DO GOVERNMENT DEFICITS CROWD OUT CONSUMER AND INVESTMENT SPENDING?

ABSTRACT: This paper examines whether government deficits financed by borrowing reduce credit availability, thereby "crowding out" business and consumer spending. To test this hypothesis, deficit variables are added to consumption and investment models and tested to see if they negatively impact private spending in a statistically significant way, and if they increase explained variance. U.S. data for 1960 - 2000 is used. A demand-driven econometric model, patterned after the work of Klein and Fair and containing eight behavioral equations is used to estimate crowd out effects. Demand models were used because of the importance ascribed to them by two recent chairs of the President's Council of Economic Advisors:(1) Mankiw (2007), who notes they "provide the foundation of much of our current understanding of economic fluctuations" and (2) Romer (2010) who notes demand deficiencies appear to have caused the severity of the recent recession. In addition, fiscal stimulus prescriptions for from such models lose effectiveness if private spending is reduced by deficits. This study finds strong statistical evidence deficits crowd out private consumption and investment. It also finds consumption and investment functions which include crowd out variables generally predict "IS" curve coefficients more accurately than other models. The actual sign of the tax variable coefficient in IS curve econometric tests was found to be positive, implying deficits generated by tax cuts actually reduce the GDP. This directly contradicts the expected result in traditional Keynesian models. However, this positive sign is well predicted from consumption and investment models containing crowd out variables. Deficits caused by government spending also had offsetting crowd out effects reducing their stimulus effect, and in some models eliminating it. The study concludes that scientifically testing for the crowd out problem, in demand driven models, indicates the crowd out problem exists. Increases in the savings components of M2, in years preceding the deficit, were found to offset crowd out effects. This occurred presumably because the savings provided an alternative source of funds to offset the reduced credit available due to government borrowing to finance the deficit. JEL Codes: C50, C51, E12, E21, E22

Keywords: Macroeconomics, Consumption, Investment, Government Deficits, Crowd Out

1. INTRODUCTION

The first question we need to ask when analyzing how crowd out affects the economy, is In what theoretical context should we examine this question? What kind of model shall we use to establish the parameters within which we evaluate the effects of crowd out?

In this study, a demand-driven econometric model, patterned after the work of Klein and Fair and containing eight behavioral equations is used to estimate crowd out effects. Demand models are used to provide the context within which crowd out is evaluated because they (1) "provide the foundation of much of our current understanding of economic fluctuations "(Mankiw (2007), (2) because demand fluctuations appear to have caused the recent economic decline (Romer 2010), and (3) because the fiscal policy prescriptions invariably found in demand models are the ones that lose much of their validity if deficits cause offsetting private consumption and investment spending by reducing private credit availability.

In a typical demand driven model of the economy *without* crowd out, the impact of taxes and government purchases can be derived using the GDP identity:

$$GDP = Y = C + I + G + (X-M) \tag{1}$$

where a simple consumption function is given as a linear function of disposable income (Y-T)

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

substituting C into (1) gives

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

The clear expectation of Keynesian demand theory is that tax changes are negatively related to the GDP, with a multiplier effect $-\beta/(1-\beta)$. Changes in government spending and net exports are related to GDP in the positive direction, with a multiplier effect $1/(1-\beta)$ and should when tested, have the same coefficients. In Section 2 below, we will test these expected relationships to see if actual econometric estimates yield the predicted results for variables.

1.1. HOW CROWD OUT MAY IMPACT CONSUMER SPENDING

However, traditional Keynesian style - demand driven theory makes no provision for the fact that private consumer or investment spending is determined year after year not only by current income but by availability of consumer credit and business credit.

If some of the savings used to ensure availability of consumer credit is diverted to finance government deficits (T-G), then our simplified consumption function must be modified by adding this "crowd out" - causing factor:

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

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

$$\begin{aligned} GDP = \quad Y &= \beta (Y-T) + \lambda(T-G) + G + I + (X-M) \\ &= [1/(1-\beta)] \; [(-\beta+\lambda) T + (1-\lambda) G + I + (X-M)] \end{aligned}$$

From which we can easily see that the impact of a change in T or G on the GDP depends on λ as well as β and the multiplier $1/(1-\beta)$. The tax multiplier, showing the marginal impact of a change in taxes is now $(-\beta+\lambda)/(1-\beta)$. The spending multiplier, showing the marginal impact of a change in government spending, is now $(1-\lambda)/(1-\beta)$. Both T, and G marginal effects will be smaller (in absolute terms) than they would have been without crowd out effects.

Table 1
EFFECTS OF CONSUMER CREDIT CROWD OUT ON THE EFFECTIVENESS OF TAXES AND GOVERNMENT SPENDING STIMULUS

	Without Crowd Out	With Crowd Out		Without Crowd Out	With Crowd Out
Tax coefficient	$(-\beta)$	$(-\beta+\lambda)$	Government Spending Coefficient	1	$(1-\lambda)$
Tax Multiplier	$\frac{(-\beta)}{(1-\beta)}$	$\frac{(-\beta+\lambda)}{(1-\beta)}$	Government Spending Multiplier	$\frac{(1)}{(1-\beta)}$	$\frac{(1-\lambda)}{(1-\beta)}$

Several conclusions follow from this result"

a) A reduction in taxes can only be an economic stimulus if the negative effect of the marginal propensity to consume (β), is larger in absolute value than the positive marginal effect (λ) on consumption of a decline in the deficit. If the consumer credit effect (λ) is positive, the stimulus effect of tax changes on the GDP will be smaller than the Keynesian model predicts, and perhaps negative. The stimulus from tax cuts may be partially (or fully) offset by reduced consumer spending resulting from reduced consumer credit availability.

b) The government spending multiplier of (1/1- β) in the "no - crowd out" model, will also decline. It is now (1-λ)/(1- β), indicating increased government spending is now offset in part by reductions in consumer spending caused by reduced credit availability due to the deficit. If (1- λ) is negative, so will be the net effect of an increase in government spending.

c) The multiplier effect of net export spending stays the same. Relatively speaking, this means a dollar increase in net exports should have a larger multiplier effect than a dollar of government spending, if crowd out is a systematic problem.

1.2. HOW CROWD OUT MAY IMPACT BOTH CONSUMER AND INVESTMENT SPENDING

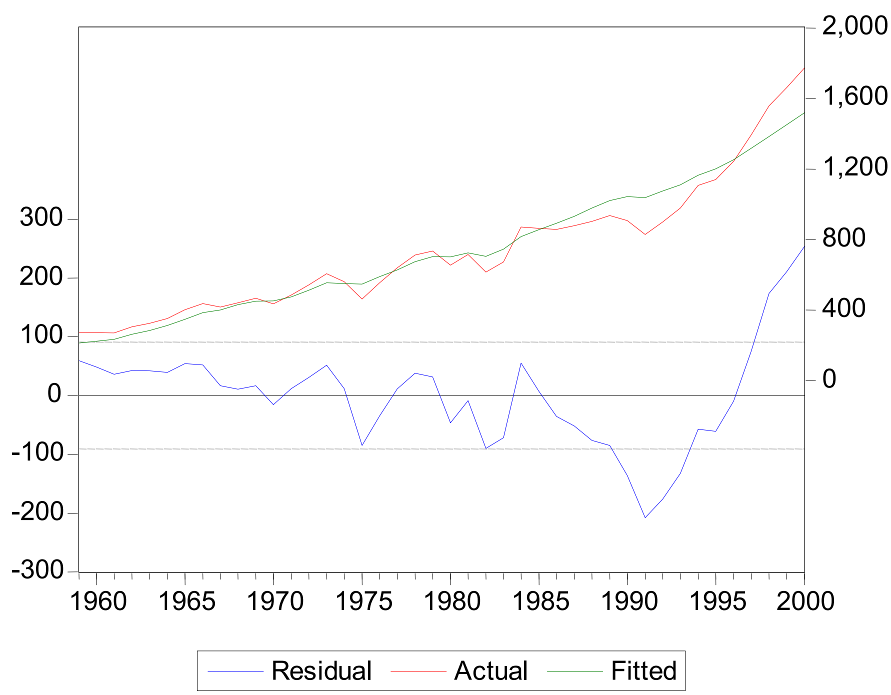
We can expand this model to include any effects of crowd out on investment spending. Assume a simple investment model in which investment is determined by real interest rates (r) and access to credit, which varies with the government deficit (T-G).

$I = \gamma(T\text{-}G) - i_{nt}\, r$

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

How the crowd out problem may affect investment is given in the following graph, which shows the predicted relationship of investment to GDP, and how actual investment deviates from the predicted value each year 1960-2000. Note particularly that during the high deficit years from the mid and late eighties, investment fell well below predicted, but in the 1996-98 surplus years, actual investment exceeded predictions. The blue line on the graph just indicates the real dollar amount, in billions of 1996 dollars) by which actual investment exceeded predictions (read using left scale)

Graph 1
PREDICTED AND ACTUAL LEVELS OF REAL INVESTMENT 1960 - 2000



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

$$GDP = Y == [1/1-\beta] \; [(-\beta+\lambda+\gamma) T + (1-\lambda-\gamma) G - i_{nt} r + (X-M)]$$

In this IS equation, the normal stimulating impact of tax cuts on the GDP ($-\beta$) is offset in part by the effects of deficit – induced changes in credit availability ($\lambda+\gamma$). Tax effects may switch from negative to positive if the crowd out effects ($\lambda+\gamma$) are larger than the disposable income effect ($-\beta$). The effect of a change in government spending is also reduced per dollar of expenditure from (1) to ($1-\lambda-\gamma$) times the spending multiplier ($1/1-\beta$). Again, 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 2.

Table 2
EFFECTS OF CONSUMER AND INVESTMENT CREDIT CROWD OUT ON THE EFFECTIVENESS OF TAXES AND GOVERNMENT SPENDING STIMULUS

	Without Crowd Out	With Crowd Out		Without Crowd Out	With Crowd Out
Tax coefficient	$(-\beta)$	$(-\beta+\lambda+\gamma)$	Government Spending Coefficient	1	$(1-\lambda-\gamma)$
Tax Multiplier	$\frac{(-\beta)}{(1-\beta)}$	$\frac{(-\beta+\lambda+\gamma)}{(1-\beta)}$	Government Spending Multiplier	$\frac{(1)}{(1-\beta)}$	$\frac{(1-\lambda-\gamma)}{(1-\beta)}$

The model we shall use for testing later in this paper is equivalent to the model above, but slightly different in form. The model above was based on the usual formulation of the GDP identity

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

Where the C, I and G variables include spending on imports as well as on domestically produced goods, necessitating subtraction of imports (M) at the end of the expression to keep the total GDP representative only of domestic production.

Hence, we can alternatively write

$$Y = C_{D+M} + I_{D+M} + G_{D+M} + (X-M) \qquad \text{(where } M = C_M + I_M + G_M \text{)}$$

Or

$$Y = C_D + I_D + G_D + X$$

This is an important distinction in calculating multipliers because only spending on domestically produced consumer goods generates the multiplier effect on the GDP. Similarly, for investment, a variable like the Samuelson accelerator is likely to affect spending on both domestic and imported investment goods (I). But accelerator effects will only be felt though the growth in domestic investment (I_D). Hence, the last formulation of the GDP identity may be the better form to use when calculating IS curve parameter estimates, since multiplier effects are more correctly estimated. (We abstract from effects on exports of growth in import demand).

Because the data available to us does not allow division of government purchases of goods and services into purchases of domestic and imported goods, the approximate form of the theory we will actually test is

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

This then presents the standard model of Keynesian mechanics, with crowd out added. Should the problem exist in reality as well as in theoretical conjecture, testing this model should reveal it. Only science and testing can show theoretical conjectures are consistent with empirical reality. After examining some previous efforts to test crowd out theory, we will test the models above, with and without crowd out.

2.0 LITERATURE REVIEW

2.1 Business Press Opinions & Facts:

A reading of the popular press, particularly the business press, tends to confirm a common belief that crowd out of private investment occurs when government deficits are financed by borrowing. However, they represent established theory or opinion, not the results of the authors' empirical studies (at least none that are cited). Examples include

1. Mulligan, Casey. (*Economix* 1/21/09). Notes G stimulus may result in people quitting private jobs to take public; that OBAMA stimulus may not work because target to areas where unemployment already low: health, ed. , construction (except housing) . Not an empirical c-o study.

2. Swanson, Evan. (*Mortgage Trust, Inc.* 3/15/10, evanswanson.com): deficits create an add'l. supply of fixed income securities that compete with private sector (incl. mortgage backed bonds) for investment dollars (opinion-not empirical study)

3. McCormick ,L.. (*Bloomberg.com*, 3/15/10) U.S. lenders bailed out by G are stepping up purchases of treasuries, helping temper a rise in borrowing costs (Heim note: rising I which could cause c-o)

4. Karlsson, S. (*Christian Science. Monitor*, 2/26/10). Ways crowd out can occur due to fiscal stimulus: 1) rising int. rates 2) trade deficit effect- some stimulus $ will by imports) 3) Ricardian equivalence means increased budget deficit means consumers cut back on spending, raising saving, lowering i rates (i.e., consumption gets crowded out) 4) monetizing deficit raises prices "crowding out" peoples ability to buy goods

5. *Chan, S.* (*NY Times,* 2/7/10, p.A16): reported the I.M.F. warned on Jan. 26 that rising sovereign debt "could crowd out private sector credit growth, gradually raising interest rates for private borrowers and putting a drag on the economic recovery."

