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Essays on Capital Gains Taxes and Housing

Zachary William Richards
University of Tennessee - Knoxville

To the Graduate Council:

I am submitting herewith a dissertation written by Zachary William Richards entitled "Essays on Capital Gains Taxes and Housing." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Economics.

Donald J. Bruce, Major Professor

We have read this dissertation and recommend its acceptance:

Matthew N. Murray, William F. Fox, Mohammed Mohsin, Thomas P. Boehm

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Essays on Capital Gains Taxes and Housing

A Dissertation
Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Zachary William Richards
August 2009

Dedication

This dissertation is dedicated to my wife Jennifer, for she has sacrificed the most for its completion.

Acknowledgments

The completion of graduate school is the culmination of my life as a student, which has consumed the overwhelming majority of my 27 years. As such, there have been countless individuals who have shaped my life, both contributing to my successes and helping me overcome my failures. While a comprehensive list of all those people could comprise another entire dissertation, I will take the opportunity here to express my gratitude to those who have contributed the most.

A disproportionate amount of thanks goes to my parents, Cheryl and James Richards, without whom I would not be the person I am today. Their unwavering love and support has been the foundation for all of my accomplishments, for which they can never be fully repaid. My wife Jen also deserves a great deal of thanks. She has continued to provide an unending flow of encouragement and has been my most treasured friend through life's ups and downs, both personal and academic. Without her, my successes would be joyless and my failures more painful.

I also owe a debt of gratitude to a long list of educators who have prepared me for my professional life, especially those at the University of Tennessee. Don Bruce has been a trusted advisor and friend, a role model of the highest regard, and an invaluable ally. No single person is more responsible for my growth as an economist. Matt Murray and Bill Fox have also been instrumental in my development. I am grateful to them for sharing their wealth of knowledge and I value our many conversations over the past several years. My dissertation has also benefitted from the contributions of Mohammed Mohsin and Tom Boehm. In general, I am extremely fortunate to have worked so closely with people of such great character and can only hope to live up to the examples they have set.

Lastly, I would like to express my appreciation for the rest of my family and my friends. My brother, grandparents, and various aunts and uncles have all touched my life in countless ways and have never ceased providing support. I will always treasure the friends and colleagues I have gained along the way, particularly Bryan Shone, with whom I've shared victories, frustrations, offices, and apartments for the better part of the past decade. I have also shared many wonderful times and conversations with Steve Cotten, Ken Baker, Brian Hill, Laura Ullrich, Kara Mitchell, and Martin Tackie. I hope to continue those friendships for years to come. The bonds one forms in graduate school are unique and I consider myself extremely lucky to have experienced them.

Abstract

This dissertation is a collection of three essays regarding the effects of federal taxation of residential capital, with a focus on owner-occupied housing. Owner-occupied housing is granted a number of tax subsidies under the federal individual income tax code. Among them are the mortgage interest and property tax deductions and the tax exclusions on imputed rental income for the homeowner and capital gains from the sale of a primary residence.

In the first essay, entitled "Does the Exclusion of Capital Gains Taxes on Housing Promote Labor Mobility?", I examine the impact of the Taxpayer Relief Act of 1997 (TRA97), which dramatically reduced effective tax rates on residential capital gains, on the liklihood of a homeowner undertaking a job-related relocation. The results indicate that homeowners with large accrued gains are more likely to move for job-related reasons after the passage of TRA97 than before, implying efficiency gains from a spatial reallocation of labor.

In the second essay, "The Effects of EGTRRA and JGTRRA Expiration on the User Cost of Housing", I calculate last-dollar user costs for owner-occupants using an augmented model that incorporates the current tax exclusion of residential capital gains. User cost calculations are made under current and future policy to determine the effects of higher marginal income and capital gains tax rates on the costs of homeownership. The results indicate that the expiration of the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA) and the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA) will have a regressive effect on user costs, with high-income homeowners receiving the largest percentage reductions despite higher long-term capital gains tax rates.

The final essay, "Residential Capital Gains Taxes and the Dynamics of Housing Markets", examines the macroeconomic implications of TRA97. I present evidence that a structural break occurred around the time of its implementation, affecting the relationship between aggregate measures of the housing market, money growth, and output. This suggests that effective tax rates on

residential capital gains play an important role in the fluctuations of residential fixed investment and may alter the impacts of monetary policy.

Contents

List of Tables

List of Figures

Chapter 1

General Introduction

Homeowners have enjoyed preferential tax treatment under the federal individual income tax code for decades, with deductions allowed for mortgage interest and property taxes paid as well as generous tax exclusions on imputed rental income for the homeowner and capital gains from the sale of a primary residence. A lengthy literature has evolved examining the effects of these policies, particularly with respect to their distribution across groups of homeowners and the ways in which they affect homeowner behavior. While the mortgage interest and property tax deductions have been the subject of the bulk of previous research, the effects of the taxation of residential capital gains have not been examined to the same degree.

Nonetheless, the effects of capital gains taxes in general on individuals are interesting to economists for a number of reasons. First, they can provide strong incentives for owners of assets to hold them since taxes are only levied upon realization rather than as they accrue over time. Numerous studies have shown that agents make strategic transaction decisions in order to avoid or minimize tax liabilities. Second, capital gains taxes have the potential to influence the allocation of capital across asset types. If certain classes of capital assets, such as owner-occupied housing, are granted tax preference, then equilibrium capital allocation could change. Third, they can differentially affect individual welfare to the extent that groups of individuals accrue different levels of gain and/or face different tax rates on gains.

Events of the past several years have vaulted housing market issues into the national and international limelight. Most notably, the U.S. experienced an historic rise in home prices beginning in the late 1990s and ending around late 2006, creating trillions of dollars of household wealth and generating billions of dollars of accrued capital gains. During this time, several significant federal tax bills were passed that directly affect the taxation of these gains. The Taxpayer Relief Act of 1997 (TRA97) expanded the capital gains exclusion on primary residences, allowing all homeowners to exclude up to $500,000 of gain from taxation, subject to a few constraints. The Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA) and Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA) lowered tax rates across the board, including those on capital gains.

The chapters that follow each focus on one aspect of residential capital gains taxes. Chapter 2 highlights the fact that taxes on accrued residential gains may keep homeowners locked in to their current residences, discouraging them from taking new jobs that require moving from one home to another. I find evidence that TRA97, through its reduction of tax-related housing transaction costs, increased homeowner mobility for those with larger levels of accrued gains. Chapter 3 examines the distributional aspect of housing-related income tax subsidies. I show that higher long-term capital gains tax rates, as would be the case after the expiration of EGTRRA and JGTRRA at the end of 2010, increase the user cost of owner-occupied housing but that higher marginal tax rates reduce user costs by a larger amount. Overall, the expiration of these bills will have a regressive effect on the user cost of housing, with larger reductions for higher-income households. Chapter 4 steps back from individual homeowners and attempts to examine key relationships between the aggregate U.S. housing market and the macro economy. I find evidence that TRA97, by increasing the after-tax return to owner-occupied housing, may have fundamentally altered many of these relationships, particularly that between home prices and residential investment.

Chapter 2

Does the Exclusion of Capital Gains Taxes on Housing Promote Labor Mobility?

Abstract

Taxes on gains realized from selling a primary residence represent a significant transaction cost on homeowners wishing to change their housing consumption or take a job in another labor market. Since the tax is only generated upon sale, it can be easily avoided by simply choosing not to sell. A number of previous studies have examined these lock-in effects. However, the literature has focused on either the lock-in effects on capital or on general homeowner mobility. The effects of capital gains taxes on labor mobility are relatively unknown. Prior to 1997, all homeowners could avoid tax by buying more expensive homes while older homeowners could decrease housing consumption and still exclude up to $125,000 of gain from tax. The Taxpayer Relief Act of 1997 (TRA97) eliminated the rollover provision but expanded the exclusion to up to $500,000 of gain and made it available to all homeowners. This paper investigates the extent to which the broad reforms contained in TRA97 affected household labor mobility decisions. Using the tax changes as a quasi-experiment, a survival model of house tenure is estimated using Panel Study of Income Dynamics data from 1990 to 2005. Results indicate that households with relatively large gains were more likely than those with lower gains to undertake a job-related move after TRA97, but not before, suggesting that TRA97 reduced tax-related mobility barriers for some households.

2.1 Introduction

Capital gains taxes have always been a topic of interest due to the incentives they create, most of which result from the ease with which they are avoided. In the U.S., taxes are levied only when gains are realized, as opposed to as they accrue over time. Therefore they can be postponed indefinitely by simply holding on to the asset. This creates a "lock-in" effect, as owners of assets avoid selling these assets when it would otherwise be optimal to do so. Capital might thus be inefficiently allocated. Lower capital gains tax rates reduce this incentive and potentially unlock accrued gains, allowing capital to be reallocated among other assets. One such asset subject to capital gains taxation is residential capital.

For more than the past half-century, gains from the sale of a primary residence have been subject to favorable treatment. Current federal tax law, effective since the passage of the Taxpayer Relief Act of 1997 (TRA97), allows homeowners to exclude up to $500,000 of gain once every two years. This provision is estimated to cost between $30 and $35 billion in 2009.[1] Previous law allowed

[1] Based on tax expenditure estimates from the Joint Committee on Taxation and the Office of Management and

only older homeowners, those aged 55 and above, a one-time exclusion of up to $125,000. However, all homeowners were able to delay paying tax if they rolled the gain from a previous home into a new home of equal or greater value. Evidence suggests that the rules instituted in 1997, which generally lowered effective tax rates for many groups of homeowners, increased overall mobility of homeowners since most could move from home to home without incurring tax.

A considerable amount of research exists on the lock-in effects of capital in general and, to a lesser extent, residential capital in particular. Residential capital gains taxes are particularly interesting due to their potential to lock in labor as well as capital. Since a homeowner's potential job opportunities are typically limited to the labor market in which his home is located, delaying or avoiding the sale of that home in order to minimize his tax burden not only locks capital into the current home but may lock him in to a specific geographic area. Other more productive job opportunities may exist in different labor markets, but pursuing those would require relocation that involves selling the current home. In this way, residential capital gains taxes may represent a significant transaction cost and provide a barrier to labor mobility. While the results of some studies suggest that capital gains taxes may reduce the overall mobility of homeowners (Farnham, 2006; Biehl and Hoyt, 2009; Cunningham and Englehardt, 2008), no study explicitly models the influence of the tax on the propensity of individuals to undertake job-related relocation.

This paper attempts to address this gap in the literature. The replacement of the rollover provision with a broadened exclusion in 1997 serves as somewhat of a natural experiment, allowing for a comparison of household labor mobility patterns across tax regimes. For the baseline analysis, I construct spells of housing tenure using the Panel Study of Income Dynamics for years 1990-2005. Homeowner move-out hazard functions are then estimated to determine the effect of TRA97 on the propensity of individuals to relocate for job-related reasons. In order to facilitate comparisons with previous studies, I also estimate probit and logit models for general homeowner mobility and job-related mobility. Results indicate that TRA97 may have unlocked labor through its expansion of the exclusion of residential capital gains from tax. Homeowners with relatively large gains were more likely than those with lower gains to undertake a job-related move after TRA97, but not before.

The remainder of this paper continues as follows: Section 2.2 outlines the current capital gains tax treatment of owner-occupied housing, along with a brief history. Section 2.3 outlines the theoretical effects of residential capital gains taxes on mobility and the way in which TRA97 might

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Budget.

have altered homeowner behavior. Section 2.4 reviews the previous literature on the effects of capital gains taxation on homeowners. Sections 2.5 and 2.6 present the empirical specification and describe the data used in the analysis. Section 2.7 discusses the results and Section 2.8 contains concluding remarks.

2.2 History of Residential Capital Gains Taxes in the U.S.

Section (§) 1034 of the Internal Revenue Code (IRC) of 1951 first gave capital gains from owner-occupied housing preferential treatment. This statute allowed all taxpayers, regardless of age, to defer all of the gains from the sale of their homes as long as they purchased another home of equal or greater value to their old home within two years. Thus taxes on capital gains could be deferred forever, so long as the homeowner continued to "trade up" until death.

The Revenue Act of 1964 created IRC §121, supplementing the benefits provided in §1034 and expanding the tax preference for owner-occupied housing. It allowed taxpayers aged 65 and older to exclude the entire gain from the sale of their primary residence, as long as the sale price was $20,000 or less and the home served as their primary residence for at least five of the eight years prior to the sale. Under §121, a taxpayer could only use the exclusion once in his or her lifetime.

Section 121 has undergone many changes since 1964. The Revenue Act of 1976 increased the maximum sale price from $20,000 to $35,000 to allow for normal home price appreciation. The Revenue Act of 1978 removed the price limit and instituted a one-time exclusion of up to $100,000 of gain. In 1979, the residency requirement was reduced to three out of the five years preceding the sale of the home. The Economic Recovery Act of 1981 lowered the age requirement by 10 years, from age 65 to 55, and increased the one-time exclusion from $100,000 to $125,000.

The Taxpayer Relief Act of 1997 significantly changed the capital gains treatment of owner-occupied housing in several ways. First, it repealed §1034, eliminating the rollover option. Second, it increased the exclusion contained in §121 to $500,000 and $250,000 for married and single filers, respectively. This essentially exempted all capital gains from taxation, since in 1997 only 2 percent of home sales occurred at prices above $500,000.[2] In order for a taxable gain to occur, the sales price would have to be significantly higher than that and the house must have experienced significant appreciation since its purchase. Third, it made the exemption available to taxpayers of all ages,

[2] Richard Woodbury, 1997. Statement to the House Committee on Ways and Means. Savings and Investment Provisions in the Administration's Fiscal year 1998 Budget Proposal, Hearing, March 19, 1997 (Serial 105-43). Available at: http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=105_house_hearings&docid=f:48616.pdf; Last accessed: 7/16/08.

not just those 55 and older. Fourth, it decreased the residency requirement to two years out of the previous five.[3] There is no limit to the number of times a taxpayer may claim this exemption throughout his or her lifetime. The only restriction is that it may be used only once every two years, as constrained by the two-year residency requirement. Lastly, TRA97 lowered capital gains tax rates, discussed below. These changes took effect on May 6, 1997. Other than tax rates, there have been no changes regarding the capital gains taxation of housing since TRA97. Thus, these rules are currently in effect as of 2008.

