Can Crowd Out Hamper Stimulus Programs In Recessions?

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ABSTRACT

In well controlled statistical tests, crowd out was found related to government deficits financed by borrowing. Roughly equal effects were found for both recession and non-recession periods. Tax cut deficits were found were found more detrimental than spending deficits Private borrowing was found to systematically decline with the growth of government deficits, and explained most variation in consumer and investment spending also related to deficits. Crowd out may be avoided if foreign borrowing increases loanable funds available, or if M2 money increases prior to the deficit. This study provides first time empirical evidence, using standard demand driven stimulus model*s,* that crowd out occurs in recessions and non-recession periods in response to deficits, fully offsetting stimulus effects. Results are robust to differences in time period tested. They offer a plausible explanation for the lackluster results of recent U.S. government stimulus programs in offsetting the 2008 recession.

INTRODUCTION

When government finances deficits by borrowing from the savings pool, the reduction in loanable funds available to consumers and businesses is "crowd out". Borrowing by both consumers and businesses is extensively used even in recessions to supplement the purchasing power of income, for example, when buying a house or new machinery. Government borrowing to finance deficits may crowd out private borrowing, and hence, spending, offsetting some or all of the deficit's stimulus effects. Whether it actually does or not is an empirical issue, examined in this paper.

The paper tests whether consumer or business borrowing is negatively impacted by deficits, in either recessions or non-recession periods. It also tests if any declines in spending are systematically related to declines in borrowing, as theorized in the crowd out model. U.S. data for the period 1960-2000 are tested. Findings are tested for robustness by dropping the first or last ten year period from the sample, and then retesting.

THE NO - CROWD OUT MODEL

Standard simple models of the economy do not allow for borrowing - related crowd out. In such models the impact of taxes and government spending are derived using the GDP identity:

$$GDP = Y = C + I + G + (X-M) \quad (1)$$

A simple consumption function might be given as a linear function of disposable income (Y-T)

$$C = \beta(Y-T) \quad (2)$$

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substituting C into (1) gives

$$Y = \left| \frac{1}{(1-\beta)} \right| * [\, -\beta T + I + G + X - M \,] \quad (3)$$

The clear expectation of standard model demand theory is that tax changes in are expected to be negatively related to the GDP, with a multiplier effect **-β /(1-β)**. Changes in government spending and net exports are related to GDP in the positive direction, with a multiplier effect **1/(1-β).**

THE CROWD OUT MODEL

However, to test the hypothesis that savings otherwise used to finance consumer credit is diverted to finance government deficits, the consumption function must be modified to add the crowd out - causing factor, the deficit (T-G), where (T-G) = taxes minus government spending:

$$C = \beta (Y-T) + \lambda(T-G) \quad (4)$$

where lambda (λ) represents the marginal effect of deficit spending on consumer demand. With this function, the model becomes

$$GDP = Y = \beta (Y-T) + \lambda(T-G) + G + I + (X-M)$$
$$= [1/(1-\beta)]\, [\, (-\beta+\lambda) T + (1-\lambda) G + I + (X-M) \,] \quad (5)$$

The impact of a change in T or G on the GDP depends on **λ** as well as **β**. The tax multiplier, is now **(-β+ λ)/ (1- β)**. The spending multiplier, is now **(1-λ)/(1-β)**. *Both T and G marginal effects on the GDP will be smaller (in absolute terms) than they would have been without crowd out effects.*

If crowd out has different effects in recession (Rec) and non-recession periods (NonRec), the formulation becomes

$$GDP = Y = \beta (Y-T) + \lambda_{Rec}(T-G) + \lambda_{NonRec}(T-G) + G + I + (X-M)$$
$$= [1/(1-\beta)]\, [\, (-\beta+\lambda_{Rec})T + (-\beta+\lambda_{NonRec})T + (1-\lambda_{Rec})\, G + (1-\lambda_{NonRec})\, G + I + (X-M) \,] \quad (6)$$

