

NOTES

A NOTE ON THE BUSH TAX CUTS: DID THEY SUCCEED IN STIMULATING BUSINESS INVESTMENT?

KY-HYANG YUHN AND CHRISTOPHER S. BENNETT

Florida Atlantic University

Traditional regression models have reported conflicting results on the effectiveness of tax incentives in stimulating business investment. This study investigates the effects of the Bush tax cuts on U.S. investment using intervention analysis in conjunction with regression analysis that controls for relevant variables. Although intervention analysis has the advantage of allowing the behavior of investment to be influenced only by the time path of exogenous shocks such as tax reforms, control variables can test for the robustness of the results. We have found that the two tax reforms enacted in 2001 and 2003 had little impact on marginal investment incentives. The intervention analysis results are further reinforced by the evidence provided by alternative regression models that control for a host of variables. The failure of the tax reforms to stimulate investment spending may be attributable to several factors, such as a global savings glut, cheap global money, inappropriate designs for tax incentives, and budget deficits.

Keywords: Marginal Tax Rates, ARIMA, Intervention Analysis, Capital Overhang

1. INTRODUCTION

The responsiveness of investment spending to changes in tax policy is one of the most contentious issues in contemporary economics. Some politicians and economists have persisted in their search for investment stability and economic prosperity through the manipulation of tax policy. This enduring belief has manifested itself in a plethora of tax reforms intended to influence the behavior of business investment. Most recently, we have witnessed this manifestation in the passage of tax-relief legislation including the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA)¹ and the Jobs and Growth Tax Relief

We would like to thank Jon Ford, James McCown, Joo H. Nam, and Sang B. Kim for their comments on the earlier versions of the paper. We are particularly grateful to the Associate Editor of this journal and two anonymous referees for their valuable and constructive comments and suggestions, which have improved this paper in a significant way. We also thank Jeremy Hagler for his excellent research assistance. Any remaining errors are the responsibility of the authors. Address correspondence to: Ky-hyang Yuhn, Department of Economics, College of Business, Florida Atlantic University, Boca Raton, FL 33431, USA; e-mail: yuhn@fau.edu.

Reconciliation Act of 2003 (JAGTRRA).² These two tax reforms, commonly known as the Bush tax cuts, promised positive changes in the economic fortunes of the United States.³

The purpose of this study is to investigate the impact of the Bush tax cuts on business investment. This study takes a different approach from the traditional regression models in order to add new evidence on the issue. We employ intervention analysis, which is well suited to mitigating the potential endogeneity problem frequently encountered in regression models, and compare the results of our intervention analysis with those of alternative regression models that control for exogenous and endogenous variables.

The Bush tax cuts have stirred up considerable debate among economists and policy makers. About 450 economists published the Economists' Statement Opposing the Bush Tax Cuts (2003).⁴ These economists included 11 Nobel Prize Laureates: Samuelson, Arrow, Klein, Modigliani, Solow, Sharpe, North, McFadden, Stiglitz, Akerlof, and Diamond. In the statement, they argued that the purpose of the tax cut is a permanent change in the tax structure and not the creation of jobs and growth in the near term. The statement further claims that the permanent dividend tax cut is not credible as a short-term stimulus, because the dividend tax cut is misdirected as a tax reform: it targets individuals rather than corporations, it is overly complex, and it is not part of a revenue-neutral tax reform.

This statement provoked a rebuttal from 250 economists who supported the Bush tax cuts. These economists included Bennett, Boskin, Feldstein, Hodrick, Jensen, Malkiel, and Mankiw, among others.⁵ In their rebuttal letter, these economists asserted that the Bush tax plan would promote more employment, economic growth, and opportunities for all Americans.

The proponents of the Bush tax reforms have made claims that the tax policy changes had the desired effect on business investment and economic growth. In particular, Hederman (2004), one of the champions of the tax reforms, claimed that JAGTRRA dramatically reduced taxes on capital investment, and the result was a boom in business investment that contributed substantially to strong GDP growth in the middle of the 2000s. Riedl (2007) has also argued that the 2003 tax cuts succeeded because of supply-side policies, i.e., cuts in marginal income tax rates and tax cuts on capital gains and dividends, but the 2001 tax cuts, which were based more on demand-side tax rebates and redistribution, did not significantly increase business investment and economic growth.

However, Gale and Potter (2002), Carroll et al. (2003), Desai and Goolsbee (2004), and Gale (2010) have found that the tax policies, specifically the dividend tax cuts of 2003 under the Bush Administration, seem to have been ineffective in restoring investment to normal levels. Carroll et al. (2003) have argued that President Bush's reductions in the tax rate on dividends and capital gains (the so-called 5–15 proposal) had an ambiguous effect on marginal effective tax rates. Desai and Goolsbee (2004) have also presented evidence that the 2003 tax reductions on dividends had little or no effect on business investment. In the same vein, Gale (2010) has maintained that the overall effect of the Bush tax cuts on economic

growth was negative, and that it would continue to be negative if the cuts were to be extended.

As the tax cuts enacted in 2001 and 2003 approached their December 31, 2010 expiration date, economists and policymaker were also equally divided on whether or not the tax reforms should be extended.⁶ President Obama signed the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010, which extended the Bush tax cuts until December 31, 2012.⁷

As the sharp conflict of opinion on the Bush tax cuts among economists suggests, the literature on the effects of tax incentives on business investment varies greatly. Studies such as Jorgenson (1963, 1971), Hall and Jorgenson (1967), Sandmo (1974), Brimmer and Sinai (1976), Sinai (1979), Summers (1981), Feldstein (1982), Sinai and Eckstein (1983), Hulten (1984), Boskin (1988), and Auerbach and Hassett (1992) have discovered a positive link between tax incentives and business investment spending.

