Empirical Project 2 Report
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Introduction

In the study of macroeconomic policy, understanding the impacts of fiscal shocks—unexpected changes in government revenues or expenditures—on the broader economy is crucial. Understanding the economic implications of tax revenue shocks is essential for policymakers aiming to stabilize the economy and promote sustainable growth. Tax revenue shocks, defined as unexpected changes in government tax collections, can significantly influence various macroeconomic variables, including output, consumption, investment, and government spending. These shocks can arise from policy changes, economic fluctuations, or other exogenous factors, and their impacts can propagate through the economy in complex ways. Analyzing these effects, economists can gain insights into the short-term and long-term consequences of fiscal policy decisions and the mechanisms through which tax changes affect economic activity.

This exercise focuses on replicating the findings of Blanchard and Perotti (2002), specifically examining how tax revenue shocks influence economic variables. By replicating and analyzing these results, we aim to provide a deeper understanding of the dynamic responses to tax revenue shocks and their broader economic implications.

The core of the analysis in Blanchard and Perotti (2002) is a three-variable vector autoregression (VAR) model with four lags, using quarterly time series data from 1960(Q1) to 1997(Q4). The main variables in this analysis are the log of real, per capita values of:
(1) tax revenues net of transfers,
(2) government spending, and
(3) gross domestic product (GDP).

This VAR framework allows for the examination of the dynamic interactions among these variables in response to tax revenue shocks. By replicating the results reported in Section V of Blanchard and Perotti (2002), specifically Figure III and Table III, this study aims to validate and deepen our understanding of the transmission mechanisms and economic impacts of tax revenue shocks.

SVAR Matrix Setup:
The matrix **bmtrix** sets up restrictions for a structural vector autoregression (SVAR) model. A break down the intuition behind each part of the matrix:

1. **Identity Matrix Initialization**: The **diag(1,3)** function initializes a 3x3 identity matrix where the diagonal elements are set to 1, and all off-diagonal elements are set to 0. This standardizes the starting point for SVAR models.

2. **Restrictions on Lagged Variables**: Setting **NA** values for the third row's first two columns (**bmtrix[3, 1:2] <- NA**) implies that the third variable (output) in the SVAR model does not have lagged effects on the first two variables (tax and government revenue). This restriction assumes contemporaneous effects only.

3. **Restriction on Impact of Tax on Output**: The value **-2.08** set at the intersection of the first row and third column (**bmtrix[1,3] <- -2.08**) imposes a specific relationship between tax and output in the SVAR model. This implies that a unit shock to tax leads to a decline of 2.08 units in output in the following period.