We can see the impact of a change in T or G on the GDP depends on $\boldsymbol{\lambda_{Rec}}$ or $\boldsymbol{\lambda_{NonRec}}$ as well as **β**. The tax multiplier, is now $\boldsymbol{(-\beta+ \lambda_{Rec})/ (1- \beta)}$ in recessions or $\boldsymbol{(-\beta+ \lambda_{NonRec})/ (1- \beta)}$ in non-recessions. If crowd out is less in recessions, the tax cut multiplier effects will be larger than in non-recessions. The spending multiplier, is now $\boldsymbol{(1-\lambda_{Rec})/(1-\beta)}$ or $\boldsymbol{(1-\lambda_{NonRec})/(1-\beta)}$ and if crowd out is less in recessions, the spending multiplier will be larger in recessions than in non-recessions.

We can expand this model to include effects of crowd out on investment spending. Assume a simple investment model in which investment is determined by real interest rates (r) and access to credit, which varies with the government deficit (T-G).

$$I = \gamma(T-G) - \theta r \quad (7)$$

where gamma (γ) indicates the marginal effect of crowd out (the government deficit) on investment spending, and (θ) represents the marginal effect of real interest rates (r).

If we replace investment in the GDP identity with its hypothesized determinants, we obtain a typical "IS" equation:

$$GDP = Y = = [1/1-\beta] [(-\beta+\lambda+\gamma) T + (1-\lambda-\gamma) G - \theta r + (X-M)] \quad (8)$$

In this IS equation, the normal stimulating impact of tax cuts on the GDP **(-β)** is offset by the effects of deficit – induced changes in credit available to consumers and investors **(λ+γ)**. Tax stimulus effects may switch from negative to positive if the crowd out effects **(λ+ γ)** are larger than the disposable income effect **(-β)**. The normal stimulating effect of government spending is reduced from **(1)** to **(1- λ-γ)**, and stimulus effects are either reduced or become negative. The net exports multiplier effect stays the same, now becoming an even stronger stimulus relative to government spending or tax cuts. Results are shown in Table 1. Crowd out reduces the stimulus of spending deficits less than tax cut deficits, because the spending stimulus effect **(1)** to be offset by crowd out is larger than the tax stimulus effect **(-β)**. Results are shown in Table 1.

Crowd out may or may not be a problem in recessions. It can be argued consumers and businesses borrow less in recessions, leaving savings available to finance new government deficits without causing crowd out. However, national savings may also drop in recessions due to falling incomes. If savings decline as much or more that private borrowing demand, new deficits will still cause new crowd out. Hence, arguments for and against crowd out in recessions can be made theoretically.

If crowd out effects are different in recessions than in non-recessions, the investment and IS functions change as follows:

$$I = - \theta r + \gamma_{Rec} (T-G) + \gamma_{NonRec} (T-G) \quad (9)$$

$$Y = [1/1-\beta] [(-\beta+\lambda_{Rec}+\gamma_{Rec}) T \text{ or } (-\beta+\lambda_{NonRec}+\gamma_{NonRec}) T + (1-\lambda_{Rec}-\gamma_{Rec}) G \text{ or } (1-\lambda_{NonRec}-\gamma_{NonRec}) G - \theta r + (X-M)] \quad (10)$$

Hence, the stimulus effect of tax cuts **(-β)** is offset by either the recession effect of crowd out **(λ_{Rec}+ γ_{Rec})** or the non-recession effect **(λ_{NonRec}+ γ_{NonRec}).** The stimulus effect of government spending **(+1)** is offset by either the recession effect of crowd out **(-λ_{Rec}- γ_{Rec})** or the non-recession effect **(-λ_{NonRec}- γ_{NonRec}).** These results are also summarized in Table 1.