The repeal of the rollover provision reduced the incentive to continually buy more expensive housing at every move. However, younger homeowners were able to take advantage of the exclusion for the first time while older homeowners were subject to a larger exclusion than they had previously enjoyed. This eliminated the incentive to wait until age 55 to realize gains. Essentially, TRA97 lowered the effective tax rate to zero for almost all homeowners that wanted to move and end up in less expensive houses. However, repeal of the rollover raised effective tax rates for those with gains above the exclusion since they could have avoided tax by trading up under the old tax regime.

Capital gains tax rates have changed several times over the past two decades. Long-term rates typically apply to assets held longer than one year and are lower than those on ordinary income. Assets held for less than one year are taxed at ordinary income rates.[4] The vast majority of home sales occur long after one year of ownership. Absent the exclusion, that means any gains are taxed at long-term rates. From 1988 to 1996, the top tax rate on long-term capital gains was 28 percent. TRA97 lowered it to 20 percent, where it stayed until 2003. The Economic Growth and Tax Relief Reconciliation Act (EGTRRA) of 2001 and the Jobs and Growth Tax Relief Reconciliation Act (JGTRRA) of 2003 lowered the maximum rate to 15 percent. Currently, any long term gains in excess of the exclusion are taxed at 5 percent for those taxpayers in the 15 percent marginal income tax rate bracket or below and 15 percent for those in higher brackets. However, EGTRRA and JGTRRA will sunset in 2011 if they are not extended and rates will revert back to pre-2003 levels.

In some special cases, homeowners who have not lived in the home for a total period of two years out of the previous five (thus not fulfilling the residency requirement) may qualify for a partial exclusion. If the homeowner can show that the sale of the home was necessitated by either a change

[3]This residency requirement applies to the sum of all residence spells within the last five years. For example, a homeowner could live in the home for 18 months, move out for the next two years, and move back in for another 6 months. His total length of residency over the prior five-year period is 24 months, or 2 years, thus making him eligible for the full exclusion.

[4]There were three asset classifications from July 1997 to July 1998. As is typical, short-term gains were generated from assets held less than one year. However, gains from assets held between 12 and 18 months and longer than 18 months had separate rate schedules.

in the place of employment, health reasons, or certain other unforeseen events, his is able to apply a pro-rated exclusion. For these individuals, the exclusion is calculated as the number of days the house was used as a residence divided by 730, times the amount of the exclusion.[5] For example, a single homeowner who sells his home as a result of switching jobs after residing in the home for 550 days would not owe any tax on gains up to $188,356. He would owe tax on any gain above that amount. Due to the relatively large exclusion and short residency requirement, it's likely that even a pro-rated exclusion is large enough to eliminate tax liability for homeowners who sold under these circumstances.

Although the nominal exclusion amount has not changed since 1997, very few home sales generate a taxable gain. According to the most recent IRS Sales of Capital Assets data, there were only 137,000 sales of residences that resulted in taxable long-term gains in 1999. Applying this to National Association of Realtors data on existing home sales for the same year, one learns that this represents only 2.6 percent of total sales. After considering the rapid home price growth over the past decade, the share of sales which are taxable is likely to have increased substantially. It is also likely that a significant share of homes are approaching this threshold. However, the recent nationwide depreciation in housing markets has tempered upward pressure on the number of homes sold that are subject to tax.

2.3 Residential Capital Gains Taxes and Mobility

Since capital gains are taxed only upon realization and not as they accrue, taxpayers can avoid paying tax by simply not selling. This may lead homeowners to stay in their current homes, even when it would be otherwise optimal not to do so. For example, many homeowners purchase large homes in which to raise a family. After the children leave home, the homeowners may desire to decrease their housing consumption by selling the home in order to purchase a smaller or less expensive home (or to become renters). Thus, capital gains taxes are expected to reduce the number of asset transactions as owners of assets postpone realizing the gains in order to avoid having to pay tax.

Homeowners may wish to use the proceeds of the sale to finance consumption, increase their liquidity or reallocate their asset portfolios, freeing up capital to invest in other assets with potentially larger returns. Capital gains taxes and the ease in which they are avoided discourage

[5] 365 days/year x 2 years = 730 days

homeowners from engaging in such "unlocking" behavior, keeping capital in inefficient allocations. These distortions affect both the household and the overall economy, where the resources could be put to other productive uses. This is typically known as the lock-in effect.

The theoretical effects of residential capital gains taxes are particularly interesting due to the unique exclusion and rollover rules. As tax rates rise and/or gains accrue, homeowners become locked into their current homes by delaying or forgoing sale. Thus, residential mobility is expected to decrease as capital gains taxes rise. This creates inefficient matches between homes and homeowners to the extent that the tax causes the homeowners to avoid moving when it would otherwise be optimal to do so.

Before 1997, younger homeowners were only able to avoid paying tax on residential gains by rolling the gain into a larger home. If not, all realized gains were taxed. This provided incentive for homeowners to remain in their current homes or "trade up" by buying increasingly more expensive houses, locking them in to their current housing situation. Since they could exclude most or all gains once they turned age 55, the lock-in was magnified as the homeowner came closer to age 55. Similarly, older homeowners who had already used their one-time exclusion were also locked in to their current homes.

All else equal, owners of more expensive homes are more likely to be locked-in since their homes are likely to produce larger tax bills at sale. That is, with equal rates of appreciation over identical time periods, a more expensive home will generate a larger nominal gain, upon which the tax is levied. Consider the following example: Home A is purchased for $300,000 and appreciates at an average annual rate of 4 percent for the next 10 years. It is then sold for $444,000. The sale, therefore, generates a gain of $144,000. If the homeowner's capital gains tax rate is 20 percent, the sale results in a tax bill of $28,800. Home B is purchased for $150,000, and appreciates at the same 4 percent average annual rate. It is also sold after 10 years for $222,000. The gain is therefore $72,000. Assuming the same 20 percent tax rate, the amount due is $14,400, half that of the more expensive home. Each homeowner is faced with a different tax if he decides to move, generated solely by the different initial purchase prices of the home.

The only difference between Home A and Home B was the purchase price. However, they generated significantly different tax bills upon sale. More expensive homes are more likely to generate taxable gains since they will have larger absolute gains and the exclusion is a fixed dollar amount. Given the above example, an exclusion will reduce the tax burden of the homeowner (in absolute dollar terms) with the more expensive home more than for the other homeowner. By allowing all homeowners to exclude virtually all of their gains, TRA97 would be expected to release from lock-in those with more expensive homes and larger gains, with stronger effects as home prices and gains increased.

Like capital, labor may also be locked in to inefficient allocations as a result of capital gains taxes on houses. The taxes may impose a cost on those who move as a result of changing job circumstances in addition to the other costs associated with moving. This barrier causes labor to be employed inefficiently to the extent that the tax discourages the marginal worker from switching to a job that entails moving to a new residence. This effect has been the subject of a remarkably small amount of literature. This paper attempts to provide insight into potential labor lock-in.

It has become increasingly common for individuals to change jobs several times throughout the course of their working lives. Often times, the switch requires a worker to move to a new geographical area or relocate within the same labor market. To the extent that an individual's home has appreciated beyond the exclusion and the new job causes the homeowner to sell his home, capital gains taxes may pose a significant transaction cost. Faced with the prospect of a large tax bill, an individual may choose not to pursue another job opportunity if it were to require relocation. Thus, an individual may remain employed with a firm or in an industry that does not make the best use of his skills. This decreases both the household's earnings potential and overall economic efficiency. These workers would be tied to a particular job and/or region based on tax policy instead of market forces.

Workers in areas that have experienced particularly rapid real estate appreciation, had high home prices initially, or underwent significant shifts in the local mix of industries would be especially locked in geographically. Rising home values increase both the probability of a sale resulting in a taxable gain and the size of the gain that is subject to tax. Similarly, as described above, homes in high-priced areas are more likely to generate expected taxable gains, even if the rate of price appreciation is more modest. In addition, an area that is experiencing an underlying shift in the type of economic activity located there will have a disproportionally high number of workers wishing to move in or out of that area, depending on their skills. For example, the recent shift of automobile production from the Great Lakes region to the southeast may cause auto workers to want to move out of Michigan, whether it be to Tennessee to continue employment in the auto industry or to another state with industries that reward their skill set.

This paper examines the extent to which TRA97 affected labor mobility through its change in the taxation of residential capital gains. Replacing the rollover provision with a broad exclusion available to all homeowners may have altered the tax-based transaction cost, influencing the probability that an individual pursues job opportunities that require moving. A 2007 Congressional Research Service report outlined the benefit of the rollover provision:

> "One of the important reasons for having some type of [capital gains tax] relief is to minimize the barriers to labor mobility. In order to have an efficient market economy that can respond to changes in tastes and technology, it is important to have as few barriers to labor mobility as possible. This consideration was reflected in the rationale for the rollover provision enacted in 1951. Americans' taste and preference for owning their own homes inevitably creates barriers to a willingness to relocate, barriers that cannot be avoided. But imposing capital gains tax at sale adds to that barrier."[6]

It appears that minimizing the tax burden associated with labor mobility is an explicit policy goal. The current exclusion results in a tax expenditure in excess of $30 billion. It seems appropriate to test whether or not the broad exclusion implemented by TRA97 increased labor mobility relative to the rollover provision of the previous tax regime.

2.4 Literature

Several studies have examined the lock-in effects of capital gains taxes, typically through estimating the relationship between tax rates and gain realizations. Feldstein et al. (1980) and Auerbach (1988) show that decreasing capital gains tax rates significantly increases realization of gains as individuals sell their assets. Eichner and Sinai (2000) use more recent data to arrive at the same conclusion. Their results also suggest that the Taxpayer Relief Act of 1986 (TRA86) increased the responsiveness of capital gains realizations to tax rates. This suggests that taxes levied upon realization of gain do indeed have lock-in effects on the holding of capital.

While most research focuses on sales of corporate equities, a few studies look specifically at the effects of capital gains taxes on housing consumption decisions that may lock homeowners into their current houses. Hoyt and Rosenthal (1990) show that taxes on realized gains create kinks in a household's budget constraint and that failing to account for them may yield biased estimates of housing demand elasticities. However, Hoyt and Rosenthal (1992) found that demand elasticities estimated from a model that accounted for capital taxes were not statistically different

[6] Gravelle and Jackson (2007)

than estimates from models that did not. However, their results do indicate that housing demand would fall by about 15 percent if households were not able to delay tax by "buying up."

Burman et al. (1996) estimate that the rollover provision previously contained in §1034 caused between 4 and 11 percent of home sellers to avoid tax by purchasing a home rather than renting, buying more expensive housing than they otherwise would have, and/or waiting to sell their homes until their tax burden was lower. Alternatively, Newman and Reschovsky (1987) find no evidence that the one-time exclusion for older homeowners effective at the time encouraged housing downsizing among those aged 65 and older, although their results suggest that it substantially increased mobility for those aged 55-64.

The studies mentioned above indicate that extensive reforms to the taxation of residential capital gains, such as those contained in the Taxpayer Relief Act of 1997, could have significant unlocking effects. For most homeowners, TRA97 drove the effective tax rate to zero on realized gains. The differences between the pre- and post-1997 policy regimes has prompted the development of a relatively small line of literature on the effects of TRA97 on the mobility of homeowners.

The first such paper, by Bier et al. (2000), found very little evidence that homeowners moved into less expensive houses following the passage of TRA97, although the authors were not able to determine statistically if this response was due to the capital gains tax changes. This result may be due to their limited dataset (four Ohio cities) and short time horizon (17 months after the tax change). More recently, Biehl and Hoyt (2009) and Cunningham and Englehardt (2008) examine the impact of TRA97 on the propensity of some homeowners to decrease their housing consumption (which can only be achieved by selling the current home and purchasing another). Both studies, using different data, find evidence that groups of homeowners that were most likely to desire less housing were more likely to decrease their housing consumption after 1997 since TRA97 eliminated the asymmetric treatment between buying up and buying down. These results suggest that TRA97 had significant impacts on residential transactions, since greater homeowner mobility indicates more frequent adjustments in housing consumption and more home sales. Shan (2008) finds evidence of this in Boston, concluding that TRA97 increased the average sales rate of homes with less than $500,000 gain by 13 to 22 percent.

These studies use standard probit and logit models to identify changes in homeowner mobility. Farnham (2006) argues that these models will lead to upwardly biased estimates on mobility because they fail to account for the negative correlation between accumulated gains and mobility implied by the positive correlation between gains and the length of housing tenure. To deal with this issue, he takes a survival analysis approach, estimating moveout hazards for various groups of households. His results are consistent with other studies, finding evidence of lock-in release of homeowners after 1997. Specifically, he finds that homeowners with larger accumulated gains are at a higher risk to move out under the current policy regime and that moveout hazards increase with accumulated gains after 1997.

These studies conclude that residential capital gains taxes lock homeowners into their current houses by discouraging moves. However, potential efficiency gains resulting from TRA97 implied by their results are limited to the unlocking of capital since they focus on general homeowner mobility or the propensity for homeowners to trade down, freeing up resources. Thus far, the literature has not explored the unique role that residential capital gains taxes may play in limiting the flow of labor across markets. Since homeowners are likely tied to their home market, the conclusions drawn from the empirical literature only suggest that such taxes may impede labor mobility. This paper attempts to complement the existing literature by specifically addressing potential labor lock-in.

