such as the price level and the interest rate to innovations in different tax groups. Our results show that different tax groups have different effects on macroeconomic activity, and the composition of the total taxes can be a major factor that explains the positive tax multipliers found for total net taxes in the previous literature.

Economic theory also suggests that different tax groups have different effects on the economy. For instance, Atkinson and Stiglitz (1980) develop a basic intertemporal model, which shows that income taxes and consumption taxes have different effects on household saving decisions. There is also empirical support for different effects of different tax groups. Using a panel of 22 OECD countries, Kneller, Bleaney and Gemmell (1999) contend that distortionary taxation (income taxes and social security taxes) reduces growth whereas non-distortionary taxation (corporate taxes and indirect taxes) does not, and productive government expenditure (such as expenditures on

infrastructure) enhances growth, while non-productive government expenditure (such as recreational expenditure) does not. The theoretical literature and empirical evidence on the effects of these tax groups are discussed in further detail in section 1.2.

The remainder of the chapter is organized as follows: section 1.2 reviews the literature on the effects of different tax groups on the economy; section 1.3 explains the data and methodology used; section 1.4 presents the empirical results, section 1.5 discusses whether the estimated shocks are reasonable, and section 1.6 presents the estimation results of an alternative model, and finally section 1.7 concludes.

1.2. Theoretical Literature on Different Tax Groups

1.2.1. Income Taxes

According to the traditional IS-LM, AD-AS type of models, an increase in the income tax rate can shift both the aggregate demand curve and the aggregate supply curve. When we look at the aggregate demand side, we see two different views regarding the effects of an increase in income tax revenues. According to the traditional view, an increase in income tax revenues (and, implicitly the income tax rate) decreases current consumption, and, thus, shifts the aggregate demand curve to the left.

According to the Ricardian equivalence hypothesis, however, a change in income tax revenues will not have any effects on the consumption behavior of agents, as consumption depends on real after-tax permanent income. The Ricardian equivalence hypothesis states that a switch from lump-sum tax finance to bond finance has no effect on the macroeconomy, holding everything else constant. Aggregate demand (AD) remains unchanged and there are no effects on the price level, income, consumption, and interest rates.

The logic behind Ricardian equivalence is that there is an intertemporal budget constraint of the government. The present value of the government revenues should be equal to the present value of government expenditures. Ricardian equivalence thus implies that economic agents are not myopic and they know that cutting taxes today merely pushes these taxes into the future. If the government cuts taxes today, and issues bonds to pay for this tax-cut, taxes must be increased in the future to repay the bonds previously issued and to meet the interest payments on these bonds. Therefore, in the Ricardian view, consumption depends upon real after-tax permanent income, not current period disposable income. When there is a current period tax cut, consumers save the entire amount in order to pay the higher taxes that will be levied later in their lifetime. Since there is no change in consumption, there will be no change in aggregate demand, output and decrease in the price level.

If the tax rate is cut, however, although the AD curve remains unchanged, the cut in the tax rate increases the after-tax expected real wage, and thus increases the labor supply and shifts the aggregate supply (AS) curve to the right. In that case, there will be an increase in output, a decrease in the price level and an increase in the interest rate.

Seater (1993) suggests that there are some reasons that may lead to the failure of the Ricardian equivalence, including finite horizons, non-altruistic motives, liquidity constraints and uncertainty. However, as Seater contends:

" Newtonian Physics is known to be false; nevertheless, physicists often treat it as true because it is an excellent approximation in many circumstances. Similarly, we

have a good reason to believe that Ricardian equivalence is false, but there is evidence that it is a very good approximation." [4]

Kormendi (1993) tests the Ricardian equivalence hypothesis and shows that when the government deficit rises, future tax liabilities also go up. However, agents do not know when these additional taxes will be levied. This uncertainty induces more savings, and thus private consumption goes down.

Graham (1995) argues that Kormendi's earlier results are not robust to alternative measures of government spending and debt. He focuses on post World War II period and uses labor income instead of permanent income. He does not find strong support for the Ricardian equivalence hypothesis

Kormendi and Meguire (1995) argue that Graham's breakdown of total income between labor income and capital income is conceptually flawed and, by using 128 different specifications, conclude that Graham's results are not typical of the entire set of results.[5]

1.2.2. Corporate Taxes

The Fisher separation theorem states that given perfect capital markets, the production decision of a firm is governed solely by an objective market criterion, namely maximizing attained wealth, independent from individual's consumption decisions. According to Fisher separation capital markets yield a single interest rate that both borrowers and lender can use in making consumption and investment decisions, and this in turn allows a separation between investment and financing decisions. Firms and individuals with access to productive investment opportunities should accept all projects,

[4] Seater, J. J. 1993. "Ricardian Equivalence." *Journal of Economic Literature,* 31: 2-90.
[5] For a detailed discussion of Ricardian equivalence literature please see Seater (1993).

whose return is greater than or equal to the market interest rate and then they should turn to the capital markets for any funding they cannot provide internally. In other words, given the opportunity set, every individual or firm will make the same production/investment decisions; however, financial instruments will change their ultimate amount of consumption. Therefore, taxation, a financial factor, should not affect the aggregate production in the economy, as argued by Fisher (1954).[6] On the other hand, according to the neoclassical investment literature, including Jorgenson (1963), Jorgenson and Siebert (1968), if there is only partial tax deductibility of interest expenses, depreciation charges and capital losses for tax purposes, the corporate tax rate affects the tax-adjusted user cost of capital and hence affects investment.

1.2.3. Indirect Taxes

Atkinson and Stiglitz (1980) present a simple inter-temporal model in order to show the effects of income and indirect taxes on household saving decision. In the model, it is assumed that an individual who lives for T years, receives a wage income w_i, and consumes C_i. If we assume that a proportional tax t (income tax) is imposed on wage and non-wage income, or a proportional tax t^* is imposed on consumption (indirect tax), the effects of these taxes on private savings will not be identical. A person who lives just two periods receives wage income only in the first period by assumption, thus, pays income tax (social security tax) only in the first period. Under a consumption tax, however, he pays $C_2(1+t^*)$ in the second period, so he has to save more or increase his work efforts in the first in order to pay tax in the second period. Therefore, a priori it is reasonable to expect smaller, or in certain cases positive tax multipliers for indirect taxes, if the

[6] For a detailed explanation see Copeland and Weston (1983) or similar corporate finance theory textbooks.

individuals' increase their work efforts in the current period to pay for their future tax liabilities.

1.2.4. Social Security Taxes

There are not many studies that investigate the effects of social security taxes on the macroeconomy. Kneller et al (1999) find that social security taxes are harmful for economic growth by using OECD data. Alesina et al (2002), on the other hand, combine social security taxes with income taxes and argue that this combined tax group, called 'labor taxes', have distortionary effects both in the short-run and the long-run.

Social security taxes are levied on labor as a payroll tax, so a priori we expect an increase in the social security taxes to decrease work incentives. First of all, an increase in the social security tax reduces the opportunity cost of an hour of leisure, therefore gives the individual a tendency to substitute leisure for work. This effect is known as the "substitution effect". However, for any number of hours worked, social security tax reduces real income, thus may induce more working hours. This effect is well known as the "income effect". Depending on the relative size of these effects, hours worked may increase, decrease or stay the same after the imposition of the tax. If the substitution effect is stronger, however, the aggregate supply curve will shift to the left.

However, empirical evidence shows that for males between the ages of 20 and 60, the effect of changes in the net wage on hours of work is usually small in absolute value, and statistically insignificant in many cases (Engen and Skinner (1996)). Therefore, it is reasonable to expect that a change in social security taxes will not have a significant effect on work efforts.

1.3. Data and Methodology

1.3.1. Data

The data series used in this chapter are obtained from two different sources: the data for four different types of government revenues, namely income, corporate, indirect and social security taxes, as well as government expenditures, government expenditure deflator indices and domestic expenditure deflator indices are obtained from the OECD Economic Outlook database. The data for GDPs, Consumer Price Indices, and long-term Government Bond Yields are obtained from the IMF International Financial Statistics database. Government expenditure is deflated using the government expenditure deflator; the tax groups are deflated by the domestic expenditure deflator. Exact definitions of the variables used are presented in Table 1.1 (Panel A)

The data used to estimate the model consist of quarterly observations for the G-7 countries, and the estimation period for each county is presented in Table 1.1 (Panel B). Because of insufficient number of observations, we were unable to test the effects of corporate, indirect and social security tax shocks for the U.K.

1.3.2. Methodology

To investigate the response of macroeconomic variables to tax policy innovations, VARs are employed. Each model comprises of the following variables: Output (Y, measured by real GDP), the price level (P, measured by the CPI[7]), the interest rate (R, long-term government bond yield), tax revenue (T, measured by tax revenue of the i^{th} tax group measured in national currencies, deflated by domestic expenditure deflator) and.

[7] We used the CPI instead of the GDP Deflator, as comparable GDP Deflator statistics were not available for all countries in the sample.

government expenditures (G, in national currency, deflated by government expenditure deflator).

Initially, we considered model estimations in both levels and differences. However, only the estimations in levels are presented in the chapter[8]. The results for models estimated in differences can be found at the end of this chapter. For the VAR models estimated in first differences, the impulse-response functions are simply accumulated, in order to get impulse response functions in levels. All the variables in the model are estimated in natural logarithms except the interest rate. In order to choose the appropriate lag-length, the results of Likelihood Ratio (LR) Test are used.

The shocks to tax policy are identified from a Choleski decomposition of the variance-covariance matrix. It is assumed that variables in the VAR model are ordered in a particular fashion, and the changes in variables higher in the ordering are assumed to cause contemporaneous changes in variables lower in the ordering. However, variables lower in the ordering are assumed to affect variables higher in the ordering with a lag. Two Wold causal orderings are considered. Our ordering, Y, P, R, T, G, suggested by Favero (2002), orders the fiscal variables last. Another ordering in the literature, suggested by Fatas and Mihov (2001), T, G, Y, P, R, orders fiscal variables first. However, we only used the first ordering as it allows for a contemporaneous effect of income on tax revenues. We compute the effects of a one-standard deviation increase in four-different types of tax revenues on output, the price level and the long-term interest rate. The results are shown in the following section. One-standard deviation confidence intervals are obtained from a Monte Carlo simulation based on 10,000 draws.

[8] Model estimations in differences are presented only for the USA due to space limitations. Full results are available upon request.

1.4. Empirical Results

1.4.1. The Effects of Income Taxes

Figure 1.1 presents the impulse response functions of all model variables to a one-standard deviation shock to income tax revenues. The increases in income tax revenues are followed by a significant decrease in output in Canada, France, Germany and United Kingdom. The effects of income tax innovations on output seem to be insignificant in the U.S. In Italy, although there is a significant decrease in output in between second and third quarters, the effects of income tax innovations on output seem to be insignificant in general. We observe quite unusual Impulse Response Functions (IRFs) in Japan. This may be due to the structural reforms Japan has gone through during the estimation period.[9] Another interesting observation is that the effects of income tax shocks are most significant in the countries where the accompanying government expenditure response is positive. (Canada and Germany). In both countries, the peak effect of income tax shocks on output lie between 4^{th} and 6^{th} quarters. On the other hand, income tax multipliers are generally small, and a one percent increase in income tax revenues causes approximately 0.05 percent decrease in output on average, tax multipliers being less than 0.1 percent in 6 countries. The only exception to small income tax multipliers is the German case, in which a one percent increase in income tax revenues seems to cause a proportionately much higher change in output (around 6 percent). This may be due to the relatively higher share of taxes in GDP in Germany, and also due to the highly progressive German income tax system.

[9] Van Aarle et. al.(2001) argue that VAR models are subject to Lucas Critique, and they also contend that the occurrence of very few large fiscal adjustments for Japan makes empirical investigations using Japanese data distorted.

When we look at the effects of income tax innovations on prices, we see that income tax innovations are accompanied by significant decreases in the price level in most cases. (Canada, Italy, U.K and the U.S.) The effects of income tax innovations on prices are insignificant in the remaining countries. The effects of income tax innovations on the interest rate exhibit considerable variation. We observe a decrease in long-term interest rate in Canada, France, and the United Kingdom, while income tax shocks are accompanied by an increase in long-term interest rate in Germany, Japan and the U.S.A.

Impulse response functions of output, price level, long-term government bond yield, the tax revenues itself and government expenditures to a one standard deviation shock to income taxes are represented, when the model is estimated in levels. The Wold Causal ordering is as follows: Y (real GDP), P (Consumer price Index), R (long-term government bond yield), T and G (Government expenditures). Panels A through G present separate graphs for Canada, France, Germany, Italy, Japan, U.K and U.S.A. respectively.

Panel A: Canada

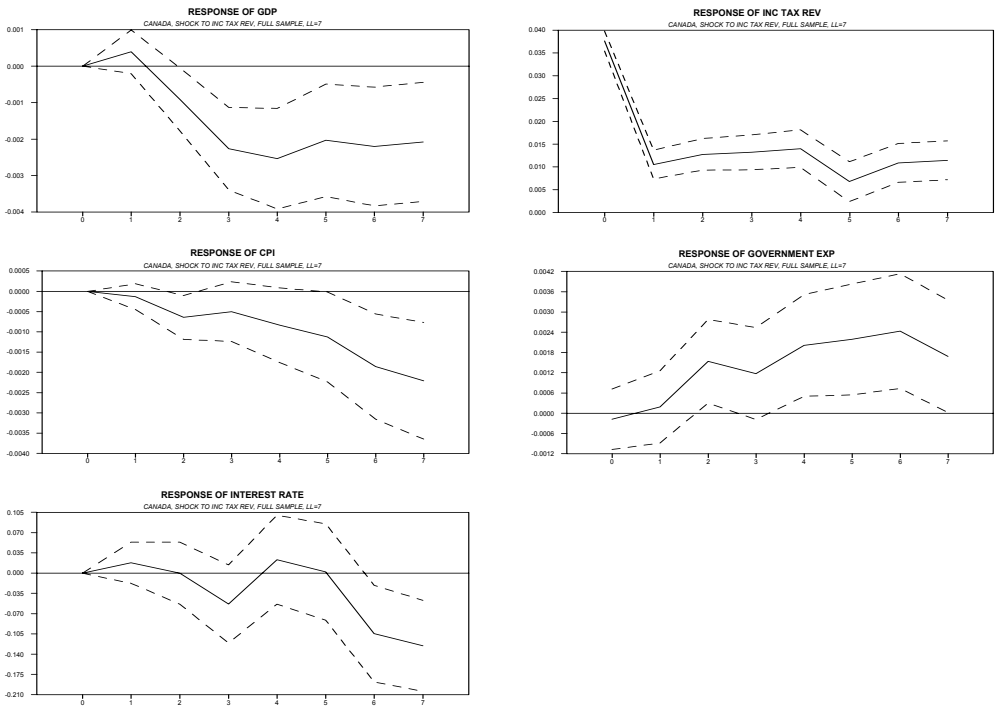


Figure 1
The effects of income taxes (figure continued)

Panel B: France

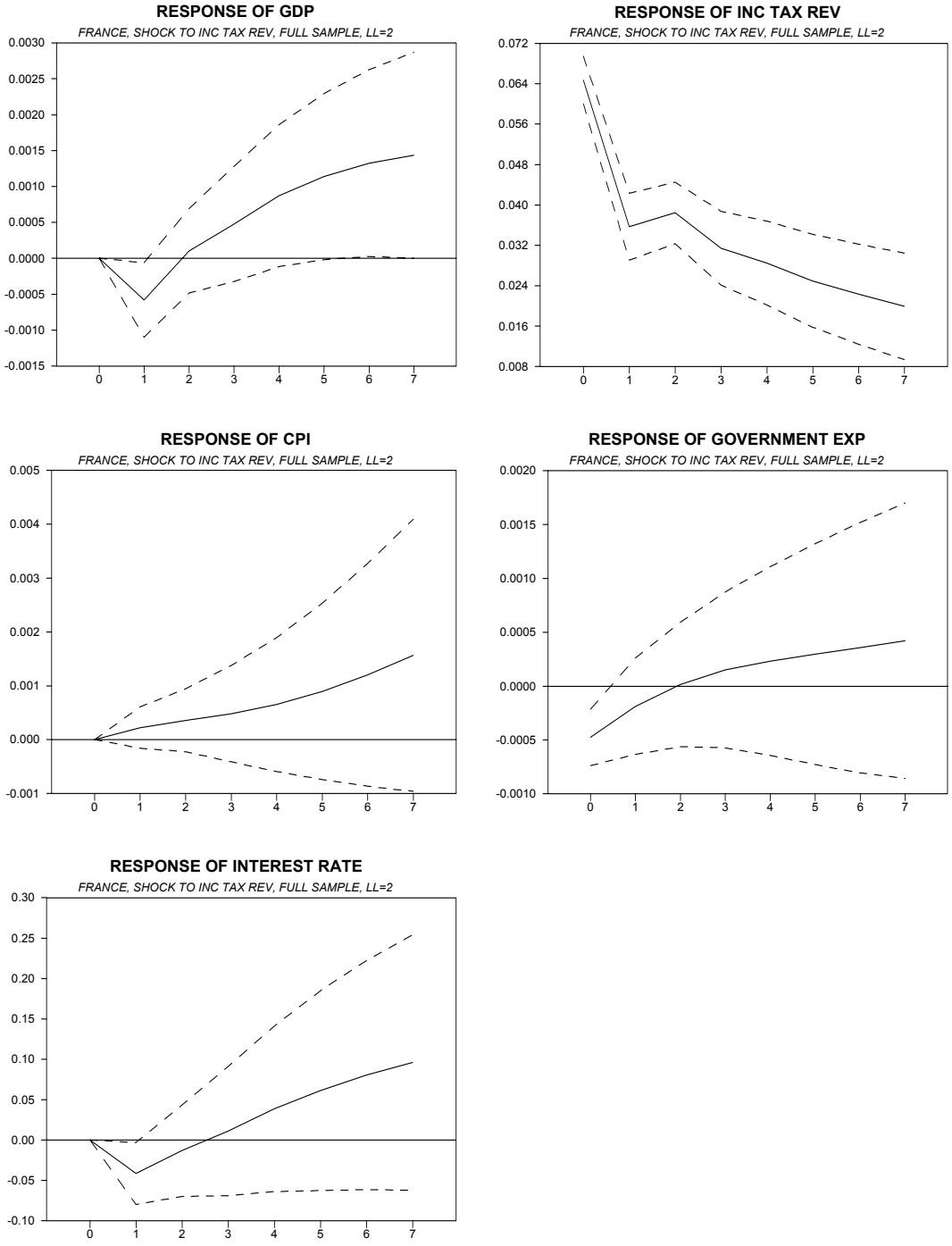


Figure 1.1
The effects of income taxes (figure continued)

Panel C: Germany

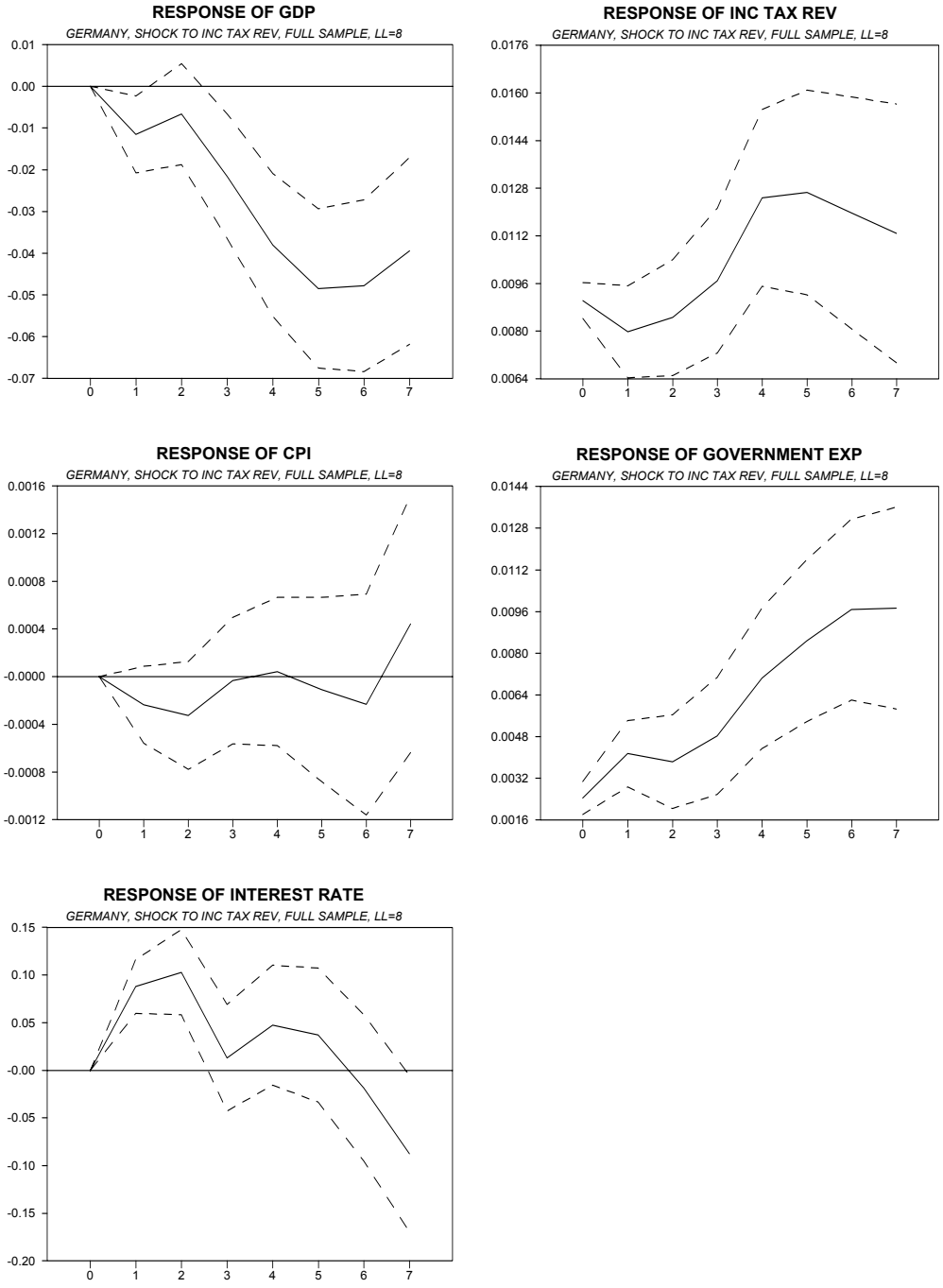


Figure 1.1
The effects of income taxes (figure continued)

Panel D: Italy

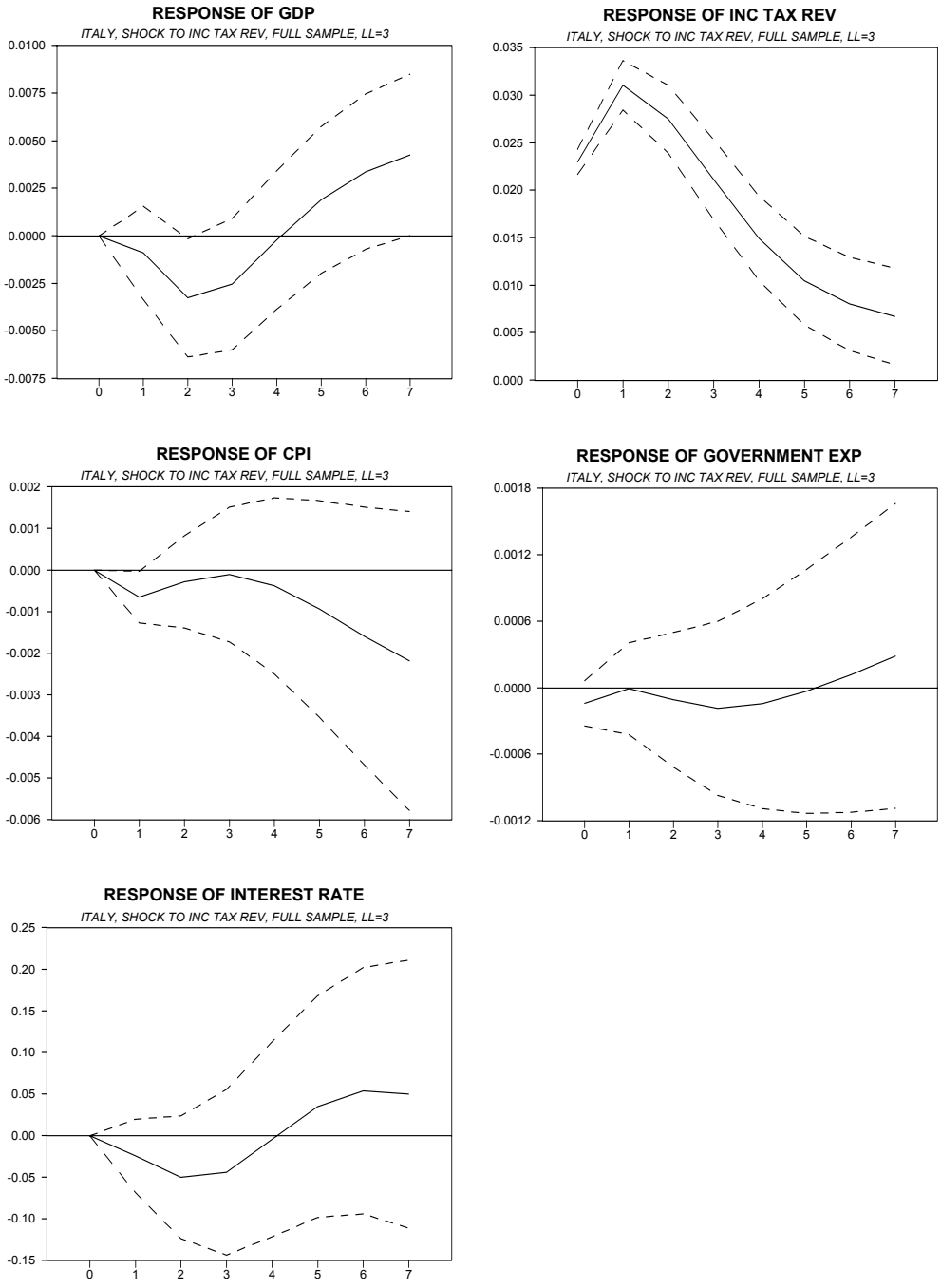


Figure 1.1
The effects of income taxes (figure continued)

Panel E: Japan

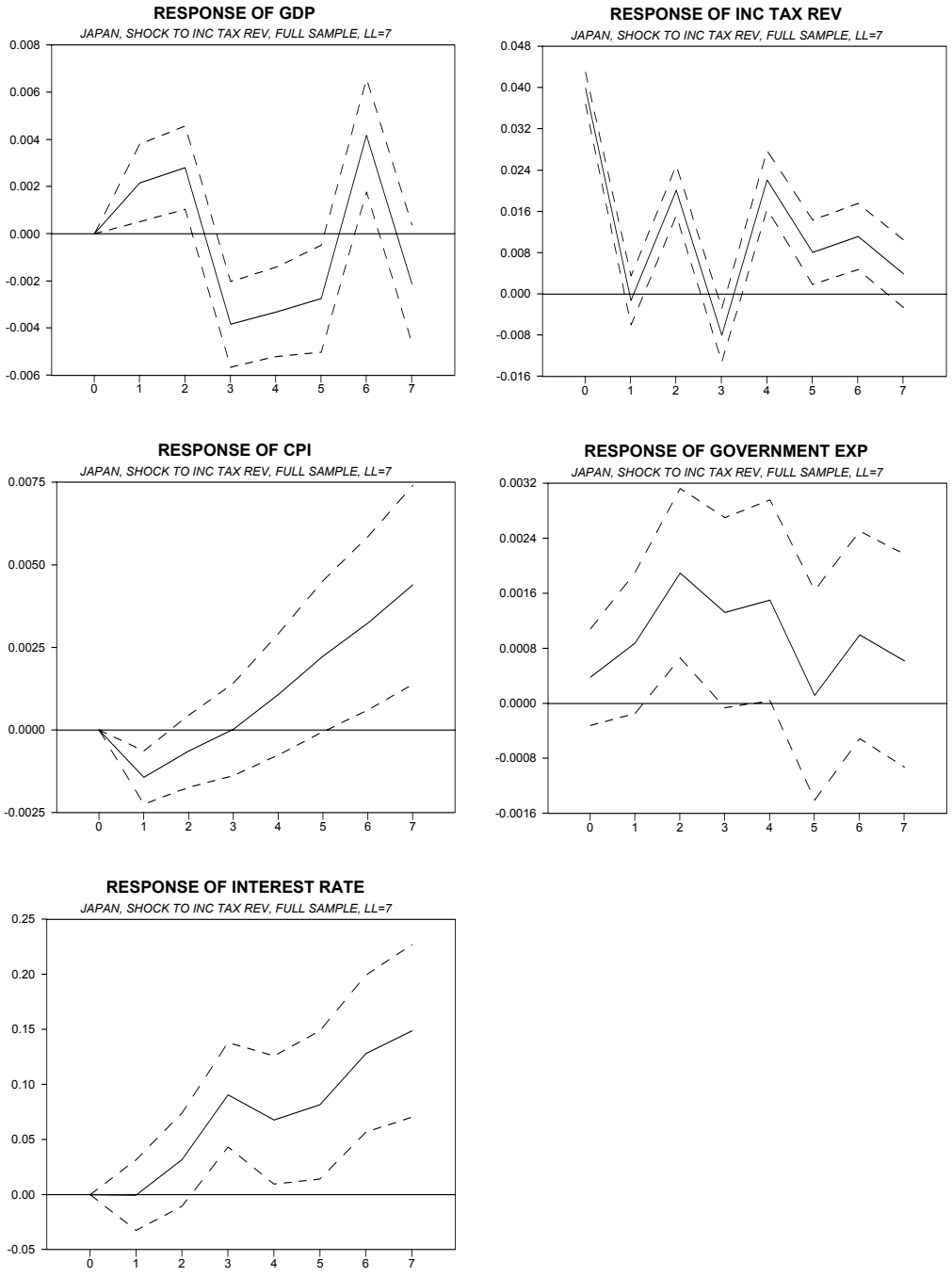


Figure 1.1
The effects of income taxes (figure continued)

Panel F: United Kingdom

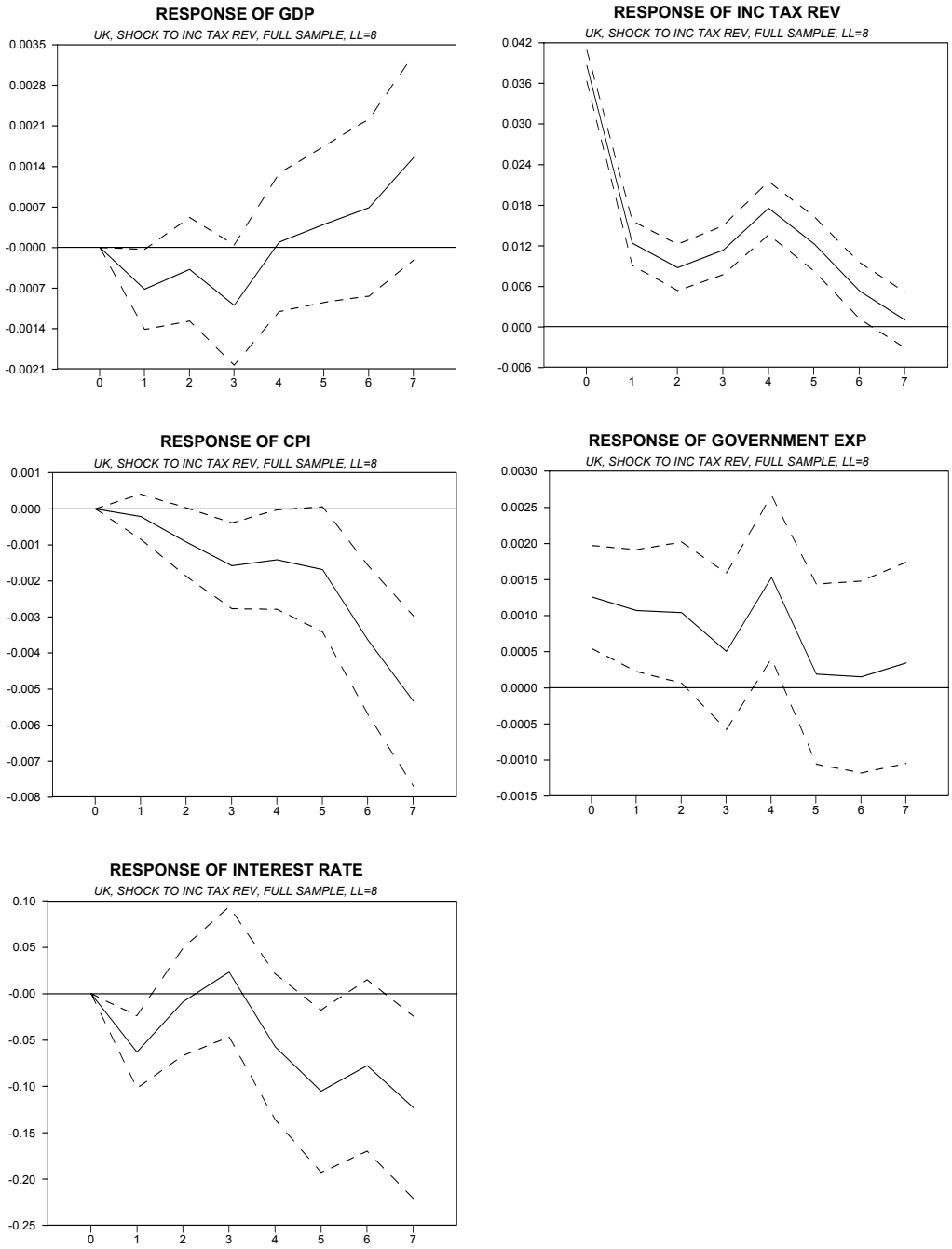


Figure 1.1
The effects of income taxes (figure continued)

Panel G: United States

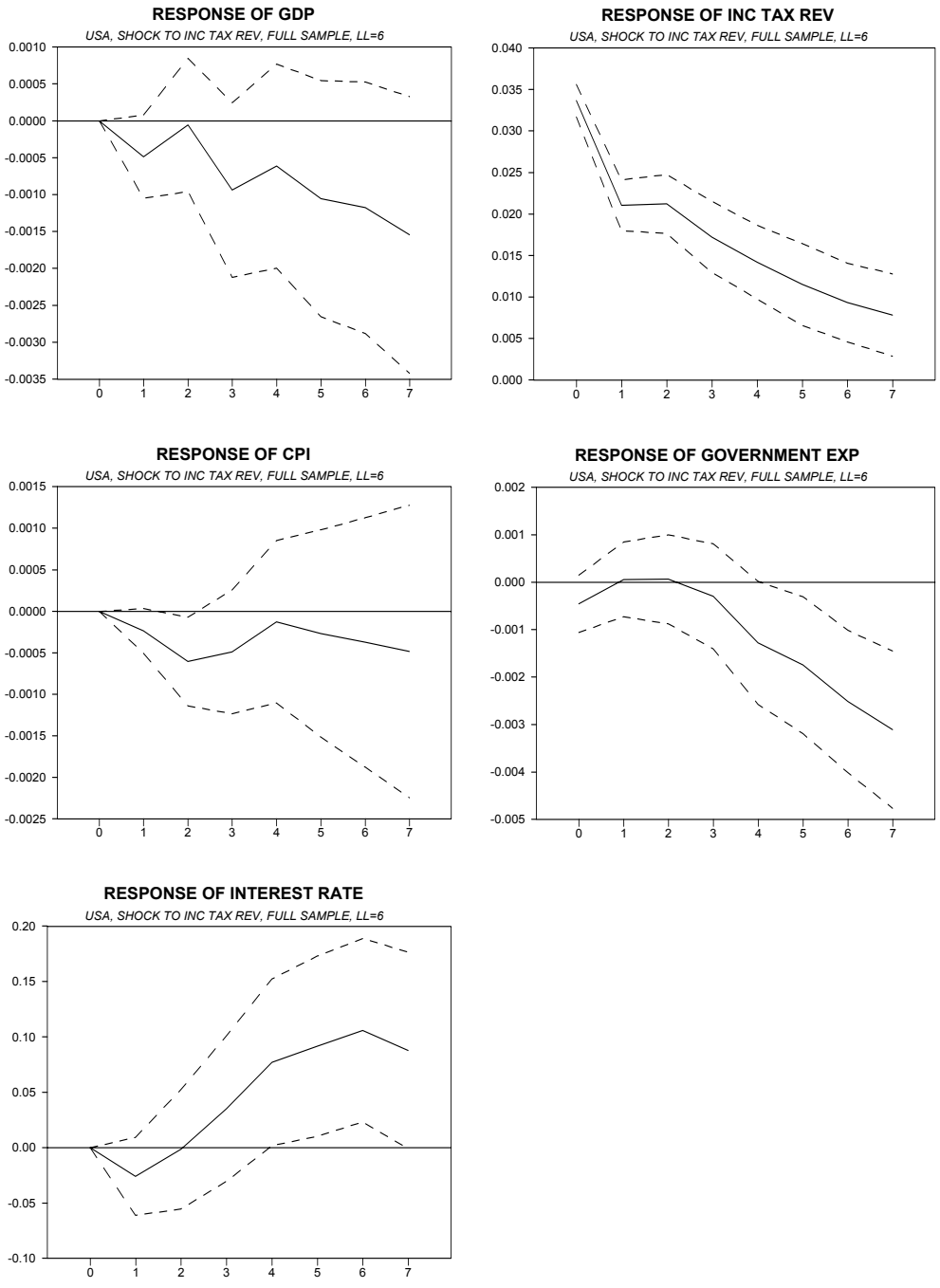


Figure 1.1
The effects of income taxes

1.4.2. The Effects of Corporate Taxes

The effects of corporate taxes are presented in Figure 1.2. Surprisingly, we find positive tax multipliers for all countries in our sample, except for the U.S. Once again, the impulse response functions for Japan is quite unusual. When we look at the magnitude of corporate tax multipliers, a one percent increase in corporate tax revenues leads to a less than 0.1 percent increase in output in nearly all countries in our sample. Once again, the corporate tax multipliers for Germany are considerably higher compared to other countries (around 0.3 percent). These positive corporate tax multipliers are intriguing, as the previous literature does not suggest any a priori explanation.

It is a well known fact that, increases in corporate taxes cause firms to shift from equity to bond financing, since interest payments are tax deductible. This shift from equity to bond financing may have some economic results that were not covered in the previous literature. If these firms perceive the increase in corporate taxes to be permanent, they may try to cover future expected interest payments by increasing output and thus sales revenue. However, we have to make sure that our shocks "make sense", or coincide with the actual policy shocks in the history. A detailed discussion of structural residuals is presented in the following section.

The corporate tax innovations are accompanied by insignificant changes in the price level in nearly all countries in our sample, with the exception of Italy in which a small increase in price level is observed. Finally, we find a cross-country variation in the sign and magnitude of the effects of corporate tax policy innovations on the long-term interest rate. Shocks to corporate tax revenues lead to a significant increase in

the long-term interest rate in Japan, and a significant decrease in the long-term interest rate in Germany and the U.S, interest rate response being insignificant in the other countries.

Impulse response functions of output, price level, long-term government bond yield, the tax revenues itself and government expenditures to a one standard deviation shock to corporate taxes are represented, when the model is estimated in levels. The Wold Causal ordering is as follows: Y (real GDP), P (Consumer price Index), R (long-term government bond yield), T and G (Government expenditures). Panels A through F present separate graphs for Canada, France, Germany, Italy, Japan and U.S.A. respectively.

