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INTERNATIONAL TRANSMISSION OF FISCAL SHOCKS
AN EMPIRICAL INVESTIGATION

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Abstract

This paper investigates how innovations in income taxes and government purchases originating in the U.S. affect the U.S. economy, and how these effects are transmitted to the Canadian economy. Using a semi-structural VAR model and data for both countries for the 1961:1-2004:3 period, we find that fiscal policy innovations originating in the U.S. are transmitted to the Canadian economy by international trade and capital flows through interest rate and exchange rate channels. Unanticipated shocks to U.S. government purchases have *beggar thy neighbor effects* on Canada. U.S. output increases and Canadian output decreases in response to a positive shock to U.S. government purchases. In response to an unanticipated increase in U.S. income taxes, U.S. output declines while U.S. and Canadian real interest rates rise. The response of Canadian output, however, is not significantly different from zero.

JEL Classification: F42, E20, H30

Keywords: Fiscal Policy, International Transmission, VAR models

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1. Introduction

As economies become more open to, and integrated with, the rest of the world by means of international trade and capital movements, shocks originating in one country are transmitted to other countries through various channels.

Literature on the international transmission of fiscal disturbances dates back to the Mundell-Fleming model and the modified versions of the Mundell-Fleming model developed by Mussa (1979), Branson and Rotemberg (1980), and Corden and Turnovsky (1983), among others. These models are basically static and have a Keynesian flavor. The more recent literature studies the international transmission of fiscal disturbances within the context of dynamic general equilibrium models based on micro foundations. Frenkel and Razin (1987), Buiter (1987), Razin (1990), Frenkel, Razin, and Sadka (1991), Turnovsky and Bianconi (1992), Baxter (1995), Roche (1996), Bianconi and Turnovsky (1997), and Mendoza and Tesar (1998) examine the international transmission of tax policies or government spending shocks using a two-country intertemporal general equilibrium framework.

Vector Auto Regressive (VAR) models have been used extensively to analyze the effects of monetary policy innovations and, more recently, the effects of fiscal policy innovations. Ramey and Shapiro (1998), Edelberg, Eichenbaum, and Fisher (1999), Yuan and Li (2000), Fatas and Mihov (2001), and Gali, Lopez-Salido, and Valles (2004) examine the dynamic response of the economy to government spending shocks. Blanchard and Perotti (2002), Perotti (2002), De Arcangelis and Lamartina (2003), and van Aarle, Garretsen, and Gobbin (2003) investigate the effects of shocks to taxes and government spending on the economy.

The empirical studies mentioned above improve our understanding of how fiscal shocks affect the economy but do not investigate how these shocks are

transmitted to other countries and how they affect those economies. The monetary and fiscal policies adopted in the U.S. have far reaching consequences which extend out beyond the borders of the U.S. The actions of the Federal Reserve are watched carefully by market participants and policymakers around the world, and the monetary policies adopted in the U.S. have short-term effects on the world economy. Fiscal policy actions, such as changes in marginal income tax rates and government purchases, also have worldwide effects.

Despite the presence of a significant number of theoretical studies analyzing the international transmission of fiscal disturbances and the presence of empirical studies analyzing the international transmission of U.S monetary shocks, there is a big gap in the empirical analysis of the transmission of fiscal shocks. The purpose of this paper is to fill this gap by investigating empirically the dynamic response of the U.S. and Canadian economies to fiscal policy shocks originating in the U.S., and analyzing how these shocks are transmitted to the Canadian economy. For this purpose we estimate a semi-structural two-country VAR model for the period 1961:1-2004:3.

We find that a positive innovation in U.S. government purchases initially increases U.S. output. The U.S. government expenditure innovations are transmitted to the Canadian economy by international trade and capital movements through interest rate and exchange rate channels. The Canadian real interest rate increases while the real exchange rate appreciates. Consequently, the Canadian GDP decreases. What we observe is a *beggar thy neighbor* effect on Canada. A positive shock to government purchases improves the U.S. GDP, but worsens the Canadian GDP. A positive innovation in U.S. income taxes raises the U.S. real interest rate and leads to a reduction in the U.S. GDP. The U.S. income tax innovations are transmitted to the Canadian economy, similarly by international trade and capital movements through

interest rate and exchange rate channels. The Canadian real interest rate rises and the real exchange rate depreciates. Due to offsetting effects of investment and the trade balance on the Canadian GDP, U.S. income tax innovations do not have a statistically significant effect on the Canadian GDP.

The remainder of the paper is organized as follows: Section 2 lays out some of the theoretical arguments surrounding the international transmission of fiscal policies. Section 3 explains the data and methodology used in this paper. Section 4 presents the empirical results. Section 5 introduces some checks for robustness, and Section 6 provides concluding remarks.

2. Theoretical Background

In Keynesian models the exchange rate plays a key role in the transmission of fiscal disturbances. For example, in a two-country model of the world economy a fiscal expansion at home leads to an appreciation of the exchange rate, which improves the current account of the foreign country and deteriorates that of the home country. Due to partial crowding-out at home, however, output increases both at home and abroad.

The international transmission of fiscal policies in general equilibrium models based on micro foundations is more complex. Assumptions related to whether the fiscal shock is permanent or temporary, whether international asset markets are complete or not, whether labor supply is fixed or variable, and assumptions on how government purchases are financed affect the outcomes of such models.

Baxter (1995), under the assumption that individuals can engage in consumption-smoothing, but not risk pooling (i.e., incomplete asset markets), and that prices are flexible, finds that a permanent increase in government purchases in the home country generates a negative wealth effect by reducing permanent income and

also leads to an increase in the real interest rate. The negative wealth effect leads to a decrease in consumption and leisure and an increase in labor input. The increase in the real interest rate generates an intertemporal substitution effect and leads to a secondary rise in labor input. When the rise in the real interest rate is transmitted to the foreign country, foreign labor input increases as well. The increase in labor input increases the marginal product of capital, which in turn leads to an increase in investment through the accelerator. With an increase in labor and capital stock, output permanently increases at home. In the foreign country output initially increases due to an increase in labor input, but investment falls. Since the foreign country finances the current account deficit of the home country, labor input is relatively lower and consumption is higher in the foreign country in this new steady state. When the economy is faced with a permanent, unanticipated decline in the tax rate, the results are a positive wealth effect, an increase in the real interest rate, and an increase in the marginal product of labor. The positive wealth effect has a negative effect on labor input. The rise in the real interest rate and the increase in the marginal product of labor increases the labor input. The two substitution effects outweigh the wealth effect and, therefore, the labor input increases. This leads to an increase in output and investment. Labor input increases in the foreign country when the real interest rate rises. Foreign output initially increases, but then falls over time. Investment falls in the foreign country, as capital moves to the home country.

Bianconi and Turnovsky (1997) find that the effects of government expenditure shocks differ based on the form of financing. An increase in government purchases financed by a lump-sum tax has a positive effect on employment and production at home, but a negative effect abroad. When government expenditures are financed by a tax on capital, just the opposite happens. An increase in government expenditures

financed by a tax on labor income has an ambiguous effect. An increase in government expenditures, financed by lump-sum taxes, decreases wealth, which leads to an increase in labor supply and a decrease in consumption. A higher labor supply increases the productivity of capital and increases capital stock at home, while decreasing it abroad, in the short-run. In the long–run, capital stock increases in both countries, but it remains below its initial equilibrium point in the foreign country. Therefore, government spending financed by lump-sum taxes is expansionary at home and contractionary abroad.

Obstfeld and Rogoff (1995) construct a model, which bridges the gap between the flexible-price dynamic general equilibrium models and the traditional sticky-price Keynesian models. Their model is based on dynamic optimization, nominal price rigidities, and microfoundations of aggregate supply. In response to a permanent increase in Home-government spending, short-run Home-income rises by more than long-run Home-income. Therefore, current consumption falls more than the increase in government spending. This leads to a fall in the short-run real interest rate. Home consumption falls relative to foreign consumption since domestic residents are paying for the government spending. This change in relative consumption levels lowers the demand for Home money, and leads to a depreciation of the Home currency. When current consumption falls more then the increase in output, the current account improves.

3. Data and Methodology

3.1. Data

The data used to estimate the model consist of quarterly observations for the U.S. and Canada for the period 1961:1-2004:3. The U.S. data employed in this paper are obtained from the DRI database and the St. Louis Federal Reserve Bank's Fred II

database. The real and nominal GDP, real government purchases, nominal national defense expenditures and nominal income tax revenue series are from the DRI database. The 3-month Treasury bill rate, and the CPI series are from the Fred II database. The Canadian data are obtained from the CANSIM database and the DRI database. Real GDP, consumption expenditures, investment expenditures, exports, and imports are from the CANSIM database. The 3-month Treasury bill rate, CPI, and the nominal exchange rate series are from the DRI database. National defense expenditures and income tax revenues series are deflated by the GDP deflator. The inflation rate is calculated as the percentage change in the CPI. Exact definitions of the variables used are presented in Table 1.