2.5 Empirical Model

As its home appreciates and capital gains accrue, a household faces an increasing cost of moving. Households may be locked in to their current home, preventing them from moving to pursue other job opportunities. To model the relationship between the potential tax liability and length of time the household lives in its home, I follow Farnham (2006) and estimate survival models of housing tenure for the baseline analysis, exploiting the exogenous shift in tax treatment from TRA97.

Since individuals continually assess their employment status and may move at any time, the decision of when to move becomes critical. Survival analysis allows for the study of this timing decision using information on the characteristics of both households that choose to move and those that do not. For this reason, a survival model approach was chosen as the baseline. I estimate both a semi-parametric survival model developed by Cox (1972) as well as several fully-parametric models. As checks against the conclusions drawn from the results of these survival models as well as to facilitate comparisons with previous studies, I also estimate probit and logit models for both overall and job-related mobility.

In this type of analysis, the survival function is defined as the probability of "surviving" beyond some specified time. Alternatively stated, it is the probability of that some "failure" occurs after some specified time. In this application, a failure occurs when a household moves from its current residence for a job-related reason, typically when the head of household or other family member takes a new job or relocates for a current employer. Mathematically, the survivor function is:

$$S(t) = Pr(T > t) \tag{2.1}$$

where $S(t)$ denotes the survivor function, T is the time of the job relocation, and t is the current time. The probability density function of T is given by:

$$f(t) = \frac{d}{dt}[1 - S(t)] \tag{2.2}$$

The hazard function, denoted $\lambda(t)$, is defined as the rate of probability of failure (any job-related relocation) immediately after time t, given that it has survived (not undertaken a job-related move) up to that time:

$$\lambda(t) = \frac{f(t)}{S(t)} = lim_{\Delta t \to 0} \frac{Pr(t \leq T \leq t + \Delta t | T > t)}{\Delta t} \tag{2.3}$$

In most empirical applications, it is assumed that every subject faces a hazard that is a function of the hazard faced by all subjects, or baseline hazard, differing according to individual-level covariates. In this paper, I assume that each household's job relocation hazard is proportional to the baseline hazard. Specifically, I use the proportional hazard model developed by Cox (1972):

$$\lambda(t|x_i) = \lambda_0(t)e^{x_i \beta} \tag{2.4}$$

where λ_0 is the baseline hazard, e is the exponential function, x_i is a vector of household-level explanatory variables, and β are the coefficients to be estimated. Each household's hazard function will shift proportional to the baseline hazard according to its own values of x, including its capital gain. With some manipulation, a linear version of the model can be written as:

$$ln \left[\frac{\lambda_i(t)}{\lambda_0(t)}\right]_{it} = \sum_{k=1}^{m} \beta_k x_{ikt} \tag{2.5}$$

The Cox model was chosen because it requires no assumptions to be made regarding the shape of the baseline hazard, $\lambda_0(t)$. Other proportional hazard models require an assumption that may or may not be valid. The benefit of those models is that, if the parametric assumptions are correct, they will yield more efficient results. However, if the parametric assumptions are incorrect, they could yield biased estimates.

In order to capture the potential unlocking effects of TRA97 on labor-related mobility, I borrow an approach from Farnham (2006), using a dummy variable to indicate the current tax regime and interact it with the household's level of real accumulated gains. I assign the dummy variable a value of 1 for all observations that occur June, 1997 or later.[7] All observations before that time are given a value of zero. This variable will capture any average lock-in release caused by TRA97.

The policy dummy is interacted with each household's calculated real accumulated gain. Households with larger real gains would have faced larger tax burdens before 1997. If these households experienced stronger lock-in under pre-1997 rules, then this interaction will capture the magnitude of that lock-in release as those households are now able to undertake job-related moves.

Including the policy variables in a simplified version of Equation (2.5) gives the empirical model to be estimated for homeowners:

$$h_{it} = \beta_1(TRA97_{it}) + \beta_2(Gains_{it}) + \beta_3(TRA97_{it} * Gains_{it}) + \sum_{k=4}^{m} \beta_k x_{ikt} + \epsilon_{it} \tag{2.6}$$

where h_{it} is the log of the ratio of household i's hazard at time t to the baseline hazard (herein referred to as the hazard ratio), or $ln\left[\frac{\lambda_i(t)}{\lambda_0(t)}\right]_{it}$. The vector of control variables denoted by x includes demographic, income, and geographic variables that may affect labor mobility decisions and vary across household and time. These variables, such as age, education, gender, race, and household composition were chosen based on the lengthy literature on the determinants of household mobility, much of which draws on the human-capital migration models of Sjaastad (1962) and Bowles (1970).[8] ϵ_{it} is the stochastic error term. This is the same empirical specification employed by Farnham (2006), with small differences in the choice of some explanatory variables and the data used in the estimation. The primary difference here is the way in which the data are defined and the focus on job movers rather than those who move for any reason.

While the semi-parametric specification of the Cox model allows the shape of the baseline job-related moveout hazard faced by all households to be estimated from the data itself without having to impose any shape *a priori*, it is also useful to compare the results with models estimated using a pre-determined baseline hazard. I estimate three models similar to that in Equation (2.6) except that h_0 is assumed to follow an exponential, Weibull, and Gompertz distribution.

[7]TRA97 went into effect May 6, 1997. It is likely that most mobility responses didn't occur for some time after the change, as changing jobs and homes involves a significant amount of planning. The complete process from deciding to move through the actual move may take several months.

[8]These variables will be discussed in further detail in the next section

Many of the studies discussed in Section 2.4 use probit and logit models to estimate the probability of a move occurring after any given observation. Although I believe the survival approach lends itself nicely to the study of the effects of accrued taxable gains on homeowner mobility due to the fact that it explicitly incorporates the timing aspect of the mobility decision, I also estimate similar models under a variety of specifications. First, I estimate probit and logit models with random effects for job-related mobility where the dependent variable is assigned a value of 1 if the homeowner is observed to have undertaken a job-related move and 0 otherwise. I then estimate similar models for overall homeowner mobility where the dependent variable is assigned a value of 1 if the homeowner is observed to have moved for any reason.

The identification of the effect of the tax treatment on accrued housing gains is the same as in the survival model discussed above, using the TRA97 policy dummy and interacting it with the level of anticipated accrued gain. Each of these models is estimated twice, once controlling for the time the homeowner has already spent in the home and once without the tenure. The results obtained from these models can be compared to those obtained from the survival models as well as those in previous studies to check for the robustness of the baseline results.

2.6 Data

In order to measure the effects of residential capital gains taxes on labor mobility, three pieces of information are necessary. First, the amount of gain must be able to be determined. This requires information on the current value of the home and the purchase price. Second, patterns of mobility must be observed, including the nature of moves (i.e. job-related). This requires a dataset that follows individuals across moves (and thus time) and provides information on why the individuals have chosen to move. In addition, since household demographics may affect job-related mobility, the inclusion of this information is extremely useful. While I am not aware of any dataset that perfectly captures the mobility and housing capital gains of households across time, the Panel Study of Income Dynamics (PSID) contains enough data to simultaneously observe residential capital gains and model mobility decisions of households. Third, there must be exogenous variation in the tax treatment of capital gains. The PSID spans several legislative changes to capital gains taxes, including TRA97, capturing the policy-related variation necessary for empirical analysis.

Beginning in 1968, the Panel Study of Income Dynamics is a longitudinal survey of a nationally representative sample of households. It was conducted annually until 1997, after which it became biennial. The PSID has a relatively high reinterview response rate, consistently above 95 percent. It contains detailed information on demographics and family composition as well as income and mobility. In particular, homeowners are asked to estimate the current value of their home. Most important to this study is that it follows households across moves, asking questions regarding the time of the move and the reason it was undertaken. Among the possible reasons are to take another job or job transfer and to move closer to work. Due to the structure of the panel and its high resampling rate, most households are observed to live in several different residences.

Since the PSID follows individuals across moves, spells of housing tenure can be constructed. Since survey waves are given at most once every year, moves are not observed until one survey wave after they occur. Any household that has moved since the last wave of the survey in which they participated (either one or two years) is asked for the month and year of the move. If a household has indicated it moved since the last survey wave, I denote the month of that move to be the beginning of the current housing spell. The household is assumed to remain in that residence as long as it does not indicate a move in subsequent surveys. If that household should indicate another move, then the month of that move marks the end of the first spell and the beginning of another.[9] The process continues until the household exits the survey or the end of the sample period is reached.

The beginning of a household's first observed housing spell is often unknown. When a new household enters the sample, the first survey wave for that household contains slightly different information on recent moves than indicated above. Whereas households present in prior waves are asked if they have moved since the date of the last survey, new households are only asked whether or not they have moved within the past year. For those that have, the beginning of the current housing tenure can be defined as the date of the move. However, if they have not moved within the past year, then the date they began their current housing spell is unknown.

Similarly, the ending of a household's last observed spell is never known. Since the conclusion of a spell is only observed after it has already ended, a subsequent observation for the household is required to define the time it ends. There are no additional observations once a household leaves the sample or the end of the sample period is reached. Thus, the full tenure length of a household's last observed housing spell cannot be known. In other words, these spells are right-censored, with

[9] Implicit in this definition of housing spells is the assumption that the household moved into its current residence the same month that it moved out its previous residence. While it is possible for multiple moves to have occurred between surveys, only the latest move is observed and recorded. As constructed, my dataset would treat such instances as one move. To the extent that this occurs, the calculated tenure length is upward biased since any time a household spent in an unobserved residence is allocated to the end of the previous observed spell.

an observed beginning and no observed end.

To summarize, for a household that was known to live in n different residences throughout the survey, n-1 complete housing spells are observed if the household has moved in the year prior to its first observation. If it had not moved within the year prior to its first survey wave, then n-2 complete housing spells are observed. For either case, one right-censored spell is observed.

What makes this study different from others is its focus on labor mobility rather then general household mobility. The ability to analyze the behavior of job switchers depends on the ability to determine the reason moves occurred. Fortunately, the PSID contains this information. Those individuals who indicate a recent move are asked to give the primary reason it was undertaken. The responses are classified into different categories. One such category is "purposive productive reasons." This includes taking another job, job transfer, and stopped going to school. This question allows me to determine why each housing spell ended, whether it was labor-related or not. In the context of the survival model I estimate, this defines a failure.

For estimation purposes, each household becomes at risk for failure at the beginning of the first complete observed housing spell. That is, the household may undertake a job-related move at any time after this point. Since workers often relocate several times, I allow for each household to have multiple failures over the time period they are observed. These households become at risk again the month they move into the new residence and begin another spell.

As mentioned above, determining a homeowner's capital gain requires knowledge of the value of the home and the price for which it was purchased. Unfortunately, while the PSID does ask the homeowner the current value of his home, it does not include the purchase price. However, it can be reasonably imputed using other housing variables contained in the survey.

If a household is observed to have moved since the last survey wave, the purchase price of the new home is estimated by adjusting the home's value reported at the interview date to capture any accrued gains or losses that may have occurred since the date of purchase. The adjustment is made using a national home price index reported by the Office of Housing Enterprise Oversight (OFHEO). These adjustments are relatively small given that the home value is reported at most two years after its purchase.[10] In many cases, the interview is conducted within several months of the purchase. Although this estimate is unlikely to precisely calculate the purchase price of any given home and it is likely to be less accurate the longer the time between the home's purchase and the owner's first subsequent interview, there is no reason to believe that this method will

[10]This would only occur for observations after 1997, when the PSID became a biennial survey.

produce systematically biased measures of the purchase price. Gains are then calculated as the difference between the reported value of the home, which is asked every survey wave, and the imputed purchase price. As such, it is a measure of accrued gains rather than realized gains.

Since this gain measure is based on the homeowner's judgment of his home's value and not the actual market value, it can be thought of as an anticipated gain. Since most homeowners' decisions regarding moving likely occur before any actual move takes place, only the anticipated gain can be factored into the decision. Thus, for the purposes of this study, I argue that it is an appropriate measure.

It is important to realize that for the purposes of computing tax liability, actual accrued gains may differ systematically from this calculation. First, homeowners are able to adjust their cost basis for the purpose of calculating taxable gains to account for any improvements. Unfortunately, the PSID does not include data on home improvements. Anticipated capital gains will be overstated to the extent that homeowners factor improvements into their reported home value. Second, homeowners are likely to systematically overestimate the value of their homes, overstating the accrued gain. Third, in the first survey after purchasing the house, many homeowners may simply report the purchase price as the current value. Since price growth is always positive through the sample period and I adjust for appreciation between the time of purchase and the time of the reported value, the imputed purchase price will be underestimated. This too will overstate accrued gains. Lastly, realtor fees and/or other sales-related expenses can be deducted from the sales price for the purpose of computing taxable gains. These costs may end up being several percentage points of the sales price. My estimate will overstate taxable gain by this amount. Each of these effects cause the measure of accrued gains to be overestimated. Therefore, the empirical results should be thought of as an upper bound on the responsiveness of labor mobility to taxes on residential capital gains.

As mentioned in the previous section, the estimation includes gains in real terms. The calculated gains were deflated by the standard Consumer Price Index. It may not be straightforward why we should model the conditional probability of undertaking a job-related move based on real accumulated gains rather than nominal realized gains, since it is the latter that are taxed. However, employment decisions that require relocation are (potentially) influenced by the expected level of current accrued gains.[11] While the tax is ultimately levied on realized gains, the homeowner's decision to undertake a job-related move typically takes place before the home is actually sold and gains are realized. The tax bill it generates is essentially a transaction cost on moving, so a dollar

[11] Homeowers also may factor in any expected gains from the time of the decision to the expected time of move.

of taxable gain may not create the same lock-in across years due to the effects of inflation.

