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Short-Run Macroeconomic Effects of Fundamental Tax Reform

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ABSTRACT

This report discusses the short-run effects on output and prices from the imposition of different forms of fundamental tax reform, including the value-added tax, the retail sales tax, and the flat tax.

Short-Run Macroeconomic Effects of Fundamental Tax Reform

Summary

Fundamental tax reform continues to receive attention from lawmakers, private advocacy groups, and tax analysts. Preeminent among the proposals is the replacement of the current income tax with some form of a consumption tax. Much of the discussion of the merits of consumption taxes relative to income taxes is centered on the kinds of incentives and efficiencies that the two kinds of taxes exhibit in the long run. Increasingly, however, analysts have begun to explore the transition (short-run) effects associated with shifting from an income tax to a consumption tax.

Some of these transition effects are common to all consumption tax proposals. For example, a shift to any consumption tax would involve some sectoral dislocation, the most important of which would be a shift of resources out of housing and into other sectors. All consumption tax proposals impose a one time tax on existing capital, as well. In all likelihood, a shift to consumption taxes would entail a temporary rise and then a decrease in interest rates.

Potentially more serious transition problems occur when taxes are imposed in their indirect form (a retail sales tax or a value-added tax). The shift from a direct tax (imposed largely on individual wage-earners) to an indirect tax (imposed on businesses) could cause a significant economic contraction if wages are “sticky” downwards, as most economists believe to be the case, because many firms would not have enough resources to pay the taxes. In this case, a one-time price increase, in the neighborhood of 20 to 25 percent, would be required to allow firms to pass the tax on to consumers and avoid a serious recession. The money supply would need to rise by a similar, or perhaps even larger, amount.

Our ability to formulate an appropriate monetary response to deal with a shock of this magnitude is questionable. Not only are there considerable uncertainties about the empirical magnitudes of crucial relationships needed to guide the monetary adjustment (even uncertainties about the definition of money), but there are also direct effects of the tax change on variables, such as interest rates, that are normally used to guide monetary policy. The magnitude of these interest rate effects is uncertain. A transitory rise in frictional unemployment, due to sectoral shifts, would also be likely. In addition, actions taken in anticipation of the tax change could cause temporary effects on aggregate demand and the interest rate.

These problems would be greatly diminished in the case of the flat tax, which is imposed as a direct tax. Even in this case, there would be short-run unemployment costs associated with sectoral dislocations, but the shock would be less severe than in the case of the retail sales tax or value-added tax. However, the price rise that would be needed to avert a contraction is also the mechanism that causes the lump-sum tax on old capital to be shared by debt as well as equity. Without the price increase, the lump sum tax would fall only on equity capital, and could impose tax burdens that are larger than net asset values in cases where assets are heavily leveraged.

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Short-Run Macroeconomic Effects of Fundamental Tax Reform

Fundamental tax reform continues to receive attention from lawmakers, private advocacy groups, and tax analysts. Preeminent among the proposals is the replacement of the current income tax with some form of a consumption tax. Much of the discussion of the merits of consumption taxes relative to income taxes is centered on the kinds of incentives and efficiencies that the two kinds of taxes exhibit in the long run. Increasingly, however, analysts have begun to explore the transition effects associated with shifting from an income tax to a consumption tax.

The transition effects differ from long-term effects in that they are temporary, and in that some effects occur only when a switch from one type of tax to another occurs. Consequently, the decision to institute a consumption tax *de novo* is somewhat different from a decision to *replace* an income with a consumption tax. For an emerging economy in eastern Europe or Asia looking to impose an entirely new tax, some of these transition issues would not exist. Consequently, the merits of a consumption tax relative to an income tax could be decided to a greater degree on the basis of their comparative efficiency, equity, simplicity, and other characteristics. For a country that already has an income tax, the decision to substitute a consumption tax must take into account any additional costs associated with the changeover itself, and these temporary transition costs might well offset any other advantages of a change. Hence, it is possible for a consumption tax simultaneously to be superior to an income tax for countries imposing the tax for the first time, but economically undesirable for a country that already has in place an income tax.

Many economists who judge a consumption tax to be superior to an income tax are in fact skeptical about the advisability of making the change because of these transition effects. Some of these transition effects have been dealt with in considerable detail, such as the burden that falls on existing capital assets, and the various sectoral shifts in demand (such as the reduction in demand for owner-occupied housing) that might affect asset prices in the short run. Despite the extensive analysis of the economic effects of fundamental tax reform, however, little attention has been devoted to potential short-run contractionary effects, particularly of proposals that would shift the liability for tax payments from individuals to businesses.

The consequences of these short-run effects are highlighted in two of the nine model simulations of a shift from an income tax to a flat tax or VAT in the Joint Tax

Committee Modeling Project.¹ While most of the studies assumed constant full employment, these two studies used macro models that focus, in large part, on short run unemployment effects (the DRI/McGraw-Hill model and Macroeconomics, Inc.). While other studies found positive output effects from shifting to these new tax systems, those models that allowed unemployment showed initial declines, in some cases in significant amounts.

Simulations using the DRI model projected output declines of about 1% in the first few years following the adoption of a flat tax. In the case of the VAT, output declines were much larger, beginning at 2%, rising rapidly, peaking at a decline of over 12% by the fourth year, and continuing to be significantly negative for the entire ten years of the simulation. The simulation with the Macroeconomics, Inc. model only examined the flat tax; GDP was projected to decline about 2%, but only in the first two years and then to rise.

These model outcomes showing recession following the adoption of these tax proposals, and of a pronounced and lengthy one following the imposition of a VAT, are relevant to the debate over the merits of fundamental tax reform. Thus far, there has been little attention to this issue, and where it has been addressed, often it has been deemed relatively unimportant, or easily handled by a straightforward monetary accommodation.² Some researchers have suggested that no monetary accommodation would be appropriate, or even needed.³

The discussant of the studies that predicted unemployment at the JCT symposium, however, suggested that monetary authorities, while recognizing the

¹Roger Brinner, "Modeling the Macroeconomic Consequences of Tax Policy" and Joel Prakken "Simulations of a Flat Tax with the Washington University Macro Model," In *Joint Committee on Taxation Tax Modeling Project and 1997 Tax Symposium Papers*, Washington, D.C.: U.S. Government Printing Office, November 20, 1997.

