Fundamental Tax Reform and Residential Housing

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The impact of consumption-based, fundamental Federal tax reform on the housing market has been a controversial and difficult topic. We employ a dynamic, numerical simulation model of the aggregate housing market to augment our understanding of the key forces at work in the short-run and over longer periods. This approach suggests that integrating the short-run and long-term impacts of tax reform leads to the possibility that there will be relatively modest impacts on the nominal values of existing housing. The results indicate that an important topic for future research is the elasticity of housing supply in the short run and long run.

1. INTRODUCTION

Recent years have witnessed numerous calls for overhaul of the United States’ Federal income tax. The most dramatic of these proposals seek to replace the income tax with a comprehensive consumption-based tax. Inter alia, such reforms would eliminate the tax-favored status of owner-occupied housing. The implications of such a change are the source of considerable concern and controversy. Some commentators raise the specter of a massive decline in housing values, substantial windfall losses in the housing wealth of U.S. households, and large-scale defaults on mortgage obligations. For example, in a widely publicized study.

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Data Resources Incorporated (DRI) predicted an apocalyptic fall in housing values, estimating that the Flat Tax (one consumption-based alternative) would result in an aggregate decline of 15% percent in housing values, equivalent to a loss of $1.7 trillion in housing equity (see Brinner et al. (1995)).

Are fears of massive housing price impacts justified? Clearly, downward pressure on residential housing values would be inescapable. Comprehensive consumption taxation would both eliminate the existing tax-subsidies to owner-occupied housing and also tax its use. It is straightforward to expect households to reduce their demand for owner-occupied housing and to expect there to be downward pressure on prices, ceteris paribus. But the DRI analysis does not reflect such optimizing behavior. Instead, the forecast $1.7 trillion decline in housing values is simply the present value of the benefits lost by elimination of the mortgage interest and property tax deductions.²

More recently, Capozza et al. (1996) (hereafter, CGH) employed a spatially based equilibrium model and reached conclusions similar to those of DRI. CGH assume that the bulk of the adjustment will occur in the asset prices and not in the user-costs of owner-occupied housing. However, if the rental price is unchanged, the long-run quantity demanded will also remain the same, suggesting that the size of the housing sector will be largely unaffected by fundamental tax reform. This stands in sharp contrast to the large body of research elucidating the deadweight cost of capital misallocation due to tax subsidies to housing (see, e.g., Taylor (1998)).

These differing conclusions reflect the underlying difficulty of the research issues. We seek to revisit the impact of consumption tax reform on housing values. In so doing, it is desirable to distinguish between the transitory response of the housing market to tax reform and the longer term (steady-state) implications. To accomplish our goals, we develop a dynamic, perfect foresight simulation model of the residential housing sector. The model is tailored to identify the aggregate impacts, tracing the intertemporal interaction between demands derived from a representative household and supplies based upon a Tobin’s q model of new construction.

In this setting, it is possible that a consumption tax reform would raise the nominal value of existing homes. To see why, consider a scenario in which individuals do not itemize deductions of mortgage interest or property taxes (which is the case for 40% of homeowners) and in which the consumption tax takes the form of a 20% value-added tax (VAT). Eliminating deductibility would, obviously, have no direct impact on existing homeowners, while the VAT would raise the cost of new homes by 20%. Older, existing homes would enjoy a tax-based advantage of 20% leading to a rise in their value, ceteris paribus. Over

² DRI estimates the value of the mortgage interest ($62 billion) and property tax ($22 billion) deductions to be $84 billion annually. Using a real discount rate of 0.05, the value of this in perpetuity is $1.7 trillion.
the longer term, construction activity would eliminate the distinction between
eexisting and new homes and the price differential along with it. But during the
transition, the tax reform would have the perhaps surprising effect of enhancing
the nominal value of older homes.\textsuperscript{3} To the extent that households itemize, the
loss of deductibility mitigates this effect, but the underlying tendency remains.

Of course, if the reform caused the prices of all other goods to rise (immediately)
by 20% percent, the real value of housing would decline, even during the transi-
tion. But the results of Besley and Rosen (1999) cast doubt on the notion that
the prices of consumption goods will rise uniformly by an amount equal to the
tax rate. We return to this below.