Panel A: Canada

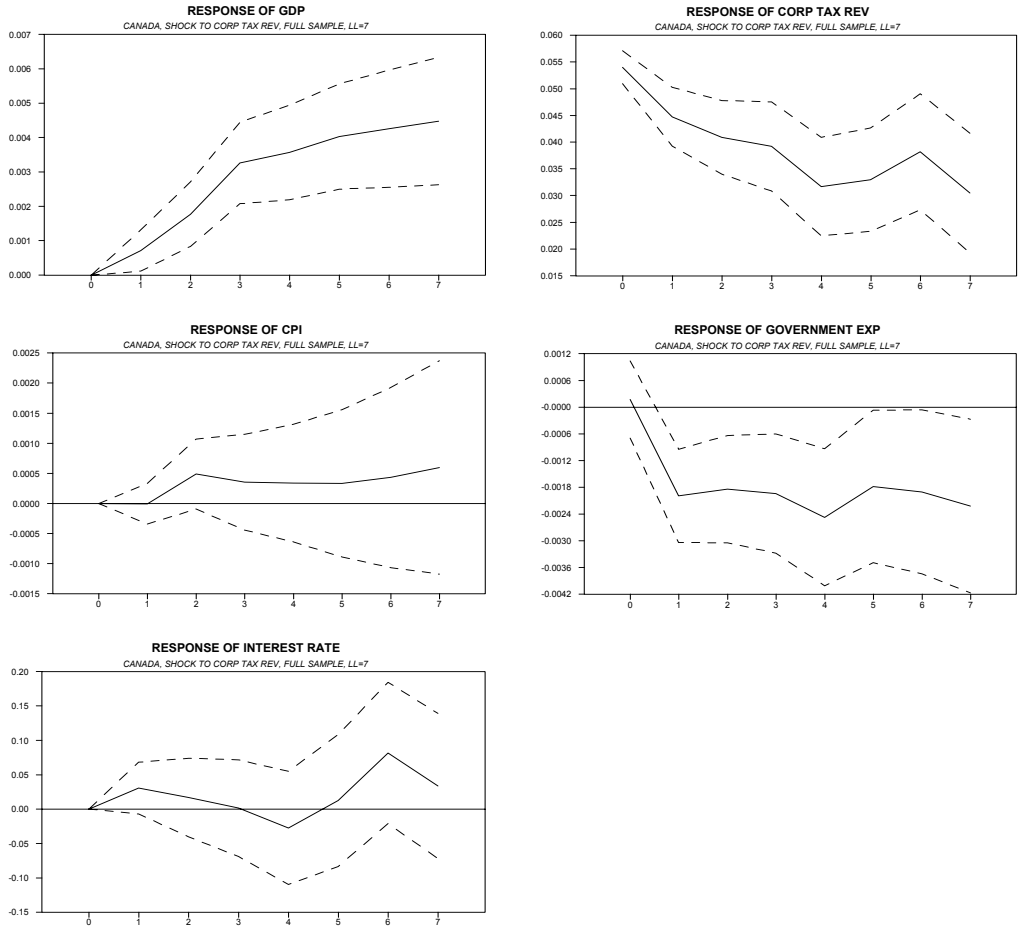


Figure 1.2
The effects of corporate taxes (figure continued)

Panel B: France

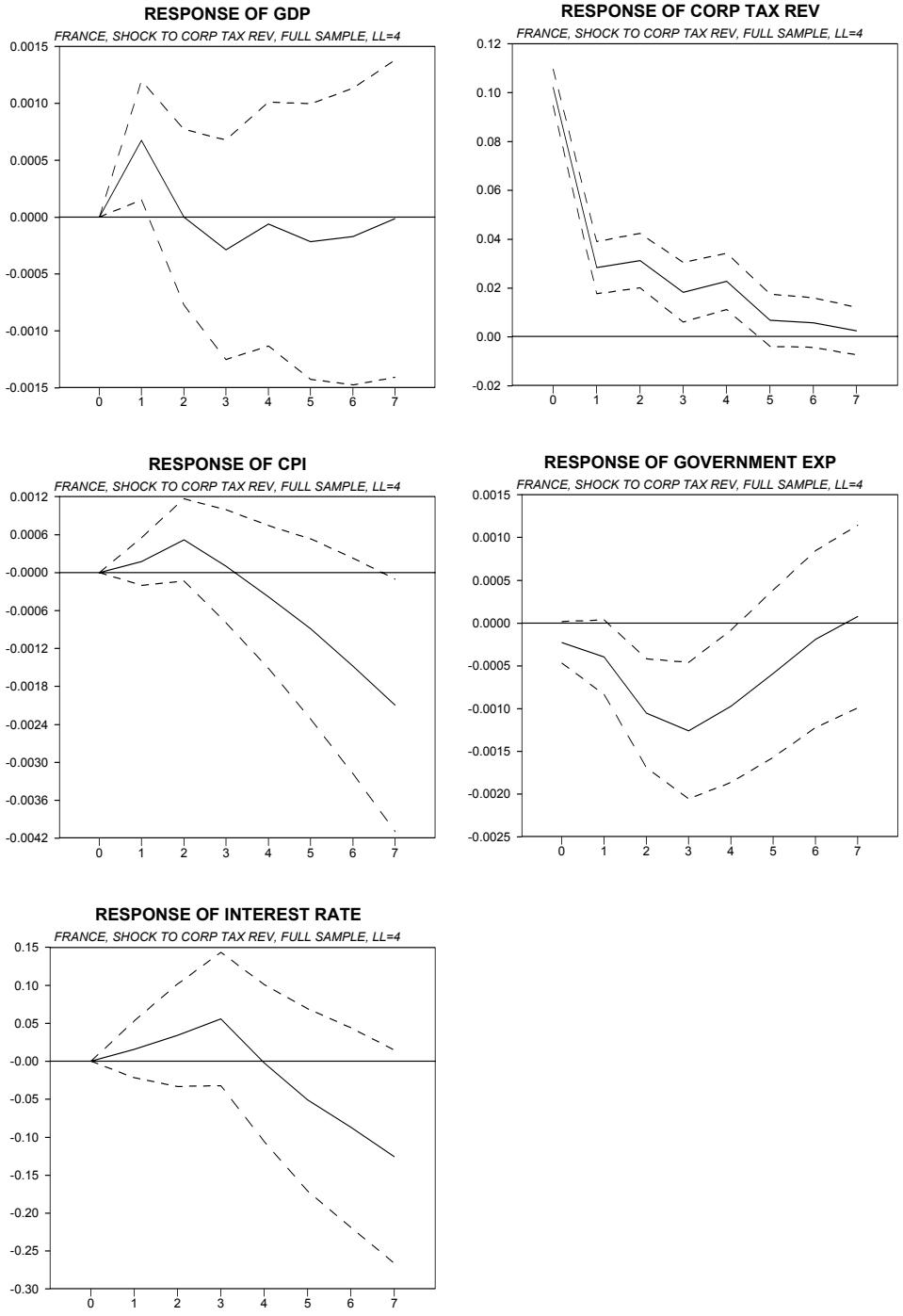


Figure 1.2
The effects of corporate taxes (figure continued)

Panel C: Germany

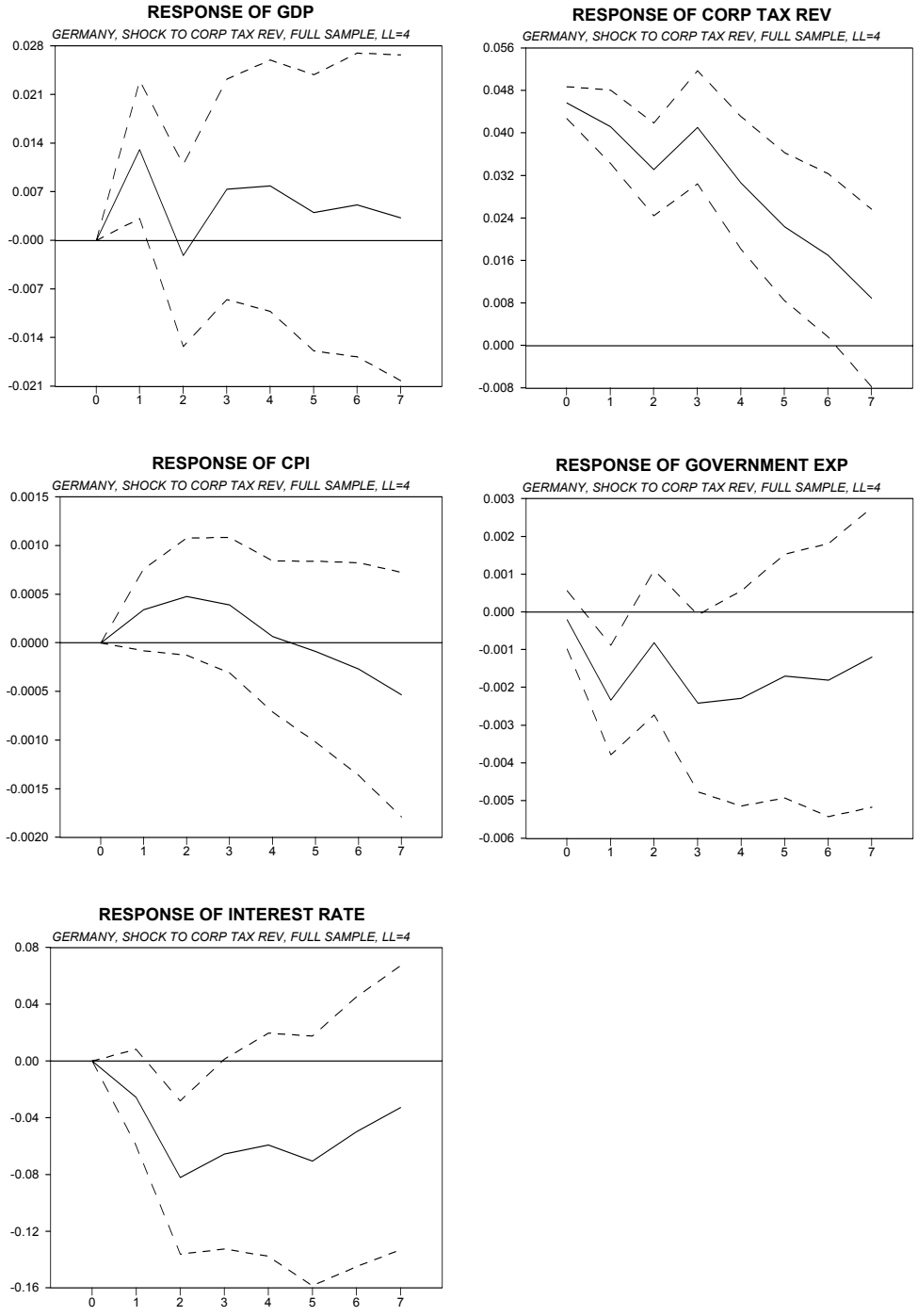


Figure 1.2
The effects of corporate taxes (figure continued)

Panel D: Italy

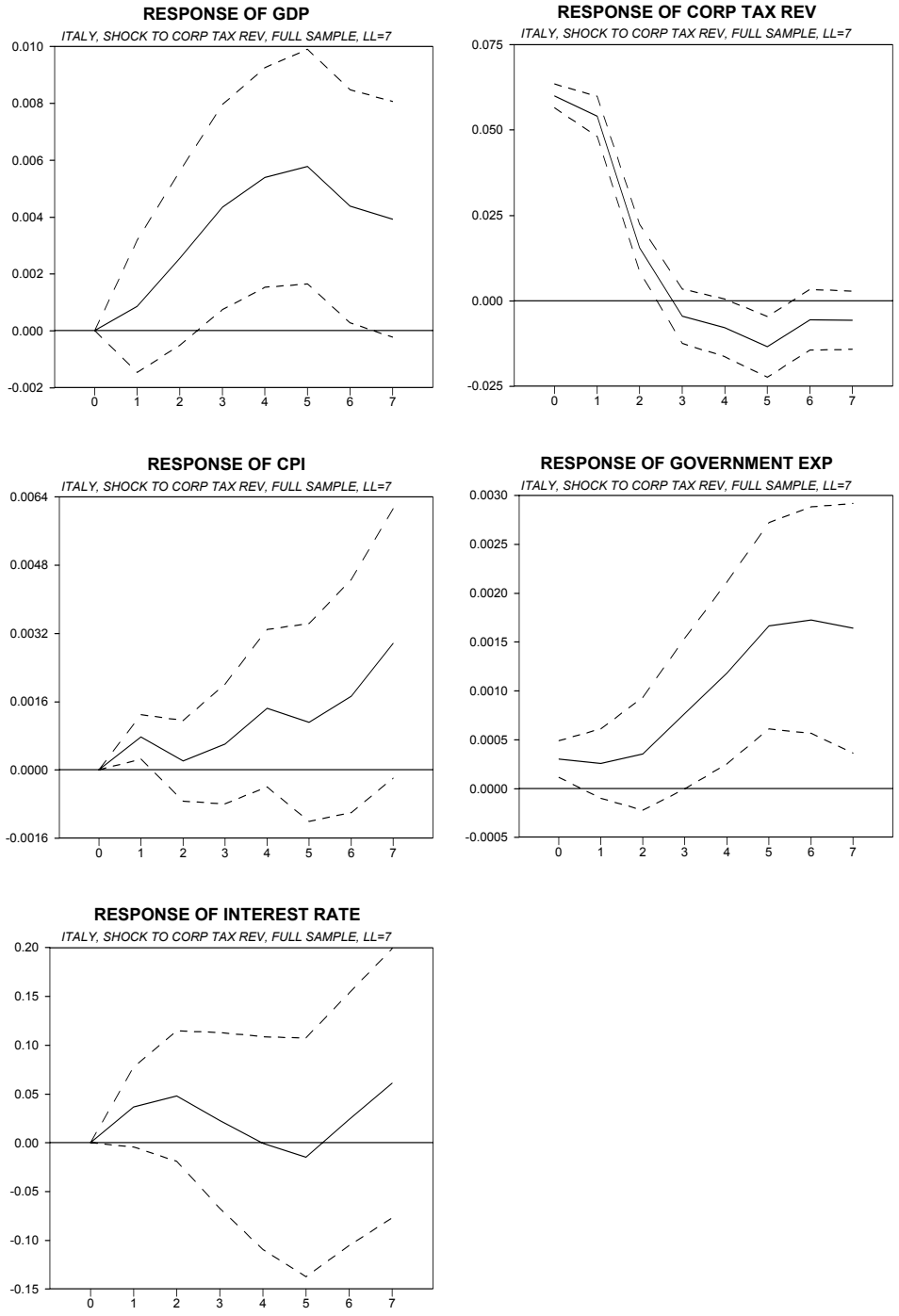


Figure 1.2
The effects of corporate taxes (figure continued)

Panel E: Japan

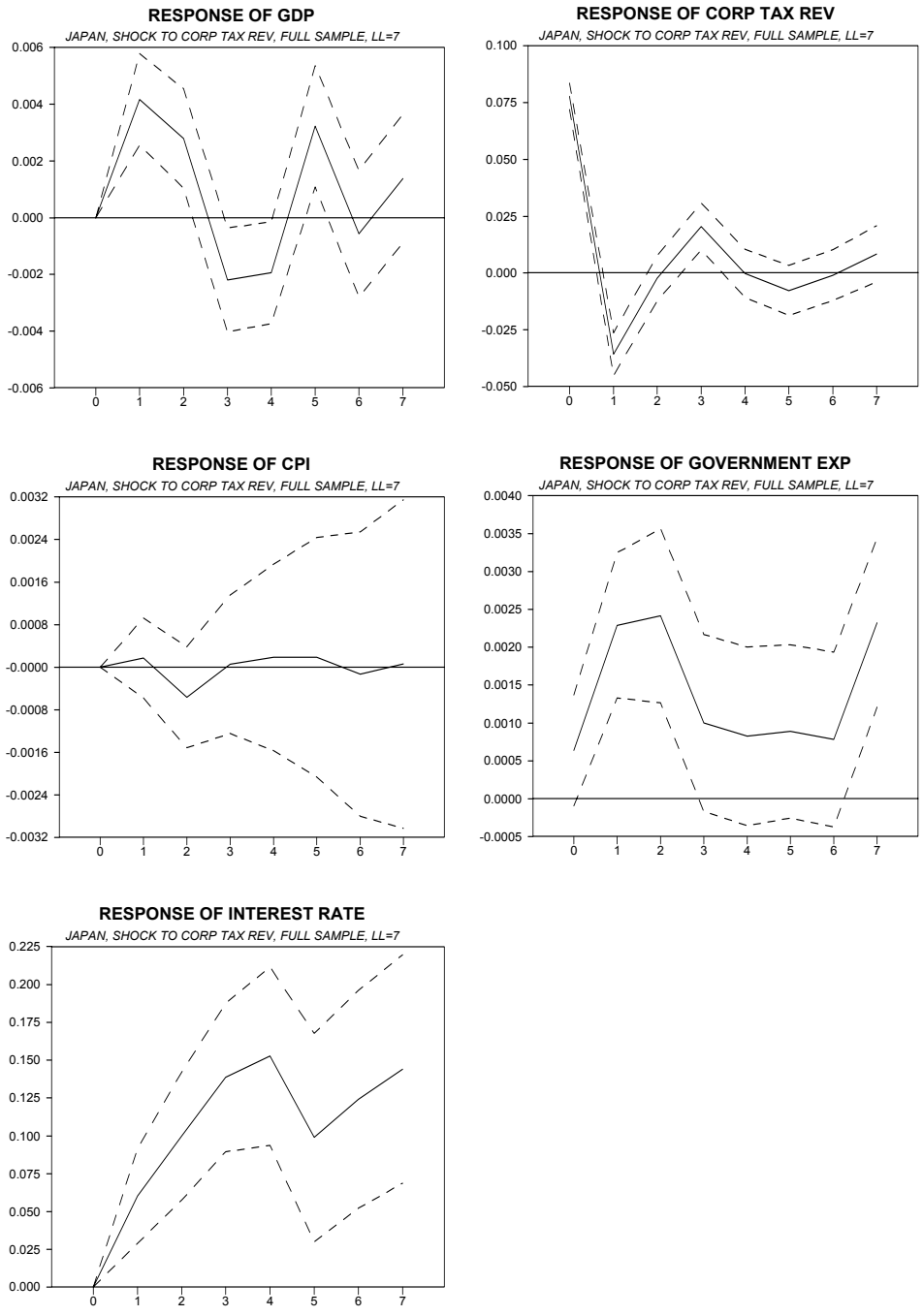


Figure 1.2
The effects of corporate taxes (figure continued)

Panel F: U.S.A

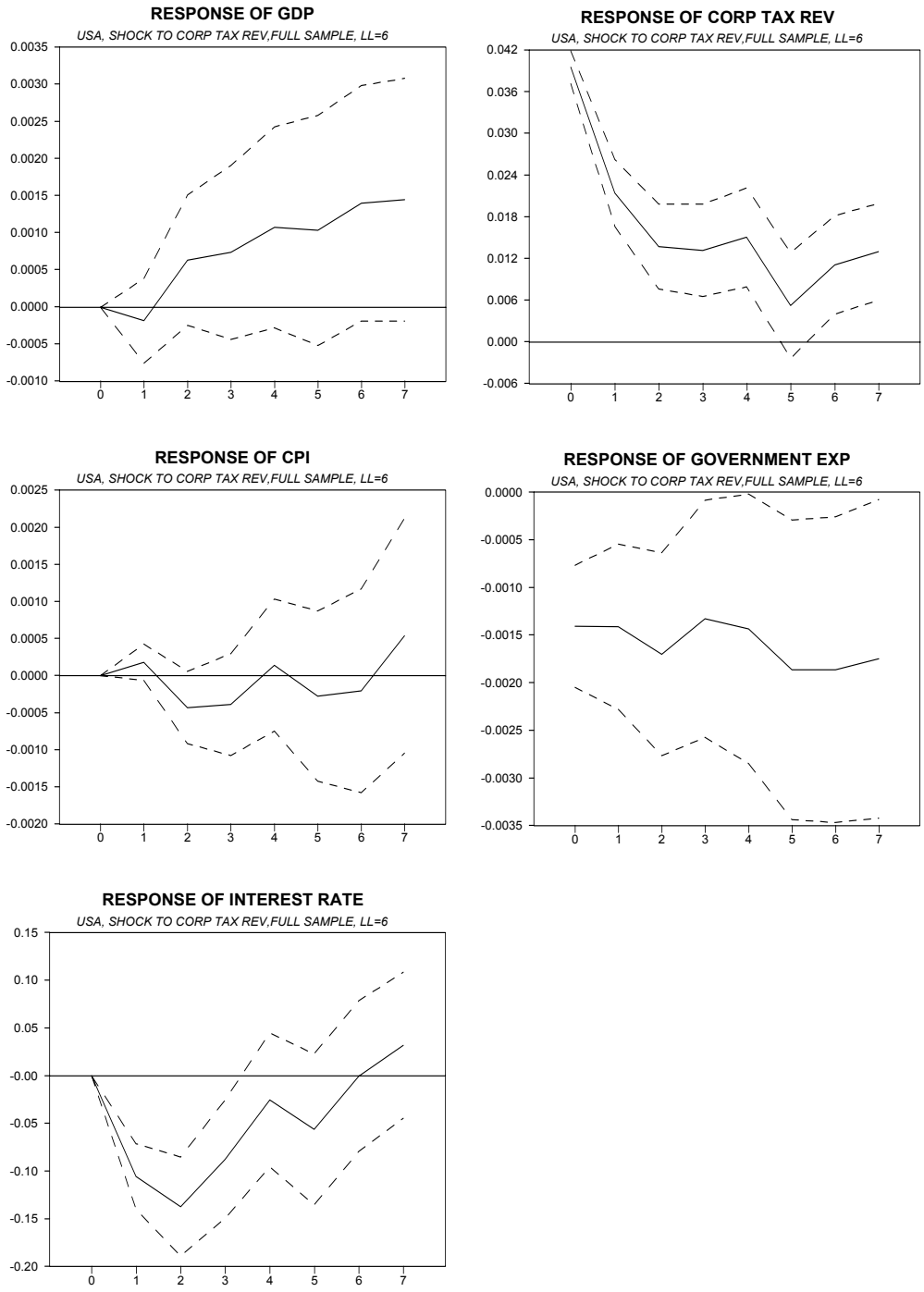


Figure 1.2
The effects of corporate taxes

1.4.3. The Effects of Indirect Taxes

Figure 1.3.1 presents the impulse response functions of model variables to a one standard deviation shock to indirect tax revenues. We find a huge cross-country variation in the sign and magnitude of indirect tax multipliers. Indirect tax innovations are accompanied by a significant decrease in output in Canada and Germany, a significant increase in output in France and Japan, and with insignificant responses of output in Italy and the U.S.

Similarly, the effects of indirect tax shocks on the price level seem to exhibit some variation. Indirect tax innovations are followed by significant decreases in price level in Japan and the U.S.A., a significant increase in the price level in Italy and Germany, while the accompanying price level response is insignificant in the remaining two countries.

When we look at the impulse response functions of the long-term interest rate, we see that indirect tax innovations lead to an initial increase in long-term government bond yield in four out of six countries in our sample (Canada, France, Germany and the U.S.). For Canada, however, we observe a permanent decrease in the interest rate after three quarters.

Once again, indirect tax multipliers are much bigger in absolute value for Germany. Apart from that, a one percent increase in indirect tax revenues cause a 0.1-0.2 percent change in GDP (which is considerably higher compared to income and corporate taxes), however, as mentioned above the sign of these multipliers exhibits considerable amount of heterogeneity: there is evidence for both positive and negative indirect tax multipliers on output.

Impulse response functions of output, price level, long-term government bond yield, the tax revenues itself and government expenditures to a one standard deviation shock to indirect taxes are represented, when the model is estimated in levels. The Wold Causal ordering is as follows: Y (real GDP), P (Consumer price Index), R (long-term government bond yield), T and G (Government expenditures). Panels A through F present separate graphs for Canada, France, Germany, Italy, Japan and U.S.A. respectively.

Panel A: Canada

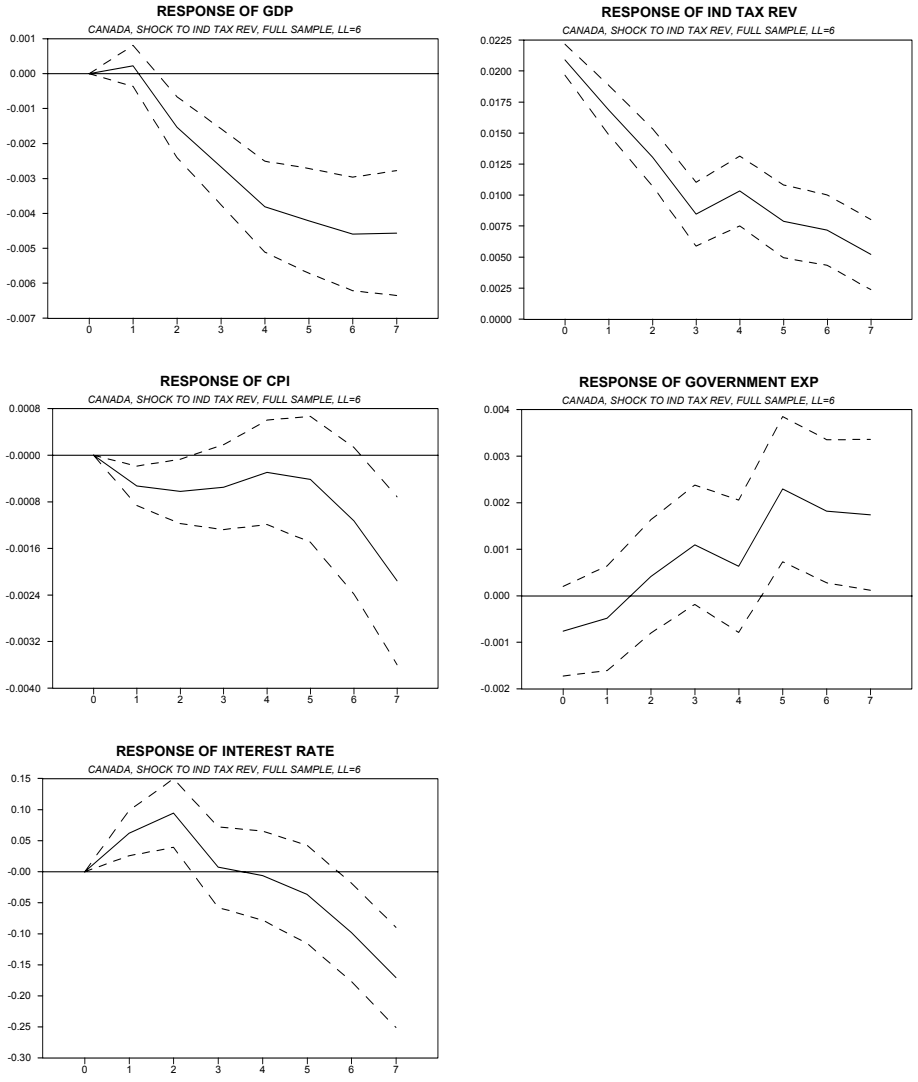


Figure 1.3.1
The effects of indirect taxes (figure continued)

Panel B: France

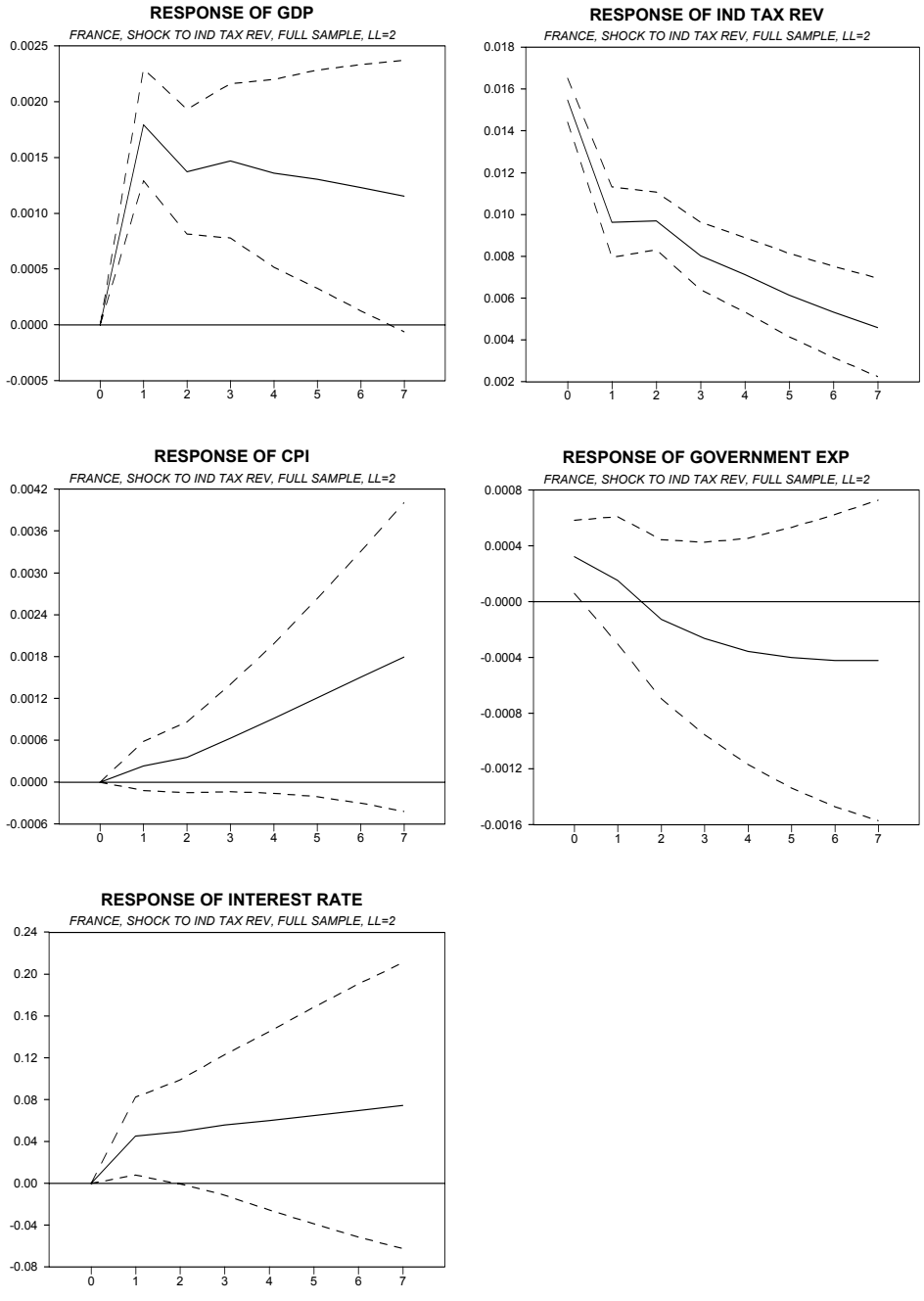


Figure 1.3.1
The effects of indirect taxes (figure continued)

Panel C: Germany

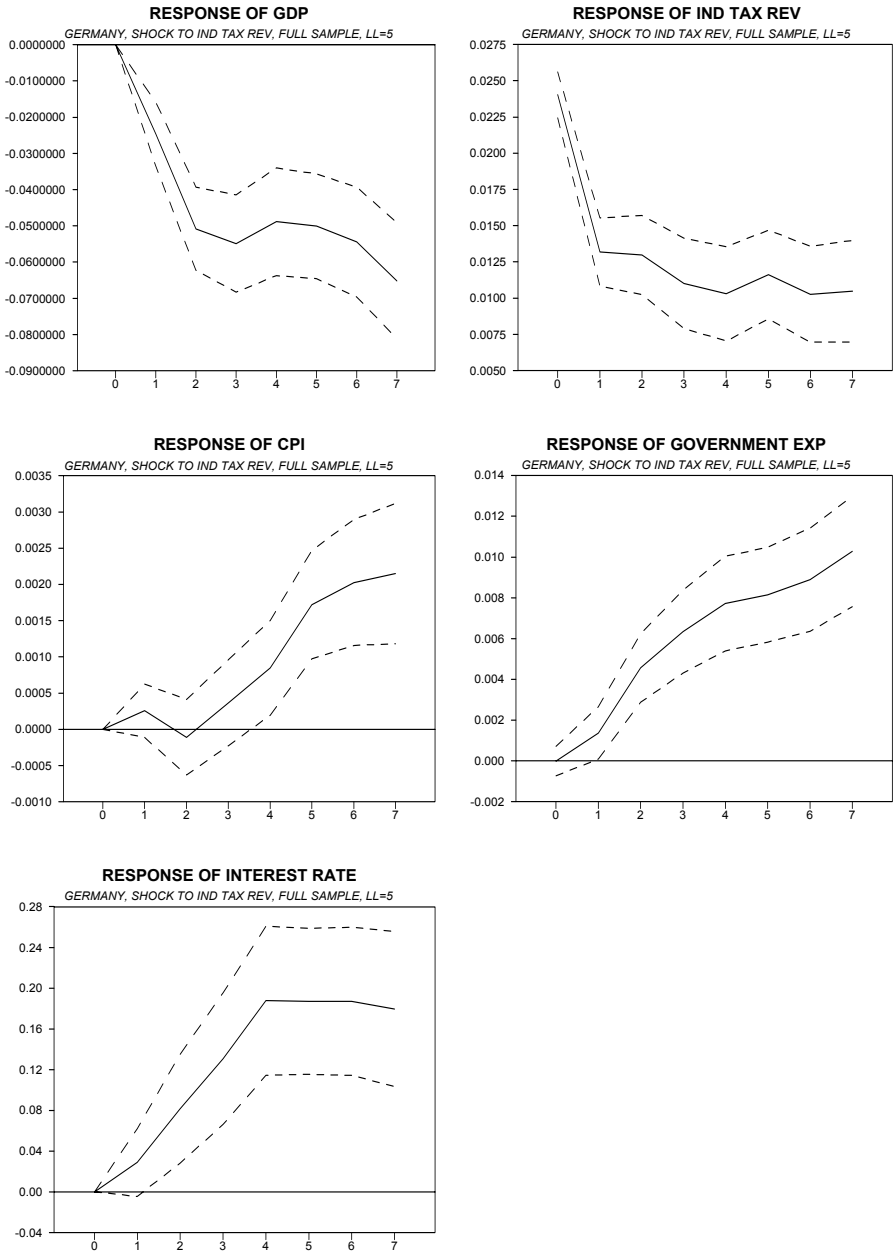


Figure 1.3.1
The effects of indirect taxes (figure continued)

Panel D: Italy

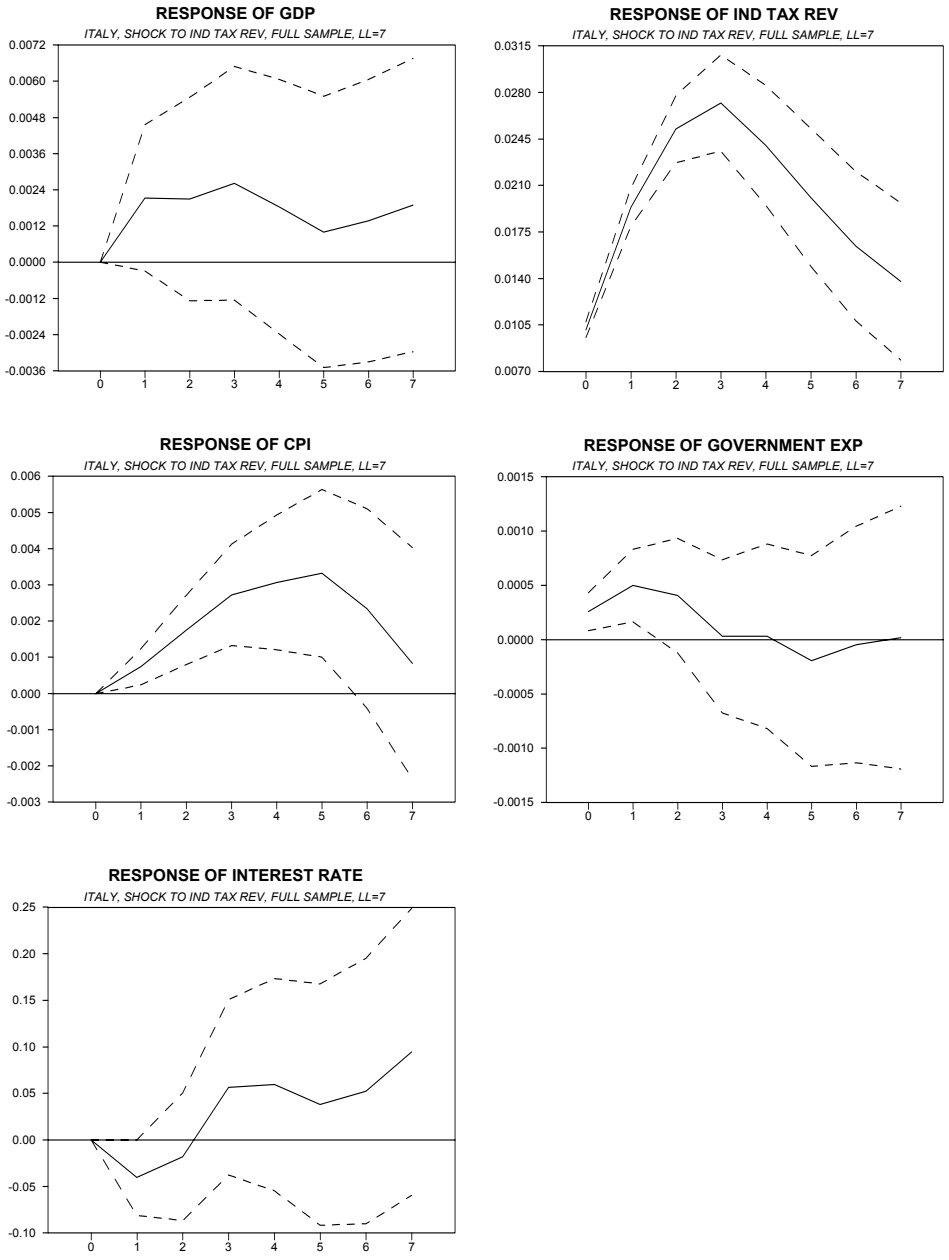


Figure 1.3.1
The effects of indirect taxes (figure continued)

Panel E: Japan

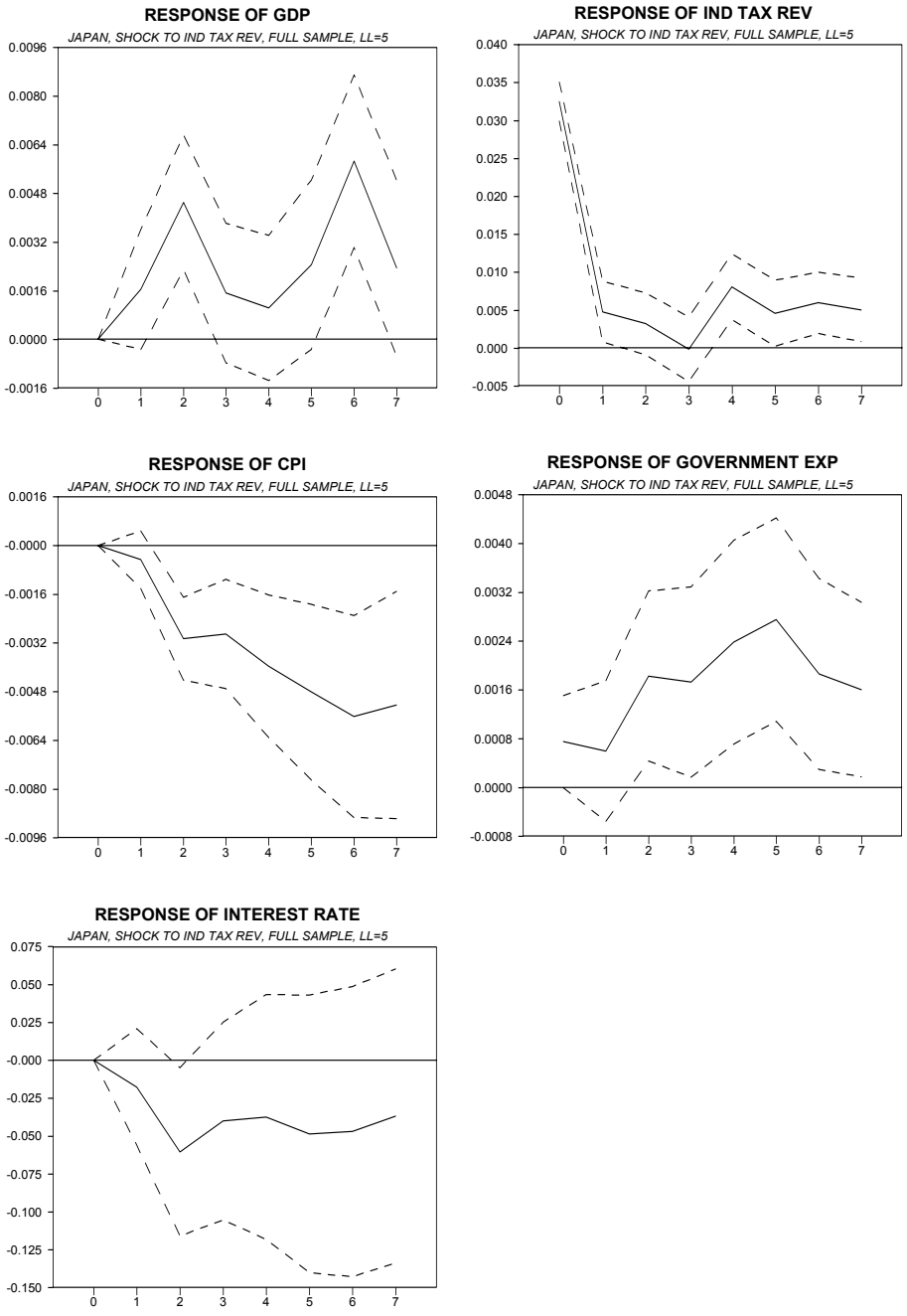


Figure 1.3.1
The effects of indirect taxes (figure continued)

Panel F: U.S.A.

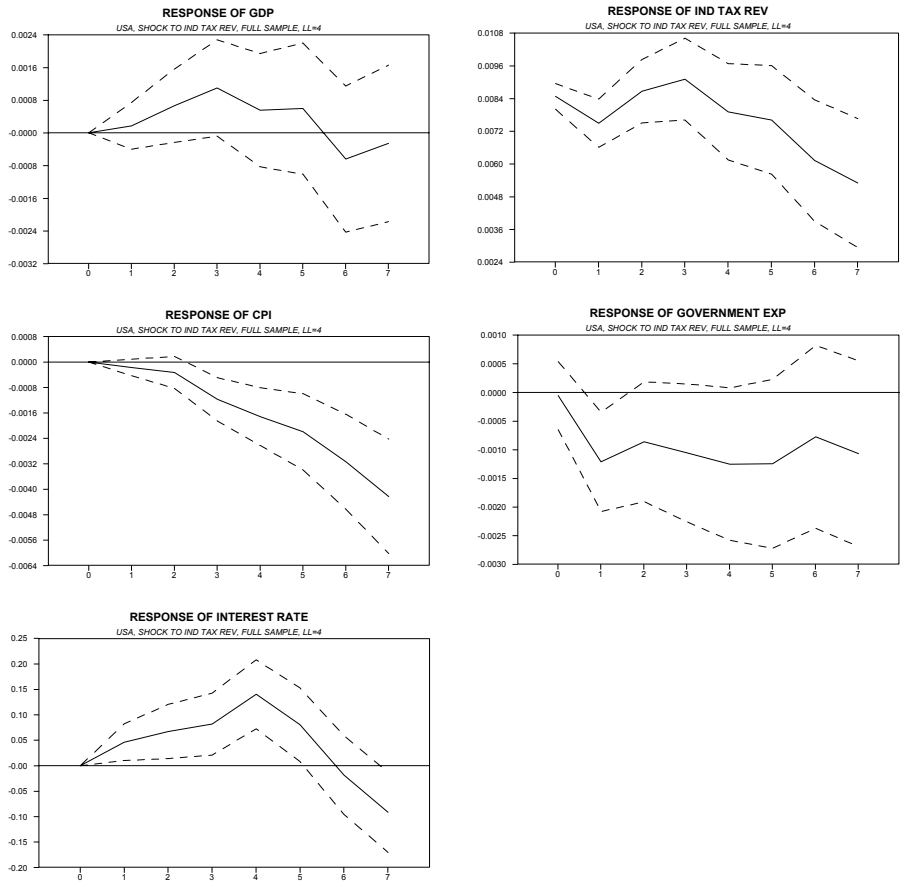


Figure 1.3.1
The effects of indirect taxes

Perotti (2002) contends that fiscal multipliers have become much smaller in the last 20 years. In order to test whether this argument can remove some of the cross-country heterogeneity in the sign of indirect tax multipliers, following Perotti (2002), we divided our sample period into two sub-periods and re-estimated the VARs with indirect tax revenues. As space permits, the results for two countries (France and U.S.A) are presented in Figure 1.3.2. We have chosen France because of the unusual positive indirect tax multipliers found for this country in the previous estimations, and

we have chosen the U.S. to allow comparison with the previous studies that use U.S. data. In the first sub-period, we observe negative indirect tax multipliers for both countries. In the second sub-period, however, there is evidence for positive indirect tax multipliers for both countries. These results are consistent with Perotti (2002), which suggest that tax multipliers became weaker in the last 20 years.

Panel A: France, to 1979

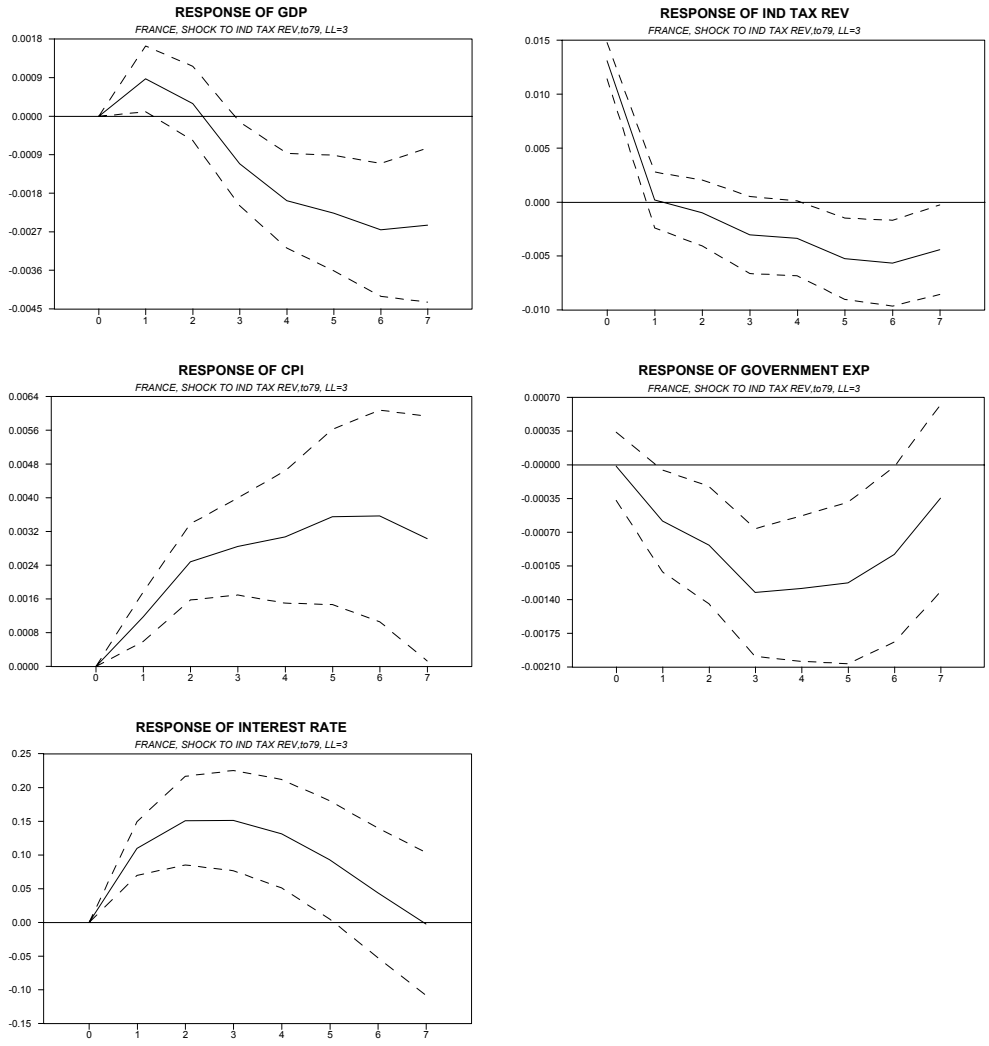


Figure 1.3.2
The effects of indirect taxes with restricted estimation periods (figure continued)

Panel B: France, 1980 on

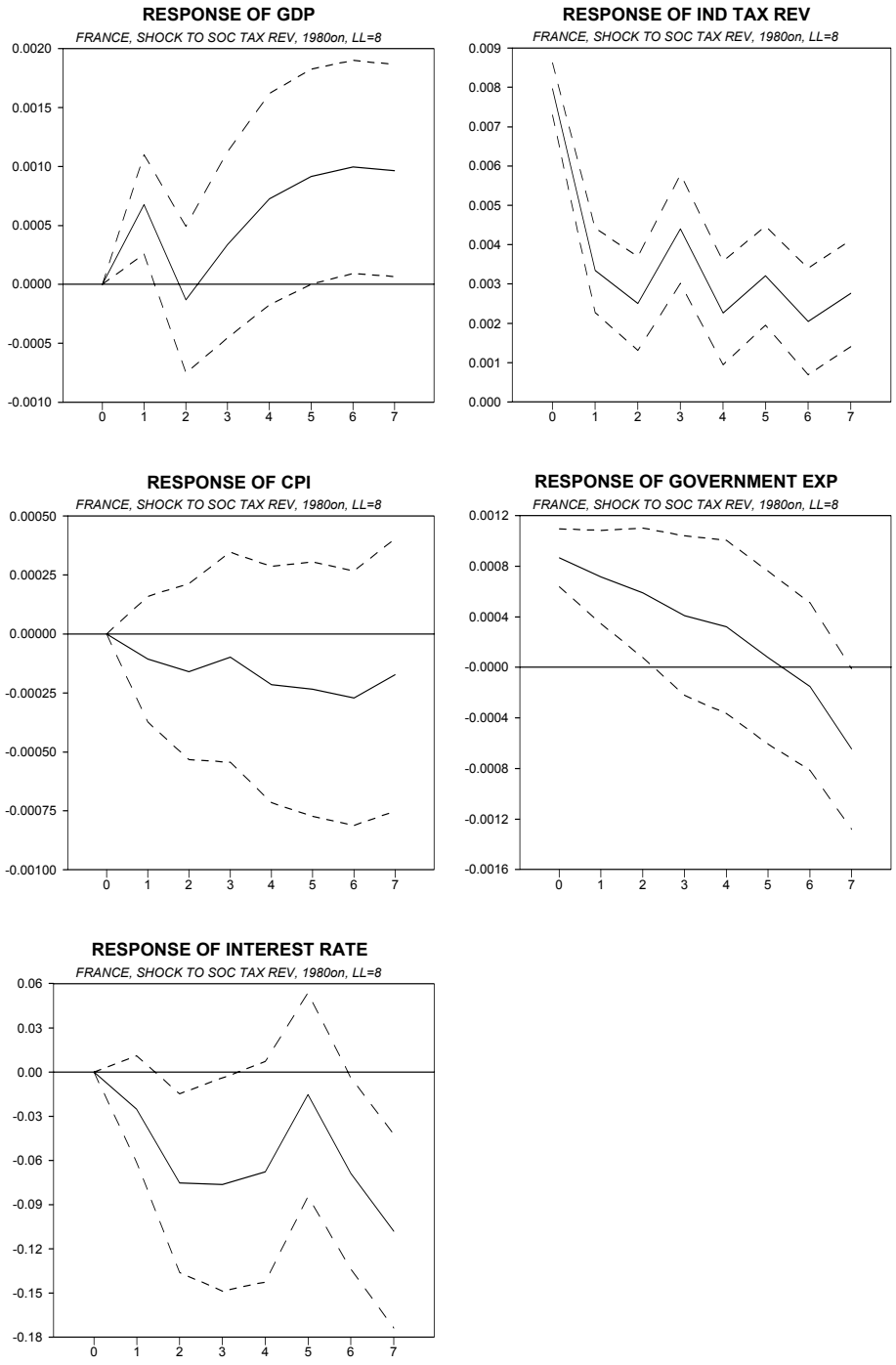


Figure 1.3.2
The effects of indirect taxes with restricted estimation periods (figure continued)