The model we shall test later in this paper is a slightly different form of the model shown above. The model above was based on the GDP identity

$$Y = C + I + G + (X-M) \quad (11)$$

But we can just as accurately write

$$Y = C_D + I_D + G_D + X \quad \text{(where subscript D denotes domestically produced goods)} \quad (12)$$

This is an important distinction in calculating multipliers because only spending on domestically produced consumer or investment goods generates the multiplier effect on the GDP. Hence, the last formulation of the GDP identity may be the better form to use when calculating IS curve parameter estimates, since multiplier effects inherent in the coefficients are more correctly estimated. (We abstract from effects on exports of growth in import demand).

Because the data available does not allow separation of government purchases into domestic produced goods and imports, the form of the model we test is:

$Y = C_D + I_D + G + X)$ (13)

Table 1: Effects of Crowd Out on Taxes and Government Spending Stimulus

	Without Crowd Out	**With Crowd Out**		**Without Crowd Out**	**With Crowd Out**
Tax coefficient	$(-\beta)$	$-\beta+(\lambda+\gamma)$	Spending Coefficient.	1	$1-(\lambda+\gamma)$
	$(-\beta)$	$-\beta+(\lambda+\gamma)_{Rec}$		1	$1-(\lambda+\gamma)_{Rec}$
	$(-\beta)$	$-\beta+(\lambda+\gamma)_{NonRec}$		1	$1-(\lambda+\gamma)_{NonRec}$
Tax Multiplier (Average-All Per.)	$\frac{(-\beta)}{(1-\beta)}$	$\frac{-\beta+(\lambda+\gamma)}{(1-\beta)}$	Spending Multiplier	$\frac{1}{(1-\beta)}$	$\frac{1-(\lambda+\gamma)}{(1-\beta)}$
Tax Multiplier (Recession Period)	$\frac{(-\beta)}{(1-\beta)}$	$\frac{-\beta+(\lambda+\gamma)_{Rec}}{(1-\beta)}$	Spending Multiplier	$\frac{1}{(1-\beta)}$	$\frac{1-(\lambda+\gamma)_{Rec}}{(1-\beta)}$
Tax Multiplier (Non-Recession)	$\frac{(-\beta)}{(1-\beta)}$	$\frac{-\beta+(\lambda+\gamma)_{NonRec}}{(1-\beta)}$	Spending Multiplier	$\frac{1}{(1-\beta)}$	$\frac{1-(\lambda+\gamma)_{NonRec}}{(1-\beta)}$

OTHER STUDIES

An extensive review of literature addressing the crowd out topic is available in Rensselaer Polytechnic Institute's Department of Economics Working paper #1103, available at the department's website.

METHODOLOGY

1960 - 2000 data on the determinants of consumption and investment spending were taken from the *Economic Report of the President 2002* and *2010. Flow of Funds Accounts* of the Federal Reserve were used to obtain data on consumer and business debt, changes in which were taken as measures of net consumer or business borrowing. The specific variables are identified in later sections.

Two -stage least squares regression was used since both consumption and investment are driven in part by income related variables (disposable income or the accelerator), and therefore 2SLS was needed to avoid issues of simultaneity. The remaining variables in the consumption and investment equations are lagged, or considered exogenous (e.g. the prime interest rate is rigidly set to reflect the federal funds rate, which is exogenously determined by the Fed; depreciation allowances are determined by prior year investment levels, etc.). They were used as 1st Stage regressors. Variables were tested in first differences instead of levels to address nonstationarity, serial correlation and multicollinearity issues commonly found

in time series data. Newey West corrections to standard errors were used to avoid heteroskedasticity problems. Durbin - Watson measures of serial correlation are shown with each regression. The 2SLS form of instrumental variables and the D.W. test for serial correlation are considered the most appropriate for use with time series data (Griffiths, Hill, Lim, 2011).