3.2. Methodology

To investigate the dynamic response of the U.S. and Canadian economies to fiscal policy shocks originating in the U.S., and to analyze how these shocks are transmitted to the Canadian economy, VARs are employed. The benchmark model comprises of the following eight variables: U.S. price level (*P*, GDP deflator), U.S. income taxes (*T*, total personal tax revenues in current dollars deflated by the GDP deflator), U.S. government purchases (*G*, real government purchases), the U.S real interest rate (*r*, measured as the difference between the 3-month U.S. Treasury bill rate and the U.S. inflation rate), U.S. output (*Y*, measured by the U.S. real GDP), the Canadian real interest rate (*r**, measured as the difference between the 3-month Canadian Treasury bill rate and the Canadian inflation rate), the real exchange rate (*RE*, calculated as the nominal exchange rate, i.e. the Canadian dollar per the U.S. dollar, multiplied by the U.S. CPI and divided by the Canadian CPI), and Canadian output (*Y**, measured by the Canadian real GDP).

All the variables in our benchmark model are estimated in natural logarithms except the real interest rate. The Likelihood Ratio (LR) test is used to choose the appropriate lag-length, which was found to be four.

The benchmark VAR model is derived from the following structural model:

$$X_t = A_0 X_t + A_1 X_{t-1} + \cdots + A_q X_{t-q} + \varepsilon_t \qquad (1)$$

where $X_t = \left[P_t, G_t, Y_t, r_t, T_t, Y_t^*, r_t^*, RE_t \right]'$ = vector of endogenous variables, A_0 = coefficient matrix specifying the contemporaneous relations among the variables in the model, A_i, $i = 1, \cdots, q$ are coefficient matrices on q lagged values of X, and ε_t = vector of structural shocks which are assumed to be uncorrelated. The VAR model is the reduced form of this structural model and can be written as:

$$X_t = B_1 X_{t-1} + \cdots + B_q X_{t-q} + U_t \qquad (2)$$

where B_i, $i = 1, \cdots, q$, $= (I - A_0)^{-1} A_i$ and $U_t = (I - A_0)^{-1} \varepsilon_t$.

U_t is the vector of reduced form residuals, and $U_t = \left[u_t^P, u_t^G, u_t^Y, u_t^r, u_t^T, u_t^{Y*}, u_{t,}^{r*} u_t^{RE} \right]'$. As can be seen from the definition of U_t, the elements of U_t will, in general, be correlated. Once the VAR model is estimated, the structural shocks can be recovered from the reduced form residuals by imposing restrictions on the contemporaneous relations among the model variables, i.e. by specifying the non-zero elements of A_0.

Structural shocks to fiscal policy are identified from a Choleski decomposition of the variance-covariance matrix. The Choleski decomposition imposes a recursive contemporaneous causal structure on the model, i.e. A_0 is a lower-diagonal matrix with one's on the diagonal. The model variables are ordered in a particular sequence, and variables higher in the ordering are assumed to cause contemporaneous changes in

variables lower in the ordering. Variables lower in the ordering are assumed to affect variables higher in the ordering only with a lag.

The ordering used is: *P*, *G*, *Y*, *r*, *T*,*Y**, *r**, *RE*. Because spending appropriation bills in the U.S. typically specify government purchases in current dollar terms, the price level is ordered before real government purchases. With spending levels specified in nominal terms, variations in the current price level affect the real value of government spending in the current period. Previous studies that ignore this type of contemporaneous feedback may well misestimate structural shocks to government purchases. With *G* ordered after *P*, structural shocks to *G* are assumed to affect *P* only with a lag. Given the common presumption of short-run rigidities in prices, this seems to be a reasonable assumption. *G* is, however, ordered before *Y* which allows changes in *G* to have contemporaneous effects on output, but allows only a lagged discretionary response of *G* to movements in *Y*. Allowing a contemporaneous effect of *G* on *Y* is appropriate since government purchases are a component of *Y* and can also affect inventories in the current period. Given the nature of decision and implementation lags in fiscal policymaking, specifying a discretionary response of government purchases only to lagged output is a plausible assumption.

With regard to income tax revenues (*T*), *P*, *G*, *Y*, and *r* are ordered before *T*. Automatic stabilizers imply a contemporaneous response of taxes and transfer payments to changes in macro variables like *P* and *Y*. Therefore, placing *T* after these variables allows for automatic stabilizing effects, but constrains changes in income taxes to affect the macroeconomy only with a lag. Since the U.S. tax code and transfer payments are not perfectly indexed to the price level, variations in current prices can affect real income tax revenues, and previous studies that omit prices from the model thus ignore a source of feedback from the current state of the economy to income taxes

and may misestimate structural shocks to income taxes. Changes in *r* affect current interest payments on short-term debt that is rolled over, and since the measure of transfers used here includes interest payments on government debt, placing *T* after *r* allows changes in *r* to affect current net taxes. Changes in income taxes affect aggregate spending primarily by altering disposable income and hence consumption; and placing *T* after the macro variables implies a lag between a change in disposable income and the implementation of any resulting change in spending plans. Placing G before T implies that decisions about government purchases are made prior to decisions about taxes and decisions about taxes and transfers affect government purchases only with a lag. This assumption is more controversial than ordering *T* after *P*, *Y*, and *r* since it is not uncommon for fiscal policymakers to discuss plans for purchases after having an idea about expected tax revenues.

The last three variables in the ordering are the Canadian GDP *Y**, real interest rate *r**, and the real exchange rate *ER*. This ordering allows contemporaneous effects of the U.S. variables on the Canadian variables and the real exchange rate as well as contemporaneous effects of the Canadian GDP and the real interest rate on the real exchange rate. The Canadian variables are ordered after the U.S. variables because Canada is a small open economy and, therefore, it is reasonable to assume that the U.S. variables have a contemporaneous effect on the Canadian variables, while the Canadian variables affect the U.S. variables with a lag.

The above ordering also reflects the channels of transmission of fiscal policy. A shock to U.S. government purchases *G* has a contemporaneous effect on *Y*, *r*, *Y**, and *r**. *Y* is affected both directly by changes in *G* and indirectly by changes in *r*. Changes in *r* have a contemporaneous effect on *r** and *RE*. A shock to U.S. fiscal policy affects *Y** through different channels. First, it alters the inter-temporal decisions of U.S.

consumers between current and future consumption and, thereby, affects U.S. net exports and, hence, Canadian net exports. Second, by changing r^* and RE it has an effect on Canadian investment expenditures and net exports and, therefore, on Y^*.

4. Empirical Results

4.1. The International Transmission of U.S. Government Purchases Innovations

The IRFs of the model variables to a positive innovation in U.S. government purchases are presented in Figure 1. U.S. output immediately rises in response to a positive innovation in government purchases, and the positive response of output is significantly different from zero during the first two quarters. The response of output quickly becomes negative after the third quarter, but this response is not significantly different from zero. The real interest rate first falls, and then rises, but the response of the real interest rate is not significantly different from zero, except for the 6^{th} and 9^{th} quarters. The decrease in Canadian output in response to a positive innovation in U.S. government purchases is significantly different from zero after the 4^{th} quarter. The Canadian real interest rate rises immediately, and its response is significantly different from zero during the first and in between the 2^{nd} and 15^{th} quarters. The real exchange rate falls in response to a positive innovation in U.S. government purchases, and its response is significantly different from zero after the 8^{th} quarter.

U.S. and Canadian GDPs react differently to a positive innovation in U.S. government purchases. When we compare the statistically significant portion of the IRFs, we find that while U.S. output increases, Canadian output decreases. This implies that unanticipated shocks to U.S. government purchases have *beggar thy neighbor* effects on Canada.

When we calculate the government purchases multipliers in our benchmark model from the IRFs, we find that a 1% increase in government purchases increases U.S. output by 0.13%, but decreases Canadian output by 0.32%. This result is quite striking because it indicates that the U.S. government purchases multiplier has a greater impact on the Canadian economy than the U.S. economy.