On the other hand, studies by Eisner and Nadiri (1968), Eisner and Lawler (1975), Eisner (1978), Chirinko and Eisner (1983), Bosworth (1985), Corker et al. (1989), Carroll et al. (2003), Desai and Goolsbee (2004), Romer and Romer (2010), and others have presented empirical evidence showing little or no contribution of tax incentives to capital accumulation.

What is of particular interest to us is the evidence provided by Romer and Romer (2010). They investigated the impact of tax changes on output using exogenous fiscal shocks. Because traditional measures of tax changes are more likely to be biased, they used the narrative record, such as presidential speeches and Congressional reports, to obtain exogenous tax changes. They separated the legislated tax changes into those that were likely to be contaminated by other factors affecting output and those that could legitimately be used to measure the effects of tax changes. Tax changes motivated by factors unrelated to the current or prospective state of the economy formed their new series of fiscal shocks. They found that the exogenous tax changes had a negative effect on output and investment.

Several studies also noted that all taxes may not influence an individual's incentive to work, invest, and save equally. As Summers (1981), Castles and Dowrick (1990), Atkinson (1995), Agell et al. (1996), and Widmalm (2001) argued, different forms of taxation may affect capital formation differently. Arbex (2013) has also shown that different tax enforcement and government spending policies induce different optimal outcomes for interest rates. Summers (1981) has claimed that the most desirable investment incentives are those that operate by reducing the effective purchase prices of new capital goods, and that cuts in dividend taxes should be avoided.

The ambivalence of the efficacy of tax policy as a stimulus for investment may be attributable to several factors. Most importantly, taxation and government spending influence capital formation through multiple channels. As Widmalm (2001) pointed out, views suggesting a positive relationship between tax incentives and capital formation are based on public good arguments and some forms of market failures. Opinions suggesting a negative relationship between tax incentives and

investment spending are grounded in tax distortions related to financing the public sector. Any tax policy that distorts incentives to accumulate capital will reduce investment. In essence, the key channel determining the relationship between tax incentives and investment spending is the effect on marginal investment incentives.

This study employs intervention analysis to evaluate the efficacy of the two U.S. tax reforms. This approach has several merits over the existing regression models, although it has some limitations. As emphasized by Hulten (1984), it is important to isolate the effect of tax policy on investment spending from other factors. Intervention analysis is an appropriate tool for capturing the pure effect of tax policy on investment behavior, because it allows the time path of investment to be influenced only by the time paths of exogenous shocks such as tax reforms.

We have found that EGTRRA and JAGTRRA were not efficacious in spurring significant increases in U.S. real gross fixed investment. Under the EGTRRA model, the coefficients of all intervention variables were negative and highly significant. Under the JAGTRRA model, the coefficients of the pulse intervention and jump intervention variables were positive but statistically insignificant. On the other hand, the coefficient of the gradually increasing intervention variable is negative and significant. Our regression analysis provides further evidence that is consistent with the results of the intervention analysis, corroborating the robustness of the intervention results. Our findings agree with recent studies including Gale and Potter (2002), Carroll et al. (2003), Desai and Goolsbee (2004), Gale (2010) and Romer and Romer (2010).

The paper is organized as follows: Section 2 provides a brief discussion of the methodology employed in this study. Section 3 discusses the data and empirical results obtained from the intervention and regression models. Section 4 contains a summary of major findings and concluding remarks.

2. METHODOLOGY

This study employs intervention analysis in the tradition of the Box–Jenkins method to examine the effects of the two U.S. tax reforms on business investment.⁸ Feldstein (1982) proposed that the investment process may be far too complex for any single econometric model of it to be convincing. He maintained that because “in practice all econometric specifications are necessary ‘false models,’ the use of several alternative ‘false models’ can strengthen our understanding and confidence because the same biases are not likely to be present in quite different models.” Romer and Romer (2010) have also noted that any regression of output on an aggregate measure of tax changes is likely to suffer from pervasive omitted-variable bias. Intervention analysis is potentially well suited for mitigating the specification problem.

To minimize these potential problems, our strategy for evaluating the effectiveness of the Bush tax cuts is to use the intervention method as a primary analytical tool and to reinforce our findings with alternative regression models that include a

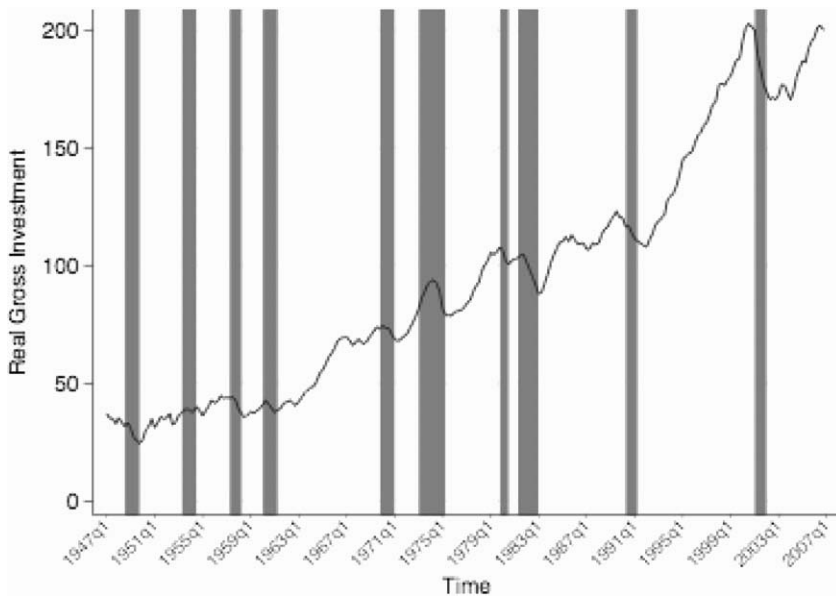


FIGURE 1. U.S. real gross private fixed investment (2000 = 100).

wide variety of control variables. We conduct intervention analysis following the Box–Jenkins technique.