It is difficult to separate consumer imports out of total imports in the *Economic Report of the President*. The Bureau of Economic Analysis (BEA) has confirmed it does not categorize import and export data into same "C" and "I" and "G" categories used elsewhere in the national GDP accounts. Absent official determinations by BEA, economists must make their own evaluations of how to divide the data. For example, it is not clear from Table 104 in the *Economic Report of the President* how much of the value of motor vehicle imports or petroleum imports should be treated as inventory investment vs. sales to consumers. Data on imported services (Table B-106) does not distinguish between imports of services by businesses and consumers, though one might suspect the former dominate. Nor do the services data extend back beyond 1974. Hence, no deduction from total imports for business services imports could be made in calculating consumer imports.

Following Heim (2010), we take as our definition of consumer imports all imports except imports of capital goods and industrial supplies and materials. The theory behind this choice was that the best definition of "consumer" imports was the one whose variation was best explained (highest R^2) by the variables theoretically thought to drive demand for consumer imports. Other definitions of consumer imports, did not explain consumer behavior as well.

To obtain separate deficit, tax or government spending variables for recession periods, they are multiplied by a dummy variable taking the value (1) when there is a depression at some time during the data year, and (0) in non-recession years. For non-recession years, the dummy variable is reversed. National Bureau of Economic Research estimates (NBER 2009) were used to define recession years.

VARIABLES INCLUDED IN CONSUMPTION AND INVESTMENT MODELS

Theory suggests a wide range of variables are determinants of consumer demand. Individual studies have provided some empirical support for many variables, though not always controlling adequately for the rest. The consumption functions tested in this paper control for an extensive list of possible factors that might influence consumption, including crowd out, thereby helping ensure the correctness of the crowd out results. Lagged or average values are used with some of these variables, reflecting the findings of earlier studies. The variables used include:

C_T = real consumer goods and services

(Y-T) = real disposable income

(T-G) = real government deficit, defined as one variable

PR = real prime interest rate

DJ_{-2} = a measure of wealth (Dow Jones Composite Index), lagged two years

XR_{AV} = exchange rate average for current and past three years

POP_{16} = ratio of young (16 -24 year olds) to old (over 65) in population

POP = population size

ICC_{-1} = Index of Consumer Confidence (Conference Board), lagged one year

$M2_{AV}$ = real M2 money supply, average of past three years

(C_{BOR}) = Net annual consumer borrowing = change in consumer debt (ΔC_{DEBT}) that period.

Theory also suggests many variables are determinants of investment demand. Here again, individual studies have provided some empirical support for many different variables, though results are not always obtained controlling adequately for other possible factors. The variables used here include:

I_T = total spending on investment goods, both domestically produced and imported

I_M = Spending on imported investment goods

I_D = Spending on domestically produced investment goods

ACC = a Samuelson accelerator variable measuring the economy's growth rate (Δ Real GDP)

DEP = real business depreciation allowances

CAP_{-1} = industrial capacity utilization, lagged one period

r_{-2} = real Prime interest rate, lagged two periods

DJ_{-2} = Dow Jones Composite Average, a proxy for Tobin's q

$PROF_{-2}$ = real corporate profits, lagged two periods

B_{BOR} = Net annual business borrowing = change in business debt (ΔB_{DEBT}) that period.

Other variables in the investment model are as defined in the consumption function.

TEST RESULTS, FINDINGS: "RECESSION/NO RECESSION" VERSUS "NO CROWD OUT" MODELS

Below, consumption and investment models are tested for separate recession and non - recession crowd out effects. The domestic consumption and investment models tested are the same as previously used. Regression results for the crowd out model are:

Domestically Produced Consumer Goods

$$\Delta C_D = .36\Delta(Y-T_G) \mathbf{+.20\Delta(T-G)_{Rec} + .35\Delta(T-G)_{NonRec}} - 4.07\Delta PR + .22\,\Delta DJ_{-2} + 1.24\,\Delta XR_{AV} - 410.32\Delta POP_{16} + .01\Delta POP \quad (21)$$