The remainder is organized as follows. In Section 2 we develop our model of
the housing sector, while in Section 3 we discuss the parameterization of our
simulation model and alternative strategies to implementing consumption-based
tax reform. Section 4 contains our results, the bulk of which suggest a relatively
modest impact of tax reform on housing values.

In Section 5 we examine the sensitivity of our baseline results to a number
of alternative assumptions, especially the role of land in the production of housing
and the dynamic adjustment of housing prices.

2. MODELING THE RESIDENTIAL HOUSING SECTOR

We require a model capable of delivering both the long-run predictions from
fundamental tax reform, as well as the explicit dynamic path for the value of
housing during the transition to the new long-run equilibrium (steady state).
In developing our model, we build upon the work of Summers (1983) and

We begin with a dynamic model of housing supply. In the spirit of Tobin’s $q$
theory of investment, define $Q_H$ as the ratio of housing value to replacement
cost, with the latter normalized to 1.0 per house. We assume that new construction
$(C)$ is an increasing function of $Q_H$.

$$
C = \dot{H} = \Phi(Q_H)H. \quad (2.1)
$$

As in the $q$-theory of investment (see, e.g., Hayashi (1982)), we assume that
when housing values equal the replacement cost, there is no incentive for the
housing stock to change; i.e., $\Phi(1) = 0.$\textsuperscript{4} An implication of this specification is

\textsuperscript{3} The key is that the consumption tax is not levied on existing housing, which seems a sensible
assumption. First, the exemption of existing housing is characteristic of most reform proposals. Moreover,
if it were politically palatable to levy a tax on housing consumption, the current tax
benefits for housing would not have survived to this day.

\textsuperscript{4} By definition, $C$ is the change in the housing stock or net new construction. Gross construction,
which includes replacement of depreciation, will still occur when $C = 0.$
that supply is infinitely elastic over long (technically, infinite) horizons. The short-run elasticity, however, may be far smaller, a feature we return to below. As will become clear, however, empirical guidance regarding supply elasticities is an important area for future investigation.\(^5\)

On the demand side, we begin with the observation that housing serves a dual role as both a consumption good and investment vehicle. The latter requires that homeowners be indifferent between holding their house and investing in an alternative asset. That is, households will choose their housing so that

\[
i(1 - \tau) = \frac{S/H - [t_p (1 - \tau) + \delta + m] P_H + \dot{P}_H}{P_H},
\]

where \(i\) is the nominal rate of return on an alternative investment, \(\tau\) is the individual’s marginal income tax rate, \(S\) is the annual implicit service flow (imputed rent) from ownership, \(H\) is the amount of housing, \(t_p\) is the property tax rate, \(\delta\) is the percentage rate of depreciation, \(m\) is the percentage rate of maintenance costs, \(P_H\) is the price of a house, and the dot “\(\dot{}\)” denotes a derivative with respect to time. In effect, (2.2) displays the requirement that the return (imputed rent plus capital gain) on housing—net of property tax, depreciation, and maintenance costs—be equal to the net return on an alternative investment.

We seek to combine (2.1) and (2.2) to generate a dynamic model of housing market equilibrium. To do so, it is useful to transform (2.2) in several ways. First, note that since \(Q_H\) is the ratio of housing value to replacement cost, \(Q_H = (P_H H)/H = P_H\). Second, we make explicit the fact that the annual service flow is a function of the quantity of housing,

\[
S = S(H).
\]

Households choose their housing so as to satisfy the investment and consumption services provided by housing. For our purposes, it is easiest to use (2.3) in (2.2) and rearrange to yield the capital gain (change in \(Q_H\)) consistent with household optimization and, when combined with supply, overall market equilibrium. The result,

\[
\dot{Q}_H = [i(1 - \tau) + t_p (1 - \tau) + \delta + m] Q_H - \frac{S(H)}{H},
\]

allows us to track the equilibrium dynamics of the price of housing relative to its replacement cost.