In order to isolate the potential effects of capital gains taxes on job-related mobility, other factors that may influence a household's decision to undertake a job-related move must be accounted for. Fortunately, the PSID contains many variables suitable for doing so. These include demographic variables such as age, sex, race, marital status, and education of the head of household. Including household-level data on the number of children and the age of the youngest child is also important since family composition may affect all mobility decisions, including those for job-related reasons. Household taxable income and lump sum payments such as insurance settlements and inheritances are also included in the estimation as measures of a household's ability to cover other costs associated with moving. Lastly, the PSID provides some geographical information such as the population of the largest city in the household's county and indicators for the four Census regions which may capture average mobility differences across labor market size and location.

Households undoubtedly choose to move for job-related reasons based the quality of the local labor market and the relative strength of other labor markets. Unfortunately, the PSID does not provide locational detail such that differences in individual labor markets can be measured. The most detailed level of labor-market information is the Census region. To attempt to control for any labor-market effects, I match regional unemployment rates to each observation by region and year. Descriptions and summary statistics for all variables used in the estimation are reported in Tables 2.1 and 2.2, respectively (all tables and figures associated with this chapter are in Appendix A).

Since many of the variables included in the analysis are not present in the PSID prior to 1990, I use this at the starting point of my sample. The sample runs through 2005, the last year for which data are available. This timeframe of study is convenient in that TRA97 essentially bisects the sample. Overall, the dataset contains 16,651 observations from 7,436 unique households.

2.7 Results

Table 2.3 presents the results obtained from estimating the Cox proportional hazard model from Equation (2.6). The estimated coefficients are in terms of a hazard ratio, which indicates the percentage shift in the baseline hazard function from a one-unit increase in the dependent variable. A hazard ratio less than one indicates that the variable has a negative effect on the job-related moveout hazard of a household.[12] Likewise, a hazard ratio greater than one indicates that the variable has a positive effect on the job-related hazard.

Of primary interest is the effect of accumulated gains and the differential tax treatment of these gains on labor mobility under the pre- and post-TRA97 policy regimes. The three variables central to the issue of how the taxation of residential capital gains affects labor mobility are $Gains$, $TRA97$, and the interaction term $TRA97 * Gains$. The coefficient on the gains variable is not statistically different from one. That is, there does not appear to be any meaningful lock-in associated with accrued gains in and of themselves. However, the results do indicate a negative and statistically significant average effect of labor mobility after TRA97, as evident by the 0.605 log-relative hazard associated with the TRA97 dummy. Although this variable captures any average mobility differences across the 1990-1997 and 1997-2005 time periods which may or may not be related to the tax treatment of housing gains, this result is perplexing. Perhaps this reflects decreased labor mobility associated with tighter labor markets resulting from the aggregate economic downturn in 2001 and 2002.

More important than each of these separate terms is their interaction. The coefficient on the interaction term is positive and statistically different from one. Recall that by its definition, this variable has a value of zero for all observations occurring before TRA97 went into effect. After the tax change, this variable takes on a value equal to the level of real accumulated gains. A statistically significant hazard ratio greater than one for the $TRA97 * Gains$ interaction indicates that every thousand dollars of real gains accumulated by a household after TRA97 increases the conditional probability that the household undertakes a job-related move. More specifically, a \$1,000 increase in real residential gains is associated with a 1.5 percent increase in the likelihood that the household undertakes a job-related move after TRA97, but has no discernible effect on labor mobility decisions pre-TRA97.[13]

At low levels of gain after 1997, this effect is outweighed by the decrease in average mobility discussed above.[14] However, the combined effect becomes positive at relatively modest levels of

[12] From this point, all references to the magnitude and direction of estimated effects are relative to the baseline move-out hazard for all households.

[13] Since homeowners with gains above the new TRA97 exclusion are no longer able to roll those gains over into a new home and would now be subject to tax should they move, the effects of TRA97 on their mobility may differ from those with gains below the new exclusion. To account for this nonlinear response, I estimated a Cox model that incorporated a dummy variable to indicate whether the household's current nominal gains are above the applicable exclusion in 1997 or later as well as the interaction of this dummy with the household's accrued real gains. The coefficients on these variables were not statistically significant, potentially due to insufficient variation generated by job-movers with such large accrued gains. Future research could focus on this nonlinear response, which would require more detailed information than the PSID can provide on the mobility patterns of households with very large gains.

[14] In addition to the taxation of residential capital gains, housing markets have undergone other significant changes

gain. Specifically, these results indicate that households with real gains above about $27,000 are more likely to move for a new job or relocate for a current employer under the current tax laws than they were under the old ones and that the liklihood grows as gains accrue. Overall, the results indicate that the tax change, through its replacement of the rollover provision with a large exclusion, had statistically significant unlocking effects on geographic labor mobility for many households and that the effect is larger for those households with larger levels of anticipated accumulated gain.

Other interesting findings should also be mentioned.[15] First, the results are consistent with the labor mobility patterns we would expect to observe across a worker's life cycle. As the head of household ages, the household becomes more likely to undertake job-related moves. This is not surprising since younger workers may bounce around several labor markets before finding a good fit. At higher ages, presumably during retirement years, the effect is mitigated.

Not surprisingly, education and income are both positively correlated with labor mobility. The education effect is particularly strong with respect to having a college degree. Even after controlling for higher incomes, those households headed by someone with a college degree are 2.6 times more likely to undertake job moves than those without. This may be due to increased awareness of opportunities outside the local labor market or due to specialized skills by the head of household. It is not clear, *a priori*, that household income would increase labor mobility. While a higher income means that moving costs are less constraining, it also signals that the household's current job match is good, reducing the number of superior jobs in other markets. Conversely, given the level of education, a lower income may indicate poor job matches or induce workers to actively search for other jobs. The results present some evidence that a higher income is associated with increased labor mobility, indicating the relative magnitude of these opposing effects.

Household composition also seems to determine labor mobility decisions. There is some evidence that a larger number of children in the household lowers labor mobility. There may be several explanations for this result. First, moving costs such as transporting household belongings can be large. These costs may increase as the family size gets larger. Second, a household with more

since the mid-1990s, such as the prevalence of subprime lending and the popularity of non-traditional mortgages. To examine this issue, I changed the timing of the TRA97 dummy variable in several alternative specifications of the Cox model (the results of which are not reported in this paper) to various points between 1994 and 1997, also interacting it with the household's real accrued gains. While the hazard ratio for the dummy variable remained statistically different from 1 in several of these regressions, the hazard ratio on the interaction term did not. This suggests that the time dummy in the baseline model is likely picking up non-tax-related differences in average mobility across time periods but that the effects do not vary with the household's capital gain. Thus, it is not likely that factors other than TRA97 are contributing to the statistically significant results for the interaction term in the baseline specification.

[15] The discussion that follows focuses on the non-tax-related variables. Overall, the results of the model are largely consistent with the theoretical effects of human-capital migration models as well as previous empirical work on the determinants of household mobility. See, for example, Fox et al. (1989), Boehm et al. (1991), and Clark et al. (2006).

children may have stronger ties to a community, through deeper involvement in school-related activities and athletics. Third, parents might take into account their childrens' psychological costs of losing friends as a result of moving from one labor market to another. However, the ages of children do not seem to matter.

Marital status is also statistically insignificant. This may be due to two competing effects. On one hand, a two-parent household might have stronger ties to the home market, whether it be from community ties if each spouse has a separate social group or from relationships developed in separate workplaces. If one spouse has a particularly strong match with its current employer, the household may not move even if the other spouse could gain a better job somewhere else. On the other hand, a job move occurs even if one spouse takes a new job in another labor market. Assuming both spouses work, the likelihood of a household with two earners having good job matches may be lower than a single earner in an unmarried household. Another noteworthy, if not surprising, result is that households headed by a minority are 58 percent less likely to undertake job relocation, even after controlling for education and income.

The variables intended to capture local labor market characteristics are not statistically significant. That is, labor mobility does not appear to be affected by the regional unemployment rate. However, the direction of the estimated coefficient reflects what we might expect - households in areas with higher rates of unemployment are more likely to undertake a job-related move. The insignificant coefficient most likely results from the heterogeneity of labor markets within a given Census region. Perhaps more surprising is that the size of the largest city in the household's county does not affect job moves. We might expect fewer job relocations to occur in more heavily populated areas as workers may be able to switch jobs without having to relocate.

The Kaplan-Meier survival function, which depicts the estimated ratio of households not taking job-related moves as a function of housing tenure, is shown in Figure 2.2. This relationship is fairly constant as the housing tenure grows. For every additional year of tenure, a household's chance of having that housing spell end with a job-related move grows by about 0.75 percentage points.

Table 2.4 contains the results from the parametric survival models. For these models, the shape of the baseline job-related moveout hazard is assumed to follow an exponential, Weibull, or Gompertz distribution. The columns in the table correspond to these specifications, respectively. As discussed previously, these alternative specifications are included as checks against the baseline results, which were obtained without imposing any distributional assumptions. Overall, the results across these parametric specifications are are very similar to one another and to the baseline Cox model.

The hazard ratio for accrued gains is not significantly different from one in any of the three specifications, again indicating that the level of accrued housing gains alone does not prevent homeowners from taking new jobs that require moving. In two of the three specifications, the coefficient on the TRA97 dummy is similar to that in the baseline Cox model. That is, there appears to be a fairly large negative and statistically significant negative average effect of labor mobility after TRA97. In the exponential model, the magnitude of the effect is much smaller, although only marginally significant.

The hazard ratio for the interaction of the policy dummy with the level of accrued gains is between 1.015 and 1.016 across the parametric specifications and is statistically different from 1, consistent with the 1.015 estimate from the baseline estimation and indicating a labor lock-in release for homeowners with larger accrued gains after the passage of TRA97. Again, this suggests that TRA97 increased job-related mobility through the replacement of the §1034 rollover with a broad exclusion available to all homeowners and that the effect is larger for those with larger accrued gains.

Comparing other results to the baseline Cox model yields similar conclusions, both in terms of the direction of the effect and the point estimate. Homeowners with more expensive homes are less likely to undertake job-related moves as are those households headed by a minority and those with more children. Similarly, households headed by someone with a college degree are more than two-and-a-half times more likely to move for a job than those without. Similar patterns regarding a worker's life-cyle are also also estimated, with job mobility increasing with age at younger ages and decreasing during later years. Also, all models suggest a 0.1 percent increase in job-related mobility for every thousand dollars of real income.

Table 2.5 contains the results from models that estimate the propensity of a household to take a job-related move. Columns (1) and (2) are random-effects probit models. Column (1) includes the same regressors as in the survival models while column (2) includes a control for the number of months the household has spent in the home at the time of the survey wave in order to account for the positive correlation between tenure length and accumulated gains. Columns (3) and (4) are random-effects logit models, not including and including the tenure length control, respectively. Estimates are reported as marginal effects evaluated at the sample means for all models.

Overall, the results are similar to those of the baseline Cox model. Specifically, in three of the four models, accumulated gains do not appear to affect labor mobility. In the logit model controlling for tenure length, there is a small but statistically significant positive effect of accrued gains on job-related mobility. There is no average mobility effect after TRA97, but the interaction term is once again positive and statistically significant. The point estimates from the probit models indicate that a $1,000 increase in real accumulated gains after TRA97 is associated with a 1.3 percent increase in the likelihood of a household undertaking a job-related move. The point estimates from the logit models indicate a response more than twice that large. The conclusions drawn from these results echo those from the baseline results, that is TRA97 had a small releasing effect on households that had accumulated large housing gains but were locked in to their home labor markets due to the potential tax liability resulting from the sale of the home.

The last set of results, contained in Table 2.6, show the effects of TRA97 on overall mobility. That is, these models do not focus on job-related mobility but estimate the likelihood of a homeowner undertaking a move for any reason. Columns (1) and (2) are probit models while (3) and (4) are logit models. Columns (2) and (4) control for tenure length. Again, all regressions include random effects and the presented estimates are marginal effects estimated at the mean.

Models that do not control for tenure length suggest that accumulated gains decrease homeowner mobility. However, the sign is reversed once the length of housing tenure is accounted for, suggesting that failing to control for this may lead to downward-biased results since gains and tenure length are positively correlated while tenure length and mobility are negatively related. Unlike the estimates on labor mobility, these models suggest a large average mobility increase after the passage of TRA97, which is not particularly surprising. TRA97 allowed all homeowners to trade down, selling homes with large gains and incurring essentially no tax liability. Prior to 1997 job movers could avoid tax by taking advantage of the rollover provision, so the effects of TRA97 on labor mobility only result from the replacement of the rollover with the large exclusion. The interaction of gains with the policy dummy is also positive and statistically significant, suggesting a larger lock-in release of 1997 on those with larger gains. Overall these results indicate that TRA97 increased overall homeowner mobility, consistent with results found in other studies.

2.8 Conclusions

The results from a variety of empirical specifications suggest that TRA97 had a statistically significant and positive effect on labor mobility and that the effect is larger for those with larger amounts of accrued gains. Despite the elimination of the rollover provision, the availability of the $500,000 maximum exclusion every two years to working-aged homeowners lowered effective capital gains tax rates, reducing tax-related barriers to job-related geographic relocation. However, given a price tag of over $30 billion, the small effect may come at a large cost. While it is true that TRA97 had significant effects on overall mobility, as presented here and in the existing literature, its effects on specifically job-related mobility alone may or may not warrant such a cost. Policymakers will need to determine whether the cost of this increased labor mobility to those with large capital gains is worth the preferential tax treatment and the resulting revenue loss and other potential inefficiencies.

The current housing slump notwithstanding, nominal home values have risen over the past 12 years while the exclusion has remained fixed. Thus, its real value has fallen. As the housing market recovers and nationwide home price depreciation reverses, more homeowners will accrue gains in excess of the exclusion. This, combined with the demonstrated preference given to housing by the federal government, will place IRC §121 back into policy discussion. The debate has typically centered around the lock-in effects that capital gains taxes create. While the capital lock-in of residential as well as other types of assets is well-documented, the labor lock-in unique to residential capital is often forgotten. The results from this paper, across a broad set of specifications, indicate that homeowners are indeed more mobile across labor markets under the current tax regime, although the effect is likely to be concentrated among homeowners with large gains.