Incorporating These Insights

When examining impulse response functions and generating economic analysis, these intuitive effects can help interpret the results. The figure below shows the Impulse response function with the impulse being "Tax":
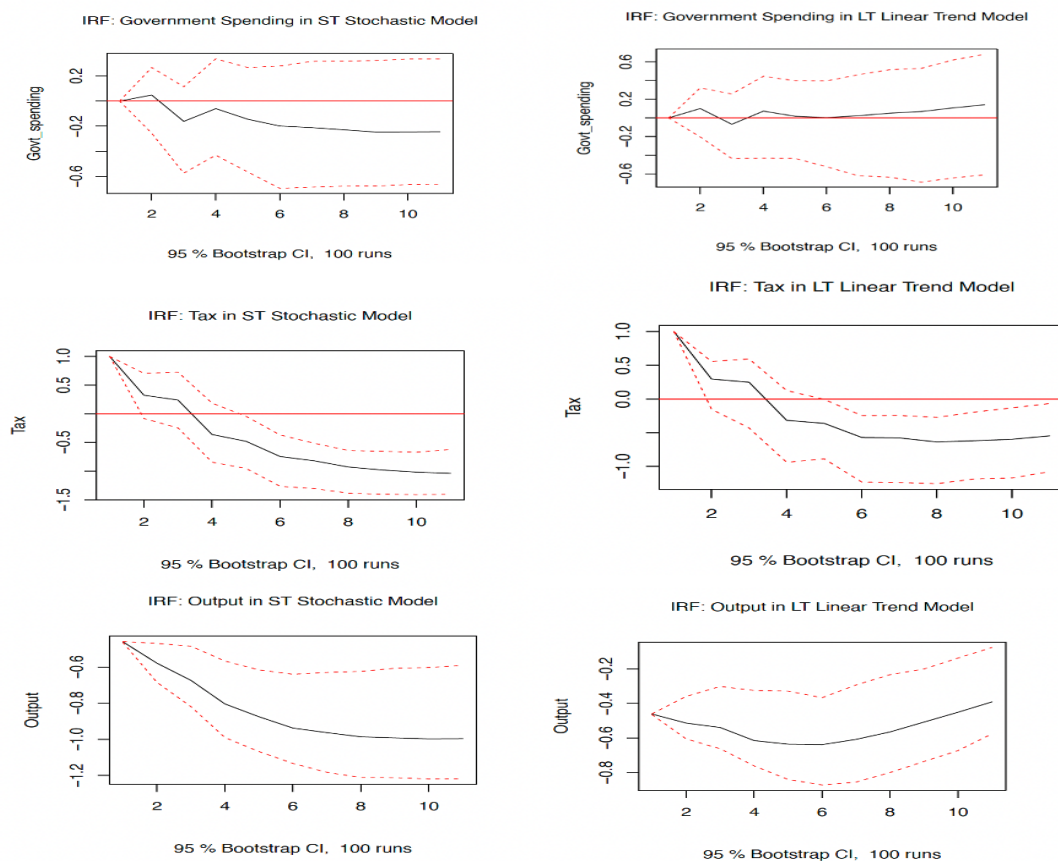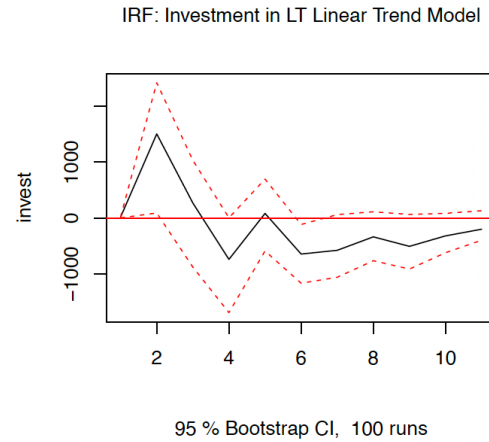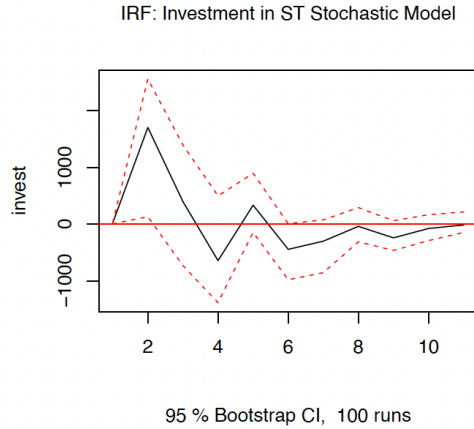
1) The observed trend of government expenditure in response to a tax shock indicates initial increase followed by a decline from short-term fiscal policies and budget constraints. Initially, temporary fiscal measures or automatic stabilizers boost spending to counteract immediate economic impacts. Subsequently, changes to the budget ensure that spending matches the decrease in revenue, to maintain fiscal responsibility and manage debt effectively. The distinction between linear and stochastic trend models highlights structured versus adaptive responses to tax shocks. Overall, this pattern reflects the balancing act of stimulating economic activity while maintaining fiscal stability

2) The initial decline in tax revenue following tax cuts reflects direct fiscal policy changes. Over time, behavioral adjustments, such as tax planning strategies, may exacerbate the revenue reduction. Macroeconomic factors, including increased budget deficits and borrowing costs, contribute to a sharp revenue decline in later years. Additionally, policymakers' responses to revenue changes, such as tax hikes or spending cuts, may further impact revenue dynamics. This trend underscores the intricate interplay between tax policy, economic behavior, and fiscal outcomes, highlighting the evolving nature of revenue effects resulting from tax shocks.

