Value-Added Taxation in LIFT

Amy Carr

Every few years, discussion of a value-added tax (VAT) for the United States enters public policy arenas, either as a means of raising additional revenue or as an alternative to personal and corporate income taxation. Most recently, President Clinton flirted with the VAT as a way to finance health care reform. In July 1992, Senators John Danforth and David Boren created an advisory committee to examine the feasibility of a national consumption tax.[1] A VAT was successfully implemented in Michigan from 1953 to 1967, and was seriously considered by the federal government in 1965, 1972, and 1980.[2] Representative Al Ullman was chairman of the Ways and Means Committee when he proposed a VAT in 1979, and some pundits claim that the tax proposal cost him the election the following year.

The United States is the only Western industrialized country that does not have a VAT or a national sales tax. All members of the European Community employ a VAT, although each country has a slightly different system. Canada and Japan are the most recent converts to value-added taxation, with the Canadian General Services Tax enacted on January 1, 1991, and the Japanese Consumption Tax established in 1989. Table 1 summarizes VAT in a number of countries.

Are value-added taxes necessarily better than other taxes? Among the arguments in favor of a consumption-based VAT[3] are that as a consumption tax, the VAT does not tax savings and would boost our savings and investment, and ultimately long-run growth. This is unlike our current income tax system, which taxes income regardless of whether it is consumed or saved, and thereby provides incentive for people to substitute current consumption for future consumption. Further, a VAT prevents cascading, which occurs when businesses pay taxes on intermediate goods that end up in the value of their final sales, which are taxed again. Cascading is a problem with national sales taxes or turnover taxes. Finally, a VAT would help prevent tax evasion that occurs both in our complicated income tax system and under retail sales tax, where transactions that are paid in cash often go untaxed.

Opponents of a VAT for the United States point out that consumption taxation is highly regressive. Because poorer people consume a larger share of their income than the rich, the poor would pay a larger proportion of their total income in taxes if a VAT were adopted. In addition, the start up, administration, and compliance costs of a VAT are tremendous. Some conservatives are opposed to a VAT, for fear that it will become a "money machine" to fuel increased government spending. State and local governments are concerned that the introduction of a VAT would infringe on their tax base for retail sales taxes.

This paper will be a brief introduction to some of the issues surrounding the VAT and a look at the economic effects of introducing a simple VAT, using a macro-industry model of the United States. I will introduce a VAT into Inforum's Long-term Interindustry Forecasting Tool (LIFT) to examine the effects of a VAT on a wide number of macroeconomic indicators.

Table 1. International VAT Rates

Country	Abbreviated name	Effective date	Standard rate percent	Consumption taxes as a percent of all taxes
Belgium	TVA	1971	19	24.9
Canada	GST	1991	7	* 30.1
Denmark	MOMS	1967	22	34.1
France	TVA	1968	18.6	29.4
Germany	USt	1968	14	25.2
Greece	FPA	1987	16	45.4
Ireland	VAT	1972	21	42.0
Italy	IVA	1973	19	28.0
Japan	JCT	1989	3	* 12.6
Luxembourg	TVA	1970	12	25.2
Netherlands	BTW	1969	18.5	25.9
Portugal	IVA	1986	17	48.1
Spain	IVA	1986	12	30.5
United Kingdom	VAT	1973	17.5	31.2
United States	...	...	...	** 3.0
				*** 12.3

* these percentages based on data before the taxes were enacted.
** U.S. data for federal excise taxes (excluding windfall profits tax) as a percent of federal government revenue.
*** U.S. data for federal excises taxes and state and local sales taxes as a percent of total government revenue.

Source: Glaser and Sartor (1993) and U.S. National Income and Product Accounts.

How Does a VAT Work?

A VAT is a tax on consumption, much like the familiar retail sales taxes. Like a sales tax, the consumer ultimately bears the burden of the tax. But unlike a sales tax, the VAT is collected in stages from producers. Each firm collects a tax on its sales, but receives a credit for any taxes it paid on goods bought for use in production. Roughly speaking, if all goods are taxed at the same rate, firms pay a tax on the difference between the nominal value of their sales and the value of purchased inputs. Value added is just this difference -- it is the sum of wages and salaries, interest payments, and before-tax profits. The firm serves as tax-collector, but the consumer, at least in theory, ultimately pays the full amount of the tax. Because they pass the tax along in the price of their goods sold and deduct any taxes paid on inputs, firms do not directly pay the tax; rather it is consumers who bear the statuatory incidence of the tax. This paper will try to address the distribution of the economic incidence of the VAT.