3. DATA AND EMPIRICAL ANALYSIS

3.1. Data

The analysis performed in this study is based on U.S. quarterly real gross private fixed investment (INV) spanning the period from 1971:Q1 through 2006: Q4. INV is defined as the sum of real private investment in nonresidential structures and industrial equipment.⁹

A casual inspection of Figure 1 shows that real business investment grew steadily over time except in the mid-1970s, the early parts of the 1980s, 1990s, and 2000s, and the late 2000s. These decreases in investment are related to U.S. recessions in 1973–1975, 1980, 1981–1982, 1990–1991, 2001, and 2007–2009. Tax reforms were initiated in 1981 (Economic Recovery and Tax Act), 1982 (Tax Equity and Fiscal Responsibility Act), 1986, 2001 (EGTRRA), and 2003 (JAGTRRA). On the surface, the recovery of real investment after the recessions seemed to have something to do with the tax incentives. However, our study suggests a dubious link between tax incentives and the recovery of investment.

3.2. Empirical Results

Our empirical results show that EGTRRA and JAGTRRA were not efficacious in stimulating significant increases in U.S. investment in the 2000s. In the EGTRRA model, the effect of the tax reform on real investment was negative in all cases of intervention. In the JAGTRRA model, the effect of the tax incentives on business investment was either positive but statistically insignificant, as in the cases of the impulse and pure jump models, or negative, in the case of the gradually changing intervention. Furthermore, the results of our regression analysis provide confirmatory evidence for those of our intervention analysis.

Figure 1 reveals that the real investment series (INV) does not seem to be stationary: there is a pronounced positive trend or drift throughout the period under investigation. The first step in the intervention analysis procedure is to ensure that the data series is stationary. We first test for structural breaks and then perform the Dickey–Fuller (DF) unit root test. The test is not able to reject the null of no breaks, nor the null of unit roots.^{10, 11}

3.3. Intervention Analysis

Three different intervention models—the impulse function, the pure jump function, and the gradually changing function—were estimated to test for the immediate and full effects of EGTRRA and JAGTRRA.

1. The impulse function assumes a purely temporary effect following the introduction of the law. Accordingly, the intervention dummy (I_{1t}) takes a value of zero for all periods except for the quarter when the EGTRRA or the JAGTRRA was enacted (2001:Q2 for EGTRRA and 2003:Q2 for JAGTRRA).
2. The pure jump function assumes effects of a single impulse that last many periods following the introduction of the law. The intervention dummy (I_{2t}) takes a value of zero for all periods prior to the start of the implementation of the law and 1 thereafter.
3. The gradually changing function assumes that the intervention may not reach its full effect immediately. This model assumes that the tax policies were implemented in stages rather than in a single impulse, and that the full effect was not experienced until sometime afterwards.

Effect of the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA).

- A. Model specification. The next step is to specify an appropriate ARIMA model for intervention analysis. Our identification test for EGTRRA shows that goodness-of-fit measures favor the ARIMA (1,1,1) over other model specifications.¹²
- B. Intervention analysis of EGTRRA. The EGTRRA legislation was enacted in the second quarter of 2001. Based on the preceding diagnostic screening, the intervention model based on the ARIMA (1,1,1) process is specified as follows:

$$\Delta \text{INV}_t = \alpha_0 + \alpha_1 \Delta \text{INV}_{t-1} + \beta_1 \varepsilon_{t-1} + \theta I_{i,t} + \varepsilon_t, \quad (1)$$

where the variable $I_{i,t}$ is the intervention dummy.

One issue to be addressed is that the impact of the enactment of EGTRRA on investment in 2001:Q2 could be contaminated by the recessionary period in the United States that started in March 2001 and ended in November 2001. Thus, in assessment of the impact of EGTRRA on the economy, it is necessary to separate out the effects of the tax policy from those of the downturn in the economy. To deal with the identification problem, we introduced two dummies: the post-2001 recession dummy (D_i) and the NBER recession dummy (REC_i). D_1 (for the pulse intervention) takes a value of 1 in 2002:Q1 and 0 otherwise; D_2 (for the pure jump intervention) takes a value of 0 before 2002:Q1 and 1 from then on; D_3 (for the gradually increasing intervention) takes a value of 0.25 in 2002:Q1, 0.5 in 2002:Q2, 0.75 in 2002:Q3, and 1 in 2002:Q4 and thereafter. For each intervention model, we considered (1) a model with the postrecession dummy (D) and (2) a model with both the postrecession dummy and the NBER recession dummy:

$$\Delta INV_t = \alpha_0 + \alpha_1 \Delta INV_{t-1} + \beta_1 \varepsilon_{t-1} + \theta I_{i,t} + \delta D_{it} + \lambda REC_{it} + \varepsilon_t. \quad (2)$$

The coefficients of the intervention dummies (θ) in equation (2) thus measure the net effect of EGTRRA on investment with the effects of the postrecession and NBER dummies on investment purged.

Table 1 shows the results of the intervention analysis. The coefficient of the temporary effect (impulse dummy), θ_1 , is negative (-3.259) and statistically significant at the conventional level of significance. The coefficient of the pure jump intervention, θ_2 , is negative (-8.365) and highly significant, as in the case of the impulse specification. An appraisal of the effect of EGTRRA measured by the gradually increasing intervention scheme (θ_3) also confirms that the coefficient is negative and significant. Thus, the results suggest that the enactment of EGTRRA led to a reduction in U.S. real gross investment in the first half of 2000s.