\(^5\) In this regard, an intriguing paper by Sinai (1998) suggests that tax reforms are capitalized into house prices to only a small degree.
Equation (2.4) ignores the distinction between equity and mortgage financing costs, assumes that all mortgage interest and property taxes are fully deducted, and assumes that interest income is fully taxable. We can relax these assumptions. Let $\beta$ denote the loan-to-value ratio (i.e., the fraction of the house value that is mortgaged), $\theta$ the portion of financing costs that are deductible, $\gamma$ the fraction of property taxes that are deductible, and $e$ the portion of interest income that is taxable. Equation (2.4) then becomes

$$Q_H = \left(1 \frac{\beta(1 - \theta \theta)}{1 - \theta \theta} \right) (1 - \beta)(1 - e \theta)$$

$$\dot{Q}_H = \left(1 - \theta \theta \right) + (1 - \beta)(1 - e \theta)$$

In isolation, (2.4') shows the relationship between current nominal housing values ($Q_H$) and quantities ($H$) and future changes in the price of housing consistent with household equilibrium. Taken together (2.1) and (2.4') compose a standard asset market-oriented model of tax incidence in the spirit of Summers (1983) and provide a setting within which to analyze the transitional dynamics of the housing market.

A convenient means to do so is the phase-diagram in Fig. 1. In this figure, the steady state is at $H^*$ and $Q_H^*$ (where market value equals replacement cost, i.e., $Q_H^* = 1$). In itself, the steady state is not very interesting—the long-run price of houses is simply the exogenous replacement cost. There are, however, some interesting dynamics present. The transition to the steady state is shown by the saddle path marked with arrows and permits short-run fluctuations in the asset price of houses.

To gain a feel for the analysis, consider the scenario discussed earlier. Specifically, in order to examine this part of the consumption tax in isolation, assume that there is no deductibility of mortgage interest or property taxes and that a consumption tax is imposed via a business-level tax such as a VAT or the Flat Tax. The key feature of such a reform is that the tax on residential housing is imposed solely on new construction and not on existing housing. Specifically, it raises the “break-even” value of a new home from 1.0 to $1 + t$, where $t$ is

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6 We develop and solve our model under the assumption of perfect foresight with respect to price changes (and other aspects of the future). A forward-looking model is essential for dynamic analysis. While this is advantageous for understanding transitional dynamics and asset accumulation, incorporation of portfolio decisions or other aspects of uncertainty such as the effects on housing investment of the “option value” of waiting to buy or sell could only be examined with much more difficulty (see, e.g., Dixit (1992)).
the consumption tax rate.\footnote{Note that $P_H = 1 + \tau$ is the price gross of tax, or consumers’ price. The price net of tax, or supply price, remains 1.0 in the new steady state, exactly the incentive required to induce zero net new construction. Our (partial equilibrium) assumption that the supply price is fixed seems appropriate. Between 1995 and 1997, residential investment constituted only a bit over one-quarter (28\%) of annual private gross fixed investment, and the owner-occupied sector is smaller yet. In 1995, 667,000 new privately owned one-family housing units were sold, compared to 3,812,000 existing one-family housing units. In other words, sales of new homes accounted for just under 15\% of all sales in 1995. In these circumstances the partial equilibrium assumption seems appropriate.} Thus, the long-run value of $Q_H$ rises from $Q_H = 1$ to $Q_H = 1 + t$; that is, in (2.1), $\Phi(1 + t) = 0$. As shown in Fig. 2, the $\dot{Q}_H = 0$ locus is unaffected, while the $\dot{H} = 0$ locus shifts upward.\footnote{We model the reform as both unexpected and permanent. The latter is in the spirit of a “fundamental” reform, while the former tends to magnify the initial effects on existing home prices. To the extent that an actual reform may be anticipated, prices will tend to rise or fall prior to the reform itself.}

As a result, the steady state level of $H$ declines to $H^*$, exactly what one would expect when a tax on housing was introduced. However, the transition to the new steady state takes place in two steps. Instantaneously, the value of $H$ is fixed; the market adjusts to the need for making the transition by having $Q_H$ (and $P_H$) jump up at the existing housing stock (from A to B). Intuitively, old houses are more valuable because they do not face the consumption tax; people...
will bid up the price of such houses until they are indifferent between the existing stock and the new, taxed housing. Note, however, that the initial jump is smaller than the amount of the tax. Thus, the supply price of new housing falls at the same time the demand price rises. This provides the correct incentive for the size of the housing sector to shrink. In the aftermath, housing prices move to the long-run equilibrium and the size of the residential sector shrinks as the market evolves toward the new steady state (B to C).