Table 2. Textbook Example of a VAT

Credit-method VAT

	Manu-facturer	Whole-saler	Retailer	Total tax
Sales (ex. VAT)	400	700	1000	
Purchases (ex. VAT)	0	400	700	
Value added	400	300	300	
5% tax on sales	20	35	50	
Credit on purchases	0	20	35	
VAT owed	20	15	15	50
Sales (inc. VAT)	420	735	1050	
Purchases (inc. VAT)	0	420	735	

Retail sales tax

Sales (ex. tax)	400	700	1000	
Sales tax owed	0	0	50	50

Source: Congressional Budget Office (1992).

Textbook examples of a VAT use a manufacturer, a wholesaler, and a retailer to illustrate the VAT. See Table 2 for an illustration. With a five percent VAT, the manufacturer collects $20 in VAT on its $400 of sales to the wholesaler. Since we assume in this simple example that the manufacturer bought no material inputs, his entire $400 in sales is value added. Thus, he has no deductions for VAT paid on purchased inputs. He remits the $20 VAT collected to the government. The wholesaler collects $35 in VAT, but has offsetting VAT credits of $20, and must pay $15 (which is five percent of the $300 value added) to the government. Likewise, the retailer has a net tax liability of $15. The tax on final sales, which is borne by the consumer, is $50, and is equal to the VAT collected in the three stages of production.

Although this simplified version of the VAT appears to be only a clumsy way of administering a retail sales tax, it offers two distinct advantages over the retail sales tax. First, it prevents taxes from cascading, which occurs whenever it is not possible to distinguish between final and intermediate purchases. For example, a retail sales tax would probably apply to all purchases of computers from retail outlets. Small businesses often buy computers from retailers and will pass along the taxes paid on computers and other intermediate goods into higher output prices.[4] Second, a VAT has higher compliance than a direct sales tax. Tax evasion occurs under a retail sales tax because many retail transactions are made in cash. Cash transactions are easy to conceal, and (assuming the probability of getting caught is negligible and that pure honesty is not a motivating factor) it is to the customer's and the retailer's advantage to do so. A VAT greatly reduces the scope for tax evasion relative to a retail sales tax because much of the tax is collected before the retail stage.

The illustration above assumes that manufacturers purchase nothing from other businesses and sell only to wholesalers. Similarly, wholesalers sell only to retailers. In reality, most industries buy and sell from many other industrial sectors. These inter-industry transactions have important implications for value-added taxation and are best illustrated using input-output analysis. The two tables below illustrate a simple input-output model (with the IO matrix in nominal flows) first with no tax, then with a five percent VAT. The example shows 3 industries: A, B, and C. Industry A is similar to the manufacturers in the table above. It buys no material inputs and sells only to industry B. Industry B buys $100 of intermediate inputs from industry A and $80 worth from industry C, and sells $60 of its output to industry C and to $240 to consumers. Likewise, C buys inputs from B and sells its output to industry B and to consumers. All figures are in nominal dollars in the example.

Table 3. Input-Output Framework, Simple Example without VAT

Buyers > Sellers	A	B	C	Final demand	Output	Total value added
A		100			100	
B			60	240	300	
C		80		120	200	
Value added	100	120	140			360
Output	100	300	200			
Total final demand				360		

Table 4. Five Percent VAT in a Simple Input-Output Framework

Buyers > Sellers	A	B	C	Final demand	Output	Total value added
A		105			105	
B			63	252	315	
C		84		126	210	
Value added	100	120	140			360
Tax on sales(5%)	5	15	10			
Credit on purchases	0	-9	-3			
VAT owed	5	6	7			18
Output	105	315	210			
Total final demand				378		

We can use this framework to illustrate the effects of a simple flat-rate five percent VAT. Following the practice of reporting flows in nominal dollars, the top three rows of this table and the output row are all reported including VAT, although values in the VAT section of the table are computed on the flows excluding VAT. Since all entries are reported in the same base (including taxes), rows can be meaningfully summed to give nominal output.[5] Industry A owes the government the entire $5 of tax that it collects from its sales (in this case the sales are only to industry B). Industry B's gross tax liability is $15 (five percent of sales of $300), but it gets to deduct the $9 paid in taxes on purchased inputs, and only remits $6 to the government. In each case with this simple flat-rate example, the VAT owed to the government is five percent of the initial value added or final demand. Nominal value added and nominal GDP have increased by $18, or five percent, and the GDP deflator has increased by five percent. In the empirical work described later, a VAT is introduced by applying the chosen tax rate to the value-added vector.