Panel C: U.S.A, to 1979

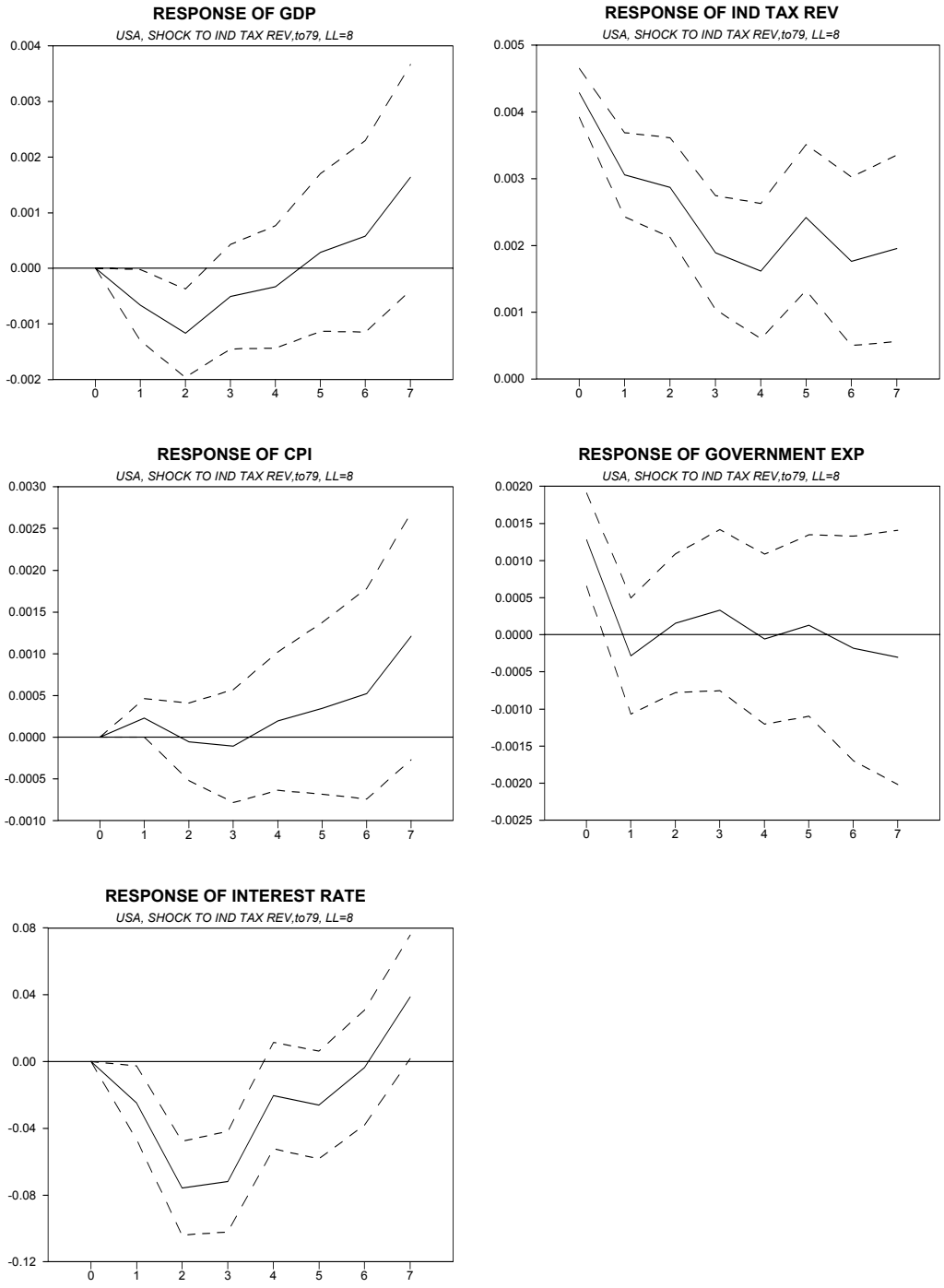


Figure 1.3.2
The effects of indirect taxes with restricted estimation periods (figure continued)

Panel D: U.S.A, 1980 on

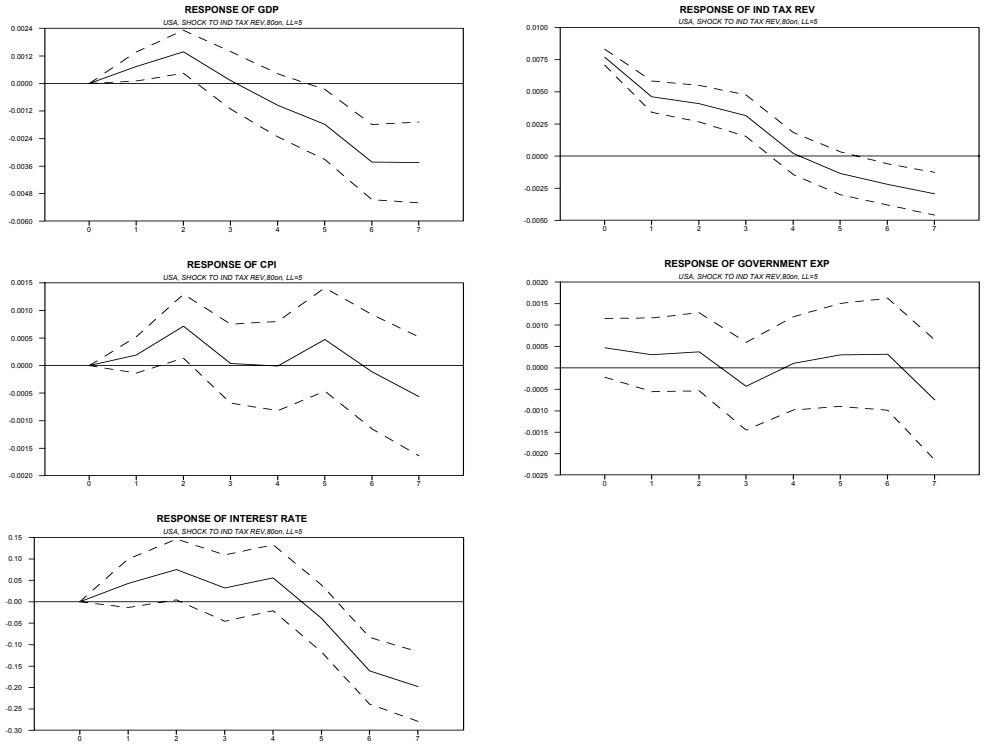


Figure 1.3.2
The effects of indirect taxes with restricted estimation periods

1.4.4. The Effects of Social Security Taxes

Figure 1.4.1 presents the impulse response functions of model variables to a positive one standard deviation shock to social security tax revenues. Social security tax innovations are accompanied by a significant decrease in output in three out of six countries in our sample (Canada, Germany and the U.S). We observe a significant increase in output in two countries (Italy and Japan), while the accompanying output response is insignificant in France. A one percent increase in social security tax revenues leads to a less than one percent change in GDP in all countries, except for Germany one more time, and once again we observe a considerable variation in the sign of social security tax multipliers.

When we look at the effects of social security tax innovations on price level and the interest rate, we observe, once again, cross-country heterogeneity. Social security tax innovations are accompanied by a significant decrease in the price level (and the interest rate) in Canada and Japan, and by a significant increase in the price level (and the interest rate) in France and the U.S. The accompanying price level response is insignificant in Germany and Italy.

Impulse response functions of output, price level, long-term government bond yield, the tax revenues itself and government expenditures to a one standard deviation shock to indirect taxes are represented, when the model is estimated in levels. The Wold Causal ordering is as follows: Y (real GDP), P (Consumer price Index), R (long-term government bond yield), T and G (Government expenditures). Panels A through F present separate graphs for Canada, France, Germany, Italy, Japan and U.S.A. respectively.

Panel A: Canada

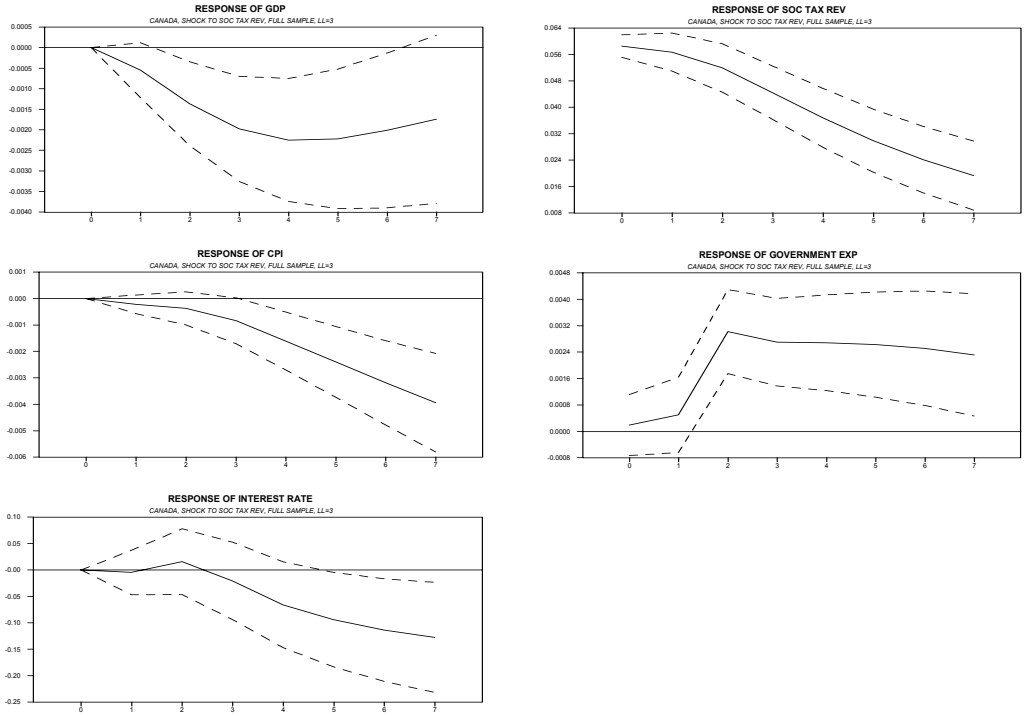


Figure 1.4.1
The effects of social security taxes

Panel B: France

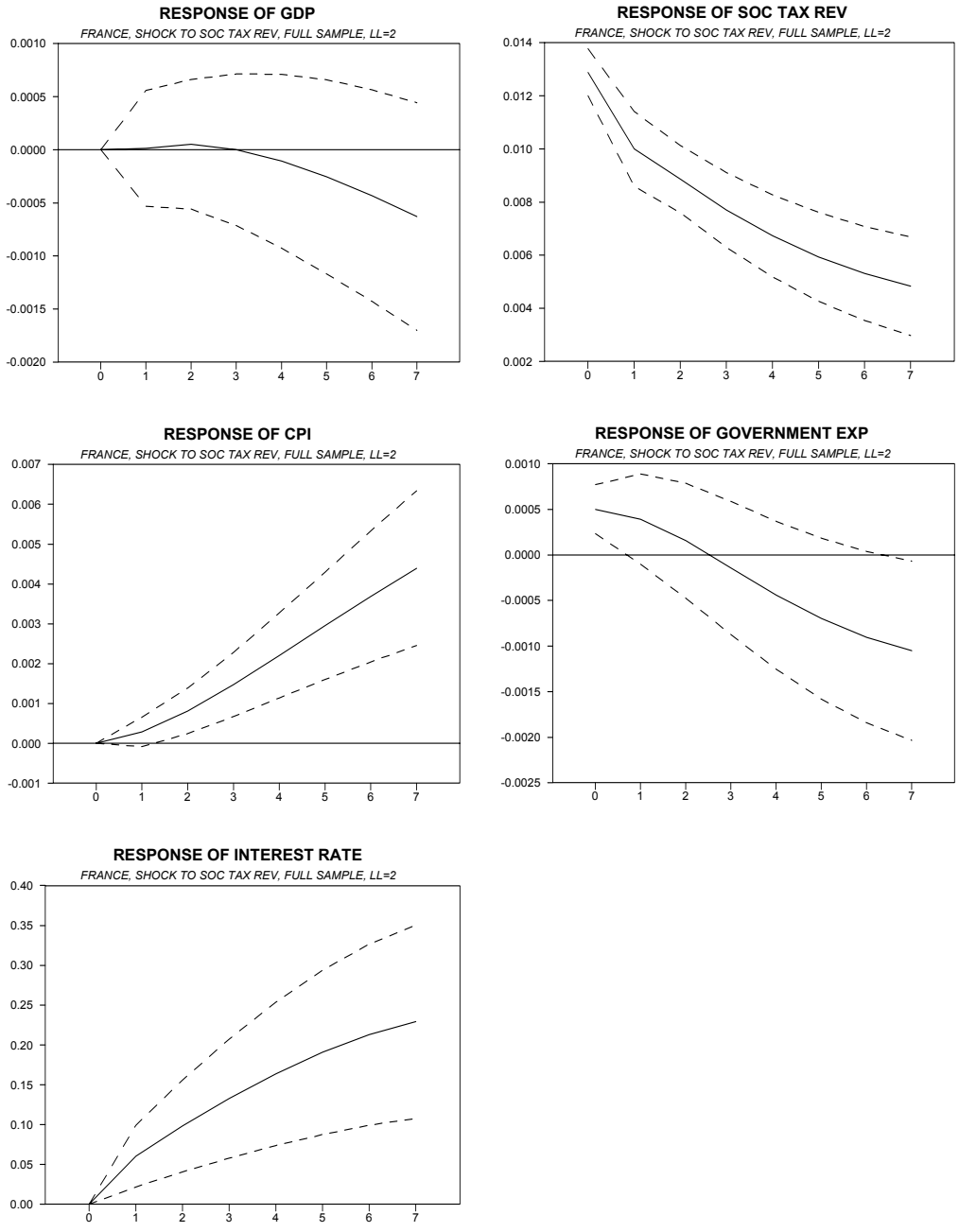


Figure 1.4.1
The effects of social security taxes (figure continued)

Panel C: Germany

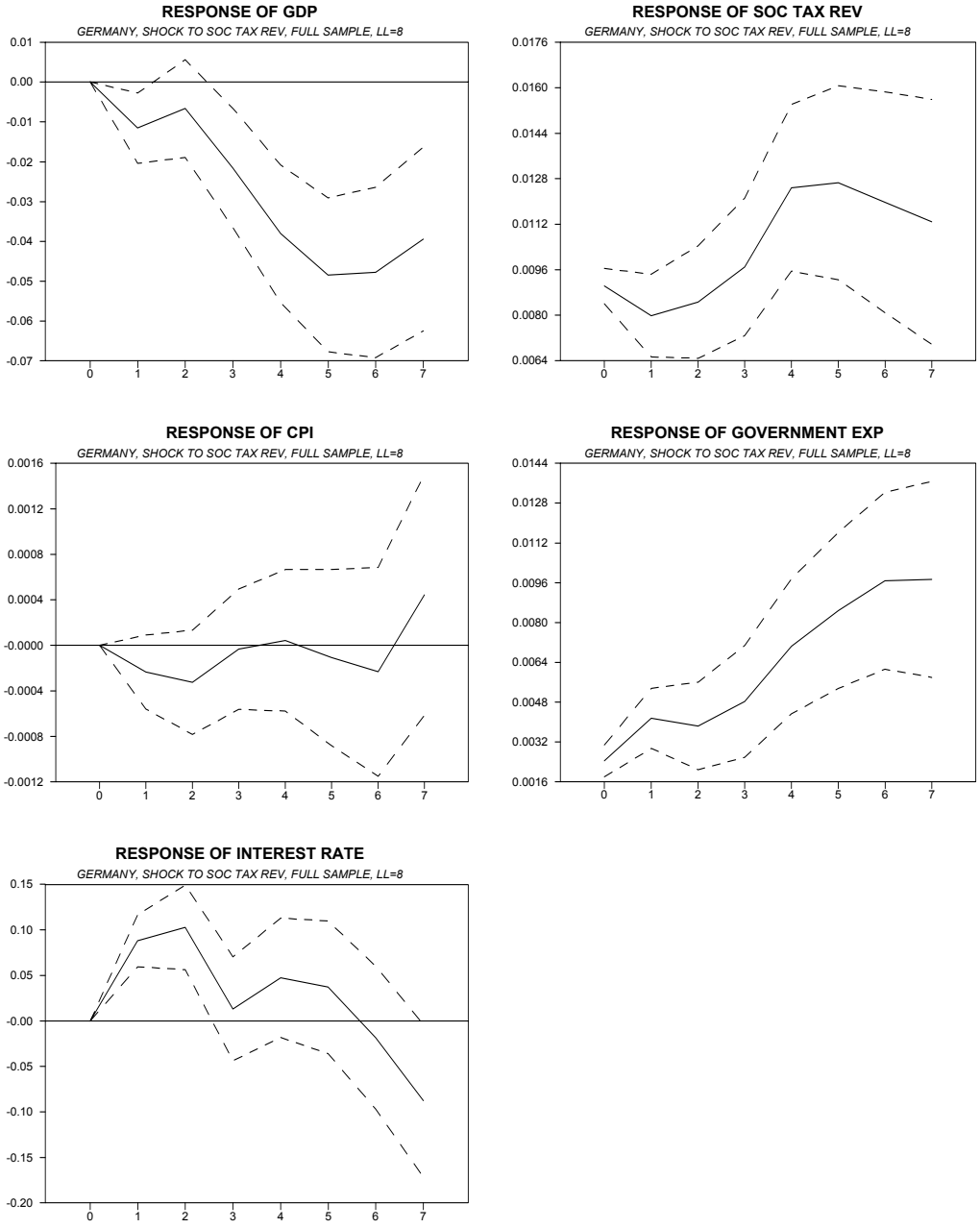


Figure 1.4.1
The effects of social security taxes (figure continued)

Panel D: Italy

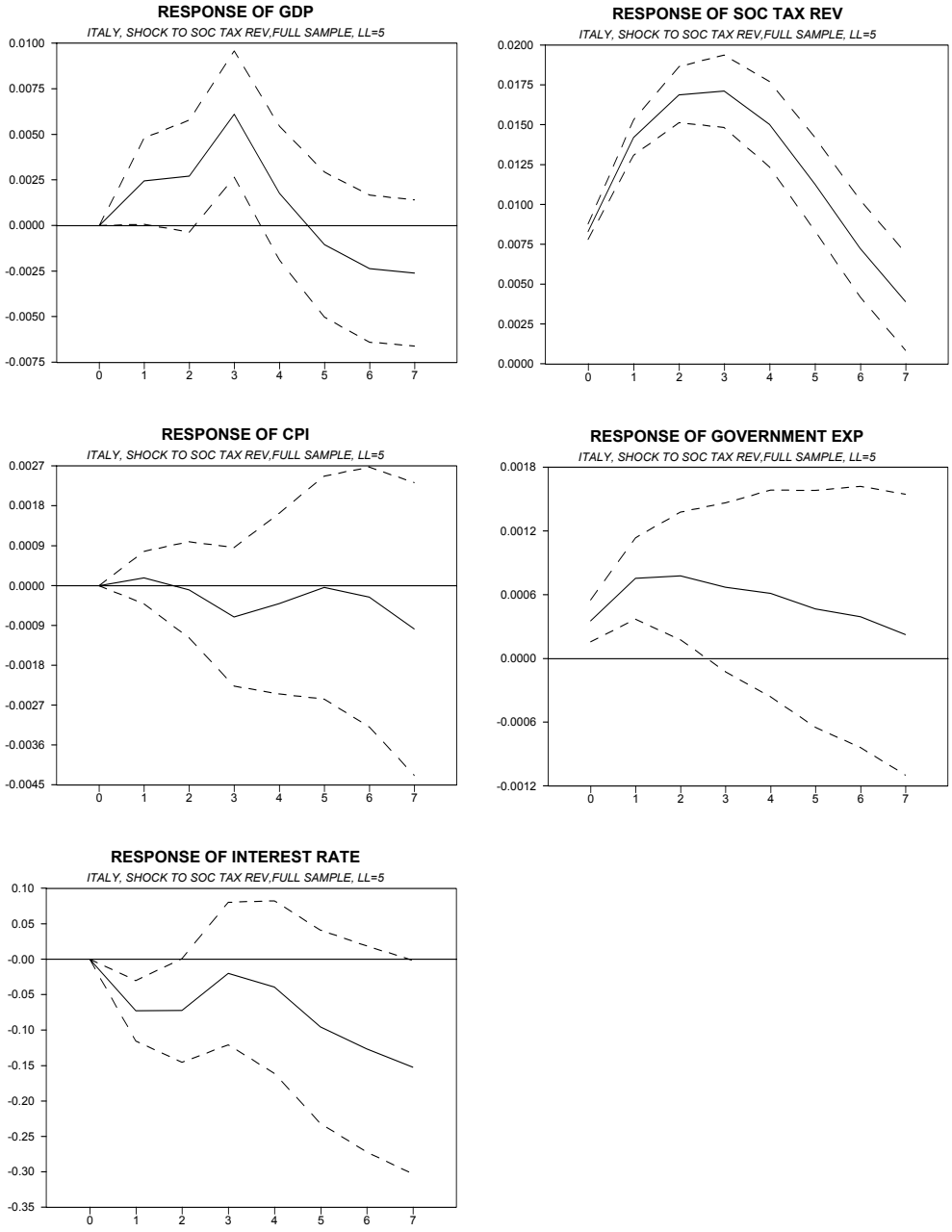


Figure 1.4.1
The effects of social security taxes (figure continued)

Panel E: Japan

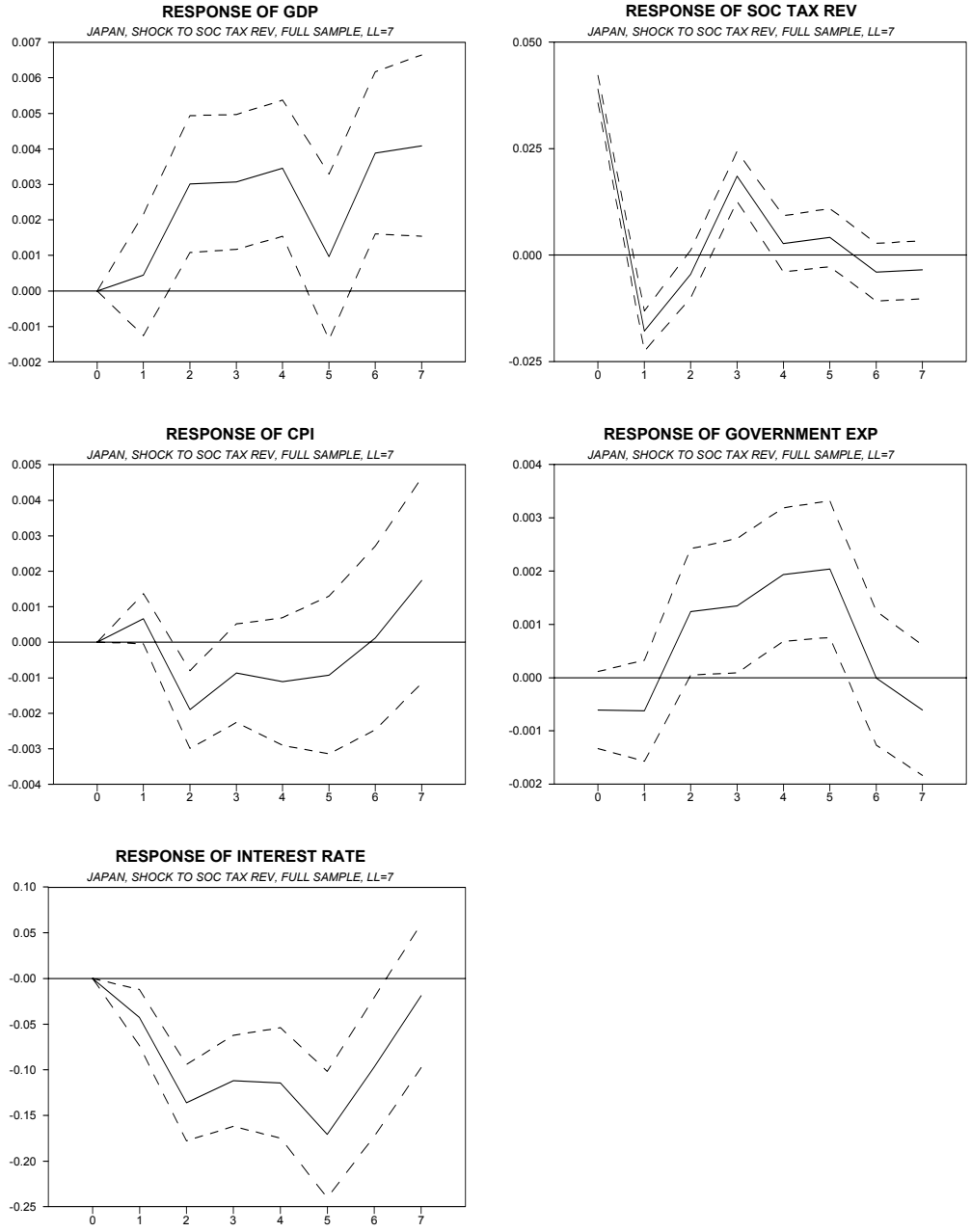


Figure 1.4.1
The effects of social security taxes (figure continued)

Panel F: U.S.A

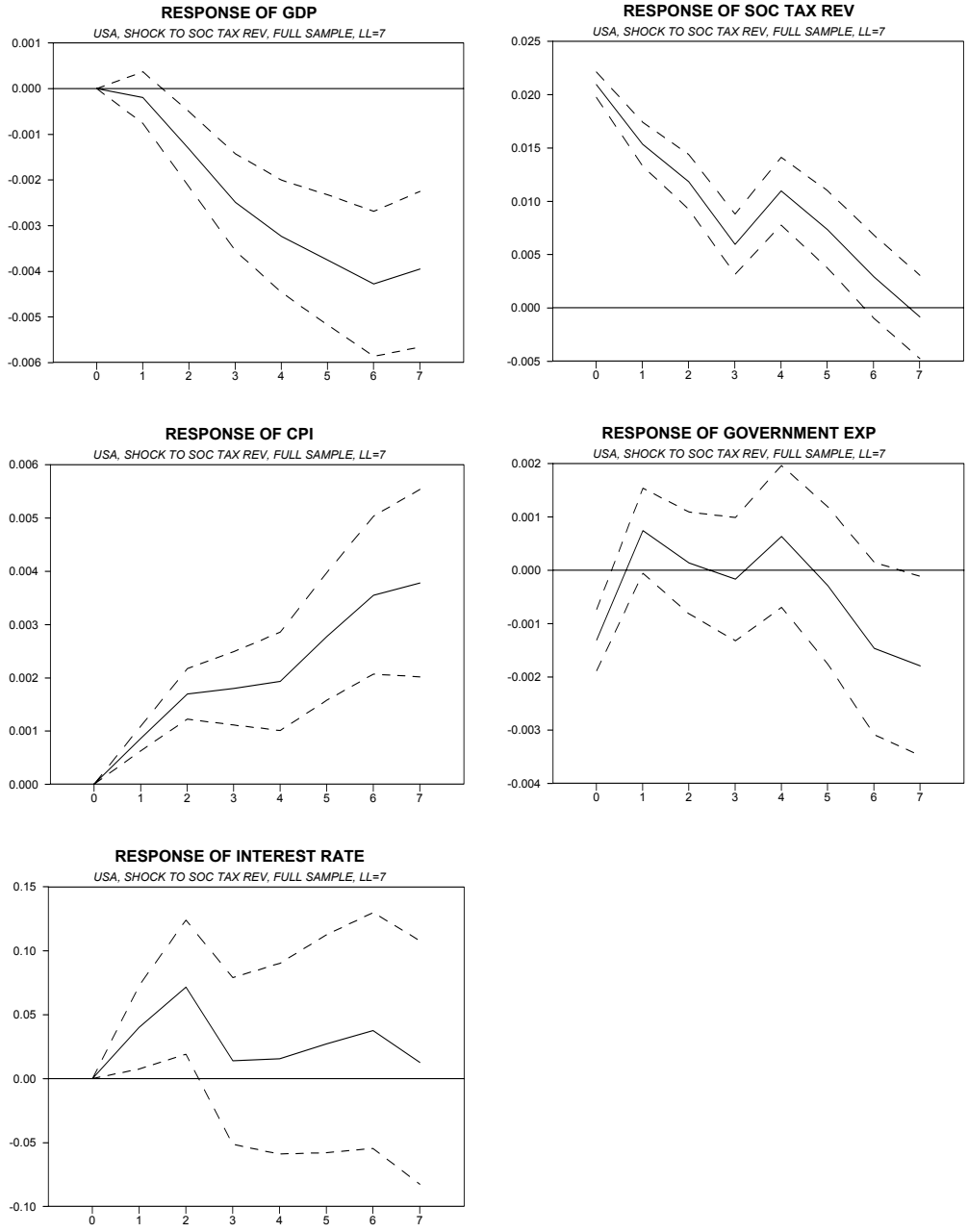


Figure 1.4.1
The effects of social security taxes

Once again, we re-estimated our VAR's for two countries, however, this time we replaced France with Italy, as Italian impulse response functions are more difficult to explain. The results of the estimations are presented in Figure 1.4.2

Although the impulse response functions are similar for the two sub-periods in Italy, we observe negative social security tax multipliers after the fifth quarter. This late effect on output is not present after 1980 period. Negative social security tax multipliers are present in both sub-periods for the U.S.

Panel A: Italy, to 1979

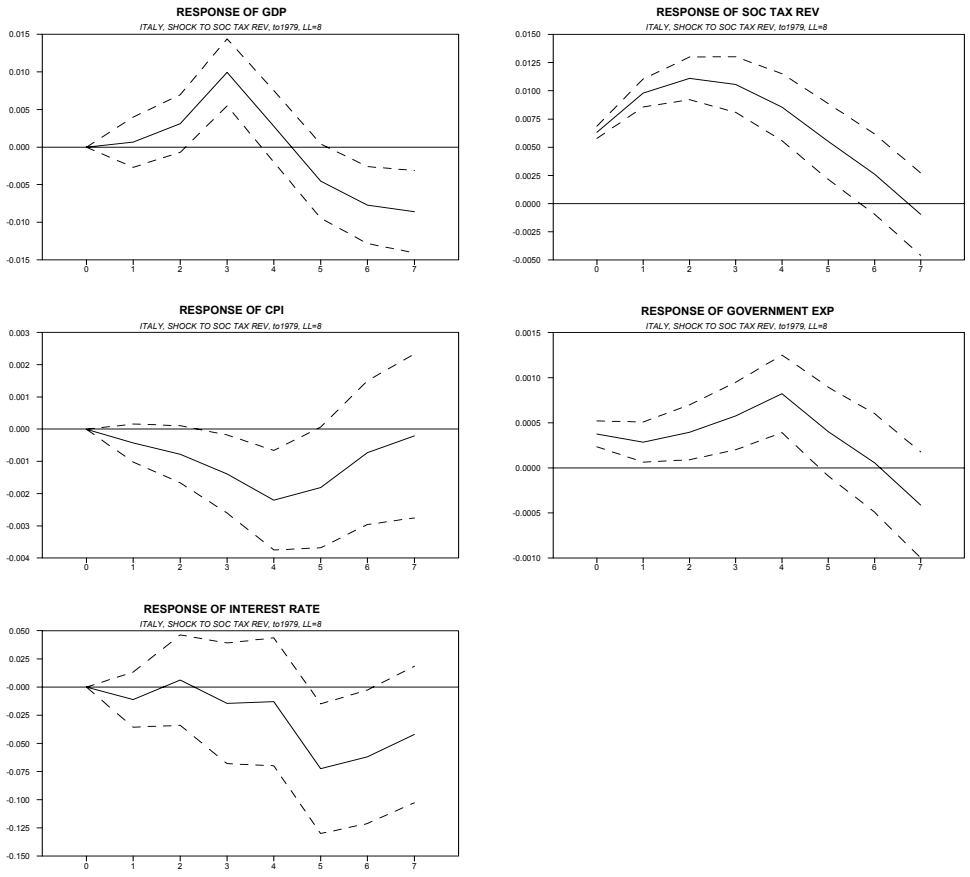


Figure 1.4.2
The effects of social security taxes: restricted estimation periods (figure continued)

Panel B: Italy, 1980 on

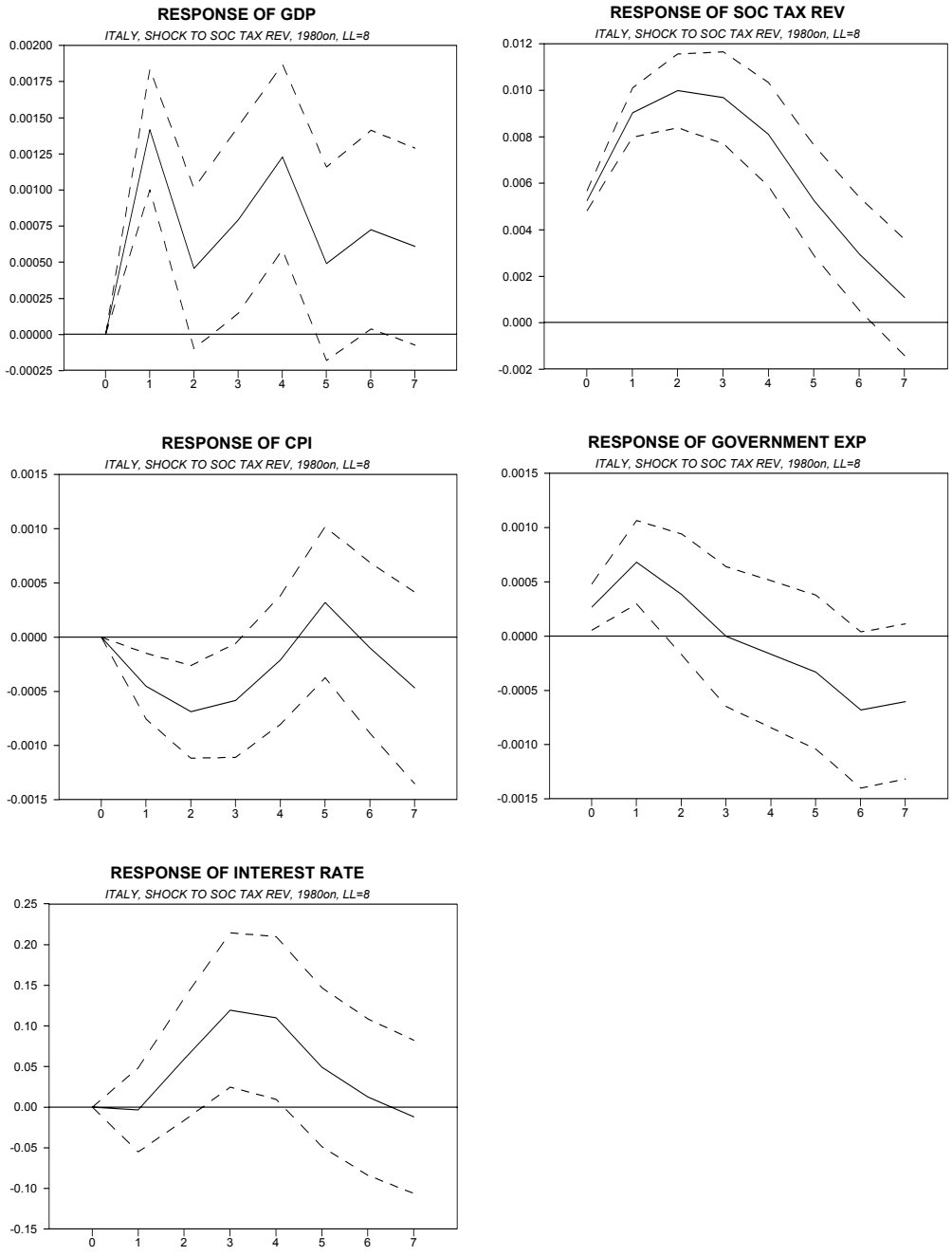


Figure 1.4.2
The effects of social security taxes: restricted estimation periods (figure continued)

Panel C: USA, to1979

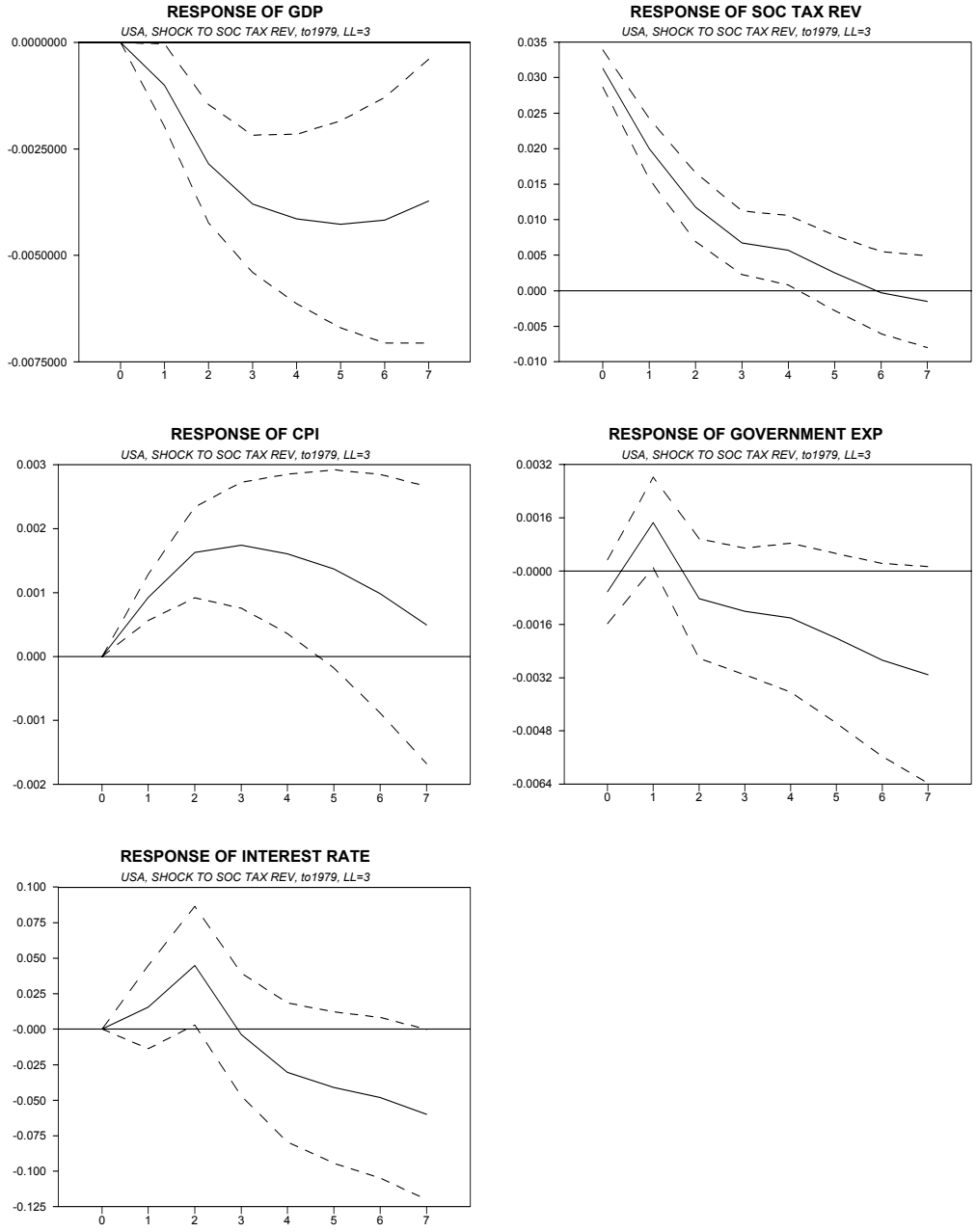


Figure 1.4.2
The effects of social security taxes: restricted estimation periods (figure continued)

Panel D: USA, 1980 on

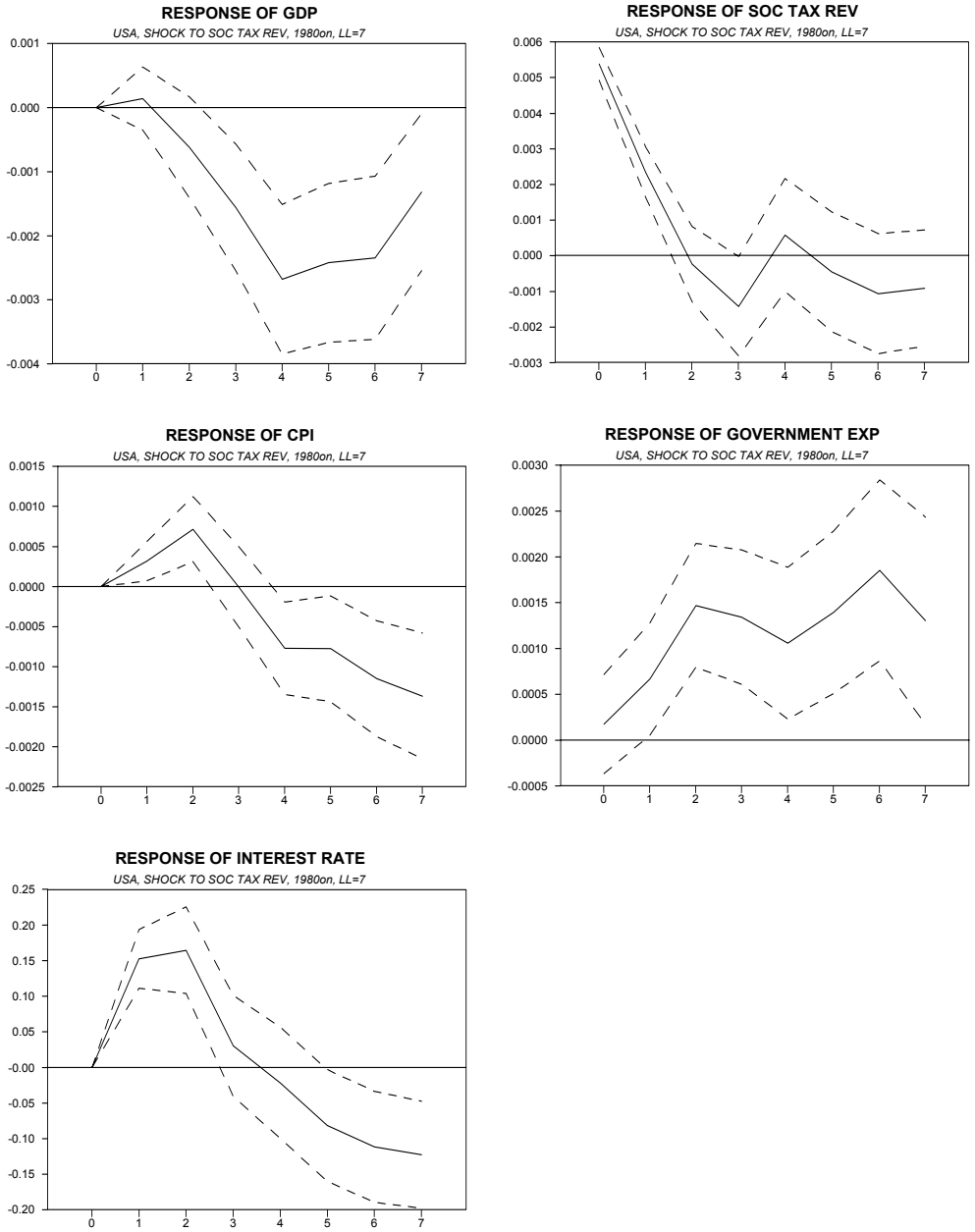


Figure 1.4.2
The effects of social security taxes: restricted estimation periods

1.5. Are the Estimated Fiscal Shocks Reasonable?

Figure 1.5 displays the estimated tax shocks from the benchmark VAR for the U.S and Germany.

First of all, when we look at the government expenditure side, the estimated shocks capture the both Ramey-Shapiro military build-ups, the first one starting 1965:1, and the second one starting 1980:1. Vertical dashed lines in the figures show these specific dates. However, as our main focus is on tax shocks, we move on to analyze the tax residuals.

The top income tax rate in the U.S has been reduced in the following years: 1964 (from 91% to 77 %), 1965 (from 77% to 70%), 1970 (77 to 71.75%), 1981 (70% to 69.13%), 1982 (69.13% to 50%). and 1987 (50% to 38.5%). These years are represented in Panel A with vertical straight lines. Some of the policy changes are very well captured by our estimated shocks, including the 1964 and 1970 cuts. In addition, we managed to capture the tax increases of 1968 and 1975[10], and these dates are represented with vertical dashed lines. The negative spike before the 1975 increase can be due to the recession caused the oil price shock, and the following temporary tax rebate designed to stimulate the recession-hit economy.

When we look at the corporate tax shocks, our estimated shocks capture the corporate tax rate cuts of 1965 (top rate was decreased from 50% to 48%), 1970 (52.8 % to 49.2 %), 1979 (48% to 46%), 1987 (46% to 40%) and finally 1988 (40% to 34%). Once again, vertical straight lines represent these specific dates of policy change. We also capture the increases in the corporate tax rate, 1968 (48% to 52%) and 1993 (top rate was

[10] Please see Perotti (2002).

increased from 34% to 35%). These dates are represented by vertical dashed lines as we did for income tax residuals.

When we look at German estimated shocks, the estimated shocks capture the income/corporate tax reductions of 1970/1971 and 1978, income tax reduction of 1974, 1980, 1981 and 1988; corporate tax increase of 1973, corporate tax cut of 1976, raises in indirect taxes in 1972, 1974, 1978 and 1979. As for the United States, tax increases are represented by dashed lines, and tax cuts are represented by straight lines.

We were unable to find the dates of policy change for social security taxes in both countries. Indirect tax revenues include taxes on many different products; therefore the dates of policy changes were not discussed.