To investigate whether the reduction in investment was also affected by the 2001 recession, we examined the coefficients of the postrecession and NBER recession dummies. First, all the coefficients of the tax policy (intervention) dummies in the models with the postrecession and NBER dummies are consistently negative and highly significant. Second, none of the coefficients of the postrecession dummy (D) and NBER recession dummy (REC) are significant at any reasonable level. Their p -values range from 0.322 to 0.920. Thus, we can conclude that the net effect of EGTRRA on U.S. investment in the first half of the 2000s is unambiguously negative. Interestingly enough, these results are strikingly similar to those obtained from the regression analysis, which will be discussed later.

The negative effect of EGTRRA may be attributable to the tax policy uncertainty effect. Bizer and Judd (1989), Hasset and Metcalf (1999), Guo and Krause (2014), and others suggest that when faced with a random tax incentive, firms will adjust the timing of their investment to use the investment subsidy more when it is greater. Summers (1981) has also provided an explanation of the negative effect of a tax incentive on investment by noting that there may be an incentive for business firms to postpone current investment to take advantage of a more substantial tax credit

TABLE 1. Estimation of the intervention model for the 2001 tax cut: ARIMA(1,1,1)

Coeff	ARIMA (1,1,1) ^a	Pulse Pulse	Pulse intervention(1)	Pulse intervention(2)	Jump intervention	Jump intervention(1)	Jump intervention(2)	Gradual intervention	Gradual intervention(1)	Gradual intervention(2)
α_0	0.878 (1.98)	0.876 (1.69)	0.876 (1.69)	0.877 (1.67)	0.937 (1.98)	0.931 (1.95)	0.931 (1.96)	1.063 (2.61)	1.081 (2.59)	1.082 (2.58)
α_1	0.672 (5.40)	0.657 (5.14)	0.653 (4.90)	0.651 (4.75)	0.654 (5.24)	0.655 (5.19)	0.658 (5.10)	0.626 (4.20)	0.625 (4.11)	0.625 (4.12)
β_1	-0.219 (-1.41)	-0.170 (-1.13)	-0.158 (-1.03)	-0.155 (-0.99)	-0.202 (-1.34)	-0.196 (-1.30)	-0.204 (-1.32)	-0.248 (-1.45)	-0.250 (-1.42)	-0.249 (-1.41)
θ		-3.259 (-5.70)	-3.291 (-5.79)	-3.557 (-4.46)	-8.365 (-5.07)	-8.340 (-5.09)	-9.358 (-4.93)	-25.341 (-6.28)	-25.273 (-6.28)	-25.259 (-5.97)
δ			1.220 (0.19)	1.497 (0.23)		0.754 (0.10)	1.742 (0.23)		-2.699 (-0.56)	-2.798 (-0.56)
λ				0.538 (0.58)			1.010 (0.99)			-0.078 (-0.10)

Notes: The numbers in parentheses are *t*-statistics. (1) represents the model with only the postrecession dummy. (2) represents the model with both the postrecession and NBER recession dummies.

^a The goodness of fit of ARIMA (1,1,1) is as follows: SSR = 2347.1; AIC = 2.391; SBC (Schwartz Bayesian criterion) = 2.438; Ljung-Box *Q*: *Q*(5) = 5.20 (11.071); *Q*(10) = 7.26 (18.307); *Q*(15) = 10.14 (24.996).

in the future. The uncertainty effect will show up strongly, especially when tax incentives are perceived to be temporary ones. Many of the provisions of Bush's pro-growth tax-relief legislations (for example, the "bonus" depreciation) in the 2001 tax reform were set to expire in 2004 and were later expanded in 2005.

Another explanation may be provided by the overhang effect, which suggests that overinvestment fueled by the IT frenzy during the latter half of the 1990s might have led to the failure of the 2001 tax cut to revitalize business investment in the 2000s.

Effect of the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JAGTRRA). We turn our analysis to the 2003 tax reform, which came under the title of the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JAGTRRA), with a view to investigating the efficacy of that piece of legislation and to seeing whether the results will depart from the preceding ones and align themselves more closely to the a priori expectations. JAGTRRA is noticeably different from EGTRRA in that the former is directed toward lowering taxes on dividends and capital gains income. Thus, we are concerned with whether these different components of JAGTRRA from EGTRRA produced different outcomes.

A. Model specification. Our identification procedure reveals that the ARIMA (2,1,0) model is the most robust specification for the JAGTRRA analysis, with respect to all goodness-of-fit measures.¹³

B. Intervention analysis of JAGTRRA. The JAGTRRA legislation was enacted in the second quarter of 2003. Based on the preceding diagnostic screening, the intervention model based on the ARIMA (2,1,0) process is specified as follows:

$$\Delta \text{INV}_t = \alpha_0 + \alpha_1 \Delta \text{INV}_{t-1} + \alpha_2 \Delta \text{INV}_{t-2} + \theta I_{i,t} + \varepsilon_t. \quad (3)$$

The intervention dummies ($I_{1,t}$, $I_{2,t}$, $I_{3,t}$) are as defined previously, but now they are modified to take a value of zero prior to the intervention in the second quarter of 2003. Thus, $I_{3,t}$ now takes a value of 0.25 in 2003:Q2, 0.50 in 2003:Q3, 0.75 in 2003:Q4, and 1 in 2004:Q1 and thereafter. As before, the intervention impact of I_t on INV_t is given by the magnitude and sign of θ_1 , θ_2 , and θ_3 , respectively.

Table 2 shows the results of the intervention analysis. The coefficient of the temporary effect, θ_1 , is positive (0.695) but not statistically significant. The coefficient for the pure jump function, θ_2 , is also positive (4.414) but is not statistically significant at any reasonable level of significance. However, the coefficient of the gradually changing function, θ_3 , which captures the long-term effect of the JAGTRRA legislation is negative (−9.341) and significant.