Methods of Value-Added Taxation

The simple example above obscures the difference between the two main methods of administering a VAT. These two methods are the subtraction method and the credit method. The credit-method VAT (European-style VAT) is the most common method of value-added taxation in practice. A firm's gross tax liability is the VAT rate times its output (or sales, but they are equivalent since we are ignoring inventories for the moment). The net VAT liability that must be paid to the government is determined by deducting the amount of VAT paid on inputs, for which the firms must show an invoice, from the gross liability. This means that intermediate goods go untaxed. The subtraction method does not require invoices to show how much VAT was paid on purchases so that it can be rebated. Rather, firms subtract their purchases from their sales and pay VAT on the difference.

If all goods are taxed at the same rate, the credit and subtraction methods are the same. Mathematically, we can write the subtraction-method VAT in industry i as

$$vat_i = t_i (s_i - \sum_j a_{ij}) ,$$

while the credit method is written

$$vat_i = t_i s_i - \sum_j t_j a_{ij} ,$$

where a_{ij} is the intermediate flow from sector j to sector i, s_i represents the sales of sector i, and t_i is that sector's VAT rate. If $t_i = t_j$, the VAT paid in industry i is the same under the two methods. The simple example above illustrates this point. We are essentially applying the subtraction method in our analysis by applying the VAT rate to the amount of value added in the model -- but our subtraction method successfully masqueraded as a credit method in the simple example above where all goods are taxed at the same rate.

Exempt Sectors, Zero Rates, and Multiple Rates

When we think about what happens in the model if we exempt some sectors from the VAT (for distributional reasons or because of high administrative costs), we see that the two methods of administering a VAT diverge. Tables 5 and 6 illustrate how each method operates if industry C is exempt from VAT. An exempt industry charges no VAT on its sales and is unable to claim

credit for VAT paid on inputs. Hence in both tables industry C collects no taxes on sales and has no VAT credits. Under the credit-method VAT, buyers of the exempt good claim rebates on the amount of VAT actually paid on inputs (as shown on invoices). Table 5 shows that under the credit method sector B actually pays $5 in VAT on inputs (from industry A), and this is the amount rebated. Under a subtraction-method VAT, the rebate is the amount of tax that would have been paid on purchases, if they had been fully taxed. Hence the implicit "credit" of $9 for industry B for VAT on inputs in the subtraction-method table, although the actual VAT paid on inputs is still only $5.

Table 5. Five Percent Credit-method VAT with Sector C Exempt

Buyers > Sellers	A	B	C	Final demand	Output	Total value added
A		105			105	
B			63	252	315	
C		80		123	203	
Value added	100	120	140			360
Tax on sales(5%)	5	15	0			
Tax credits	0	-5	0			
VAT owed	5	10	0			15
Output	105	315	203			
Total final demand				375		

Table 6. Five Percent Subtraction-method VAT with Sector C Exempt

Buyers > Sellers	A	B	C	Final demand	Output	Total value added
A		105			105	
B			63	248	311	
C		80		123	203	
Value added	100	120	140			360
Tax on sales(5%)	5	15	0			
(Implicit) credits	0	**-9**	0			
VAT owed	5	6	0			11
Output	105	315	203			
Total final demand				371		

Under a pure credit-method VAT, exemption must be distinguished from zero-rating. If a good is zero rated for the VAT, the industry does not charge VAT on its sales, but it does get

to deduct the VAT paid on purchases. Zero rating means that a good enters the market free of all taxes, and is therefore especially useful for exports. This distinction between zero rating and exemption is useless in our subtraction-method VAT. The net VAT liability is determined by applying the assumed rate to value added; we get the same result whether VAT is exempt or it is subject to a zero tax rate.

It may make sense to apply rates other than the standard rate to different goods in order to make the VAT less regressive. In Spain, for example, the standard VAT rate is twelve percent, but some goods are subject to only six percent VAT, while the rate on luxury goods is thirty-three percent. Rates other than the standard rate or zero are not feasible in our version of the subtraction-method VAT. Indeed, it was the desire for a system with flexible rates that led the European countries to adopt a credit rather than subtraction-method VAT. In his book The Value-Added Tax: Key to Deficit Reduction?, Charles McClure proposes a "sophisticated" subtraction method VAT that distinguishes between zero-rated and exempt goods and accommodates multiple rates.