4.2. The International Transmission of U.S. Income Tax Innovations

The IRFs of the model variables to a positive innovation in income taxes are presented in Figure 2. The response of U.S. output is negative and significantly different from zero after the second quarter. The U.S. real interest rate rises in response to a positive innovation in income taxes. The positive response of the real interest rate is significantly different from zero in between the first and third quarters and after the fourth quarter. As expected, the rise in the real interest rate is correlated with the decline in output. What seems surprising, however, is the way the real interest rate responds to the tax innovation. Neither the Keynesian, nor the general equilibrium models predict a rise in the real interest rate in response to an increase in taxes. The rise in the real interest rate, however, can be explained by modifying the sticky-price intertemporal model of Obstfeld and Rogoff (1996). With an increase in taxes, short-run Home income falls by a greater amount than does long-run Home income. Home residents adjust their current consumption upwards to smooth consumption. This results in a decrease in current savings and, hence, the real interest rate increases.

The response of the Canadian output is not significantly different from zero at all horizons. The Canadian real interest rate rises in response to a positive innovation in U.S. income taxes, and it is significantly different from zero during the second, fourth, and in between the seventh and thirteenth quarters. The real exchange rate rises, but its response is not significantly different from zero.

When we calculate the tax multipliers from the IRFs, we find that a 1% increase in income taxes decreases U.S. output by 0.13%, which is similar to the number we had for government purchases multiplier.

Extensions and Checks for Robustness

Why does the Canadian output decline in response to an innovation to U.S. government purchases? The IRFs indicate that the U.S. and Canadian real interest rates both rise in response to an unanticipated increase in U.S. government purchases and the real exchange rate (the value of the U.S. basket in terms of the value of the Canadian basket) depreciates. The depreciation of the real exchange rate is consistent with the real interest rate parity relationship. The response of the U.S. and Canadian real interest rates and the real exchange rate highlight the real interest rate and the real exchange rate as the two channels of transmission. A plausible explanation is that when the U.S. real interest rate rises, capital flows from Canada to the U.S. lead to a rise in the real interest rate in Canada. An increase in the Canadian real interest rate is expected to reduce consumption and investment expenditures. These changes would explain the decline in Canadian output.

To investigate the response of Canadian consumption C^* and investment I^* expenditures, we estimated two different VAR models where $X_t = \left[P_t, G_t, Y_t, r_t, T_t, Y_t^*, C_t^*, r_t^*, RE_t \right]'$ and $X_t = \left[P_t, G_t, Y_t, r_t, T_t, Y_t^*, I_t^*, r_t^*, RE_t \right]'$. The IRFs of these two models reveal that while the response of consumption expenditures is not significant, the negative response of investment expenditures is significantly different from zero, indicating that the decline in investment expenditures is the reason for the decrease in Canadian output (see Figures A.1.1 and A.1.2).

Figure 2 indicates that Canadian output responds differently to unanticipated innovations in government purchases and income taxes. For example, while an unanticipated increase in U.S. government purchases leads to a decrease in Canadian output and this response is significantly different from zero, the response of Canadian output to unanticipated increases in income taxes is not significantly different from zero. A plausible explanation is that a positive innovation to U.S. income taxes affects the components of Canadian output in opposite directions.

To investigate the response of Canadian consumption expenditures *C**, investment expenditures *I**, and the trade balance *TB**, we estimated three different VAR models where $X_t = \left[P_t, G_t, Y_t, r_t, T_t, Y_t^*, C_t^*, r_t^*, RE_t \right]'$, $X_t = \left[P_t, G_t, Y_t, r_t, T_t, Y_t^*, I_t^*, r_t^*, RE_t \right]'$, and $X_t = \left[P_t, G_t, Y_t, r_t, T_t, Y_t^*, TB_t^*, r_t^*, RE_t \right]'$. The IRFs of these models indicate that in response to an unanticipated increase in taxes, consumption decreases, but its response is not significantly different from zero. Investment decreases, and its response is significantly different from zero. The trade balance, however, responds positively, and its response is significantly different from zero. The decrease in the Canadian investment expenditures is in line with the increase in the Canadian real interest rate, and the improvement of the Canadian trade balance is consistent with depreciation of the Canadian real exchange rate (see Figures A.2.1, A.2.2, and A.2.3).

In our identification scheme we make the assumption that decisions regarding government purchases have a contemporaneous effect on income taxes, but that income taxes affect government purchases with a lag. This assumes that decisions involving government purchases are prior to those of income taxes. In reality it is quite possible that decisions related to income taxes are prior to those regarding government

purchases. If this is the case, our identification scheme requires us to make the assumption that income taxes have a contemporaneous effect on government purchases. To check the robustness of our results, we reversed the Choleski ordering of the two variables, and estimated the VAR model where $X_t = \left[P_t, T_t, G_t, Y_t, r_t, Y_t^*, r_t^*, RE_t \right]'$. Changing the ordering did not change any of the results (see Figures A.3.1 and A.3.2).

In our analysis we used government purchases as a measure of government spending since this was the most comprehensive measure. Are the results sensitive to using other measures of government spending? To check the robustness of our results, we estimated our benchmark model by replacing real government purchases with national defense expenditures. The results are quite robust. The only exception is the IRF of U.S. output in response to an innovation to national defense expenditures. We find that U.S. output increases during the first two quarters, and then decreases after the fourth quarter, and these responses are significantly different from zero. This result is interesting by itself because it indicates that although national defense expenditures have a stimulating effect on output initially, the rise in output is followed by a persistent decline in output later on (see Figures A.4.1 and A.4.2).

6. Concluding Remarks

In this paper we investigate the dynamic response of the U.S. and Canadian economies to fiscal policy shocks originating in the U.S. We find that a positive innovation in U.S. government purchases has a short-run stimulating effect on U.S. output and it also leads to an increase in the U.S. real interest rate. The increase in the U.S. real interest rate is transmitted to the Canadian economy as capital flows in from Canada to the U.S. Capital outflows from Canada increases the Canadian real interest rate. The increase in the Canadian real interest rate reduces Canadian investment expenditures and Canadian output. Thus, unanticipated increases in U.S. government

purchases have a *beggar thy neighbor* effect on Canada. A positive shock to government purchases improves U.S. GDP but worsens Canadian GDP. While a 1% increase in U.S. government purchases increases U.S. output by .13%, it decreases Canadian output by .32%. In response to an unanticipated increase in U.S. income taxes, U.S. output declines. A positive innovation in U.S. income taxes also raises the U.S. real interest rate. U.S. income tax innovations are transmitted to the Canadian economy via interest rate and exchange rate channels. The Canadian real interest rate rises and the real exchange rate depreciates, although the response of the Canadian real exchange rate is not significantly different from zero. The response of Canadian output is negative for the most part, but this is not significantly different from zero. Thus, unlike shocks to U.S. government purchases, U.S. income tax shocks do not have *beggar thy neighbor* effects on Canada.

These findings have important policy implications when considered within the context of President Bush's tax cuts over the next ten years and a significant rise in government spending. Our findings about the effects of tax cuts are in contrast to Mendoza (2001) who, using a calibrated two-country general equilibrium model, shows that while a 5% cut in capital income tax in the United Kingdom increases the trend level of consumption per capita by 1.1% in the United Kingdom, the same tax cut decreases the trend level of consumption per capita by 3.7% in Continental Europe. Our income tax multipliers are smaller than those suggested by Mendoza (2001), and have the opposite sign. Perotti (2002) also indicates that the estimated tax multipliers are smaller when compared to the ones suggested by the theoretical literature.

Future econometric work analyzing the transmission of U.S. fiscal policies to other countries would indicate whether the results reached in this study could be generalized or not.

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TABLE 1
Definition and Data Sources for the Variables Used

Variable	Definition	Data Source and Code
GDP (U.S.)	chained 2000 dollars, SAAR	DRI, GDPR
GDP (U.S.)	current dollars, SAAR	DRI, GDP
Government Purchases (U.S.)	Government Consumption and Gross Investment, chained 2000 dollars	DRI, GR
National Defense Expenditures (U.S.)	National defense, Government consumption expenditures and gross investment, current dollars	DRI, GFML
Income Taxes (U.S.)	Personal Current Taxes (Federal, state, local) current dollars	DRI, TXP
Treasury-bill rate (U.S.)	3-month Treasury bill, secondary market rate	FRED II, TB3MS
CPI (U.S.)	Consumer price index for all urban consumers, all items, SA	FRED II, CPIAUSL
GDP (CAN)	chained 1997 dollars, SAAR	CANSIM, v1992067
Consumption Expenditures (CAN)	Personal expenditures on consumption goods and services, chained 1997 dollars, SAAR	CANSIM, v1992044
Investment Expenditures (CAN)	Business gross fixed capital formation, chained 1997 dollars, SAAR	CANSIM, v1992052
Exports (CAN)	Exports of goods and services, chained 1997 dollars, SAAR	CANSIM, v1992060
Imports (CAN)	Imports of goods and services, chained 1997 dollars, SAAR	CANSIM, v1992063
CPI (CAN)	Consumer price index for all urban consumers, all items, SA	DRI, L64@C156
Treasury-bill rate (CAN)	3-month Treasury bill, secondary market rate	DRI, L60@C156
Exchange Rate	Canadian dollar per U.S. dollar	RX@CN