Empirical implications. Under the JAGTRRA legislation, depreciation allowances for equipment investment were increased; the tax rate on dividend income was cut sharply; and the tax rate on capital gains income was cut more modestly. It is interesting to note that the coefficients of the intervention dummies in the JAGTRRA specification are positive in the cases of the pulse and pure

TABLE 2. Estimation of the intervention model for the 2003 tax cut: ARIMA (2,1,0)

Coefficient	ARIMA (2,1,0) ^a	Pulse intervention	Pure jump intervention	Gradually increasing intervention
α_0	0.875 (1.70)	0.863 (1.66)	0.841 (1.59)	0.937 (1.77)
α_1	0.434 (4.48)	0.435 (4.42)	0.423 (4.39)	0.427 (4.22)
α_0	0.149 (1.83)	0.149 (1.81)	0.177 (2.18)	0.165 (1.96)
θ		0.695 (0.62)	4.414 (0.95)	-9.341 (-2.23)

Note: The numbers in parentheses are *t*-statistics.
^a The goodness of fit of ARIMA (2,1,0) is as follows: SSR = 2496.5; AIC = 2.395; SBC (Schwartz Bayesian criterion) = 2.440; Ljung-Box *Q*: *Q*(5) = 6.77 (11.071); *Q*(10) = 8.83 (18.307); *Q*(15) = 9.99 (24.996).

jump interventions, but none of them are significant. The coefficient of the intervention dummy for the gradually increasing intervention scheme is negative and significant at the conventional level of significance. Thus, our estimation result suggests that the JAGTRRA failed to stimulate U.S. business investment in the 2000s. However, the positive signs of the coefficients of the intervention dummies in the JAGTRRA specification are in contrast to the negative coefficients of all the intervention dummies in the EGTRRA specification. This might be related to the fact that EGTRRA was enacted in the middle of 2001 recession, which confounds the impact of the policy with that of the ongoing contraction in economic activity.

There has been enduring debate surrounding the effect of dividend taxation on investment behavior. The new view of dividend taxation says that dividend tax cuts do not reduce the cost of capital for marginal investments, whereas the traditional view maintains that such cuts do reduce the marginal cost of capital and thus stimulate investment. Santoro and Wei (2012) have found that progressive dividend taxation distorts investment decisions because of endogenous variations in the marginal tax rate caused by stochastic taxable income over the business cycle.

Those who are skeptical about the effectiveness of the tax cuts in stimulating business investment emphasize that lower capital gains taxes are neither good tax incentives for investment nor good budgetary policy. Our empirical evidence shows that the dividend tax incentives under JAGTRRA had little or no effect on investment, thus providing support for the new view. This conclusion is in agreement with that of Carroll et al. (2003), Desai and Goolsbee (2004), and Gale (2010), who have found that the tax policies, specifically the dividend tax cuts of 2003 under the JAGTRRA legislation, failed in restoring investment to normal levels.

Some analysts attribute the investment malaise of the early 2000s to the phenomenon of “capital overhang,” i.e., the unusually high investment of the 1990s stoked by the asset price bubble. In this view, the capital overhang resulted in corporations’ holding excess inventory of capital stock, which tamed the appetite for investment during the 2000s. However, Desai and Goolsbee (2004), although not without critics [for instance, Hassett and Leahy (2004)], contended that data at the firm, asset, and industry levels do not support the explanation of the capital overhang effect, and that the general evidence shows that rapid growth of investment in the 1990s had very little correlation with the investment declines in the 2000s.

According to *Pitchbook Data*, private equity capital overhang was less than \$50 billion in 1998, but it began to rise steeply in the 2000s, reaching \$150 billion in 2000. It climbed to \$230 billion in 2002 and \$292 billion by 2006. The capital overhang view holds that business investment will not recover fully until normal economic growth eliminates it.

Another plausible explanation for the inefficacy of the Bush tax cuts enacted in the 2000s is that there was a global savings glut in the 2000s, at least until the outbreak of the 2007–8 global financial crisis. Cheap global money might have been a dominant influence on U.S. investment expenditure in the 2000s, and consequently any tax incentives would not have exerted significant effects on capital formation. The global savings glut helped international financial markets maintain low interest rates, which made it easier for U.S. firms to borrow at lower costs. Also, persistent budget deficits might have a detrimental effect on the channel between the tax cuts and business investment. Our regression analysis in the next section provides some evidence on these arguments.

Comparison with regression results. This section compares our intervention analysis results with those based on the traditional regression models that control for fundamental determinants of business investment. The purpose of this section is twofold. First, this analysis aims to test the robustness of our intervention analysis results by controlling for explanatory variables. Second, we compare the effects of our intervention variables with those of Romer and Romer’s (2010) fiscal shocks. This comparison is meaningful because, in order to avoid the potential correlation of tax changes with other underlying factors, they used exogenous tax changes that are not systematically correlated with other factors affecting output.

In this regression, we control for a wide variety of variables. These variables include GDP, real interest rate (INT), 3-month Eurodollar London-interbank offered rate (LIBOR), trade-weighted exchange rates (EXCH, March 1973 = 100), credit available to business firms (CREDIT, measured by credit market instruments issued by nonfinancial corporate businesses, in billions of dollars) as a measure of credit tightening, private equity capital overhang (OVERHANG), gross capital inflows (INFLOW, measured by credit market borrowing from the rest of the world, in billions of dollars) as a measure of global money, the Conference Board’s leading economic indicators (LEI), NBER recession measures (REC,

1 for recession and 0 otherwise), and monetary and fiscal policy variables. We use budget deficits (DEF, in billions of 2000 dollars) and the federal funds rate (FFRATE) as proxies for fiscal and monetary policies, respectively. The variable of focus is tax policy actions (TAX). We use three tax policy variables: Romer and Romer's fiscal shocks and intervention variables: pure jump and gradually changing interventions.¹⁴