Panel A: USA, Income Taxes

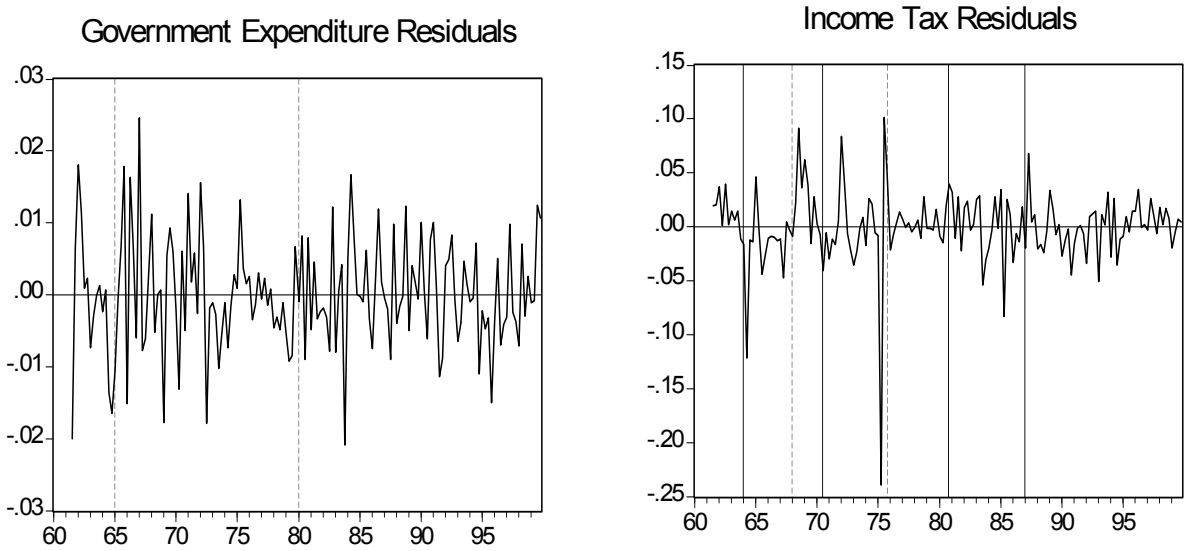
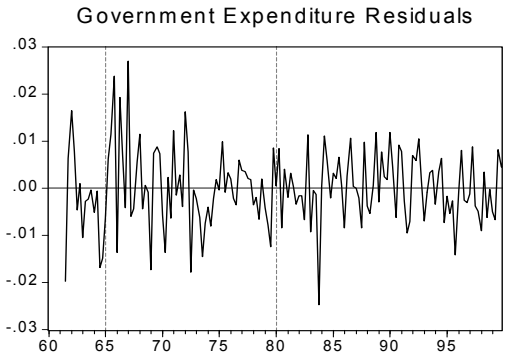
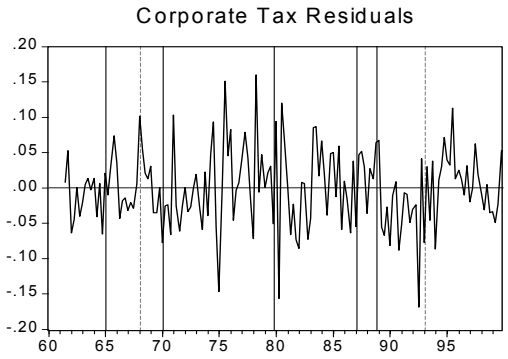


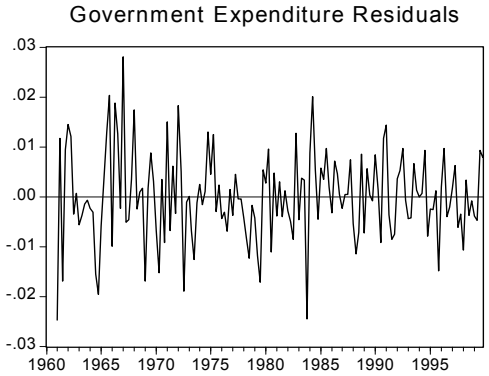
Figure 1.5
The Residual Analysis (figure continued)

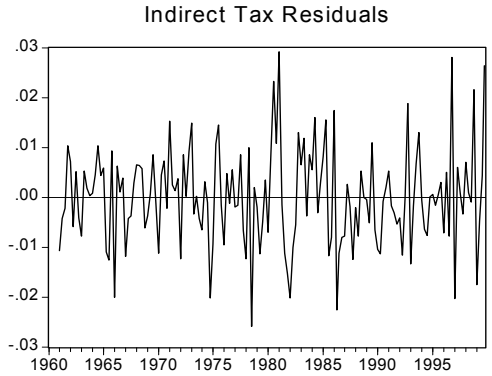
Panel B: USA, Corporate Taxes



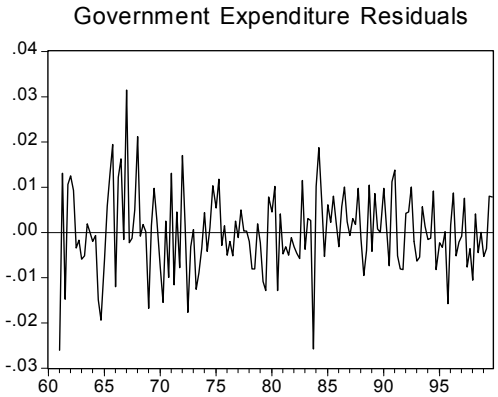


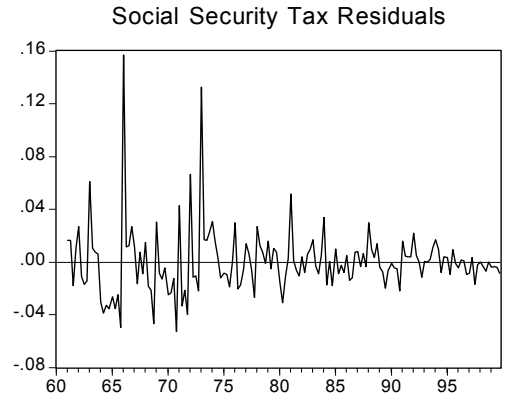
Panel C: USA, Indirect Taxes



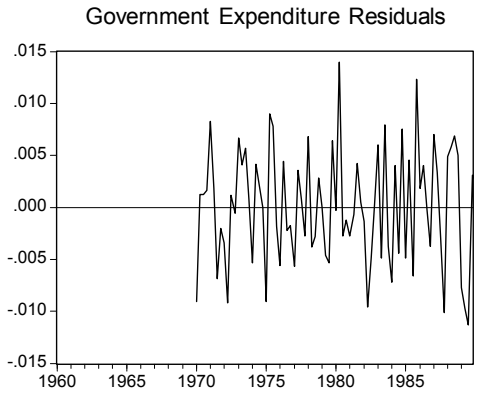


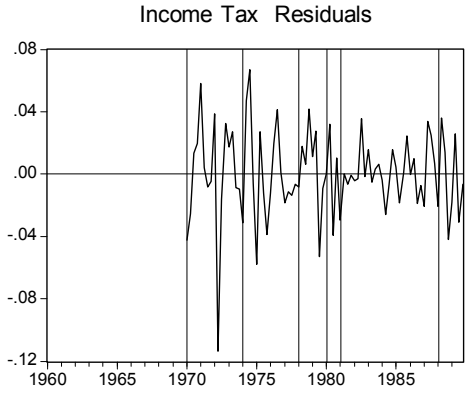
Panel D: USA, Social Security Taxes



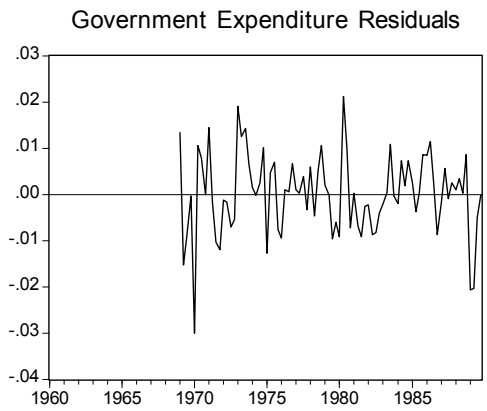


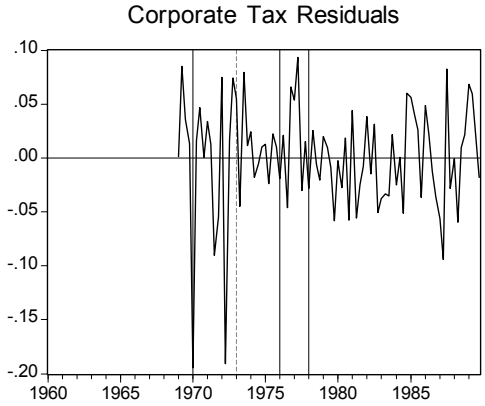
Panel E: Germany, Income Taxes



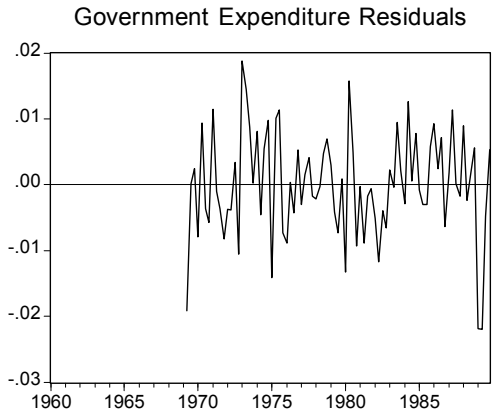


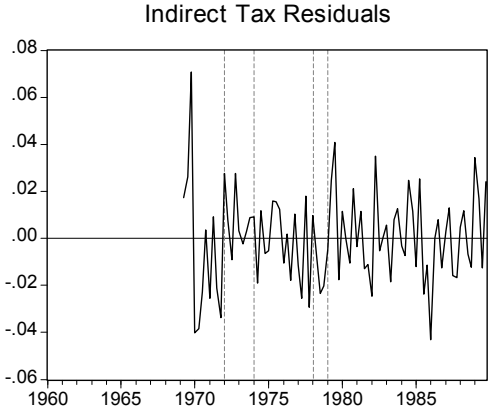
Panel F: Germany, Corporate Taxes



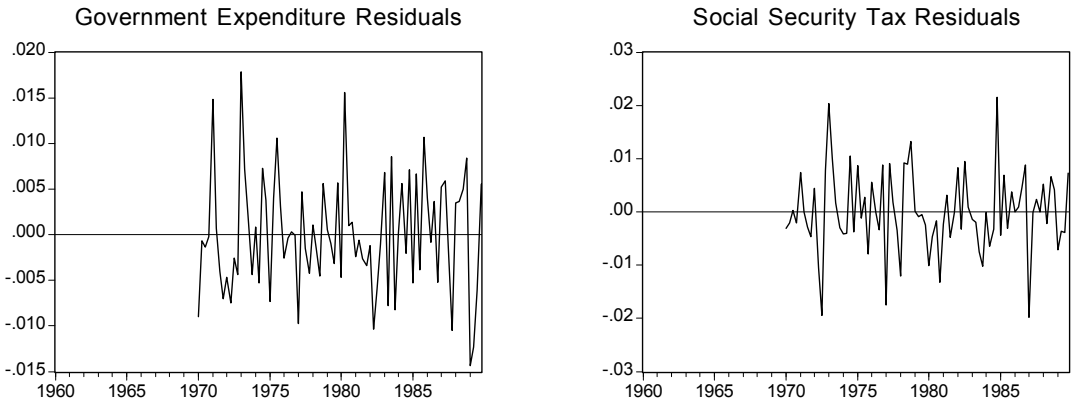


Panel G: Germany, Indirect Taxes





Panel H: Germany, Social Security Taxes



1.6. Estimation Results from an Alternative Model

The estimation results from our benchmark model suggest that there is no evidence for positive income tax multipliers, and there is no evidence for negative corporate tax multipliers. However, when output and interest rate both respond to tax shocks in the same quarter, our benchmark model that uses contemporaneous restrictions may not provide a correct estimate of the structural fiscal shocks. In addition our benchmark model does not allow tax revenues and government expenditures to simultaneously affect output. Therefore, we estimated an alternative structural model, which controls for these problems associated with our benchmark model. The model variables are in levels and the ten identifying restrictions of the alternative model can be represented in matrix form as follows:

$$\begin{bmatrix} Y \\ P \\ R \\ T \\ G \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 & b_{14} & b_{15} \\ b_{21} & 0 & 0 & 0 & 0 \\ b_{31} & b_{32} & 0 & b_{34} & b_{35} \\ b_{41} & b_{42} & 0 & 0 & 0 \\ 0 & b_{52} & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} u_Y \\ u_P \\ u_R \\ u_T \\ u_G \end{bmatrix} \tag{1.1}$$

Our alternative model implies that output is contemporaneously affected by both taxes and government expenditures. The price level, on the other hand, is contemporaneously affected only by changes in income, which implies that there is price stickiness in the short-run. Long-term interest rate is assumed to be contemporaneously affected by all other four variables. And finally tax revenues are assumed to be contemporaneously affected by both output and price level, while government expenditures are only contemporaneously affected by the price level. The estimation results for the alternative model are presented in figures from 1.6.1 to 1.6.4.

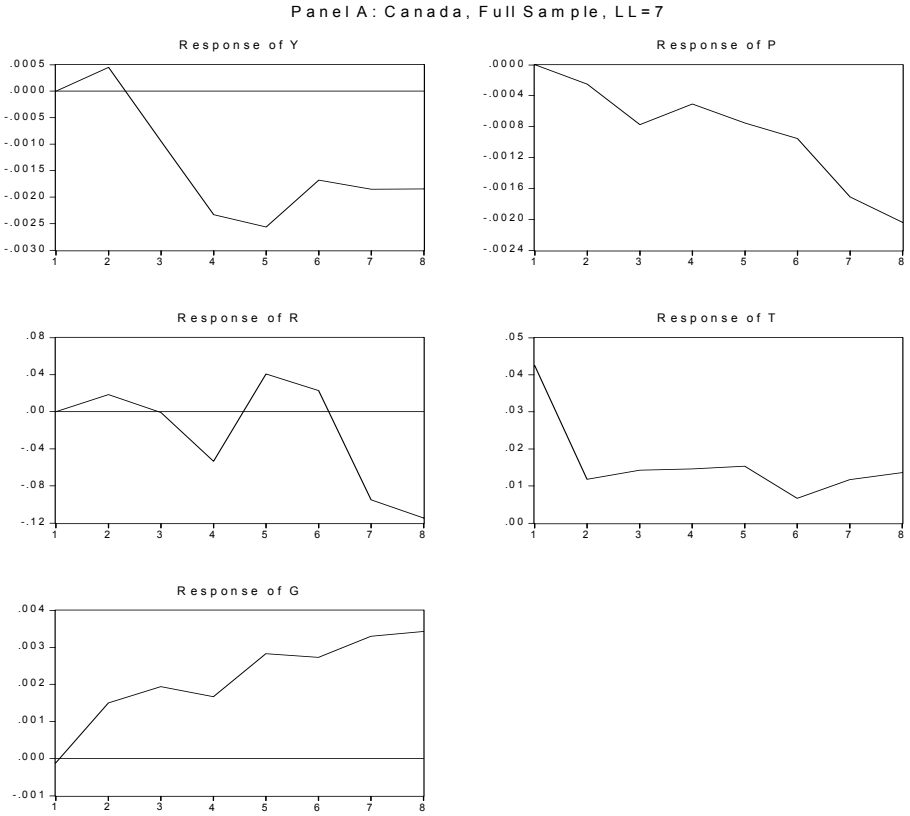


Figure 1.6.1
Shock to Income Tax Revenues (figure continued)

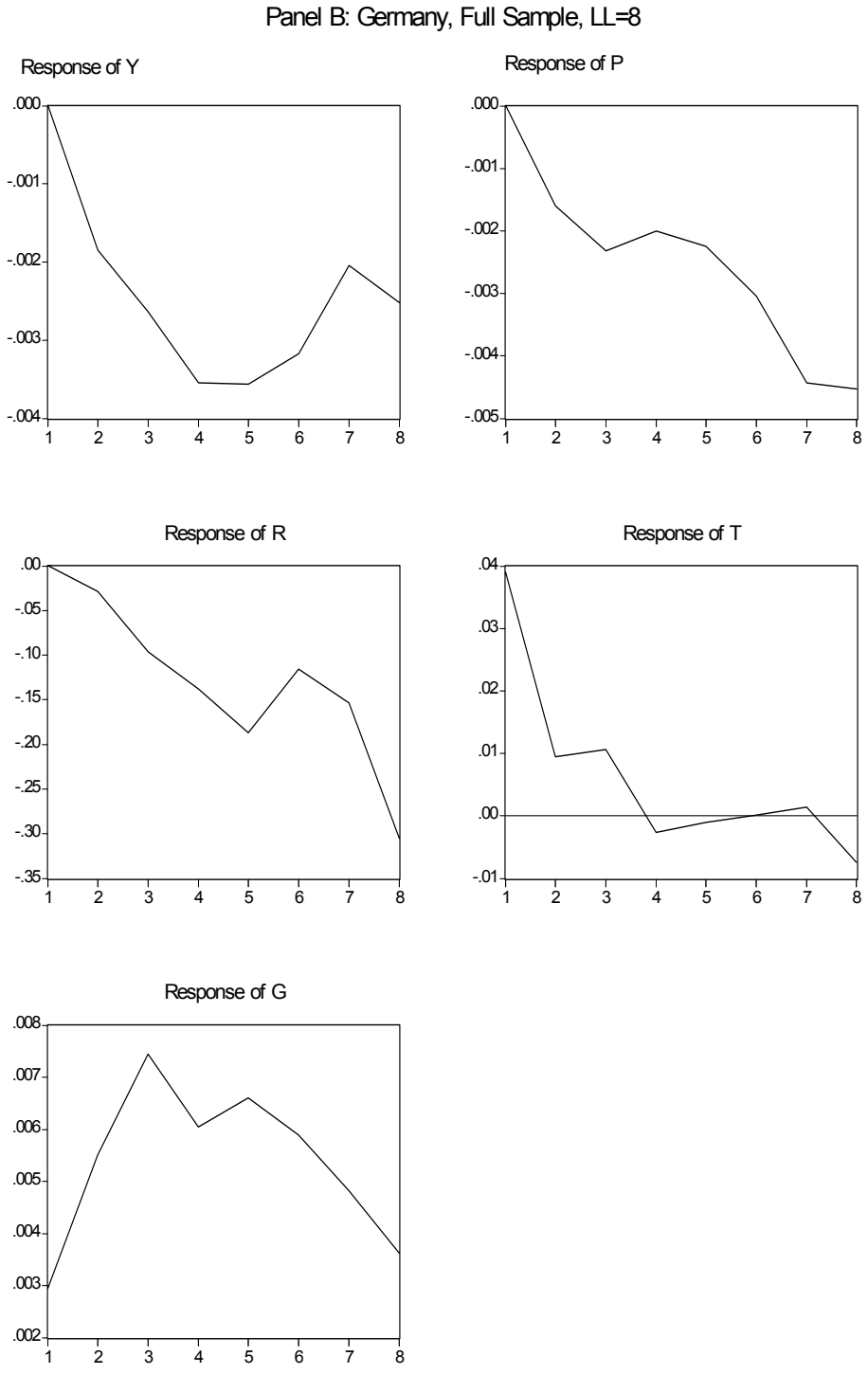


Figure 1.6.1
Shock to Income Tax Revenues (figure continued)

Panel C: Japan, Full Sample, LL=7

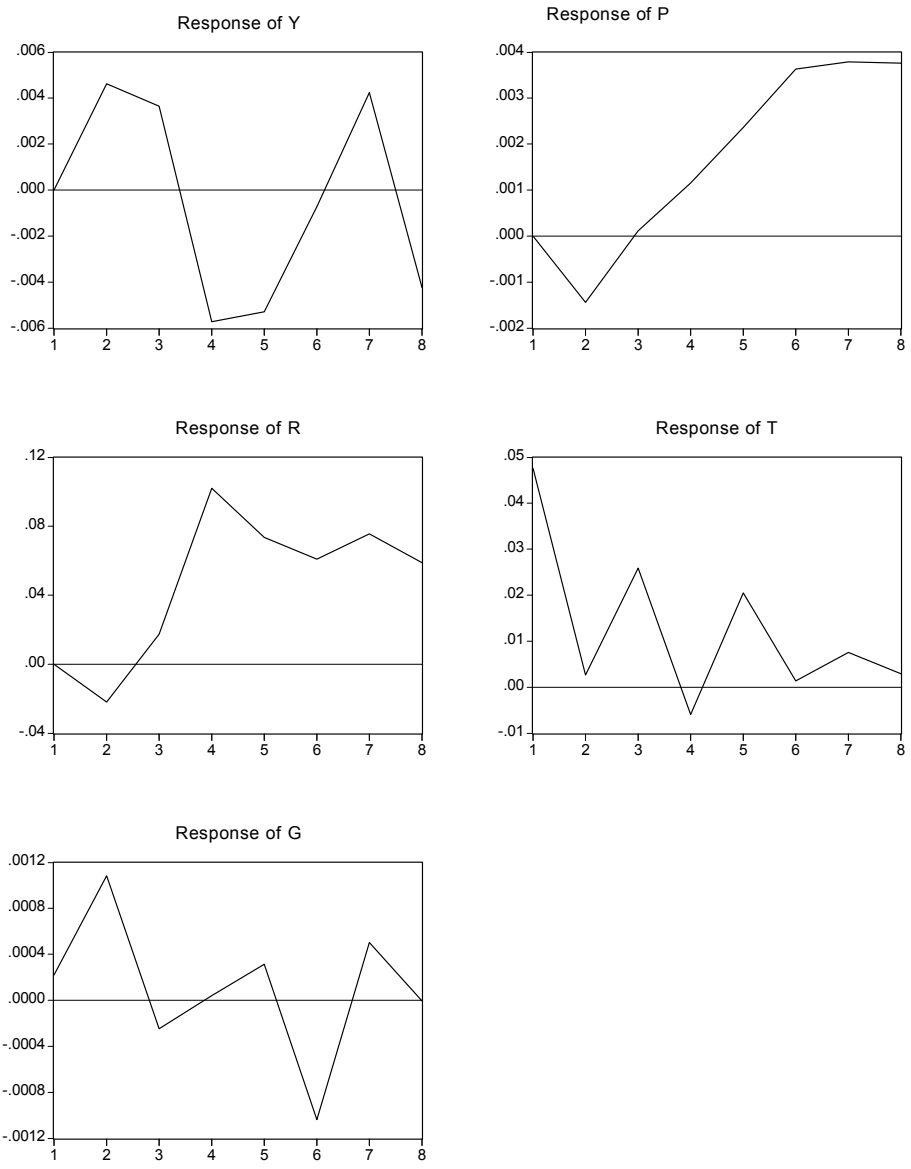


Figure 1.6.1
Shock to Income Tax Revenues (figure continued)

Panel D: UK, Full Sample, LL=7

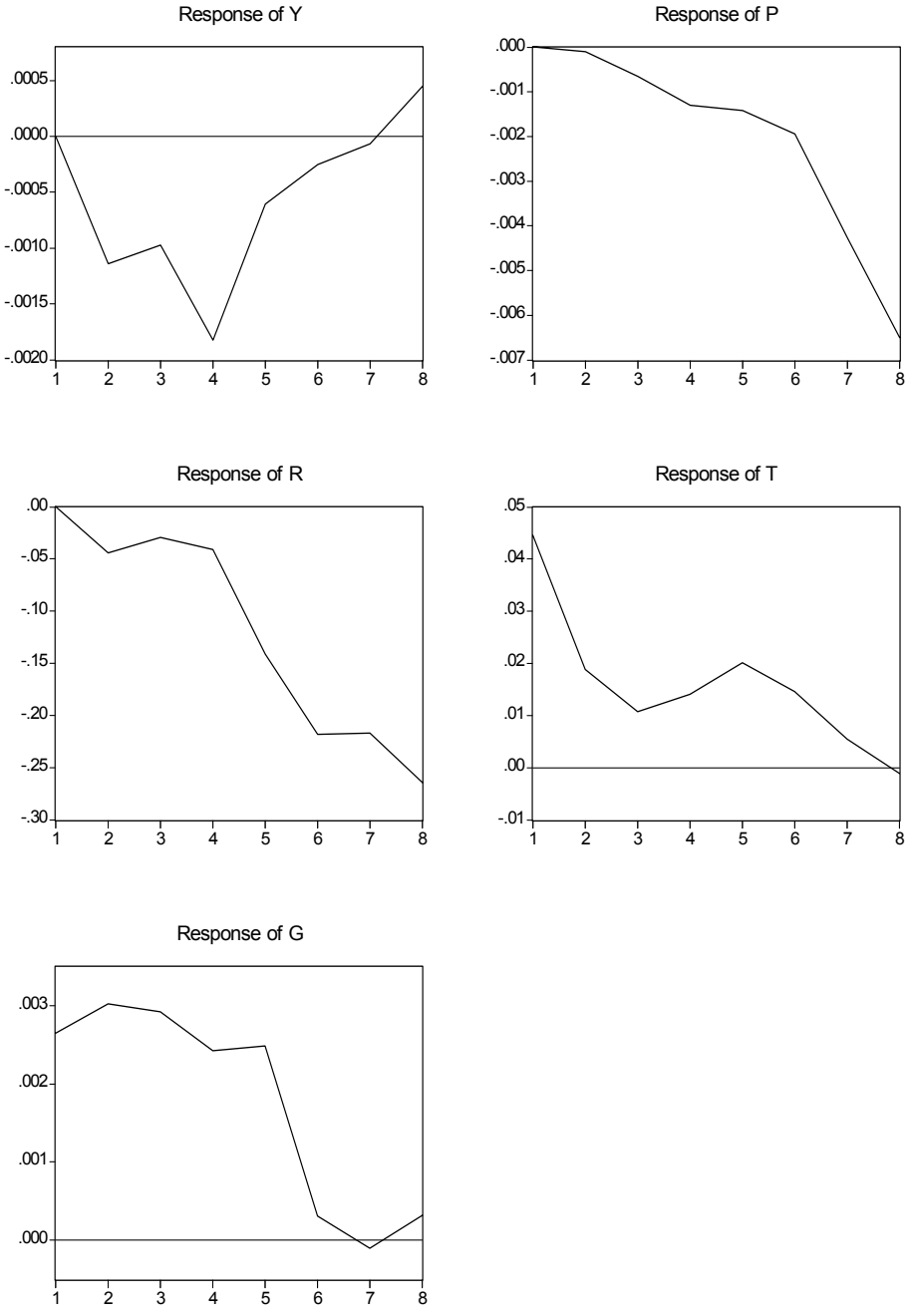


Figure 1.6.1
Shock to Income Tax Revenues (figure continued)

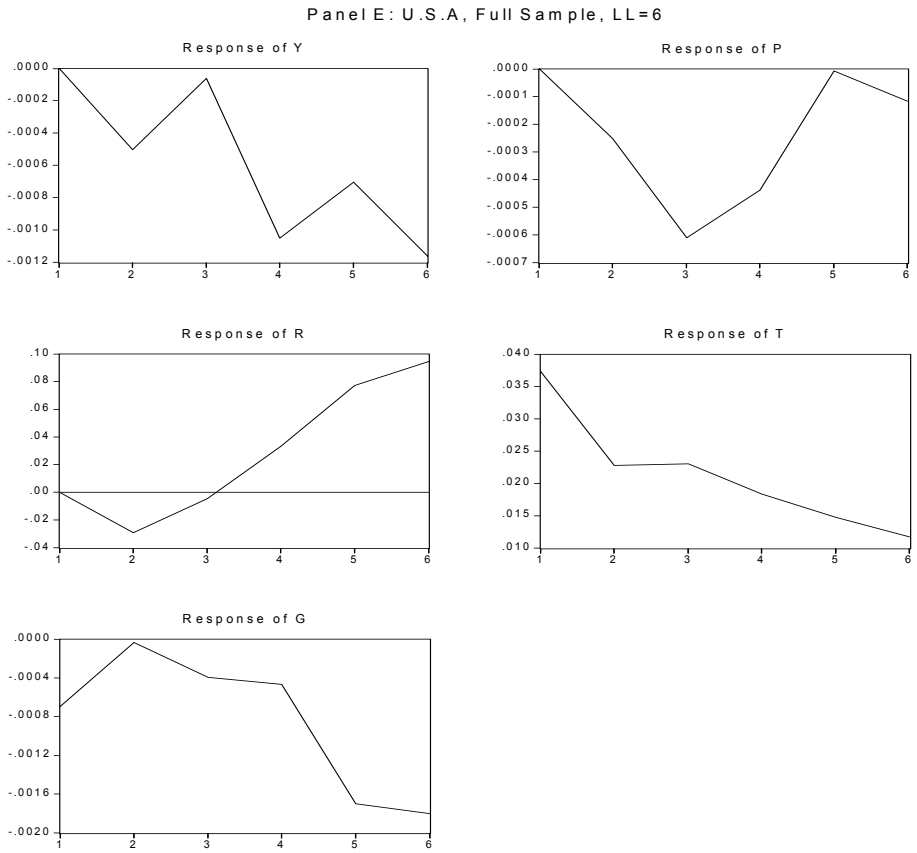


Figure 1.6.1
Shock to Income Tax Revenues

Figure 1.6.1 presents the impulse response functions of all model variables to a one-standard deviation positive shock to income tax revenues in our alternative model for countries for which the system has converged[11], without the Monte Carlo confidence bands. With the alternative model, the impulse response functions look quite similar. In all countries, a one percent increase in income tax revenues is accompanied by an up to 0.05 percent decrease in output, except for Japan, for which we observe an unusual IRF. In Canada, Germany and the U.K, the peak effect occurs between fourth and sixth quarters, whereas in the U.S., the peak effects seem to come after 8th quarter. These

[11] The Hessian matrix was near singular for France and Italy, therefore the system has not converged for these two countries.

results are consistent with the results from our benchmark model that uses contemporaneous restrictions.

When we look at the effects of income tax innovations on the price level, we see that in four countries, income tax innovations are followed by a decrease in the price level for at least six quarters. This is also consistent with the results from our benchmark model.

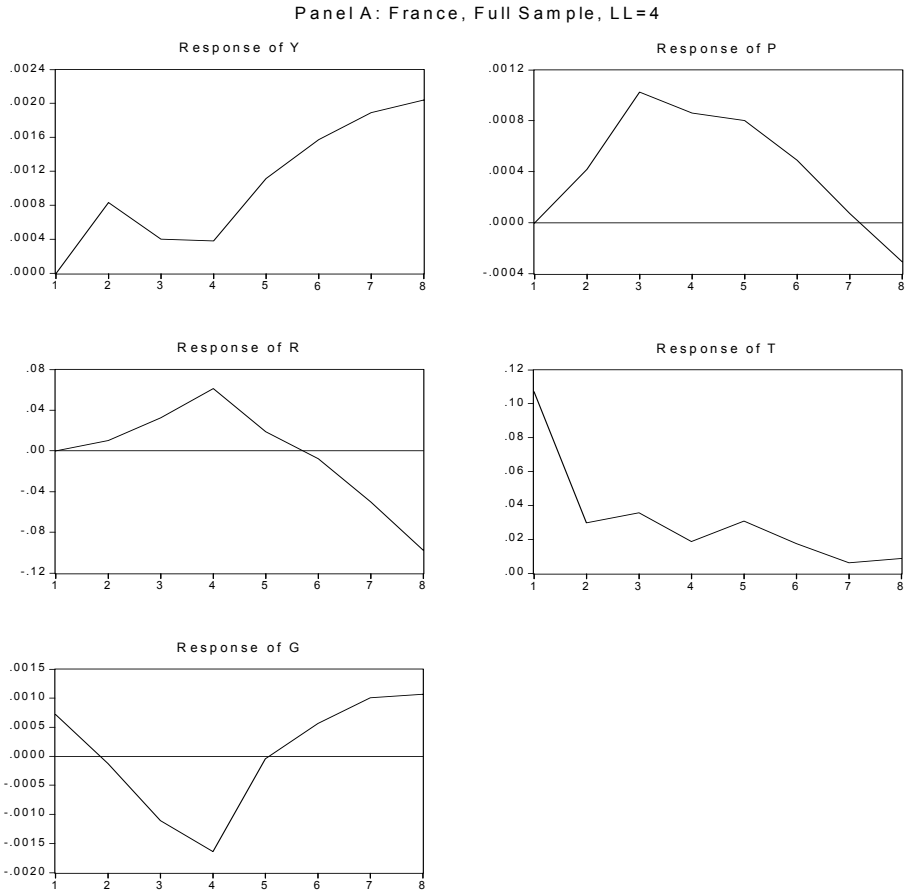


Figure 1.6.2
Shock to Corporate Tax Revenues (figure continued)

Panel B: Germany, Full Sample, LL=4

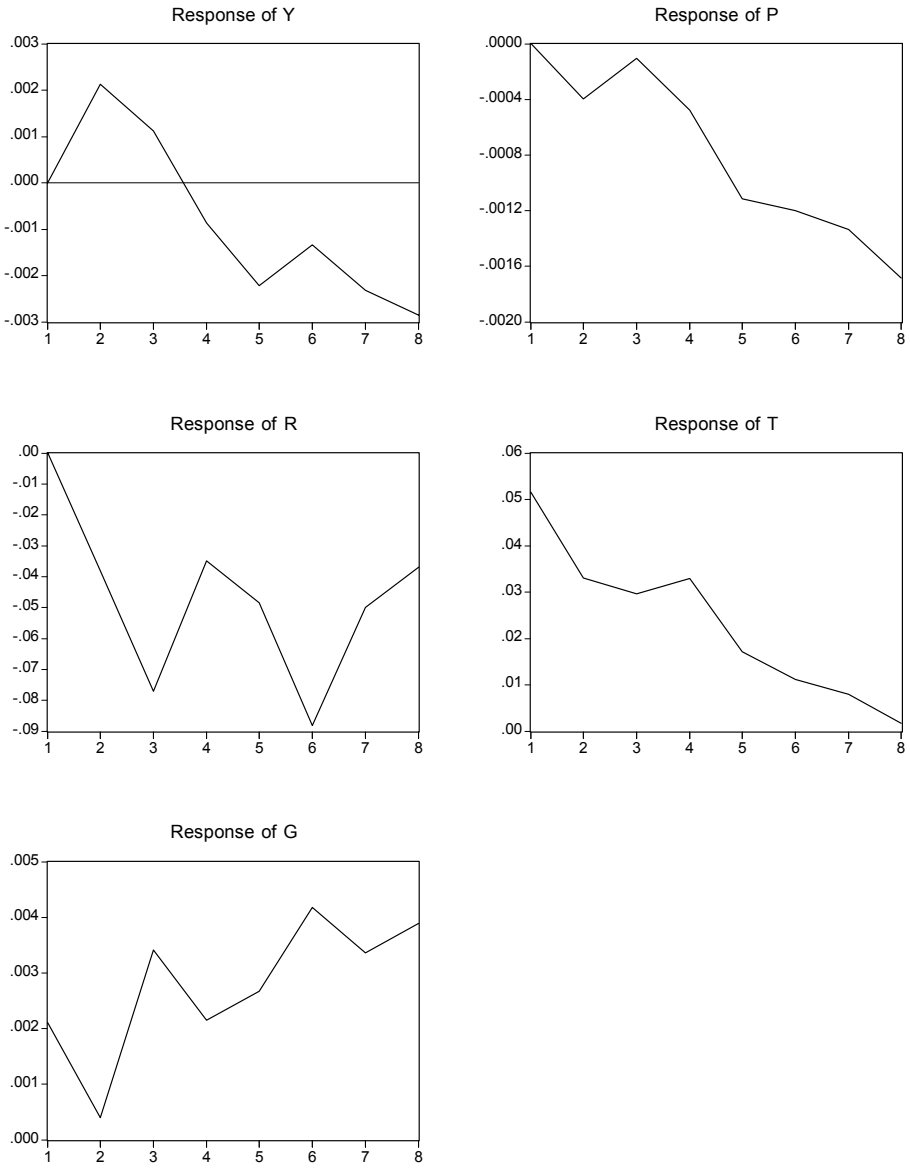


Figure 1.6.2
Shock to Corporate Tax Revenues (figure continued)

Panel C: Italy, Full Sample, LL=7

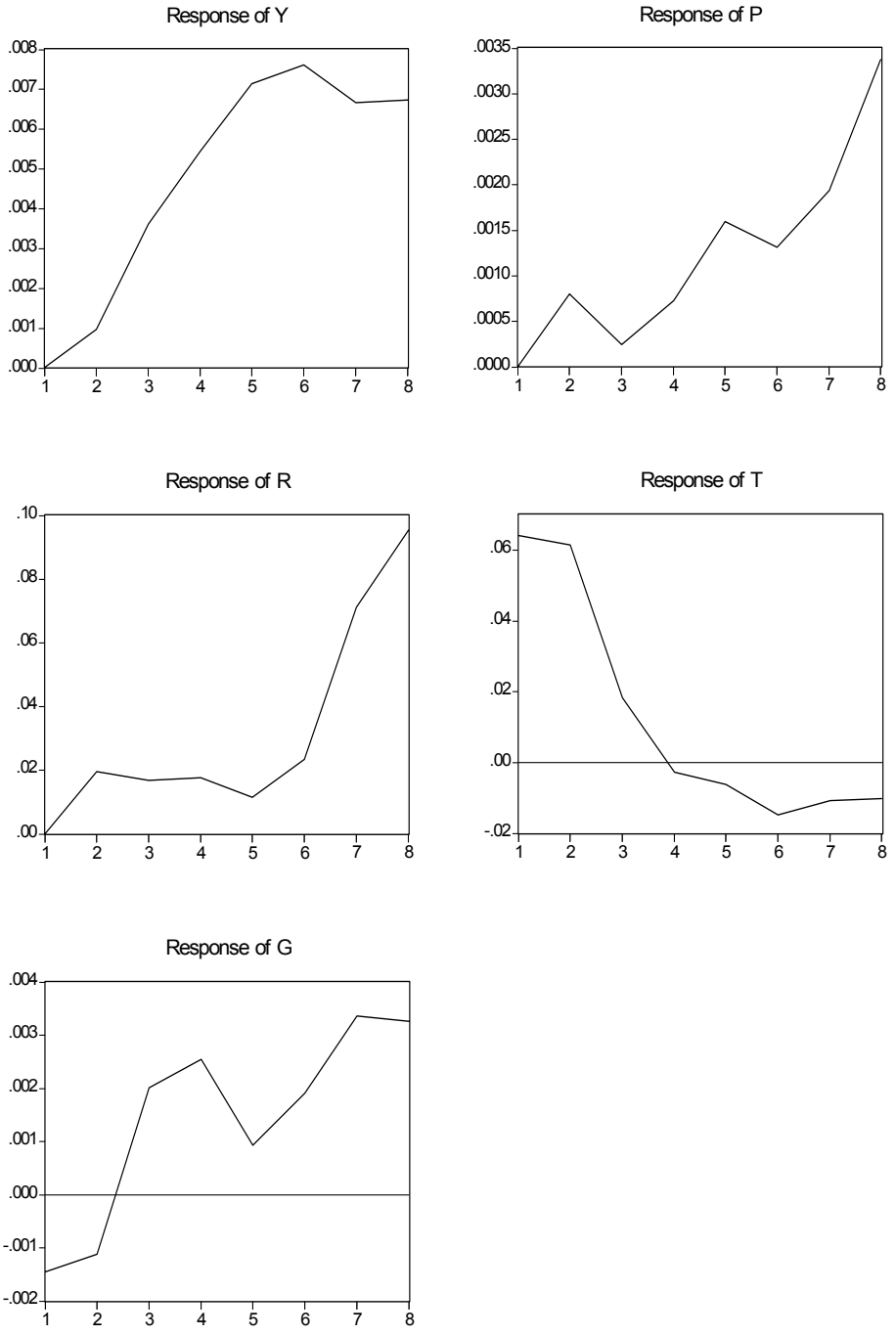


Figure 1.6.2
Shock to Corporate Tax Revenues (figure continued)

Panel D: Japan, Full Sample, LL=7

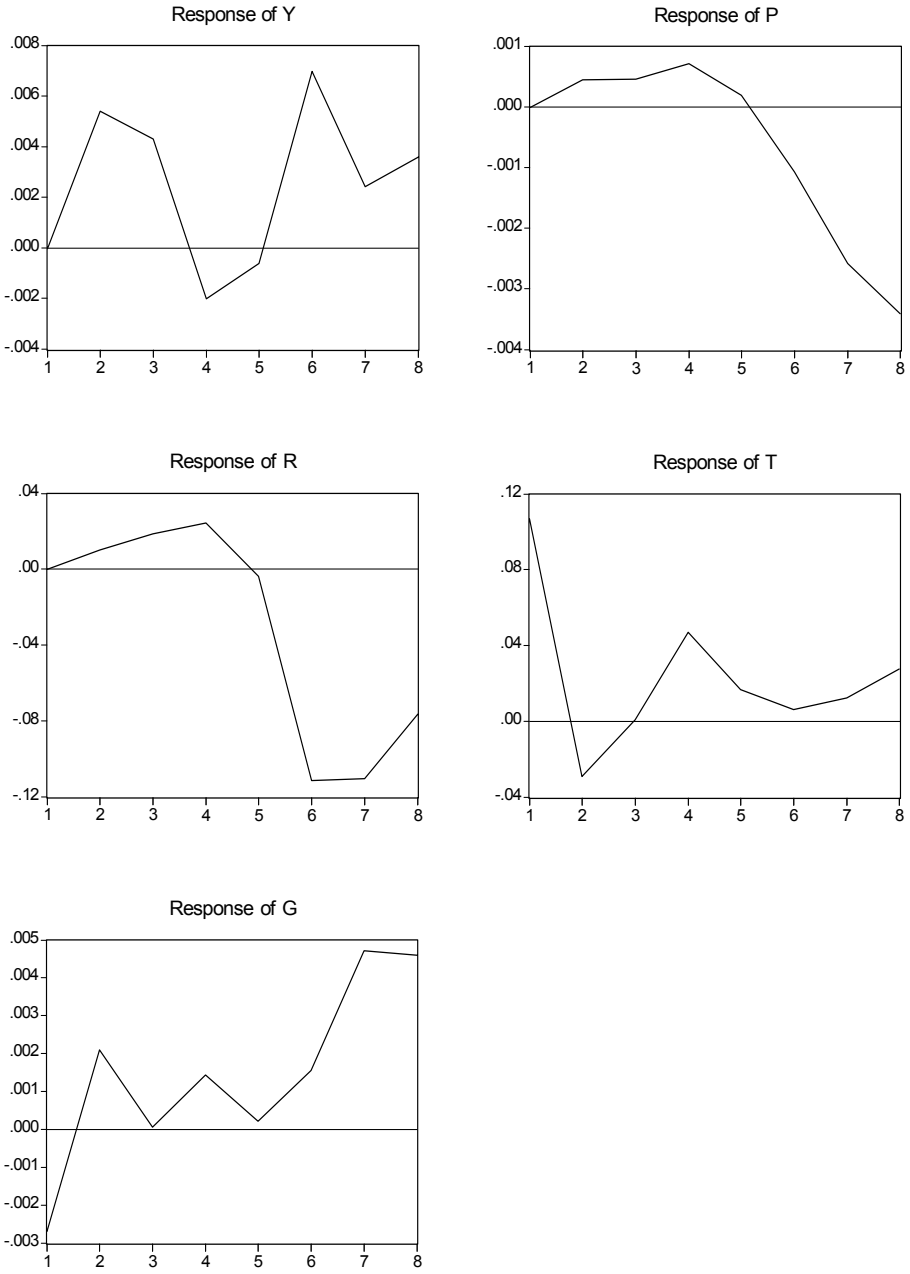


Figure 1.6.2
Shock to Corporate Tax Revenues (figure continued)

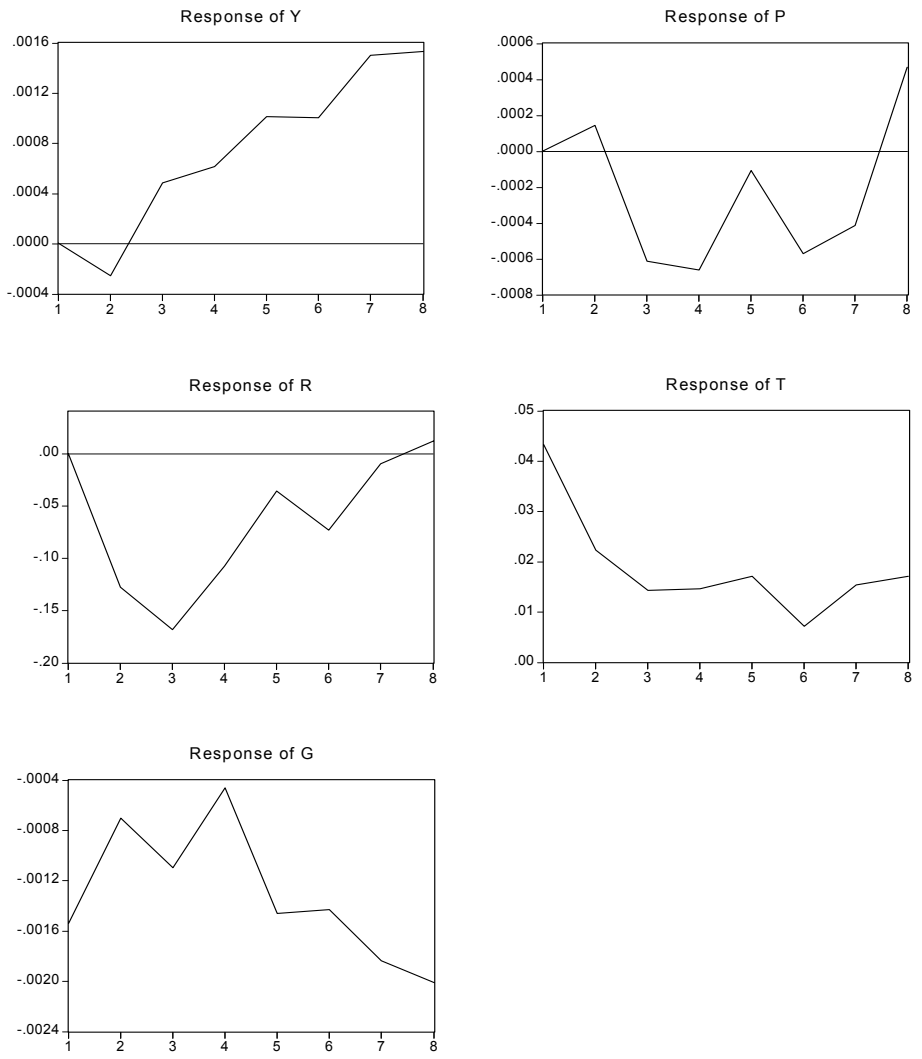


Figure 1.6.2
Shock to Corporate Tax Revenues

Figure 1.6.2 presents the results of (the alternative) model variables to a one-standard deviation shock to corporate tax revenues for countries for which the system has converged[12]. Positive corporate tax multipliers, found with the previous identification scheme, are present for all countries in the sample. Interestingly, the positive response of

[12] The Hessian matrix was near singular and therefore the system has not converged for Canada. The results for the U.K have not been reported because of the data limitations.

output to corporate tax innovations last longer this time, except for Germany, in which the output decreases after the fourth quarter. The effects of corporate tax innovations on the price level and the interest rate exhibit cross-country heterogeneity; and it is difficult to talk about a common pattern.