Taxing Internationally Traded Goods

The last distinguishing characteristic of VAT systems concerns internationally traded goods. Traded goods can be taxed on a destination or origin basis. An origin-based VAT means that goods are taxed where they are produced, regardless of whether they are consumed domestically or traded abroad. A destination-based VAT taxes goods where they are consumed. Almost all current VAT systems employ destination-based taxes. If our goal is to tax consumption, origin-based taxes clearly miss the mark if our economy is open to international markets. Applying an origin-based VAT means that domestic goods enter world markets with taxes on previous value added incorporated in their price; our exports would be at a competitive disadvantage if other countries do not use an origin-based VAT or if they have lower VAT rates. Likewise, imports may enter our country with an advantage over domestic goods that have been subject to VAT. Our method of applying the tax rate to value added vector means that, unless we make adjustments, we are using an origin-based VAT in our empirical work.

Border tax adjustments are necessary to transform a simple tax on value added in production to a destination-based VAT. In order to tax goods where they are consumed, we need to zero rate exports and tax imports at our VAT rate. This means we must exempt exported goods from the VAT and rebate any taxes already paid at prior stages of production. In this way our exports enter world markets at domestic producer prices. In order to equalize the tax burden on imports and domestically produced goods, imports must be taxed at the point of entrance, and then taxed just like domestic goods during all subsequent transactions.

If we apply the VAT rate to domestic sales of domestically produced goods minus purchases, we succeed in excluding exported goods from VAT. We would rewrite the equation above for subtraction-method VAT as

$$vat_i = t_i (s_i - x_i - \sum_j a_{ij}) \ ,$$

where x_i are the imports of sector i. A firm that produces primarily exports may end up with a negative value-added tax -- that is it may be owed a rebate because it paid more in VAT on its

inputs than it collected in VAT from its domestic sales. To complete our border-tax adjustment we also need to apply an import tariff equal to the VAT rate, so that the foreign importer rather than the domestic firm bears the legal tax burden.

The above procedure is slightly difficult in LIFT since our value added is at the fifty-one sector level, while exports and imports have eighty-three sector detail. With a flat-rate VAT on all goods, we know that domestic prices will rise by roughly the same percentage as the tax. A fully flexible exchange rate will rise (the value of the dollar will decline) to compensate for this change in domestic prices. LIFT has recently been modified to more realistically model exchange rate movements, especially when LIFT is run as a stand-alone model, without linking to Inforum's entire international system. LIFT's new exchange rate scaler takes into account changes in domestic prices relative to prices abroad, as well as changes in interest differentials.[6]

Unlike individual European countries, the United States has the option of letting exchange rates move so that our exports remain competitive when a VAT is imposed. Likewise, an appreciation of the exchange rate will implicitly "tax" imports so that they do not have a price advantage over domestically produced goods, which were subject to VAT. For the simple VAT simulations below, exchange rates are allowed to fluctuate and so we avoid having to explicitly model border tax adjustments.

The VAT in LIFT

LIFT has fifty-one value-added sectors (the sectoring scheme for value added, which is included in the price side of the model, is at the industry level). To introduce value-added taxes into the model, the user must fix the variable VXR (**v**alue-added ta**x** **r**ate) in the file PFIXES.DAT. For obvious reasons, government sectors, as well the sector for private households, are assumed exempt from VAT in all of our simulations. Table 7 at the end of this paper lists the industry sectors subject to a VAT. As described above, when a VAT fix is specified, the VAT rate is applied to the value added vector to get value-added taxes for each sector. Alternatively, it is possible for the model user to specify the value of the LIFT variable VTX, which gives total VAT revenue.

Effect of a Simple Two Percent VAT, with Revenues Allocated to Deficit Reduction

For the first VAT simulation in LIFT, we apply a two percent VAT beginning in 1994 and allow the receipts to accumulate as government revenue. An interesting, but admittedly implausible, thought experiment behind this simulation is to assume that Congress passes a balanced-budget amendment requiring the elimination of the deficit in ten years. The results from this simulation are shown in table 8. The first line after each title shows the base value of the specified variable and the next line shows the simulation's deviation from the base value. As we hoped, the VAT eliminates the deficit by the year 2005. (See the last two lines of the table -- in the year 2005 the deficit in the base was $106 trillion (a negative surplus) and our simulation produced a surplus $246 billion higher than the base surplus. By taking the difference, we see that the simulation actually produced a positive surplus.)