In short, in the absence of deductibility, the transition to this consumption-based tax on new houses leads to a short-run rise in values of existing homes. However, the example ignores several features of reality, most notably deductibility of mortgage interest and property tax payments and the reaction of other consumer prices to tax reform. As noted at the outset, the rise in the nominal value of housing will still represent a decline in purchasing power if all other consumer prices rise by the full amount of the tax. But will they? Recent research on this fundamental issue of tax incidence by Besley and Rosen (1999) suggests that full, forward-shifting of taxes into consumers’ prices may not be the norm. Instead, prices may rise by less than, equal to, or more than the amount of the

The magnitude of the jump from A to B depends upon the size of the change in the steady state values and the speed of adjustment as determined by Eq. (2.1).
Removing deductibility results in an immediate fall in values of new and existing houses, and a subsequent transition to a new steady state that has lower quantities of housing. Taking Figs. 2 and 3 together, the transition from the current system to a consumption-based tax system has an ambiguous effect on housing purchase prices. Moreover, to the extent that values either rise or fall, the persistence of these effects will depend upon the speed of adjustment embodied in the dynamics of housing supply (Eq. (2.1)). Thus, the sign, size, and duration of the net effect may be determined only by a quantitative evaluation, to which we now turn.

10. Note that relative to other assets, existing housing clearly benefits because it embodies untaxed consumption. All other “old” assets may be converted to consumption only at gross-of-tax prices, and hence will fall in value after the reform.
3. SIMULATING TAX REFORM

Consumption-based tax reforms could be implemented in a variety of ways. The most direct is a national retail sales tax which would entail a tax on the purchase of a new home, raising its price. Similarly, the consumption tax could be implemented as a VAT; again the reform would appear in the housing market as a tax on transactions in the construction and sale of new homes. Finally, “Flat Tax” proposals derived from the work of Robert Hall and Alvin Rabushka may best be viewed as a VAT in which taxes on the wage base are collected at the household level, while taxes on the remainder of value added remain collected at the firm level.

Numerical analysis of any given proposal requires that we choose among these alternatives, but that we transform the model in three ways. First, we must choose specific functional forms for our demand-side and supply-side relationships. Next, we must adopt specific values for the parameters for our functions and for both the current system and proposed tax systems. Finally, we must solve the nonlinear, simultaneous equations that characterize the evolution of housing market prices and quantities.

3.1. Solution Method

We solve the model in three steps. First, we work with a version of the model in which the variables of interest (e.g., housing prices and quantities) are entered as logarithms. This moves the center of attention away from overall levels in favor of logarithmic changes, i.e., percentage changes. Next, we linearize (in logs) the model in the vicinity of the postreform steady-state values and compute our simulations using this linearized version. Finally, we impose upon our solutions perfect foresight. Specifically, using an iterative search, we calculate the initial decline or jump in asset prices such that the sequence of asset price changes consistent with asset market equilibrium leads precisely to the postreform steady state.

3.2. Functional Forms and Parameter Values

The basic parameters are shown in Panel A of Table I. We assume that the representative homeowner faces a property tax at a rate of 1.4% and that mainte-

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11 In equilibrium, the purchase price of the house is equal to the present value of the future consumption stream. Hence a tax on the purchase price is equivalent to “prepaying” a stream of future taxes on the annual consumption value.

12 The equivalence between the retail sales tax and the VAT is perhaps most easily seen by viewing the VAT as a multistage collection mechanism for the tax on the final product.