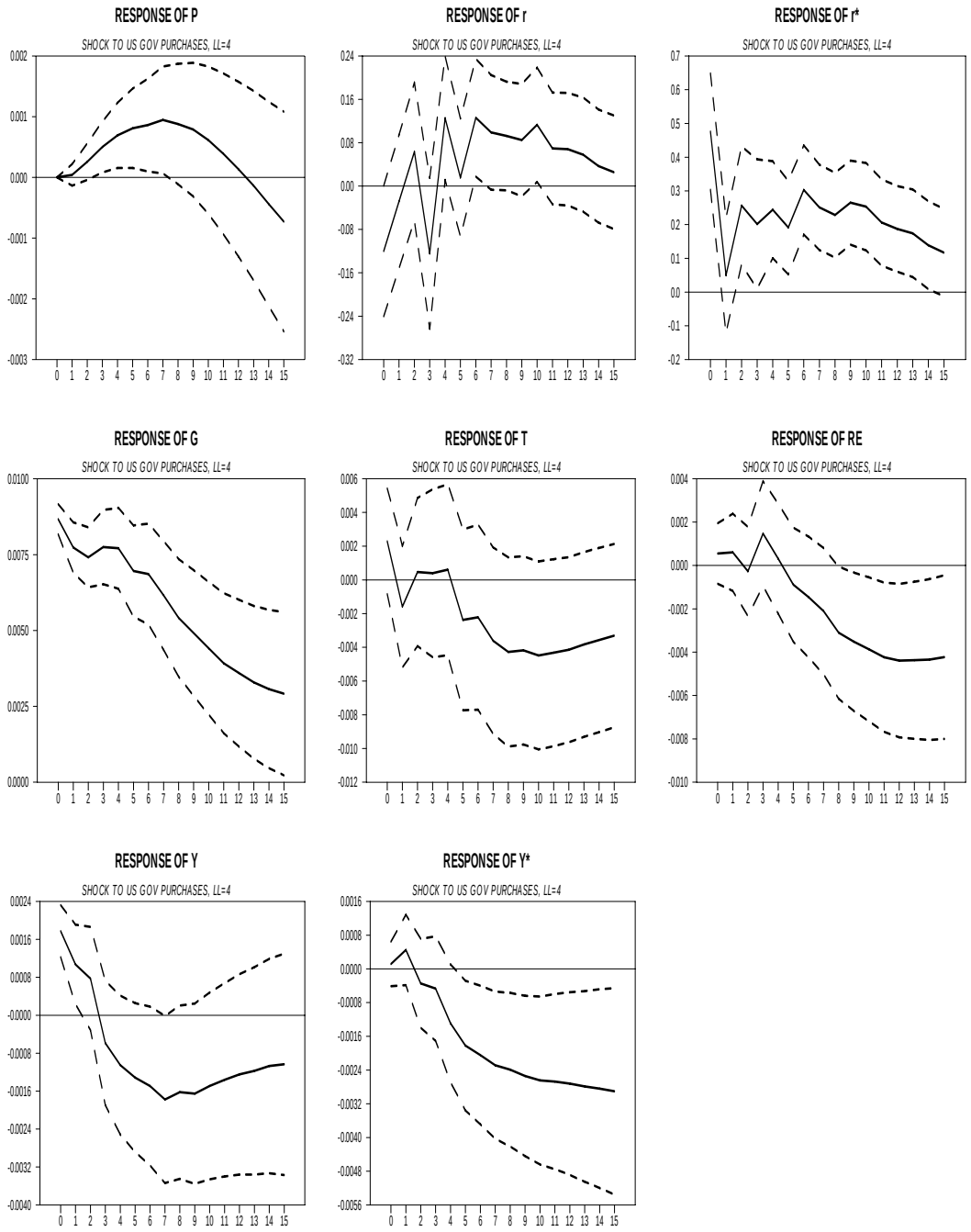

Figure 1 Shock to U.S. Government Purchases

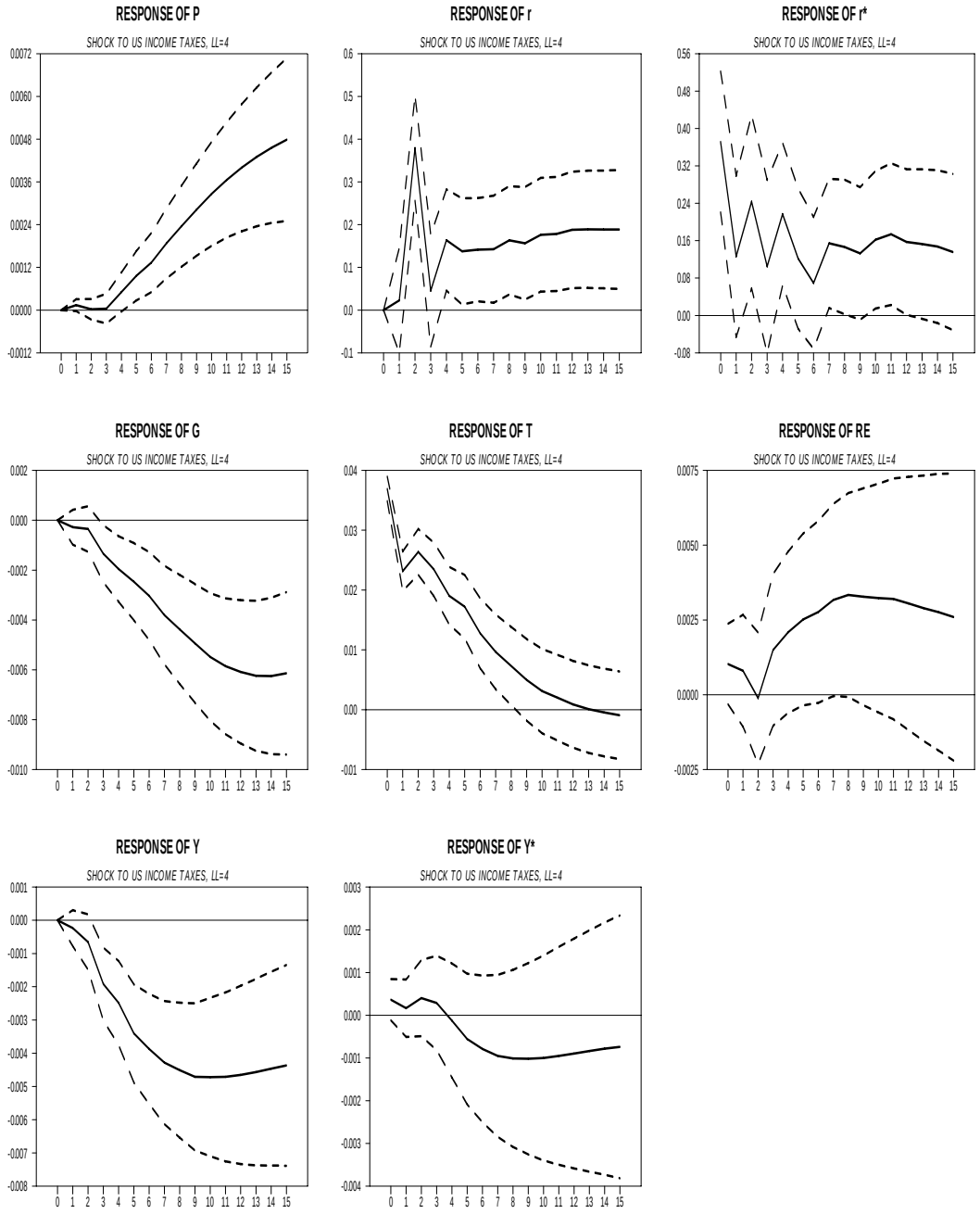

Figure 2 Shock to U.S. Income Taxes

APPENDIX