We expect a one-time jump in the price level at the time VAT is implemented, but no significant acceleration of inflation. Experiences from countries with a VAT seem to validate this

intuition. Alan Tait of the International Monetary Fund concluded that in thirty-one countries studied with value-added taxes, inflation accelerated with the introduction of the VAT in only four countries.[7] Our results alsosupport this intuition. The consumption deflator jumps by almost exactly two percent in 1994 and is roughly constant thereafter. Monetary policy is kept exogenous in the simulation; if we had let the monetary authority accommodate the initial jump in prices, we would generate inflation in the years after 1994.

Of course, this increase in taxes without any corresponding increase in government expenditures harms the economy. In the long run, standard economic intuition tells us that reducing the deficit will boost economic growth, but the year 2010, which is the last year of our model, is not far enough in the future to see these effects. Real GDP falls 1.7 percent in 1994 relative to the baseline, but by the year 2010 the reduction in GDP amounts to only 0.7 percent of GDP. Employment also falls relative to the base in 1994, but is almost back to the base level by 2010.

Interest rates in LIFT are determined by an equation that incorporates a three-year moving average of inflation with a positive coefficient, the unemployment rate with a negative coefficient, and a crowding-out term, so that higher deficits tend to increase interest rates. In this simulation a lower deficit and higher unemployment reduces nominal and real interest rates.

Consumption bears most of the burden of the decline in activity relative to the base. This is what we expect, since the VAT has raised domestic prices, but left wages relatively unchanged. The exchange rate rises (value of the dollar falls), both because domestic prices have risen and because real interest rates have fallen. The exchange rate rise, coupled with weakened domestic demand, induces a large increase in net exports. By the year 2010, our net exports are almost fifty billion dollars higher than the baseline. Equipment and residential investment are substantially lower than the base in the first few years after the VAT is imposed, but increase in later years, presumably because of lower interest rates.

Savings has a countercyclical role in the model. The savings rate falls with the imposition of a VAT, boosting consumption over what it might have been if savings had remained constant. Often, it is argued that the VAT encourages savings -- and it does -- but only when compared with other methods of raising government revenue.

Effect of a Two Percent VAT, with Revenues Going to Increased Transfer Payments

The second experiment is a rough attempt to examine the effects of a revenue-neutral VAT. Again, value-added taxes are imposed at a rate of two percent beginning in 1994. This time, however, the revenues are returned to the public in the form of transfer payments. Table 9 gives this result of this simulation. The figures at the bottom of the table show that our transfer payments increase, relative to the base, by slightly more than the VAT revenue, but the difference is within ten percent, and is an endogenous response of the model to slightly higher unemployment and interest rates. The deficit increases in the model as a result of an increase in other federal expenditures.

In this simulation, without the large increase in the unemployment rate or decrease in the deficit that we had in the previous scenerio, price effects dominate the contribution of other

variables and lead to increased nominal interest rate. We may want to limit the effect of inflation on interest rates in further work on the VAT in LIFT; since the price changes due to the introduction of a VAT should be fully anticipated, the interest rate should jump discretely at the imposition of the tax, rather than responding with a lag to the change in prices. In this scenerio, the initial rise in nominal interest rates boosts savings in 1994 -- higher interest rates encourage people to save rather than consume. Investment, both residential and nonresidential, responds negatively to the higher interest rates, as we would expect. By 1997 interest rates return to the baseline value and so do many of the interest-sensitive variables.

The tax is neutral in many effects -- real interest rates and wages are both stable. Exchange rates rise in this simulation, but by only about half as much as in the previous scenerio. Prices again jump by two percent in 1994, but we do not see a rise in the inflation rate after the first year. Employment falls initially. By the end of the simulation, however, employment and real output appear to have recovered to the baseline. The composition of output has changed slightly -- the revenue-neutral VAT has lowered consumption and investment and increased net exports.