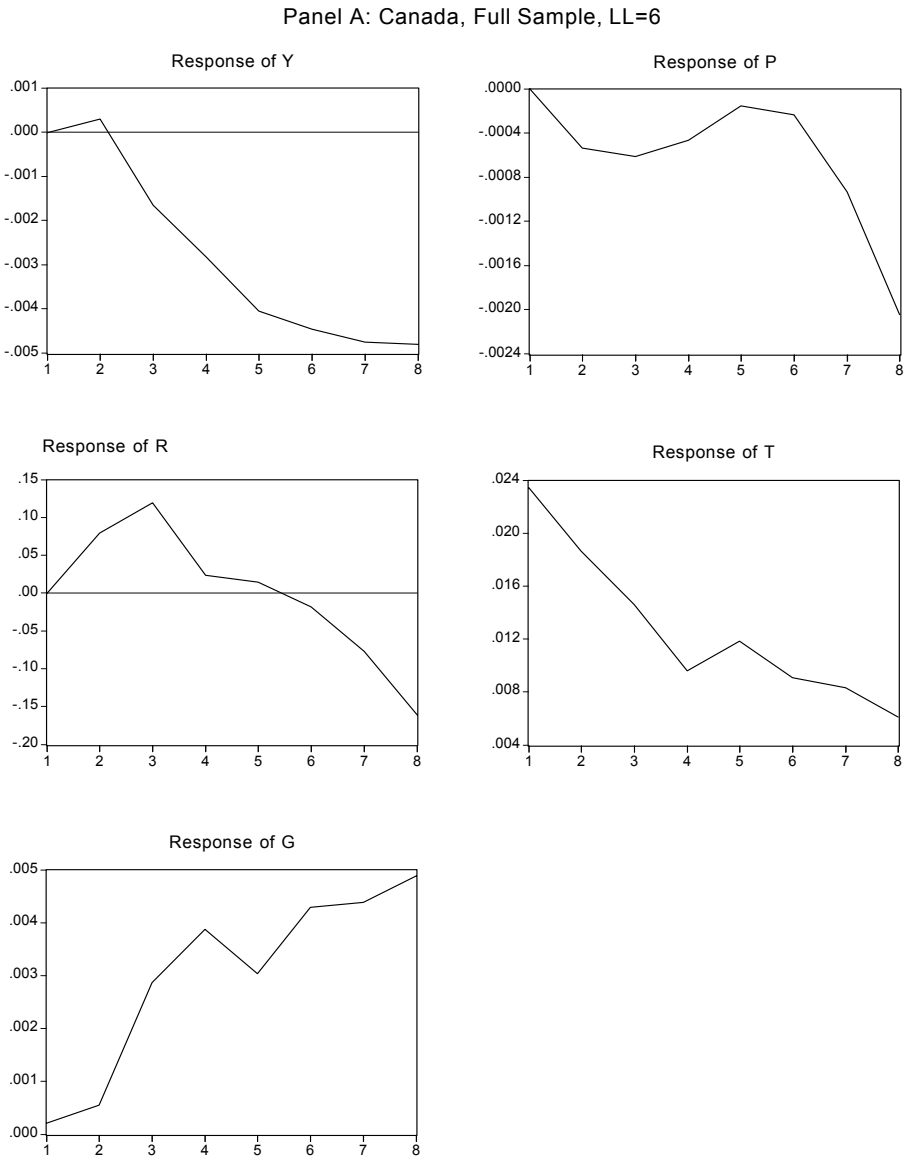


Figure 1.6.3
Shock to Indirect Tax Revenues (figure continued)

Panel B: France, Full Sample, LL=2

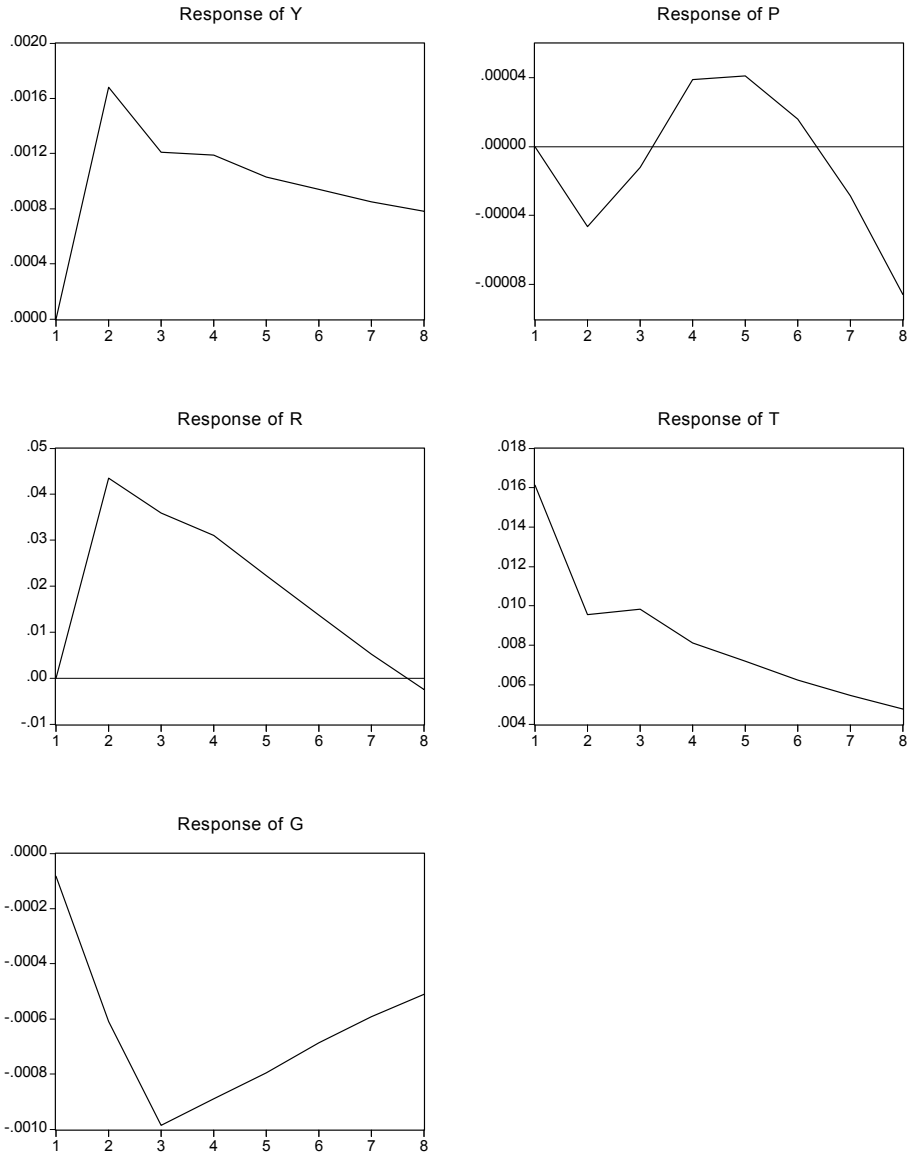


Figure 1.6.3
Shock to Indirect Tax Revenues (figure continued)

Panel C: Italy, Full Sample, LL=7

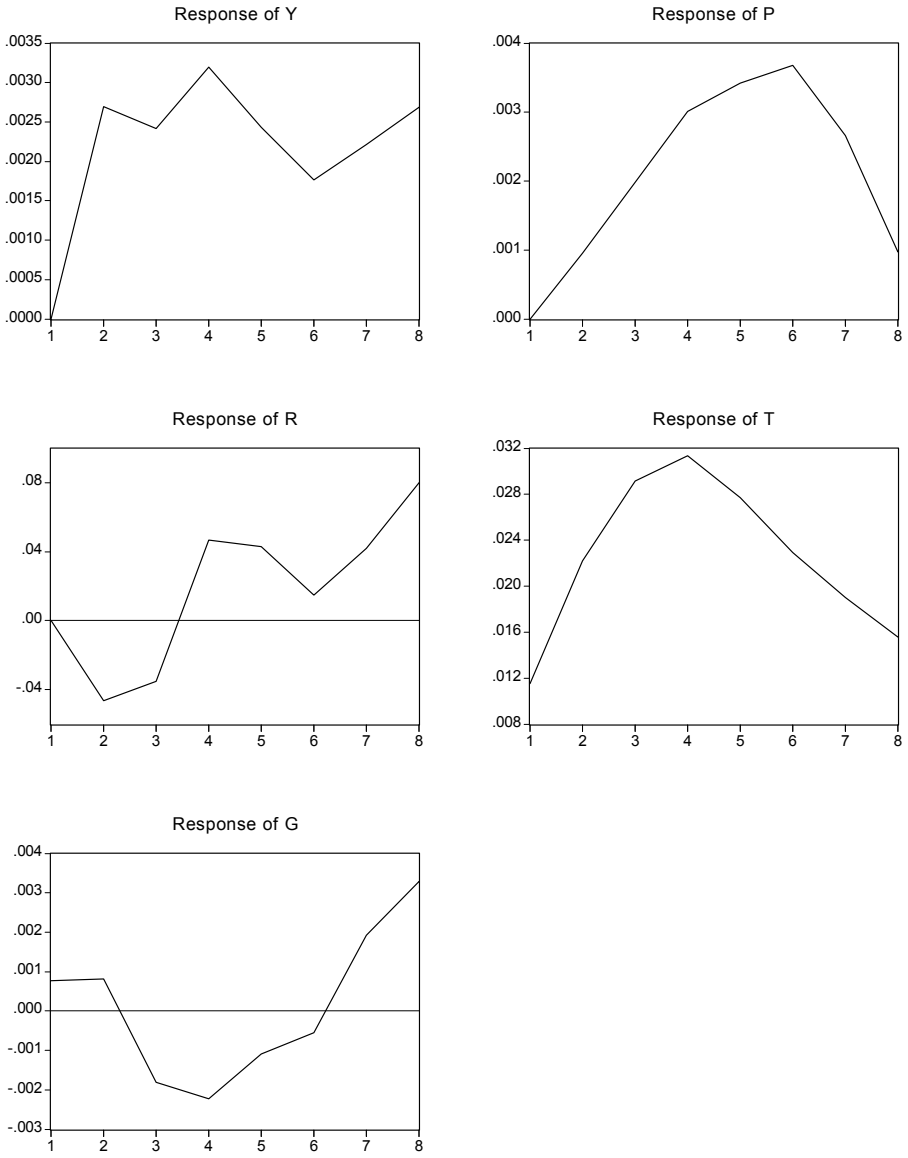


Figure 1.6.3
Shock to Indirect Tax Revenues (figure continued)

Panel D: Japan, Full Sample, LL=5

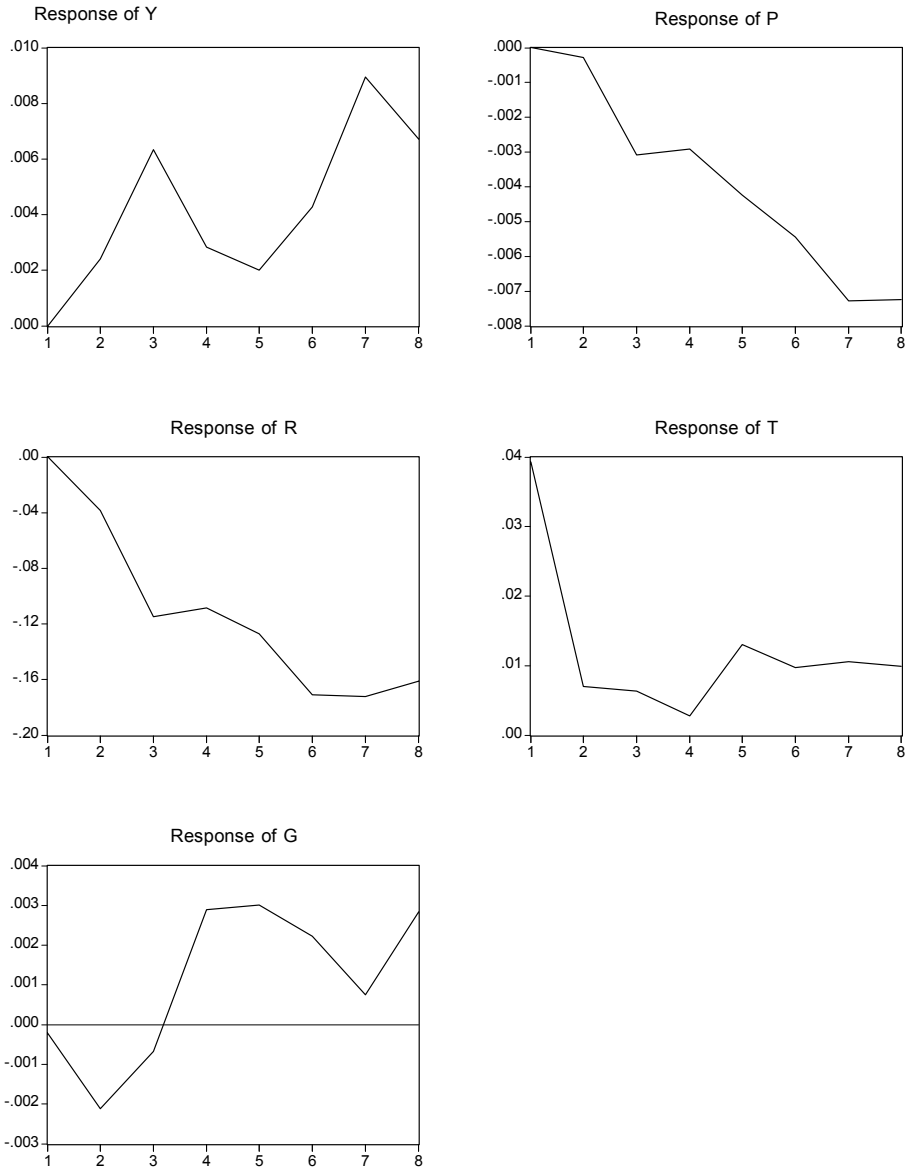


Figure 1.6.3
Shock to Indirect Tax Revenues (figure continued)

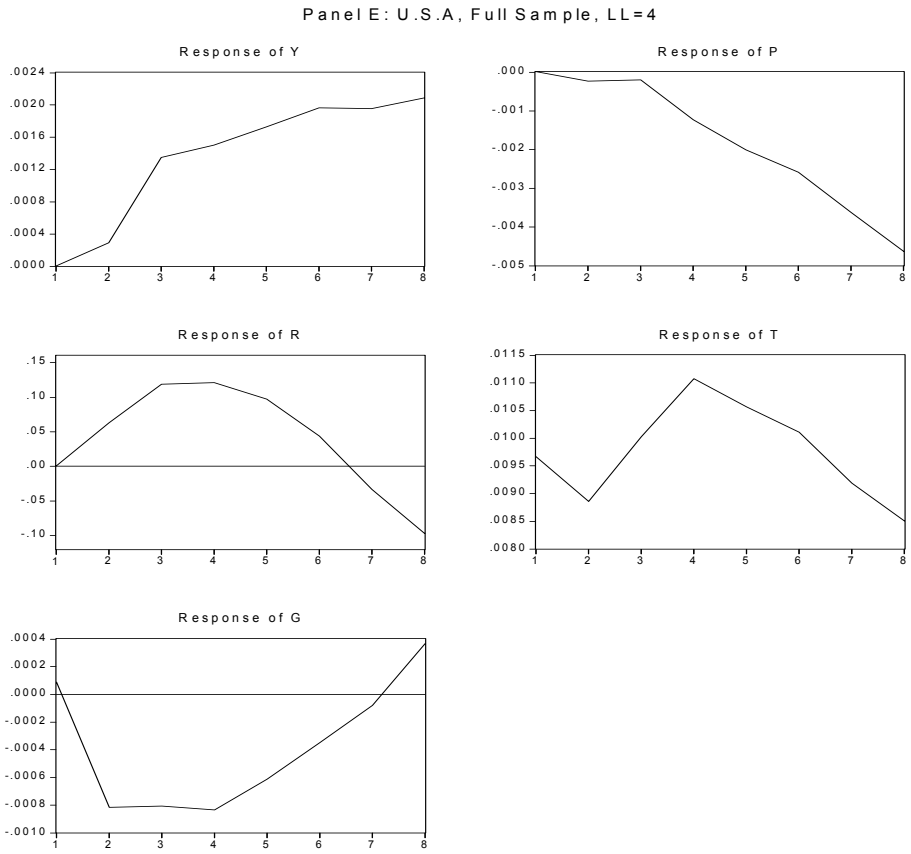


Figure 1.6.3
Shock to Indirect Tax Revenues

Figure 1.6.3 presents the impulse response functions of all model variables to a one-standard deviation positive shock to indirect tax revenues in our alternative model for countries for which the system has converged[13], without the Monte Carlo confidence bands. With the alternative model, the impulse response functions look quite similar. For all countries except Canada, an increase in indirect tax revenues is accompanied by an increase in output

[13] The Hessian matrix was near singular for Germany, therefore the system has not converged for that country. The results for the U.K have not been reported because of data limitations.

When we look at the effects of indirect tax innovations on the price level, we see that indirect tax innovations are followed by a decrease in the price level in all countries, with the exception of Italy.

Finally, indirect tax innovations lead to an initial increase in the long-term interest rate in three countries (Canada, France and the U.S.A), and interest rate falls after the 6th or the 7th quarter. For other countries, there is a considerable degree of cross-country heterogeneity, and it is difficult to observe a common pattern in terms of the effects of indirect taxes on the interest rate.

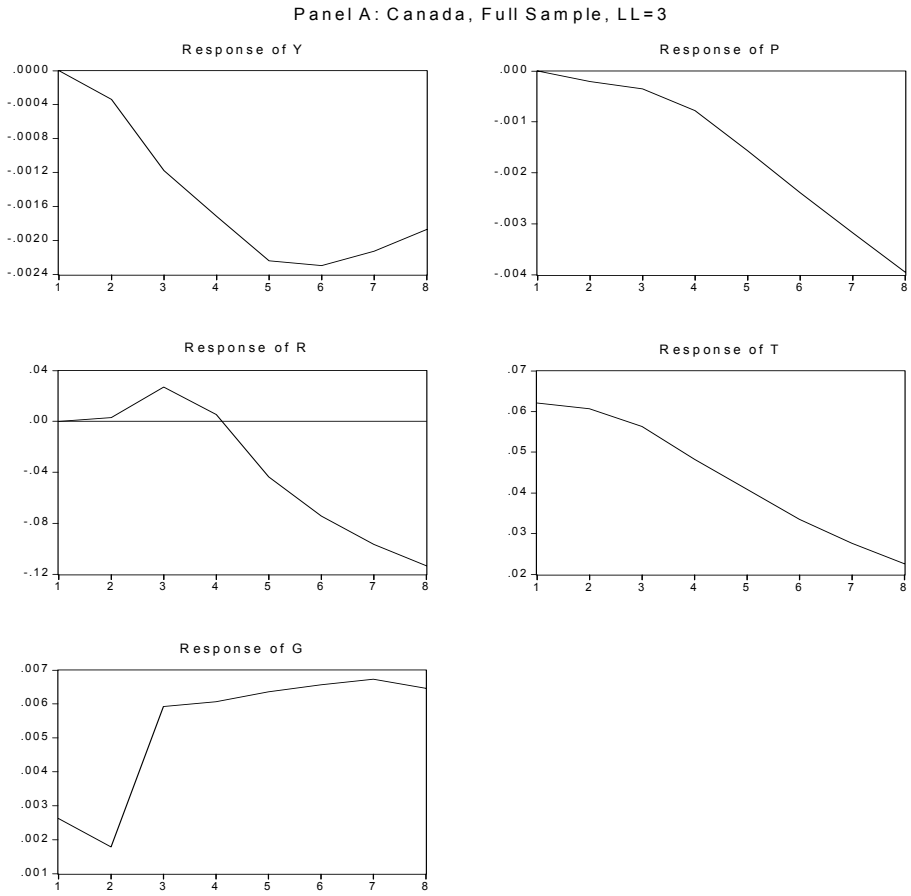


Figure 1.6.4
Shock to Social Security Tax Revenues (figure continued)

Panel B: France, Full Sample, LL=2

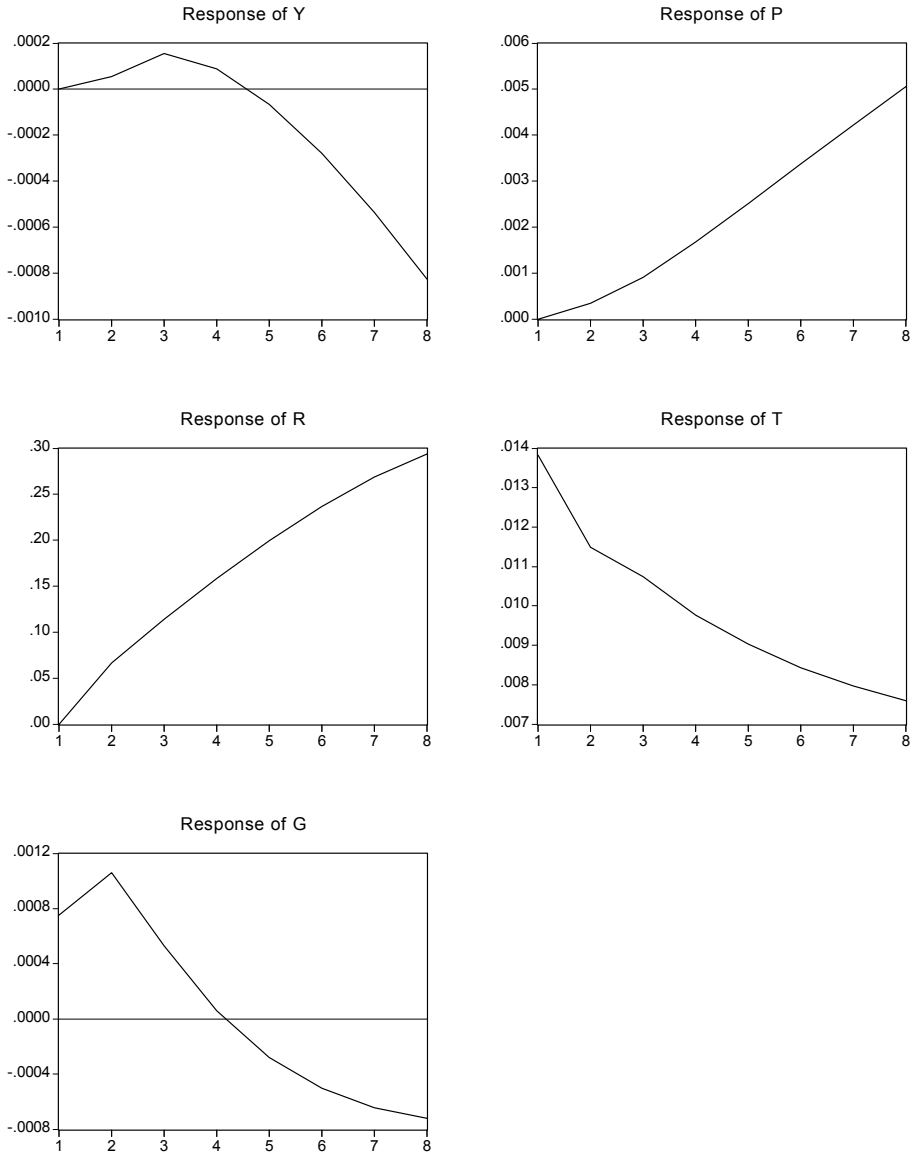


Figure 1.6.4
Shock to Social Security Tax Revenues (figure continued)

Panel C: Germany, Full Sample, LL=8

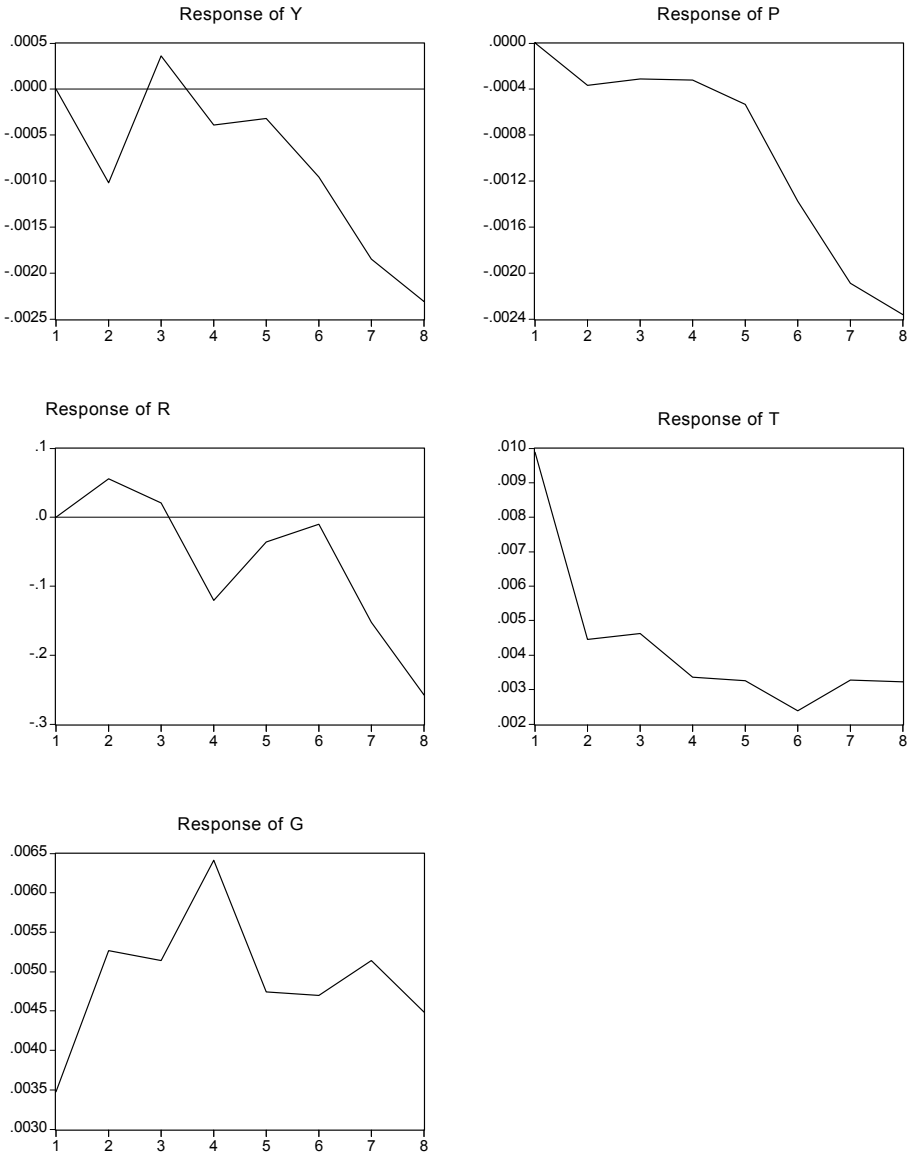


Figure 1.6.4
Shock to Social Security Tax Revenues (figure continued)

Panel D: Italy, Full Sample, LL=5

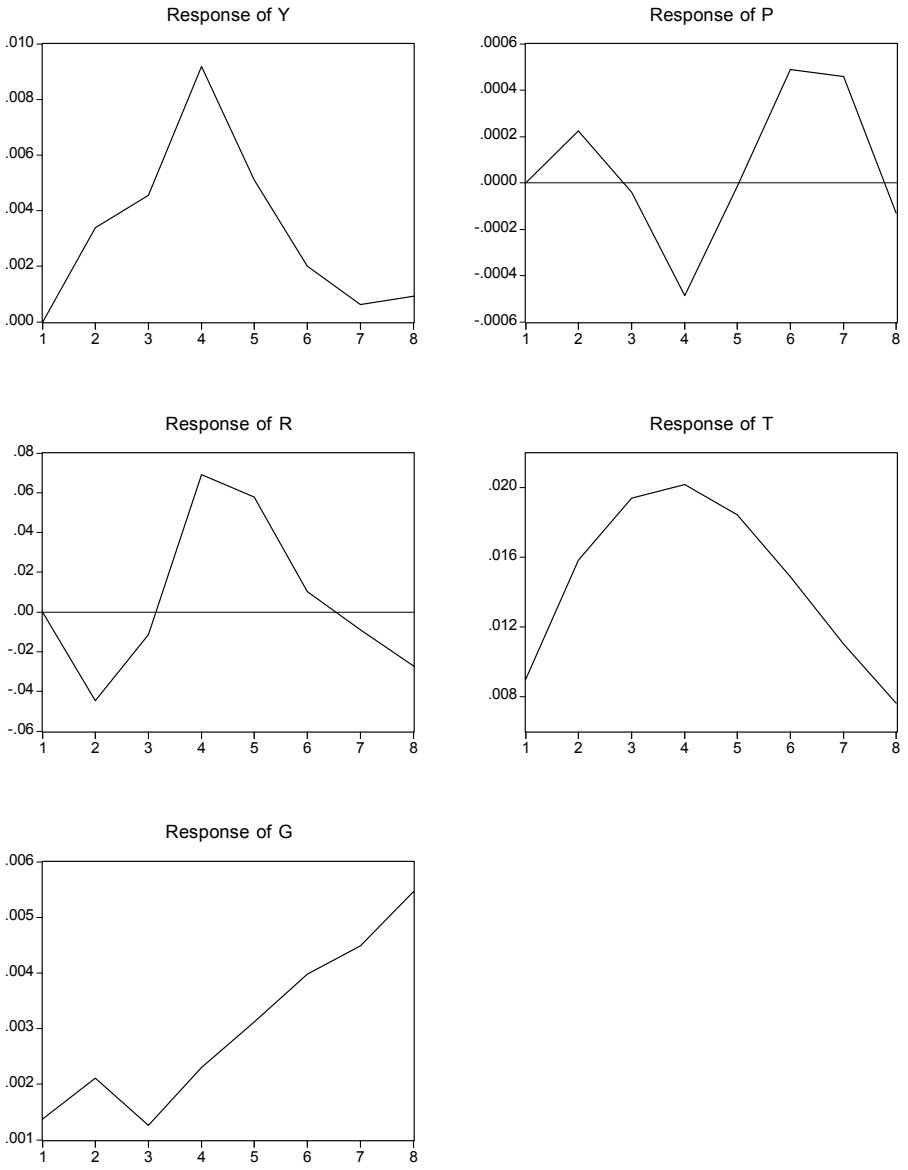


Figure 1.6.4
Shock to Social Security Tax Revenues (figure continued)

Panel E: Japan, Full Sample, LL=7

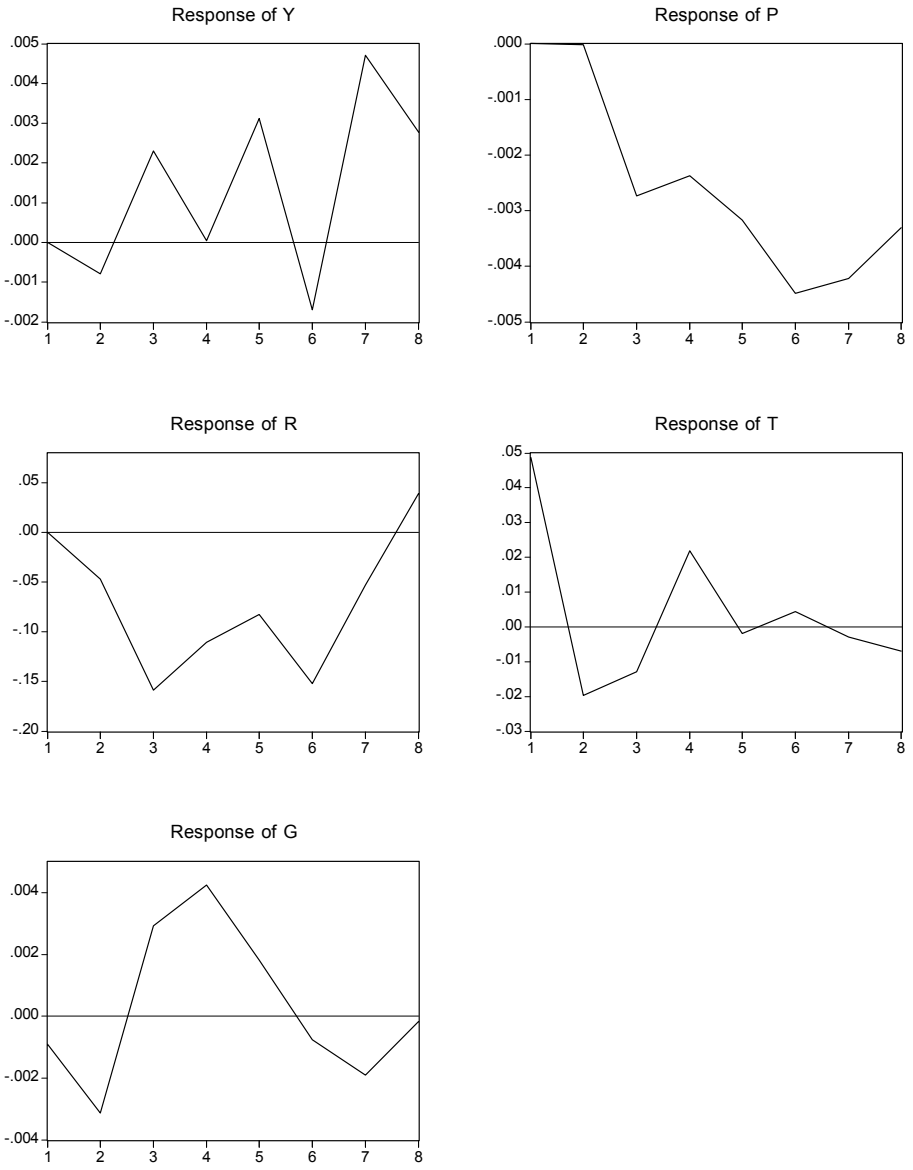


Figure 1.6.4
Shock to Social Security Tax Revenues (figure continued)

Panel F: U.S.A, Full Sample, LL=7

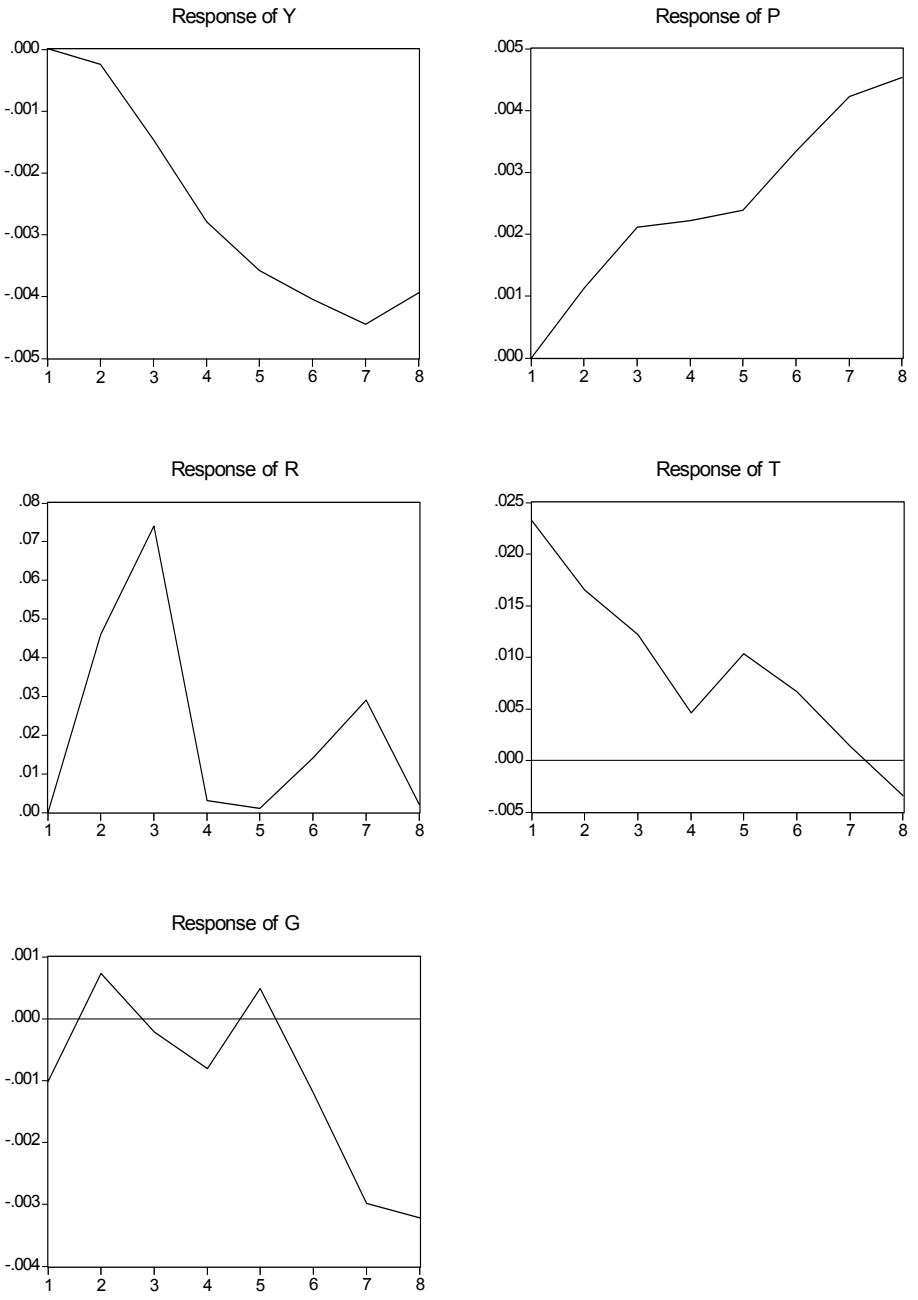


Figure 1.6.4
Shock to Social Security Tax Revenues

Figure 1.6.4 presents the results of (the alternative) model variables to a one-standard deviation shock to social security tax revenues for countries[14]. We find negative social security tax multipliers for Canada, France, Germany and the U.S., while the output responds positively in Italy and Japan. The effects of social security tax innovations on the price level and the interest rate exhibit cross-country heterogeneity; and it is difficult to talk about a common pattern.

1.7. Conclusion

There has been a revival of the controversy regarding the effectiveness of fiscal policy during the last decade. There does not exists a consensus on the effects of fiscal policy because of the scant and mixed empirical evidence, and the cross country variation among fiscal multipliers provided by studies like van Aarle et al. (2001) and Perotti (2002). The results in this chapter show that different tax groups have different effects on the economy, so the composition of the tax innovation is as important as – if not more important than – the magnitude of the overall tax response.

While we do not find any evidence for the existence of positive income tax multipliers, there is no evidence for the existence of negative corporate tax multipliers. Thus, the composition of the total tax innovation may explain at least some part of the positive tax multipliers. Although the cross-country heterogeneity is much more visible for indirect tax and social security tax innovations, the cross-country heterogeneity becomes much smaller if the estimation period is restricted, a result which support Perotti (2002) arguing fiscal multipliers became smaller in the last 20 years.

[14] The results for the U.K have not been reported because of the data limitations.

TABLE 1.1:
Panel A: Definition and Data Source for the Variables Used[15]

Variable	Definition	Data Source
Income Taxes	Direct Taxes on Households	OECD Economic Outlook
Corporate Taxes	Direct Taxes on Businesses	OECD Economic Outlook
Indirect Taxes	Sales Taxes, Taxes on Goods and Services	OECD Economic Outlook
Social Security Taxes	Social Security Contributions Received by the Government	OECD Economic Outlook
Government Expenditures	Government Purchases, Subsidies, Wages and Transfers.	OECD Economic Outlook
Real GDP	Gross Domestic Product of the Country calculated at 1995 Prices	IMF Financial Statistics
CPI	Consumer Price Index	IMF Financial Statistics
Long-Term Interest Rate	Interest Rate on Long-term Government Bonds	IMF Financial Statistics

Panel B: Data Range for the Variables Used

Variable	CAN	FRA	GER	ITA	JPN	U.K.	U.S.A.
Income Taxes	1961:1-1999:4	1963:1-1999:4	1968:1-1989:4	1960:1-1999:4	1960:1-1989:4	1960:1-1999:4	1960:1-1999:4
Corporate Taxes	1961:1-1999:4	1963:1-1999:4	1968:1-1989:4	1960:1-1999:4	1960:1-1989:4	N/A	1960:1-1999:4
Indirect Taxes	1961:1-1999:4	1963:1-1999:4	1971:1-1989:4	1960:1-1999:4	1960:1-1989:4	N/A	1960:1-1999:4
Social Security Taxes	1961:1-1999:4	1963:1-1999:4	1968:1-1989:4	1960:1-1999:4	1960:1-1989:4	N/A	1960:1-1999:4
Government Expenditures	1961:1-1999:4	1963:1-1999:4	1968:1-1989:4	1960:1-1999:4	1960:1-1989:4	1960:1-1999:4	1960:1-1999:4
Real GDP	1961:1-1999:4	1970:1-1999:4	1968:1-1989:4	1960:1-1999:4	1960:1-1989:4	1960:1-1999:4	1960:1-1999:4
CPI	1961:1-1999:4	1963:1-1999:4	1968:1-1989:4	1960:1-1999:4	1960:1-1989:4	1960:1-1999:4	1960:1-1999:4
Long-Term Interest Rate	1961:1-1999:4	1963:1-1999:4	1968:1-1989:4	1960:1-1999:4	1967:1-1989:4	1960:1-1999:4	1960:1-1999:4

[15] All variables are in national currencies. For countries in the EMU area, national currencies are Euro.

Impulse response functions of output, price level, long-term government bond yield, the tax revenues itself and government expenditures to a one standard deviation shock to tax revenues are presented. The Wold Causal ordering is as follows: Y (real GDP), P (Consumer price Index), R (long-term government bond yield), T and G (Government expenditures). Panels A through D present separate graphs for income, corporate, indirect and social security taxes, respectively for U.S.A. The appropriate lag-length is chosen as 6 for income taxes, 5 for corporate taxes, 3 for indirect taxes and 6 for social security taxes.