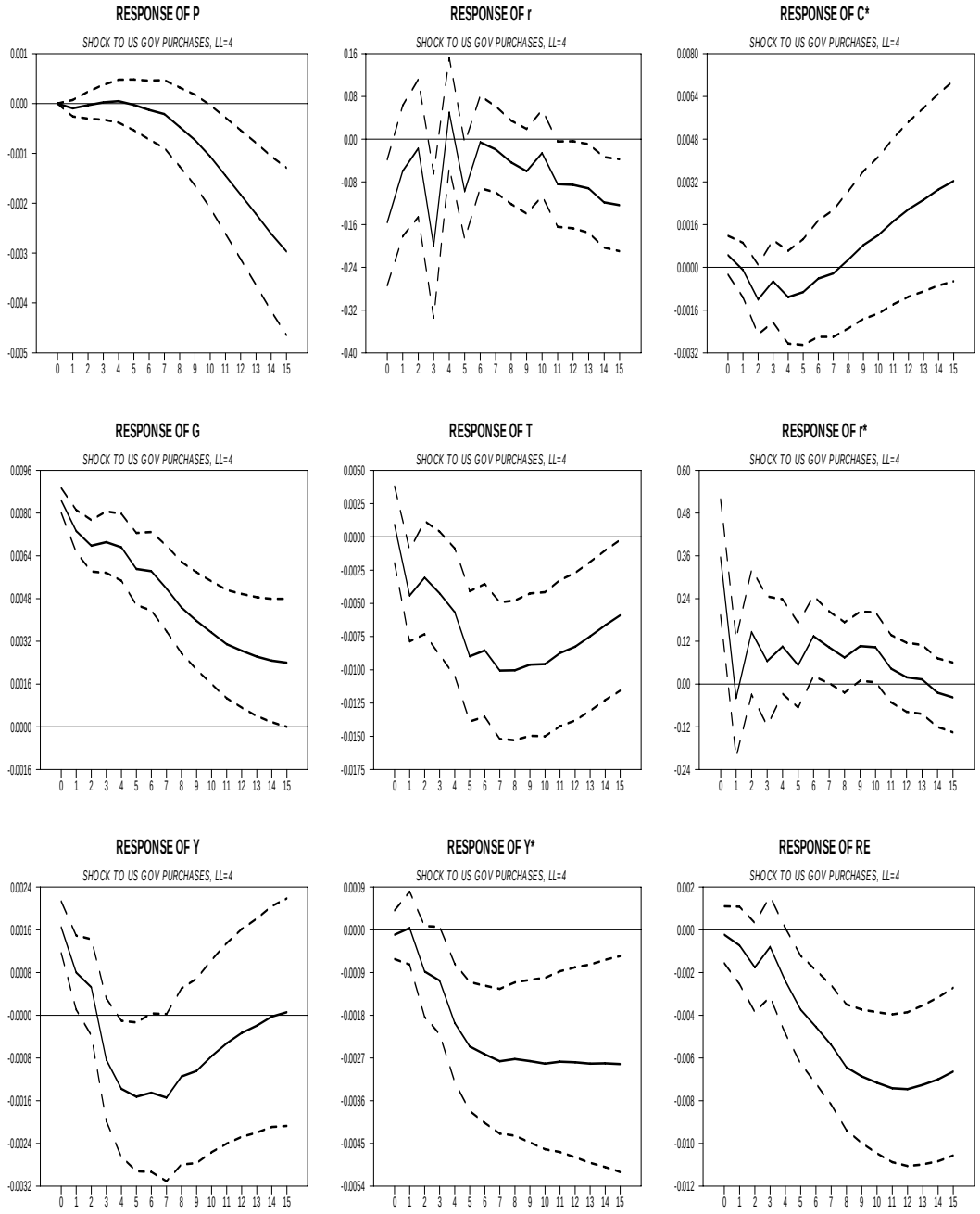

Figure A.1.1 Shock to U.S. Government Purchases

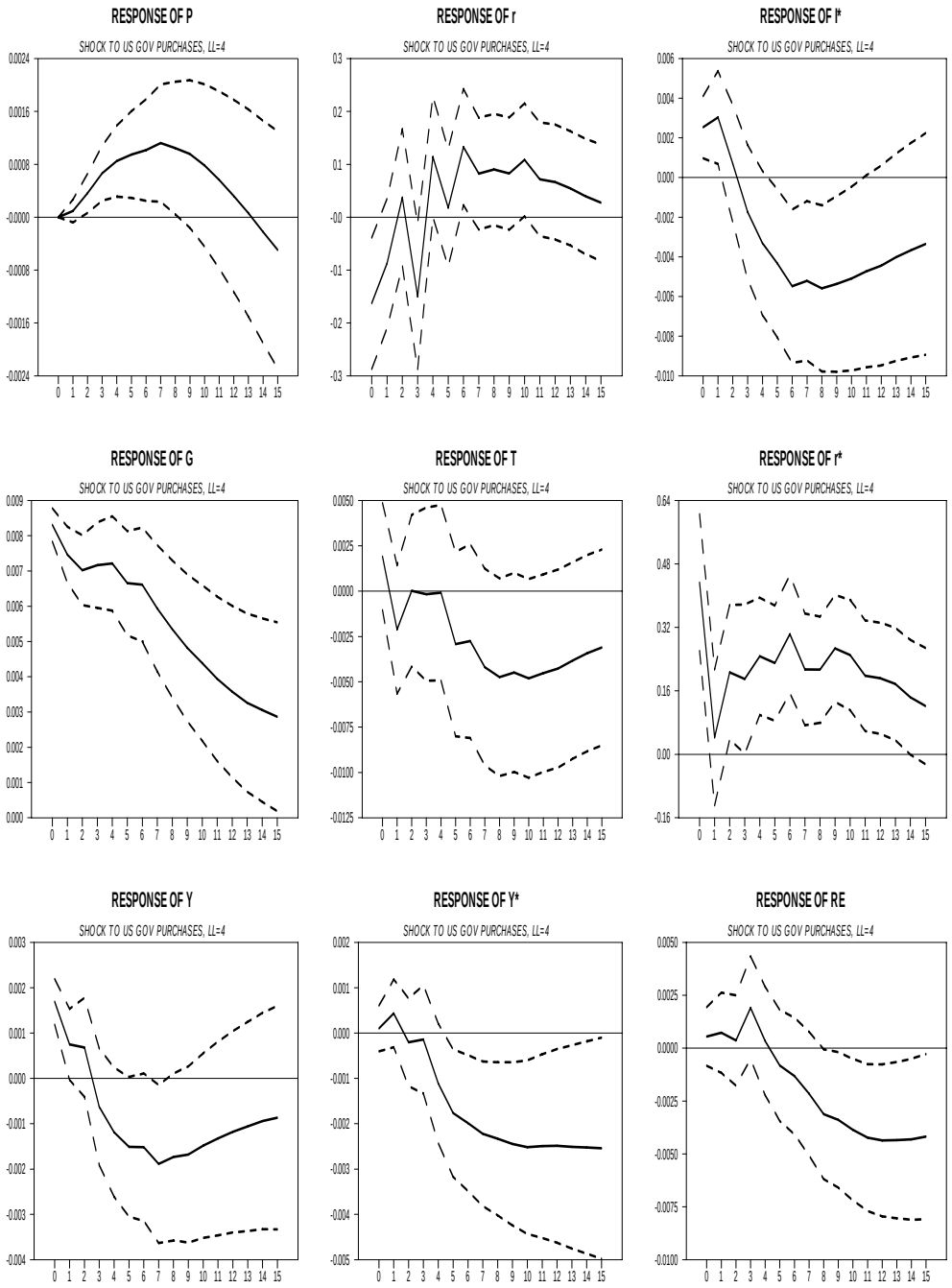

Figure A.1.2 Shock to U.S. Government Purchases

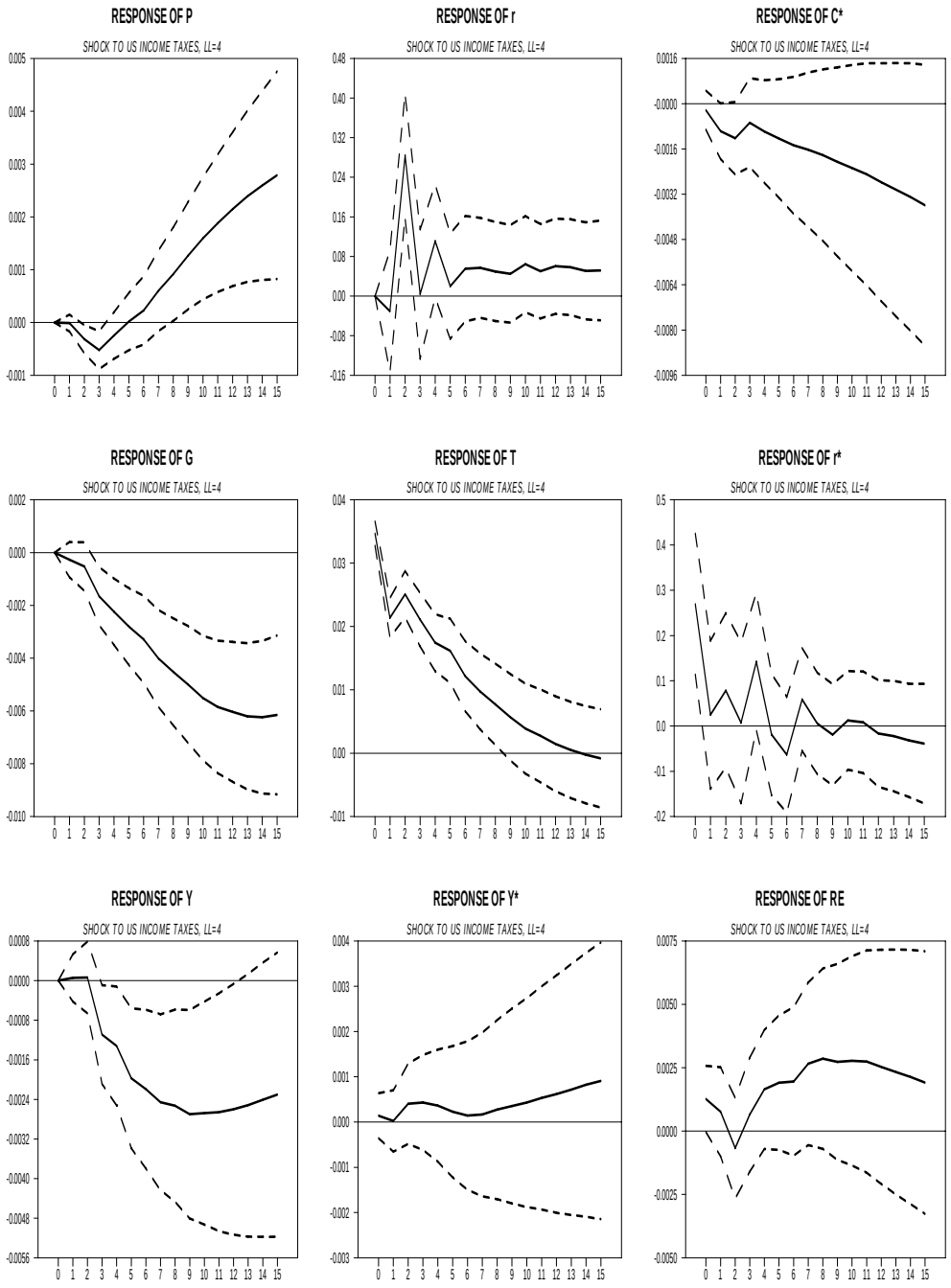