13 Another possibility is a “consumed income tax” administered entirely at the household level; however, political realities appear to preclude this approach. Thus, for example, we do not address the USA tax of Senators Nunn and Domenici.
TABLE I
Parameter Values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A</td>
<td></td>
</tr>
<tr>
<td>Property tax rate ($t_p$)</td>
<td>0.014</td>
</tr>
<tr>
<td>Housing supply elasticity ($e$)</td>
<td>0.8</td>
</tr>
<tr>
<td>Inverse price elasticity of demand ($\eta$)</td>
<td>−2.0</td>
</tr>
<tr>
<td>Maintenance and depreciation ($m + \delta$)</td>
<td>0.03</td>
</tr>
<tr>
<td>Panel B</td>
<td></td>
</tr>
<tr>
<td>Interest rate ($i$)</td>
<td>0.075</td>
</tr>
<tr>
<td>Average marginal income tax rate ($\tau$)</td>
<td>0.220</td>
</tr>
<tr>
<td>Percent of mortgage interest deductible ($\theta$)</td>
<td>0.600</td>
</tr>
<tr>
<td>Percent of property tax deductible ($\gamma$)</td>
<td>0.600</td>
</tr>
<tr>
<td>Loan-to-value ratio ($\beta$)</td>
<td>0.400</td>
</tr>
<tr>
<td>$Q_H$</td>
<td>1.000</td>
</tr>
<tr>
<td>Percent of interest income taxable ($\varepsilon$)</td>
<td>0.500</td>
</tr>
</tbody>
</table>

Maintenance and depreciation average 3.0% of the house value. Also, we assume that the service flow and housing stock are linked by the constant elasticity function

$$S = S_0 H^\eta$$ \hfill (3.1)

where $S_0$ is a constant and $\eta < 0$ is the inverse price elasticity of demand. Our settings for the parameters of the function are also shown in the table. For our baseline simulations, we choose the (inverse price) elasticity of demand for housing services to be $\eta = −2.0$, but we vary this value between $−0.5$ and $−3.0$ to gauge the impact of this parameter on the simulations. On the supply side, we use a baseline elasticity of construction with respect to $Q_H(\varepsilon)$ of 0.8. Again, however, because the responsiveness of new construction to the alterations in the tax regime are central to the dynamics of the housing market, we vary this elasticity between 0.1 and 0.9.\textsuperscript{14}

We model two reforms: (1) a partial reform, eliminating the deductibility of mortgage interest and property taxes, and (2) the variant of the Flat Tax proposed by Congressman Armey and Senator Shelby. For purposes of comparison, we follow closely the choices of CGH in choosing our numerical parameter values for these reforms, which are shown in Panel B of Table I.

\textsuperscript{14} Many observers feel that housing market supply responses are asymmetric—increases are more elastic than contractions in supply. Our simulations focus exclusively on scenarios that result in a decline in the stock of housing, and our elasticities are best interpreted in this context.
We set the nominal, pretax interest rate at 7.5% and assume that it is unaffected by the tax reform. There is considerable debate regarding the impact of tax reform on interest rates; our goal is to focus on the act of reform itself and abstract from ancillary economic impacts. Note that, ceteris paribus, this choice likely serves to maximize the negative impact of tax reform, because any reduction in interest rates would serve to raise housing values. Following CGH, we set the average marginal tax rate in the current system at 0.22. When simulating the effects of removing deductibility in a revenue-neutral framework, we again follow their guidance and employ a rate of 0.194. We set the tax rate for the Flat Tax at 0.17.

As noted in CGH, roughly 40% of homeowners do not itemize; we set the fraction of mortgage interest and property tax deductible equal to 0.60. Under each of the reforms mortgage interest is not deductible, so we set \( \theta = 0 \). Similarly, property taxes lose their deductible status under both of the reforms examined.

The next two rows of the table show the financing and construction cost of housing, respectively. To focus on the real valuation of assets, we fix the loan-to-value ratio \( (\beta, \text{above}) \) at 0.4 throughout. We assume that the (normalized) replacement cost of a unit of housing is exogenously set at 1.0. Under the Flat Tax the business-level tax raises the tax-inclusive break-even replacement cost correspondingly. The final row of Table I shows a parameter that indicates the fraction of capital income that is subject to tax \( (e) \). We choose a prereform value of \( e = 0.5 \), a choice based on Engen and Gale (1996) that reflects the widespread existence of tax-preferred saving vehicles that permit substantial amounts of interest (and other capital income) to escape income taxation. Because capital income taxation is eliminated by the Flat Tax, \( e \) falls to \( e = 0.0 \).