Appendix A

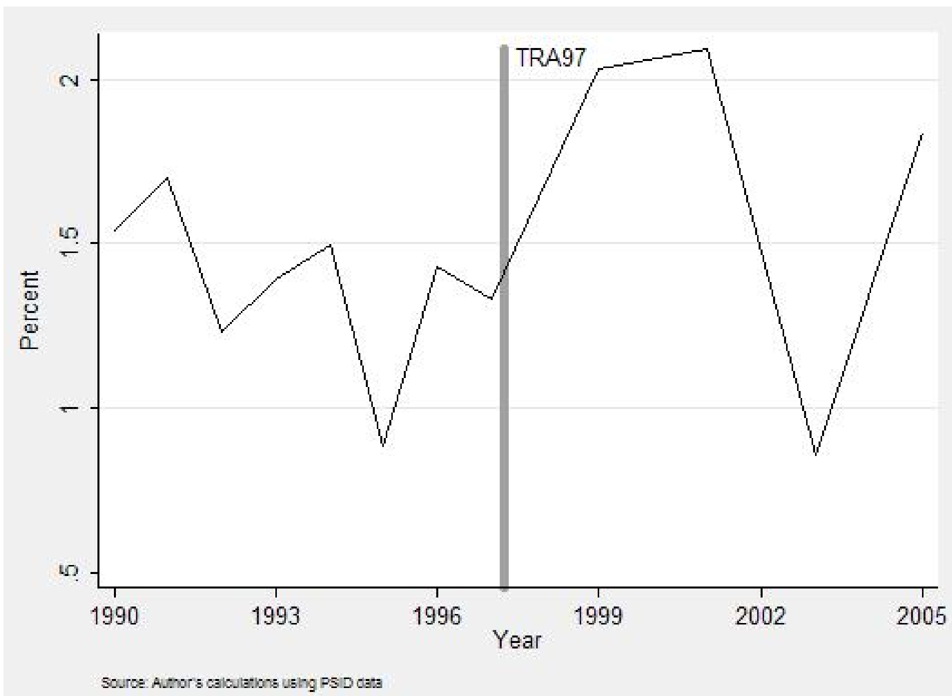


Figure 2.1: Labor Mobility Rate

Table 2.1: Variable Descriptions

Variable	**Description**
Gains	Real accrued gains ($thousands)
TRA97	Dummy variable: 1 if observation occurs June, 1997 or later
TRA97*Gains	Product of TRA97 and real gains variables
Home value	Real value of home ($thousands)
Age	Age (in years) of the household head
Age of youngest child	Age (in years) of the youngest child in the household under 18
Married	Dummy variable: 1 if household head is married
Female	Dummy variable: 1 if household head is female
Non-white	Dummy variable: 1 if household head is a race other than white
Number of children	Number of children under 18 in the household
College degree	Dummy variable: 1 if household head has college degree
Taxable income	Real household taxable income ($thousands)
Lump sum payments	Real lump sum payments in previous year ($thousands)
City size > 100,000	Dummy variable: 1 if population of largest city in the household's county of residence is greater than 100,000
Northeast	Dummy variable: 1 if state of residence is CT, ME, MA, NH, NJ, NY, PA, VT, RI
North central	Dummy variable: 1 if state of residence is IL, IN, IA, KS, MI, MN, MO, NE, ND, OH, SD, WI
West	Dummy variable: 1 if state of residence is AL, AZ, CA, CO, HI, ID, MT, NV, NM, UT, WA WY
South	Omitted Census region (all other states not listed above, plus the District of Columbia)
Unemployment	Regional unemployment rate
Tenure*	Length of time in current home (months)

Note: All real variables are in terms of year 2000 dollars. Tenure variable is for probit/logit models only.

Table 2.2: Summary Statistics for PSID Data

Variable	**Mean**	**S.D.**	**Min**	**Max**
Real gains ($thousands)	10.591	34.9513	-233.676	1,911.202
Real home value ($thousands)	128.275	140.393	0.001	11,616.910
Age	44.830	19.293	17	101
Age of youngest child	3.262	4.874	1	17
Number of children	0.942	1.222	0	10
College degree	0.219	0.414	0	1
Taxable income ($thousands)	38.702	58.391	-909.620	4,849.642
Lump sum payments ($thousands)	0.933	17.052	0	2645.259
Married	0.522	0.500	0	1
Female	0.302	0.459	0	1
Non-white	0.399	0.490	0	1
City size > 100,000	0.325	0.468	0	1
Region: Northeast	0.146	0.353	0	1
Region: North central	0.221	0.415	0	1
Region: West	0.190	0.392	0	1
Region: South	0.439	0.496	0	1
Unemployment rate	5.935	1.172	3.4	8.5

Note: All real variables are in terms of year 2000 dollars.

Table 2.3: Estimates from Cox Proportional Hazards Model

Variable	**Hazard Ratio**	**Std. Error**	**Prob.**
Gains	0.999	0.003	0.825
TRA97	0.605∗	0.153	0.046
TRA97*Gains	1.015∗	0.003	0.000
Home value	0.997∗	0.001	0.000
Age	1.123	0.068	0.057
Age squared	0.998∗	0.001	0.005
Age of youngest child	0.996	0.017	0.788
Number of children	0.879	0.065	0.083
College degree	2.580∗	0.372	0.000
Taxable income	1.001∗	0.001	0.032
Lump sum payments	0.979	0.182	0.259
Married	1.153	0.269	0.542
Female	0.536	0.187	0.074
Non-white	0.424∗	0.093	0.000
City size > 100,000	0.971	0.147	0.848
Unemployment rate	0.964	0.104	0.738
Number of households		7,436	
Number of observations		16,651	
Failures		212	

Note: Level of significance is for testing the null-hypothesis that the estimated hazard ratio is equal to 1. * denotes statistical significance at the 0.05 level or better. Regression includes regional dummies. Complete results can be obtained from the author by request.

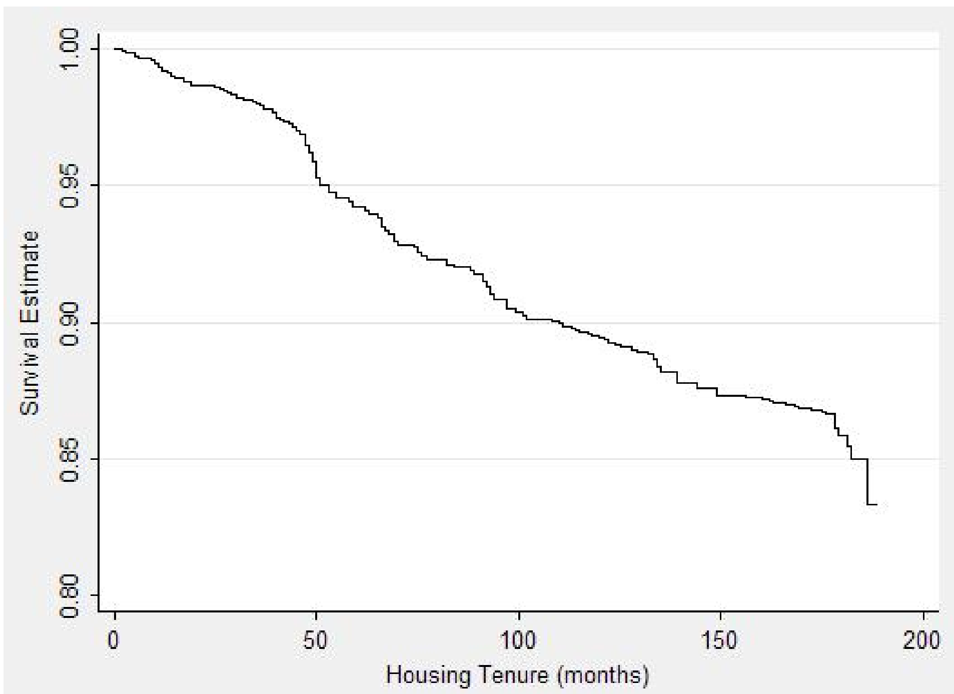


Figure 2.2: Kaplan-Meier Survivor Function

Table 2.4: Estimates from Parametric Hazard Models

Variable	Exponential	Weibull	Gompertz
Gains	0.999 (-0.29)	1.001 (0.48)	1.000 (0.09)
TRA97	0.718 (-1.72)	0.177* (-5.10)	0.293* (-3.50)
TRA97*Gains	1.015* (4.76)	1.016* (5.48)	1.015* (5.15
Home value	0.998* (-4.44)	0.997* (-5.67)	0.997* (-4.94)
Age	1.164* (2.49)	1.095 (1.50)	1.109 (1.68)
Age squared	0.998* (-3.31)	0.998* (-2.58)	0.998* (-2.72)
Age of youngest child	0.993 (-0.42)	0.993 (-0.42)	0.992 (-0.48)
Number of children	0.884 (-1.67)	0.864* (-1.96)	0.869 (-1.88)
College degree	2.613* (6.66)	2.673* (6.82)	2.663* (6.77)
Taxable income	1.001* (2.17)	1.001* (2.08)	1.001* (2.09)
Lump sum payments	0.978 (-1.16)	0.978 (-1.16)	0.978 (-1.16)
Married	1.102 (0.42)	1.143 (0.57)	1.134 (0.54)
Female	0.528 (-1.82)	0.569 (-1.62)	0.560 (-1.66)
Non-white	0.418* (-4.00)	0.442* (-3.73)	0.441* (-3.74)
City size > 100,000	0.957 (-0.29)	0.978 (-0.15)	0.968 (-0.22)
Unemployment rate	1.039 (0.46)	0.849 (-1.75)	0.930 (-0.80)
Constant	0.000* (-6.72)	0.000* (-6.93)	0.000* (-5.22)
Number of households		7,436	
Number of observations		16,651	
Failures		212	

Note: Reported estimates are hazard ratios. The null-hypothesis is that the hazard ratio is equal to 1. Test statistics are in parentheses. * denotes significance at the 0.05 level or better. All regressions contain region dummies. Complete results can be obtained from the author by request.

Table 2.5: Probit and Logit Models for Job Mobility

Variable	**Probit** (1)	(2)	**Logit** (3)	(4)
Gains	0.000 (0.03)	0.002 (1.63)	0.001 (0.32)	0.006* (2.63)
TRA97	-0.071 (0.66)	-0.143 (-1.32)	-0.140 (-0.54)	-0.278 (-1.05)
TRA97*Gains	0.013* (6.95)	0.012* (6.88)	0.031* (6.80)	0.029* (7.48)
Home value	-0.002* (-3.91)	-0.002* (-4.26)	-0.005* (-4.62)	-0.005* (-5.22)
Tenure		-0.008* (-4.15)		-0.024* (-4.26)
Age	0.041 (1.51)	0.053 (1.91)	0.135 (1.91)	0.161* (2.28)
Age squared	-0.001* (-2.29)	-0.001* (-2.64)	-0.002* -(2.64)	-0.002* (-2.97)
Age of youngest child	-0.007 (-0.75)	-0.006 (-0.65)	-0.02 (-0.94)	-0.019 (-0.88)
Number of children	-0.054 (-1.37)	-0.055 (-1.41)	-0.119 (-1.28)	-0.117 (-1.28)
College degree	0.488* (5.71)	0.478* (5.71)	1.188* (6.17)	1.192* (6.36)
Taxable income	0.001 (1.27)	0.001 (1.29)	0.001 (1.36)	0.001 (1.46)
Lump sum payments	-0.007 (-0.95)	-0.008 (-0.99)	-0.021 (-0.95)	-0.022 (-0.98)
Married	-0.009 (-0.08)	0.016 (0.13)	0.015 (0.05)	0.078 (0.27)
Female	-0.305 (-1.70)	-0.304 (-1.72)	-0.788 (-1.77)	-0.816 (-1.85)
Non-white	-0.403* (-3.53)	-0.41* (-3.62)	-1.009* (-3.59)	-1.026* (-3.71)
City size > 100,000	-0.019 (-0.24)	-0.027 (-0.34)	-0.011 (-0.06)	-0.023 (-0.12)
Unemployment rate	0.007 (0.17)	-0.016 (-0.35)	0.007 (0.06)	-0.061 (-0.56)
Constant	-2.933* (-4.41)	-2.781* (-4.20)	-6.676* (-4.09)	-6.001* (-3.67)
Number of households		7,432		
Number of observations		16,631		

Note: Reported estimates are marginal effects evaluated at the mean of the dependent variable. Marginal effects for dummy variables are measured from value of 0 to value of 1. Columns (1) and (2) are probit models and columns (3) and (4) are logit models. All regressions are random effects models and contain region dummies. The null hypothesis is that the estimated marginal effect is equal to zero. Test statistics are in parentheses and * denotes significance at the 0.05 level or better. Complete results can be obtained from the author by request.