6. *Barley, R.* (*Wall Street Journal*, 2/24/10 p.C14): "any government-bond buying by banks is another form of crowding out, potentially reducing supply of consumer and corporate lending"

2.2. Professional Literature

Opinions in the mass media are popularly held, but are not science, and should not be construed as such. To examine the science has to say, a number of prior professional studies examining this topic were reviewed. Some have been entirely, or principally, been reports on other people's science, i.e., literature reviews. Spencer and Yohe, (1970), in reviewing the literature, found that the dominant view the past two hundred years has been that government deficits cause crowding out. Friedman's work (1978), is principally theoretical. He shows portfolio theory suggests the LM curve may shift in response to an IS shift due to a fiscal stimulus like a government deficit. Therefore crowd out effects are indeterminate theoretically: it depends on how much LM shifts relative to IS. Friedman's found his own empirical tests ,based on money demand models, were ambiguous. Gale and Orszag's work (2004) was principally a review of other work, concluding most studies do show a positive relationship between interest rates and deficits (which may cause crowd out), and that most studies that don't show this relationship are VAR types. They note that VAR projections have been shown to be inferior to projections produced by OMB and DRI (p.152). Their paper does includes some empirical testing of a model of the determinants of a consumption consumption, also indicating crowd out matters. In the model demand was hypothesized to be a function of current and one period lagged Net National Product (NNP), government purchases, taxes, transfer payments, interest payments and the size of the government debt. Results of tests of whether tax cuts stimulated consumption were determined by the sign and statistical significance of the coefficient on the tax variable. A negative and statistically significant coefficient on the tax variable was taken as evidence tax cuts were not just saved; i.e., that Ricardian Equivalence does not hold. (However, the same finding affirms traditional Keynesian theory regarding the stimulus effect of tax cuts without complete crowd out). Other tests indicated a positive relationship between deficits and interest rates, further providing proof for crowd out.

Other tests of deficits causing crowd out by constraining private spending include Cebula (1978) who tested U.S. and Canadian data 1949-76 using the following model:

$$\text{Investment (I)} = f(I_{-1}, \text{ \% Capacity Utilization, Government Deficit})$$

and found the deficit negatively related to investment, for both U.S. and Canada. Respecifying the lagged investment and capacity utilization variables as Almon lags and using 2SLS did not change the results. Mofidi and Stone (1990) found that what government spending was on affected private investment levels. Spending on transfer payments reduced private investment; spending on public investment activities such as infrastructure, health and education did not . Finally, Mitra (2006) using 1969-2005 data for India, found that government borrowing resulted in fewer funds available for the private sector (crowd out).

This study focuses on crowd out caused government borrowing financed by reducing private credit. Other, different definitions of crowd out have been used to describe different phenomena. For example, some studies have examined whether introducing public services which directly duplicate private services reduces private provision (Beladi and Lyon 1989). Others deal with whether provision of public funding to charities crowds out private philanthropy (Andreoni 1993). Such studies are outside the scope of this paper and are not discussed here.

3.0 TESTING THE MODEL

If crowd out influences consumption or investment spending

- The deficit should be found to be a statistically significant variable in functions that attempt to include all other factors that can significantly influence consumption and investment, and increases the amount of variance explained in these functions.

- Tests should find the tax variable has a negative coefficient smaller than predicted from traditional Keynesian theory of consumption and investment (which ignores crowd out effects), because reduced spending due to crowd out partially offsets the stimulus effect. If crowd out completely offsets the stimulus, the tax variable will have a positive coefficient.

- The government spending multiplier should be smaller than the exports multiplier if spending generated deficits cause crowd out.

We shall proceed to undertake these tests in the remainder of Section 3 below.

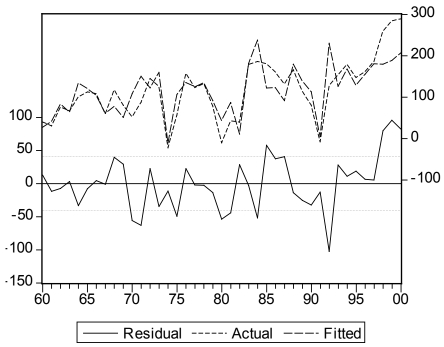
3.1. TESTING THE MODEL: DOES CROWD OUT AFFECT CONSUMER DEMAND?

A simple representation of the Keynesian consumption function would show demand for consumer goods to be a function of disposable income. The definition of disposable income used in this study (Y-T) is closely related to national income(REALNATINC), the income variable used by Kuznets (1952) in his path breaking work on consumption/income relationships.

GRAPH 2

$\Delta C_{D\&M}$ = .83Δ(REALNATINC)$_t$ = .82 Δ(Y-T) R^2=.68

(t=12.6)

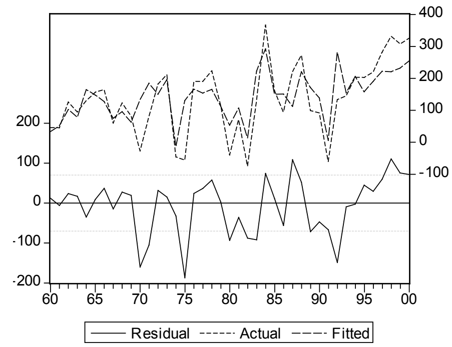


Source: Heim, 2008, Graph 4

GRAPH 3

Δ(REALNATINC) = 1.01 Δ(Y-T) R^2=.60

(t=11.1)



Source: Heim, 2008, Graph 5

Estimating the simple "no crowd out" consumption model used in Section 1 above to define the role of domestic consumption (C_D) in crowd out theory gives, in first differences,

$$\Delta C_D = .65\ \Delta(Y-T) \qquad R^2 = .64 \quad DW\ 1.8$$
$$(t=) \quad (20.2)$$

All tests in this paper are run using first differences of the data rather than levels. This is done to reduce autocorrelation, multicollinearity and nonstationarity problems. The above result implies

$$\begin{aligned} \Delta Y &= \Delta C_D + \Delta I_D + \Delta G + \Delta X \\ &= .65\ \Delta(Y-T) + \Delta I_D + \Delta G + \Delta X \\ &= [1/(1-.65)]\ [-.65\ \Delta T + \Delta I_D + \Delta G + \Delta X] \end{aligned}$$

Where the simple multiplier is 1/(1-.65) = 2.86

Hence, the simple Keynesian "no crowd out" IS model based on this multiplier is

Predicted IS Curve: No - Crowd Out Model:

$$\Delta Y = -1.86\ \Delta T + 2.86\ \Delta G + 2.86\ \Delta I + 2.86\ \Delta X$$

Notice this IS function has the typically expected characteristic: the sign on the tax variable is negative, indicating a stimulus effect, the coefficients on G and X variables are the same.

However, if consumption of domestically produced goods is also a function of crowd out, expressed as (T-G) subjecting the function to testing yields the following estimates:

Using 1-Var. Crowd Out: $\Delta C_D = .63\ \Delta(Y-T) + .17\Delta\ (T - G)$ $\qquad R^2 = .68$ DW=2.0
$(t=) \quad (20.9) \qquad (1.4)$

Using 2-Var. Crowd Out: $\Delta C_D = .57\ \Delta(Y-T) + .19\Delta\ T + .27\ G$ $\qquad R^2 = .74$ DW=2.1
$(t=) \quad (18.8) \qquad (2.3) \qquad (1.5)$

In this revised formulation of the consumption function, the multiplier becomes 1/1-.57 = 2.33, and the predicted IS curve from the crowd out model becomes
If the deficit's two component parts G and T are estimated separately, the tax effect in the consumption function is significantly related to C. The positive sign on its coefficient sign affirms that tax-cut caused

deficits can crowd out private consumption. However, since the Government spending component of the deficit has a positive sign, this suggests that a spending - generated deficit may be a stimulus, not the negative effect predicted by crowd out theory. In a later section, when we add the money supply as a control variable allowing for offsetting increases in credit, the sign on the government spending variable will turn negative, as predicted by crowd out theory.

Sec. 3.1:Predicted IS Curve

Using No-Crowd Out Model:	$\Delta Y = -1.86\ \Delta T + 2.86\ \Delta G + 2.86\ \Delta I + 2.86\ \Delta X$
Using 1-Var. Crowd Out:	$\Delta Y = -\ 1.24\ \Delta T + 2.24.\Delta G + 2.70\ \Delta I + 2.70\ \Delta X$
Using 2-Var. Crowd Out:	$\Delta Y = -\ .89\ \Delta T + 2.96.\Delta G + 2.33\ \Delta I + 2.33\ \Delta X$

The model for testing these alternate theories is the same:

Hypothesis To Test: $\Delta Y = +\beta_1 \Delta T + \beta_2 \Delta G + \beta_3 \Delta I + \beta_4 \Delta X$

Actual IS Curve Test Results: $\Delta Y = -\ .29\Delta T + 2.47\Delta G + 1.84\ \Delta I + 2.27\ \Delta X$ $R^2 = .80$
(t=) (-1.6) (8.2) (8.5) (6.3) DW=1.4

As predicted by crowd out theory, the regression provides estimates of the effect of taxes lower than no - crowd out theory. Hence, it would seem more consistent with real economic behavior than traditional, non- crowd out versions of Keynesian theory. While predictions for the G variable are about the same for both theories, crowd out (with a positive/negative sign on G) does predict a government spending coefficient greater than/less than the exports or investment coefficients, which matches our empirical results . In addition, the actual size of the coefficients on the investment and exports variable was found to be closer to that predicted by crowd out theory. (Predictions do not precisely match test results, even though the predictions are inferred from other econometric results generated by the same data set. This results from different levels of multicollinearity in the original C and I equations used to predict the IS curve, and the multicollinearity levels in the IS equation itself (Heim 2009b). The problem is discussed in more detail in Section 3.3 below.

Summarizing the results:

- Adding a crowd out variable to the consumption function, added 4-10% to explained variance in the consumption function; In the deficit formulation, taxes was statistically significant, government spending was not. This appears to be a specification problem, corrected later in the paper.

- Crowd out model predictions of values for IS curve coefficients better matched actual regression results for most variables in the Is equation except government spending, (for reasons of inadequate model specification).

We conclude that even for the simplest textbook IS model, where crowd out is assumed to affect consumption, but not investment, *the evidence of crowd out effects due to government deficits is substantial.*

3.1.1 TESTING THE MODEL: DOES CROWD OUT AFFECT CONSUMER DEMAND IN MODELS WITH A SLIGHTLY MORE SOPHISTICATED FORMULATION OF INVESTMENT?

We can replace domestic investment (I) in the formulation in section 3.1 with a simplified version of its determinants: $I_D = f$(Accelerator, the prime interest rate, lagged two periods) = f(ACC, r_{-2}). Econometrically, this function was found to be

$\Delta I_D = .32\ \Delta ACC - 9.31 \Delta\ r_{-2}$ ($R^2 = .42$; DW=1.0) (without crowd out)
(t=) (8.5) (-2.9)

Later in the paper, more sophisticated formulations will be used.

A equally simple representation of the Keynesian consumption function would show demand for consumer goods to be a function of disposable income. As noted earlier, estimating the simple "no crowd out" consumption model gives, in first differences,

$$\Delta C_D = .65\ \Delta(Y\text{-}T) \qquad R^2 = .64\ \ DW\ 1.8$$
$$(t=)\quad (20.2)$$

However, if consumption of domestically produced goods is also a function of crowd out, expressed as (T-G) subjecting the function to testing yields the following estimates:

Using 1-Var. Crowd Out: $\Delta C_D = .63\ \Delta(Y\text{-}T) + .17\Delta\ (T - G)$ $\qquad R^2 = .68\ DW{=}2.0$
$(t=)\quad (20.9) \qquad (1.4)$

Using 2-Var. Crowd Out: $\Delta C_D = .57\ \Delta(Y\text{-}T) + .19\Delta\ T + .27\ G$ $\qquad R^2 = .74\ DW{=}2.1$
$(t=)\quad (18.8) \qquad (2.3) \qquad (1.5)$

And the predicted and actual IS curves are:

Sec. 3.1.1.
Predicted IS Curve:

No - Crowd Out Model: $\Delta Y = -1.86\ \Delta T + 2.86\ \Delta G + 2.86\ \Delta X + .91\ \Delta ACC - 25.53\ \Delta r_{-2}$
1 Var. Crowd Out Model: $\Delta Y = -1.24\ \Delta T + 2.24\ \Delta G + 2.70\ \Delta X + .86\ \Delta ACC - 25.14\ \Delta r_{-2}$
2 Var. Crowd Out Model: $\Delta Y = -\ .89\ \Delta T + 2.96\ \Delta G + 2.33\ \Delta X + .75\ \Delta ACC - 21.60\ \Delta r_{-2}$
Actual IS Curve Obtained: $\Delta Y = +\ .45\ \Delta T + 2.60\ \Delta G + 2.59\ \Delta X + .50\ \Delta ACC - 15.88\ \Delta r_{-2}$ $\quad R^2 = .64$
$(t=)\quad (1.6) \qquad (6.2) \qquad (5.4) \qquad (7.1)$ $\qquad DW = 1.2$

As predicted by crowd out theory, the regression provides estimates the stimulus effect of taxes lower than no - crowd out theory. In fact, it shows crowd out dominates stimulus effects, yielding a positive sign. Hence, crowd out theory would seem more consistent with real economic behavior than non- crowd out versions of consumption theory. While predictions for the G variable are about the same for both theories, crowd out with a positive(negative) sign on G does predict a government spending coefficient greater than (less than) the exports or investment coefficients, which matches our empirical results . In addition, the actual size of the coefficients on the investment and exports variable was found to be closer to that predicted by crowd out theory. (Predictions do not precisely match test results, even though the predictions are inferred from other econometric results generated by the same data set. This results from different levels of multicollinearity in the original C and I equations used to predict the IS curve, and the multicollinearity levels in the IS equation itself (Heim 2009b). The problem is discussed in more detail in Section 3.3 below.