In this regression, we used lagged variables to check if these variables are causing investment, and not the policy. Our regression model is given by¹⁵

$$\begin{aligned}\Delta INV_t = & \alpha + \beta_1 \Delta GDP_{t-1} + \beta_2 \Delta INT_{t-1} + \beta_3 \Delta CREDIT_{t-1} \\ & + \beta_4 \Delta INFLOW_{t-1} + \beta_5 \Delta LEI_{t-1} + \beta_6 \Delta LIBOR_{t-1} + \beta_7 \Delta EXCH_{t-1} \\ & + \beta_8 \Delta DEF_{t-1} + \beta_9 \Delta FFRATE_{t-1} + \beta_{10} \Delta REC_{t-1} \\ & + \beta_{11} \Delta OVERHANG_{t-1} + \gamma TAX_t + \varepsilon_t.\end{aligned}\quad (4)$$

Table 3 reports the estimation of the coefficients. Our estimation results are robust to the inclusion of any explanatory variables. The coefficient of interest is that of TAX, because we are interested in the sign and significance of the variable after relevant variables are controlled for. Overall, the regression results are consonant with those of our intervention analysis and Romer and Romer's VAR analysis. First, the coefficients of the EGTRRA dummies are in conformity with those of the intervention models. They are all negative, and the coefficient of the pure jump intervention is significant, although the coefficient of the gradually changing intervention is insignificant. The coefficients of the JAGTRRA dummies are also in line with those of intervention models. The coefficient of the pure jump intervention is positive, but insignificant as in the case of the intervention model. The only difference between the regression and intervention results is that the coefficient of the gradually increasing intervention is negative, and significant in the intervention model, whereas it is positive, but insignificant in the regression model. On the other hand, the coefficient of the Romer–Romer fiscal shocks is positive, but its *p-value* is 0.775.

The coefficients of control variables (GDP, budget deficits, and NBER recession measures) are statistically significant and have the anticipated signs. Although capital overhang had a negative impact on investment in all cases including the model with Romer and Romer's fiscal shocks, they are all insignificant.

4. CONCLUSION

The purpose of this study is to examine the interplay between tax policy and business investment behavior. There has been a proliferation of the literature on the issue, but the evidence on the subject is far from conclusive. In this study we have used a powerful, but simple tool known as intervention analysis to analyze the relationship between tax incentives and business investment spending. We have investigated the effects of the two recent tax reforms commonly called

TABLE 3. Estimation of regression models: Romer–Romer model versus intervention model

Variable	Romer fiscal shocks	EGTRRA		JAGTRRA	
		Pure jump	Gradual change	Pure jump	Gradual change
GDP	0.012 (2.39)	0.012 (2.46)	0.012 (2.41)	0.012 (2.33)	0.012 (2.35)
INT	−0.429 (−0.68)	−0.311 (−0.50)	−3.392 (−0.62)	−0.443 (−0.70)	−0.454 (−0.72)
CREDIT	0.016 (1.47)	0.013 (1.19)	0.015 (1.41)	0.016 (1.47)	0.016 (1.48)
INFLOW	−0.00006 (−0.73)	0.0003 (1.79)	0.00005 (0.26)	−0.0002 (−1.12)	−0.0002 (−1.03)
LEI	0.011 (0.63)	0.010 (0.61)	0.011 (0.62)	0.011 (0.65)	0.011 (0.63)
LIBOR	0.722 (1.03)	0.641 (0.94)	0.732 (1.05)	0.745 (1.07)	0.747 (1.07)
EXCH	0.043 (0.64)	0.036 (0.55)	0.039 (0.59)	0.046 (0.69)	0.043 (0.64)
DEF	−0.013 (−2.62)	−0.009 (−1.85)	−0.012 (−2.33)	−0.013 (−2.62)	−0.013 (−2.57)
FFRATE	−0.460 (−0.67)	−0.369 (−0.55)	−0.456 (−0.67)	−0.488 (−0.71)	−0.487 (−0.71)
REC	−2.802 (−3.67)	−2.468 (−3.28)	−2.728 (−3.35)	−2.884 (−3.80)	−2.877 (−3.79)
OVERHANG	−1.353 (−0.84)	−0.923 (−0.58)	−1.273 (−0.79)	−1.332 (−0.83)	−1.342 (−0.84)
ROMER	0.004 (0.29)				
DUM2E		−2.654 (−2.58)			
DUM3E			−0.853 (−0.74)		
DUM2J				1.012 (0.85)	
DUM3J					0.949 (0.74)
R^2	0.413	0.441	0.415	0.416	0.415
F	7.55	8.48	7.62	7.64	7.62

Notes: ROMER = Romer and Romer's measure of fiscal shocks; DUM2E = pure jump intervention for EGTRRA (2001); DUM3E = gradually changing intervention for EGTRRA (2001); DUM2J = pure jump intervention for JAGTRRA (2003); DUM3J = gradually changing intervention for JAGTRRA (2003). The numbers in parentheses are t statistics.

the Bush tax cuts—EGTRRA and JAGTRRA—on U.S. real gross investment using quarterly data from 1971:I to 2006:IV.

JAGTRRA is noticeably different from EGTRRA in that the former tax reform includes reductions in the tax rates on dividends and capital gains. There has been a perennial debate surrounding the effect of dividend taxation on investment behavior. Summers (1981) and the economists who signed the Economists' Statement Opposing the Bush Tax Cuts have argued that reductions in dividend taxes are not credible as a short-term stimulus. Our study has presented evidence that the reductions in taxes on dividends and capital gains under JAGTRRA proved ineffective in stimulating business investment, thus giving support to those economists who opposed the Bush tax cuts. The designs and components of the tax reforms may not be appropriate for creating marginal investment incentives.

Notably, the results of our regression analysis corroborate those of the intervention model. All the coefficients of the intervention dummies in the regression model are negative in the EGTRRA case indicating that the tax changes had small or negative effects on real investment during the sample period. The coefficients of the intervention dummies are all positive, but none of them are significant at any reasonable level in the JAGTRRA case. The JAGTRRA legislation might have been a bit more favorable to investment, but it did not succeed in stimulating U.S. investment.