²A number of recent studies of fundamental tax reform either failed to mention the potential problem of unemployment or gave it cursory mention assuming that any problems that arose could be handled by the monetary authorities. See *Economic Effects of Fundamental Tax Reform*, ed. Henry J. Aaron and William G. Gale, Washington, D.C: The Brookings Institution, 1996; *Frontiers of Tax Reform*, Ed. Michael J. Boskin, Standard: Hoover Institution Press, 1996; George Zodrow, The Transition to a Consumption Tax in *Tax Conversations: A Guide to the Key Issues in the Tax Reform Debate*, ed. Richard Krever, Boston: Kluwer Law International, 1997; Joel Slemrod and Jon Bakija, *Taxing Ourselves: A Citizen's Guide to the Great Debate over Tax Reform*, Cambridge, The MIT Press, 1996; David E. Bradford, *Fundamental Issues in Consumption Taxation*, Washington, D.C., The AEI Press, 1996; U.S. Congressional Budget Office, *The Economic Effects of Fundamental Tax Reform*, Washington, D.C., U.S. Government Printing office, 1997. Only the CBO study explicitly addressed short-run unemployment, although the mention was brief.

³See for example, Nicholas Bull and Lawrence B. Lindsey, "Monetary Implications of Tax Reforms," *National Tax Journal* 49 (September 1996), pp. 359-378; Daniel R. Feenberg, Andrew W. Mitrusi, and James M. Poterba, "Distributional Implications of Adopting a National Sales Tax." In *Tax Policy and the Economy*, ed. James M. Poterba, National Bureau of Economic Research, Cambridge, MIT Press, 1997.

need for a price rise, may find it difficult to engineer such a policy.⁴ Foreign experience with a VAT provides some evidence, although many of these countries were replacing existing indirect taxes with a VAT. Moreover, some of these countries used price controls, an approach that the U.S. government might be reluctant to undertake.⁵ Researchers examining the response to a shift in the share of indirect taxes in the U.K. and the U.S. found some evidence that it was followed by both higher prices and reductions in output.⁶

The first section of this paper describes the basic types of tax proposals and how they vary in collection source, which is crucial to assessing the need for a price increase. The second section describes the reaction of interest rates and some of the sectoral effects (e.g. out of owner-occupied housing) that would be expected to occur when a consumption tax is substituted for an income tax. The third section describes the potential macroeconomic effect of a switch to consumption taxes with emphasis on the effects on the overall price level. The next section explains how monetary accommodation — in theory at least — can prevent the shift to certain types of consumption taxes from causing a short-run decline in economic activity. The following section outlines the problems that would arise in actually making the such a monetary adjustment. The final section examines the distributional consequences of not experiencing an accommodated price increase — i.e., how either having a general price increase or not affects the distribution of the tax burden.

Types of Consumption Tax Proposals

Several different types of fundamental consumption taxes have been proposed, but one difference is crucial for considering macroeconomic effects: whether taxes are collected from businesses or individuals (that is, whether they are largely indirect or direct).

A type of consumption tax familiar to most people is a retail sales tax (RST), a tax commonly used by the states. Goods sold for final use to consumers are subject to a tax. In this case, the liability for the tax is imposed on the business establishment that makes the final sale.

An alternative to the retail sales tax, and a tax used by many other countries, is the value-added tax (VAT). A VAT is the economic equivalent of the RST (assuming both are administered correctly), but the tax is collected at each stage of production. When all of the taxes on a good are added up, they are the same as the one-stage tax paid under the RST. Under a VAT, a tax is imposed on the difference

⁴See comments of David Reifschneider, in *Joint Committee on Taxation Tax Modeling Project and 1997 Symposium Papers*, pp. 291-293.

⁵See Alan Tait, *Value Added Tax: International Practice and Problems*, Washington, D.C., International Monetary Fund, 1988.

⁶James M. Poterba, Julio J. Rotemberg, and Lawrence H. Summers. "A Tax-Based Test for Nominal Rigidities." *American Economic Review*, vol. 76, September 1986, pp. 659-676.

between business sales and purchases: a business adds up all of its sales and subtracts purchases of materials, inventory, and assets (but not wages); the resulting base is subject to a tax.⁷

One difference between these taxes that is not important in an economic sense, but that is very confusing, is how the tax rate is stated. Retail sales taxes are often stated as tax-exclusive rates, while subtraction method VATS are often stated in tax-inclusive rates. The difference is simple. If a good costs \$100, a 20% tax-inclusive rate collects \$20. However, a typical sales tax rate would be 25%: merchandise that costs \$80 is subjected to a 25-percent tax of \$20, for a total price of \$100. It also means that if prices are to rise to cover a tax, they would have to rise by 25%.

It is also possible to split the VAT into two parts and collect them at different places, resulting in a tax called the flat tax. The VAT base is composed of two parts: wages and other labor compensation, and business cash flow (the difference between profits and investments in capital). The flat tax allows the firm to deduct wages from its base; individual recipients of wages pay a tax on their wage income. This converts the VAT to a mostly direct tax, similar to the current income tax in its point of collection.

All of these taxes are equivalent in economic terms and all result in a change in the relative attractiveness of different types of investment. All are consumption taxes that impose no tax on the return to *new* capital investment, because in all cases investments are deducted from the tax base (as in the VAT and flat tax) or are not subject to tax at all (as in the RST). Consumption taxes are taxes on wages and *old* capital; that is, when consumption purchases are made with wage income or when capital assets are sold to finance consumption, a tax is imposed. Basically, the real purchasing power of capital assets is reduced in all of these taxes, imposing a fixed tax on old capital (although, as discussed subsequently, the distribution of that lump-sum tax among owners of capital is not necessarily the same). New capital investments are effectively exempt because they are deducted or excluded from the consumption base when made.

Eliminating the tax on investment also eliminates differentials in the tax treatment of different types and forms of investment, which can lead to important behavioral effects. All three of these approaches also have the common characteristic of not imposing taxes on flows of financial capital. Thus, there is no taxation of dividends, interest, and capital gains on corporate stock at the individual level. Also, unlike the treatment under the present income tax, interest paid by firms is not deductible. (Sales of business assets are subject to tax, but this is not strictly a capital gains tax, since the entire sales price of the asset is included in income). It is also possible, however, to have a direct consumption tax, that includes financial flows; loans would be included in income and deductions would be allowed for financial investments. The USA tax, originally proposed by Senators Nunn and Domenici,

⁷ This method is used for a subtraction-method VAT. Most other countries actually use a credit method, where each firm pays a tax on its total sales but takes a credit for taxes paid by its suppliers. The distinction between a credit and subtraction method does not matter for the issues addressed in this paper.

was of that general form, although it had many modifications from the pure consumption base.