Table 2.6: Probit and Logit Models for Overall Mobility

Variable	Probit (1)	Probit (2)	Logit (3)	Logit (4)
Gains	-0.002*	0.003*	-0.004*	0.005*
	(-6.08)	(6.66)	(-6.23)	6.33
TRA97	6.405*	6.327*	13.100*	13.714*
	(19.35)	(18.92)	(12.88)	(13.38)
TRA97*Gains	0.236*	0.227*	0.496*	0.501*
	(2.51)	(2.52)	(2.58)	(2.67)
Home value	0.000	-0.001*	0.001	-0.002*
	(1.67)	(-5.29)	(1.92)	(-5.1)
Tenure		-0.012*		-0.022*
		(-35.97)		(-34.71)
Age	0.013	0.050*	0.022	0.086*
	(1.69)	(5.89)	(1.61)	(5.37)
Age squared	0.000	0.000*	0.000	-0.001*
	(-0.32)	(-3.67)	(-0.24)	(-3.15)
Age of youngest child	0.003	0.012*	0.005	0.022*
	(0.71)	(2.77)	(0.72)	(2.86)
Number of children	0.011	-0.012	0.017	-0.033
	(0.66)	(-0.64)	(0.56)	(-0.98)
College degree	-0.119*	-0.127*	-0.235*	-0.272*
	(-2.95)	(-2.89)	(-3.30)	(-3.37)
Taxable income	0.000	0.000	0.000	0.001
	(-0.57)	(0.77)	(-0.53)	(0.79)
Lump sum payments	0.000	-0.001	0.000	-0.001
	(-0.19)	(-0.72)	(-0.19)	(-0.79)
Married	-0.226*	-0.119*	-0.416*	-0.239*
	(-3.81)	(-1.83)	(3.89)	(-1.96)
Female	-0.037	-0.065	-0.093	-0.157
	(-0.54)	(-0.86)	(-0.74)	(-1.09)
Non-white	-0.074	-0.062	-0.121	-0.097
	(-1.83)	(-1.38)	(-1.68)	(-1.15)
City size > 100,000	0.109*	0.090*	0.209*	0.174*
	(3.13)	(2.33)	(3.38)	(2.46)
Unemployment rate	1.510*	1.583*	2.729*	3.158*
	(46.27)	(44.69)	(41.18)	(38.26)
Constant	-9.623*	-10.602*	-17.422*	-21.068*
	(-34.73)	(-35.15)	(-32.46)	(-32.27)
Number of households	7,432			
Number of observations	16,631			

Note: Reported estimates are marginal effects evaluated at the mean of the dependent variable. Marginal effects for dummy variables are measured from value of 0 to value of 1. Columns (1) and (2) are probit models and columns (3) and (4) are logit models. All regressions are random effects models and contain region dummies. The null hypothesis is that the estimated marginal effect is equal to zero. Test statistics are in parentheses and * denotes significance at the 0.05 level or better. Complete results can be obtained from the author by request.

Chapter 3

The Effects of EGTRRA and JGTRRA Expiration on the User Cost of Housing

Abstract

The Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA) and Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA) lowered both marginal income and capital gains tax rates for almost all taxpayers, affecting the after-tax cost of owner-occupied housing. However, these Acts are set to expire automatically in 2011, with rates returning to pre-2001 levels. Rising tax rates on ordinary income and capital gains have theoretically opposing effects on the user cost of ownership. Since mortgage interest and property taxes are deductible for federal tax purposes at a homeowner's marginal tax rate, user costs will fall. Conversely, higher capital gains tax rates on residential gains in excess of the current exclusion will increase user costs. This paper measures these effects by applying an augmented user cost model of housing that includes taxes on residential capital gains to data from the most recent Survey of Consumer Finances. It is estimated that the expiration of EGTRRA and JGTRRA would decrease user costs for almost all households, despite higher rates on residential capital gains, although the reductions will be larger for higher-income households.

3.1 Introduction

Absent new legislation, almost all U.S. taxpayers will face higher federal income tax rates in 2011. The majority of the tax cuts contained in the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA) and Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA) will automatically expire on January 1, 2011. The current 10 percent marginal tax rate for the lowest-earning Americans will be eliminated, the rate applied to the 28, 31, and 36 percent brackets will each increase by three percentage points, and the highest bracket will increase from 35 percent to 39.6 percent. Additionally, tax rates on long-term capital gains will rise from zero or 15 percent, depending on the taxpayer's income, to 10 or 20 percent, respectively.

The federal tax code implicitly subsidizes homeowners through a number of special provisions, primarily the mortgage interest and property tax deductions and the exclusion of both imputed rent and most capital gains from the sale of a primary residence from taxation. The amounts of these subsidies are directly related to the tax rates faced by the homeowner. Wealthier households are able to deduct state and local property taxes as well as interest paid on home mortgages at higher rates. And since wealthier households also face higher rates on capital gains, the tax exclusion of residential gains is more valuable to them relative to poorer households. The expiration of

EGTRRA and JGTRRA will impact the level of these subsidies through the increase of marginal income and capital gains tax rates.

This paper takes a standard approach to modeling the after-tax cost of owner-occupied housing by constructing a user cost model that incorporates various aspects of the tax code that affect homeowners (Poterba, 1992; Sinai, 1998; Anderson et al., 2007; Poterba and Sinai, 2008b), augmenting it to include the taxation of residential capital gains above the current $500,000 maximum exclusion. Data from the 2007 Survey of Consumer Finances (SCF) are used to extrapolate the tax situations households are likely to face in 2010, the last year EGTRRA and JGTRRA are in effect, and 2011, the first year after they have expired. These data are used in conjunction with the National Bureau of Economic Research's Taxsim model to estimate several effective marginal tax rates for each household under the current and future regimes, comparing the results in order to determine the effect of the expiration on the user cost of owner-occupied housing. Under a variety of assumptions and alternative scenarios, the results show that the reversion of tax rates to 2000 levels will decrease the marginal cost of housing primarily through an increase in the value of the mortgage interest and property tax deductions but that the decrease is largest for the wealthiest homeowners. The higher capital gains tax rates are shown to increase user costs, particularly for older households with relatively low incomes, but not by enough to outweigh the larger subsidies provided by the higher marginal income tax rates.

The rest of this paper continues as follows: Section 3.2 provides an overview of EGTRRA and JGTRRA and their implications for homeowners. Section 3.3 outlines previous literature on the relationship between federal income taxes and the user costs of owner-occupied housing. Section 3.4 develops a user cost framework to model the tax aspects of the costs of homeownership. Section 3.5 describes the construction of the dataset used in the analysis. Section 3.6 discusses the results and Section 3.7 provides concluding remarks, drawing relevant policy implications and options for policymakers.

3.2 EGTRRA and JGTRRA

The Economic Growth and Tax Relief Reconciliation Act of 2001 (P.L. 107-16) and Jobs and Growth Tax Relief Reconciliation Act of 2003 (P.L. 208-27) were sweeping pieces of legislation that reduced the federal income tax burden for nearly all taxpayers. Their many provisions included reductions in individual income tax rates, capital gains tax rates, and estate and gift taxes as well as expanding the tax preference for retirement and education savings plans.

EGTRRA was historically unique in two respects. First, many of the tax reductions were to be phased in over a period of several years. Second, absent further legislation, the Act is scheduled to "sunset" automatically on January 1, 2011. At that time, many tax parameters will revert back to 2000 levels. Despite much discussion in policy circles, no major legislation has been passed regarding extensions to any part of the bill.

The components of the bill most significant to this paper involve the individual income tax. Of primary interest is its lowering of marginal tax rates on ordinary income. Prior to its implementation, there were five income tax brackets with associated rates of 15, 28, 31, 36, and 39.6 percent. Beginning with the 2002 tax year, EGTRRA created a new 10 percent marginal tax bracket that applied to the first $6,000 of taxable income. The 15 percent bracket then began at this level, essentially splitting the old 15 percent bracket into two brackets. The marginal tax rates associated with the higher brackets were to fall incrementally over the next several years. By 2006, the former 28, 31, 36, and 39.6 percent marginal rates would be 25, 28, 33, and 35 percent.

In addition to the rate reductions, income thresholds for marginal tax brackets and the phaseout for various deductions and exemptions were adjusted upward as well. The major adjustments to tax bracket thresholds occurred in the lowest income brackets, with the standard deduction and 15 percent brackets increased for married filers to twice that of single filers, reducing the so-called marriage penalty. This too was to be phased in over a period of years, fully implemented by 2008 for the standard deduction and 2009 for the 15 percent bracket. The phaseout of itemized deductions was to be reduced from a 3 percent floor under deductions to a 2 percent floor in 2006, a 1 percent floor in 2008, and fully repealed in 2010. The personal exemption phaseout was to be lowered by one-third by 2006, two-thirds by 2008, and repealed in 2010.

EGTRRA changed the taxation of dividends and capital gains as well. The law stated that in 2003, the tax rate on dividend income would be reduced to 5 percent for those in the 15 percent marginal rate bracket or lower and 15 percent for taxpayers in higher brackets. The 5 percent rate was to be lowered to zero in 2008. Prior to 2001, gains realized from the sale of capital assets were either classified as short-term or long-term. Those assets that had been held for less than one year were considered short-term and taxed at ordinary income tax rates while those held for one year or longer were considered long-term and taxed at lower rates. Under prior law, long-term gains for taxpayers in the 15 percent bracket carried a tax rate of 10 percent while all other taxpayers were subject to a rate of 20 percent. EGTRRA split long-term gains into two subcategories. The tax on gains from the sale of assets held for at least five years was 8 percent for those in the new 10 percent marginal bracket while gains from assets held for more than one year but less than five years were taxed at the previous long-term rates.

While the above changes have direct implications for the user cost of housing through the taxation of residential gains and the value of the mortgage interest and property tax deductions, there were other aspects of EGTRRA that warrant mention. First, for taxpayers with children, the child tax credit was to be gradually increased over a period of 10 years, rising from $500 per child in 2000 to $1,000 by 2010, although the refundability of the credit was limited after the second child. In addition, the amount deductible for child care expenses was increased. Second, the estate tax was to be completely phased out, with exemption levels increasing and tax rates decreasing until 2010 when it was to be repealed. Lastly, EGTRRA expanded the scope of tax-preferred retirement accounts. For example, Individual Retirement Account (IRA) contribution limits were to be increased by $1,000 increments every two years from 2002 to 2008, at which time they would be indexed annually. Taxpayers over the age of 50 were able to make additional "catch-up" contributions as well.

JGTRRA contained fewer new provisions for individual taxpayers. Its major impact was the acceleration of many of the rate reductions and phaseout increases already scheduled under EGTRRA. Most significantly, the marginal tax rate cuts that were to be instituted gradually to 2006 were fully phased in immediately. The child credit increase and marriage penalty relief were also fully phased in, with the child credit becoming fully refundable. Additionally, the upper threshold on the 10 percent bracket was increased from $6,000 to $7,000.

The most significant new provision for taxpayers was the further reduction of capital gains tax rates. While short-term gains (those from assets held less than a year) were still taxed at the new lower ordinary income tax rates, rates applied to longer-held assets were lowered. The bill eliminated the distinction between assets held for one to five years and those held longer longer. For those in the 10 and 15 percent brackets, the long-term capital gains tax rate dropped to 5 percent. The rate for those in higher brackets dropped from 20 percent to 15 percent. Further, JGTRRA stipulated that the 5 percent long-term rate for the lowest two income brackets would drop to zero percent in 2008.

Current policy with regards to both marginal income tax rates and capital gains will remain in effect through the end of 2010, absent future changes. That is, taxpayers in the 10 and 15 percent brackets face no taxes on long-term capital gains. All others face a rate of 15 percent. In 2011, many of the provisions of EGTRRA and JGTRRA will sunset, including the marginal tax rate reductions. The 10 percent marginal rate bracket will merge back into the 15 percent bracket and the 25, 28, 33, and 35 percent brackets will rise to 28, 31, 36, and 39.6 percent, respectively. Rates on long-term capital gains will rise from 0 percent to 10 percent for those in the lowest brackets and from 15 percent to 20 percent for those in the higher brackets. Table 3.1 shows the changes in marginal income and long-term capital gains tax rates, by bracket, from 2010 to 2011 (all tables and figures associated with this chapter are in Appendix B).

The implication of EGTRRA and JGTRRA expiration for homeowners is clear. Those that itemize deductions on their federal tax returns will be able to deduct a larger share of their local property taxes and mortgage interest paid since these amounts are deducted at the taxpayer's (higher) marginal tax rate. Thus, in this respect, the marginal cost of an additional dollar of housing will decline. The user cost of housing for those that do not itemize will not be affected by the marginal rate increases. Conversely, higher capital gains tax rates will increase the user cost of housing for all homeowners with gains in excess of the exclusion created by the Taxpayer Relief Act of 1997.[1] Those with gains under the exclusion (or losses as it may be) will not be affected by the higher rates.

3.3 Previous Literature

The subsidies to owner-occupied housing provided through the federal income tax code have been the subject of a great deal of literature. Early work focused on the way in which housing tax subsidies, such as the mortgage interest and property tax deductions and the exclusion of net imputed rent from the stream of housing services consumed by the homeowner, affect equilibrium levels of housing. Building on work by Laidler (1969) and Aaron (1972), Rosen (1979b) shows that housing demand functions estimated without taking into account tax provisions yield inaccurate elasticity estimates. Even more significantly, he provides evidence that homeowners are indeed aware of the change in effective housing costs resulting from changes in tax parameters.

Complementing this result, Rosen (1979a) shows that tax-induced changes in housing costs affect a taxpayer's decision to rent or own. This result was confirmed later by Green and Vandell

[1]The Taxpayer Relief Act of 1997 allowed single homeowners to exclude up to $250,000 of capital gains from the sale of a home provided the household had lived in the home for at least two of the previous five years, although a pro-rated exclusion was available for some homeowners who failed the residency requirement but had extenuating circumstances. Married taxpayers could exclude up to $500,000. Gains in excess of the exclusion are taxed at the homeowner's applicable capital gains tax rate. In almost all cases, this will be the lower long-term rate.

(1999), who showed that the size of housing-related income tax deductions positively affects the probability that a households selects homeownership. They note that because of this relationship, the federal income tax can be used to manipulate housing markets. Likewise, Poterba (1984) develops a dynamic model of the housing market based on a cost of capital framework to show how inflation affects the tax subsidy to owner-occupied housing, primarily through untaxed capital gains, which in turn affects housing demand and thus construction. However, Bruce and Holtz-Eakin (1999) show that even drastic tax reform, such as replacing the federal individual income tax with a consumption tax, will have little effect on home prices in the long run.