Four of the five IS curve coefficients are better predicted by IS curve models with crowd out. Only one was not.

Summarizing the results:

- Adding a crowd out variable to the consumption function, added 4-10% to explained variance in the consumption function; In the deficit formulation, taxes was statistically significant, government spending was not. This appears to be a specification problem, corrected later in the paper.

- Crowd out model predictions of values for IS curve coefficients better matched actual regression results for 4 of 5 variables in the IS model. The variable not better predicted was government spending (G), for reasons of inadequate model specification.

We conclude that even for the simplest textbook IS models, where crowd out is assumed to affect consumption, but not investment, *the evidence of crowd out effects due to government deficits is substantial.*

3.2 TESTING THE MODEL - DOES CROWD OUT AFFECT INVESTMENT DEMAND IN THE SIMPLEST KEYNESIAN MODEL?

How would our *predictions of* the IS equation coefficients look if crowd out was hypothesized to affect investment, but not consumption spending? Would they better predict actual IS equation regression results, or would the no - crowd out model? The domestic consumer demand and investment demand equations (with and without crowd out) look as follows:

$\Delta C_D = .65\ \Delta(Y\text{-}T)$ ($R^2 = .64$; DW=1.8) (without crowd out, repeated from Section 3.1 above)
(t=) (20.2)

$\Delta I_D = .32\ \Delta ACC - 9.31 \Delta\ r_{-2}$ ($R^2 = .42$; DW=1.0) (without crowd out)
(t=) (8.5) (-2.9)

$\Delta I_D = .24\ \Delta ACC - 4.56\ \Delta r_{-2} + .53\ \Delta(T\text{-}G)$ ($R^2 = .69$; DW=1.0) (with 1-Variable crowd out)
(t=) (8.1) (-1.5) (3.6)

$\Delta I_D = .26\ \Delta ACC - 6.17\ \Delta r_{-2} + .49\ \Delta T + .04 \Delta G$ ($R^2 = .76$; DW=1.4) (with 2-Variable crowd out)
(t=) (10.4) (-2.5) (4.3) (0.4)

Crowd out clearly adds hugely to explained variance in the investment model: the 1 - variable formulation adds 27% to explained variance, the 2 - variable formulation 34% (suggesting the two components have different effects on crowd out, the tax cut induced deficits clearly causing crowd out, and government spending induced deficits having a positive, but statistically insignificant, effect, contrary to crowd out theory predictions. As noted earlier (Section 3.1), further below we will find that deficits caused by increased government spending are often preceded by increases in the savings components of the M2 money supply, offsetting the loss of private savings caused by borrowing to finance the deficit. Controlling for M2, the sign on the government spending variable becomes negative, consistent with the theory government deficits cause crowd out (but implying policies to increase saving can offset the spending - induced crowd out problem. In this simplest Keynesian model, the M2 variable is not included.

The accelerator (ACC) variable represents the impact on investment (I) of current period changes in the rate of GDP growth, ACC = ($Y\text{-}Y_{-1}$), i.e., a Samuelson - type accelerator effect on investment, (Samuelson, 1939). The interest rate variable r_{-2} represents the 2 year lagged value of the real prime interest rate (defined as the nominal rate minus the past two years average inflation rate). This was found to be overwhelmingly the interest rate formulation most systematically related to the GDP in Heim (2008). Government revenues (T) and government expenditures on goods and services (G) are the same as used earlier. Because this simplified investment model does not include other known explanatory variables (e.g. stock prices, depreciation, profits), some t statistics and levels of explained variance are relatively low. This problem will also disappear when more complete models tested later in the paper.

Substituting the C and I equations into the GDP identity yields the following predicted IS curves:

<u>Sec. 3.2</u>
<u>Predicted IS Curve</u>

No Crowd Out Model:	$\Delta Y = -1.86\ \Delta T + 2.86\ \Delta G + .92\ \Delta ACC - 26.62\ \Delta\ r_{-2} + 2.86\ \Delta X$	
Crowd Out Model (1-Var C-O)	$\Delta Y = -.34\ \Delta T + 1.34\ \Delta G + .69 \Delta ACC - 13.04\ \Delta\ r_{-2} + 2.86\ \Delta X$	
Crowd Out Model (2-Var C-O)	$\Delta Y = -.46\ \Delta T + 2.97\ \Delta G + .74 \Delta ACC - 17.65\ \Delta\ r_{-2} + 2.86\ \Delta X$	
Actual Regression Results	$\Delta Y = +.45\ \Delta T + 2.63\ \Delta G + .50 \Delta ACC - 16.05\ \Delta\ r_{-2} + 2.56\ \Delta X$	R^2=.67
	(t=) (1.9) (4.7) (4.6) (-4.2) (6.2)	DW=1.1

(The low Durbin-Watson statistic, often a sign of an model missing important explanatory variables, will rise to normal levels the additional determinants of consumption and investment not included in this simple model are added.)

Summarizing the statistical results:

Predicted IS Curve; No Crowd Out Model:	$-1.86\ \Delta T + 2.86\ \Delta G + .92\ \Delta ACC - 26.62\ \Delta\ r_{-2} + 2.86\ \Delta X$
Predicted IS Curve:1-Var. Crowd Out Model:	$-\ .34\ \Delta T + 1.34\ \Delta G + .69\ \Delta ACC - 13.04\ \Delta\ r_{-2} + 2.86\ \Delta X$
Predicted IS Curve:2-Var. Crowd Out Model:	$-\ .46\ \Delta T + 2.97\ \Delta G + .74\ \Delta ACC - 17.65\ \Delta\ r_{-2} + 2.86\ \Delta X$
Actual IS Curve: Regression Results:	$+\ .45\ \Delta T + 2.63\ \Delta G + .50\ \Delta ACC - 16.05\ \Delta\ r_{-2} + 2.56\ \Delta X$

3of the 5 variables were better predicted from the crowd out model than the no-crowd out model, only one (government spending) worse. In more sophisticated models, including M2, this will change and the crowd out model will better predict government spending, too. The 2-variable crowd out formulation, appears to be the better formulation, since it allows for differential effects of taxes and government spending on crowd out, which the data seem to clearly show exist. As predicted by the 2 - variable crowd out model, the coefficient on the government spending variable was larger than the coefficients on the export variable. In addition, the sign on the tax variable coefficient was positive, as predicted by crowd out theory in cases where negative crowd out effects of tax cuts are greater than the stimulus effect of tax reductions on disposable income (complete crowd out). In the next section, we will find that where predictions are based on C and I equations which both include crowd out effects, our predicted sign on the tax variable in the IS function is also positive, wholly consistent with actual regression results.

Summarizing the results:

- Adding a crowd out variable to the investment function, (1 variable formulation) added 27% to explained variance, and the crowd out variable was significant at the 1% level

- Adding crowd out variables to the investment function, (2 variable formulation) added 34% to explained variance, and the tax crowd out variable was significant at the 1% level, though G was not significant and had a positive sign.

- Crowd out model predictions of IS curve coefficients better matched actual regression results for 3 of 5 variables in the IS model, and only one worse:government spending, (again for reasons of inadequate model specification).

We conclude that even for the simple textbook - level Keynesian IS model, with crowd out only affecting investment, *the evidence of crowd out effects of government deficits appears quite strong.*

3.3. TESTING FOR BOTH INVESTMENT AND CONSUMPTION CROWD OUT EFFECTS SIMULTANEOUSLY IN THE SIMPLE KEYNESIAN MODEL

How would our *predictions of* IS equation coefficients look like if our estimates of crowd out's effect on both consumption and investment were used as a basis for the prediction? The domestic consumer demand and investment demand equations (with and without crowd out) look as follows:

$\Delta C_D = .65\ \Delta(Y\text{-}T)$ ($R^2 = .64$; DW=1.8) (without crowd out, repeated from) Section 3.1 above
(t=) (20.2)

$\Delta C_D = .63\ \Delta(Y\text{-}T) + 17\Delta\ (T\text{-}G)$ ($R^2 = .68$; DW=1.9) (with crowd out, from Section 3.1 above)
(t=) (20.9) (1.7)

$\Delta C_D = .57\ \Delta(Y\text{-}T) + 19\Delta T + .27\Delta G$ ($R^2 = .74$; DW=2.1) (with 2-Var. crowd out)
(t=) (18.8) (2.3) (1.5)

$\Delta I_D = .32\ \Delta ACC - 9.31 \Delta\ r_{-2}$ (R^2 = .42; DW=1.0) (without crowd out)
(t=) (8.5) (-2.9)

$\Delta I_D = .24\ \Delta ACC - 4.56\ \Delta r_{-2} + .53\ \Delta(T-G)$ (R^2 = .69; DW=1.0) (with crowd out)
(t=) (8.1) (-1.5) (3.6)

$\Delta I_D = .26\ \Delta ACC - 6.17\ \Delta r_{-2} + .49\ \Delta T + .04 \Delta G$ (R^2 = .76; DW=1.4) (with 2-Var. crowd out)
(t=) (10.4) (-2.5) (4.3) (0.4)

When the deficit's two components are estimated separately, the tax effect is positively related to C and I, as crowd out theory predicts. However, the Government spending variable also has a positive sign, contrary to predictions, suggesting that a G - generated deficit may have a positive stimulus effect on private spending, not the negative effect predicted by crowd out theory. As noted in Section 3.1, later in this paper we will find that deficits caused by increased government spending are often preceded by increases in the savings components of the M2 money supply. This appears to offset the loss of savings available to finance private credit caused by borrowing to finance the deficit. When we correct this specification error by controlling for M2, the sign on the government spending variable becomes negative, consistent with the theory government deficits cause crowd out. In the meantime, the missing M2 variable positive effect, which offsets G's negative effect, leaves G appearing statistically insignificant, i.e. having neither a systematic positive or negative effect.

The accelerator (ACC) variable represents the impact on investment (I) of current period changes in the rate of GDP growth, ACC = $(Y-Y_{-1})$, i.e., Samuelson - type accelerator effects on investment, (Samuelson, 1939). The interest rate variable r_{-2} represents the 2 year lagged value of the real prime interest rate (defined as the nominal rate minus the past two years average inflation rate). This was found to be the interest rate formulation most systematically related to the GDP in Heim (2008). Government revenues (T) and government expenditures on goods and services (G) are the same as used earlier in section 1.2. Because this simplified model does not include other known explanatory variables (e.g. wealth, depreciation, profits), some t statistics and levels of explained variance are relatively low. This problem will disappear when the more complete model is tested later in the paper.

Substituting the C and I equations into the GDP identity yields the following predicted IS curve without crowd out:

Sec. 3.3.

Predicted IS Curve

No Crowd Out Model:	ΔY =	$-1.86\ \Delta T$	$+ 2.86\ \Delta G$	$+ .92\ \Delta ACC$	$- 26.62\ \Delta\ r_{-2}$	$+2.86\ \Delta X$	
Crowd Out Model (1-Var C-O)	ΔY =	$+.19\ \Delta T$	$+ .81\ \Delta G$	$+ .65 \Delta ACC$	$- 12.31\ \Delta\ r_{-2}$	$+2.70\ \Delta X$	
Crowd Out Model (2-Var C-O)	ΔY =	$+.23\ \Delta T$	$+3.05\ \Delta G$	$+ .60 \Delta ACC$	$- 14.38\ \Delta\ r_{-2}$	$+2.33\ \Delta X$	
Actual Regression Results	ΔY =	$+ .45\ \Delta T$	$+ 2.63\ \Delta G$	$+ .50 \Delta ACC$	$- 16.05\ \Delta\ r_{-2}$	$+2.56\ \Delta X$	R^2=.67
	(t=)	(1.9)	(4.7)	(4.6)	(-4.2)	(6.2)	DW=1.1

(The low Durbin-Watson statistic, often a sign of an model missing important explanatory variables, will rise to normal levels the additional determinants of consumption and investment not included in this simple model are added.)

Summarizing results:

Predicted IS Curve; No Crowd Out Model:	$-1.86\ \Delta T$	$+ 2.86\ \Delta G$	$+ .92\ \Delta ACC$	$- 26.62\ \Delta\ r_{-2}$	$+2.86\ \Delta X$
Predicted IS Curve:1-Var. Crowd Out Model:	$+ .19\ \Delta T$	$+ .81\ \Delta G$	$+ .65\ \Delta ACC$	$- 12.31\ \Delta\ r_{-2}$	$+2.70\ \Delta X$
Predicted IS Curve:2-Var. Crowd Out Model:	$+ .23\ \Delta T$	$+ 3.05\ \Delta G$	$+ .60\ \Delta ACC$	$- 14.38\ \Delta\ r_{-2}$	$+2.33\ \Delta X$
Actual IS Curve: Regression Results:	$+ .45\ \Delta T$	$+ 2.63\ \Delta G$	$+ .50\ \Delta ACC$	$- 16.05\ \Delta\ r_{-2}$	$+2.56\ \Delta X$

All variables were better predicted from the crowd out model than the no-crowd out model, except government spending, though both predictions for the government spending variable were relatively close to the actual test value. In more sophisticated models, including M2, this will change and the crowd out model will better predict this variable, too. As predicted by the crowd out model, the coefficient on the government spending variable was larger than the coefficients on the export variable. In addition, the sign on the tax variable coefficient was positive, as predicted by crowd out theory. Neither result is predicted by the no-crowd out model.