These taxes differ in a variety of ways. For example, it is quite easy, using the flat tax approach, to allow progressivity at the individual level by allowing an exemption. It would also be easy to graduate the wage tax rates. These adjustments are more difficult and complicated with the VAT and RST. The ability to enforce a tax is probably greater with the VAT and the flat tax than in the case of the RST, for a variety of reasons.

An important difference between these types of proposals, for the purposes of analyzing macroeconomic effects, is the location of the tax, and the changes in prices and wages that need to occur to permit the payment of the tax without output losses. The RST shifts the entire legal burden of the tax to retail establishments, and a sales tax is often much larger than the firms' existing profit margins. In order to have the funds to pay the tax, product prices must rise and/or input prices (both to business suppliers and to workers) must fall. If input prices to retailers fall, then each intermediate supplier in the economy must also be able to reduce his own wages and supply prices. Hence, all of the wages in the economy must fall by the tax rate if the tax is to be passed back proportionally to labor and business net cash flow.

The VAT shifts the legal burden to all businesses in accordance with their value added. These firms must either pass the tax forward in higher prices for output, or backwards in lower supply prices. The flat tax imposes a cash flow tax that has a base that is similar to the current income tax, so there is not an enormous shift in tax liability; most firms could probably continue to pay the tax without altering wage rates or prices very much.⁸

Sectoral Effects and Demand-Side Shifts

A shift from income to consumption taxes would produce sectoral and long-term economy-wide changes. These have been addressed in a number of other papers and reports.⁹ There are several, however, that have relevance to the short-term

⁸ The flat tax does disallow a business deduction of some fringe benefits, most importantly health insurance, which shifts some of the burden of the tax on wages to firms, so that there would probably be a need for some price or wage adjustment. Firms will also differ in other ways. The size of the cash flow tax versus the existing income tax reflects offsetting tax savings (lower rates and expensing of investments) and increases (loss of deductions for interest and depreciation on existing assets). Firms that rely heavily on debt and are growing slowly (have lower rates of new investment) would pay higher taxes, while faster-growing firms that rely heavily on equity would have lower taxes.

⁹See Martin Feldstein, *The Effect of a Consumption Tax on the Rate of Interest*, National Bureau of Economic Research Working Paper 5397, December 1995; this paper makes a case that the interest rate will rise, largely on grounds of comparing debt and equity returns. See Robert E. Hall, *Potential Disruption from the Move to a Consumption Tax*, *American Economic Review*, vol. 87, May 1997, pp. 147-150 for a case that interest rates will fall,

(continued...)

macroeconomic effects that are discussed later in the report. These changes would directly alter output and prices, including interest rates.

Interest Rates

As discussed subsequently, direct effects of tax changes on interest rates will complicate the task of the monetary authorities who rely on the interest rate as a signal. Interest rates have the potential to change because of savings responses, portfolio shifts, and effects arising from the imperfect measurement of income under the current system. (They may also be influenced by expectations during the legislative consideration of the tax switch; expectations are discussed subsequently. This discussion refers to the direct and permanent effects of the tax substitution).

To illustrate these effects, consider first a simple world where all capital is financed by debt, where all income and deductions are measured correctly and where the capital stock (and the savings rate) is fixed. In that case, moving to a consumption tax would not affect the interest rate. Although firms are taxed on profits under an income tax, they are also allowed deductibility of interest, so there is no tax on debt-financed capital at the firm level. Thus, firms have no change in their demand for capital and, if individuals do not increase their savings, there will be no change in the interest rate.

In fact, however, both debt and equity finance investment. Under the current income tax system, equity-financed investment is taxed more heavily than investment that is debt financed. Consequently, a shift to a consumption tax, which eliminates this disparity in the taxation of debt versus equity financing, should induce a portfolio shift toward more equity financing. Holding the capital stock (and therefore the average pretax return to capital) fixed, this switch to equity will likely be accompanied by a fall in the before-tax cost of equity and a rise in the cost of debt (the interest rate).¹⁰

At the same time, the amount of interest or dividends that an individual keeps after taxes rises with a shift away from income taxes. If individuals increase their savings as a consequence, this effect alone (absent a portfolio shift) causes interest rates to fall.

⁹(...continued)

largely on the grounds of increased savings response. Alan J. Auerbach, Tax Reform, Capital Allocation, Efficiency and Growth, in *The Economic Effects of Fundamental Tax Reform* ed. Henry J. Aaron and William G. Gale, Washington D.C., The Brookings Institution, 1996 also suggested a fall in the interest rate. Jane Gravelle, *The Flat Tax and Other Proposals: Effects on Housing*, Congressional Research Service report 96-379, Library of Congress, April 29 1996, indicates that interest rates could also be affected by mismeasurement of income and deductions.

¹⁰Modeling the debt/equity decision is not straightforward; see (name redacted), *The Flat Tax and Other Proposals: Effects on Housing*, for a mathematical model which includes an allocation of demand by firms and supply by individuals.

Another important complication, however, is the fact that income and expense is not measured correctly under the current tax system. The most important aspect of this mismeasurement is that *nominal* interest (which includes an inflation component) is deducted from income, while only the real return to capital (roughly) is taxed.¹¹ As a result, rather than no tax on debt financed earnings at the firm level, there is currently a subsidy. When a shift is made to consumption taxation, this subsidy is lost, which means that the cost of debt goes up. Therefore, when this measurement effect is taken into account, holding other effects constant, the interest rate has to fall to keep the overall cost of capital the same.

It is difficult to project the effects on interest rates from the combination of portfolio and saving effects, particularly given uncertainty about the response of saving and the substitutability of debt and equity. But the effect that results from the mismeasurement of income under the current income tax system is unambiguous, and likely of greater magnitude than the first two. The interest rate would have to fall to allow firms to break even on a new investment. The effect would obviously vary depending on the level of expected inflation. With a tax rate of 35% and an inflation rate close of 3%, the subsidy is approximately one percentage point (0.35 times .03); thus, an interest rate fall of 1% would result from the shift to a consumption tax.