Issues for Further Thought

In theory, imposing a consumption tax such as a VAT implies a lump-sum tax on the holders of capital wealth at the time the tax is imposed. A VAT lowers the cost of capital goods, which are not subject to the tax, relative to taxable final goods. It lowers the real value of existing machinery by lowering the after-tax cost of new machinery. If we apply a uniform VAT of rate v to all consumption goods, then a business asset that was worth one unit of consumption goods prior to the imposition of the tax would be worth only 1/(1+v) after the imposition of a VAT. The magnitude of this windfall may be large, but occurs only once when the VAT is imposed. The relative importance of this windfall loss to owners of capital declines over time as capital is replaced or reallocated. How this can best be modelled in an input-output model like LIFT needs further thought.

Another important issue that bears attention is the distribution of the burden of taxes among consumer groups. Most economists agree that a VAT will worsen the distribution of income. We could examine this more closely by looking at changes in prices by industry, and examining consumption patterns of consumers by income to see if indeed the poorer consumers pay a larger proportion of their income in taxes than the rich.

The model ignores the administration costs of a VAT. Glaser and Sartor reference a 1984 Treasury study that estimated that a credit-method VAT with minimal exemptions would take 20,000 additional federal employees and a $700 million annual budget. Our revenue in this simple exercise was $103 billion in 1994, so the costs do not seem prohibitive. The important fact is how the costs compare with alternative means of raising revenues. Administrative costs for a VAT are fairly static (the percent of revenue that must go towards administrative costs go down as the rates increase). In Europe, the OECD claims that administrative costs, as a percentage of revenue, are much lower for the VAT than for income taxes.

Table 7. Taxed Value Added Sectors in LIFT

1	Agriculture
2	Crude oil
3	Mining
4	Construction
5	Food
6	Textile mills
7	Apparel
8	Paper
9	Printing
10	Chemicals
11	Petroleum refining
12	Rubber,plastic
13	Leather
14	Lumber
15	Furniture
16	Stone,clay,glass
17	Primary metals
18	Metal products
19	Transportation equipment
20	Non-electrical machinery
21	Electrical machinery
22	Motor vehicles
23	Instruments
24	Misc. manufacturing
25	Railroads
26	Air transportation
27	Trucking
28	Communications
30	Electric,gas,sanitary
31	Wholesale,retail trade
32	Financial,insurance
33	Real estate
34	Hotels,repair
35	Business services
36	Auto repair
37	Motion pictures
38	Educational,Social,NPO services
46	Rest of World
51	Health services

Table 8. Effect of a Simple Two Percent VAT, with Revenues Allocated to Deficit Reduction

Titles of Alternate Runs

Line 1: BASE
Line 2: VAT1 - simple 2% VAT, exchange rates flexible

Alternatives are shown in deviations from base values.