Figure A.2.1 Shock to U.S. Income Taxes

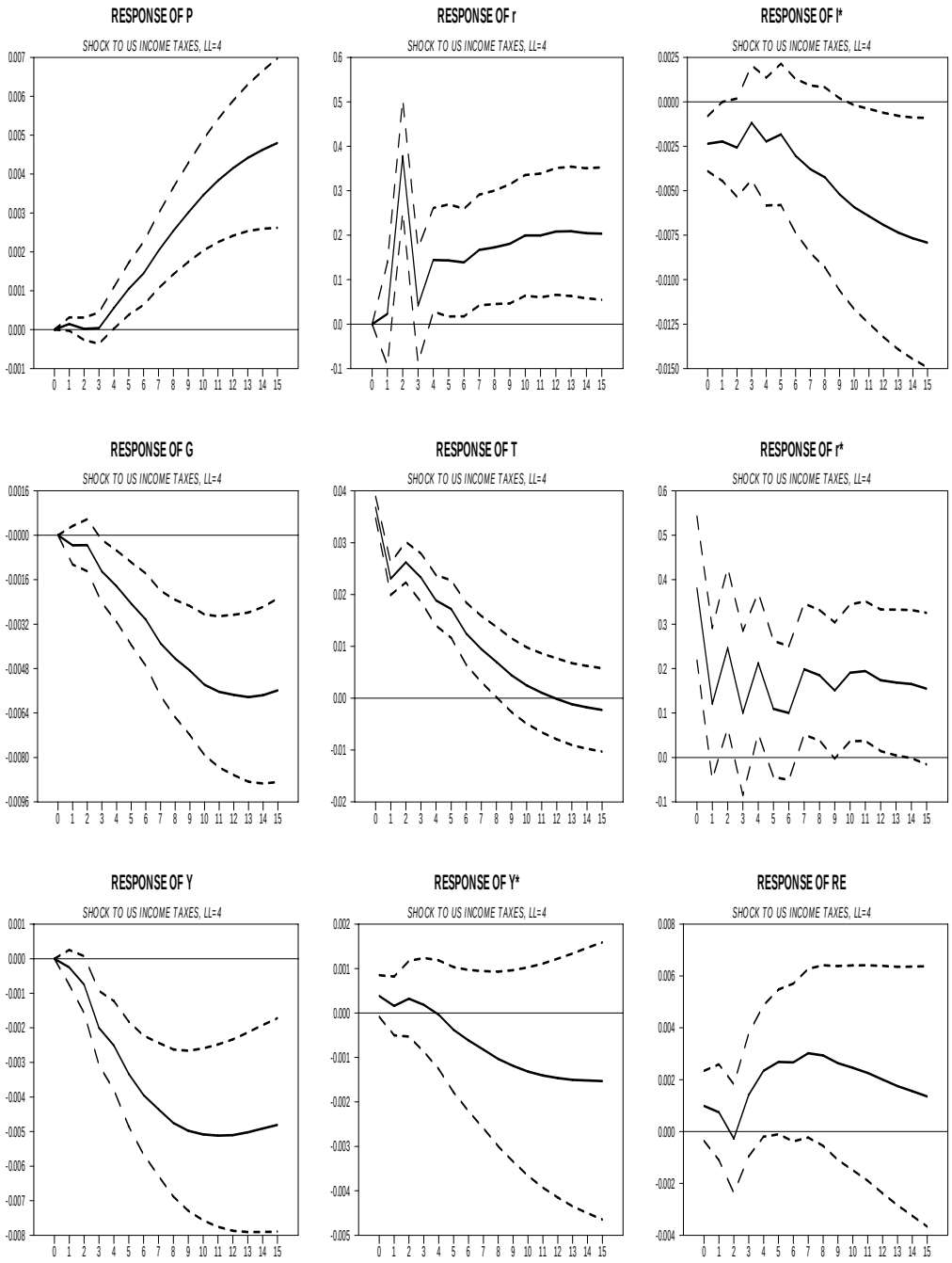

Figure A.2.2 Shock to U.S. Income Taxes

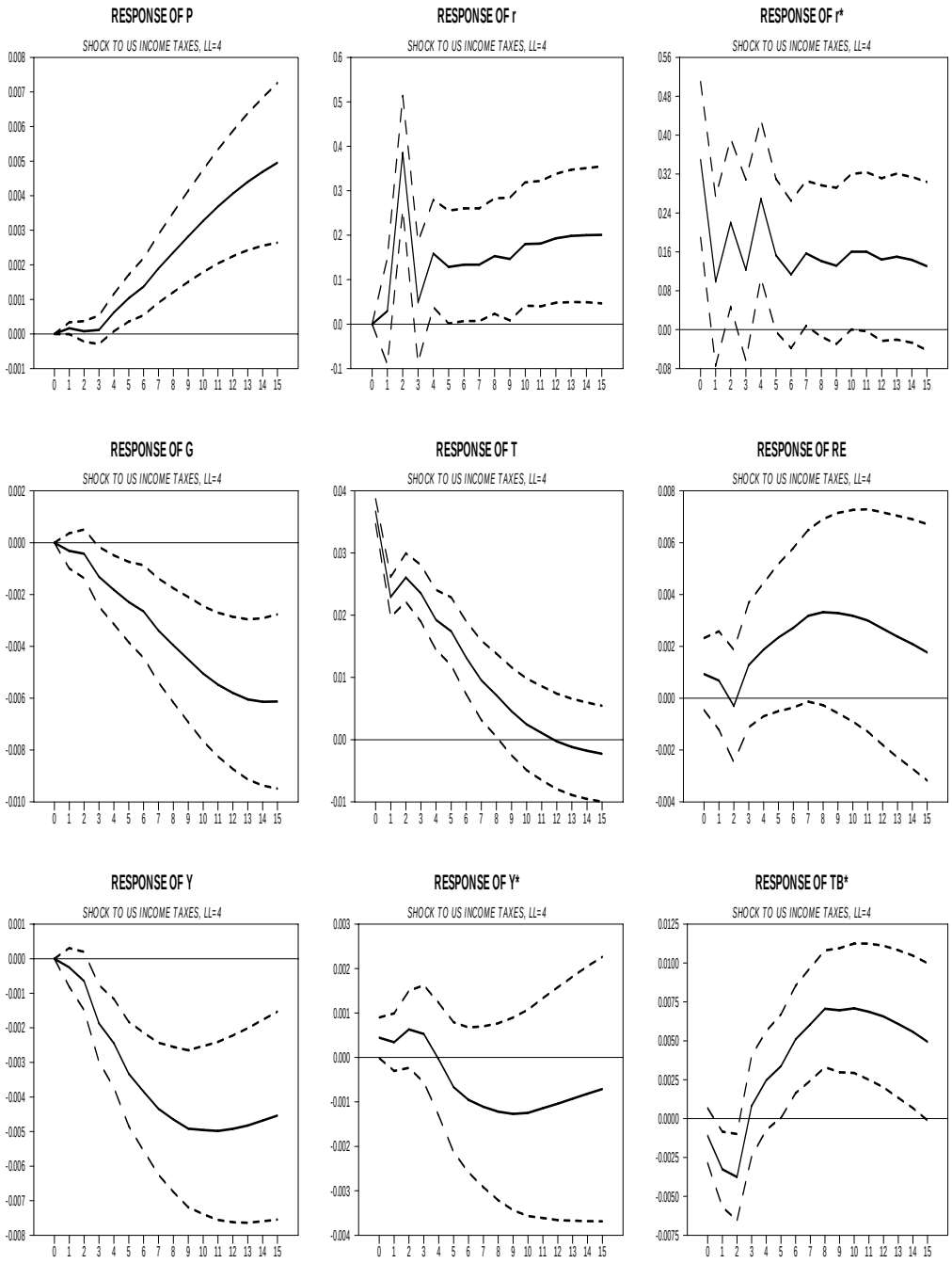