Effects on the Composition of Output

A second major effect of the adoption of a consumption tax would be a reallocation of resources. The sector most likely to be strongly affected in this regard is owner-occupied housing, which is likely to be single-family. Under the current income tax, investment in owner-occupied housing is favored over business investment because the rental value of housing is not included in income. A shift to a consumption tax, by ending this preference, would be expected to reduce the demand for owner-occupied housing, which could cause unemployment in the construction industry and in industries that supply that activity. These contractions would occur more quickly than demand might be restored through the accompanying increase in business investment.

It is difficult to estimate the magnitude of that demand shift, but the DRI simulations referred to earlier showed significant declines in housing construction even in the case of the flat tax where the overall negative effects on the economy were relatively small. These contractions were in the 12% to 16% range initially for the flat tax.

There are other activities that would be depressed or stimulated by a consumption tax, although none is probably so important as the shift out of housing construction. Activities that might be depressed potentially include health care (whose favorable treatment would be reduced by the loss of tax subsidies to

¹¹At moderate inflation rates, the overstatement of income due to failure to index depreciation is approximately offset by accelerated depreciation methods. A rise in the inflation rate increases both the size of the interest deduction and the understatement of depreciation, but the former effect is larger. Hence, there is always a subsidy, and it is larger the higher the rate of inflation.

insurance), state and local construction (which would lose the advantage of tax-exempt interest), activities carried out by non-profits that rely on charitable contributions, and business activities of firms that tend to be heavily leveraged or growing more slowly. The transmission routes for financial funds would also be affected as pensions and insurance companies lose their tax favoritism.

Short-Run Macroeconomic Effects

Typically one would not expect the substitution of one tax for another to have a significant macroeconomic effect if the change were revenue neutral. This is because the fiscal effect of imposing a tax is offset by the fiscal effect of removing an identical amount of taxes. (There could be a contraction in demand, likely to be slight, if a tax substitution increases the private savings rate, which could occur with a shift to a consumption tax, however. This point is set aside in the following discussion because such a shift is uncertain in direction and likely to be modest).

Short-Run Demand-Side Effects

On the demand side of the economy, the imposition of a tax affects output, employment and prices because of its effect on the government's deficit and the balance between investment and saving. When taxes are increased, the government's borrowing requirements are reduced. Total saving in the economy (i.e., output that is not consumed), which includes government saving, is freed up to be invested (i.e., devoted to the future). Initially, because there is less demand for goods and services, output tends to decline, and the increase in availability of resources for investment tends to push interest rates down.

But in the case of substituting a tax for another tax, total demand is typically not affected. There is no effect on the government's deficit. The tax saving freed up by collecting more in consumption taxes is offset by the reduction in income tax collections. Disposable income is unchanged. There is no change in the demand for consumption, and the savings and investment balance is unaffected. Viewed from the demand side alone, no change in output, employment, or interest rates would be expected.

But in addition to the fiscal effects of the government's budget, demand is also influenced by any monetary effects induced by the tax change. Monetary effects concern the supply and demand for exchange media, i.e., the currency, deposits, and other financial instruments that are used to engage in transactions. A tax change typically does not influence the underlying demand for or supply of exchange media (money). Neither the government's provision of money or the public's demand for it changes due to a tax shift. Consequently, one does not ordinarily expect a tax reform — even if it is not revenue neutral — to have monetary effects on demand.

The need for transactions media in the economy, however, may be somewhat more complex than is often believed. In general, it is assumed that — all other things equal — an increase in income leads to a proportionate increase in the demand for money, regardless of the form that income takes. But some analysts have suggested

that different components of Gross Domestic Product generate different transactions patterns. In particular, it has been suggested that the government may not have the same need for money balances in its revenue and expenditure transactions as the private sector does in consumption and investment outlays.¹²

A switch to a consumption tax from an income tax does not involve a larger volume of government outlays or receipts. But it may (depending on the type of consumption tax) affect the amount of money needed for transactions because of a change in the manner in which the tax is collected. When income taxes are collected primarily by means of withholding, the receipts are remitted quickly to the government without ever having to pass into the hands of consumers. In the case of consumption taxes such as the VAT and RST, the amount of the tax is present in the price of goods rather than being absent from paychecks. Hence, the public may need greater cash balances to pay a consumption tax than an income tax of equal value.

It is not at all clear whether the means by which the tax is collected really influences money demand, or if it does by how much. If there is such an effect, it would be contractionary. That is, the switch to a consumption tax would tend to increase the demand for money, which, if not forthcoming from the monetary authorities, would tend to drive up interest rates and depress economic activity and raise unemployment in the short run.

Short-Run Supply-Side Effects

At worst, the demand side of the macroeconomic equation might react to the switch to consumption taxes with a reduction in demand, depending on the relative requirements for money to pay taxes through withholding or by consumers. At best, there is no adverse reaction at all. The supply side of the macroeconomic equation is another matter. It is here that analysis indicates that a switch from income to certain types of consumption taxes would have significant macroeconomic effects.

Under either a VAT or RST, firms have a tendency to increase their prices by the amount of the tax. In the case of the VAT, this occurs at each stage of production as the tax in the amount of a percentage of value added is passed on. In the case of the RST, the price increase represents the tax imposed at final sale.

Of course, in the case of both these taxes, the elimination of the income tax creates some offset to input costs that the firms pay. However, there is good reason to expect that the principal input cost, wages and salaries, would not immediately decline in response to the tax substitution. In addition, other input costs may be resistant to downward revision as well.

¹²N. Gregory Mankiw and Lawrence H. Summers, "Money Demand and the Effects of Fiscal Policies," *Journal of Money Credit and Banking*, vol. 18, November 1986, pp. 415-429; Daniel R. Feenberg, Andrew W. Mitrusi, and James M. Poterba, "Distributional Effects of Adopting a National Retail Sales Tax," *Tax Policy and the Economy*, vol. 11, edited by James M. Poterba, National Bureau of Economic Research, Cambridge, MA, MIT Press, 1997.

Briefly, when the income tax is eliminated, workers should be willing to work for a lower pretax wage. This is because the difference between aftertax and pretax income is eliminated. Under a VAT or RST, the wage a worker gets after taxes is the wage the firm pays — no tax is taken out of it. If the firm lowered its wages and salaries by the amount of the income tax removed, the worker would still get the same income.

But wages and salaries are set by both formal and informal agreements. These agreements — many of which are set in contracts — are not easily changed. In many if not most instances, a firm will unlikely be able to get its employees to accept lower wages and salaries, even if potentially they are no worse off after the reduction.