Summarizing the results:

- Adding a crowd out variable to the consumption function, (1 variable formulation) added 4% to explained variance, and the crowd out variable was significant at the 10% level
- Adding a crowd out variable to the consumption function, (2 variable formulation) added 10% to explained variance, and the tax crowd out variable was significant at the 3% level, though G was not significant (due to specification error discussed above)
- Adding a crowd out variable to the investment function, (1 variable formulation) added 27% to explained variance, and the crowd out variable was significant at the 1% level
- Adding a crowd out variable to the investment function, (2 variable formulation) added 34% to explained variance, and the tax crowd out variable was significant at the 1% level, though G was not significant.
- Crowd out model predictions of values for IS curve coefficients better matched actual regression results for all variables in the Is equation except government spending, (again for reasons of inadequate model specification).

We conclude that even for the simple textbook - level Keynesian IS model, *the evidence of crowd out effects of government deficits appears quite strong, if not overwhelming.*

3.4. CAN CROWD OUT BE SHOWN TO AFFECT DEMAND IN MORE FULLY DEVELOPED MODELS?

A large number of variables and their lagged values commonly thought to affect consumer and investment demand, were tested by Heim (2009a). Using stepwise regression testing, he found the explanatory variables (and lag levels) shown below to be the most statistically significant determinants of consumption or investment. (C, I) represent total consumption and investment, (C_M, I_M)represent imports of the same goods, and C_D, I_D represent domestically produced consumer and investment goods. The components of the deficit variable (G-T) were entered separately in the regression to test whether they had different effects on C, I and Y. (Section 4 below analyzes the differences found.)

<u>Consumption Equations - 1 Variable Deficit Formulation:</u>

ΔC_0 =.72$\Delta(Y\text{-}T_G)_0$ **+.45Δ(T-G)** – 6.80 ΔPR_0. +.75 ΔDJ_{-2} + 3.36 ΔXR_{AV0123} R^2=89%
(t =) (24.3) (5.2) (-2.8) (7.0) (4.0) D.W.= 1.8

$\Delta(C_M)_0$ =.13$\Delta(Y\text{-}T_G)_0$ **+.29Δ(T-G)** – 5.02 ΔPR_0. + .35 ΔDJ_{-2} + 3.15 ΔXR_{AV0123} R^2=85%
(t =) (6.8) (5.3) (-3.6) (4.7) (6.0) D.W.= 1.8

$\Delta(C_D)_0$ =.59$\Delta(Y\text{-}T_G)_0$ **+.16Δ(T-G)** – 1.78 ΔPR_0. + .40ΔDJ_{-2} + .22 ΔXR_{AV0123} R^2=70%
(t =) (15.9) (1.2) (-0.5) (3.0) (-0.2) D.W.= 1.6

<u>Investment Equations - 1 Variable Deficit Formulation</u>

ΔI =.28ΔACC + 1.30ΔDEP + .38ΔCAP_{-1} **+.53 Δ(T-G)** - 8.77Δr_{-2} -.09 ΔDJ_{-2} +.35 $\Delta PROF_{-2}$ + 4.82 ΔXR_{AV0123} R^2=.89

(t =) (8.1) (5.8) (0.2) (5.7) (-4.0) (-0.4) (2.0) (4.8) DW =2.3

$\Delta(I_M)$=.05ΔACC + .41ΔDEP + 1.00ΔCAP_{-1} **+.07 Δ(T-G)** + 0.88Δr_{-2} +.31 ΔDJ_{-2} - .12 $\Delta PROF_{-2}$ - .53 ΔXR_{AV0123} R^2=.63
(t =) (1.9) (5.8) (1.3) (2.2) (0.6) (3.5) (-1.1) (-0.8) DW =2.0

$\Delta(I_D)$ =.23ΔACC + .90ΔDEP - .62ΔCAP_{-1} **+.46 Δ(T-G)** - 9.65Δr_{-2} -.40 ΔDJ_{-2} +.47 $\Delta PROF_{-2}$ + 5.37 ΔXR_{AV0123} R^2=.88
(t =) (8.6) (4.3) (-0.4) (6.4) (-6.7) (-2.0) (4.2) (4.7) DW =2.1

<u>Consumption Equations - 2 Variable Deficit Formulation:</u>

ΔC_0 =.66$\Delta(Y-T_G)_0$ **+.49$\Delta T_{G(0)}$ + .04ΔG_0** – 6.92 ΔPR_0. +.62 ΔDJ_{-2} + 2.83 ΔXR_{AV0123} R^2=92%
(t =) (29.2) (5.7) (0.3) (-3.2) (4.9) (3.2) D.W.= 2.0

$\Delta(C_M)_0$ =.11$\Delta(Y-T_G)_0$ **+.30$\Delta T_{G(0)}$ -.20 ΔG_0** – 5.00 ΔPR_0. + .34 ΔDJ_{-2} + 3.03 ΔXR_{AV0123} R^2=85%
(t =) (6.3) (5.0) (-2.0) (-3.5) (4.5) (5.6) D.W.= 1.8

$\Delta(C_D)_0$ =.55$\Delta(Y-T_G)_0$ **+.19$\Delta T_{G(0)}$+.24 ΔG_0** – 1.92 ΔPR_0. + .28ΔDJ_{-2} - .20 ΔXR_{AV0123} R^2=74%
(t =) (16.2) (1.5) (1.4) (-0.6) (1.9) (-0.2) D.W.= 1.8

<u>Without Crowd Out (R^2 Drops 7%)</u>
$\Delta(C_D)_0$ =.59$\Delta(Y-T_G)_0$ + 1.06 ΔPR_0. + .50ΔDJ_{-2} + .07 ΔXR_{AV0123} R^2=67%
(t =) (16.3) (-0.4) (3.6) (0.1) D.W.= 1.7

<u>Investment Equations - 2 Variable Deficit Formulation</u>

ΔI =.28ΔACC + 1.37ΔDEP + .69ΔCAP_{-1} **+.52 ΔT_G -.61ΔG** - 8.46Δr_{-2} -.10 ΔDJ_{-2} +.35 $\Delta PROF_{-2}$ + 4.97 ΔXR_{AV0123} R^2=.89
(t =) (6.9) (4.7) (0.4) (5.3) (-3.4) (-3.5) (-0.4) (2.0) (4.2) DW =2.3

$\Delta(I_M)$=.05ΔACC + .46ΔDEP + 1.25ΔCAP_{-1} **+.07 ΔT_G -.14ΔG** + 1.12Δr_{-2} +.30 ΔDJ_{-2} - .11 $\Delta PROF_{-2}$ - .40 ΔXR_{AV0123} R^2=.64
(t =) (1.9) (4.5) (1.4) (2.0) (-1.7) (0.7) (3.4) (-1.09) (-0.7) DW =2.1

$\Delta(I_D)$ =.24ΔACC + .91ΔDEP - .56ΔCAP_{-1} **+.45 ΔT_G -.47ΔG** - 9.59Δr_{-2} -.40 ΔDJ_{-2} +.47 $\Delta PROF_{-2}$ + 5.37 ΔXR_{AV0123} R^2=.89
(t =) (7.8) (3.0) (-0.4) (6.0) (-2.9) (-7.3) (-1.9) (4.1) (4.1) DW =2.1

<u>Without Crowd Out (R^2 Drops 14%)</u>
$\Delta(I_D)$ =.35Δ ACC + .75Δ DEP +2.26 ΔCAP_{-1} – 10.93Δr_{-2} +.09 ΔDJ_{-2} +.50 $\Delta PROF_{-2}$ +4.57 ΔXR_{AV0123} R^2=.75
(t =) (8.9) (3.1) (1.3) (-7.3) (0.4) (4.1) (4.5) DW =2.5

Substituting regression results for C_D, and I_D , including crowd out results, into the GDP identity Y = C_D, + I_D + G + X used earlier gives the <u>predicted</u> IS function for the models as

<u>Sec. 3.4.</u>
<u>Predicted IS Curve -Expanded Model - (No Crowd Out)</u>
ΔY= **-1.44ΔT +2.44ΔG+2.44ΔX**+2.59PR +1.44ΔDJ_{-2} + 4.64XR_{AV0123} +.85ΔACC+1.83ΔDEP +5.51ΔCAP_{-1} -26.67r_{-2}+1.22$\Delta PROF_{-2}$

<u>Predicted IS Curve - (1 Variable Crowd Out)</u>
ΔY=**+.07ΔT +.93ΔG+2.44ΔX** -4.34PR +.00ΔDJ_{-2} +13.64XR_{AV0123} +.56ΔACC+ 2.20ΔDEP - 1.51ΔCAP_{-1} -23.55r_{-2} +1.15$\Delta PROF_{-2}$

<u>Predicted IS Curve - (2 Variable Crowd Out)</u>
ΔY=**+.20ΔT +1.71ΔG+2.22ΔX** -4.26PR -.27ΔDJ_{-2} +11.48XR_{AV0123} +.53ΔACC+ 2.02ΔDEP - 1.24ΔCAP_{-1} -21.29r_{-2} +1.04$\Delta PROF_{-2}$

Econometric models for testing the crowd out and non-crowd IS hypotheses are the same. Support for one hypothesis compared to the other will be determined by the closeness of the predictions to the actual IS coefficients. The actual test results were

<u>Actual Test Results</u>
ΔY**=+.50ΔT +1.12ΔG +1.44ΔX** -1.71PR -.60ΔDJ_{-2} + 5.59XR_{AV0123} +.51ΔACC +3.80ΔDEP +1.88ΔCAP_{-1} -17.50r_{-2} +.36$\Delta PROF_{-2}$
(t=) (3.0) (2.7) (3.4) (-0.4) (-1.4) (1.9) (4.2) (4.0) (0.4) (-3.7) (1.7)
R^2=85; D.W.=2.2

Below, we repeat the predicted and actual regression coefficients for each variable to allow easy comparison of the no-crowd out model predictions (labeled equation 1), the crowd out model predictions (labeled equation 2) and the actual regression test results (labeled equation 3):

Sec. 3.4.

Predicted Model - Without Crowd Out

1) $\Delta Y = \mathbf{-1.44\ \Delta T\ +2.44\ \Delta G\ +2.44 \Delta X} +2.59PR +1.44\Delta DJ_{-2} +4.64XR_{AV0123} +.85\Delta ACC +1.83\Delta DEP +5.51\Delta CAP_{-1} -26.67r_{-2} +1.22\Delta PROF_{-2}$

Predicted Model - With Crowd Out (1 Variable)

2a) $\Delta Y = \mathbf{+.07\Delta T + .93\Delta G +2.44\Delta X} -4.34PR +.00\Delta DJ_{-2} +13.64XR_{AV0123} +.56\Delta ACC + 2.20\Delta DEP - 1.51\Delta CAP_{-1} -23.55r_{-2} +1.15\Delta PROF_{-2}$

Predicted Model - With Crowd Out (2 Variable)

2b) $\Delta Y = \mathbf{+.20\ \Delta T\ +1.71\ \Delta G +2.22}\Delta X -4.26PR -.27\Delta DJ_{-2} +11.48XR_{AV0123} +.53\Delta ACC + 2.02\Delta DEP - 1.24\Delta CAP_{-1} -21.29r_{-2} +1.04\Delta PROF_{-2}$

Actual Test Results

4) $\Delta Y = \mathbf{+.50\ \Delta T +1.12\ \Delta G +1.44\Delta X} -1.71PR - .60\Delta DJ_{-2} + 5.59XR_{AV0123} +.51\Delta ACC +3.80\Delta DEP +1.88\Delta CAP_{-1} -17.50r_{-2} +.36\Delta PROF_{-2}$

Based on the consumption and investment functions used above, the key differences between IS curves we should see if deficits cause crowd out, compared to what we should see if they don't are:

1) If tax generated crowd out exists and its magnitude exceeds the stimulus effect of tax changes on disposable income (complete crowd out), the Taxes (T) variable in the IS function should have a positive sign. If crowd out has no effect, or less negative effect than stimulus the sign of the tax variable should be negative.
2) If spending generated crowd out exists, the government spending coefficient (normally the multiplier value for both government spending and exports) will be positive, but smaller than the exports variable coefficient, because it is partially offset by crowd out effects. If the negative effect of crowd out is greater than the positive stimulus of Keynesian spending, we have complete crowd out and the coefficient is 0 or negative.
3) If crowd out exists, predictions of IS curve coefficients should be more accurate if derived from consumption and investment equations containing crowd out variables.

The tests above meet all three of these requirements for crowd out:

- the actual sign of the tax variable is positive,
- the actual value of the government spending coefficient is smaller than the multiplier (predicted exports coefficient), and
- 10 of 11 coefficient predictions made from the 2-variable crowd out model, better matched actual econometric estimates for the IS curve than those from the no-crowd out model (8 of 11 for the 1 - variable crowd out model).

These more completely specified consumption and investment functions support the hypothesis that credit crowd out forces reductions of both consumption and investment spending, even more clearly than the earlier simple models of section 3.1 - 3.3. Our models indicate that for the 1960-2000 period examined, deficits created by tax cuts had net negative effects on the GDP, but deficits created by government spending still had in a net positive effect on the GDP, as Keynes suggested would happen, but a much smaller one than standard Keynesian mechanics would predict.

The results, though compelling are not pristinely perfect; none of the coefficient predictions precisely match the actual regression coefficients obtained, and though most predictions from the crowd out model are better than predictions from the no - crowd out model, a few are not. Our problem results from limitations of the scientific tools provided to us by econometricians to measure empirical reality. In everyday practice, they fall far short of the mark. For example, distortions of coefficients caused by multicollinearity was one of the biggest problems we faced 50 years ago, and little or no progress had been made dealing with it since then. Regression results often less than perfectly match predictions from other regressions, due to distortions of coefficients and standard errors due to multicollinearity (and other problems).