Panel A: Income Taxes

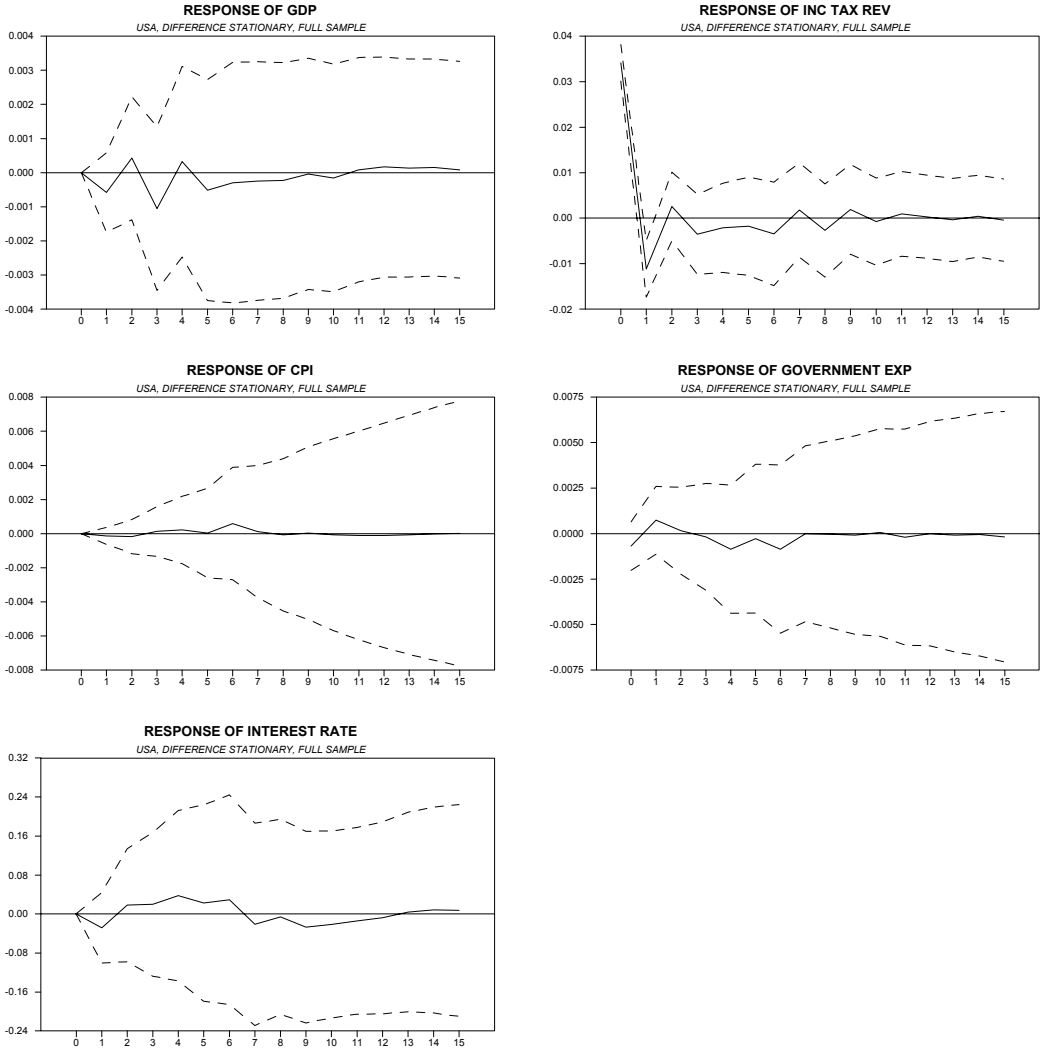


Figure 1.A.1
Benchmark Model in Differences (figure continued)

Panel B: Corporate Taxes

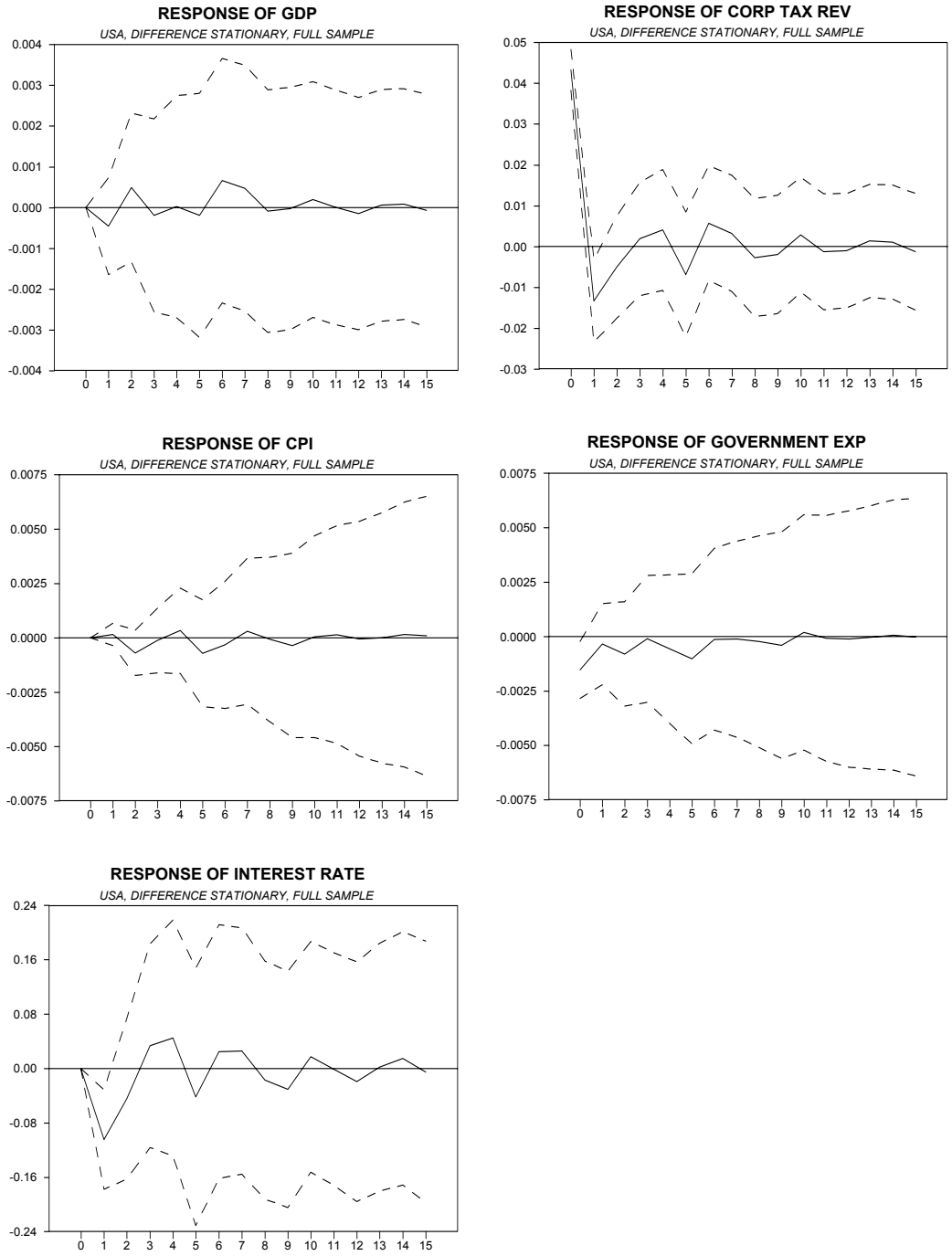


Figure 1.6.5
: Benchmark Model Estimated in First Differences (figure continued)

Panel C: Indirect Taxes

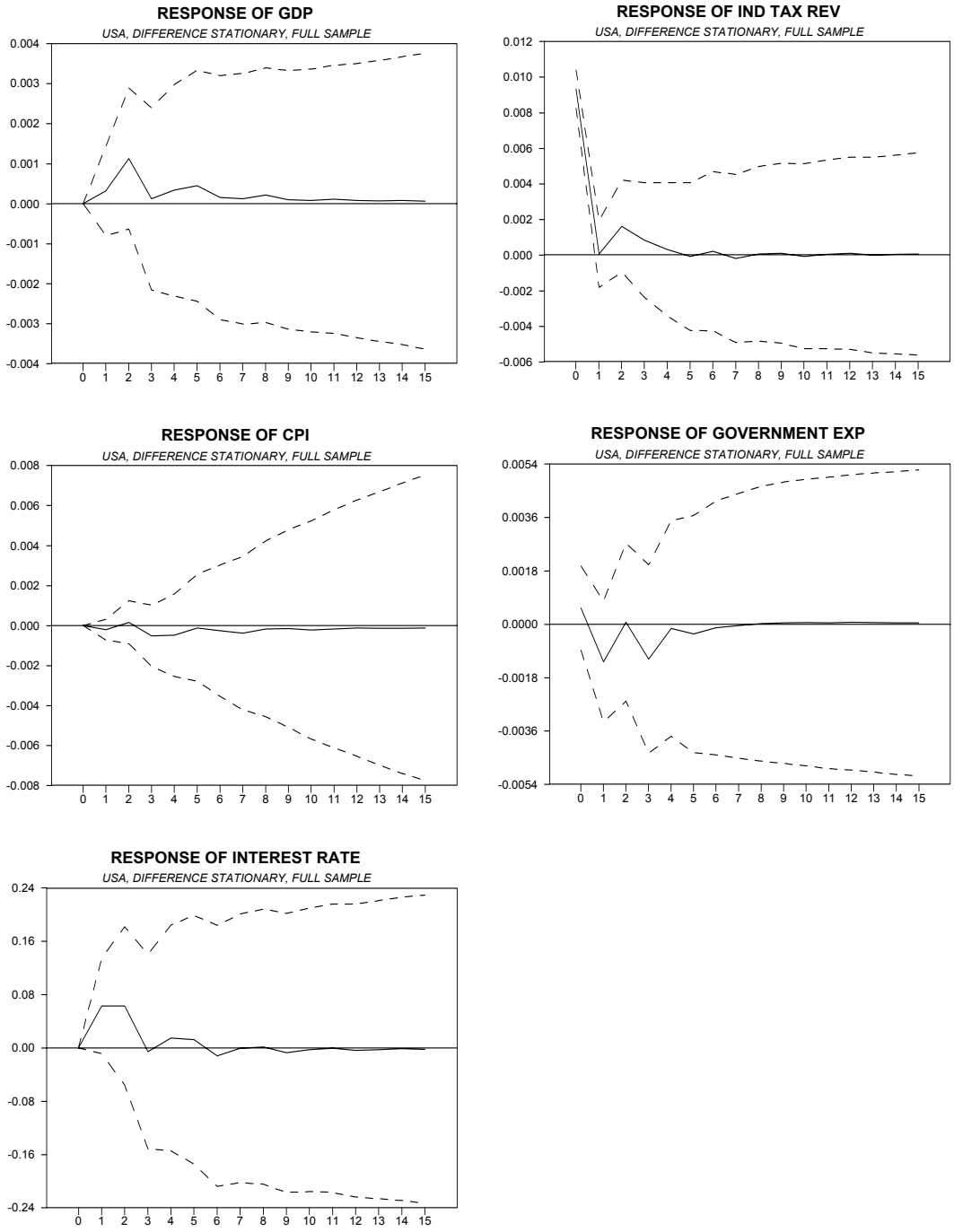


Figure 1.6.5
Benchmark Model Estimated in First Differences (figure continued)

Panel D: Social Security Taxes

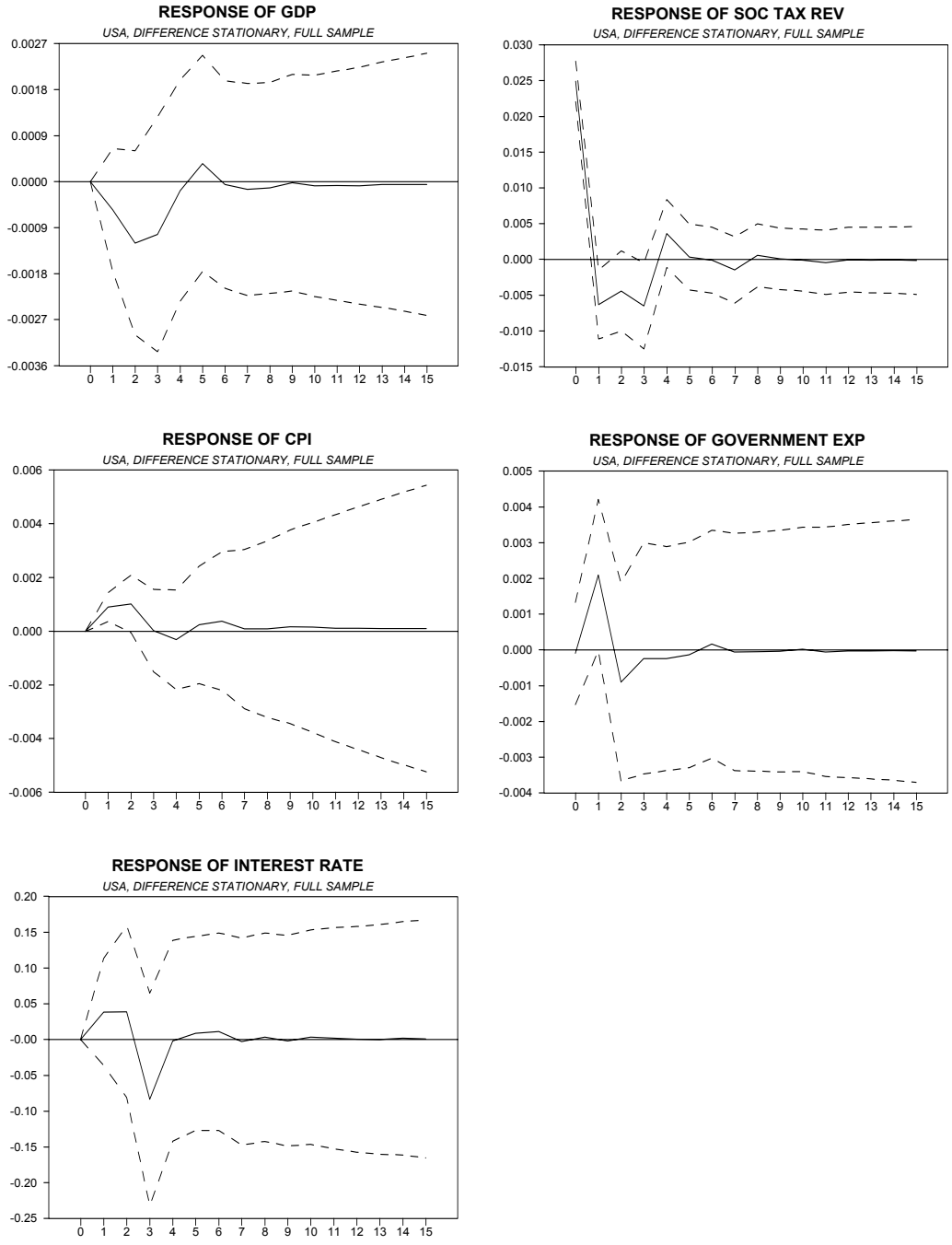


Figure 1.6.5
Benchmark Model Estimated in First Differences

CHAPTER 2
TAX POLICY AND ECONOMIC ACTIVITY: EVIDENCE FROM FIVE OECD COUNTRIES

2.1. Introduction

The last two decades have witnessed the revival of scientific discussion about the effectiveness of fiscal policy. In Europe, with the introduction of EMU, fiscal adjustments became crucially important for the member countries, and thus, since 1995 many European countries implemented extensive fiscal reforms. In the U.S., with President Bush's proposed tax cuts, more attention has been directed towards the transmission mechanisms of fiscal policy. Unfortunately, we have not yet reached enough empirical depth in the dynamic effects of fiscal policy actions. This chapter investigates the role of fiscal policy (tax policy in particular) in stimulating economic activity in five OECD countries by using a structural vector autoregressive (SVAR) analysis.

Monetary policy has received more academic attention than fiscal policy despite the existence of more contradicting opinions on the effects of fiscal policy with respect to those of fiscal policy. As such, vector autoregressive (VAR) models have been extensively used in the literature to analyze the effects of monetary policy shocks. SVAR models also originate from monetary policy analyses, where it helped researchers study the transmission of monetary shocks (Sims (1992), Bernanke and Blinder (1992)).

There is a relatively smaller number of studies that investigate the empirical effects of fiscal policy actions within a VAR framework, and Perotti (2002) classifies four different approaches to identify the fiscal shocks used in the previous literature:

(1) Eichenbaum, Edelberg and Fisher (1999) use a "narrative approach" in which exogenous shocks are measured by a narrative based dummy created by Ramey and

Shapiro (1997), that consists of four historical events that are associated with major increases in defense spending: the Korean War, the Vietnam War and the Carter-Reagan military spending build-ups. The main problem with the narrative approach is after-the-fact identification of fiscal policy shocks. The researcher may look hard for finding the dates that will give him the results that he is looking for. Consequently, fiscal policy shocks may not be correctly specified. In addition, these episodes may not be entirely unanticipated.

(2) Mountford and Uhlig (2002) use "sign restrictions" to identify revenue shocks. For instance, revenue shocks are identified by the requirement that tax revenue response increases while government expenditure does not, and by the requirement that if both tax revenues and output increases this is a business cycle shock. By imposing some 'a priori" restrictions like this, this scheme rules out a whole set of output responses to revenue shocks. Recent literature , including Alesina, Ardagna, Perotti and Schiantarelli (2002) point out the existence of "Non-Keynesian" effects of fiscal policy actions, and these unexpected effects can not be captured with the sign restrictions.

(3) Fatas and Mihov (2001) and Favero (2002) use a Choleski decomposition of the variance/covariance matrix. The main disadvantage of the Choleski decomposition is that when output, price level and the interest rate all respond to tax policy innovations in the same quarter, a Choleski decomposition will not provide a correct estimate of the structural fiscal shocks.

(4) Finally, Blanchard and Perotti (1999) and Perotti (2002) use a structural VAR analysis that combines economic theory and contemporaneous restrictions. Blanchard and Perotti (1999) is the first major study that incorporates an aggregate tax revenue variable

into the VAR models. They estimate the effects of exogenous shocks to real government purchases and real net taxes within a semi-structural VAR model by computing impulse response functions (IRFs)[16]. The authors consider both a model with a deterministic trend (quadratic) and a model with stochastic trend (unit root with drift), since unit root tests prove to be in favor of neither. Their results consistently show that positive government spending shocks have a positive effect on output, while positive tax shocks have a negative effect. They also find that persistence is stronger under stochastic trends. Perotti (2002) studies the effects of fiscal policy on GDP, prices and interest rates in five OECD countries using a structural VAR approach. He argues that the effects of fiscal policy on GDP and its components have become substantially weaker in the last 20 years, the tax multipliers tend to be negative but small, despite some evidence on positive tax multipliers, and net tax shocks have very small effects on prices. Finally, he argues that the U.S. is an outlier in many dimensions, so the responses to fiscal shocks estimated on U.S. data are often not representative of the average OECD country.

Long-run restrictions on variables are also classified under SVAR analysis by many, including van Aarle, Gobin and Garretsen (2001). Prior to implementing this procedure, the model is transformed into first differences. Then, real variables are ordered before nominal variables, and policy variables are ordered after output. The long-run effect of a shock on the level of a variable is simply the cumulative sum of the relevant moving average representation.

[16] As Blanchard and Perotti (1999) use institutional information about tax and transfer systems and the timing of tax collections to identify the automatic stabilizing aspects of fiscal policy to construct some of the coefficients of the contemporaneous relations among the variables, it is often called a "semi-structural" model.

While investigating the effects of tax shocks on the economy, the previous literature concentrates on the effects of net taxes (tax revenues- transfers). However, economic theory suggests that different tax groups have different effects on the economy. For instance, Atkinson and Stiglitz (1980) develop a basic intertemporal model, which shows that income taxes and consumption taxes have different effects on household saving decisions. There is also empirical support for the different effects of different tax groups. For instance, using a panel of 22 OECD countries, Kneller, Bleaney and Gemmell (1999) contend that distortionary taxation (income taxes and social security taxes) reduces growth whereas non-distortionary taxation (corporate taxes and indirect taxes) does not, and productive government expenditure (such as expenditures on infrastructure) enhances growth, while non-productive government expenditure (such as recreational expenditure) does not. The previous theoretical and empirical literature on the effects of different tax groups was discussed in detail in Section 1.2.

In this chapter, we investigate the response of output and other macroeconomic variables such as the price level and the interest rate to innovations in different tax groups within a SVAR model that uses long-run restrictions. Our results show that different tax groups have different effects on macroeconomic activity. We do not find, for instance, any evidence of positive tax multipliers for income tax innovations. Meanwhile, we do not find any evidence for negative corporate tax multipliers. Thus, composition of the fiscal response can be a major factor that explains the positive tax multipliers, which the previous literature documents, including van Aarle et al (2001) and Perotti (2002).

The remainder of the chapter is organized as follows: section 2.2 explains the data and methodology used; section 2.3 presents the empirical results, and section 2.4 presents the robustness tests, and section 2.5 concludes.

2.2. Data and Methodology

2.2.1. Data

The data used in this chapter are obtained from two different sources: the data for four different types of government revenues, namely income, corporate, indirect and social security taxes, as well as government expenditures, government expenditure deflator indices and domestic expenditure deflator indices are obtained from the OECD Economic Outlook database. The data for GDPs, Consumer Price Indices, reserve money statistics and long-term Government Bond Yields are obtained from the IMF International Financial Statistics database. Government expenditure is deflated using the government expenditure deflator; the tax groups are deflated by the domestic expenditure deflator.

The data used to estimate the model consist of quarterly observations for the G-7 countries, and the estimation period for each county is presented in Table 2.1 (Panel A).

2.2.2. Methodology

To investigate the response of macroeconomic variables to tax policy innovations, SVARs are employed. Our structural VAR model imposes long-run identifying restrictions, pioneered by Blanchard (1989) and Blanchard and Quah (1989), on an ordinary VAR model in order to infer structural shocks from it. The long-run restrictions are based on neutrality restrictions. Prior to implementing this procedure, the model is transformed into first differences. Then, real variables are ordered before nominal

variables, and output is ordered before the policy variables. The long-run effect of a shock on the level of a variable is simply the cumulative sum of the relevant moving average representation.

Assume an unrestricted VAR model written in moving average form:

$$\Delta X_t = A(L)e_t \ , \qquad (2.1)$$

where X is a vector of macroeconomic variables, $A(L)$ is a polynomial matrix of lag-length l, L is the lag operator and e is a vector of reduced form shocks in the elements of X with variance-covariance matrix $E(e_t e_t') = \Sigma$. These reduced form shocks are likely to be correlated so they cannot be interpreted as pure structural shocks. However, by imposing identifying restrictions, the SVAR model obtains:

$$\Delta X_t = B(L)u_t \ , \qquad (2.2)$$

where B(L) is a polynomial matrix in L, u_t is a vector of serially and contemporaneously uncorrelated, normalized structural residuals with $E(u_t u_t') = I$, and $A\Sigma A' = BB'$. Here A and B are k x k matrices to be estimated and the expression on either side is symmetric. This model only requires a minimum number of k(k+1)/2 restrictions, and it enables us to make the same assumptions regarding each and every tax group. In addition, in many cases, economic theory provides more guidance about long-run relationships between economic variables rather than their short-run dynamics.

The vector X of macroeconomic variables comprises of the following variables: Output (Y, measured by real GDP), the price level (P, measured by the CPI[17]), the interest rate (R, long-term government bond yield), real tax revenue (T, measured by tax revenue of the i^{th} group measured in national currencies, deflated by domestic

[17] We used the CPI instead of the GDP Deflator, as comparable GDP Deflator statistics were not available for all countries in the sample.

expenditure deflator), and real government expenditures (G, in national currency, deflated by government expenditure deflator). As mentioned above, each variable was differenced before being included in the estimation. In order to choose lag-lengths, the results of the Likelihood Ratio (LR) Tests are used.

To identify the structural shocks from the VAR model, ten identifying restrictions are required. These are: Tax revenue innovations do not have a permanent effect on output (1); government expenditure shocks do not have a permanent effect on output (2), and on tax revenues (3). Price level shocks do not have a permanent effect on output (4), on tax revenues (5) and on government expenditures (6), and finally, interest rate shocks do not have a permanent effect on output (7), on tax revenues (8), on government expenditures (9) and on the price level (10).

Like every identification scheme, our restrictions have some drawbacks as well. Assumption (1) implies that tax shocks do not have any supply-side effects on output. However, ordering output before the tax revenues is crucial, as an increase in output directly increases tax revenues. Assumption (3) implies that there is no balanced budget. However, if government expenditures are ordered before the tax revenues, results essentially remain the same. These results were not reported, but they are available upon request. Finally, as government expenditures include transfer payments, it can be argued that the interest rate should affect government expenditures in the long run. However, ordering G before R enables us to capture the long-run effect of expenditures on the interest rate, predicted and discussed by many theoretical economic models, including keynesian, and overlapping generations models.

These restrictions can be illustrated in the matrix form:

$$\begin{bmatrix} \Delta Y \\ \Delta T \\ \Delta G \\ \Delta P \\ \Delta R \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 \\ b_{21} & b_{22} & 0 & 0 & 0 \\ b_{31} & b_{32} & b_{33} & 0 & 0 \\ b_{41} & b_{42} & b_{43} & b_{44} & 0 \\ b_{51} & b_{52} & b_{53} & b_{54} & b_{55} \end{bmatrix} \begin{bmatrix} u_Y \\ u_T \\ u_G \\ u_P \\ u_R \end{bmatrix} \tag{2.3}$$

This approach has been recently implemented by van Aarle et al (2001) without estimating Monte-Carlo confidence bands. In our chapter, one-standard deviation confidence intervals are obtained from a Monte Carlo simulation based on 10,000 draws.

2.3. Empirical Results

2.3.1. The Effects of Income Taxes

Figure 2.1 presents the impulse response functions of all model variables to a one-standard deviation positive shock to income tax revenues in our benchmark model. The increases in income tax revenues are followed by a significant decrease in output in two countries in our 5-country sample, namely Canada and Germany. In both countries a one percent increase in income tax revenues causes approximately 0.15 percent decrease in output. In the remaining three countries, the effect of income tax policy innovations on output seems to be insignificant. For income taxes, we do not find any evidence for positive tax multipliers documented by previous literature. The effects of income tax shocks on the price level and interest rate, however, exhibit a huge variation in terms of sign and magnitude across countries. Income tax shocks are followed by a significant decrease in the price level for Canada, by a significant increase in Italy, and by insignificant responses in the remaining three countries.

Impulse response functions of output, price level, long-term government bond yield, the tax revenues itself and government expenditures to a one standard deviation shock to income taxes are represented. Panels A through E present separate graphs for Canada, France, Germany, Italy and U.S.A. respectively

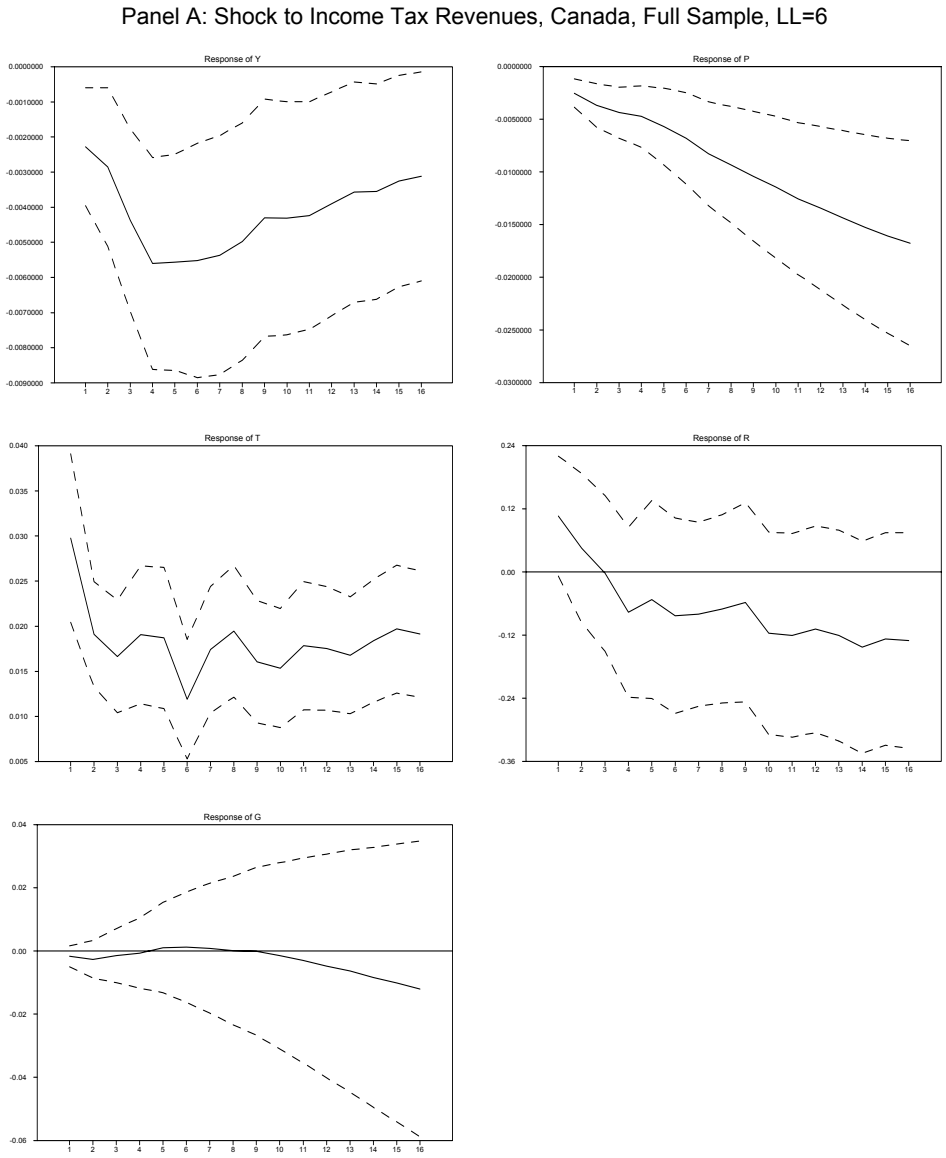


Figure 2.1
The effects of income taxes (figure continued)

Panel B: Shock to Income Tax Revenues, France, Full Sample, LL=4

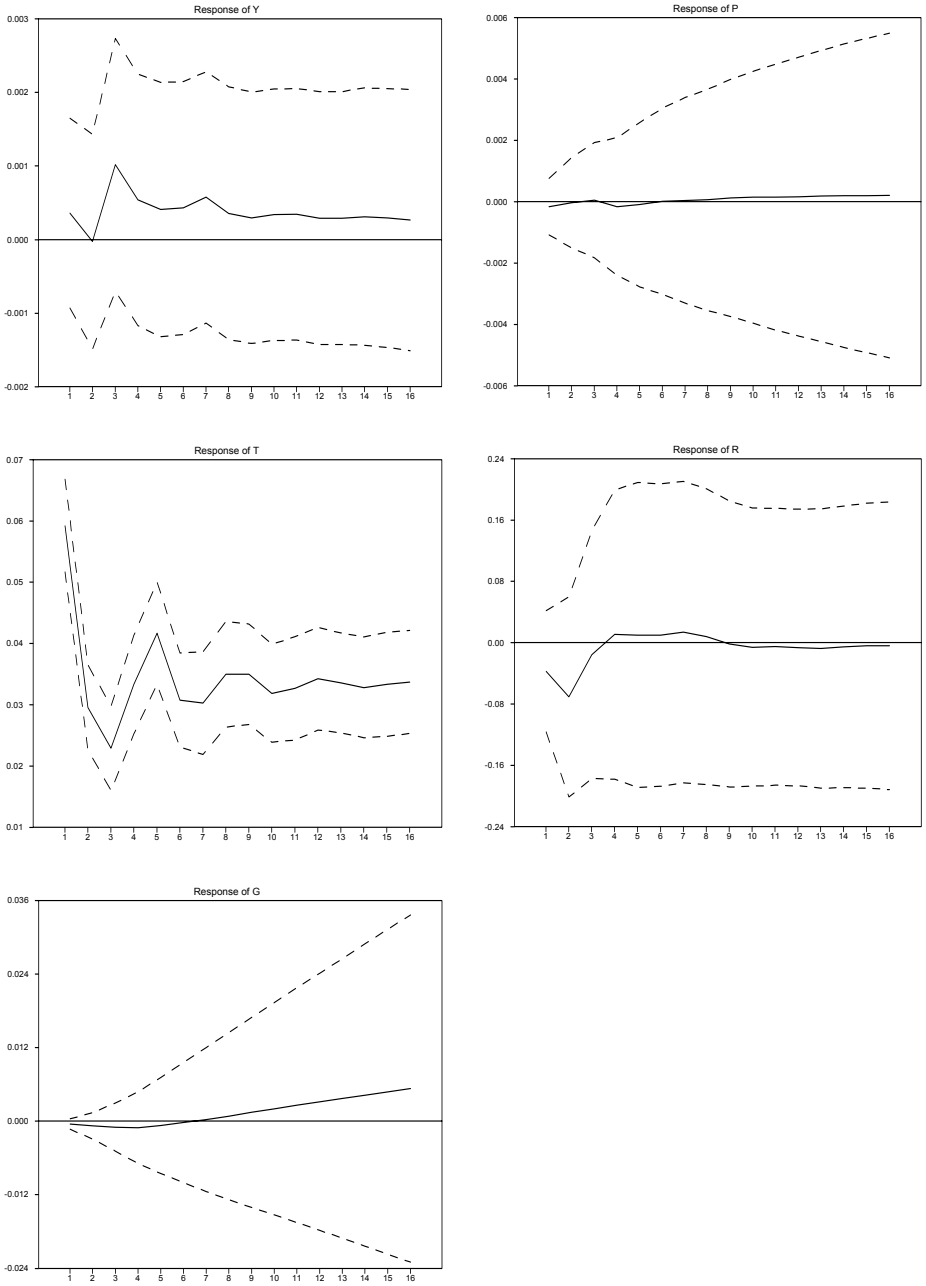


Figure 2.1
The effects of income taxes (figure continued)

Panel C: Shock to Income Tax Revenues, Germany, Full Sample, LL=8

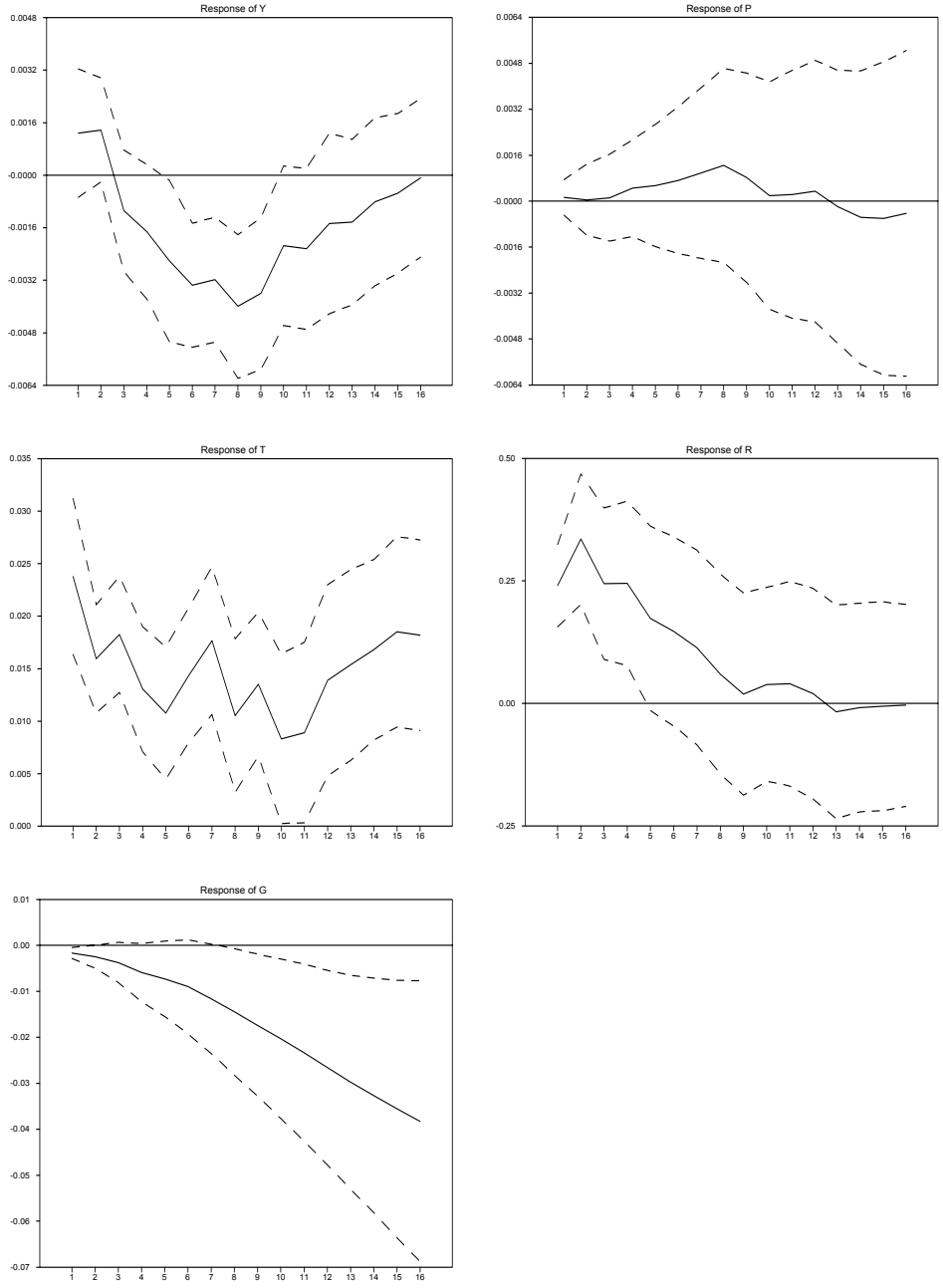


Figure 2.1
The effects of income taxes (figure continued)

Panel D: Shock to Income Tax Revenues, Italy, Full Sample, LL=7

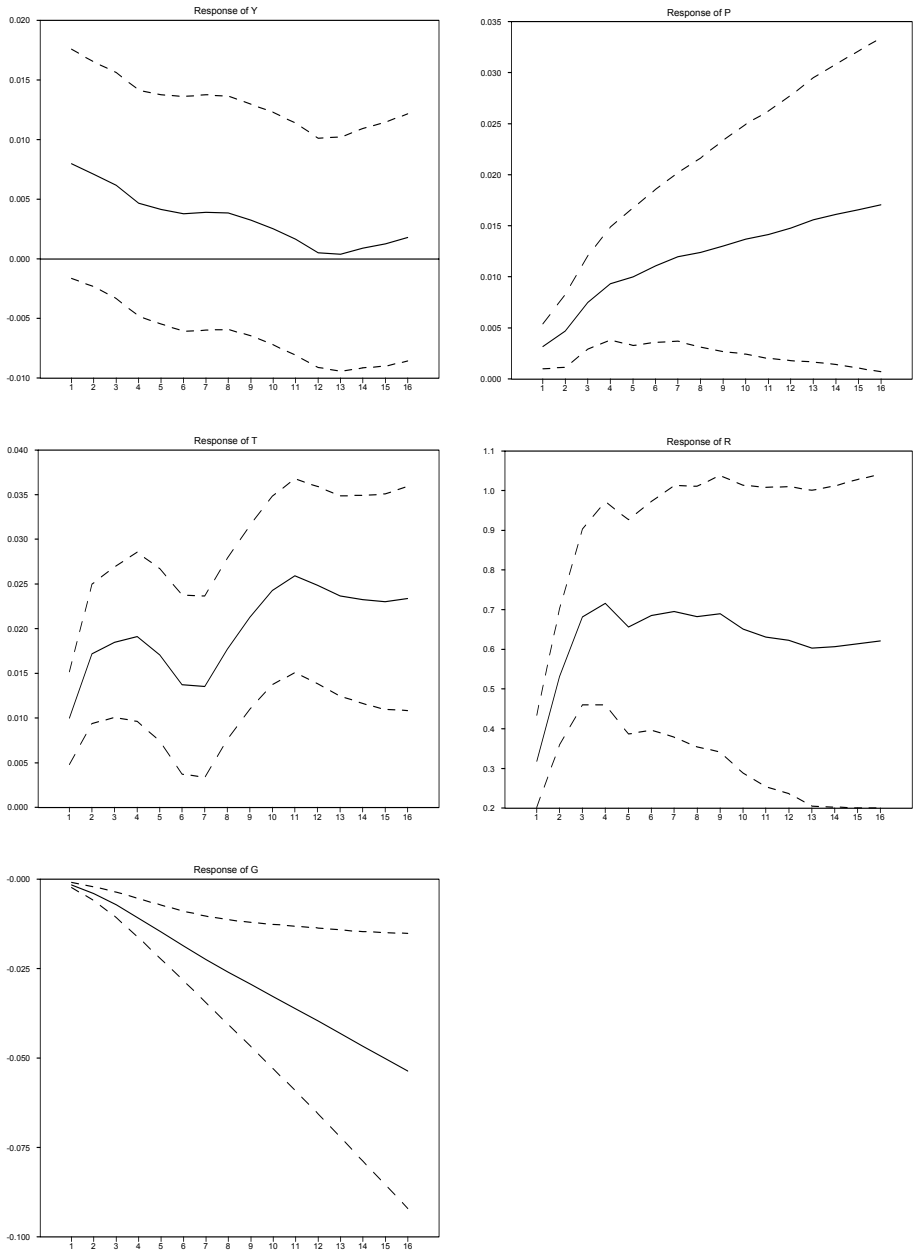


Figure 2.1
The effects of income taxes (figure continued)

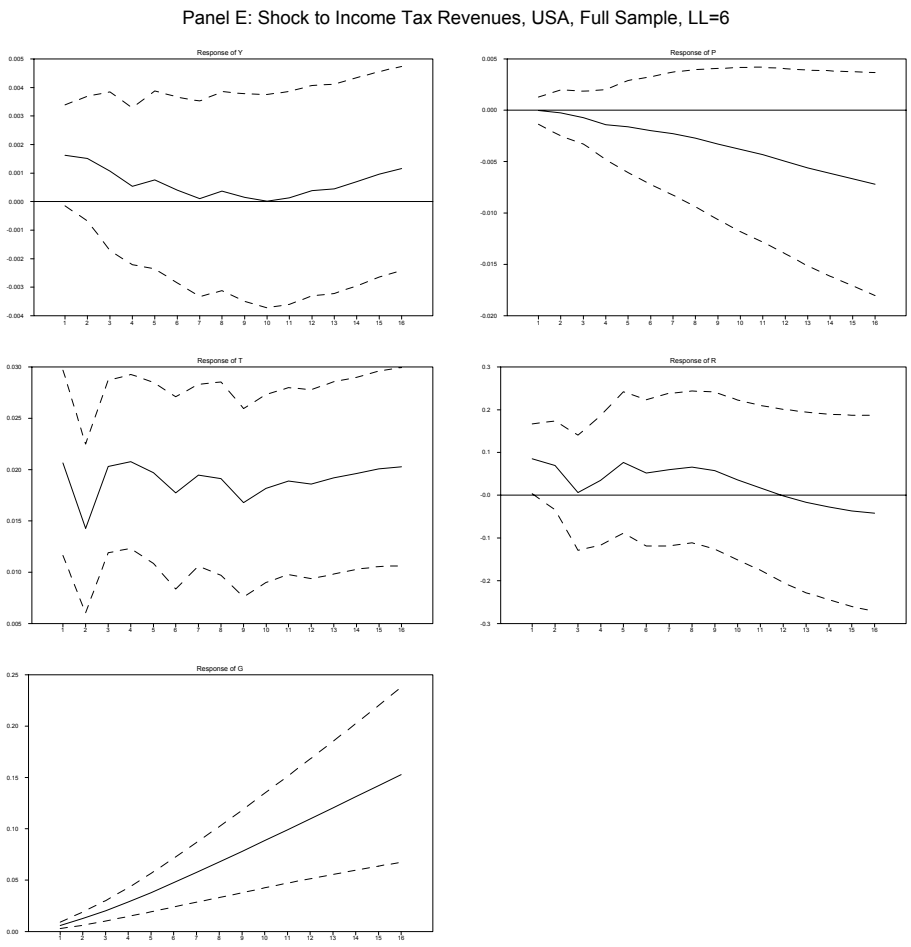


Figure 2.1
The effects of income taxes

2.3.2. The Effects of Corporate Taxes

The effects of corporate taxes are presented in Figure 2.2. Surprisingly, we find no evidence for negative multipliers for corporate taxes for all of the five countries included in our sample. This result is intriguing, as previous literature does not suggest any explanation for these results. It is a well known fact that, increases in corporate taxes cause firms to shift from equity to bond financing, since interest payments are tax deductible. This shift from equity to bond financing may have some economic effects that have not yet been covered by the previous theoretical and/or empirical literature. If these

firms perceive the increase in corporate taxes to be permanent, they may try to cover future expected interest payments by increasing output and thus sales revenue. Corporate tax shocks are accompanied by a significant increase in output in France and Germany for nearly 6 quarters. For both countries, a one percent increase in income tax revenues causes a less than 1 percent increase in output. These are also the two countries where corporate tax shocks lead to a significant increase in the price level. The corporate tax innovations have insignificant effects on output and/or price level in the remaining three countries.