Auerbach and Hassett (1992) have asserted that "frequent manipulation of tax policy suggests that policymakers believe it to be an effective tool for altering the level and composition of investment. Yet, despite all the policy changes that have occurred, there is very little convincing empirical evidence that this view is accurate." One important conclusion drawn from our study is that the Bush tax cuts were based on articles of faith among policy makers that were not materialized [Hall and Jorgenson (1967)].

NOTES

1. EGTRRA promised (1) to reduce tax rates, including a new 10% tax bracket, for every American who paid income taxes; (2) to increase the child tax credit to \$1,000 by 2010; (3) to reduce the marriage penalty beginning in 2005; (4) to phase out the death tax; and (5) to increase education tax benefits.

2. JAGTRRA promised (1) to accelerate income tax rate reductions effective January 1, 2003; (2) to expand the 10% bracket effective January 1, 2003; (3) to increase the child credit to \$1,000 effective January 1, 2003; (4) to reduce the marriage penalty effective January 1, 2003; (5) to quadruple small business expenses from \$25,000 to \$100,000; (6) to increase bonus depreciation for businesses to 50% through 2004; and (7) to reduce the top tax rate on dividends and capital gains to 15%.

3. See Public Law 108–27, Jobs and Growth Tax Relief Reconciliation Act of 2003 (May 28, 2003), for a detailed description of the JAGTRRA provisions. Notably, there is some overlap between several of the provisions of EGTRRA and JAGTRRA, as the latter was in part designed to accelerate many of the tax reductions in the former, which were intended to be phased in over a period of up to 9 years.

4. This statement can be retrieved from <http://www.epi.org/publication/econ.stmt.2003/>.

5. The names of the economists who endorsed President Bush's tax cuts appear on the homepage of the U.S. Department of the Treasury: home>>press center>>>250 Economists Endorse President Bush's Jobs and Growth Plan." On the other hand, statements by the 11 Nobel Laureates and 450 other economists who opposed the tax cuts were printed as a full-page ad in *The New York Times*, February 10, 2003.

6. The political debate surrounding the extension of the Bush tax cuts centered on whether the tax cuts should be permanent or not, and whether the extension should be applied to all taxpayers or only to middle-income families, limiting the extension to individuals making less than \$200,000 and married couples earning less than \$250,000.

7. As the Bush tax cuts expired on December 31, 2012, the Senate passed a compromise bill, the American Tax Payer Relief Act of 2012, and President Obama signed the bill, which reinstated many of the tax cuts for two months effective retroactive to January 1, 2013. The bill delayed the budget sequestration by two months. However, President Obama and Congress failed to resolve the budget sequestration by March 1, 2013.

8. The Box-Jenkins technique involves model selection (ARIMA) to find the most robust representation of the process; estimation of the most plausible ARIMA model; and diagnostic checks on the estimated equations.

9. The data series after 2007 was excluded, because the series might be contaminated by the recent global economic crisis. The data used for the analysis of intervention and regression models in the study have been taken from various sources including the Department of Commerce's Bureau of Economic Analysis (BEA), St. Louis Federal Reserve Bank's FRED (<http://research.stlouisfed.org/fred2>), www.federalreserve.gov/econresdata at the Board of Governors, www.nber.org/cycles, <http://elsa.berkeley.edu> fromer, www.conference-board.org/data/bcicountry.cfm?cid=1, and others.

10. The sample size in this study contains 217 preintervention observations and 23 postintervention observations for EGTRRA analysis and 225 preintervention observations and 15 postintervention observations for JAGTRRA analysis.

11. We have tested for the presence of unit roots and structural breaks in the INV series. Our unit root test indicates that the series contains a unit root (difference-stationary). Our CUSUM test shows that there seemed to be a noticeable incline in CUSUM from 1992 until early 2000, when it began to decline. However, the deviation of the CUSUM was within the 95% confidence interval, indicating that there was no significant break in the mean of investment. Our CUSUMSQ test indicates that there was a significant deviation of the CUSUMSQ from 1984 until the early 2000s, but it showed stable movement.

12. To err on the side of caution, we have estimated four models and compared their results: ARIMA (1,1,0), ARIMA (0,1,1), ARIMA (1,1,1), and ARIMA (2,1,2). To ensure comparability, we estimated all models over the same sample period, as presented in Table 1.

13. We estimated six models and compared their results: ARIMA(2,1,0), ARIMA(0,1,2), ARIMA(1,1, 1), ARIMA (1,1, 2), ARIMA(2,1,1), and ARIMA(2,1, 2).

14. Refer to Section 3.1 for the sources of these data sets. The data used in this regression cover the period from 1971:Q1 to 1986:Q4. Because quarterly data for private equity capital overhang are not available, we use the ratio, CREDIT/INV, as a proxy for the capital overhang variable. The higher the ratio, the larger is capital overhang.

15. To deal with nonstationarity in the variables, we also estimated a model in level form, but with a trend variable. The estimation results for the tax dummies are basically the same as those of the first-differenced regression model, but are more closely in agreement with those of the intervention model:

$$\begin{aligned} INV_t = & \alpha + \beta_1 GDP_{t-1} + \beta_2 INT_{t-1} + \beta_3 CREDIT_{t-1} + \beta_4 INFLOW_{t-1} + \beta_5 LEI_{t-1} \\ & + \beta_6 LIBOR_{t-1} + \beta_7 EXCH_{t-1} + \beta_8 DEF_{t-1} + \beta_9 FFRATE_{t-1} + \beta_{10} REC_{t-1} \\ & + \beta_{11} OVERHANG_{t-1} + \beta_{12} TIME + \gamma TAX_t + \varepsilon_t. \end{aligned}$$