In addition, the prices of intermediate goods reflect the wages and salaries that producers pay their employees. These prices are also subject to agreements and contracts. Even if a firm is able to reduce its cost of labor by persuading workers to reduce their pretax wage by the amount of the tax, it may still attempt to hold the line on the prices it charges for its output, where these prices are set in legally binding contracts.

An array of contracts, agreements, and understandings underpins virtually all commercial activity. Many of the provisions of these agreements are unspoken and unspecified. All are geared to the specific circumstances of normal trade and do not contain provisions for all contingencies. A change in conditions as significant as the switch from income to consumption taxes is not envisioned in existing trade relationships. Some agreements may be renegotiated, some vendors will attempt to hold fast to the prices set in their contracts. In general, however, the incentive for workers and sellers of intermediate goods to accept lower wages and prices is weak.

Even without contracts or other agreements that make it difficult to renegotiate prices, workers and suppliers may be reluctant to accept a cut in wages and prices if they have reason to think that other workers and suppliers will not. For if firms cannot pay less to their suppliers, they will attempt to charge more for their output. Higher aftertax wages will be needed to pay the higher prices. It only makes sense to accept a lower wage if everyone else does too. In short, the *possibility* that wages and prices are sticky makes the *probability* of stickiness greater. Because the consumption tax might be passed through in prices, it makes sense for suppliers and workers not to accept lower wages and prices; they may need that income to pay the higher prices that may result from others refusing to accept wage and price cuts.

The existence of sticky wages and prices thus has implications for the economy's supply-side response to the VAT or RST. If the firms cannot lower wages and input prices in the short run, they must either raise their prices by the amount of the tax, or reduce their output. In short, the aggregate supply of output in the economy goes down: producers require a higher price for any given level of output, or conversely, they are willing to produce less output for any given price level. Interaction with demand results in both higher prices and lower output.

In short, the removal of the income tax does not create an offsetting effect because wages are set in pretax terms. The elimination of the income tax would increase the workers' after-tax income, so that they could take a pretax wage cut

without being made worse off. But the existence of contracts, implicit agreements, and traditions would cause any such cut to come slowly, yielding a short-term contraction in output. If wages and prices were flexible in the short run, then the decrease in aggregate supply in the economy would not occur. However, the evidence of short-run stickiness is overwhelming.

The Role of Monetary Accommodation

The previous analysis indicates that the reduction in supply caused by the imposition of a VAT or RST unambiguously causes output to decline and prices to rise in the short run. There may also be a demand effect if more cash balances are needed to remit sales or VAT taxes than to remit incomes taxes. This demand effect, if it occurs, would reinforce the output decline (but tends to offset slightly the price effects).¹³ Thus, whether by itself or in combination with a demand effect, *the supply effect of substituting a VAT or RST for an income tax tends to depress economic activity in the short run.* (See the appendix for a mathematical treatment of these issues).

The story is not complete, however, without including the effects of monetary policy. If monetary policy is aimed at keeping output from falling below capacity, then the monetary authorities can be expected to expand the money supply to keep output and employment from falling. They would lower interest rates to encourage investment and increase aggregate demand to restore capacity output and full employment.

If they did so, they would also drive up the price level. Essentially, the monetary authorities validate the higher prices that firms try to impose, making it possible for consumers to buy the firms' output at higher prices. If the one-time price increase were not accommodated, the result would be a money supply too small for full employment. The price increase "purchases" a quicker and less painful return to capacity.¹⁴ Note that the price effects from the monetary policy are the same regardless of which hypothesis is true about the relative need for cash balances for paying taxes under the two different systems, but the monetary expansion required to maintain full employment would differ.

If the authorities did not accommodate the supply shift with a more expansionary monetary policy, the economy would experience a recession. After a period of adjustment, the economy will return to full employment and capacity output

¹³Curiously, Feenburg, Mitrusi, and Poterba point out the potential demand effect of the differing need for cash balances but get the implications for monetary policy reversed. They argue that if greater balances are needed to pay the RST or VAT, it could help offset the contractionary effects of the supply reaction. In fact, because the demand effect would be to increase money demand and depress economic activity, even more monetary stimulus would be needed to maintain the economy at full employment.

¹⁴This is *not* an inflation-unemployment tradeoff or "Phillips Curve." Nothing in this analysis implies any kind of permanent tradeoff between prices and economic activity.

without a price increase.¹⁵ However, the magnitude of the tax shift involved indicates that the macroeconomic disruption would be severe. A single shift in the supply of output by the economy equivalent to a 20% or 25% increase in prices in a single year or less would be an economic shock outside of contemporary experience.

In short, the analysis concludes that the switch to a VAT or RST will result in a recession unless offset by monetary policy. The only way this would not be the case is under the implausible assumption that wages and prices are flexible in the short run.¹⁶ The conclusion is unaltered even if it is untrue that greater cash balances are needed to pay a consumption tax than an income tax. The result does not ensue from all consumption-type taxes; it does not occur, for example, in the case of a flat tax when taxes are collected directly from wage earners.¹⁷ If accommodated by expansionary policy, the result will be a higher price level. This would be only a one-time increase in prices, however, and not the continuously rising level that constitutes inflation.

The Challenge in Adjusting the Money Supply

Typically, discussions of the short-run stabilization problems posed by an RST or VAT are dealt with simply by pointing out the above: the unemployment and output effects could be avoided by an appropriate monetary policy, and the price effect would be one-time only, not an inflation that continues year after year. Unfortunately, the theoretical ability to implement such a monetary program is not the same as formulating one in practice.

Normal Uncertainties Besetting Monetary Policy

The basic principle of monetary management is to maintain a supply of money consonant with the demand for money that occurs when an economy is fully employed. More money than this would overheat the economy and drive up prices. Less money would tend to push up interest rates and depress economic activity.

However, the demand for money is only imperfectly known, the central bank controls only part of the money supply, the definition of money itself is in question, and no one knows with certainty what full employment really is. These problems are compounded by the fact that long and variable lags intervene between the time the monetary authorities undertake an action and when output and prices respond to it.

¹⁵Indeed, if money demand does change in response to the tax switch, an unaccommodated substitution would result in a lower price level after all the contractionary effects work their way through the economy.

¹⁶These effects could, in theory, be greatly moderated by a slow phase-in of the tax substitution to allow time for adjustment. Even in this case, behavioral responses in anticipation of the change could be disruptive to the economy.