### 4. SIMULATION RESULTS

We turn now to the results of simulating the reforms. The simulations provide two types of responses: changes in the steady-state in the housing market and the dynamics of adjustment between the original and new steady states. Although

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15 See Hall and Rabushka (1995) for a discussion suggesting a decline in interest rates. Feldstein (1995) argues that reform would not lower, and might even raise interest rates.

16 The long-run tax rate is 0.17 in the Armey-Shelby bill, although a higher tax rate prevails during a transition period.

17 Households will also respond to tax reforms by altering the financing of their homes (see Follain and Melamed (1998)). Of course, in doing so, they will choose the financing mix that is most advantageous, thereby serving to minimize the impact on housing prices. In this way, our assumptions allow us to provide an upper bound to the impact of tax reform.

18 The flat tax would be a simultaneous reform of the individual and corporate income taxes. Within the context of this analysis, the elimination, for example, of the corporate income tax would affect all sectors of the economy and would be captured by the impact on the cost of capital. As noted, we do not attempt to quantify these impacts, focusing instead on the differential effects of the (new) consumption tax on (new versus existing) residential housing.
not the primary focus of this study, we begin with the former before turning to an analysis of the adjustment paths.

4.1. Tax Reform and Steady-State Responses

Our examination of steady-state responses begins in Table II. As shown, and in direct analogy to Figs. 2 and 3, the steady state changes in the value of $Q_H$ are dictated directly by the tax regime. Under the Flat Tax the steady-state value of $Q_H$ rises by a percentage amount equal to the business-level tax on new construction. As noted above, however, the real value of $Q_H$ is unchanged in the steady state if all other prices rise by the amount of the tax. Simply removing deductibility has no effect on $Q_H$.

In contrast, the contraction in the quantity of housing stock differs markedly across the alternative reforms. Consider the first row of the table, which shows the results of our baseline simulation. Under these assumptions, removing the deductibility of mortgage interest and property taxes induces a steady-state decline of 1.9% in the housing stock. By contrast, the Flat Tax results in a greater steady-state decline of 8% in the quantity of owner-occupied housing. In short, removing the tax-subsidy to owner-occupied housing and/or taxing it leads to a smaller housing stock, an unsurprising qualitative result. Moreover, because the Flat Tax raises the effective price of housing consumption more dramatically, it has a greater effect on the quantity demanded.

The steady state values are computed by setting $\dot{Q}_H = 0$ in Eq. (2.3), imposing the long-run value of $Q_H$, and solving for the corresponding value of $H$.

These results are consistent with those found in static, general equilibrium analyses of housing. Berkovec and Fullerton (1992) estimate that the removal of the mortgage interest (property tax) deduction would reduce the stock of housing by 2.6 (2.1)%.

Nakagami and Pereira (1996) find that removing the mortgage interest deduction would reduce housing wealth by less than 1%.
These steady states are constructed under the partial equilibrium assumption that the long-run supply of housing is perfectly elastic at a constant replacement cost, so changes in the parameters of the construction function do not affect these simulations. Changes in the parameterization of housing demand, however, do influence the nature of the steady state. In particular, the rows of the table show the effect of varying the value of $\eta$. Looking across columns, varying the service-flow-to-stock relationship does not alter the ordering of the housing stock impacts of the reforms. Glancing down rows, however, indicates that the parameter is crucial for determining the real impacts of tax reform. As the absolute value of the elasticity of the demand for housing (with respect to the rental rate) falls (i.e., as $\eta$ grows in absolute value), the decline in the stock of housing becomes smaller. Not surprisingly, the more elastic the demand, the greater the impact of introducing a tax.

4.2. Tax Reform and Dynamic Adjustment

At the heart of our model is the specification of housing market dynamics. Consider Fig. 4, which shows the impact of removing the deductibility of mortgage interest and property taxes. As shown, the immediate effect is a reduction in housing values, an impact consistent with the theoretical prediction in Fig. 3. However, the magnitude of the decline is only a bit more than one percentage point and is quickly reversed.