Figure A.2.3 Shock to U.S. Income Taxes

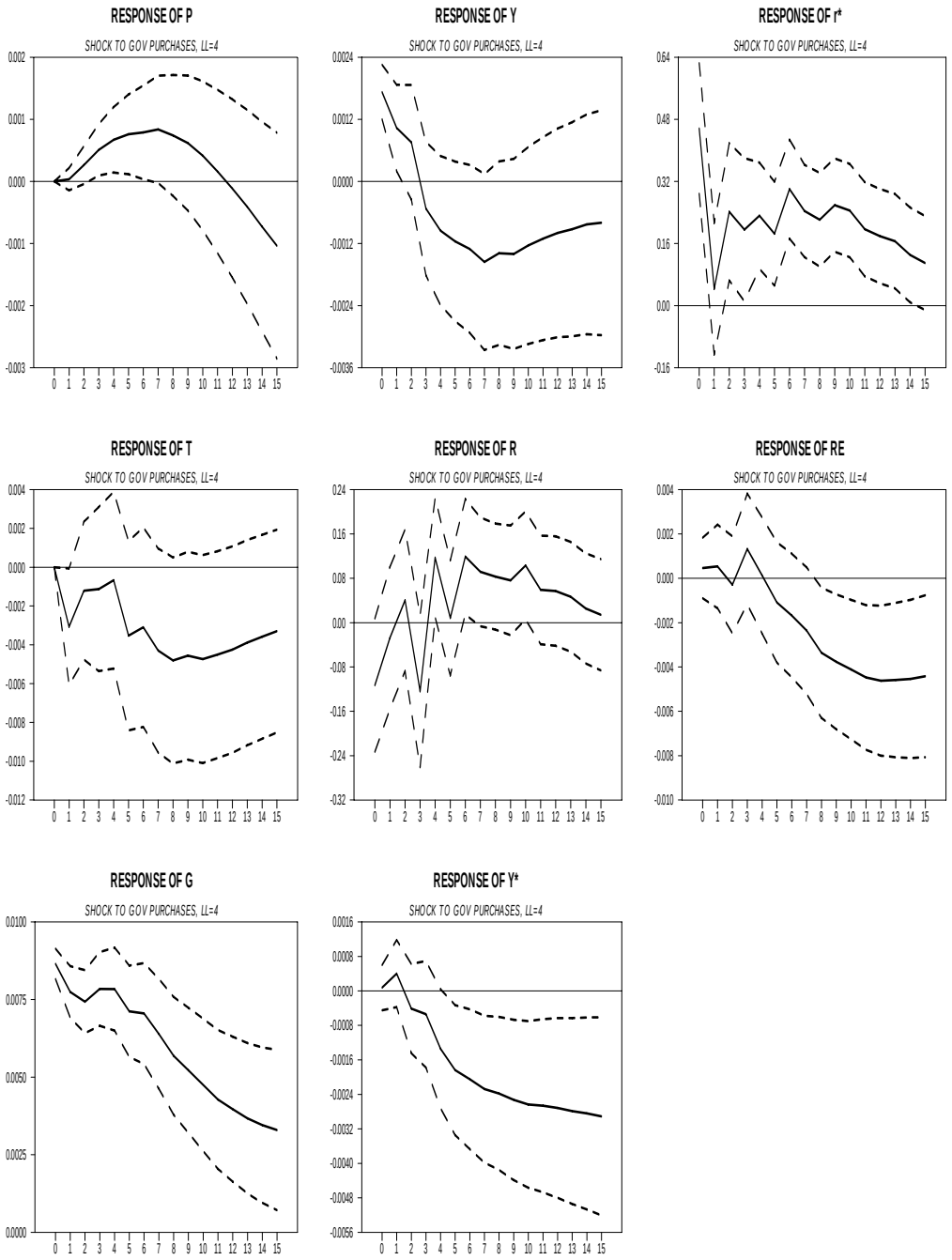

Figure A.3.1 Shock to U.S. Government Purchases

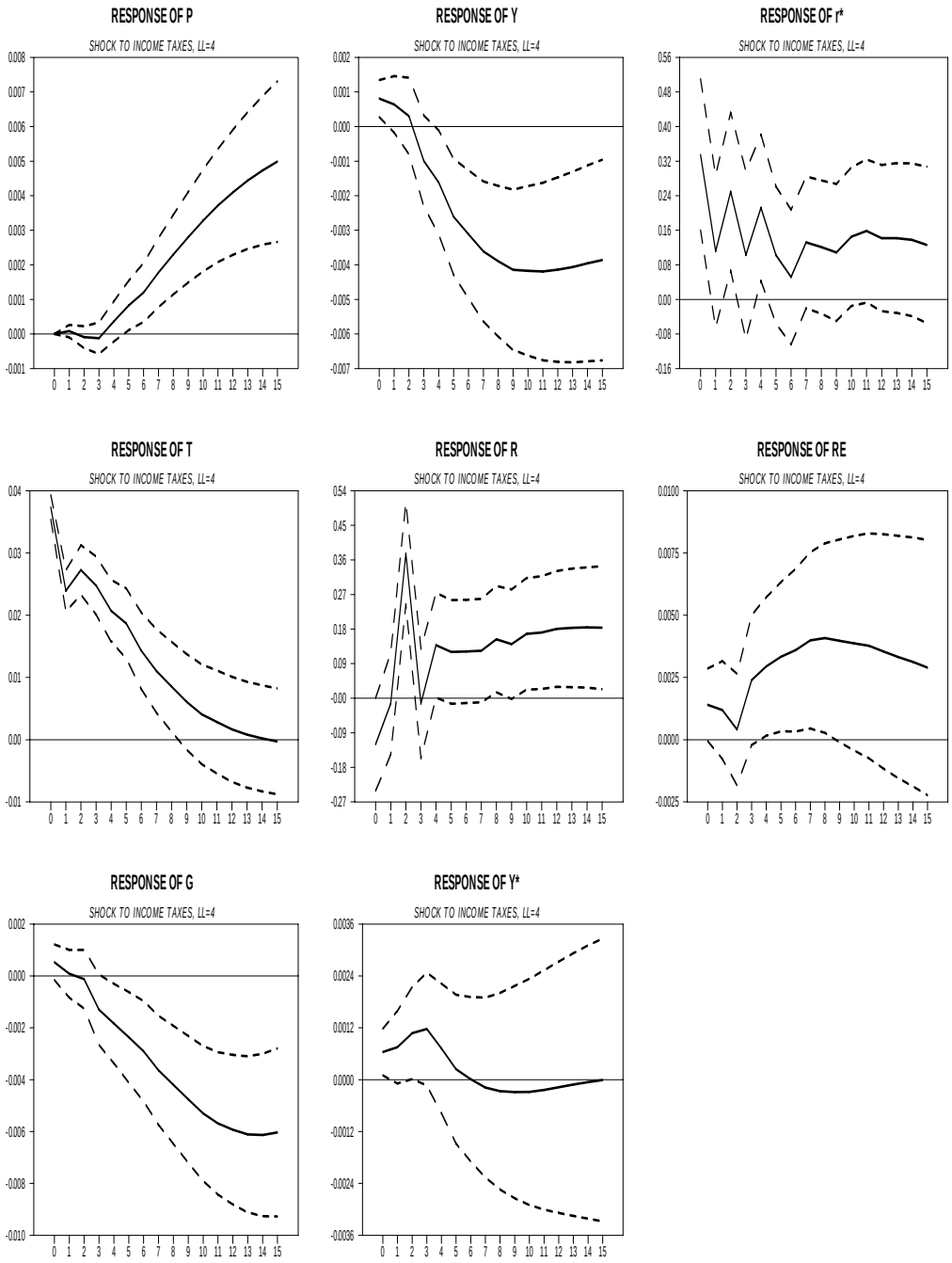

Figure A.3.2 Shock to U.S. Income Taxes