¹⁷The flat tax could cause contractionary effects because fringe benefits are taxed at the firm level; in addition, there could be effects from sectoral demand shifts.

The Federal Reserve conducts its policy largely by means of a series of cautious adjustments. As an operating target, it uses short-term interest rates (specifically, it uses the federal funds rate, which is the rate at which banks lend reserves to each other). Over a period of six weeks between meetings of the Federal Open Market Committee (FOMC), the Fed buys and sells Treasury securities in quantities sufficient to keep the federal funds rate close to the determined target. At each FOMC meeting, the interest rate target is reevaluated in terms of the level of economic activity the Fed is trying to achieve. The target itself is based on what the Fed has learned through experience will move the economy in the direction of full employment — the output level believed to be consistent with a stable inflation rate.

The level of full employment is based on previous experience. But a rate of unemployment that yielded accelerating inflation in the previous business cycle may yield decelerating inflation in the current cycle. Heavily dependent on the underlying frictions in the economy, the unemployment rate associated with stable inflation changes over time, and can never be known with certainty. Similarly, the interest rate that will yield a given economic growth rate changes within a business cycle. Early in an expansion when optimism is still tentative, there is relatively less demand for loans, and interest rates must be very low to stimulate more borrowing and investment. Near the top of a business cycle when business managers, consumers, and investors are sanguine, borrowing is heavy and rates tend to rise. Consequently, the interest rate that yields only a 2% growth rate in the early stages of the expansion — and therefore is too low to bring the economy to full employment — may bring 5% growth when the economy is fully employed — and therefore dangerously overheat the economy.

Because of the lags in reaction to policy changes, it is difficult to adjust incrementally to the goal of full employment. If a decrease in interest rates boosts output, the authorities may not know until 4 to 9 months down the road. If in the meantime they have grown impatient with the lack of reaction and have added further stimulus, the result can be too much expansion. The reaction of prices to a monetary stimulus may take up to two years. If the authorities embark on a policy of expanding the economy until price pressures emerge, with the intention of cutting back at that point, their cutback will come too late. Inflation will already be under way, and to arrest the increase they will have to do more than just end the stimulus. They will have to contract.

As a result, the Fed must act preemptively with respect to inflation. But it must base its preemptive moves on the levels of interest rates and unemployment that yielded stable inflation in the past — levels that may have changed in the meantime. Consequently, monetary policy will be most successful in times of relative stability. When full employment remains the same from cycle to cycle, when interest rates induce the same type of behavior in one cycle as they did at the same stage of the previous cycle, and when the economy is not subject to significant outside shocks, the authorities are more likely to be able to make the right moves and gradually adjust to a level of output consistent with stable inflation. Consequently, big discrete changes in economic relationships create big problems for the monetary authorities.

Additional Uncertainties Posed by a Consumption Tax

A shift from income to a consumption tax — if the latter takes the form of a VAT or RST — would imply a very large shock to the system to be accommodated with monetary policy. A 20% increase in prices to be accommodated is beyond the size of any supply shock the Fed has ever had to deal with. It would set in motion changes that would also alter all the relationships that the Fed depends on in formulating its policies, including the level of full employment and the level of interest rates associated with stable inflation.

Presumably, a 20% increase in prices overall would require a 20% increase in the money supply (with a larger required increase in money supply if there are demand-side effects as well). However, the money supply has been an increasingly difficult target to deal with in the last decade. The Fed no longer uses it in policy making. First of all, the relationship between bank reserves — which is what the Fed actually has control over — and the money supply has been changing and is not currently stable or predictable. In addition, there are different measures of money; and at various times in the business cycle, these different measures send contradictory signals. If, for example, M1 were increased by a given amount, M2 would change by some other amount, perhaps even shrink.¹⁸ Consequently, no baseline money growth can be established as a benchmark to increase by 20%; and unless one knows how much the money supply should increase or decrease in the absence of the tax switch, one cannot know to what levels to change it.

As explained earlier, the Fed currently uses an interest rate as its operating target. In normal circumstances, it may be possible to continue using it in incremental steps to keep the economy on track. But nothing in the experience of the Fed could provide the information necessary to know how much the rate would have to change to fully offset the contractionary effects of a shift to a consumption tax.

Even incremental changes in interest rates would take on different characteristics due to the changes in interest rates engendered by the tax switch. Thus uncertainties regarding the magnitude of the effect of a tax switch on the interest rate further complicate the problems of the monetary authorities. For example, even if the Fed decided to accommodate the price increases resulting from the tax substitution, monetary expansion might fall well short of what was needed as the monetary authorities mistake a fall in interest rates as a sign that they have loosened, when in fact the interest rate decline is simply the consequence of a change in the tax treatment of debt finance. In that case, their actions could worsen a contraction.

Interestingly, because of the use of interest rates as an operating target for the Fed, even a shift to the flat tax might set in motion certain macroeconomic dislocations. Although the flat tax does not create the kind of supply-side and price effects characteristic of the RST and VAT, its effect on interest rates could send very

¹⁸M1 is the sum of currency, demand deposits, travelers checks and other checkable deposits. M2 is M1 plus money market mutual funds, savings deposits (including money market deposit accounts) and small time deposits.

misleading signals to the monetary authorities, who might contract the money supply in reaction to the fall in interest rates, thereby inducing a downturn in the economy.

The interest rate effects would not be the only problem created by the tax switch for monetary policy. As explained, interest rates are adjusted in order to achieve a level of output associated with sustainable inflation, i.e., full employment. The Fed must base its notion of full employment and sustainable growth on past experience. Yet, one of the effects of a shift to a consumption tax would be a reallocation of economic activity. And such a reallocation would tend to decrease potential output for a period of time.

The reason is straightforward: there are always some resources in an economy that are unemployed because of frictions. Disruptions shift demand away from some industries (creating unemployment there) while new demands elsewhere create vacancies and input shortages. But vacancies and the unemployed are not always a good match; price signals take some time to direct inputs to where they are needed. Frictional unemployment, therefore, represents the continuing balance between the tendency of incentives to direct unemployed resources to where they are needed and the changes in tastes and technology that create those unemployed resources in the first place. In periods of volatile sectoral shifts, frictional unemployment can be expected to increase. The sectoral shifts described earlier in the report would be significant and potentially large enough to cause a temporary fall (or slowdown in growth) in potential output.