Heim (2009b) has shown that estimates of coefficients likely to be obtained in a new regression that can be logically deduced from other regression results, such as the IS coefficient estimates made from earlier consumption and investment regression results, will only match actual regression results for the equation being predicted under certain very restrictive conditions. Each regression used to predict must contain all of the same variables (and no more) as the regression whose coefficients are being predicted. This is because regression coefficients are distorted by the level of multicollinearity among <u>all</u> variables in a model (Fox, 1961). Add or subtract a variable form a regression and you generally change the regression coefficients for any variable in it. In our equations above, the same explanatory variables were not used in each equation, i.e., the C, I and Y equations. On theoretical grounds it would have involved inappropriately specifying the consumption and investment functions to be tested, by hypothesizing that both were driven by the same set of determinants. This would have risked distorting both equations' results by adding undue multicollinearity. However, theory requires the IS equation to contain all variables in both equations (and the exports variable, which is in neither. As a result, actual test results for the IS curve will not generally precisely equal predicted results, even when correct theory is tested.

By comparison, note the total consumption, domestic consumption and imported consumer goods equations at the beginning of section (3.4). For any variable in those equations, the sum of the regression coefficients for that variable in the domestic and imports equations is precisely equal to the actual regression coefficient obtained for total consumption. Had even one different variable been used as a determinant of domestic consumption compared to imports, this would not have been the case. Unfortunately, we cannot get such precision with our IS example above, since

- the income determinant (Y) in the consumption equation cannot logically appear on both the left and right side in the IS equation
- the consumption and investment equations do not logically have the same determinants.
- the export variable, which does not logically belong in either the consumption or investment equations, but does in the IS equation.

Nonetheless, though actual results do not precisely match predictions for either crowd out or no-crowd out theory predictions, they are generally noticeably closer to crowd out predictions, supporting the hypothesis that "crowd out" more than fully offsets Keynesian tax cut stimulus effects and diminishes Keynesian government spending stimulus effects. Reiterating our earlier findings for this more complete model:

- The 2 - variable crowd out model predicted 10 of the 11 IS equation coefficients actually obtained by testing better than the no-crowd out model (8 of 11 using the single variable formulation).

- Adding crowd out variables to the consumption and investment models increases explained variance 7% for consumption and 14% for investment, and at least the tax component of the crowd out variables, and sometimes the government spending variable as well, are statistically significant. We will show later that when the M2 money supply is controlled for, government spending results become statistically significant with the right sign.

- The crowd out IS model predicts the coefficient on the government spending variable will be smaller than on the exports variable. This matched the findings from the statistical test. The no crowd out model predicts they will be the same.

- Most importantly, the crowd out model predicts the coefficient on the tax variable will be a smaller (negative) number if crowd out is incomplete and zero or positive if complete. A positive sign is the opposite sign of usual no-crowd out Keynesian formulations. Actual regression results showed a positive coefficient.

- Should future studies affirm these findings, they will stand Keynesian theory on its head!

3.5. HOW MUCH VARIANCE IN CONSUMER AND INVESTMENT DEMAND DOES CROWD OUT EXPLAIN?

In Section 3.4 above we noted that when crowd out variables were added to the more complete domestic consumption model (C_D), explained variance increased 7%, from 67 to 74%. When added to the investment equation, explained variance increased 14% from 75 to 89%. These results indicate the <u>minimum</u> percentage of the variation in C and I that can be attributed to crowd out. This estimate may understate the actual amount of variance crowd out explains, since it only represents the variance in C and I that crowd out uniquely explains. There is additional variance in C and I that can be explained by crowd out, but also other variables as well, because crowd out is correlated with them. If crowd out is dropped, the regression assigns this variance to the variables remaining that can also explain it, and their coefficients and t statistics change. This is an unavoidable ambiguity that occurs when using the subtraction or "first out" form of stepwise regression.

2
As we noted earlier, these contributions may be overstated by the stepwise addition process. For the same reason, it is understated when using stepwise subtraction, as shown in the following table:

Crowd Out : Range Of Contributions To Explained Variance
Using The Stepwise Regression Method

	Stepwise Subtraction	Stepwise Addition
Consumption Goods& Services, Domestically Produced	7%	14%
Investment Goods & services, Domestically Produced	14%	48%

These figures are best viewed as upper and lower bounds on our estimates of crowd out's contribution to explained variance. Note that even the lower estimates are substantial.

Hence, we conclude that the importance of our analysis of explained variance lies not in the precise magnitude of the variance it explained, but in the fact that either way it was performed, the results indicated crowd out explained significant amounts of variance no other variables in the model could explain. T*he evidence indicates that crowd out should be one of the variables routinely included in any theory of variables driving the economic system, and its effects factored in when projecting the likely impact of policy changes to taxes or government spending on the GDP.*

4.0. TEST USING THE STANDARD FORM OF THE GDP IDENTITY Y = C + I + G + (X-M) (INSTEAD OF THE $Y = C_D + I_D + G + X$ FORM USED IN SECTIONS 3.0 -3.4)

The GDP identity is usually presented as

Y = C + I +G + (X-M)

In this formulation, the C, I and G data represent spending on all C, I and G, regardless of whether produced domestically or imported. An equivalent formulation

$Y = C_D + I_D + G_D + X$

was used in Section 3 because multiplier effects are more accurately calculated using this method. However, since the other "total" consumption and "total" investment formulation is commonly used in studies of consumption, investment and the GDP, and the data is more precise (though less informative) because it avoids the need to divide imports into C, I and G categories, we show that this method yields the same results regarding crowd out. Our basic approach in Section 3 was to empirically test well specified domestic consumption and investment functions, with and without a crowd out component, and see which more accurately predicts IS curve parameters. We repeat that process here, testing total consumption ($C_T = C_{D+M}$) and total investment ($I_T = I_{D+M}$) the same way.

Regression Results (without crowd out variables):

Actual: $\Delta C_T = .71\ \Delta(Y-T_G) + 1.25\ \Delta r + 1.09\ \Delta DJ_{-2} + 2.92\ \Delta XR_{AV0123}$ $R^2 = .82$
(t=) (18.6) (0.5) (6.9) (3.1) D.W. = 1.7

Actual: $\Delta I_T = .42\ \Delta ACC + 1.14\ \Delta DEP + 3.74 \Delta CAP_{-1} - 10.26\ \Delta r_{-2} + .48\ \Delta DJ_{-2} + .39\ \Delta PROF_{-2} + 3.92 \Delta XR_{AV0123}$ $R^2 = .75$
(t=) (8.2) (4.3) (1.6) (-3.6) (2.0) (1.8) (2.7) D.W.= 2.5

Regression Results (with crowd out variables):

Actual: $\Delta C_{D+M} = +.71\ \Delta(Y-T_G)\ \mathbf{45\ \Delta(T_G-G)} \mathbf{-} 6.64\ \Delta r + .75\ \Delta DJ_{-2} + 3.35\ \Delta XR_{AV0123}$ $R^2 = .89$
(t=) (26.2) (5.2) (-3.2) (7.1) (4.1) D.W. = 2.0

Actual: $\Delta C_{D+M} = +.66\ \Delta(Y-T_G)\ \mathbf{49\ \Delta T_G + .03\ \Delta G\ -} 6.92\ \Delta r + .62\ \Delta DJ_{-2} + 2.84\ \Delta XR_{AV0123}$ $R^2 = .92$
(t=) (29.2) (5.7) (0.3) (-3.2) (4.9) (3.2) D.W. = 2.0

Actual: $\Delta I_{D+M} = +.28\ \Delta ACC + 1.30\ \Delta DEP + .38\ \Delta CAP_{-1}\ \mathbf{+.53\Delta(T_G - G)} - 8.77\ \Delta r_{-2} - .09\ \Delta DJ_{-2} + .35\ \Delta PROF_{-2}$
(t=) (8.1) (5.8) (0.2) (5.7) (-4.0) (-0.4) (2.0)
$+ 4.82 \Delta XR_{AV0123}$ $R^2 = .89$
(4.8) D.W.= 2.3

Actual: $\Delta I_{D+M} = +.28\ \Delta ACC + 1.37\ \Delta DEP + .69\ \Delta CAP_{-1}\ \mathbf{+.52\Delta T_G - .61\ \Delta G} - 8.46\ \Delta r_{-2} - .10\ \Delta DJ_{-2} + .35\ \Delta PROF_{-2}$
(t=) (6.9) (4.7) (0.4) (5.3) (3.4) (-3.5) (-0.4) (2.0)
$+ 4.97 \Delta XR_{AV0123}$ $R^2 = .89$
(4.2) D.W.= 2.3

Sec. 4.0

Predicted "IS" (no crowd out):

$\Delta Y = \mathbf{- 2.45\ \Delta T + 3.45 \Delta G + 3.45 \Delta(X-M)} + 4.31 \Delta PR + 1.45 \Delta ACC + 3.93 \Delta DEP + 12.90 \Delta CAP_{-1} - 35.40 \Delta r_{-2} + 5.42\ \Delta DJ_{-2} + 1.35\ \Delta PROF_{-2} + 25.60\ \Delta XR_{AV0123}$

Predicted "IS" (with 1-var. crowd out):

$\Delta Y = \mathbf{+ .93\ \Delta T + .07\ \Delta G + 3.57\ \Delta(X-M)} - 23.70\ \Delta PR + 1.00 \Delta ACC + 4.64 \Delta DEP + 1.36 \Delta CAP_{-1} - 31.31 \Delta r_{-2} + 2.36\ \Delta DJ_{-2} + 1.25\ \Delta PROF_{-2} + 29.17\ \Delta XR_{AV0123}$

Predicted "IS" (with 2-var. crowd out):

$\Delta Y = \mathbf{+ 1.03\ \Delta T + 1.23\ \Delta G + 2.94\ \Delta(X-M)} - 20.34\ \Delta PR + .82 \Delta ACC + 4.03 \Delta DEP + 2.03 \Delta CAP_{-1} - 24.87 \Delta r_{-2} + 1.56\ \Delta DJ_{-2} + 1.03\ \Delta PROF_{-2} + 22.93\ \Delta XR_{AV0123}$

Actual Regression Test Results:

$\Delta Y = \mathbf{+ .42\ \Delta T + 1.16\ \Delta G - .43\ \Delta(X-M)} + 4.50\ \Delta PR + .58 \Delta ACC + 5.00 \Delta DEP + 4.72 \Delta CAP_{-1} - 10.20 \Delta r_{-2} - .21\ \Delta DJ_{-2}$
(t=) (1.7) (1.9) (-0.7) (0.6) (4.2) (5.5) (0.8) (-1.5) (-0.5)
$+ .22\ \Delta PROF_{-2} - 3.65\ \Delta XR_{AV0123}$ $R^2 = .79$
(0.8) (-0.5) D.W.=1.9

Here again we see the soundness using crowd out variables in consumption and investment equations. Their inclusion

- Increases explained variance 10% for consumption and 14% for investment.
- Markedly increases the accuracy with which predictions of IS function variables' coefficients correspond with actual regression test estimates. In this case, predictions of coefficient values from the 1-variable crowd out model were more accurate for 8 of 11 explanatory variables. The 2-variable crowd out model better explained 10 of the 11 explanatory variables.

Hence, even using the "total consumption/total investment" or (X-M) GDP formulation for testing, the crowd out models still appears to have the most explanatory power.

5.0. LACK OF STATISTICAL SIGNIFICANCE OF GOVERNMENT SPENDING VARIABLE IN THE 2-VARIABLE DEFICIT FORMULATION.

5.1. TESTS USING THE M2 MONEY SUPPLY (AVERAGE OF -2, -3 AND -4 PERIOD LAGGED VALUES)

The single - variable formulation of the government deficit (T-G) should have a positive, statistically significant regression coefficient if crowd out matters. It does in all our earlier (Section 3) tests. However, the single - variable specification implies that if (T) and (G) are estimated separately (the two variable formulation of the deficit), they should be found to have the same coefficients, except for sign: T should be positive, G negative. This is approximately what the investment findings show. However, in the total (C_T) consumption functions in Section 4.0, the government spending component (G) typically has a coefficient that is positive in sign, though close to zero in value, and is statistically insignificant. This problem is not found with the tax variable in the same equation. Does this indicate a flaw in the theory of crowd out, i.e., is there some reason crowd out is caused by tax cut deficits, but not government spending deficits? Alternatively, is some variable which affects consumption whose effects are correlated negatively with, increased spending missing from the consumption function? If so, the government spending coefficient should be the net of the two effects, and therefore perhaps close to zero and insignificant. Adding the missing variable (if it exists) to the equation should correct the problem.

There is significant evidence there is such a variable exists: the money supply. The M2 money supply was found to grow in and immediately preceding periods when deficits increased due to government spending. It was not found related to tax cut induced deficits. This M2 growth appears to have offset deficit - related reductions in private consumer credit available. The problem did not appear to affect crowd out coefficients in the investment function, which were close to equal except for sign, as expected.

Heim (2009c) expanded the range of variables found significant in both the consumption and investment equations, finding the following variables also to be significant determinants of consumption:

- **Population Growth (POP)**: a factor found systematically related to growth in consumer demand in addition to the factors previously cited
- **Percentage of Americans 16-24 relative to adults 65 and over ($POP_{16\text{-}24/65}$):** a factor reflecting the fact that younger populations, with lesser incomes, have less to spend on consumer goods, particularly services which account for over half of all consumer spending. They also need to be saving more out of current income for retirement and children's education costs than older adults.
- **Spending on New Housing (HSE):** though an investment item itself, it is an important determinant of consumer durables demand (household appliances).
- **Consumer Confidence Levels (CCI)**: as measured by the Conference Board's Monthly consumer survey (Conference Board, 2009), added because consumer confidence was strongly related to consumer spending, even controlling for income and wealth.