![FIG. 4. Remove deductions baseline.](image-url)
By comparison to removing deductibility, the Flat Tax is a much more fundamental reform. However, our simulation of the effects of the Flat Tax (Fig. 5) does not suggest a dramatic decline in nominal housing values. Instead, the short-run impact is for prices to rise by roughly 10% and ultimately by 17%, a response suggested by Fig. 2. That is, the decline due to the loss of deductibility is more than offset by the positive impact of the business-level tax on prices. Again, note that the net-of-tax price of new housing initially declines, exactly the incentive required to induce a contraction in the supply of housing.

Not surprisingly, the supply elasticity is important to the process of dynamic adjustment. To gain a feel for the impact, we recomputed our simulated reforms using a much lower value of the supply elasticity, \( e \), of 0.3 instead of 0.8. Comparing Fig. 6 with Fig. 4 indicates that the lowered responsiveness generates a larger initial decline and a slower convergence to the new long-run equilibrium. A similar lesson emerges from comparing Figs. 5 and 7. Again, a less responsive construction industry leads to stronger downward pressure on prices—in this case a smaller rise—and slower adjustment to the steady state.

To summarize, our assumptions lead to the conclusion that the long-run impact of tax reform on housing prices appears to be minimal. The key is our view that, despite its large absolute size, the housing market is best thought of as a price-taker with respect to the remainder of the economy. Hence, long-run prices are best thought of as driven by highly elastic supply conditions. Of course, housing...
quantities will be responsive to reform. Those reforms that reduce the tax-subsidy to housing and raise the effective price will lower the demand for housing. The more interesting implication is that in the transition to the steady state, we find that, for plausible parameter values, the likely impact of tax reform on the housing market is quite modest.

5. ROBUSTNESS CHECKS

Our results do not lead to the conclusion that the housing market will crash in response to tax reform. Why? One possibility is that the model is just not capable of producing adverse effects on the housing market at all. Or, the possibility remains that our model is too stylized to capture important dynamics. In this section, we address each issue in turn. First, we construct “worst case scenarios” that maximize the short-run impact on housing prices. Next, we examine the sensitivity of the dynamic structure to the introduction of a relatively slowly adjusting residential land market into our simulations.

5.1. Worst-Case Scenarios for Tax Reform

Figures 8 and 9 show the short-run impacts and dynamic adjustments to tax reform under worst-case conditions. Specifically, we seek to stack the deck in
order to maximize the negative price effects of tax reform. To do so, we assume that all homeowners itemize their deductions and that each home is fully mortgaged (i.e., the loan-to-value ratio, \( \beta \), is 1.0), thereby maximizing the aggregate size of the deductions for mortgage interest and property taxes. Moreover, to make these deductions as valuable as possible, we focus the analysis on the homes of the well-to-do by assuming that our representative household has a marginal tax rate of 39.6%. Finally, price responses will be largest with minimal supply responses—we set \( \varepsilon \) equal to 0.1—and large demand responses—we allow for highly elastic demand by setting \( \eta \) equal to \(-0.5\).

The combined effect of these choices is that housing prices are forecast to fall by roughly 18% in response to the loss of deductibility (see Fig. 8) and to recover much more slowly. Similarly (see Fig. 9), in these circumstances the move to a Flat Tax results in a decline of 12% in housing prices, in contrast to the upward pressures found before.

There are a variety of possible reactions to these results. A first possible interpretation is that a housing market “disaster” is possible, but only if the aggregate market is characterized by a relatively unlikely combination of forces. Alternatively, it might be taken as a sign that within the aggregate housing market one might expect particular market segments to show a greater response to tax reform. A final possibility is that a highly levered, high-tax household is the marginal buyer for the market as a whole, and that prices reflect the behavior
of such a marginal buyer. If so, our “worse-case” scenario becomes the appropriate specification of housing market dynamics.

5.2. The Role of Land in Housing

The discussion thus far has treated housing as a reproducible capital good available at an exogenously set long-run price (normalized to the replacement cost of 1.0). At the other extreme, one might argue that the essence of housing is residential land that is fixed in supply. Thus, one should treat the quantity of housing as exogenous and permit the long-run price to adjust. In practice, both capital and land are embodied in housing units and neither is perfectly inelastic in supply. Hence, following Poterba (1984), we expand the model to incorporate the use of both land and capital in the production of housing units.