(t =) (6.8) **(2.2)** **(2.2)** (-1.5) (1.1) (1.5) (-2.4) (2.3)

$$+.13\Delta ICC_{-1} + 40.02\Delta M2_{AV} \quad R^2 = 86.4\%$$

(0.4) (4.2) D.W.= 2.1

Domestically Produced Investment Goods:

$$\Delta I_D = \mathbf{+.50\,\Delta(T-G)_{Rec}} = \mathbf{+.52\,\Delta(T-G)_{NonRec}} + .23\Delta ACC + .13\Delta DEP - .35\Delta CAP_{-1} - 8.15\Delta r_{-2} - .27\,\Delta DJ_{-2} + .44\,\Delta PROF_{-2} + 5.58\Delta XR_{AV} \quad (22)$$

(t =) **(8.3)** **(3.5)** (9.0) (0.5) (-0.3) (-7.0) (-1.4) (4.0) (5.7)

$$+ .008\Delta POP \quad R^2 = 89.8\%$$

(3.7) DW =2.3

Using the parameter estimates from these domestic consumption (C_D) and investment (I_D) equations, the IS curve parameters are predicted to be:

Predicted IS Curve (With A Separate Crowd Out Variable (T-G) Included For Recessions/Non-recessions)

$$\Delta Y = \mathbf{+.53\Delta T_{rec} + .80\Delta T_{NonRec} + .47\Delta G_{Rec} + .20\Delta G_{NonRec} + 1.56\Delta X} - 6.35PR - .08\Delta DJ_{-2} + 10.64XR_{AV0123} - 640.10\,\Delta POP_{16}$$

$$+.03\Delta POP + .20\Delta ICC_1 + 62.43\Delta M2 + .36\Delta ACC + .20\Delta DEP - .55\Delta CAP_{-1} - 12.71r_{-2} + .69\Delta PROF_{-2} \quad (23)$$

Actual IS Curve Test Results (With Separate (T) And (G) Variables For Recession/Non-Recessions)

$\Delta Y = \mathbf{+.87\Delta T_{Rec} +.60\Delta T_{NonRec} - .65\Delta G_{Rec} - .23\Delta G_{NonRec} + .63\Delta X} - 8.00\Delta PR + .24\Delta DJ_{-2} + 4.97XR_{AV} + 445.43\Delta POP_{16}$ (24)

(t=) **(5.3) (2.3) (-1.1) (-0.6) (2.0)** (2.2) (0.6) (2.6) (1.3)

$+.05\Delta POP + 1.59\Delta ICC_{-1} + 44.51\Delta M2 + .59\Delta ACC + .68\Delta DEP + 8.36\Delta CAP_{-1} - .40r_{-2} + .22\Delta PROF_{-2}$ R^2=97.8%