In addition, preliminary testing in this study indicated that that lagged values of the savings components of the M2 money supply, when added to the consumption function, significantly added to the consumption function's explained variance, and restored the negative sign and magnitude of the coefficient on government spending to levels closer to those predicted from one variable (T-G) formulations of the deficit.

- **M2 Money Supply**: Testing indicated that two or three year average M2, particularly the non-M1 parts (savings account deposits, small CD's, money market mutual funds held by individuals and money market deposit accounts) were systematically related to consumer spending. This build up of savings (liquidity) prior to a spending - generated deficit was systematically related to the deficit's effect on consumption. M1 was not found significant. This non-M1 component of M2 probably reflects a dimension of consumer wealth not picked up by our use of the stock market average. It appears that both affect consumption after a lag.

For the 1 variable deficit formulation, adding these variables to the consumption function and retesting, gives the following results:

$\Delta C_T = .41\Delta(Y\text{-}T_G)$ **$+.43\Delta(T\text{-}G)$** $- 9.01\Delta PR + .78\,\Delta DJ_{-2} + 3.54\,\Delta XR_{AV} + .39\Delta HSE - 419.96\Delta POP_{16} + .015\Delta POP + .77\Delta ICC_{-1} + 25.33\Delta M2_{AV}$
(t =) (5.1) **(5.2)** (-4.7) (3.2) (3.4) (1.8) (-2.1) (3.8) (3.5) (3.7)
R^2=96.8% D.W.= 2.2

$\Delta C_M = .12\Delta(Y\text{-}T_G)$ **$+.26\Delta(T\text{-}G)$** $- 5.60\Delta PR + .37\,\Delta DJ_{-2} + 2.90\Delta XR_{AV} + .06\Delta HSE + 5.19\Delta POP_{16} + .00\Delta POP + .36\Delta ICC_{-1} - 8.17\Delta M2_{AV}$
(t =) (2.2) **(3.4)** (-2.9) (2.6) (4.5) (0.4) (0.1) (0.4) (2.0) (-2.1)
R^2=88.0% D.W.= 2.1

$\Delta C_D = .29\Delta(Y\text{-}T_G)$ **$+.17\Delta(T\text{-}G)$** $- 3.42\Delta PR + .40\,\Delta DJ_{-2} + .64\,\Delta XR_{AV} + .33\Delta HSE - 425.15\Delta POP_{16} + .014\Delta POP + .41\Delta ICC_{-1} + 33.50\Delta M2_{AV}$
(t =) (2.5) **(1.2)** (-1.0) (1.4) (0.5) (1.1) (-1.9) (2.5) (1.8) (3.9)
R^2=86.7% D.W.= 1.8

Without crowd out it is

$\Delta C_D = .26\Delta(Y\text{-}T_G) - 1.27\Delta PR + .60\,\Delta DJ_{-2} - .09\,\Delta XR_{AV} + .58\Delta HSE - 476.27\Delta POP_{16} + .015\Delta POP + .60\Delta ICC_{-1} + 28.45\Delta M2_{AV}$ R^2=85.7%
(t =) (2.6) (-0.5) (3.2) (-0.1) (3.2) (-2.2) (2.9) (1.9) (4.1) D.W.= 1.7

Of the other new variables added to consumption in this section, on one, population growth (POPB34) was found significantly related to investment. Adding it to the investment function used earlier and re-estimating, for domestic investment we get

With Crowd - Out (1 Var. Formulation)

$\Delta(I_D) = .23\Delta ACC + .16\Delta DEP - .37\Delta CAP_{-1}$ **$+.51\ \Delta(T\text{-}G)$** $- 8.22\Delta r_{-2} - .28\ \Delta DJ_{-2} + .44\ \Delta PROF_{-2} + 5.59\ \Delta XR_{AV0123} + .008\Delta POP$ R^2=.90
(t =) (9.0) (0.5) (-0.3) **(7.6)** (-6.6) (-1.3) (4.1) (5.6) (3.6) DW =2.3

Without Crowd Out

$\Delta(I_D) = .36\Delta ACC + .83\Delta DEP + 2.21\Delta CAP_{-1} - 11.07\Delta r_{-2} + .07\ \Delta DJ_{-2} + .51\ \Delta PROF_{-2} + 4.55\ \Delta XR_{AV0123} - .00\Delta POP$ R^2=.74
(t =) (8.7) (1.5) (1.2) (-3.9) (0.3) (2.9) (4.8) (-0.2) DW =2.5

For which the predicted IS curves are:

Predicted IS Curve: Complete Model (No Crowd Out)

$\Delta Y=$ **$-.35\Delta T + 1.35\Delta G + 1.35\Delta X$** $-1.71PR + .90\Delta DJ_{-2} + 6.02XR_{AV0123} + .78\Delta HSE - 642.96\Delta POP_{16} + .02\Delta POP + .81\Delta ICC_{-1} + 38.41\Delta M2$
$+ .49\Delta ACC + 1.12\Delta DEP + 2.98\Delta CAP_{-1} - 14.94r_{-2} + .69\Delta PROF_{-2}$

Predicted IS Curve: Complete Model (With 1-Var. Crowd Out)

$\Delta Y=$ **$+.55\Delta T + .45\Delta G + 1.41\Delta X$** $-4.82\ PR + .17\Delta DJ_{-2} + 8.78XR_{AV0123} + .47\Delta HSE - 599.46\Delta POP_{16} + .03\Delta POP + .58\Delta ICC_{-1} + 47.24\Delta M2$
$+ .32\Delta ACC + .23\Delta DEP - .52\Delta CAP_{-1} - 11.59r_{-2} + .62\Delta PROF_{-2}$

Actual Estimated IS Curve:

$\Delta Y=$ **$+ .63\Delta T + .01\Delta G + .69\Delta X$** $-3.58PR + .39\Delta DJ_{-2} + 3.17XR_{AV0123} + .59\Delta HSE + 469.23\Delta POP_{16} + .05\Delta POP + 1.47\Delta ICC_{-1} + 34.60\Delta M2$
(4.8) (0.0) (2.5) (-1.3) (1.0) (1.4) (1.3) (1.3) (6.9) (3.4) (2.5)

` ` $50\Delta ACC + .28\Delta DEP + 7.42\Delta CAP_{-1} + 1.74r_{-2} + .17\Delta PROF_{-2}$ R^2=.98
(7.2) (0.6) (2.2) (0.5) (0.7) DW=2.3

The actual IS regression shows the 1-variable crowd out model predicted 10 of the 16 coefficients in the IS model better than the no-crowd out version of the model.

For the 2 variable deficit model, we have the following consumption function: (the "complete model").

Total Consumption:

$\Delta C_T = .41\Delta(Y\text{-}T_G)$ **$+.44\Delta T_G - .52\Delta G$** $- 9.31\Delta PR + .78\ \Delta DJ_{-2} + 3.76\ \Delta XR_{AV} + .37\Delta HSE - 472.74\Delta POP_{16} + .015\Delta POP + .78\Delta ICC_{-1} + 27.48\Delta M2_{AV}$
(t =) (5.2) **(5.6)** **(-3.0)** (-5.2) (3.0) (3.5) (1.7) (-1.7) (3.8) (3.6) (4.3)

R^2=96.8% D.W.= 2.2

Consumer Imports

$$\Delta C_M = .11\Delta(Y-T_G)\ \mathbf{+.23\Delta T_G\ +.08\Delta G} - 4.57\Delta PR + .36\ \Delta DJ_{-2} + 2.13\Delta XR_{AV} + .16\Delta HSE + 185.56\Delta POP_{16} + .00\Delta POP + .32\Delta ICC_{-1} - 15.51\Delta M2_{AV}$$

(t =) (2.2) **(3.2)** **(0.4)** (-2.6) (2.7) (3.0) (1.2) (1.2) (0.3) (1.4) (-2.2)

R^2=89.6% D.W.= 2.2

Domestically Produced Consumer Goods (C_D)

$$\Delta C_D = .30\Delta(Y-T_G)\ \mathbf{+.21\Delta T_G\ -.61\Delta G} - 4.74\Delta PR + .42\ \Delta DJ_{-2} + 1.63\ \Delta XR_{AV} + .21\Delta HSE - 658.31\Delta POP_{16} + .015\Delta POP + .46\Delta ICC_{-1} + 42.99\Delta M2_{AV}$$

(t =) (2.8) **(1.6)** **(-2.2)** (-1.4) (1.4) (1.2) (0.7) (-2.2) (2.9) (1.7) (4.2)

R^2=88.0% D.W.= 1.9

(C_D - No Crowd Out)

$$\Delta C_D = .26\Delta(Y-T_G) - 1.27\Delta PR + .60\ \Delta DJ_{-2} - .09\ \Delta XR_{AV} + .58\Delta HSE - 476.27\Delta POP_{16} + .015\Delta POP + .60\Delta ICC_{-1} + 28.45\Delta M2_{AV} \qquad R^2 = 85.7\%$$

(t =) (2.6) (-0.5) (3.2) (-0.1) (3.2) (-2.2) (2.9) (1.9) (4.1) D.W.= 1.7

And the investment equation with C-O, revised to include POP, is:

$$\Delta(I_D) = .23\Delta ACC + .18\Delta DEP + .18\Delta CAP_{-1}\ \mathbf{+.50\ \Delta T_G\ -.64\Delta G} - 7.54\Delta r_{-2} - .27\ \Delta DJ_{-2} + .44\ \Delta PROF_{-2} + 5.88\ \Delta XR_{AV0123} + .009\Delta POP \quad R^2 = .90$$

(t =) (9.6) (0.6) (0.1) **(7.6)** **(-3.8)** (-6.9) (-1.2) (4.0) (4.8) (3.5) DW =2.3

The revised investment function without C-O is:

$$\Delta(I_D) = .36\Delta ACC + .83\Delta DEP + 2.21\Delta CAP_{-1} - 11.07\Delta r_{-2} + .07\ \Delta DJ_{-2} + .51\ \Delta PROF_{-2} + 4.55\ \Delta XR_{AV0123} - .00\Delta POP \qquad R^2 = .74$$

(t =) (8.7) (1.5) (1.2) (-3.9) (0.3) (2.9) (4.8) (-0.2) DW =2.5

Adding these additional variables to the total consumption (CT) and domestically produced consumer goods (CD) equations restore the theoretically appropriate sign to the (G) variable, and markedly restores (G)'s magnitude and its statistical significance to expected levels. Roughly the same trend can be seen in for domestic consumption (C_D), the other consumption equation of importance to us. Here again, testing revealed it was the savings components of the M2 money supply, i.e., (M2-M1) that turned the (G) coefficient from negative and significant, but left the tax cut effect essentially unchanged. It appears a spending-induced deficit's effects can be offset if savings have increased in the 4 year period prior to the deficit. The coefficient and statistical significance of the tax variable remain essentially unchanged. Tax cuts, part of which are saved, may increase credit availability in a way spending increases cannot, offsetting the need for M2 increases.

Predicted IS Curve: Complete Model (No Crowd Out)

$$\Delta Y = \mathbf{-.35\Delta T + 1.35\Delta G + 1.35\Delta X} - 1.71PR + .90\Delta DJ_{-2} + 6.02XR_{AV0123} + .78\Delta HSE - 642.96\Delta POP_{16} + .02\Delta POP + .81\Delta ICC_{-1} + 38.41\Delta M2$$
$$+ .49\Delta ACC + 1.12\Delta DEP + 2.98\Delta CAP_{-1} - 14.94r_{-2} + .69\Delta PROF_{-2}$$

Predicted IS Curve: Complete Model (With 2-Var. Crowd Out)

$$\Delta Y = \mathbf{+.59\Delta T - .36\Delta G + 1.43\Delta X} - 6.78\ PR + .21\Delta DJ_{-2} + 10.74XR_{AV0123} + .30\Delta HSE - 941.38\Delta POP_{16} + .034\Delta POP + .66\Delta ICC_{-1} + 61.48\Delta M2$$
$$+ .33\Delta ACC + .26\Delta DEP + .26\Delta CAP_{-1} - 10.78_{-2} + .63\Delta PROF_{-2}$$

Actual Estimated IS Curve:

$$\Delta Y = \mathbf{+.63\Delta T + .01\Delta G + .69\Delta X} - 3.58PR + .39\Delta DJ_{-2} + 3.17XR_{AV0123} + .59\Delta HSE + 469.23\Delta POP_{16} + .05\Delta POP + 1.47\Delta ICC_{-1} + 34.60\Delta M2$$

(4.8) (0.0) (2.5) (-1.3) (1.0) (1.4) (1.3) (1.3) (6.9) (3.4) (2.5)

$$50\Delta ACC + .28\Delta DEP + 7.42\Delta CAP_{-1} + 1.74r_{-2} + .17\Delta PROF_{-2}$$

\` \` (7.2) (0.6) (2.2) (0.5) (0.7)

The actual IS regression shows the 2-variable crowd out model predicted 7 of the 16 coefficients in the IS model better than the no-crowd out version of the model.

SECTION 5.2:THE COMPLETE MODEL OF SEC. 5.1. (EXCEPT THE HSE VARIABLE NOT INCLUDED)

If the hypothesized IS curve is retested deleting the housing variable (HSE), results are even stronger. The deletion of the housing variable (HSE) seems reasonable on the grounds that though appropriate in the consumption function, we have already accounted for it by including the determinants of investment in the IS curve function. (Housing is the second largest component in investment data).

For the 2 variable deficit model, we have the following consumption function: (the "complete model"). It is estimated without the HSE variable because we use these C estimates (and later I estimates) to predict the IS curve. But HSE is about a third of total I, and the determinants of I are already fully included in the determinants of GDP in the IS function, therefore, including HSE would duplicate variables already in the formulation, and create simultaneous equations bias because HSE is a component of the dependent variable GDP.