	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010
Gross Domestic Product, bil $	6415	6748	7146	7479	7918	8408	8900	9371	12246	16125
	0	-16	-43	6	73	82	56	45	51	-5
Gross Domestic Product, bil 77$	2899	2958	3008	3026	3095	3167	3222	3267	3568	3923
	0	-50	-54	-31	-9	-20	-31	-30	-27	-28
GDP Components, bil 77$										
Personal consumption	1950	1964	1990	1996	2037	2075	2105	2135	2313	2515
	0	-42	-48	-43	-40	-48	-52	-53	-64	-74
Fixed investment	446	469	473	464	485	510	524	530	607	685
	0	-25	-27	-10	6	-0	-8	-8	-3	-1
Residential	108	111	109	104	108	116	116	114	129	143
	0	-9	-9	1	6	3	0	2	5	6
Equipment	250	267	271	267	279	291	300	305	351	403
	0	-12	-14	-8	-0	-3	-8	-9	-7	-8
Structures	88	91	93	93	98	104	108	111	127	139
	0	-4	-4	-3	0	0	-1	-1	-0	1
Inventory change	18	17	16	13	15	16	16	15	17	18
	0	-3	-1	1	3	1	-0	0	1	1
Exports	449	473	497	516	533	549	565	578	659	771
	0	1	4	8	11	12	12	13	19	24
Imports	448	454	466	467	485	500	511	521	585	650
	0	-17	-17	-13	-11	-15	-17	-17	-20	-23
Inflation and Financial Indicators										
PCE deflator, % ch	2.46	2.92	4.37	4.43	3.78	3.90	4.21	4.01	3.80	3.79
	0.00	2.08	-0.01	-0.17	0.04	0.39	0.04	-0.19	-0.08	-0.13
Mfg. Avg Hourly comp, % ch	3.09	4.57	4.69	4.03	4.22	3.96	4.11	3.97	4.03	4.09
	0.00	0.13	-0.11	-0.21	0.26	0.24	-0.09	-0.24	-0.05	-0.06
Exchange rate scaler	1.00	0.99	1.00	1.02	1.02	1.02	1.02	1.03	1.05	1.07
	0.00	0.04	0.05	0.04	0.04	0.04	0.05	0.05	0.06	0.05
10-year Treasury notes, %	5.9	5.6	6.4	6.9	7.1	7.2	7.2	7.2	6.9	6.7
	0.0	-0.1	-0.5	-0.4	-0.7	-0.5	-0.7	-0.9	-1.1	-1.2
Real rate, %	3.2	3.3	3.3	3.2	3.2	3.4	3.4	3.3	3.1	3.0
	0.0	-0.6	-0.9	-0.8	-0.6	-0.7	-0.9	-0.9	-1.0	-1.1
Employment Indicators										
Total jobs, mil	125.7	127.6	128.9	129.3	130.8	133.0	135.0	136.4	145.3	155.3
	0.0	-1.4	-2.1	-1.6	-1.0	-1.1	-1.5	-1.6	-1.7	-1.8
Unemployment rate, %	6.6	6.2	6.0	6.3	6.6	6.3	6.2	6.4	6.0	5.1
	0.0	1.1	1.6	1.2	0.7	0.8	1.1	1.1	1.1	1.1
Income Variables										
Personal income, bil $	5346	5600	5918	6211	6573	6987	7401	7797	10161	13372
	0	-55	-115	-97	-72	-69	-109	-144	-254	-436
Personal disposable income, bil	4668	4888	5162	5420	5738	6102	6467	6816	8914	11771
	0	-48	-100	-85	-62	-60	-95	-126	-223	-384
Personal savings, bil $	186	199	197	214	219	257	283	292	403	610
	0	-39	-78	-65	-56	-54	-81	-97	-140	-204
Savings rate, %	4.00	4.09	3.82	3.95	3.82	4.21	4.38	4.28	4.53	5.19
	0.00	-0.76	-1.47	-1.15	-0.94	-0.86	-1.20	-1.38	-1.49	-1.62
Federal Government Revenue and Expenditures										
Federal receipts, bil $	1280	1353	1442	1509	1601	1702	1801	1894	2454	3204
	0	76	75	90	110	115	113	116	145	170
VAT revenue, bil $	-0	-0	-0	-0	-0	-0	-0	-0	-0	0
	0	102	108	113	121	129	136	143	188	247
Federal expenditures, bil $	1467	1506	1582	1679	1778	1872	1968	2067	2560	3192
	0	28	20	10	-7	-12	-19	-33	-101	-189
Transfer payments, bil $	643	670	710	755	798	837	881	931	1198	1583
	0	22	28	26	22	26	31	32	38	42
Federal surplus, bil $	-187	-153	-140	-170	-176	-170	-167	-173	-106	12
	0	48	56	80	116	127	132	149	246	359

Table 9. Effect of a Two Percent VAT, with Revenues Going to Increased Transfer Payments

Titles of Alternate Runs

Line 1: BASE
Line 2: VAT2 -- 2% VAT, with revenues into transfer payments

Alternatives are shown in deviations from base values.