The user cost model of homeownership has also been used to determine the effects of major tax legislation on the level of housing tax subsidies. Most notably, Poterba (1992) examines how the Economic Recovery Tax Act of 1981, Deficit Reduction Act of 1984, and Tax Reform Act of 1986 altered the user cost of housing. He finds that from 1980 to 1990, average user costs increased as a result of dramatically lower marginal income tax rates and that those with high incomes (and the largest rate reductions) experienced the largest percentage increase. Specifically, a taxpayer with a $30,000 income in 1990 saw his user cost of owned housing grow 25 percent over the previous decade while the estimated user cost of a taxpayer with a $250,000 income grew by almost 170 percent over the same period. The dramatic subsidy reductions are shown to have lowered both tax-induced demand distortions by as much as two-thirds and deadweight loss by as much 87 percent.

More recent work has focused on the distribution of housing tax subsidies and the differences in user costs across groups of households. Poterba and Sinai (2008b) show that the last-dollar user cost of owner-occupied housing under 2003 tax law falls as income rises, a reflection of the greater value of the deductions and exclusion of imputed rental income. In particular, the average tax savings from the mortgage interest deduction for a household with an income of $250,000 or more is $5,459 while its value to a household with less than $40,000 in income is only $91. Similarly, the average tax savings from the exclusion of imputed rent is 20 times larger for those with $250,000 or more in income than for those with less than $40,000. These large differences in average savings are a result of both more expensive homes and higher marginal tax rates.

Since home values affect average user costs, it is of no surprise that the tax code affects homeowners differently across housing markets. Sinai and Gyourko (2004) examine the geographic distribution of housing tax subsidies. They find a large disparity between metropolitan areas with high home values and those with lower values and that the disparity grew between 1979 and 1999, likely due to spatial differences in home price appreciation. They find that in 1979, homeowners in the 20 metropolitan statistical areas (MSAs) with the largest estimated subsidies received between 2.7 and 8 times the subsidy as those in the 20 least-subsidized MSAs. By 1999, this differential had widened to 3.4 to 17.1 times the subsidy. In a related study, Anderson et al. (2007) find that the cap on the mortgage interest deduction affects the user cost of owned housing more in higher-priced areas and provide several options for lowering the cap, some of which are designed to reduce the geographic disparity of the subsidy.

This paper attempts to add to the existing literature in two ways. First, the literature on tax subsidies to homeowners has thus far focused on the exclusion of imputed rent, the mortgage interest deduction, and the property tax deduction. The effect of capital gains taxes on homeowner costs has been largely ignored due to the generous exclusion. However, unprecedented home price appreciation from 2000 to 2007 has increased the share of homeowners with gains in excess of the exclusion, warranting examination of the effect of capital gains taxes on homeowner costs. Second, the pending sunset of EGTRRA and JGTRRA provides a unique opportunity to examine the effects of future policy on homeowners, which may be particularly useful in light of recent falls in home values and continued weakness in housing markets.

3.4 The User Cost of Homeownership

As far back as Laidler (1969), economists have employed the user cost approach to model income tax subsidies to owner-occupied housing. This framework is based on the user cost of capital in neoclassical investment models where the cost of purchasing an additional dollar of housing services is measured as a function of borrowing, maintenance, and opportunity costs as well as housing-related taxes and deductions. This paper follows suit by constructing a last-dollar user cost framework, most similar to that in Poterba and Sinai (2008a,b).

User cost models of owner-occupied housing are typically constructed by first assuming that the implicit rent that homeowners receive for each unit of housing net of various housing-related costs is equal to the rental value of that unit in equilibrium and that each are fully taxed at the homeowner's marginal tax rate. That is, both homeowners and landlords are assumed to be subject to a Haig-Simons-type income tax and that the economic return to homeownership is zero. This can be represented by

$$(1 - t_y)R = (1 - t_y)(i_m + t_p + m - \pi)P \tag{3.1}$$

where t_y is the marginal tax rate that would apply to both the imputed rent of owner-occupied housing for a homeowner as well as on rental income for a landlord, i_m and t_p denote the homeowner's mortgage interest rate and effective property tax rate, respectively, m denotes maintenance and depreciation costs, and π is nominal home price appreciation. R and P are units of rental and owner-occupied housing, respectively. Simplifying the above equation, it is evident that under this type of tax system, the rental value of a unit of owner-occupied housing is simply equal to the sum of the homeowner's mortgage interest, effective property tax, and upkeep costs less any appreciation in value (i.e. capital gain):

$$R = (i_m + t_p + m - \pi)P \tag{3.2}$$

However, current federal income tax deductions available to homeowners offset some of these costs. Adding in the ability of homeowners to deduct the interest they pay on their home mortgage as well as property taxes paid to state and local governments, the above equation becomes

$$R = [(1 - t_{mid})i_m + (1 - t_{ptd})t_p + m - \pi]P \tag{3.3}$$

where t_{mid} and t_{ptd} are the homeowner's marginal tax rates that apply to the mortgage interest and property tax deductions, respectively.[2] However, t_{mid} and t_{ptd} are zero if the homeowner does not itemize. The tax benefit to itemizers from each of these provisions is $t_{mid}i_m$ and $t_{ptd}t_p$. The relationship between the amount of the subsidy and the homeowner's marginal income tax rate is positive and linear.[3] In other words, those with higher marginal income tax rates receive larger subsidies.

In most cases, homes are purchased with a combination of debt and equity. Only the portion of the home purchased with debt accrues interest and is thus subject to the mortgage interest deduction. Also, the share of housing services purchased with equity entails an opportunity cost. If λ is the share of the home financed with debt, or loan-to-value ratio, then Equation (3.3) becomes

$$R = [\lambda(1 - t_{mid})i_m + (1 - \lambda)(1 - t_i)r_e + (1 - t_{ptd})t_p + m - \pi]P \tag{3.4}$$

where r_e is the return on an alternative asset and t_i is the marginal tax rate associated with the

[2] Most previous studies do not differentiate between these two rates. However, they may diverge slightly since the deduction for mortgage interest is capped at a principal balance of $1 million.

[3] This is not technically always true due to the cap on the mortgage interest deduction. Although, as Anderson et al. (2007) find, less than 0.5% of all mortgages originated as recently as 2004 exceeded $1 million.

homeowner's investment income. The second term in the brackets captures the opportunity cost of equity financing. Instead of purchasing an additional unit of housing services, a homeowner could have invested in an asset yielding a return of r_e and generating post-tax earnings of $(1 - t_i)r_e$.[4]

Note that the above equations explicitly assume that the capital gains on owner-occupied housing are untaxed. However, each dollar of nominal appreciation above $250,000 for single homeowners and $500,000 for married filers is taxed at the taxpayer's capital gains tax rate. Previous studies have ignored this and maintained the assumption of tax-free capital gains. However, Survey of Consumer Finances data indicate that at least 6 million homeowners had gains in excess of the applicable exclusion in 2007, which is over 7.5 percent of the roughly 81 million owner-occupant households represented in the survey. Allowing for the taxation of these gains, as well as normalizing the value of a unit of housing, the last-dollar user cost for owner-occupied housing is given by

$$c = \lambda(1 - t_{mid})i_m + (1 - \lambda)(1 - t_i)r_e + (1 - t_{ptd})t_p + m - (1 - t_{cg})\pi \tag{3.5}$$

where $c = \frac{R}{P}$ and t_{cg} is the taxpayer's tax rate on capital gains.[5] For a homeowner with gains below the exclusion, t_{cg} is zero. For a homeowner with gains above the exclusion, t_{cg} is his statutory long-term capital gains tax rate.[6] As discussed above, this rate is either 0 or 15 percent, depending on the homeowner's marginal tax bracket, until 2011 when those rates rise to 10 and 20 percent, respectively.

In the calculation of homeowner user costs, I assume that marginal residential gains in excess of the exclusion are always taxed at long-term rates. Tax law stipulates that in order for a homeowner to receive the maximum exclusion, he or she must have met the residency requirement of two out of

[4]Bruce and Holtz-Eakin (1999) note that households have the option of investing in tax-advantaged assets. They attach a multiple of 0.5 to the tax rate on investment income to capture the average allocation of savings across taxable and tax-advantaged assets found by Engen and Gale (1996). This played an important role in their analysis since the aim was to model the effects of switching to a consumption-based tax system, eliminating capital taxation. The usefulness of including this in the current model is more limited. While it would increase the household's user cost by raising the effective yield on alternative assets, the parameter would not vary in the present analysis. After the methodology is described in the next section, it will become evident that the effects would largely wash out. Thus it has been excluded.

[5]Other than its implication for the potential wedge between t_{mid} and t_{ptd}, the current cap on the mortgage interest deduction is ignored in this analysis. While Anderson et al. (2007) include terms that capture the cost of debt financing above and below the cap, they find that this only increases user costs by an average of 0.02% due to the small number of mortgages that exceed the cap.

[6]Several components of the user cost equation are periodic expenditures that occur every unit of time, such as property tax and mortgage interest payments and maintenance. The capital gains treatment here is slightly different. Although gains are taxed only upon realization, this term can be thought of as the accrued tax per period. Upon realization, the homeowner would bear the full cost of the taxable gain accrued across all previous periods. Alternatively, one could think of this user cost as though gains were fully taxed as they accrue.

the previous five years. However, some homeowners who realize gains under special circumstances after a shorter period may qualify for a partial exclusion. Therefore, the applicable tax rate for homeowners in the first year of ownership is not able to be definitively determined. For purposes of estimating user costs, the following set of alternative assumptions were considered. First, no homeowners would qualify for the partial exclusion. Second, homeowners with less than one year of tenure would face short-term rates on their housing gains while homeowners in their second year of tenure would face long-term rates on all gains. It was determined that the resulting complexity from adding this to the model exceeded the benefit of a slightly more accurate estimate of user costs.

To briefly recap, the last-dollar user cost of owner-occupied housing depicted by Equation (3.5) is the sum of the household's cost of debt financing (first term), the opportunity cost of housing equity (second term), local property taxes net of federal deduction (third term), and maintenance and depreciation, minus any after-tax capital gain (last term).

3.5 Data and Methodology

In this paper, the 2007 Survey of Consumer Finances was used to estimate Equation (3.5) for households. The SCF contains direct information for several of the parameters in the user cost equation. More importantly, it contains income data that allows for the estimation of the household's various marginal tax rates that impact the user cost of owner-occupied housing. Unsurprisingly, the SCF has been used in other studies of this kind (Poterba and Sinai, 2008a,b).

The SCF is a cross-sectional dataset sponsored by the Federal Reserve Board and U.S. Department of Treasury that focuses on the income, assets, and balance sheets of households, including owner-occupied housing and other real estate. The 2007 wave contains 22,090 observations corresponding to five implicates of each of 4,418 unique households. 2,915 of the households were selected using a multi-stage area-probability methodology designed to yield a sample of households with characteristics representative of the population of U.S. households. The remaining households were chosen based on Internal Revenue Service (IRS) Statistics of Income (SOI) data. These households are disproportionally wealthy, chosen to give the overall sample good coverage of households of all levels of wealth.

One major advantage of the SCF is that there are no missing values in the public dataset. Any values coded as missing in the raw survey data, either due to non-response or other reasons, are imputed using a multiple imputation technique. This involves drawing five values from an estimate of the conditional distribution of the data. Thus, five values for each missing value are given, stored in the data as five implicates of the same underlying household. This is why the total number of observations in the dataset is five times the number of surveyed households.[7] As noted in Kennickell (2009), multiple imputation is desirable relative to single imputation because it generates more efficient estimates due to providing multiple outcomes from a random process.

Each observation is given a weight by the Federal Reserve designed to generate aggregate totals across households and implicates that are consistent with those estimated from the Current Population Survey. In the 2007 SCF, the sum of weights within a given implicate for all observations total approximately 116.1 million, representing 116.1 million households.[8]

Central to this analysis is the household's current income and primary residence-related information. All income and most expenditure values, such as mortgage interest and property taxes paid, reported in the 2007 SCF are from the 2006 calendar year while current home value is measured at the time of interview.

The first part of the analysis involves comparing user costs calculated using a model that incorporates the taxation of gains above the exclusion to those using a model that does not.[9] To do these calculations, each household's effective marginal tax rates that apply to the mortgage interest and property tax deductions must be calculated. The Taxsim model maintained by the National Bureau of Economic Research was employed to estimate these rates.[10] I use the mapping of SCF variables to tax return line items based on that originally used in Moore (2004) and replicated by Poterba and Sinai (2008a,b).[11] After running the data through Taxsim to calculate the household's federal income tax liability, in three separate runs, \$1,000 was added to each of the taxpayer's mortgage interest and property tax deductions and subtracted from the taxpayer's taxable interest income. The marginal tax rates that influence the household's user cost, t_{mid}, t_{ptd}, and t_i from Equation (3.5), were calculated as the change in the household's federal income tax liability in each of these scenarios relative to the initial run through Taxsim, respectively, divided by \$1,000.[12] In

[7]For more information on the multiple imputation methodology used in the SCF, interested readers can consult Kennickell (1998) and Montalto and Sung (1996). For more discussion of multiple imputation in general, see Rubin (1987).

[8]For further technical details of the weighting methodology, see Kennickell (1999).

[9]The difference is simply the last term in Equation (3.5). Ignoring the taxation of excess gains is equivalent to setting t_{cg} to zero for all households.

[10]Taxsim can be accessed at http://www.nber.org/~taxsim. For information regarding the Taxsim model, see Feenberg and Coutts (1993).

[11]The SAS code can be found at http://www.nber.org/~taxsim/to-taxsim/scf/taxsimscf07.sas.

[12]This method of calculating last-dollar marginal tax rates is also used in Poterba and Sinai (2008a,b).

other words, if a household has an estimated \$12,000 federal tax liability that is reduced to \$11,750 after adding \$1,000 to its property tax deduction, *ceteris paribus*, its marginal tax rate that applies to the property tax deduction, or t_{ptd}, is 25 percent.