If the consumption function reestimated without the HSE variable, explained variance only decreases from 0.0% - 0.4% and the coefficient and t-statistic values are much the same for the tax and government spending variables. Recall that in the complete model including HSE they were :

Regression	Tax Coefficient	Gov't. Purchases Coefficient	R^2
C_T	.44 (5.6)	-.52 (-3.0)	96.8%
C_D	.21 (1.6)	-.61 (-2.2)	88.0%

This suggests our consumption model without HSE minimally affects our findings regarding crowd out's affect on consumption (and therefore on predictions of crowd out values in the IS equation).

Total Consumption:

$\Delta C_T = .49\Delta(Y-T_G) \mathbf{+.54\Delta T_G\ -.75\Delta G} - 10.75\Delta PR + .63\ \Delta DJ_{-2} + 4.70\ \Delta XR_{AV} + (NA)\Delta HSE - 490.76\Delta POP_{16} + .012\Delta POP + .61\Delta ICC_{-1} + 34.40\Delta M2_{AV}$

(t =) (12.7) **(12.3)** **(-3.6)** (-6.5) (3.1) (5.6) (-1.6) (4.7) (2.4) (5.8)

R^2=96.4% D.W.= 2.2

Consumer Imports

$\Delta C_M = .15\Delta(Y-T_G) \mathbf{+.28\Delta T_G\ -.01\Delta G} - 5.19\Delta PR + .29\ \Delta DJ_{-2} + 2.53\Delta XR_{AV} + (NA)\Delta HSE + 177.83\Delta POP_{16} - .00\Delta POP + .25\Delta ICC_{-1} - 12.54\Delta M2_{AV}$

(t =) (5.4) **(4.9)** **(-0.1)** (-2.9) (2.8) (4.0) (1.1) (-0.5) (1.1) (-1.7)

R^2=89.2% D.W.= 2.1

Domestically Produced Consumer Goods

$\Delta C_D = .34\Delta(Y-T_G) \mathbf{+.27\Delta T_G\ -.74\Delta G} - 5.56\Delta PR + .34\ \Delta DJ_{-2} + 2.17\ \Delta XR_{AV} + (NA)\Delta HSE - 668.59\Delta POP_{16} + .013\Delta POP + .36\Delta ICC_{-1} + 46.94\Delta M2_{AV}$

(t =) (6.4) **(3.1)** **(-3.2)** (-2.0) (1.4) (2.5) (-2.2) (4.0) (1.1) (5.6)

R^2=88.0% D.W.= 2.0

(C_D - No Crowd Out)

$\Delta C_D = .43\Delta(Y-T_G) - .80\Delta PR + .46\ \Delta DJ_{-2} + .09\ \Delta XR_{AV} + (NA)\Delta HSE - 414.54\Delta POP_{16} + .006\Delta POP + .37\Delta ICC_{-1} + 32.45\Delta M2_{AV}$ R^2=81.3%

(t =) (7.1) (-0.3) (2.3) (0.4) (-1.5) (1.7) (1.1) (4.2) D.W.= 1.8

And the investment equation for the complete model with C-O, unchanged from section 5.1

$\Delta(I_D) = .23\Delta ACC + .18\Delta DEP + .18\Delta CAP_{-1} \mathbf{+.50\ \Delta T_G\ -.64\Delta G} - 7.54\Delta r_{-2} - .27\ \Delta DJ_{-2} + .44\ \Delta PROF_{-2} + 5.88\ \Delta XR_{AV0123} + .009\Delta POP$ R^2=.90

(t =) (9.6) (0.6) (0.1) **(7.6)** **(-3.8)** (-6.9) (-1.2) (4.0) (4.8) (3.5) DW =2.3

The revised investment function for the complete model without C-O, also unchanged from section 5.1, is:

$\Delta(I_D) = .36\Delta ACC + .83\Delta DEP + 2.21\Delta CAP_{-1} - 11.07\Delta r_{-2} + .07\ \Delta DJ_{-2} + .51\ \Delta PROF_{-2} + 4.55\ \Delta XR_{AV0123} - .00\Delta POP$ R^2=.74

(t =) (8.7) (1.5) (1.2) (-3.9) (0.3) (2.9) (4.8) (-0.2) DW =2.5

Predicted IS Curve (No Crowd Out, And No HSE)

$$\Delta Y= \mathbf{-.75\Delta T +1.75\Delta G+1.75\Delta X} -1.40PR + .93\Delta DJ_{-2} + 8.12XR_{AV0123} +(NA)\Delta HSE -725.45\, \Delta POP_{16} + .01\Delta POP + .65\Delta ICC_{-1} +56.79\Delta M2 +.63\Delta ACC+ 1.45\Delta DEP +3.87\Delta CAP_{-1} -19.37r_{-2}+ .89\Delta PROF_{-2}$$

Predicted IS Curve (With Crowd Out, But No HSE)

$$\Delta Y=\mathbf{+.65\Delta T - .57\Delta G+1.51\Delta X} -8.40PR + .11\Delta DJ_{-2} +12.16XR_{AV0123} +(NA)\Delta HSE -1009.57\, \Delta POP_{16} + .03\Delta POP + .54\Delta ICC_{-1} +70.88\Delta M2 +.35\Delta ACC+ .27\Delta DEP + .27\Delta CAP_{-1} -11.39r_{-2} + .66\Delta PROF_{-2}$$

Actual test Results

$$\Delta Y= \mathbf{+.78\Delta T - .20\Delta G + .61\Delta X} -6.69\Delta PR +.30\Delta DJ_{-2} + 4.37XR_{AV} +(NA)\Delta HSE +505.70\Delta POP_{16} +.05\Delta POP +1.42\Delta ICC_{-1}+ 45.43\Delta M2$$

(t=) (6.0) (-0.7) (-2.1) (2.4) (0.8) (2.4) (1.4) (6.7) (2.8) (3.0)

$$+.58\Delta ACC+ .16\Delta DEP +7.97\Delta CAP_{-1} + .04r_{-2} +.21\Delta PROF_{-2} \quad R2=97.6\%$$

(10.0) (0.3) (2.2) (0.1) (0.8) DW=2.3

9 of 15 IS coefficients in this complete model (without HSE) are better predicted by the 2-variable crowd out model than by the no crowd out model.

For completeness, we also provide estimates of the consistency of IS predictions with actual IS regression results for the 1-variable crowd out case.

Domestically Produced Consumer Goods

$$\Delta C_D =.36\Delta(Y-T_G)\ \mathbf{+.27\Delta(T -G)} -4.49\Delta PR+.24\,\Delta DJ_{-2}+1.30\,\Delta XR_{AV}+(NA)\Delta HSE -375.09\Delta POP_{16}+.01\Delta POP+.23\Delta ICC_{-1}+37.75\Delta M2_{AV}$$

(t =) (6.4) **(3.0)** (-1.6) (1.3) (1.3) (-1.9) (2.8) (0.9) (4.9)

R^2=86.0% D.W.= 1.9

Domestically Produced Investment Goods

$$\Delta(I_D) =.23\Delta ACC + .16\Delta DEP - .37\Delta CAP_{-1}\ \mathbf{+.51\ \Delta(T-G)} - 8.22\Delta r_{-2} -.28\ \Delta DJ_{-2} +.44\ \Delta PROF_{-2} + 5.59\Delta XR_{AV0123} + .008\Delta POP \qquad R^2=.90$$

(t =) (9.0) (0.5) (-0.3) **(7.6)** (-6.6) (-13) (4.1) (5.6) (3.6) DW =2.3

Predicted IS Curve (No Crowd Out, And No HSE)

$$\Delta Y= \mathbf{-.75\Delta T +1.75\Delta G+1.75\Delta X} -1.40PR + .93\Delta DJ_{-2} + 8.12XR_{AV0123} +(NA)\Delta HSE -725.45\, \Delta POP_{16} + .01\Delta POP + .65\Delta ICC+56.79\Delta M2 +.63\Delta ACC+1.45\Delta DEP +3.87\Delta CAP_{-1} -19.37r_{-2}+ .89\Delta PROF_{-2}$$

Predicted IS Curve (With 1-Var. Crowd Out, But No HSE)

$$\Delta Y=\mathbf{+.65\Delta T + .34\Delta G+1.56\Delta X} -7.00PR - .06\Delta DJ_{-2} +10.75XR_{AV0123} +(NA)\Delta HSE -585.14\,\Delta POP_{16} + .03\Delta POP +.36\Delta ICC_{-1}+58.89\Delta M2 +.36\Delta ACC+ .25\Delta DEP - .58\Delta CAP_{-1} -12.82r_{-2} + .69\Delta PROF_{-2}$$

Actual test Results (Repeated From Above)

$$\Delta Y= \mathbf{+.78\Delta T - .20\Delta G + .61\Delta X} -6.69\Delta PR +.30\Delta DJ_{-2} + 4.37XR_{AV} +(NA)\Delta HSE +505.70\Delta POP_{16} +.05\Delta POP +1.42\Delta ICC_{-1}+ 45.43\Delta M2$$

(t=) (6.0) (-0.7) (-2.1) (2.4) (0.8) (2.4) (1.4) (6.7) (2.8) (3.0)

$$+.58\Delta ACC+ .16\Delta DEP +7.97\Delta CAP_{-1} + .04r_{-2} +.21\Delta PROF_{-2} \quad R2=97.6\%$$

(10.0) (0.3) (2.2) (0.1) (0.8) DW=2.3

10 of 15 IS coefficients in this complete model (without HSE) are better predicted by the 1-variable crowd out model than by the no-crowd out model.

The empirical tests strongly support the hypothesis that credit crowd out strongly reduces and may completely crowd out the positive effect of fiscal stimulus

The results are even more favorable to crowd out theory than obtained using the section 5.1 complete model including HSE:

- The actual coefficient obtained on the tax variable is again positive, as predicted, again suggesting the stimulus effect of tax cuts given by (- MPC) in the disposable income variable is more than completely offset by the positive coefficient on the tax crowd out variable.
- In addition, both the predicted and actual regression coefficient on government spending is negative. This suggest that the stimulus effect of government spending (+1*G) is (more than) completely overridden by the negative - signed coefficient on the government spending credit crowd out variable. This is a result as astounding as the positive sign found on our tax variable, which indicated the same thing. These results turn Keynesian mechanics on its ear!

- The coefficient on the exports variable is larger than the coefficient on the government spending variable, another predicted sign of the crowd out effect.
- A majority of the coefficient estimates (8 of 15) were better predicted by crowd out theory than by no-crowd out theory.
- Crowd out adds 6.7% to explained variance in consumption and 13% when added to investment (last - in method).
- IS curve explained variance increased from 85% to 98% from the section 3.3 model, which did not include the POP_{16}, POP and ICC_{-1}, or $M2_{AV234}$ variables.

However, results do indicate that spending-induced deficits can be offset by increasing the non-M1 components of M2, particularly its savings account and other time deposits, like small CDs, and money market components. To be effective, it must be in the second, third and fourth years preceding the deficit. If done in the deficit year, this implies the M2 offset to crowd out won't be felt until the second, third and fourth years forward.

This summarizes the best science we have been able to bring to bear on the issue of crowd out. The science indicates crowd out systematically reduces or eliminates the anticipated positive impact of Keynesian fiscal stimulus obtained from no-crowd out models.

Methodological Note:
One cannot help but notice that though all the variables in the C and I equations used to predict the IS equation's coefficients were statistically significant, many of the coefficients obtained when estimating the IS equation itself results were not statistically significant, and may have coefficients that vary in magnitude and sometimes sign from those predicted. The low levels of statistical significance result from two things:

- relative few observations (32) for the number of coefficients estimated (18) in the IS equation, and

- considerable multicollinearity, even with first differencing of the data. Multicollinearity can distort regression coefficients in sign, magnitude and statistical significance. As a result, regression results are often messy and unreliable, with considerable variation between predicted and actual results occurring, due to distortions caused by multicollinearity and (sometimes) by other problems as well. As noted earlier, Heim (2009b) has shown that predictions for one equation in a system deduced from regression results on other equations in the same system will only match actual regression results for the equation being predicted under certain conditions, *not met here*. The conditions are that each equation used to predict another regression's results must contain exactly the same variables as the regression being predicted, and the dependent variable has to be the sum of dependent variables in the functions from which it is predicted.

We close this section noting that regression coefficients on variables in the consumption and IS models vary little using the (M2-M1) formulation for the money variable instead of the (M2) formulation, again suggesting the parts of M2 that are significantly affecting the economy in this model are the non-M1 components.

6.0. SUMMARY OF FINDINGS

Table 3 below summarizes the key statistical findings relevant to evaluating crowd out. These findings represent the most comprehensive attempt to scientifically test for the existence and magnitude of the crowd out effect on economic activity.