REFERENCES

- Agell, J., T. Lindh, and H. Ohlsson (1997) Growth and the public sector: A critical review essay. *European Journal of Political Economy* 13, 33–52.
- Arbex, M. (2013) A quantitative analysis of tax enforcement and optimal monetary policy. *Macroeconomic Dynamics* 17, 1096–1117.
- Atkinson, A.B. (1995) The welfare state and economic performance. *National Tax Journal* 48, 171–198.
- Auerbach, A.J. (1987) The tax reform act of 1986 and the cost of capital. *Journal of Economic Perspectives* 1, 73–86.
- Auerbach, A.J. and K. Hassett (1992) Tax policy and business fixed investment in the United States. *Journal of Public Economics* 47, 141–170.
- Bizer, D.S. and K.L. Judd (1989) Taxation and uncertainty. *American Economic Review* 79, 331–336.
- Boskin, M.J. (1988) Tax policy and economic growth: Lessons from the 1980s. *Journal of Economic Perspectives* 2, 71–97.
- Brimmer, A.F. and A. Sinai (1976) The effects of tax policy on capital formation, corporate liquidity and the availability of investible funds: A simulation study. *Journal of Finance* 31, 287–308.
- Carroll, R., K.A. Hassett, and J.B. Mackie III (2003) The effect of dividend tax relief on investment incentives. *National Tax Journal* 56, 629–651.
- Castles, F.G. and S. Dowrick (1990) The impact of government spending levels on midterm economic growth in the OECD, 1960–85. *Journal of Theoretical Politics* 2, 173–203.
- Chirinko, R.S. and R. Eisner (1983) Tax policy and investment in major U.S. macroeconomic models. *Journal of Public Economics* 20, 139–166.
- Corker, R., O. Evans, and L. Kenward (1989) Tax policy and business investment in the United States: Evidence from the 1980s. *IMF Staff Papers* 36, 31–62.
- Desai, M.A. and A.D. Goolsbee (2004) Investment, overhang, and tax policy. *Brookings Papers on Economic Activity* 2, 285–338.
- Eisner, R. (1978) *Factors in Business Investment*. Cambridge, MA: Ballinger.
- Eisner, R. and P.J. Lawler (1975) Tax policy and investment: An analysis of survey responses. *American Economic Review* 65, 206–212.
- Eisner, R. and M.I. Nadiri (1968) Investment behavior and neoclassical theory. *Review of Economics and Statistics* 50, 369–382.
- Enders, W. (2004) *Applied Econometric Time Series*, 2nd ed. Hoboken, NJ: Wiley.
- Engen, E.M. and J. Skimmer (1992) Fiscal Policy and Economic Growth. NBER working paper 4223.
- Feldstein, M.F. (1982) Inflation, tax rules and investment: Some econometric evidence. *Econometrica* 50, 825–862.
- Gale, W.G. (2010) Five myths about the Bush tax cuts. Available at http://www.washingtonpost.com/wp-dyn/content/article/2010/07/30/AR2010073002671_pf.html.
- Gale, W.G. and S.R. Potter (2002) The Bush tax cut: One year later. Available at http://www.brookings.edu/papers/2002/06useconomics_gale.aspx?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+BrookingsRSS%2Fseries%2Fbrookingspolicybrief+%28Brookings%3A+Series+-+Brookings+Policy+Brief+Series%29&utm_content=Google+Feedfetcher.
- Guo, J.T. and A. Krause (2014) Optimal dynamic nonlinear income taxation under loose commitment. *Macroeconomic Dynamics* 18, 1403–1427.
- Hall, R.E. and D.W. Jorgenson (1967) Tax policy and investment behavior. *American Economic Review* 57, 391–414.
- Hassett, K.A. and J.V. Leahy (2004) Investment, overhang, and tax policy: Comments and discussion. *Brookings Papers on Economic Activity* 2, 339–355.
- Hassett, K.A. and G.E. Metcalf (1999) Investment with uncertain tax policy: Does random tax policy discourage investment? *Economic Journal* 109, 372–393.
- Hederman, R.S. (2004) Tax cuts boost business investment. Available at <http://www.heritage.org/Research/Taxes/wm412.cfm?renderforprint=1>.

- Hulten, C.R. (1984) Tax policy and the investment decision. *American Economic Review* 74, 236–241.
- Jorgenson, D.W. (1963) Capital theory and investment behavior. *American Economic Review* 53, 247–259.
- Jorgenson, D.W. (1971) Econometric studies of investment behavior: A survey. *Journal of Economic Literature* 9, 1111–1147.
- Levine, R. and D. Renelt (1992) A sensitive analysis of cross-country regressions. *American Economic Review* 82, 942–963.
- Riedl, B.M. (2007) Ten Myths about the Bush Tax Cuts. No. 2001. Background: The Heritage Foundation.
- Romer, C.D. and D. Romer (2010) The macroeconomic effects of tax changes: Estimates based on a new measure of fiscal shocks. *American Economic Review* 100, 763–801.
- Sandmo, A. (1974) Investment incentives and the corporate income tax. *Journal of Political Economy* 82, 287–302.
- Santoro, M. and C. Wei (2012) A note on the impact of progressive dividend taxation on investment decisions. *Macroeconomic Dynamics* 16, 309–319.
- Sinai, A. (1979) Tax Expenditures and Business Capital. Testimony presented at hearings on tax expenditures, Committee on Ways and Means, 96th Congress, pp. 35–38.
- Sinai, A. and O. Eckstein (1983) Tax policy and business fixed investment, revisited. *Journal of Economic Behavior and Organization* 4, 131–162.
- Summers, L.H. (1981) Taxation and corporate investment: A q-theory approach. *Brookings Papers on Economic Activity* 1, 67–140.
- Widmalm, F. (2001) Tax structure and growth: Are some taxes better than others? *Public Choice* 107, 199–219.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.