The relative fall in potential output would further complicate the Fed's task. While it is possible to use monetary policy to ameliorate the contractionary effects of the tax switch that were described earlier, monetary policy cannot reduce frictional unemployment. Consequently, the Fed would not only have to deal with the problems associated with shifts its operating target, but also with a change in its medium-term output goal.

Timing Difficulties Posed by a Consumption Tax

Ignoring the obvious difficulties associated with determining the magnitudes of the changes needed to offset the contractionary effects of a tax switch, the timing of a monetary accommodation would be crucial. The price and output effects associated with a switch in tax regimes would not commence immediately and fully with the implementation of the new tax.

The anticipation of a VAT or RST would be expected to generate changes in economic behavior immediately upon passage (indeed, as passage becomes likely). With an impending VAT or RST, consumers would make major purchases before the tax is imposed. If a VAT is anticipated, firms would begin accumulating inventory to reduce the tax on their inputs. Both effects would tend to significantly boost demand. It is unclear whether the authorities would want to begin anticipating the price increase with accommodation, or would try to moderate the demand increase with contractionary policy until the tax is actually imposed and a looser policy is needed. The timing required for the latter is beyond the capabilities of the system.

In addition, the expectation of a price increase would affect capital markets. Since the price increase — even if it is a one-time surge — would be expected, short-term interest rates would reflect the expectation. Thus, before the switch to a consumption tax could have its permanent effect of lowering interest rates, it likely would have the temporary effect of raising them, further confusing the signal that the Fed gets with respect to interest rates.

Finally, it is not clear that a single increase in the price level really can be accommodated cleanly without affecting future price increases. In general, there is no reason to believe that a one-time price increase due to the new tax — if fully understood — would engender expectations of additional price increases. This is especially true if due allowance is made to avoid double-compensation through escalator clauses. But the formation of expectations is imperfectly understood. In general, they are believed to depend at least partly on experience.

In all likelihood, whether the public expects a price increase to continue would depend on whether inflation has been a recent problem. If the economy has been experiencing inflation to a significant degree, it is more likely that the public would take any significant upsurge in prices as a signal that more increases would follow. In this respect, the current favorable inflation environment makes it more likely that the price increase caused by the tax switch would not generate significant expectations of more price increases, that it would truly be a one-time price surge with inflation soon resuming its low path. Nonetheless, the prospect for an increase in inflation expectations, and all the economic effects that such an increase sets in motion, would create a whole new set of concerns for the Fed.

Distributional Consequences of Price Accommodation

The contractionary effects of the shift to a VAT or RST could be huge. If not dealt with, they could result in adverse employment and output effects not experienced in the post war period. However, the practical problems associated with offsetting them with appropriate monetary policy are formidable. The adjustments that would be required of the monetary authorities are outside of any recent experience. It is virtually certain that the monetary response would prove either significantly inadequate or overdone.

In terms of short-run macroeconomic stability, transition would be easier with the flat tax version of the consumption tax than approaches such as the VAT and RST.¹⁹ But the issue of prices and price accommodation is intimately tied up with another important issue: that of the incidence of the tax. *Without a price accommodation, all of the lump-sum tax on assets would fall on equity capital.*

¹⁹The short-run macroeconomic effects, however, are only part of the transition. Other advantages and disadvantages are not dealt with here. For example, the flat tax more easily incorporates relief for lower-income individuals, and the more indirect forms of the consumption tax reduce the number of taxpayers, permitting economies in the collection process.

As explained, a consumption tax is equivalent to a tax on wage and old capital. But, depending on the price effects, some forms of capital would bear a greater burden than others. The increase in prices that results from an accommodated RST or VAT would be the route through which the tax would be imposed on bonds and other forms of wealth denominated in fixed dollar amounts, by means of a decrease in their real value via inflation. If no price increase occurred, bonds, bank accounts and other similar financial instruments would bear none of the tax. Indeed, the fall in interest rates would increase the value of bonds. The tax on old wealth would tend to fall on equity, and especially hard on leveraged equity.

For individuals with highly leveraged investments, the tax could be larger than the actual net value of the asset. Consider, for example, the consequences of the flat tax and the case of an unincorporated business. For illustration, suppose an individual has a rental building with a market value of \$100,000, a \$90,000 mortgage and an undepreciated basis of \$95,000. Under the current income tax, when the building is sold, the individual pays a capital-gains tax on the difference between the sales price of \$100,000 and the basis, or on \$5,000. Suppose this tax is 20%; the individual has a \$1,000 tax which can easily be paid out of his net sales proceeds after paying off debt.

Under the flat tax, however, the entire sales price would be subject to tax, so that individual would have a tax liability of \$20,000. He has borne the total asset tax burden on his equity share, and actually does not have enough cash from the sale to repay the mortgage, while the mortgage holder has escaped tax. Thus, in the absence of an accommodated price increase, the tax on old assets would be borne entirely by the equity owner. In the case of corporate assets, this effect would be transmitted to stock market values, where, at least in theory, virtually all of the value of stock might be lost for some heavily leveraged firms.²⁰

Suppose, instead, that prices had been increased to accommodate the tax, as would likely be the case under a VAT. A 25% tax exclusive rate is equal to a 20% tax inclusive rate. In this case, all prices in the economy, including asset prices, would rise by 25%, so the price of the building would be \$125,000 and the tax would be \$25,000. In that case, the individual would realize a net of \$35,000 from the sale after repaying the \$90,000 loan; after paying the tax, he would have \$10,000. However, the purchasing power of this \$10,000 in consumption goods is only \$8,000, given the new higher prices, so the equity holder would bear the asset tax only on his share. The owner of the debt claim also would lose 20% in purchasing power.

This mechanism is slightly different for a retail sales tax, where there is no price rise for capital goods, and no tax imposed on the sale of a capital asset. In this case, the individual has \$10,000 in proceeds from the sale after paying the mortgage off,

²⁰In the case of a corporate investment, this asset price effect would be reflected in stock market prices. A 20% tax would be expected to cause stock market values to fall by 20% if a firm has no debt. If a firm has debt equal to a third of total assets, the stock market would be expected to fall by 30%; if the firm has debt equal to half of assets, the stock market would be expected to fall by 40%. See (name redacted), *The Flat Tax and Other Proposals: Who Will Bear the Tax Burden?* Congressional Research Service Report 95-1141, Library of Congress, Washington, D.C., November 29, 1995..

but the purchasing power of this amount in consumer goods is only \$8,000. Similarly, the mortgage holder has lost purchasing power. The same real effects occur as in the case of the VAT.