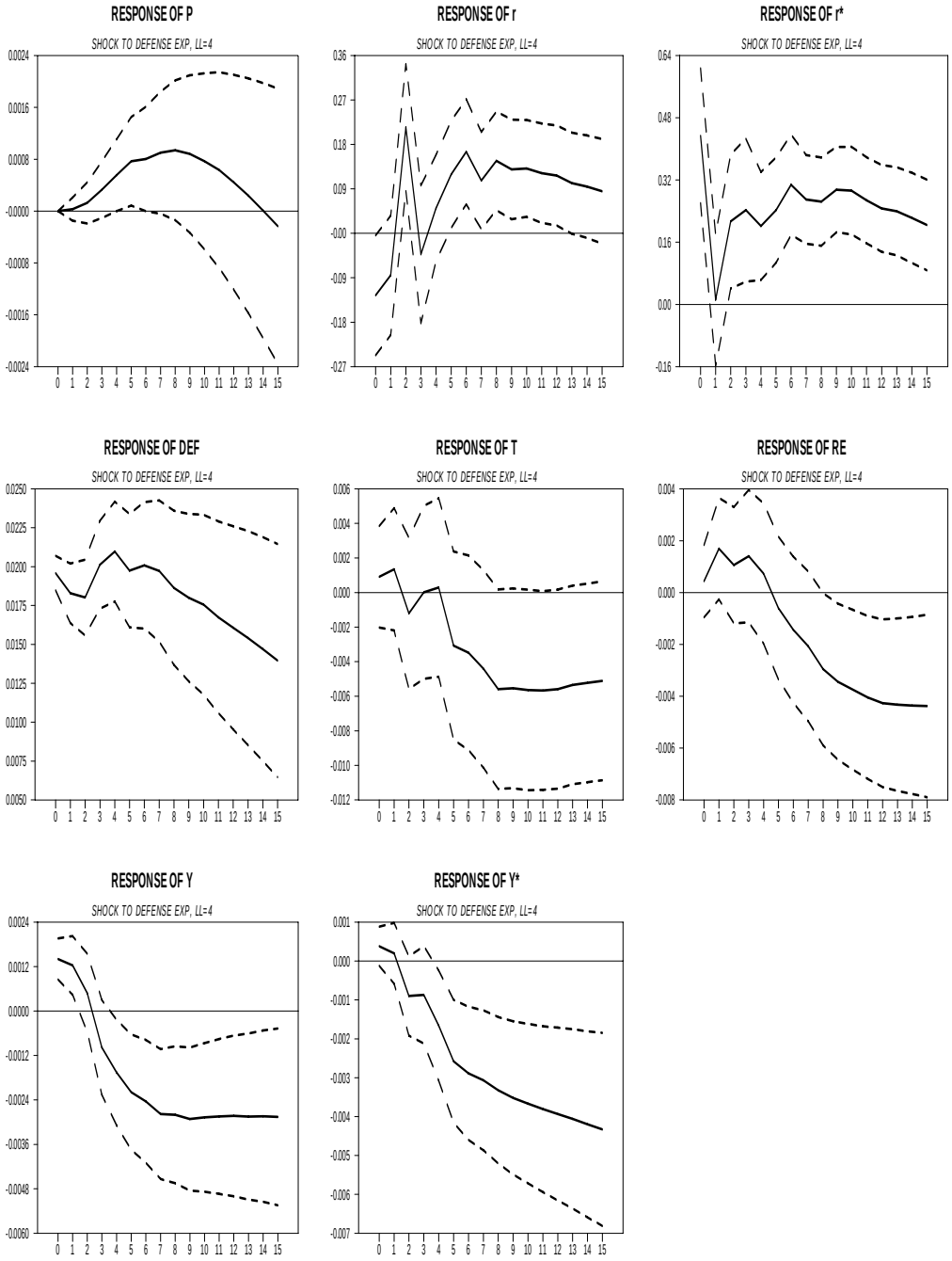

Figure A.4.1 Shock to U.S. Defense Expenditures

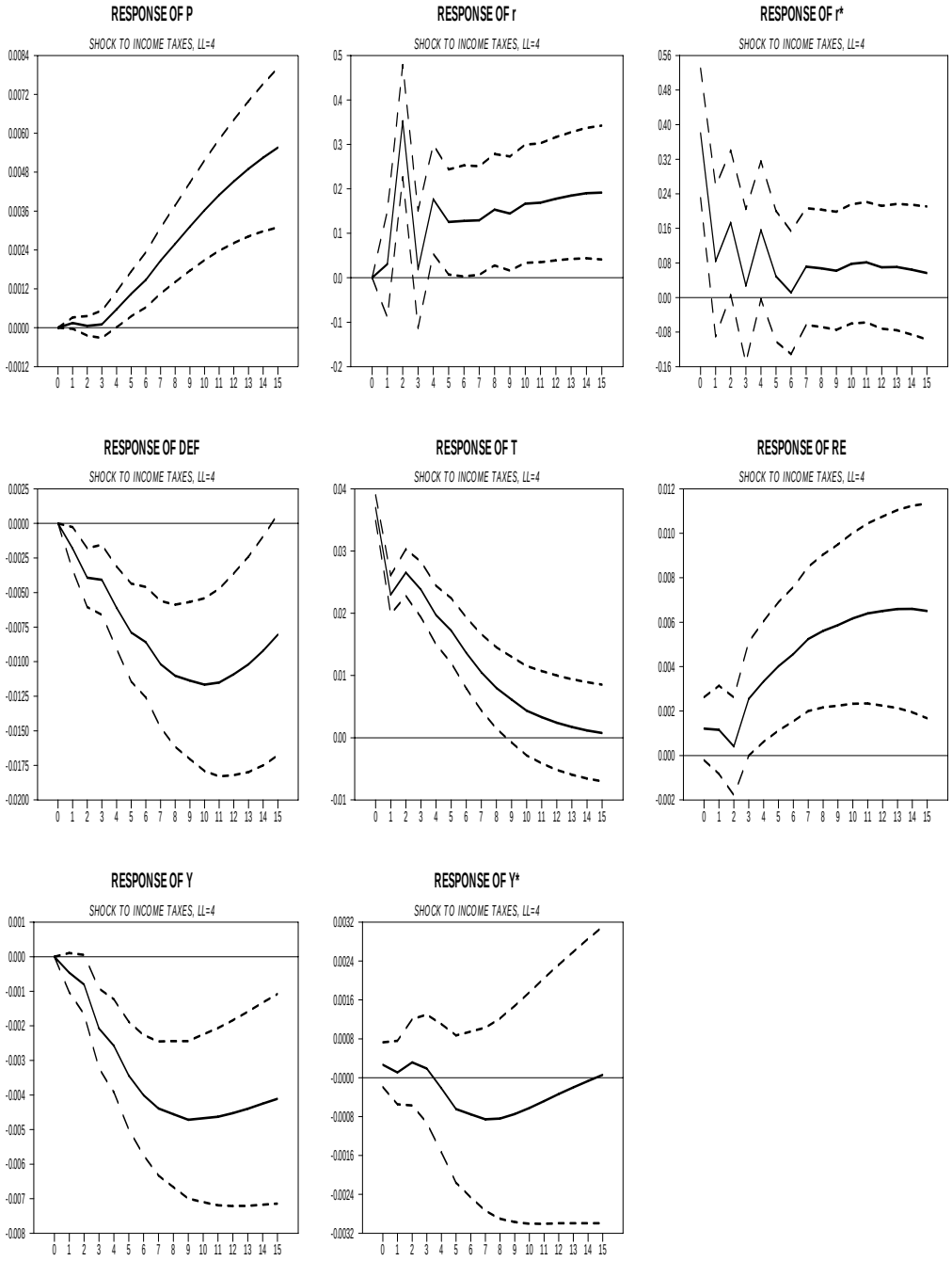

Figure A.4.2 Shock to U.S. Income Taxes