3) In the stochastic trend model, a tax shock induces immediate GDP decline due to heightened economic volatility. Over time, adaptation to the new tax regime fosters confidence, prompting slight GDP recovery. Conversely, the linear trend model exhibits an initial GDP dip, reflecting direct negative impacts of tax shocks on consumption and investment. Policy responses, like monetary stimulus, mitigate effects, fostering subsequent GDP growth. The contrasting patterns underscore the interplay between short-term volatility and long-term structural adjustments in tax shock effects on economic growth
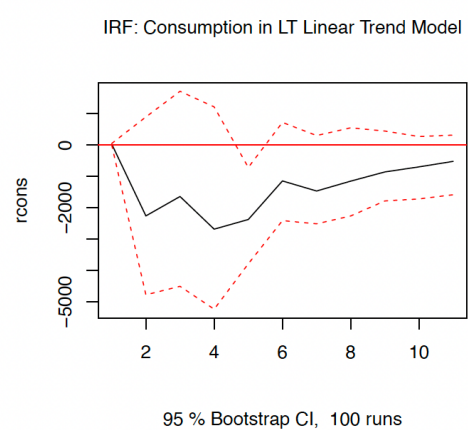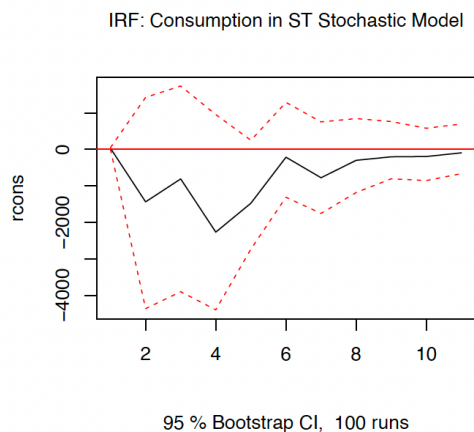
Additional variables were incorporated to enhance the study's depth. Impulse response functions were conducted for both Consumption and Investment using FRED, extending the analysis beyond GDP and providing insights into the dynamics of these critical economic components. This expanded scope allows for a more comprehensive understanding of how tax shocks affect various aspects of economic activity, shedding light on consumption patterns and investment behavior in response to changes in taxation.

- **Investment**: The zigzag pattern observed in investment following a tax shock can be attributed to several economic factors. Initially, the uncertainty surrounding tax policy changes may lead to hesitation among businesses, causing a temporary decline in investment as firms postpone or scale back capital expenditures. However, as businesses gain clarity on the new tax environment and assess the long-term implications, they may resume investment activities, resulting in an uptick in capital spending. Subsequent fluctuations in investment may occur in

response to changes in economic conditions, business sentiment, or policy adjustments, reflecting the dynamic nature of investment decision-making in the face of tax shocks

IRF: Investment in ST Stochastic Model

IRF: Investment in LT Linear Trend Model

95 % Bootstrap CI, 100 runs

95 % Bootstrap CI, 100 runs

- **Consumption**: The sharp decline in consumption following a tax cut initially reflects several economic dynamics. Firstly, households may exercise caution in spending as they adjust to changes in their disposable income caused by the tax reduction. This initial hesitation can lead to a temporary reduction in consumption levels. However, as households adapt to the new tax environment and perceive their overall financial situation to be more favorable, consumer confidence may rise, prompting increased spending over time. Thus, while the immediate response to the tax cut may be a decline in consumption, the subsequent increase suggests a gradual recovery as households adjust their spending behavior

IRF: Consumption in ST Stochastic Model

IRF: Consumption in LT Linear Trend Model

95 % Bootstrap CI, 100 runs

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