This problem with the flat tax's asset tax falling only on equity claims would not arise in a consumption tax that included financial as well as physical investments (as in the USA tax). In that case, the \$100,000 would be included in income, but the \$90,000 mortgage repayment would be deductible to the building owner and includable in the income of the recipient. Again the tax would be shared by equity and debt holders. The problem with including financial investments in the consumption tax base, however, is that it would greatly complicate the tax calculations, causing each individual taxpayer to have to keep a balance sheet that accounts for assets and liabilities, and their changes.

Price accommodation has some other potentially important distributional consequences. Without price accommodation, none of the tax burden would fall on transfer payments, while transfer payments would be unaffected by the tax with a price accommodation only if they were indexed to the price level.

Some economists have suggested that asset price effects in the shift to consumption taxes could be relieved by allowing recovery of basis and by allowing firms to continue to depreciate assets. There are limitations to this approach. First, such relief would be costly in revenue and require much higher rates. In addition, it would be imperfect because depreciation would only allow the present value of depreciation to be recovered, which would burden firms with long-lived assets relative to firms with short-lived assets. Secondly, it is the lump-sum tax on old assets that is responsible for much of the savings response to a consumption tax in the short run. The entire asset tax could be eliminated by shifting to a wage tax rather than a consumption tax, but such a shift would require much higher tax rates and many models do not project such a shift as increasing savings and output in the long run.

Mathematical Appendix

The following is a formal treatment of the effects of a shift to a retail sales tax, using a simple IS-LM analysis.

To demonstrate these points, we use a simplified four-equation money wage model, with the conventional treatment of the transactions demand for money as:

$$(1) \quad y = c(y-T) + i(r) + g$$

$$(2) \quad M/P = l(r) + k(y)$$

$$(3) \quad h(N) = (P/(1+v))f(N)$$

$$(4) \quad y = y(N,K)$$

Equation (1) is the IS equation where y is income, T is taxes, $c(y-T)$ is consumption, i is investment, r is the interest rate, and g is government spending.

Equation (2) is the LM equation, where the demand for real money balances is a function of liquidity demand and transactions demand.

Equation (3) equates wage rates in labor supply and demand, where N is the labor supply, and v is the tax exclusive rate of indirect tax (sales or value added taxes) imposed on firms.

Equation (4) is the economy's production function, with output a function of labor and capital (K).

If we hold K constant for a short run production function, this system is four equations in four variables (y , r , N , and P). The exogenous variables are M , g , T and v , with T being the sum of v times consumption net of tax and any other taxes.

We obtain the following by differentiating the equations and setting the initial value of v to zero.

$$(5) \quad dy = c'(dy-dT) + i' dr + dg$$

$$(6) \quad \frac{(PdM - MdP)}{P^2} = l' dr + k' dy$$

$$(7) \quad h' dN = P f' dN + f(N) (dP - P dv)$$

$$(8) \quad dy = y' dN$$

The case to be considered is the replacement case, where dv changes but dT is zero. Spending (g) is also fixed so that $dg = 0$.

Consider first what must happen to P if output is held constant. If dy is zero, then dN is zero. Therefore, equation (7) becomes simply:

$$(9) \quad dP = Pdv$$

Thus, the price change to hold income constant must be equal to the tax.

Now consider what is required of the money supply to obtain this constant income result. When dT is zero (the replacement case), the dr is also zero (as shown in equation (5), since dy is set at zero. Therefore, equation (6) is:

$$(10) \quad dM/M = dP/P = dv$$

The proportional change in the money supply is equal to the proportional change in the tax rate (and the price level).

Consider the alternative specification for equation (2), where the transactions demand for money is a function of private spending:

$$(2a) \quad M/P = l(r) + k(c(1+v) + i)$$

When (2a) is differentiated (again setting initial v to zero) the result is:

$$(6a) \quad \frac{(PdM - MdP)}{P^2} = l'dr + k'(dc + cdv + di)$$

If dg is equal to zero, and dy is equal to zero, then the sum of dc and di is equal to zero. Similarly, by equation (5), dr is equal to zero, if dT is equal to zero. Therefore (noting that $dP/P = dv$):

$$(10a) \quad dM/M = dv (1 + kcP/M)$$

This effect could be quite large. For example, in the case where liquidity demand is very insensitive to the interest rate and transactions demand is proportional to private transactions (the LM curve is vertical), the term in parentheses on the right hand side is $(1 + c/(c+i))$. Since c is a large fraction of private demand, the required increase in the money supply is almost twice as large.

Similarly, by setting $dM =$ to zero, we can see the effects on output and price. In the case of the traditional transactions demand:

$$(11) \quad dy = \frac{-(i'/l')(M/P)}{(1 - c' + i'k'/l' + (i'/l')(M/P)(h' - Pf)/(Pf(N)y'))} dv$$

Since c' is less than 1 and both i' and l' are negative, the effect on output is negative as long as labor supply is upward sloping.

By substitution:

$$(12) \quad dP/P = \frac{1 - c' + i'k'/l'}{(1 - c' + i'k'/l' + (i'/l')(M/P)(h' - Pf')/(Pf(N)y'))} dv$$

Thus, the price level also rises, but not as much as in the case of monetary accommodation.

In the case where transactions demand is a function of private spending, including the tax, the negative effect on income is greater:

$$(11a) \quad dy = \frac{-(i'/l')(M/P + k'c)}{(1 - c' + i'k'/l' + (i'/l')(M/P)(h' - Pf')/(Pf(N)y'))} dv$$

and the effect on prices is smaller.

$$(12a) \quad dP/P = \frac{1 - c' + i'k'/l' - ci'k'/l'}{(1 - c' + i'k'/l' + (i'/l')(M/P)(h' - Pf')/(Pf(N)y'))} dv$$

It might be somewhat easier to characterize these relationships by elasticities. Define E_s as the aggregate supply elasticity (percentage change in quantity supplied divided by percentage change in price) and E_d as the absolute value of the aggregate demand elasticity, then $dy/y = -(E_s E_d / (E_s + E_d)) dv$ and $dP/P = (E_s / (E_s + E_d)) dv$ in the case of the traditional function. Where money demand is dependent on aggregate private transactions, $dy/y = -(1 + k'Pc/M)(E_s E_d / (E_s + E_d)) dv$ and $dP/P = (1 - Edk'Pc/M)(E_s / (E_s + E_d)) dv$. These additional terms make the output effect larger and the price effect smaller.

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