Impulse response functions of output, price level, long-term government bond yield, the tax revenues itself and government expenditures to a one standard deviation shock to corporate taxes are presented. Panels A through E present separate graphs for Canada, France, Germany, Italy and U.S.A. respectively

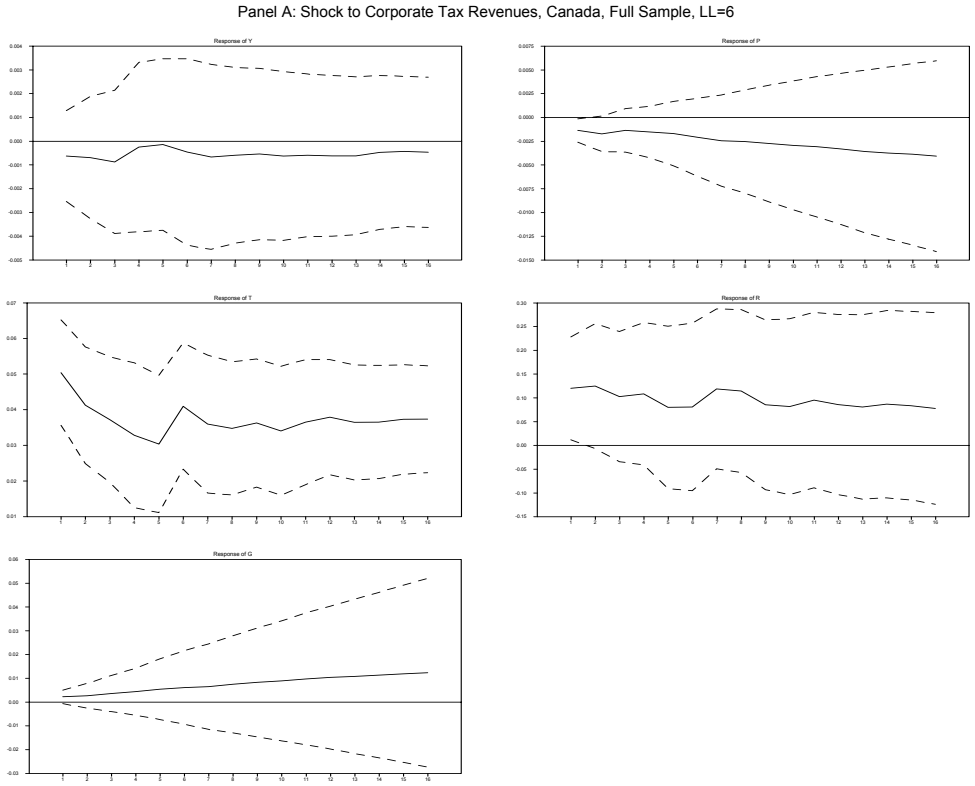


Figure 2.2
The effects of corporate taxes (figure continued)

Panel B: Shock to Corporate Tax Revenues, France, Full Sample, LL=3

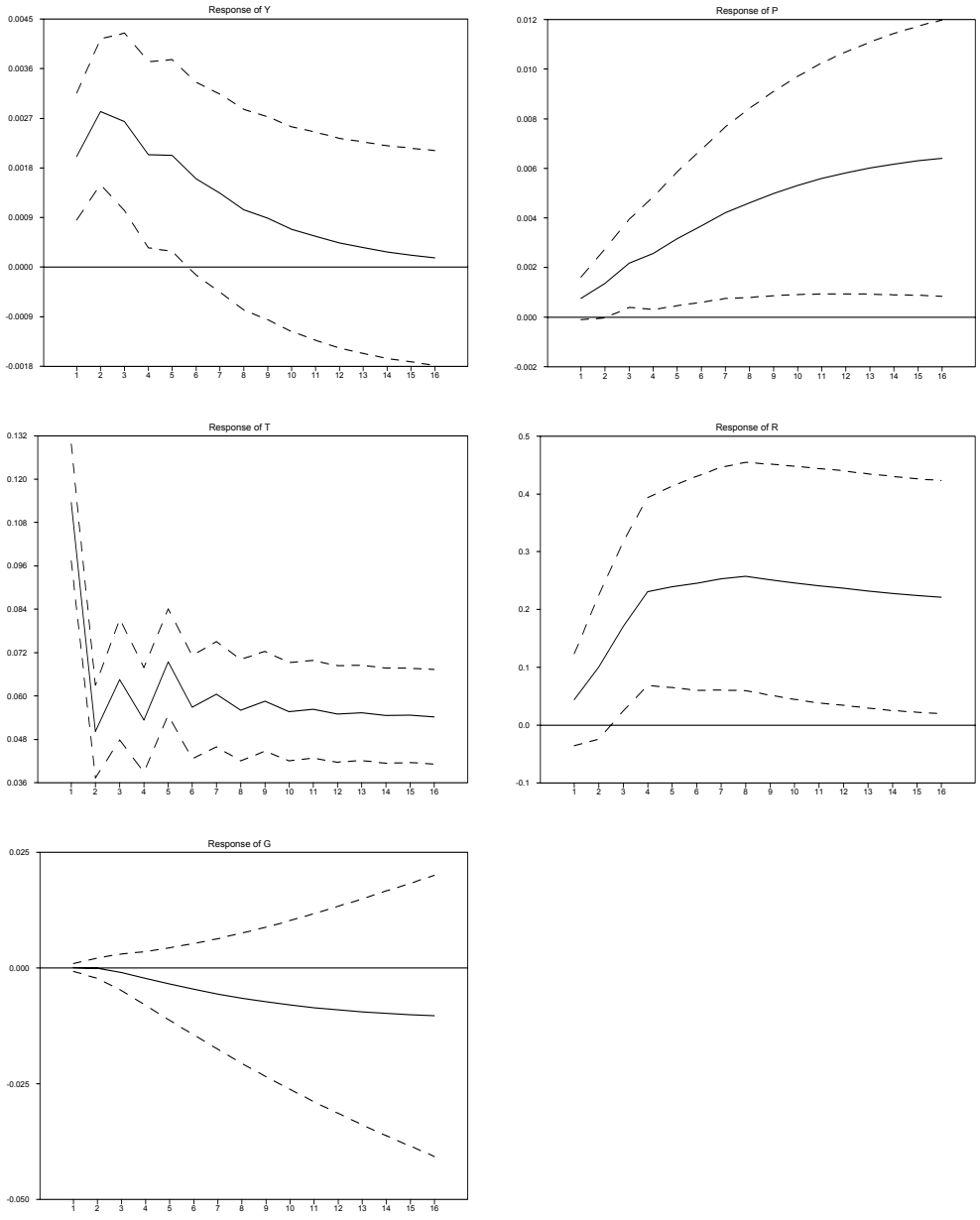


Figure 2.2
The effects of corporate taxes (figure continued)

Panel C: Shock to Corporate Tax Revenues, Germany, Full Sample, LL=7

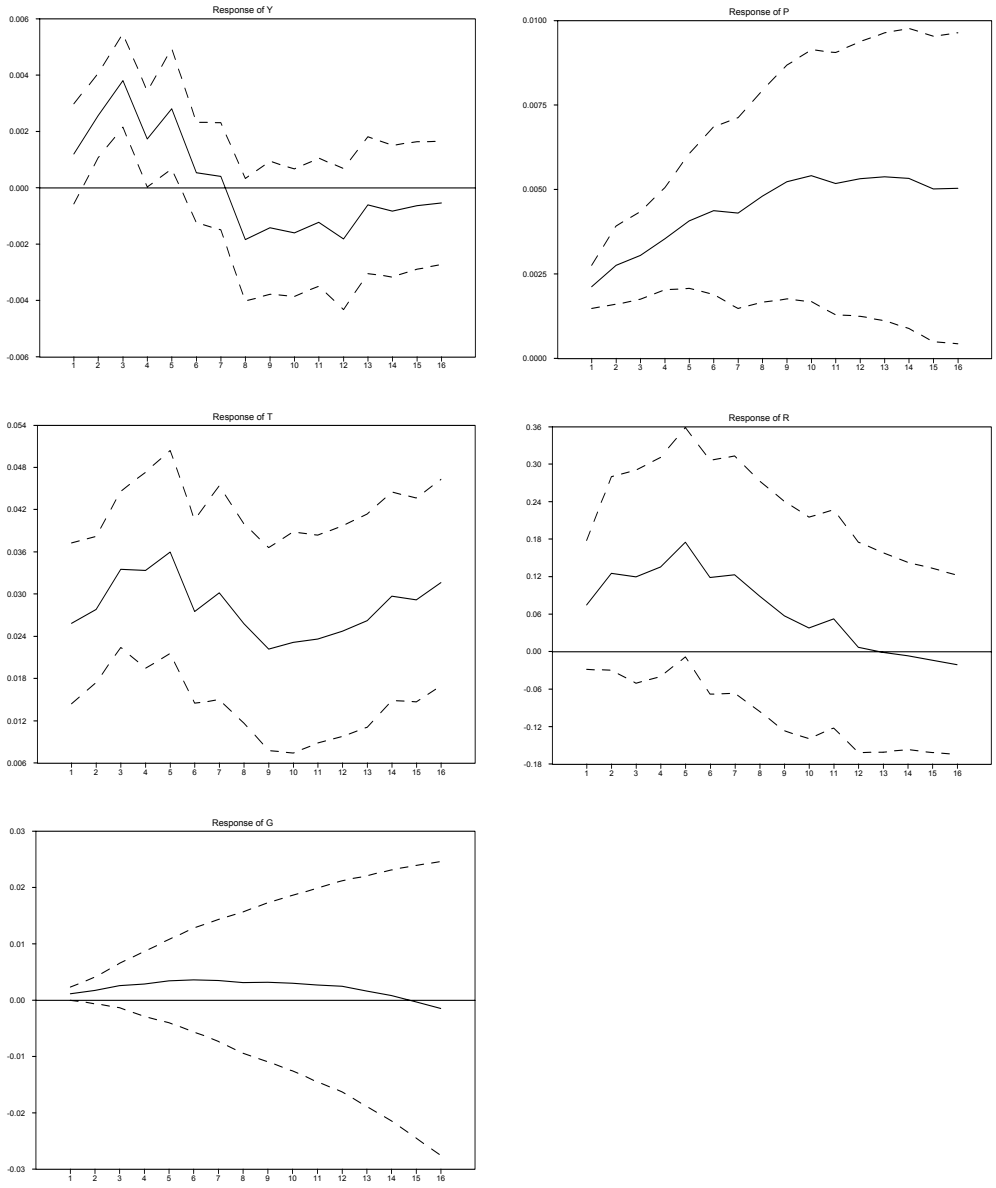


Figure 2.2
The effects of corporate taxes (figure continued)

Panel D: Shock to Corporate Tax Revenues, Italy, Full Sample, LL=4

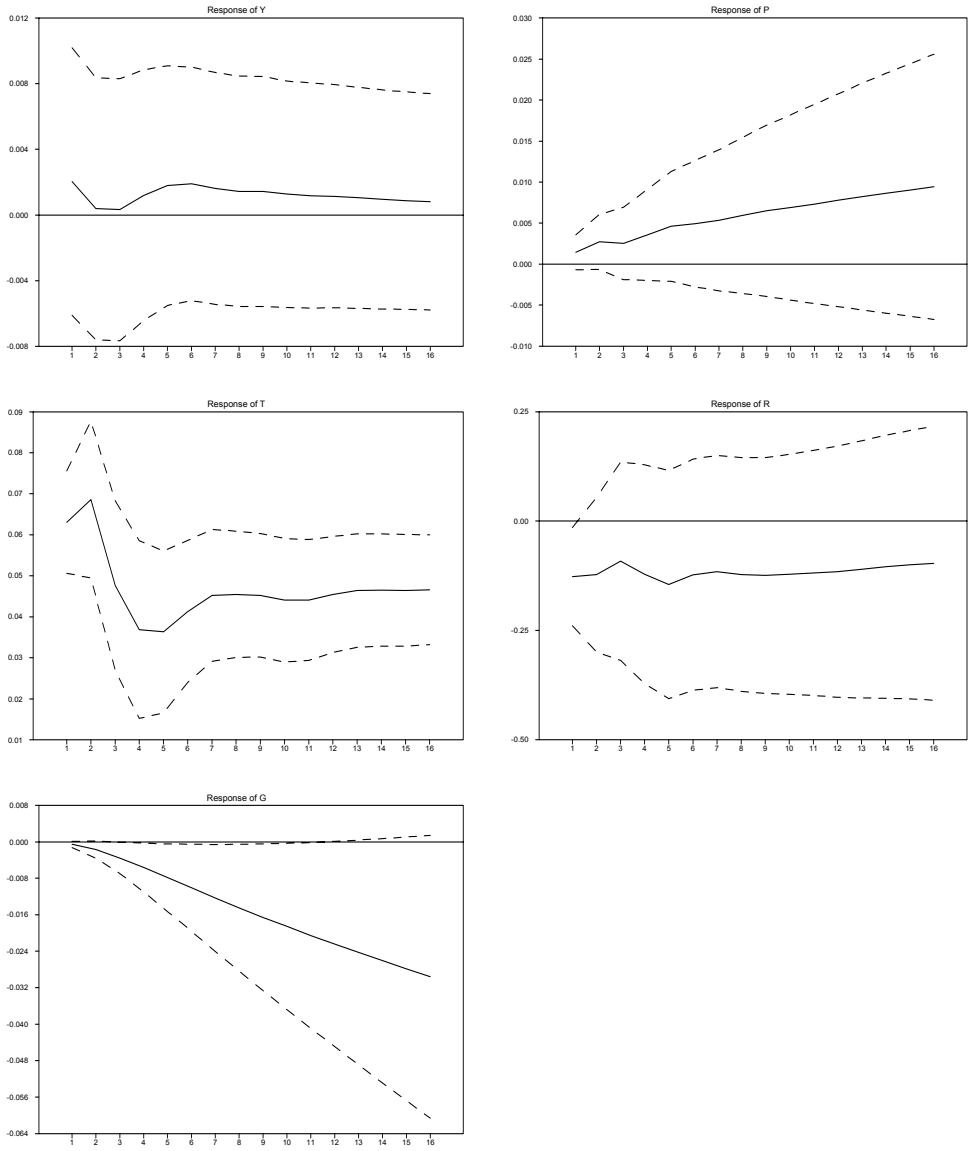


Figure 2.2
The effects of corporate taxes (figure continued)

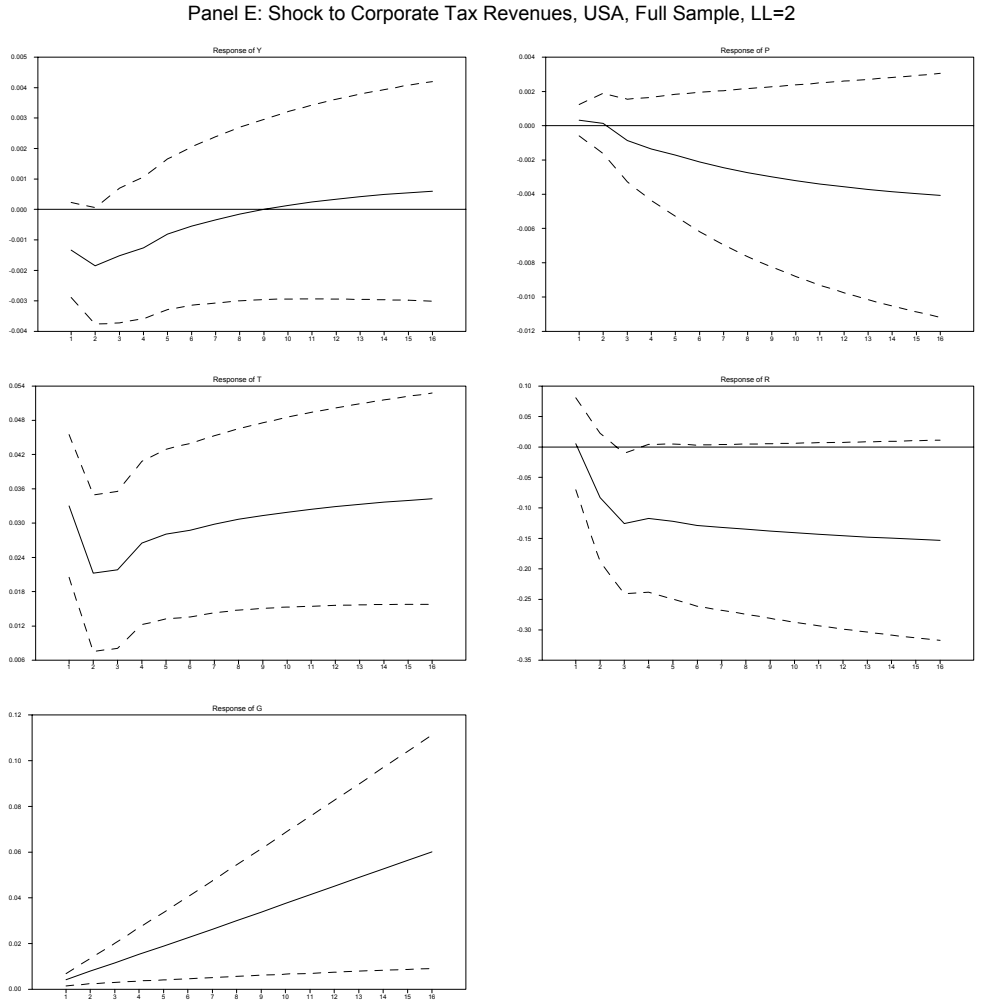


Figure 2.2
The effects of corporate taxes

2.3.3. The Effects of Indirect Taxes

Figure 2.3 displays the impulse response functions of model variables to a one standard deviation positive shock to indirect tax revenues. Indirect tax innovations are accompanied by a significant decrease in output in Canada, Italy, and the U.S., while the response of output is positive in France. In Germany, we initially observe a significant decrease in GDP; however, this initial response becomes significantly positive after sixth

quarter. The magnitude of indirect tax multipliers are once again small, as a one percent increase in indirect tax revenues cause a less than 0.5 percent change (in absolute value) in output. Finally, indirect tax innovations are followed by insignificant changes in the price level in most cases. Out of the five countries in our sample, indirect tax shocks cause a decrease in interest rate in three countries, while the response of interest rate is insignificant in the remaining two.

Impulse response functions of output, price level, long-term government bond yield, the tax revenues itself and government expenditures to a one standard deviation shock to indirect taxes are presented. Panels A through E present separate graphs for Canada, France, Germany, Italy and U.S.A. respectively

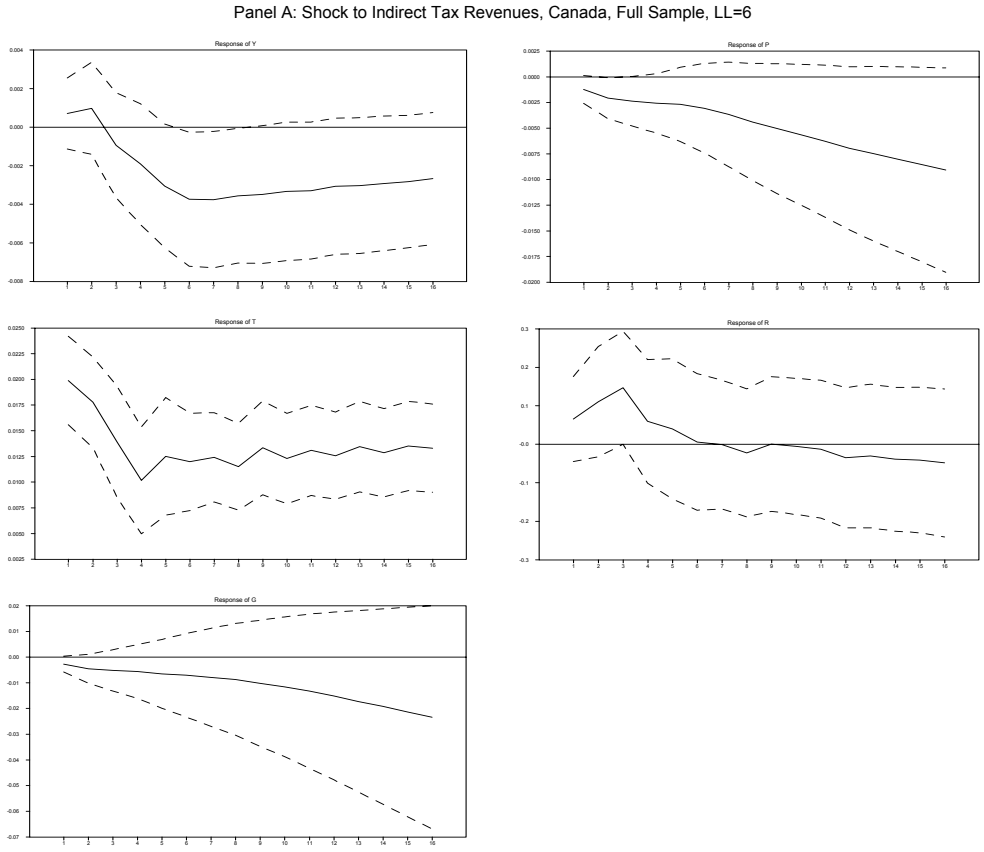


Figure 2.3
The effects of indirect taxes (figure continued)

Panel B: Shock to Indirect Tax Revenues, France, Full Sample, LL=4

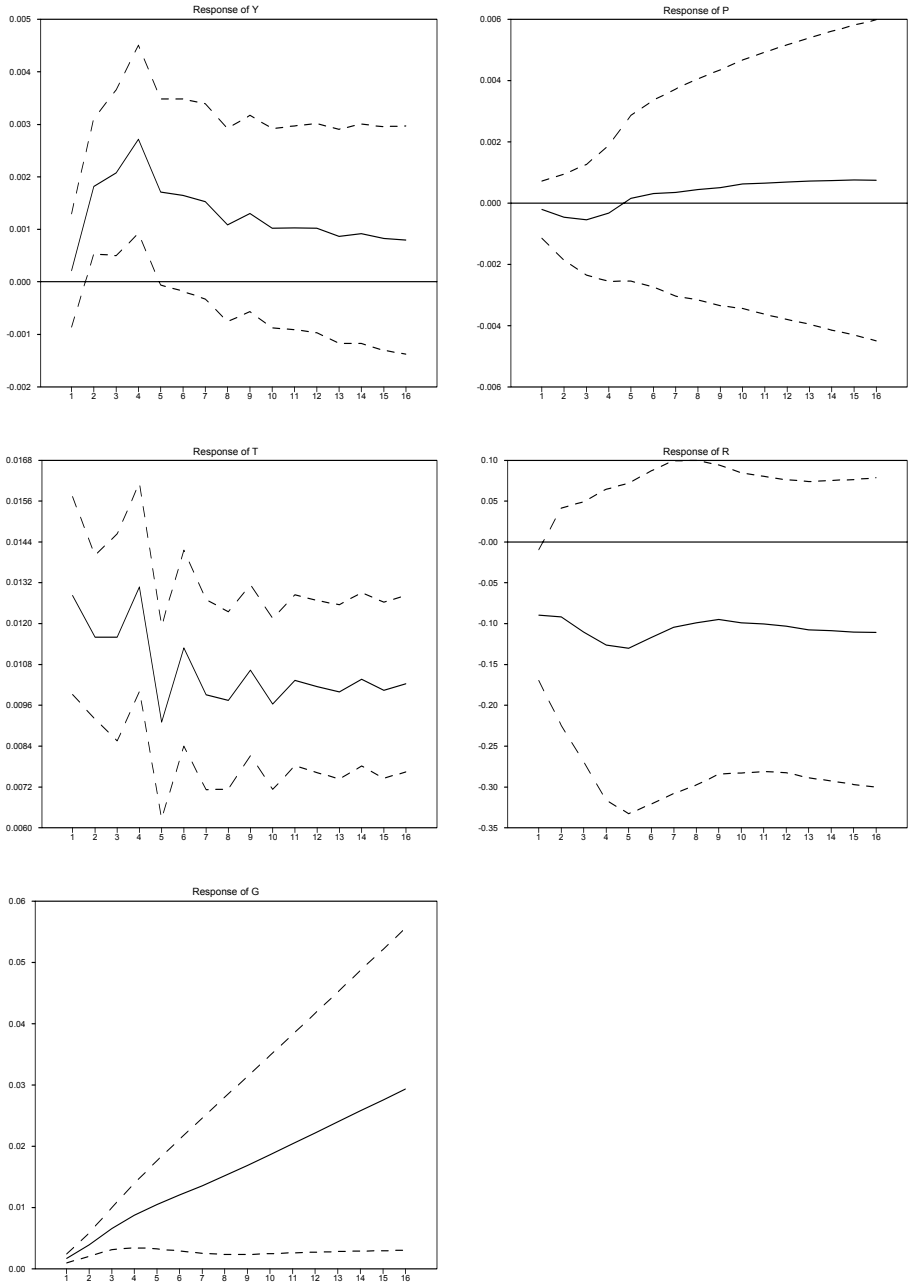


Figure 2.3
The effects of indirect taxes (figure continued)

Panel C: Shock to Indirect Tax Revenues, Germany, Full Sample, LL=7

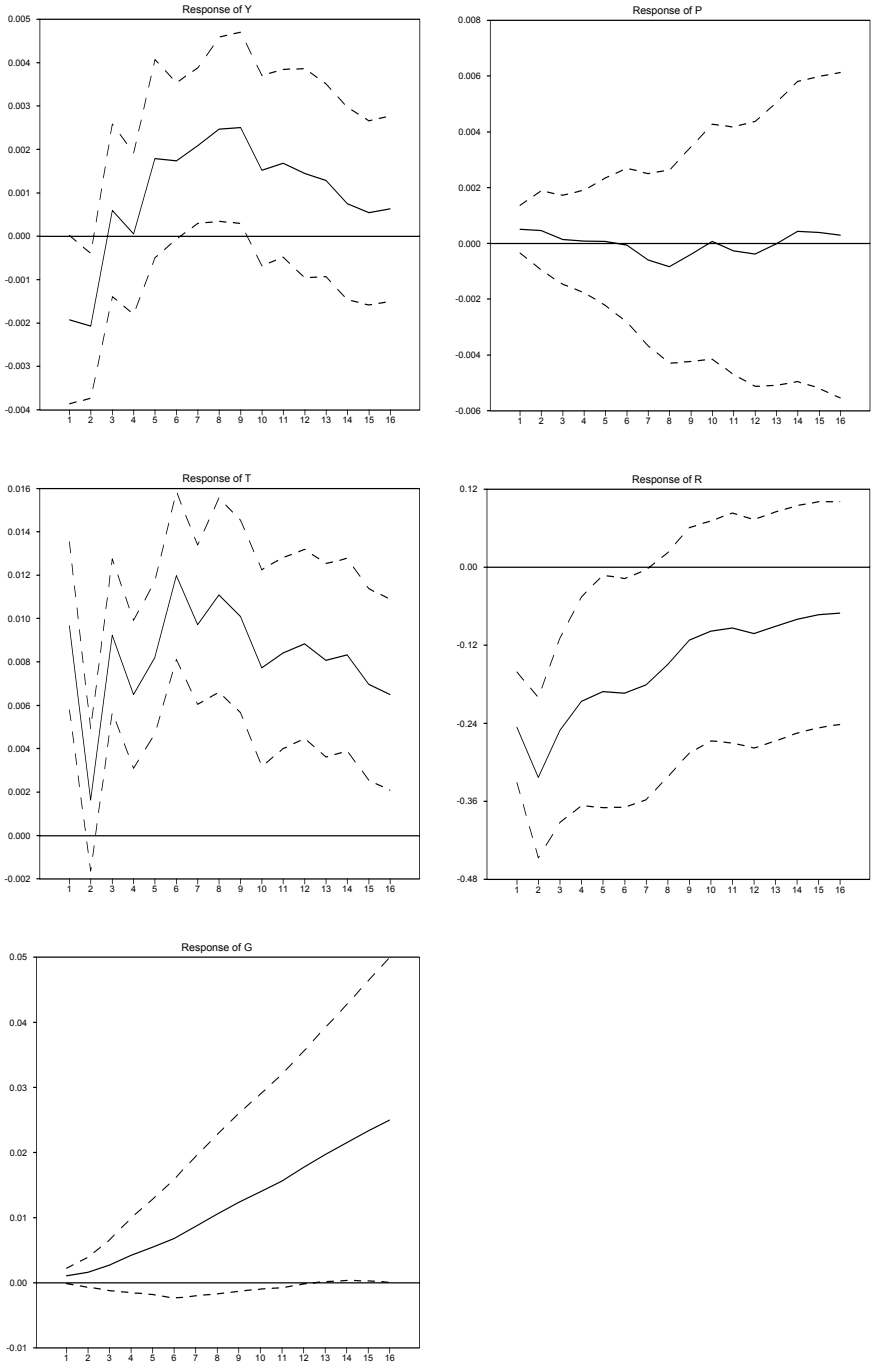


Figure 2.3
The effects of indirect taxes (figure continued)

Panel D: Shock to Indirect Tax Revenues, Italy, Full Sample, LL=8

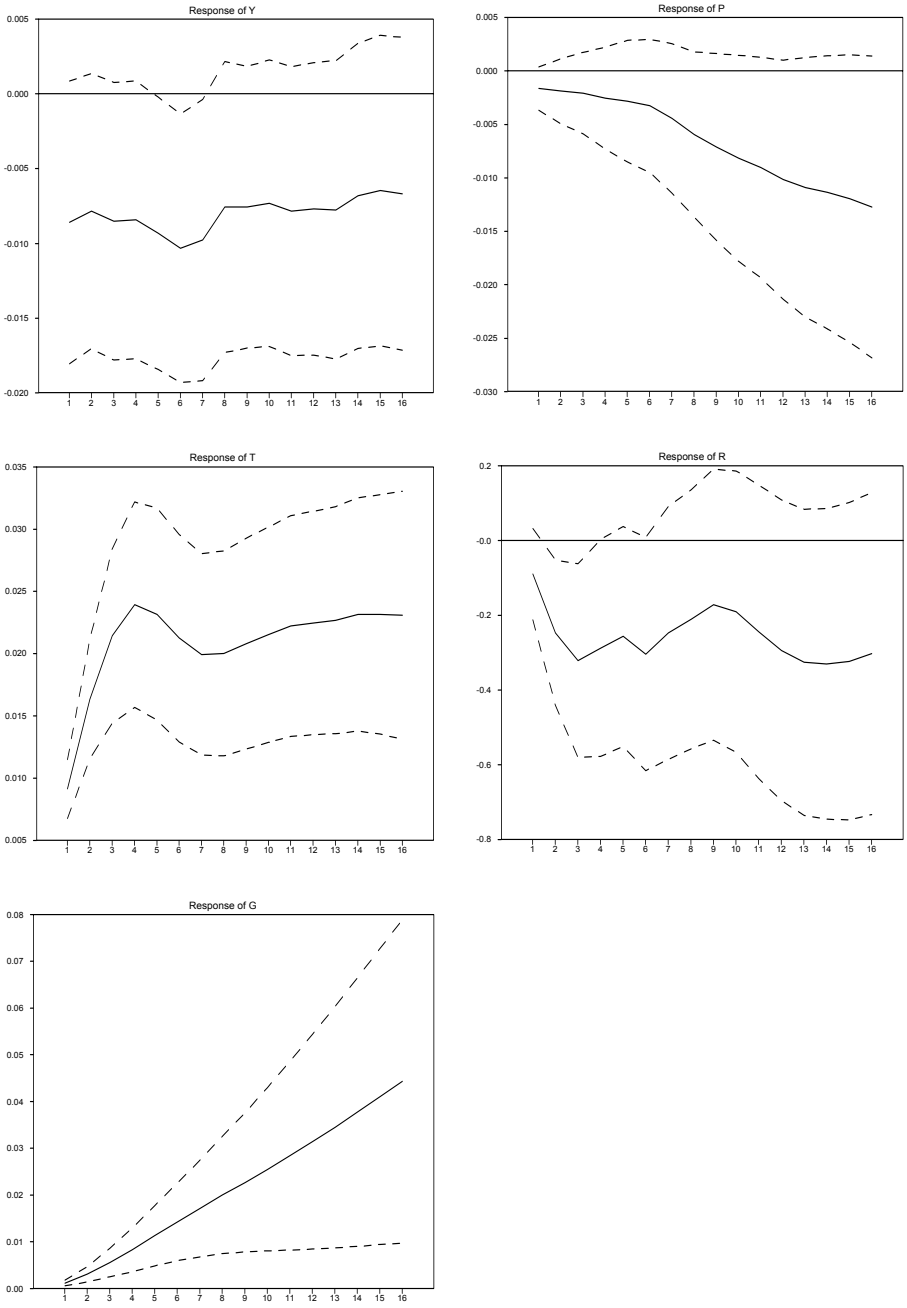


Figure 2.3
The effects of indirect taxes (figure continued)

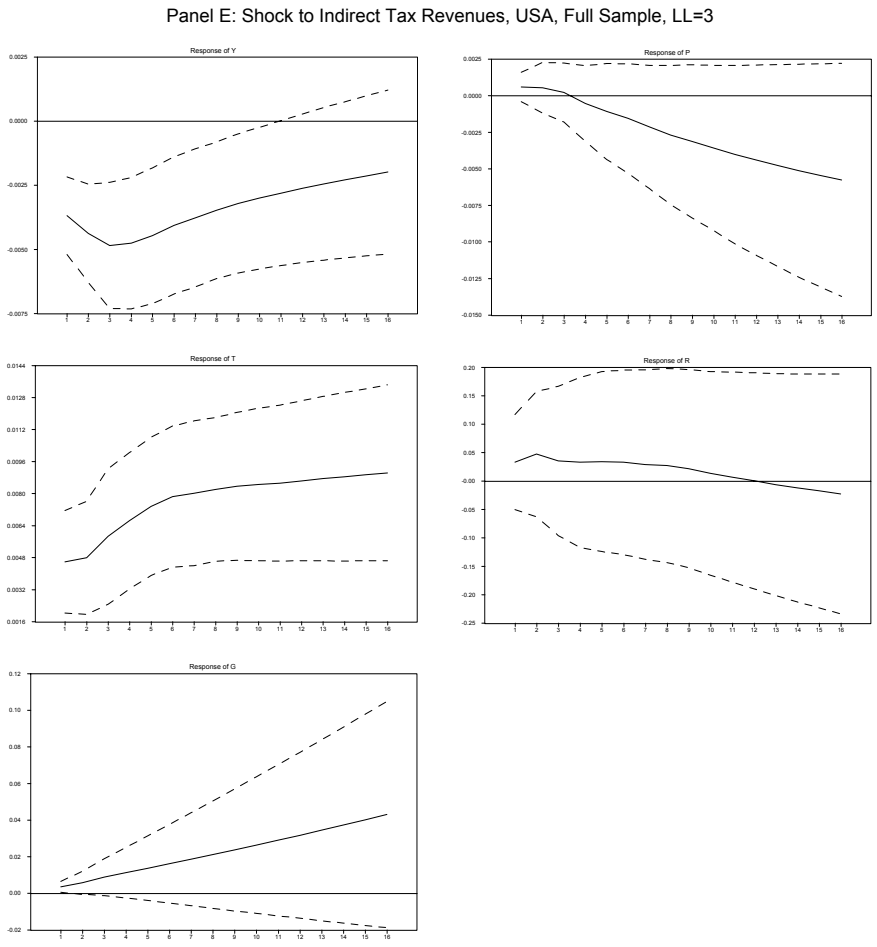


Figure 2.3
The effects of indirect taxes (figure continued)

2.3.4. The Effects of Social Security Taxes

Figure 2.4 presents the impulse response functions of model variables to a positive one standard deviation shock to social security tax revenues. Social security tax innovations are accompanied by significant decreases in France, Germany, Italy and the U.S. while the response of government expenditures is insignificant in Canada. It seems like social security tax innovations are associated mostly with contractionary government

policy actions in the G-7 countries. However, the impact of social security tax innovations on output is insignificant in all 5 countries in our sample. Social security tax shocks also lead to insignificant changes in the price level, with the exception of France in which the price level rises significantly after the tax shock. We observe a temporary positive response of the interest rate in all European countries in our sample, while there is an insignificant response in the U.S and Canada.

Impulse response functions of output, price level, long-term government bond yield, the tax revenues itself and government expenditures to a one standard deviation shock to social security taxes are presented. Panels A through E present separate graphs for Canada, France, Germany, Italy and U.S.A. respectively

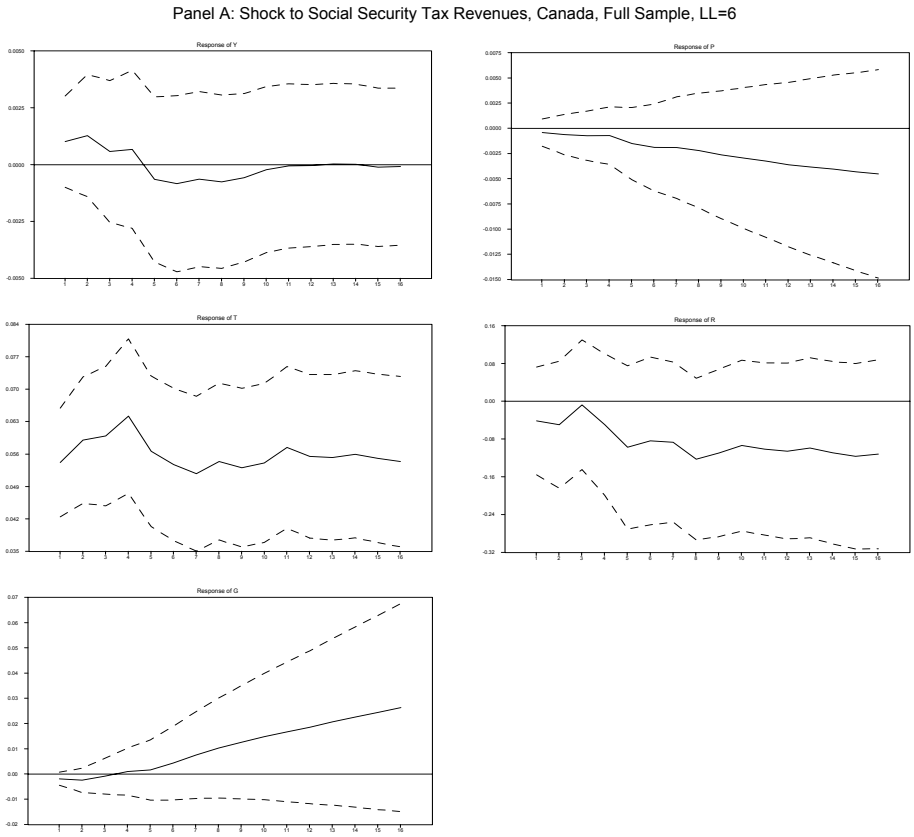


Figure 2.4
The effects of social security taxes (figure continued)

Panel B: Shock to Social Security Tax Revenues, France, Full Sample, LL=2

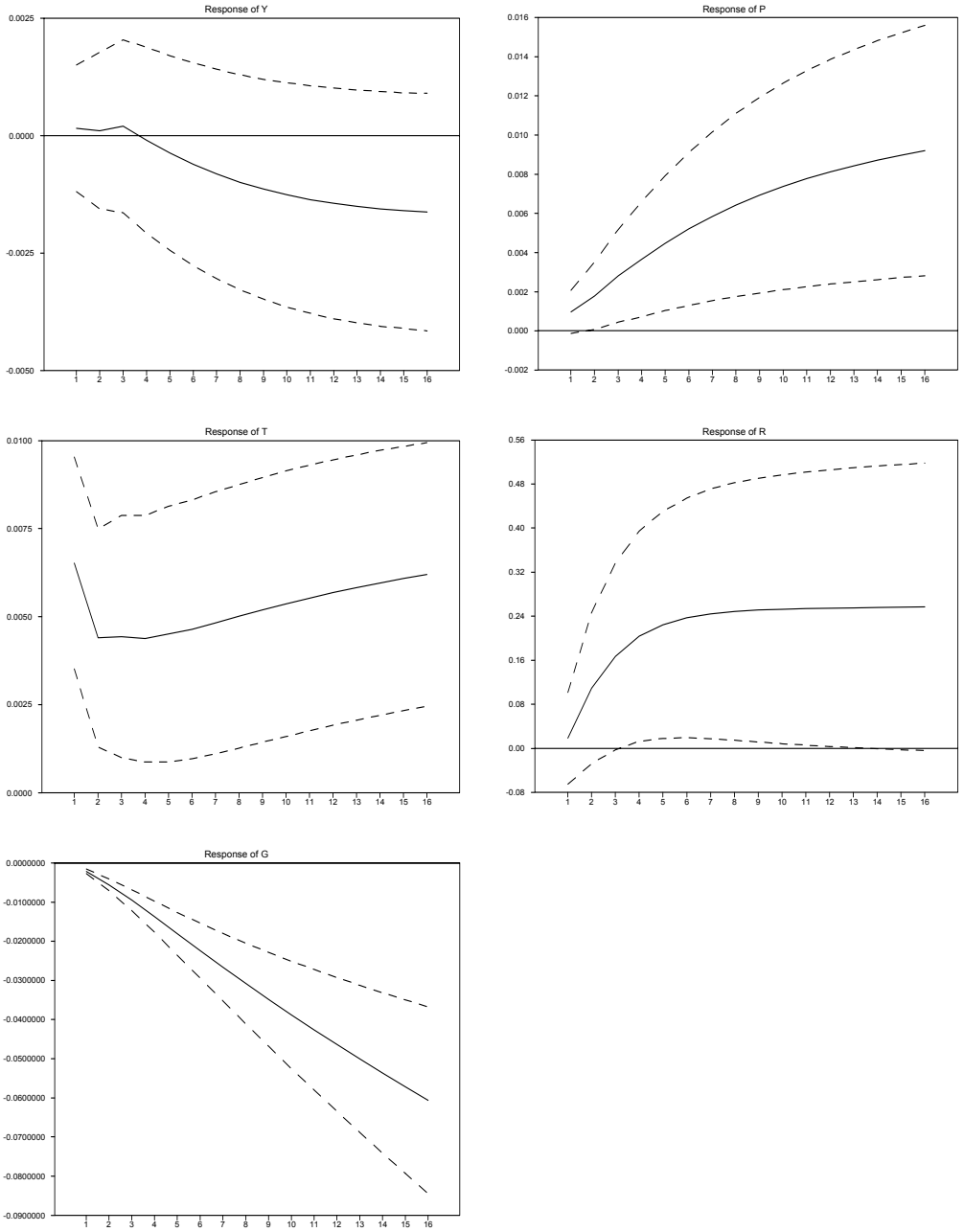


Figure 2.4
The effects of social security taxes (figure continued)

Panel C: Shock to Social Security Tax Revenues, Germany, Full Sample, LL=7

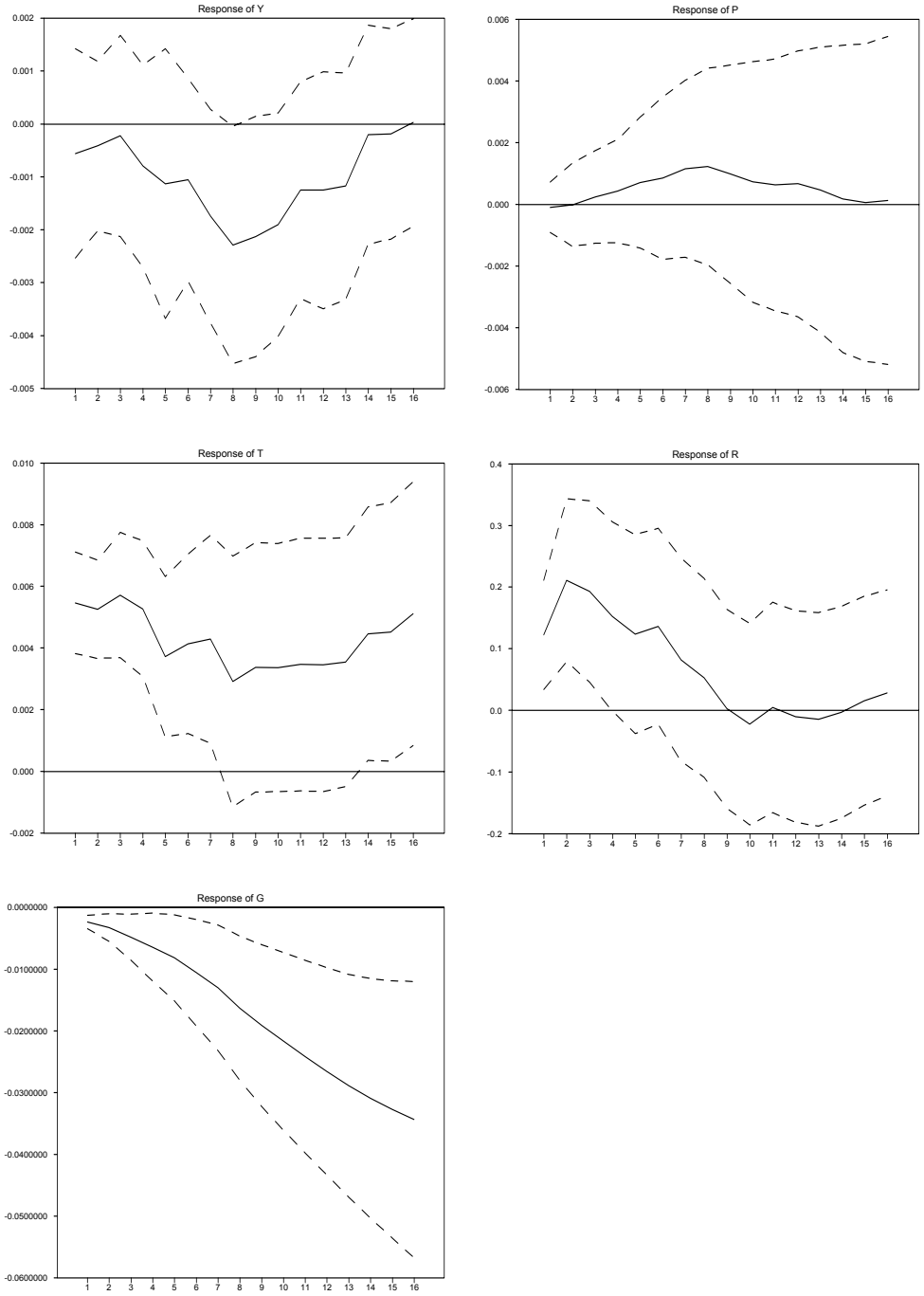


Figure 2.4
The effects of social security taxes (figure continued)

Panel D: Shock to Social Security Tax Revenues, Italy, Full Sample, LL=3

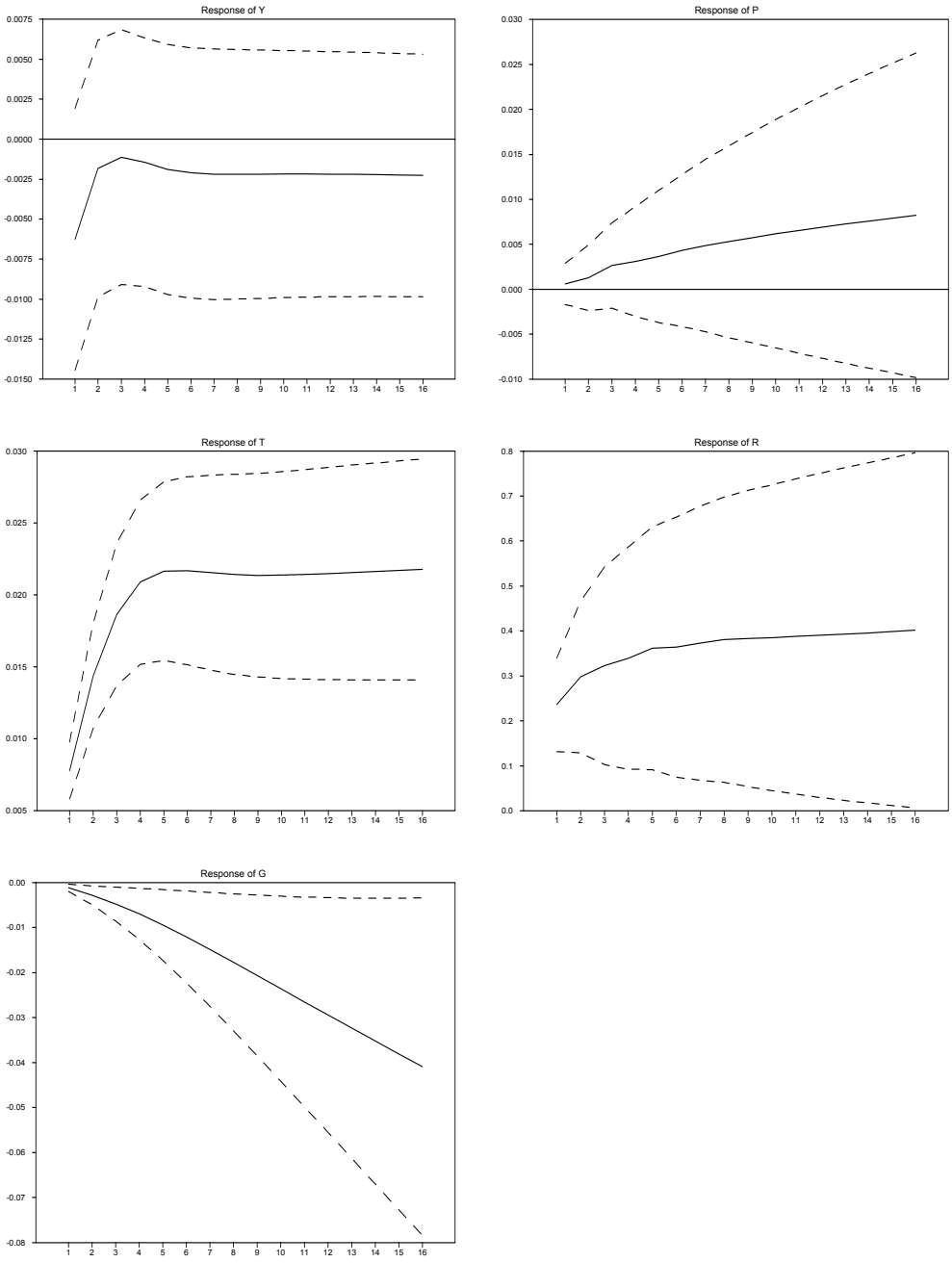


Figure 2.4
The effects of social security taxes (figure continued)