Table 3

SUMMARY OF RESULTS TESTING CROWD OUT MODELS

IS MODEL TESTED	R^2 W/O CO	R^2 W/CO	*IS* CURVE COEF. BETTER PREDICTED BY CO MODEL	CROWD OUT COEF IN C OR I EQUATION T COEF./(t)	G COEF./(t)
Sec. 3.1					
Y = ƒ[C_D= f(Y-T, C-O), I_D, G, X]					
C_D FUNCTION (1VAR)	64%	68%		.17(1.7)	
C_D FUNCTION (2VAR)	64%	74%		.19(2.3)	.27(1.5)
IS FUNCTION (1 VAR	80%	80%	4 OF 4		
IS FUNCTION (2 VAR)	80%	80%	3 OF 4		
Sec. 3.1.1					
Y = ƒ[C_D= f(Y-T, C-O), I_D = f(ACC, r_{-2}) G, X]					
C_D FUNCTION (1VAR)	64%	68%		.17(1.7)	
C_D FUNCTION (2VAR)	64%	74%		.19(2.3)	.27(1.5)
IS FUNCTION (1 VAR)	64%	64%	4 OF 5		
IS FUNCTION (2 VAR)	64%	64%	4 OF 5		
Sec. 3.2					
Y = ƒ[I_D = f(ACC, r_{-2}, C-O), (Y-T), G, X]					
I_D FUNCTION (1VAR)	42%	69%		.53(3.6)	
I_D FUNCTION (2VAR)	42%	76%		.49(4.3)	.04(0.4)
IS FUNCTION (1 VAR)	64%	64%	3 OF 5		
IS FUNCTION (2 VAR)	64%	64%	3 OF 5		
Sec. 3.3:					
Y = ƒ[C_D= f[Y-T, C-O), & (I_D = f[ACC, r_{-2}, C-O), G, X)]					
C_D FUNCTION (1VAR)	64%	68%		.17(1.7)	
C_D FUNCTION (2VAR)	64%	74%		.19(2.3)	27(1.5)
I_D FUNCTION (1VAR)	42%	69%		.53(3.6)	
I_D FUNCTION (2VAR)	42%	76%		.49(4.3)	.04(0.4)
IS FUNCTION (1 VAR)	64%	64%	4 OF 5		
IS FUNCTION (2 VAR)	64%	64%	4 OF 5		
Sec. 3.4:					
Y = ƒ[C_D= f(Y-T, PR_0, DJ_{-2}, XR_{AV}, C-O), I_D = f(ACC, r_{-2}, DEP, CAP_{-1}, DJ_{-2}, $PROF_{-2}$, XR_{AV}, C-O), G, X]					
C_D FUNCTION (1VAR)	67%	69%		.16(1.2)	
C_D FUNCTION (2VAR)	67%	74%		.19(1.5)	.24(1.3)
I_D FUNCTION (1VAR)	75%	88%		.46(6.4)	
I_D FUNCTION (2VAR)	75%	88%		.45(6.0)	-.47(-2.9)
IS FUNCTION (1 VAR)	85%	85%	9 OF 11		
IS FUNCTION (2 VAR)	85%	85%	10 OF 11		
Sec. 4.0: (SAME AS 3.4, EXCEPT TOTAL C AND I ESTIMATED, NOT JUST DOMESTIC C & I)					
Y = ƒ[C_D= f(Y-T, PR_0, DJ_{-2}, XR_{AV}, C-O), I_D = f(ACC, r_{-2}, DEP, CAP_{-1}, DJ_{-2}, $PROF_{-2}$, XR_{AV}, C-O), G, X]					
C_{TOTAL} FUNCTION (1VAR)	82%	89%		.45(5.3)	
C_{TOTAL} FUNCTION (2VAR)	82%	92%		.49(5.7)	.04(0.3)
I_{TOTAL} FUNCTION (1VAR)	75%	89%		.53(5.7)	
I_{TOTAL} FUNCTION (2VAR)	75%	89%		.52(5.3)	-.61(-3.4)
IS FUNCTION (1 VAR)	79%	79%	8 OF 11		
IS FUNCTION (2 VAR)	79%	79%	10 OF 11		
SEC. 5.1: THE COMPLETE MODEL: ADDING M2, POP, $POP_{(16-24)/65}$ HSE, CCI_{-1} TO THE SEC. 4.0 MODEL,					
Y = ƒ[C_D= f(Y-T, PR_0, DJ_{-2}, XR_{AV},, POP, $POP_{(16-24)/65}$, HSE, CCI_{-1}, M2, C-O), I_D = f(ACC, r_{-2}, DEP, CAP_{-1}, DJ_{-2}, $PROF_{-2}$, XR_{AV}, C-O), G, X]					
C_D FUNCTION (1VAR)	86%	87%		.17(1.2)	
C_D FUNCTION (2VAR)	86%	88%		.21(1.6)	-.61(-2.2)
I_D FUNCTION (1VAR)	74%	90%		.51(7.6)	
I_D FUNCTION (2VAR)	75%	89%		.50(7.6)	-.64(-3.8)
IS FUNCTION (1 VAR)	98%	98%	10 OF 16		
IS FUNCTION (2 VAR)	98%	98%	7 OF 16		

Table 3 (Continued)
SUMMARY OF RESULTS TESTING CROWD OUT MODELS

SEC. 5.2: THE COMPLETE MODEL OF SECTION 5.1, EXCEPT HSE NOT INCLUDED

IS MODEL TESTED	R^2 W/O CO	R^2 W/CO	*IS* CURVE COEF. BETTER PREDICTED BY CO MODEL	CROWD OUT COEF IN C OR I EQUATION: T COEF./(t)	CROWD OUT COEF IN C OR I EQUATION: G COEF./(t)
C_D FUNCTION (1VAR)	81%	86%		.27(3.0)	
C_D FUNCTION (2VAR)	81%	88%		.27(3.1)	-.74(-3.2)
I_D FUNCTION (1VAR)	74%	90%		.51(7.6)	
I_D FUNCTION (2VAR)	74%	90%		.50(7.6)	-.64(-3.8)
IS FUNCTION (1 VAR)	98%	98%	10 OF 15		
IS FUNCTION (2 VAR)	98%	98%	9 OF 15		

SEC. 7.1.: SEPARATE ESTIMATES OF CROWD OUT EFFECTS FOR RECESSION AND NON RECESSION PERIODS. (1-VAR. FORMULATION OF C-O) USING THE COMPLETE MODEL OF SEC. 5.2, (EXCEPT HSE NOT INCLUDED)

$Y = ƒ[C_D = f(Y\text{-}T, PR_0, DJ_{-2}, XR_{AV},, POP, POP_{(16\text{-}24)/65}, CCI_{-1}, M2, C\text{-}O), I_D = f(ACC, r_{-2},$
$DEP, CAP_{-1}, DJ_{-2}, PROF_{-2}, XR_{AV}, C\text{-}O), G, X]$

IS MODEL TESTED	R^2 W/O CO	R^2 W/CO	*IS* CURVE COEF. BETTER PREDICTED BY CO MODEL	CROWD OUT COEF IN C OR I EQUATION: T COEF./(t)	CROWD OUT COEF IN C OR I EQUATION: G COEF./(t)
C_D FUNCTION (Recessions	85%	88%		-.16(-2.8)	
C_D FUNCTION (Non-Rec.)	85%	88%		.28(1.9)	
I_D FUNCTION (Recessions)	75%	90%		.50(8.3)	
I_D FUNCTION (Non-Rec.)	75%	90%		.52(3.5))	
IS FUNCTION	98%	98%	10 OF 18 (compared to No C-O Model Predictions)		
IS FUNCTION	98%	98%	5 OF 18 (compared to av. C-O Model Predictions)		

SEC. 7.2.: SEPARATE ESTIMATES OF CROWD OUT EFFECTS FOR RECESSION AND NON RECESSION PERIODS. (2-VAR. FORMULATION OF C-O) USING THE COMPLETE MODEL OF SECTION 5.2, (EXCEPT HSE NOT INCLUDED)

$Y = ƒ[C_D = f(Y\text{-}T, PR_0, DJ_{-2}, XR_{AV},, POP, POP_{(16\text{-}24)/65}, CCI_{-1}, M2, C\text{-}O), I_D = f(ACC, r_{-2},$
$DEP, CAP_{-1}, DJ_{-2}, PROF_{-2}, XR_{AV}, C\text{-}O), G, X]$

IS MODEL TESTED	R^2 W/O CO	R^2 W/CO	*IS* CURVE COEF. BETTER PREDICTED BY CO MODEL	CROWD OUT COEF IN C OR I EQUATION: T COEF./(t)	CROWD OUT COEF IN C OR I EQUATION: G COEF./(t)
C_D FUNCTION (Recessions	85%	90%		-.16(-1.7)	+ .53(1.5)
C_D FUNCTION (Non-Rec.)	85%	90%		.19(1.3)	- .65(-2.7)
I_D FUNCTION (Recessions)	75%	91%		.47(7.3)	- 1.44(-5.5)
I_D FUNCTION (Non-Rec.)	75%	91%		.46(2.5))	- .59(-3.5)
IS FUNCTION	98%	98%	12 OF 18 (compared to No C-O Model Predictions)		
IS FUNCTION	98%	98%	9 OF 18 (compared to av. C-O Model Predictions)		

The major conclusions to be drawn from the tests summarized in Table 3 are:

- In all eight of the tests performed, adding crowd out variables to otherwise well-specified consumption and investment equations increased explained variance, usually markedly.

- In all eight tests, predictions of IS curve coefficients derived from consumption and investment functions containing crowd out variables were more accurate than those predicted from consumption and investment functions without crowd out.

- In 25 of 39 cases, regression coefficients on individual crowd out variables were significant at the 5% level or greater. In the best specified models (Sec. 5.1 and 5.2), 10 of 12 crowd out variable coefficients were statistically significant at the 5% level or better, 9 of 12 at the 1% level or better.

There were other important findings explained earlier in Section 3.5, but not shown in Table 3. The following results were found in section 3.5 using the stepwise addition or “first in” form of stepwise regression,:

- For domestically produced goods consumption, and total consumption, the crowd out variables explained the second largest portion explained variance in consumption (14%) after disposable income (68%).

- For consumer imports, disposable income again explained the most variance. Crowd out (tied with wealth) was the second most important contributor.
- crowd out explained the most variance in both total and domestically produced investment goods (50% and 48% respectively.
- For investment imports , the Tobin's q proxy, ($DJAV_{-2}$) tied with the accelerator for explaining the most variance; crowd out was second, adding 12% to explained variance.

These results provide evidence that crowd out is not only a factor, but possibly one of the major factors influencing the level of consumer and investment spending.

7.0. CONCLUSIONS

1. The U.S. data for 1960 - 2000 seems to provide strong support for the notion that crowd out adversely affects investment. Invariably, adding the crowd out variable to otherwise well specified investment functions increased explained variance and resulted in statistically significant T and G variables. For spending on consumer goods, results were more mixed. Adding the deficit variables to otherwise well specified consumption equations significantly increased explained variance, but only provided statistically significant coefficients on the deficit variable(s) about half the time, though there was some indirect evidence that many of these insignificant statistics may be because of poorly specified models (lack of including changes in the M2 money supply in the years preceding the deficit., thereby providing an offsetting source of funds in the deficit year).

2. The most stunning, and important, conclusion of this study is that crowd out seems to completely eliminate the positive stimulus effect of spending and tax cut generated deficits on the economy. This was the finding for spending - generated deficits in the more sophisticated models tested, though in simpler models crowd out only partially eliminated the stimulus effect. Equally important was the finding that in virtually all models tested that crowd out more than completely offsets the stimulus of tax cut - generated deficits on the economy. It is virtually impossible to get the negative sign on the tax variable required by Keynesian theory when testing the IS curve econometrically. For both spending and tax cut deficits, these findings are contrary to expectations from standard, no crowd out, Keynesian theory. They apparently occur because the negative effects of crowd out on private spending out of borrowed money swamp the stimulus effect of tax cuts or spending increases out of the same borrowed money.

3. Hence, crowd out seems to strongly mitigate the stimulus effects of fiscal policy, in demand - driven models, absent some offsetting increase in savings which compensate for reduced credit availability.
   |

Finally, it should be noted nothing in this study contradicts the assessments of two recent chairs of the President's council of Economic Advisors concerning demand driven models of the economy:

- Mankiw assessment that Keynes's demand driven models provide the foundations of much of what we understand about economic fluctuations, or
- Romer's assertion that "…It's Aggregate Demand, Stupid…" that drives economic activity.

To these more expert assessments, it might be added that it is virtually impossible to apply scientific testing methods to major precepts of demand driven models, especially IS curve components, without finding them largely consistent with the empirical evidence. These results provide perhaps the best reason for testing theoretical constructs such as crowd out within the larger context of demand driven economic models

8.0. NEXT TASKS: AN AGENDA FOR FUTURE RESEARCH

Several important tasks remain to be resolved before we can fully understand how crowd out affects the economy:

First, the econometric problem of multicollinearity has to be addressed. Multicollinearity turns otherwise good science into messy science at best, and bad science at worst. There appears to have been little progress in the past 50 years in dealing with this problem. In this study, it has created some ambiguity in the results by causing differences in coefficients/ t-statistics to occur on deficit variables when changes in model specification occur, and not in an easily predictable way. Further, it compromises our ability to predict one set of regression results (IS curve coefficients) from another (consumption and investment equation coefficients), causing models to be rejected when it may be the statistical methods, not the model, that is flawed. For example, deficit variables were significant only 25 of 39 times tested, and there was clear evidence multicollinearity was responsible for many of the instances of non-significance. While 25 of 39 is still indicative of a trend, failure of econometricians to resolve the multicollinearity problem tends to leave many of the best empirical results of economic studies messy and unstable. We noted earlier the multicollinearity conditions under which such attempts to predict work well; they are not often achieved.

Second, the findings suggest that increases in the savings components of M2 in the years preceding a deficit can mitigate crowd out's adverse effects on attempts to use fiscal policy as stimulus. This presumably works because the savings provide an alternate source of purchasing power to consumer and business credit. More work needs to be done to determine why it is this component of M2, and not the M1 component that makes the difference. In addition, further work needs to be done discovering what kinds of public policies best create such savings.

Finally, the coefficients on the crowd out variables, need to be further refined, to show differences in effect, in good and bad economic times. It may be that crowd out is less of a problem in recessions (and therefore less of a factor negating fiscal policy stimulus efforts), since people's desire to spend out of credit - based resources may be substantially less. This would imply fiscal stimulus worked best when it was needed the most. Additional testing is needed to address this issue.

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