Specifically, we assume a Cobb–Douglas function for the production of housing $H$,

$$H = K^aL^{1-a}$$  \hspace{1cm} (5.1)

where $K$ is housing structures and $L$ is land. In analogy to the discussion above, the supply of capital and land to the housing sector is determined by the valuation...
of these factors relative to their (exogenous) replacement cost. Specifically, if \( \varepsilon_K \) and \( \varepsilon_L \) are supply elasticities,

\[
\dot{K} = \phi (Q_K)K = Q_K^\varepsilon K, \quad \text{and} \quad (5.2)
\]
\[
\dot{L} = \psi (Q_L)L = Q_L^{\varepsilon L}L. \quad (5.3)
\]

Thus, the specification permits differential speeds of adjustment for the capital market and the land market.

To parameterize the model, we assume that \( \alpha \) is equal to 0.85, that \( \varepsilon_K \) is 0.8, and that \( \varepsilon_L \) is 0.2. The latter two assumptions are intended to capture the relatively slow adjustment of the land market compared with the market for capital goods. The implications of these assumptions are apparent in Fig. 10, which displays the impact of removing deductibility on factor usage in the residential housing market. As the figure shows, the quantity of capital inputs reaches the steady state value relatively quickly, while the use of land inputs adjusts much more slowly.

Interestingly, the initial impact of the tax reform is to raise the usage of land, a feature that may be traced to the factor price movements depicted in Fig. 11.
FIG. 10. Remove deductions—Baseline two-factor model stock movements.

FIG. 11. Remove deductions—Baseline two-factor model price movements.
In the aftermath of the tax reform, the asset price of land falls relatively more (1.9% versus 1.2%) than that for capital. *Ceteris paribus* producers shift to a more land-intensive mix of factor usage. Eventually, however, the overall contraction of the housing sector leads to less demand for both capital and land.

As before, however, the overall magnitudes of the shifts in prices and inputs are relatively modest, under 2%. The overall impacts are collected in Fig. 12, which shows the time path of the adjustment of the composite good “housing” and its price. Even with the inclusion of a more realistic specification of the production structure, this particular (partial) reform does not generate a large dislocation in the housing market.

The results of analogous simulations for the Flat Tax are depicted in Figs. 13–15. Beginning with the last, one finds that the two-factor housing model generates the same overall implications as those from our more parsimonious specification. Turning to the former figures, one sees that the Flat Tax generates the same short-run incentives to shift the mix of factor usage toward land and away from capital (Fig. 13).\(^\text{21}\) And, as captured by Fig. 14, the Flat Tax places upward pressure on the prices paid by producers of new housing.\(^\text{22}\)

\(^{21}\) This is hardly surprising, as the Flat Tax reform embodies the removal of deductibility.

\(^{22}\) The prices are gross of tax. Returns net of tax decline during the transition, providing the incentive to shift capital and land out of the housing sector.
FIG. 13. Flat tax—Baseline two-factor model stock movements.

FIG. 14. Flat tax—Baseline two-factor model price movements.
6. CONCLUSIONS

The implications of tax reform for housing markets are a difficult area of research. We explore the implications of one approach, namely, a numerical simulation model crafted to integrate the short-run and long-term impacts of tax reform on the housing market. We find relatively modest impacts from even fundamental reform of the Federal income tax. These results do not seem to suggest dramatic impacts on the housing market. The difference from other analyses may be traced to a modeling strategy that embodies forward-looking household behavior in the demand for housing services and housing assets. Or perhaps the difference is unsurprising. As Gale (1997) points out, the British tax system has steadily scaled back tax preferences for housing with essentially no noticeable impact on the housing market.

Of course, our analysis comes with several caveats. As with any simulation study, the results are dictated by the parameter values chosen; improved empirical guidance regarding some of the key parameters would be a valuable avenue for future research. In particular, much remains to be learned regarding the relationship between new construction and the valuation of existing houses. Second, our aggregate model is not capable of delineating important distributional effects, whether computed across individuals, across density of housing (urban versus suburban), or across regions. Finally, the model is partial equilibrium. While this permits one to focus on owner-occupied housing, it precludes understanding fully
the implications of the relationships between the market for owner-occupied housing, rental housing, and the economy as a whole.

REFERENCES