Panel E: Shock to Social Security Tax Revenues, USA, Full Sample, LL=7

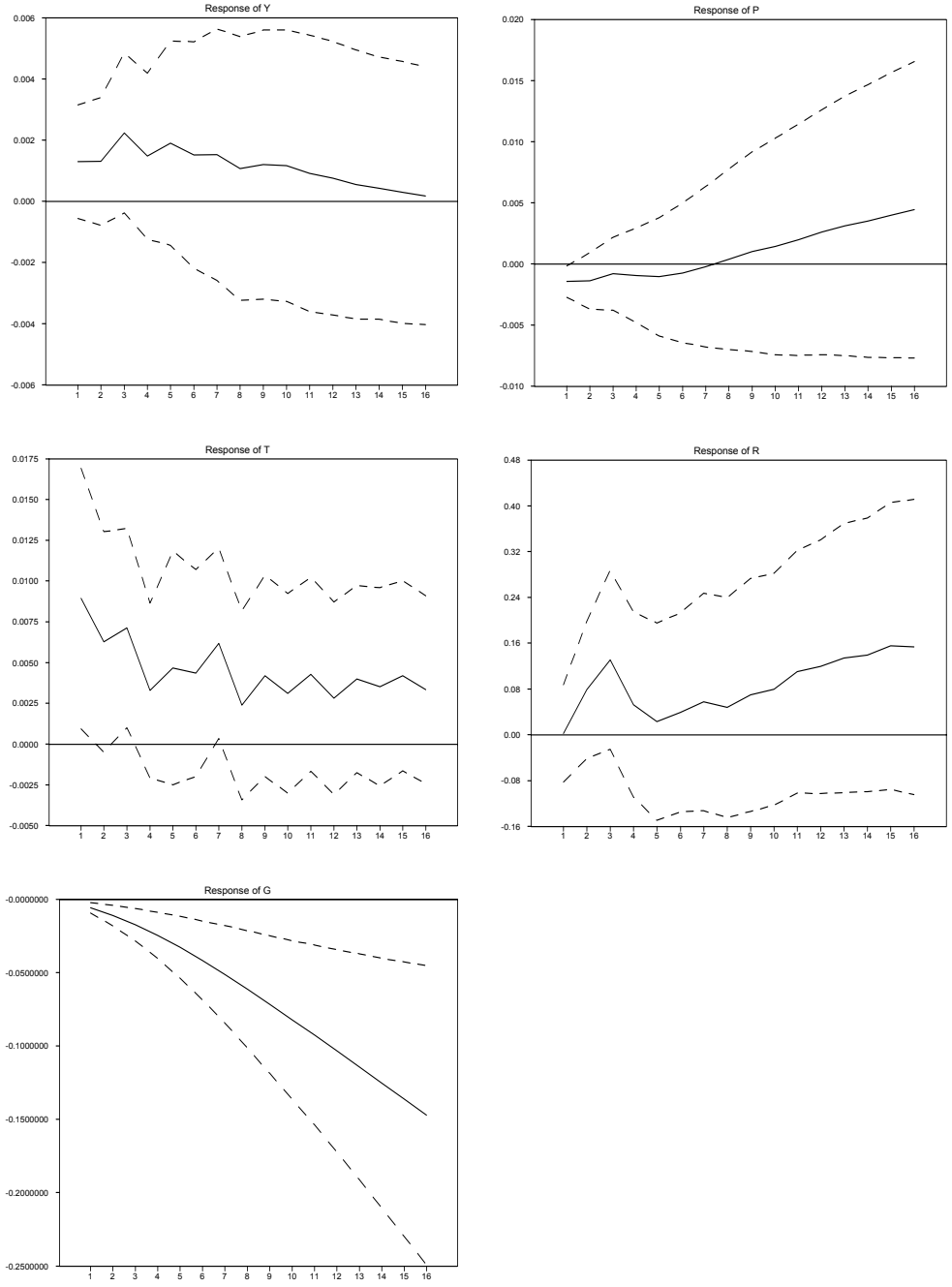


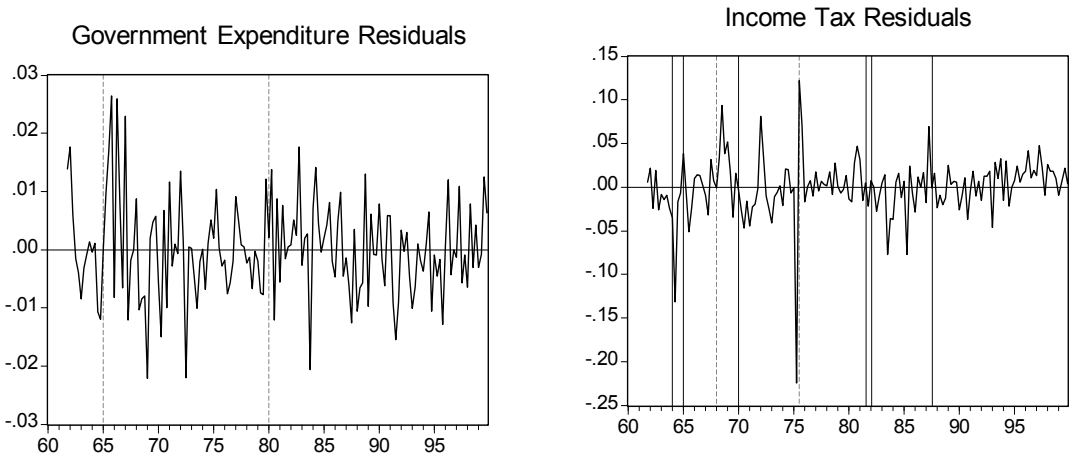
Figure 2.4
The effects of social security taxes

2.4. Residual Analysis

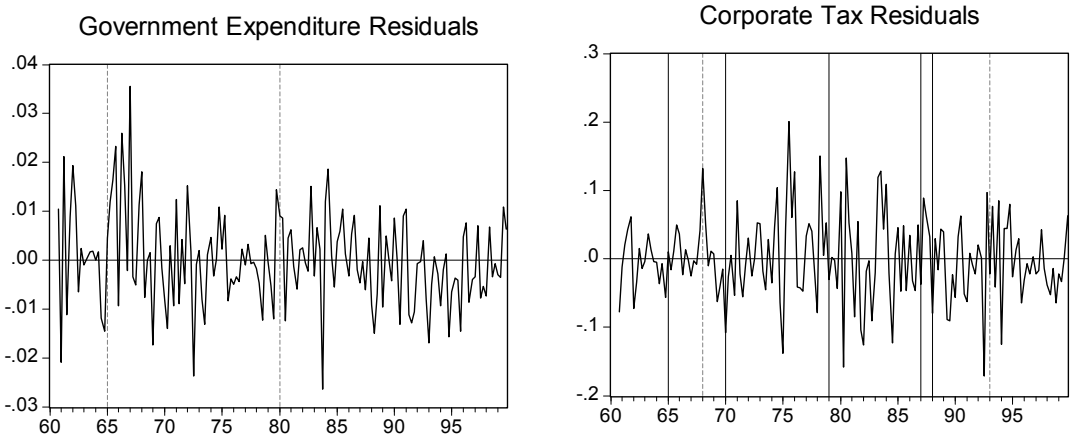
Do estimated shocks make sense? As the history of tax policy is most well known for the U.S., we compared the estimated shocks with the dates of actual policy changes. Figure 2.5 displays the residual analysis for the U.S.

Figure 2.5
Residual Analysis for U.S.A.

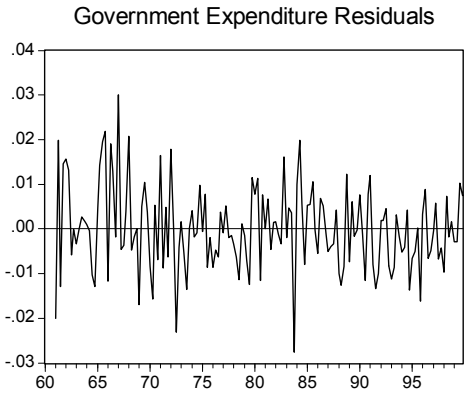
Panel A: Model with Income Taxes

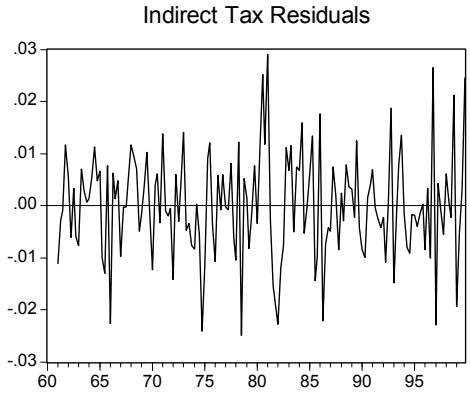


Panel B: Model with Corporate Taxes

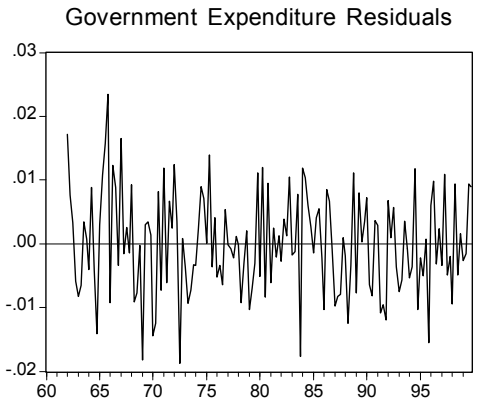


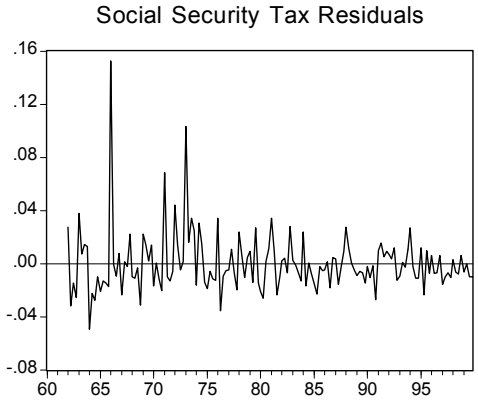
Panel C: Model with Indirect Taxes





Panel D: Model with Social Security Tax Revenues





The top income tax rate in the U.S has been reduced in the following years: 1964 (from 91% to 77 %), 1965 (from 77% to 70%), 1970 (77 to 71.75%), 1981 (70% to 69.13%), 1982 (69.13% to 50%). and 1987 (50% to 38.5%). All of these policy changes are captured by our estimated shocks. In addition, we managed to capture the tax resurges of 1968 and 1975. When we look at the corporate tax shocks, our estimated shocks capture the corporate tax rate cuts of 1965 (top rate was decreased from 50% to 48%), 1970 (52.8 % to 49.2 %), 1979 (48% to 46%), 1987 (46% to 40%) and finally 1988 (40%

to 34%). We also capture the increases in the corporate tax rate, 1968 (48% to 52%) and 1993 (top rate was increased from 34% to 35%). However, the biggest estimated negative shocks (1975 and 1992) do not coincide with actual policy changes.

2.5. Conclusion

A consensus does not exist on the effects of fiscal policy because of the scant and mixed empirical evidence, and the cross-country variation among fiscal multipliers provided by studies like van Aarle et al. (2001) and Perotti (2002). The results in this chapter show that different tax groups have different effects on the economy, so the composition of the tax innovation is as important as – if not more important than – the magnitude of the overall tax response.

Our empirical results show that there is no evidence of positive tax multipliers for "distortionary" taxes (in an intertemporal sense), which may interfere with the labor/leisure decisions of individuals. We have this result with three different identification schemes, namely, contemporaneous restrictions, long-run restrictions, and with a structural model. On the contrary, there is no evidence of negative tax multipliers for corporate taxes with the three identification schemes used in this dissertation. Although it is true that OECD countries react differently to tax policy innovations, the cross-country heterogeneity is comparatively lower for income, corporate, and social security taxes. Indirect tax innovations, on the other hand, exhibit a huge cross-country variation. Although we find negative and positive tax multipliers for social security tax innovations with contemporaneous restrictions, we do not find any evidence of any significant effects of social security tax innovations on output with long-run restrictions.

TABLE 2.1:
Panel A: Definition and Data Source for the Variables Used[18]

Variable	Definition	Data Source
Income Taxes	Direct Taxes on Households	OECD Economic Outlook
Corporate Taxes	Direct Taxes on Businesses	OECD Economic Outlook
Indirect Taxes	Sales Taxes, Taxes on Goods and Services	OECD Economic Outlook
Social Security Taxes	Social Security Contributions Received by the Government	OECD Economic Outlook
Government Expenditures	Government Purchases, Subsidies ,Wages and Transfers.	OECD Economic Outlook
Real GDP	Gross Domestic Product of the Country calculated at 1995 Prices	IMF Financial Statistics
CPI	Consumer Price Index	IMF Financial Statistics
Long-Term Interest Rate	Interest Rate on Long-term Government Bonds	IMF Financial Statistics

Panel B: Data Range for the Variables Used

Variable	CAN	FRA	GER	ITA	U.S.A.
Income Taxes	1961:1-1999:4	1963:1-1999:4	1968:1-1989:4	1960:1-1999:4	1960:1-1999:4
Corporate Taxes	1961:1-1999:4	1963:1-1999:4	1968:1-1989:4	1960:1-1999:4	1960:1-1999:4
Indirect Taxes	1961:1-1999:4	1963:1-1999:4	1971:1-1989:4	1960:1-1998:4	1960:1-1999:4
Social Security Taxes	1961:1-1999:4	1963:1-1999:4	1968:1-1989:4	1960:1-1999:4	1960:1-1999:4
Government Expenditures	1961:1-1999:4	1963:1-1999:4	1968:1-1989:4	1960:1-1999:4	1960:1-1999:4
Real GDP	1961:1-1999:4	1970:1-1999:4	1968:1-1989:4	1960:1-1999:4	1960:1-1999:4
CPI	1961:1-1999:4	1963:1-1999:4	1968:1-1989:4	1960:1-1999:4	1960:1-1999:4
Long-Term Interest Rate	1961:1-1999:4	1963:1-1999:4	1968:1-1989:4	1960:1-1999:4	1960:1-1999:4

[18] All variables are in national currencies. For countries in the EMU area, national currencies are Euro.

CHAPTER 3
FISCAL POLICY, PRIVATE INVESTMENT AND ECONOMIC GROWTH: EVIDENCE FROM G-7 COUNTRIES

3.1. Introduction

According to the neoclassical growth model (Solow (1956), Swan (1956)), government policy does not have any long-run effect on economic growth. However, in endogenous growth models some fiscal policy instruments are harmful for growth while others are not (Barro (1990), Lucas (1990)). The empirical evidence on the effects of fiscal policy on growth is also scant and mixed. Many cross-country studies like Easterly and Rebelo (1993) and Mendoza et al. (1997) find that long-run growth rates do not respond to taxation. In contrast, Widmalm (2001) finds a negative effect of income tax on growth, by using pooled cross-sectional data for 23 OECD countries. From time-series data over 100 years for United States and United Kingdom, Kocherlakota and Yi (1997) find that when both a tax variable and a public capital variable are included in the regression, fiscal variables are found to be significant determinants of growth. Using a panel of 22 OECD countries, Kneller, Bleaney and Gemmell (1999) contend that distortionary taxation reduces growth whereas non-distortionary taxation does not, and productive government expenditure enhances growth, while non-productive expenditure does not.

However, cross-section studies cannot control for the country-specific effects, and time series studies cannot satisfactorily control for time-specific effects. In addition, fiscal variables used in previous studies may not reflect the actual stance of fiscal policy, because of the mutual causality between these variables and output. Government budget deficit automatically increases during recessions, due to the decrease in tax revenues and

the increase in government expenditures. Similarly, during an economic boom, when more taxes are collected and transfer payments fall, budget deficits fall. Evidently, this stabilizing property is stronger when the tax system is more progressive (van den Noord, 2000). For this reason, the size of the actual deficit is not a reliable measure of the current fiscal policy. (de Leeuw and Holloway (1982, 1983), Holloway (1984, 1986) and Eisner (1986)). In a similar manner, individual fiscal variables not isolated from the effects of cyclical movements do not reflect the true magnitude of the fiscal policy applied by policymakers. The literature on growth generally uses 5-year averages of economic variables in order to remove the effects of short-run factors (Kneller, Bleaney Gemmell (1999)). However, alternative methods to remove the effects of short-run factors from fiscal variables have been proposed in the literature. The cyclically adjusted budget (structural budget) is what the government budget stance would be after the automatic responses of receipts and expenditures to economic fluctuations are removed (de Leeuw and Holloway (1982, 1983), Holloway (1984, 1986), Eisner (1986) and van den Noord (2000)). Since the use of cyclically adjusted variables can increase the accuracy of empirical results, it is an important extension of the previous literature.

This chapter uses annual structural (cyclically adjusted) estimates for six different fiscal policy variables defined according to OECD Revenue Statistics: Government Expenditures, Capital Outlays, Income Tax Revenues, Corporate Tax Revenues, Indirect Tax (Consumption Tax) Revenues, and Social Security Tax Revenues. The definitions of all the variables used in the analyses are presented in Table 3.1. Then, by using these estimates as a percentage of GDP, the effects of fiscal policy on the economic growth rate

are estimated. We also check the robustness of our results by using 5-year averages of cyclically unadjusted variables.

In the previous literature, generally an aggregate tax variable is used. However, economic theory suggests that different tax groups may have different effects on the economy. For instance, Atkinson and Stiglitz (1980) develop a basic intertemporal model to show that income taxes and consumption taxes have different effects on the household saving decision. Peretto (2001) argues that only a tax on household asset income has an effect on the steady-state growth rate of income per capita. The results in our chapter, also suggest that different tax groups have different effects on the steady-state growth rate, and thus, should not be aggregated in empirical studies. It is shown that increases in income tax revenues are associated with declining growth rates. The results are robust to the use of annual cyclically adjusted or 5-year averages of cyclically unadjusted variables. We also show that when the government wage bill is included in government expenditures, the spending side has distortionary effects on growth. This result is consistent with the recent literature that emphasizes the non-Keynesian effects of fiscal policy through the labor market, profits and private investment. Finally, we show that government expenditures and income taxes actually retard growth by decreasing private investment.

The following section presents the data and methodology used in calculating structural estimates. Section 3.3. provides the theoretical framework. Section 3.4 presents the results of growth regressions. Section 3.5 concludes.

3.2. Estimating Structural Fiscal Variables

The raw data used in this chapter was obtained from the OECD Economic Outlook database. The data includes annual values of government expenditures, capital outlays, income tax, corporate tax, indirect tax and social security tax revenues for the G-7 countries from 1965 to 2000. All variables are in national currencies and for the EMU area all statistics are in Euro. The shares of these variables in GDP have been calculated by dividing nominal values of fiscal variables by their respective nominal GDP levels. In order to find the per capita real GDP growth and real GDP growth statistics, nominal GDP figures are deflated by using respective GDP deflator series obtained again from OECD Economic Outlook Database.

van den Noord (2000) uses the following methodology; the structural component of the budget is estimated by subtracting the cyclical components of tax revenues and government expenditures from their actual levels.

$$bs = ba - bc, \qquad (3.1)$$

where,

bc = cyclical component of the budget balance,

bs = structural component of the budget balance (ratio to the potential output),

ba = actual budget balance (ratio to the potential output).

The structural component of the budget also equals to:

$$b^s = \frac{\sum T_i^* - G^* + X}{Y^*}, \qquad (3.2)$$

where

T_i^* = structural component for the i^{th} category of tax,

G^* = structural current primary government expenditures,

X = net capital outlays[19],

Y^* = level of potential output,

and

$$\frac{T_i^*}{T_i} = \left(\frac{Y^*}{Y}\right)^{\alpha_i}, \tag{3.3}$$

$$\frac{G^*}{G} = \left(\frac{Y^*}{Y}\right)^{\beta}, \tag{3.4}$$

where

α_i = elasticity of i^{th} category of tax with respect to output for categories of corporate tax, personal income tax, social security tax and indirect tax.

β = elasticity of current government expenditure with respect to output.

From (1) and (2), the cyclical component of the budget can be found as:

$$b^c = \frac{\sum_{i=1}^{4} T_i - G + X}{Y} - \frac{\sum T_i^* - G^* + X}{Y^*} \tag{3.5}$$

Substituting (3) and (4) into (5) yields:

[19] Net capital outlays include revenue and expenditure items that are not considered "cyclical". For instance, net capital outlays comprise revenue items, which are not considered as recurrent such as notably IMF support. In practice this item is zero or very small for most countries. However, capital expenditure can be cyclical. The reason why they are not adjusted for the cycle is that they should be considered as discretionary and therefore are to be included in the fiscal stance indicator (i.e. cyclically adjusted balance). It also includes interest expenditures that are not cyclically adjusted because the impact of the cycle on this item is found to be small.

$$b^c = \frac{T_i - G + X}{Y} - \frac{\sum_{i=1}^{4}\left(T_i\left(\frac{Y}{Y^*}\right)\right)^{\alpha_I}}{Y^*} + \frac{\left(\frac{Y}{Y^*}\right)^{\beta} G}{Y^*} - \frac{X}{Y^*}. \tag{3.6}$$

Therefore, the cyclical part of the budget will be equal to:

$$b^c = \frac{1}{Y}\sum_{i=1}^{4}\left[T_i - \left(\frac{Y}{Y^*}\right)\left(\frac{Y^*}{Y}\right)^{\alpha_i} T_i\right] - \frac{G}{Y} + \frac{Y}{Y^*}\frac{1}{Y}\left(\frac{Y^*}{Y}\right)^{\beta} G + \frac{X}{Y} - \frac{X}{Y}.\frac{Y}{Y^*} \tag{3.7}$$

Or,

$$b^c = \frac{1}{Y}\sum_{i=1}^{4}\left[T_i\left(1 - \left(\frac{Y^*}{Y}\right)^{\alpha_I - 1}\right)\right] - \frac{G}{Y}\left[1 - \left(\frac{Y^*}{Y}\right)^{\beta - 1}\right] + \frac{X}{Y}\left[1 - \left(\frac{Y^*}{Y}\right)^{-1}\right] \tag{3.8}$$

Here, the first term represents the cyclical part of the revenues, the second term is the cyclical part of the expenditures and the last term is the cyclical part of capital outlays.

The cyclically adjusted estimates for the four different types of taxes are obtained from OECD Economic Outlook database. The cyclically adjusted estimates for government expenditures and net capital outlays are calculated by using the methodology above.

The summary statistics for all cyclically adjusted and unadjusted variables are presented in Table 3.2. Summary statistics yield some interesting observations. Japan experiences the highest per capita real GDP growth while the share of income taxes, indirect taxes and government expenditures in GDP are the lowest for Japan among the seven countries in the sample. On the other hand, the highest percentage share of corporate taxes in GDP in our sample occurs also in Japan. The following sections try to

answer the question whether contractionary fiscal policy actions are accompanied by improving growth rates.

3.3. Theoretical Framework: What is distortionary and what is non-distortionary?

The difference in the impact of various tax groups can be explained by their impact on household saving behavior model presented by Atkinson and Stiglitz (1980). In the model, it is assumed that an individual who lives for T years, receives a wage income only in the first period, and has consumption expenditures in both periods. The model assumes that a proportional income tax is imposed on wage and non-wage income, or a proportional indirect tax is imposed on consumption. The model shows that the effects of these taxes on private savings will not be identical. A person who lives just two periods receives wage income only in the first period, thus, pays income tax in the first period. Under a consumption tax, however, he has to pay the consumption tax in both periods, so he has to save more in the first in order to pay tax in the second. Therefore, income taxes are assumed to have greater distortionary effects on savings, and therefore investment compared to indirect taxes.

In endogenous growth theory, distortionary taxation also affects the saving and investment decisions of agents with respect to physical and or human capital. However, as corporations are infinite-life institutions, taxes on corporate income do not interfere with the corporations' intertemporal investment decisions[20]. Although previous literature

[20] Neoclassical investment literature predicts a negative effect of corporate taxation on output. On the other hand, finance theory separates the investment decisions of firms from their financing decisions (Fisher, 1930). Since increases in corporate taxation, cause firms only to change their capital structure (prefer tax-deductible debt financing to taxable equity financing), due to fisher separation, it is not expected to affect their investment decisions, assuming that firms operate in perfect capital markets. Perfect capital markets are characterized by a large number of fully informed buyers and sellers none of whom have the power to influence market prices; the absence of market frictions such as fees and transaction costs, unanimity of opinion (homogenous expectations), perfectly competitive product and factor markets that are at equilibrium and costless and instantaneous market access for all participants (Megginson, 1997).

(Kneller et. al (1999)) considers social security taxes as distortionary, the Atkinson–Stiglitz model suggests that social security taxes may be non-distortionary in the sense that the person who pays social security taxes in the first period receives them as a benefit in the second. The empirical results in this chapter also provide evidence for this proposition. Income taxes are found to be harmful for growth, while corporate taxes, social security taxes and indirect taxes are not.

On the spending side, much attention has recently been directed towards the effects of government spending on private investment through labor market. In these models, an increase in public employment increases total labor demand and therefore creates wage pressure for the private sector (Finn (1998)), decreasing firm profits and business investment. Empirical evidence for these effects has been provided recently in Alesina et al (2002) by using a panel of OECD countries. Hence, a priori, we expect a negative effect of government expenditures on economic growth.

3.4. Empirical Results and Discussion

Previous literature emphasizes the inclusion of both an expenditure and tax variable in the growth regressions. Both Kocherlakota and Yi (1997) and Kneller et. al (1999) argue that failure to take into consideration the government budget constraint leads to improper specification of the estimated equation. Thus, in order to investigate the effects of structural fiscal policy variables on growth, the following model is used:

$$\text{Per Capita Real GDP Growth}_{j,t} = \beta_0 + \beta_1(X_{j,t}) + \beta_2(G_{j,t}) + \beta_i(T_{i,j,t}) + \varepsilon. \qquad (7)$$

where T_i corresponds to the i^{th} tax group, while G represents the government expenditures and X represents net capital outlays for country *j* at time *t*. In order to see the interaction between different fiscal policy variables and to avoid perfect multi-collinearity, all structural fiscal policy variables except one are used in each regression. In other words, for each specification, only one fiscal policy variable is excluded. It should be noted that, we do not consider the specification in which government expenditures are excluded as misspecified, since a public capital variable (capital outlays) is present. We initially considered both a two-way fixed effects and a two-way random effects model in order to be able to control for both country specific and time specific effects. We do not use any conditioning variables, except country and time dummies, almost all of which are significant in our specifications[21]. Both annual cyclically adjusted fiscal policy variables as a percentage of income, and 5-year averages of cyclically unadjusted variables as a percentage of income in different specifications are considered.

Table 3.3 presents the regression results when annual cyclically adjusted variables are used. Panel A presents the random effects estimation results, and Panel B represents the fixed effects estimation results. As the Hausman test results are always in favor of random effects estimations, we base our discussion on the results of random effects estimations[22]. The results, consistent with the endogenous growth models of Barro (1990), Lucas (1990) and Peretto (2001), suggest that taxes on household income have a negative and significant effect on the growth rate (Regressions 1, 2, 3 and 6), while other

[21] We are not able to use conditioning variables because of insufficient degrees of freedom, however, previous literature reports that the results are robust to exclusion of conditioning variables, like initial GDP, percentage of investment expenditures in GDP and population growth rate (Kneller et al (1997) and Widmalm (2001)). In addition, our sample includes only G-7 countries, a homogenous sample of countries similar in terms of initial GDP, fertility rate..etc.

[22] Hausman's (1978) specification tests the appropriateness of the random effects estimator. If one believes the model is correctly specified and the test returns significant results, this will provide evidence that the regressors are correlated with random effects.

taxes do not (Regressions 1,2, 4,5 and 6). On the spending side, we find a negative effect of government expenditures on economic growth, which is significant at 1% level in all regressions that include government expenditures. As the government expenditure variable used in the regressions include government wage bill, our results can be used to support theoretical models that emphasize the distortionary effects of government employment on private investment.

Results do not significantly change when we use the 5-year averages of cyclically unadjusted variables. The regression results for 5-year averages are reported in Table 3.4. Random effects estimation results are presented in Panel A, and fixed effects estimations results are presented in panel B. Once again, the Hausman test results were in favor of random effects estimations, except for the Regression 5. Once again, we provide evidence that higher income taxes are associated with declining growth rates. (Regressions 2 and 3, Panel A) As mentioned above government expenditures have also significant negative effects on growth in all the specifications used, and when government expenditures are excluded, social security taxes capture the negative effect.[23] The only difference between the regression that use cyclically adjusted variables and 5-year averages is with respect to capital outlays. Capital outlays are also found to be harmful for growth in all specifications.

We also investigate the effects of fiscal policy variables on private investment, as recent literature focuses on distortionary effects of fiscal policy on private investment. In order to get an elasticity measure, all variables in the regression (dependent variable:

[23] Government expenditures and social security taxes have a Pearson correlation coefficient of 0.3591 significant at one percent level, further strengthening this argument. This is not surprising, as our government expenditure variable includes the government wage bill, and as social security tax revenues also increase with government employment.

private investment as a percentage of GDP, independent variables: cyclically adjusted fiscal policy variables) are estimated in log-levels. Because of the mutual causality between indirect taxes and consumption (therefore investment), we instrumented indirect tax with its lag and used two stage least squares estimation. The results are presented in Table 3.5. As Hausman test results are consistently in favor of fixed effects estimations, we concentrate on fixed-effects estimations results this time. Once again, we find that both government expenditures and income taxes are harmful for private investment, which is consistent with our previous findings. When either of these variables is excluded from the regressions, the distortionary effect is captured by indirect taxes (Regressions 4 and 5, Panel A). We should also remind that because of the co-linearity between fiscal regressors, the actual effect of fiscal variables on growth and private investment may be larger than what is suggested by the estimated coefficients.

3.5. Conclusion

This study provides further evidence that fiscal policy does indeed matter for growth. Our results suggest that taxes on household income interfere with the labor/leisure choice of the individuals and create distortions for output growth whereas other tax groups do not. Previous literature generally either uses an aggregate tax measure or aggregates social security taxes with income taxes to create a labor tax measure. However, our results show that income taxes interfere with the individual's intertemporal labor-leisure decision, and create real distortions – therefore, income taxes are different than the rest of the taxes by nature. Consequently, different tax groups should be incorporated separately into empirical studies. Our results also suggest that the

composition of the fiscal response is more important than the overall magnitude in the determination of economic growth.

Consistent with recent theoretical and empirical literature, we find that when government wage bill is included in government expenditures, the spending side also has distortionary effects on private investment and growth. Perhaps surprisingly, the spending side has larger effects compared to the revenue side, in both magnitude and significance. More theoretical and empirical studies are needed to clarify the channels through which fiscal policy affects long-run growth.

Table 3.1
Definition of Variables[24, 25]

Fiscal Variable	Definition
Income Taxes	Direct Taxes on Households
Corporate Taxes	Direct Taxes on Businesses
Indirect Taxes	Sales Taxes, Taxes on Goods and Services
Social Security Taxes	Social Security Contributions Received by the Government
Government Expenditures	Government Purchases, Subsidies, Transfers and Wages
Capital Outlays	Government Fixed Capital Value Formation-Government Other Value Transactions-Net Capital Transfers Received-Government Consumption of Fixed Capital

[24] All variables are in national currencies. For countries in the EMU area, national currencies are Euro.
[25] Fiscal variables as a percentage of GDP are calculated by dividing nominal values for all fiscal variables by the nominal GDPs of respective countries.

Table 3.2
Descriptive Statistics (as a % of GDP except growth)

Panel A: Cyclically Unadjusted

Variable	N	Mean	Min	25%	Median	75%	Max
Capital Outlays	224	0.0232	-0.0129 (Germany)	0.0129	0.0218	0.0321	0.0594 (Japan)
Government Expenditure	245	0.1836	0.0983 (Japan)	0.1658	0.1845	0.2042	0.2447 (France)
Income Tax	245	0.0905	0.0363 (Japan)	0.0625	0.0982	0.1134	0.1721 (U.K)
Corporate Tax	224	0.0305	0.0070 (Italy)	0.0219	0.0310	0.0382	0.0620 (Japan)
Indirect Tax	224	0.1126	0.0619 (Japan)	0.0811	0.1199	0.1366	0.1731 (France)
Social Security Tax	224	0.1059	0.0202 (Canada)	0.0570	0.0928	0.1504	0.2083 (France)
GDP per capita growth	245	0.0225	-0.0958 (Germany)	0.0110	0.0232	0.0347	0.1061 (Japan)
Private Investment Ratio	245	0.1699	0.1191 (U.S.A)	0.1439	0.1711	0.1892	0.2483 (Japan)

Panel B: Cyclically Adjusted

Variable	N	Mean	Min	25%	Median	75%	Max
Capital Outlays	224	0.0232	-0.0129 (Germany)	0.0128	0.0218	0.0319	0.0600 (Japan)
Government Expenditure	245	0.1835	0.0972 (Japan)	0.1660	0.1850	0.2041	0.2406 (France)
Income Tax	227	0.0682	0.0025 (Italy)	0.0354	0.0637	0.1033	0.1481 (U.K)
Corporate Tax	224	0.0303	0.0073 (Italy)	0.0228	0.0301	0.0375	0.0609 (Japan)
Indirect Tax	210	0.0844	0.0064 (Italy)	0.0495	0.0788	0.1273	0.1749 (Italy)
Social Security Tax	210	0.0781	0.0071 (Italy)	0.0363	0.0655	0.1025	0.2131 (France)

Panel C: Five-Year Averages

Variable	N	Mean	Min	25%	Median	75%	Max
Capital Outlays	45	0.0231	-0.0015 (U.K)	0.0133	0.0221	0.0309	0.0535 (Japan)
Government Expenditure	49	0.1836	0.1014 (Japan)	0.1668	0.1844	0.2039	0.2369 (France)
Income Tax	49	0.0905	0.0377 (Japan)	0.0634	0.0968	0.1123	0.1450 (U.K)
Corporate Tax	45	0.0305	0.0097 (Italy)	0.0228	0.0323	0.0372	0.0558 (Japan)
Indirect Tax	45	0.1126	0.0656 (Japan)	0.0816	0.1201	0.1362	0.1654 (France)
Social Security Tax	45	0.1058	0.0211 (Canada)	0.0575	0.0928	0.1498	0.2061 (France)
Growth	49	0.0318	0.0102 (France)	0.0210	0.0307	0.0373	0.1110 (Japan)
GDP per capita growth	49	0.0224	-0.0114 (Germany)	0.0148	0.0198	0.0265	0.0962 (Japan)

Table 3.3
Fiscal Policy and Economic Growth, Cyclically Adjusted Variables

The dependent variable in the regressions is per capita annual real GDP growth. The time period covered is between 1965 and 2000. The fiscal policy variables used in the regressions are percentage shares in GDP. Cyclically adjusted fiscal policy variables have been used in order to remove the effects of short-run factors.

Panel A: Effects of Fiscal Variables on Per Capita Real GDP Growth, Random Effects Estimations

	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.1096***	0.1143***	0.1167***	0.0980***	0.0351***	0.1184***
	(6.27)	(5.99)	(6.46)	(5.77)	(4.66)	(6.04)
Capital Outlays	-0.1602	-0.1555	-0.1402	-0.0965	-0.2043	-
	(-1.27)	(-1.21)	(-1.14)	(-0.77)	(-1.57)	
Government	-0.4531***	-0.4763***	-0.4882***	-0.4081***	-	-0.5263***
Expenditure	(-4.78)	(-4.64)	(-4.86)	(-4.22)		(-5.00)
Income Tax	-0.1989**	-0.1412*	-0.2060**	-	-0.0741	-0.1852*
	(-2.12)	(-1.74)	(-2.13)		(-0.80)	(-1.89)
Corporate Tax	0.0516	0.1671	-	0.0803	0.1908	0.0346
	(0.36)	(1.27)		(0.53)	(1.29)	(0.23)
Indirect Tax	0.1369	-	0.1784*	0.1116	-0.0326	0.1435
	(1.45)		(1.74)	(0.12)	(-0.31)	(1.17)
Social Security	-	0.0491	-0.0345	-0.0283	-0.0923	0.0029
Tax		(0.76)	(-0.50)	(-0.39)	(-1.53)	(0.04)
Number of Cross-sections	7	7	7	7	7	7
Time Series Length	35	35	35	35	35	35
Hausman Test (p-value)	0.1444	0.1279	0.1031	0.4178	0.3954	0.1229
R^2	0.15	0.16	0.16	0.14	0.06	0.16

*significant at the 10% level
** significant at the 5% level
*** significant at the 1% level

Panel B: Effects of Fiscal Variables on Per Capita Real GDP Growth, Fixed Effects Estimations

	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.1138***	0.1278***	0.1264***	0.1115***	0.0315**	0.1282***
	(5.15)	(5.16)	(5.12)	(5.75)	(2.35)	(5.19)
Capital Outlays	-0.0703	-0.0294	-0.0099	0.0021	-0.1890	-
	(-0.52)	(-0.21)	(-0.07)	(0.02)	(-1.33)	
Government	-0.5131***	-0.6121***	-0.6070***	-0.5654***	-	-0.6198***
Expenditure	(-4.69)	(-4.52)	(-4.49)	(-4.41)		(-4.73)
Income Tax	-0.111	-0.1363	-0.1190	-	0.0566	-0.1275
	(-0.88)	(-1.13)	(-0.96)		(0.45)	(-1.03)
Corporate Tax	0.0206	0.0993	-	0.0726	0.0514	0.0991
	(0.12)	(0.67)		(0.41)	(0.27)	(0.57)
Indirect Tax	0.1046	-	0.0358	-0.0576	0.0191	-0.0131
	(0.99)		(0.31)	(-0.43)	(0.13)	(-0.09)
Social Security	-	0.1489	0.1261	0.1371	-0.1840*	0.1623
Tax		(1.58)	(1.08)	(1.09)	(-1.71)	(1.32)
Number of Cross-sections	7	7	7	7	7	7
Time Series Length	35	35	35	35	35	35
F test for no fixed effects	4.95***	5.56***	5.00***	5.72***	4.88***	5.10***
R^2	0.63	0.63	0.63	0.63	0.58	0.63

*significant at the 10% level
** significant at the 5% level
*** significant at the 1% level

Table 3.4
Fiscal Policy and Economic Growth: Cyclically Unadjusted Variables

The time period covered is between 1965 and 2000. The fiscal policy variables used in the regressions are percentage shares in GDP. Five year averages have been used in order to remove the effects of short-run cyclical factors.

Panel A: Effects of Fiscal Variables on Per Capita Real GDP Growth, Random Effects Estimations

	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.1014***	0.1246***	0.1245***	0.1161***	0.1064***	0.1059***
	(6.19)	(6.22)	(5.06)	(4.83)	(3.77)	(4.75)
Capital Outlays	-0.3296*	-0.4038**	-0.3851**	-0.2621	-0.4607**	-
	(-1.93)	(-2.09)	(-2.09)	(-1.52)	(-2.31)	
Government	-0.4319***	-0.3678***	-0.3878***	-0.4476***	-	-0.4208***
Expenditure	(-3.84)	(-2.93)	(-2.85)	(-3.52)		(-3.08)
Income Tax	-0.1678	-0.2461*	-0.2157*	-	-0.2880**	-0.1247
	(-1.63)	(-1.94)	(-1.69)		(-2.05)	(-1.05)
Corporate Tax	-0.0312	0.1274	-	-0.0326	0.0163	-0.0696
	(-0.18)	(0.63)		(-0.15)	(0.06)	(-0.31)
Indirect Tax	0.2066*	-	0.0898	0.0488	-0.0803	0.1452
	(1.84)		(0.55)	(0.27)	(-0.37)	(0.86)
Social Security Tax	-	-0.0751	-0.1307	-0.0975	-0.3809***	-0.0909
		(-0.80)	(-1.17)	(-0.85)	(-3.11)	(-0.88)
Number of Cross-sections	7	7	7	7	7	7
Time Series Length	7	7	7	7	7	7
Hausman Test (p-value)	0.6345	0.3890	0.4874	0.2674	0.0001	0.1269
R^2	0.42	0.45	0.47	0.39	0.37	0.41

*significant at the 10% level
** significant at the 5% level
*** significant at the 1% level

Panel B: Effects of Fiscal Variables on Per Capita Real GDP Growth, Fixed Effects Estimations

	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.0999***	0.1072***	0.1194***	0.1071***	0.1191***	0.1107***
	(3.23)	(3.60)	(3.71)	(3.78)	(3.46)	(3.13)
Capital Outlays	-0.3623*	-0.3841*	-0.3809*	-0.3415*	-0.4209**	-
	(-1.81)	(-1.95)	(-2.01)	(-1.84)	(-2.12)	
Government	-0.3914***	-0.2633	-0.2228	-0.2709	-	-0.2693
Expenditure	(-2.96)	(-1.55)	(-1.29)	(-1.64)		(-1.46)
Income Tax	-0.0529	-0.1583	-0.1427	-	-0.2336	-0.0263
	(-0.28)	(-0.81)	(-0.75)		(-1.24)	(-0.13)
Corporate Tax	0.1171	-0.0707	-	0.0182	0.0210	-0.0586
	(0.43)	(-0.31)		(0.07)	(0.08)	(-0.21)
Indirect Tax	-0.1497	-	-0.2067	-0.2474	-0.3225	-0.2197
	(-0.55)		(-0.91)	(-0.91)	(-1.20)	(-0.76)
Social Security	-	-0.3136	-0.3754	-0.2942	-0.5963***	-0.3141
Tax		(-1.22)	(-1.46)	(-1.20)	(-3.02)	(-1.13)
Number of Cross-sections	7	7	7	7	7	7
Time Series Length	7	7	7	7	7	7
F test for no fixed effects	2.41**	3.35***	2.58**	3.00***	4.00***	2.15**
R^2	0.77	0.78	0.79	0.78	0.77	0.76

*significant at the 10% level
** significant at the 5% level
*** significant at the 1% level

Table 3.5
Effects of Fiscal Variables on Private Investment: Cyclically Adjusted Variables

The time period covered is between 1965 and 2000. The fiscal policy variables used in the regressions are percentage shares in GDP. Both the independent and dependent variables are in log-levels. Cyclically adjusted fiscal policy variables have been used in order to remove the effects of short-run factors. Indirect taxes are instrumented with its lag. R-square statistics are not reported in some specifications because of the 2 stage least squares estimation.

Panel A: Effects of Fiscal Variables on Private Investment, Fixed Effects Estimations

(Everything in log-levels)

	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-3.2599***	-2.9003***	-3.1958***	-3.3166***	-2.0670***	-2.9314***
	(-24.59)	(-20.97)	(-17.38)	(-19.38)	(-19.13)	(-20.96)
Capital Outlays	0.0041	0.0039	0.0031	0.0034	-0.0077	-
	(0.38)	(0.35)	(0.29)	(0.31)	(-0.59)	
Government	-0.5374***	-0.5659***	-0.5440***	-0.5305***	-	-0.5265***
Expenditure	(-7.42)	(-8.13)	(-7.51)	(-7.22)		(-7.43)
Income Tax	-0.0927*	-0.1846***	-0.1017*	-	-0.0580	-0.0870
	(-1.81)	(-3.40)	(-1.76)		(-0.75)	(-1.40)
Corporate Tax	0.0134	0.0313	-	-0.0563	0.0230	0.0049
	(0.57)	(1.38)		(-0.27)	(0.83)	(0.22)
Indirect Tax	0.0500	-	-0.0567	-0.0941***	-0.1311***	-0.0728*
	(-1.33)		(-1.50)	(-2.90)	(-2.92)	(-1.95)
Social Security	-	0.0342	0.0432	-0.3594	0.0295	0.0485
Tax		(0.47)	(0.58)	(-0.61)	(0.33)	(0.67)
Number of Cross-sections	7	7	7	7	7	7
Time Series Length	35	35	35	35	35	35
F Test for no Fixed Effects	49.47***	7.79***	52.20***	61.25***	45.33***	64.43***
R^2	N/A	0.25	N/A	N/A	N/A	N/A

*significant at the 10% level
** significant at the 5% level
*** significant at the 1% level

Panel B: Effects of Fiscal Variables on Private Investment, Random Effects Estimations

(Everything in log-levels)

	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-2.9030***	-2.3786***	-2.6708***	-2.2785***	-1.3822***	-3.1393***
	(-15.28)	(-10.15)	(-15.37)	(-13.29)	(-12.68)	(-15.05)
Capital Outlays	0.0791***	0.1030***	0.0769***	0.0849***	0.0957***	-
	(5.77)	(6.41)	(5.23)	(5.44)	(5.88)	
Government	-0.5833***	-0.4877***	-0.4439***	-0.2783***	-	0.6518***
Expenditure	(-6.89)	(-5.29)	(-7.07)	(-4.21)		(7.32)
Income Tax	0.2107***	0.0251	0.1692***	-	0.0202	0.2335***
	(5.83)	(0.72)	(4.61)		(0.60)	(5.31)
Corporate Tax	-0.0830**	-0.1231***	-	0.0011	0.0772***	-0.0649*
	(-2.47)	(-3.36)		(0.03)	(2.78)	(-1.86)
Indirect Tax	-0.1914***	-	-0.2122***	-0.1014***	-0.1654***	-0.2386***
	(7.71)		(-7.58)	(-4.26)	(-5.23)	(-8.30)
Social Security	-	0.0745***	-0.0083	0.0496**	-0.0008	0.0257
Tax		(3.42)	(-0.38)	(2.41)	(-0.03)	(1.23)
Number of Cross-sections	7	7	7	7	7	7
Time Series Length	35	35	35	35	35	35
Hausman Test (p-value)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
R^2	N/A	0.55	N/A	N/A	N/A	N/A

*significant at the 10% level
** significant at the 5% level
*** significant at the 1% level

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