(5.6) (3.5) (2.3) (10.4) (0.7) (2.3) (-0.1) (0.8) DW=2.5

The results indicate that

- Adding crowd out to the consumption model increases explained variance from 81.3% to 86.4%, slightly more than the average effect model (86.0%). For investment, adding crowd out increased explained variance about the same as the average crowd out model: from 75% to 89.8%, slightly less than the average model (90.0%). Though there are differences in specific recession/non-recession coefficients for taxes and spending, they are each within the confidence intervals of the other, suggesting they may be the same. This indicates dividing crowd out into recession and non-recession variables adds little information not already available in the average crowd out model. This actual IS curve results again suggest more than complete crowd out for tax cut deficits, and complete crowd out for spending deficits. The predicted IS curve results again indicate the same for tax cuts, but only partial crowd out for spending deficits. The lack of a significant difference in crowd out effects in the two periods is further explored in section 7.2.3. below.
- All four crowd out variables in the consumption and investment models are statistically significant at the 1% or 3% level. Statistical significance in both recession and non-recession periods strongly supports the hypothesis crowd out has negative effects in both periods.
- Deficits appears to have about the same marginal effect in recession and non-recession periods on investment (.50 vs.52). For consumption, point estimates of effects are larger for non-recession periods, but well within the other estimates confidence intervals, suggesting the differences may not be significant.
- The recession/non-recession crowd out model, predicted 9 of 17 IS curve coefficients more accurately than the no crowd out model. The no crowd out model predicted 7 better. The standard for judging results was an IS model tested with separate (T) and (G) variables for recession and non-recessions.
- When the standard for judging results was an IS model tested with only one set of (T) and (G) variables (average crowd out), the recession/non-recession model predicted 10 of 17 coefficients better than the no crowd out model.
- The regression coefficient estimates of IS curve crowd out effects, indicate more than complete crowd out of government spending deficit stimulus, but the coefficient is insignificantly different from zero, suggesting only full crowd out. Results do indicate tax cuts more than fully crowd out stimulus effects. Results are shown in Table 3 below. R/NR model predictions of actual IS coefficients were also found to be far more accurate than no crowd out model predictions.

Table 3: IS Curve Coefficients for Tax and Government Spending Variables

	Tax		Spending .	
	Rec.	**No Rec.**	**Rec.**	**No Rec.**
No Crowd Out model Prediction	- 0.75	- 0.75	+ 1.75	+ 1.75
R/NR Crowd Out Model Prediction	+ 0.53	+ 0.80	+ 0.47	+ 0.20
Actual Regression Result	+ 0.87	+ 0.60	- 0.65	- 0.23
(t=)	(5.3)	(2.3)	(-1.1)	(-0.6)

- Actual IS curve regression coefficients suggest substantially different recession and non-recession period effects ($+.87\Delta T_{Rec} + .60\Delta T_{NonRec} - .65\Delta G_{Rec} - .23\Delta G_{NonRec}$), *with deficits causing a substantially worse crowd out problem in recession than non-recessions.* This may occur because savings fall faster than borrowing in recessions, necessitating a much larger cutback in credit based spending by both consumers and businesses than just that caused by the crowd out effects. This decline would be *coincidental with, but not part of, the crowd out effect.* Our models do not provide an easy way of disentangling the two effects. That said, these differences also cannot be considered different with any statistical certainty; 5% confidence intervals around each estimate contain the other as a possibility.

CONCLUSION

The findings indicate crowd out has a statistically significant negative effect on domestic consumer and investment spending in both recession and non-recession periods.

Though the IS curve coefficients indicate both tax cuts and government spending had larger crowd out effects in recessions than non-recessions, the confidence intervals around these estimates were large enough to indicate there may not be a real difference. The likely reason we find crowd out in recessions is because loanable funds availability (savings) drops as much or more than borrowing demand. *This is a key finding, for it is sometimes argued that crowd out is not a problem in recessions, when deficit stimulus is needed most, because private demand for loanable funds declines.*

Actual regression results for the IS curve in both recession and non-recession periods indicate crowd out *more than* fully offset all tax stimulus, but *only* fully offset government spending stimulus in both periods. Predicted results were the same for tax cuts, but only suggested partial crowd out for spending deficits. IS curve coefficients are predicted more accurately from crowd out models than from no crowd out models.

OTHER RESULTS

Additional tests were undertaken comparing the predictive ability of average and recession/no-recession models, and concluded little difference between them existed. Other tests indicated the same

models which explained the decline in consumption and investment fully explained the decline in business borrowing and most of the decline in consumer borrowing. A final section notes that crowd out can be avoided if foreign borrowing is used to finance stimulus programs rather than domestic borrowing, and increases in savings components of M2 in the three years immediately prior to stimulus borrowing, presumably because this offers an alternative source of loanable funds. These topics are examined in detail in Department of Economics Working Paper #1103, available from Rensselaer Polytechnic Institute's Department of Economics website.

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