	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010
Gross Domestic Product, bil $	6415	6748	7146	7479	7918	8408	8900	9371	12246	16125
	0	72	64	102	153	170	168	173	240	317
Gross Domestic Product, bil 77$	2899	2958	3008	3026	3095	3167	3222	3267	3568	3923
	0	-15	-21	-9	6	-1	-6	-4	-1	-1
GDP Components, bil 77$										
Personal consumption	1950	1964	1990	1996	2037	2075	2105	2135	2313	2515
	0	-10	-13	-5	0	-5	-6	-4	-5	-6
Fixed investment	446	469	473	464	485	510	524	530	607	685
	0	-10	-15	-9	1	-3	-8	-7	-5	-6
Residential	108	111	109	104	108	116	116	114	129	143
	0	-3	-5	-3	2	-1	-2	-1	0	0
Equipment	250	267	271	267	279	291	300	305	351	403
	0	-6	-9	-5	-1	-3	-5	-6	-5	-6
Structures	88	91	93	93	98	104	108	111	127	139
	0	-1	-1	-1	0	0	-0	-1	-0	-0
Inventory change	18	17	16	13	15	16	16	15	17	18
	0	-1	-1	0	1	0	-0	-0	0	0
Exports	449	473	497	516	533	549	565	578	659	771
	-0	-1	0	1	2	2	2	2	4	5
Imports	448	454	466	467	485	500	511	521	585	650
	0	-5	-6	-3	-1	-3	-4	-4	-4	-5
Inflation and Financial Indicators										
PCE deflator, % ch	2.46	2.92	4.37	4.43	3.78	3.90	4.21	4.01	3.80	3.79
	0.00	2.04	0.16	-0.02	-0.01	0.31	0.04	-0.13	-0.01	-0.02
Mfg. Avg Hourly comp, % ch	3.09	4.57	4.69	4.03	4.22	3.96	4.11	3.97	4.03	4.09
	0.00	-0.00	-0.21	-0.10	0.01	0.11	-0.01	-0.15	-0.03	-0.01
Exchange rate scaler	1.00	0.99	1.00	1.02	1.02	1.02	1.02	1.03	1.05	1.07
	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
10-year Treasury notes, %	5.9	5.6	6.4	6.9	7.1	7.2	7.2	7.2	6.9	6.7
	0.0	0.6	0.4	0.6	0.1	0.2	0.1	0.0	-0.0	-0.0
Real rate, %	3.2	3.3	3.3	3.2	3.2	3.4	3.4	3.3	3.1	3.0
	0.0	0.1	-0.1	-0.0	0.1	0.1	-0.0	-0.1	-0.0	-0.0
Employment Indicators										
Total jobs, mil	125.7	127.6	128.9	129.3	130.8	133.0	135.0	136.4	145.3	155.3
	0.0	-0.5	-0.7	-0.6	-0.0	0.0	-0.2	-0.2	-0.1	-0.1
Unemployment rate, %	6.6	6.2	6.0	6.3	6.6	6.3	6.2	6.4	6.0	5.1
	0.0	0.3	0.5	0.4	0.0	-0.0	0.1	0.2	0.1	0.1
Income Variables										
Personal income, bil $	5346	5600	5918	6211	6573	6987	7401	7797	10161	13372
	0	107	92	130	162	182	177	176	229	301
Personal disposable income, bil	4668	4888	5162	5420	5738	6102	6467	6816	8914	11771
	0	93	80	114	141	159	154	154	201	265
Personal savings, bil $	186	199	197	214	219	257	283	292	403	610
	0	21	2	12	18	25	13	9	16	24
Savings rate, %	4.00	4.09	3.82	3.95	3.82	4.21	4.38	4.28	4.53	5.19
	0.00	0.34	-0.02	0.13	0.22	0.30	0.10	0.03	0.07	0.08
Federal Government Revenue and Expenditures										
Federal receipts, bil $	1280	1353	1442	1509	1601	1702	1801	1894	2454	3204
	0	108	111	125	143	152	158	165	218	286
VAT revenue, bil $	-0	-0	-0	-0	-0	-0	-0	-0	-0	0
	0	103	109	115	123	131	138	145	191	252
Federal expenditures, bil $	1467	1506	1582	1679	1778	1872	1968	2067	2560	3192
	0	129	139	154	158	166	174	179	223	289
Transfer payments, bil $	643	670	710	755	798	837	881	931	1198	1583
	0	111	120	125	130	138	148	155	202	264
Federal surplus, bil $	-187	-153	-140	-170	-176	-170	-167	-173	-106	12
	0	-21	-28	-29	-15	-14	-16	-14	-5	-4

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ENDNOTES

1. Glaser and Sartor, 1993, p. 26.

2. Lindholm, 1980, p.23-34.

3. Throughout this paper the term VAT technically means a consumption-based value-added tax. Atkinson and Stiglitz (1980, p.129) point out several other definitions for the base of a VAT. An income-based VAT and product-based VAT are equivalent to a uniform payroll tax plus an equal rate profits tax, but with different provisions for depreciation and interest deductibility.

4. The Congressional Budget Office (1992) report cites a study that claims that twenty percent of the revenue from state sales taxes comes from taxing business purchases.

5. Bardazzi, Grassini, and Longobardi (1991) stress the importance of a consistent representation of VAT in an IO model.

6. See the discussion paper by Ralph Monaco for a detailed description of the new macroeconomic properties of LIFT.

7. Glaser and Sartor, 1993, p. 29.