The homeowner's capital gain is calculated as the difference between the home's current value as reported by the homeowner at the time of the interview and the reported purchase price.[13] If the calculated gain was under the exclusion amount of \$250,000 or \$500,000, depending on the filing status of the taxpayer, the marginal tax rate on the housing gain, or t_{cg}, was given a value of zero. For one set of calculations, this parameter is the household's statutory tax rate on long-term capital gains, which depends on its tax bracket and is discussed in Section 3.2, if the gain was above the exclusion. For example, a married couple that is in the 31 percent bracket and has accumulated gains in excess of \$500,000 is given a value of 15 percent for t_{cg}. According to the last term in Equation (3.5), the user cost of the last dollar of accumulated gain decreases the household's user cost of owning the home by $1-0.15$, or 85 cents, the after-tax return from a dollar of appreciation. For an otherwise identical couple with residential gains below the exclusion, its last-dollar user cost is offset by the full dollar of appreciation since its effective long-term rate is zero. For another set of calculations that do not incorporate the taxation of excess gains, such as in previous studies, this rate is zero for all households.

The household's loan-to-value ratio, λ, is calculated by dividing each household's home value by the total balance reported outstanding on the homeowner's first and second mortgages. The SCF contains questions regarding current loan balances as well as original principal amounts and terms for first and second mortgages as well as home equity loans.[14] The mortgage rate used in the analysis, i_m, is an average of the interest rates reported by the homeowner associated with each mortgage, weighted by the amount borrowed. For example, a homeowner who borrowed \$80,000 at 6 percent and \$20,000 at 9 percent faces an average mortgage rate of 6.6 percent on each dollar borrowed. The household's effective property tax rate, t_p, is calculated as as the amount of local property taxes paid divided by the current value of the home.[15]

[13] This method may overstate accrued gains due to the ability of homeowners to include some additional costs when calculating their cost basis. In particular, they will be overstated to the extent that home improvements are captured in the homeowner's assessment of the home's value but not in his report of the price paid. Unfortunately, the SCF does not include sufficient detail to make the appropriate adjustment.

[14] Although current tax code allows for interest on up to \$100,000 worth of home equity loans to be deducted from federal AGI, this paper follows previous literature and omits this from the analysis. Since a significant share of home equity debt is used to finance non-housing consumption, it is not clear how this should be modeled in a user-cost framework. While one could include a term that captures this benefit to homeowners and reduces their user cost, any assumption regarding parameter values would be highly arbitrary.

[15] Previous studies often use a uniform mortgage rate and/or property tax rate across all homeowners, typically due to a lack of household-level data. This highlights a relative strength of the SCF for this application.

The remaining variables in the model are assumed to be constant across households. The average return on 10-year Treasury notes in 2007 was 4.63 percent. This is used as a measure of the homeowner's opportunity cost of housing equity, denoted by r_e in Equation (3.5).[16] Nominal home price appreciation (π) in 2007, based on an index constructed by the Office of Housing Enterprise Oversight (OFHEO), was 2.15 percent. Maintenance and depreciation costs for all homeowners are assumed to be 2.5 percent, within the range of previous studies.

For analysis purposes, adjustments were made to the data. First, 5,420 observations were dropped due to not owning the primary residence. An additional 1,355 observations were dropped corresponding to those who live in mobile homes or on farms. An additional 70 observations were dropped for those households headed by someone under the age of 25 and 221 more for those observations with estimated marginal tax rates higher than is plausible.[17] This leaves 15,024 observations representing 71,620,129 households.

The second part of the analysis involves analyzing the effects of future tax policy (EGTRRA and JGTRRA expiration). To do so using current or historical data, either the data must be scaled to future values or future tax parameters must be scaled to the year of the data. Since this study utilizes the NBER Taxsim model to estimate marginal tax rates, which uses future tax parameters to estimate federal tax rates and liabilities for upcoming years, the former approach was taken.

For the baseline calculation of last-dollar user costs in the last year of current policy, each of the variables was inflated to year-2010 equivalents using a variety of growth rates obtained from the firm Global Insight (G.I.).[18] These rates are reported historical data through 2008 and forecast rates thereafter. For example, they report a wage and salary index value of 1.021 for 2006 and 1.087 for 2008 based on actual data and a forecast value of 1.115 for 2010, relative to the baseline period of December, 2005. Reported wages for each homeowner were therefore inflated by 9.21 percent, converting 2006 income to projected 2010 levels. In this baseline calculation, other tax-related variables such as social security and pension income, transfer payments, and unemployment benefits were inflated using past values of CPI through 2008 and G.I. forecast CPI values from 2009 and 2010, a cumulative increase of 7.1 percent.

[16] Poterba and Sinai (2008a,b) use the 10-year Treasury rate while Sinai and Gyourko (2004) use 7-year Treasuries. Many other studies either do not include the opportunity cost of equity or use assumed values not based on actual rates. An alternative to Treasury yields is the homeowner's mortgage rate, as used by Himmelberg et al. (2005). They note that mortgage rates are typically higher than Treasuries due to the homeowner's options to default and/or refinance and that this premium is deductible, providing additional financial benefits.

[17] These adjustments mimic Poterba and Sinai (2008a,b).

[18] Projections from the latest short-term forecast by G.I. available at the time of writing, dated May 2009, were used.

This "2010-equivalent" of the 2007 SCF was then run through the Taxsim model to obtain estimates for the household's various effective marginal tax rates, as described above. While most tax parameters for future years, such as marginal tax rates, are known based on current tax law, bracket dollar thresholds are not set sufficiently in advance to know them with certainty. For Taxsim calculations, NBER assumes that bracket amounts are indexed by 2.5 percent per year after 2008.

To calculate the homeowner's applicable capital gains tax rate in 2010, a similar extrapolation as described above for the income variables was conducted. The homeowner's reported home value in the 2007 SCF was adjusted to 2008 using G.I.'s index of average existing home prices (9.7 percent decline) and then further adjusted to 2010 using their forecast. Overall, home values are projected to be 21.1 percent lower in 2010 than they were in 2007, the end of the housing bubble. The gain is the difference between this estimate of 2010 value and the reported purchase price. The homeowner was then assigned its statutory rate on long-term gains dependent on marital status, level of gain, and marginal tax bracket.

The household's loan-to-value ratio and weighted average mortgage rates were calculated as described above and the remaining variables take on assumed values. The return on 10-year Treasury notes in 2010 is forecast by G.I. to be 3.05 percent, to be used as the opportunity cost of equity. Nominal home price appreciation in 2010, based on G.I.'s forecast, is predicted to be 2.11 percent. Maintenance and depreciation remains 2.5 percent.

The preceding several paragraphs have outlined the procedure used to construct a dataset of households based on the 2007 SCF that is designed to approximate the financial and housing situation of households in 2010. This allows for the calculation of homeowner user costs in the last year EGTRRA and JGTRRA will be in effect. An identical approach was used to extend the data an additional year. That is, home values, wages, and other monetary values were adjusted by the latest Global Insight forecast to create a "2011 version" of the SCF. These data were used to estimate households' effective marginal tax rates, via Taxsim, and housing user costs under post-EGTRRA and JGTRRA tax law.[19] Comparing the user costs under the two tax regimes gives insight into the effects of the sunset on homeowners.

Again, several adjustments were made to the data. For the 2010 dataset, 5,420 observations were dropped due to not owning the primary residence. An additional 1,355 observations were dropped

[19] In its calculation of federal tax liabilities for future years, Taxsim assumes that policy will be set according to current law. Current law states that EGTRRA and JGTRRA will expire on January 1, 2011. Thus, calculated tax liabilities for 2011 and beyond reflect their expiration.

corresponding to those who live in mobile homes or on farms. An additional 70 observations were dropped for those households headed by someone under the age of 25, 7 more for those with loan-to-value ratios greater than 1.5, and 102 more for those observations with unreasonable estimated marginal tax rates.[20] This leaves 15,136 observations representing 71,611,655 households. Trimming the 2011 dataset in a similar fashion resulted in 15,190 observations corresponding to 71,961,187 households. Table 3.2 breaks these observations down by income and age where income is defined as federal adjusted gross income plus transfer payments, Social Security and unemployment benefits, and any AMT preference items that can be estimated from the SCF.

3.6 Results

Table 3.3 contains the estimated last-dollar user cost of owner-occupied housing in 2007 by both the household's age and income with and without incorporating the taxation of the last dollar of accrued gains in excess of the $250,00 and $500,000 exclusion.[21] These results show that on average, the two calculations do not differ by much (0.36 percent). However, these differences vary considerably across household groups due to the asymmetric distribution of households with excess gains. The difference is larger for those groups that are likely to have accrued gains in excess of the exclusion, particularly those with higher incomes and older homeowners. The taxation of excess gains has essentially no impact on those households headed by an individual under age 34 and those with incomes under $40,000, increasing user costs for each by less than one-tenth of one percent. Conversely, the user costs for households with annual incomes exceeding $250,000 increase by 2.6 percent after taking into account taxes on long-term gains.

The difference is even more pronounced when only looking at those that are affected by the tax. Overall, failing to account for the taxation of a marginal dollar of housing gain for these households leads to a user cost estimate that is downward biased by over 5 percent. The variation across household types is also quite large. The user costs for the lowest-income homeowners differ by less than 2 percent while calculations for the highest-income homeowners will be more than 7 percent lower in a model that ignores the current tax treatment of residential capital gains. These results suggest that user cost estimates obtained from models that ignore taxes on housing gains may not suffer from a large downward bias when conducted on full representative samples. However, this bias systematically affects households with higher incomes and those otherwise expected to have

[20] These adjustments mimic Poterba and Sinai (2008a,b).

[21] All user costs estimates presented are weighted averages using the 2007 SCF weights.

large accrued gains. Thus, comparisons of user costs across groups using these models may also suffer from bias.

Table 3.4 contains the estimated user costs under several aspects of EGTRRA and JGTRRA expiration. Column (1) shows the last-dollar user costs for households using both the 2010 dataset (described in the previous section) and 2010 tax law. User costs decrease steadily as the age of the head of household increases, falling from an average of 6.75 cents for the last dollar of housing for households aged 25 to 34 to 4.78 cents for those over age 65, a decrease of almost 30 percent. This is likely to due to older households having lower loan-to-value ratios due to longer tenure and time spent paying down debt. While a lower loan-to-value ratio decreases the cost of debt financing, it increases the opportunity cost of equity, having a theoretically ambiguous effect on the user cost. However, since average mortgage rates are higher than the risk-free rate of return used as the measure of opportunity cost, the lower cost of debt financing will dominate for most households, resulting in a negative relationship between the loan-to-value and user cost.

As shown in the second grouping of Table 3.4, user costs increase from 0.0543 for those with household income under $40,000 in 2010 to 0.0601 for those with incomes between $40,000 and $75,000. However, after this point, user costs decrease as income rises. This is primarily due to the effect of the property tax and mortgage interest deductions. Homeowners are more likely to itemize deductions as their incomes grow and are thus able to take advantage of housing-related deductions. In addition, higher income households have higher marginal tax rates. As explained above, higher marginal tax rates reduce the user cost of owner-occupied housing through larger subsidies.

Column (2) contains the user cost estimates for homeowners in 2011, after EGTRRA and JGTRRA sunset. This reflects increases in both marginal tax rates (which decrease user costs) and long-term capital gains tax rates (which increase user costs). These user costs exhibit the same patterns: user costs decrease with household age and (generally) income. Comparing these values with those in column (1) gives the impact of the full expiration on homeowner user costs from 2010 to 2011. Since the goal of this study is to determine the effects of future policy on user costs under current policy, all comparisons are made to the baseline 2010 calculations.

Columns (3) and (4) contain the user costs under two hypothetical tax regimes, each of which aims to capture one aspect of the tax change. To make this comparison, I take the calculated user costs in 2011 and set effective marginal and long-term capital gains tax rates, separately, back to 2010 levels. Each of these sets of calculations thus gives the estimated user cost that households would have faced in 2011 if only marginal tax rates (MTR) or long-term capital gains rates (LTCG) had reverted back to pre-EGTRRA levels. Column (3) is the average user cost in 2011 under all aspects of that year's tax policy except marginal income tax rates, which are set back to what the household's estimated effective rate was in 2010. Comparing these values to those in column (1) isolates the impact of the rising capital gains tax rates since the MTRs are held constant in both calculations but the LTCG rates are allowed to change. Column (4) is the average user cost in 2011 under that year's policy, save long-term capital gains rates, which are set back to 2010 levels. Comparing these values to those in column (1) isolates the effect of the rising marginal income tax rates on homeowner user costs since these differ between the two columns.[22]

Table 3.5 shows these percentage changes. Column (1) is the change due to the full expiration of all provisions, while columns (2) and (3) separate the effects of the capital gains and marginal income tax rates, respectively. Overall, EGTRRA and JGTRRA will lower the average last-dollar user cost of owner-occupied housing across all households by 4.3 percent.[23] The percentage decrease is relatively similar across households under the age of 65. However, the percentage decrease for those households aged 65 and above is much smaller. This is due in part to the large portion of retirement-age households in low income brackets. According to the information generated from the data and Taxsim, over 40 percent of all households above age 65 will have taxable income below the threshold for the lowest tax bracket. Thus, marginal income tax rate increases will have no effect on these households. Additionally, fewer households of this age itemize on their federal returns. The user cost for non-itemizers is not impacted by marginal tax rate changes.

The next panel indicates that the change in user costs is highly variable across income groups, with the largest percentage reductions for those with the highest incomes. This is due to a number of factors. First, higher income households are more likely to itemize, benefiting from the larger mortgage interest and property tax deductions. Second, as shown in Table 3.4, user costs are already lower for higher income households, so a similar percentage-point increase in marginal tax rates for households in different income groups contributes to a larger percent reduction in those households'

[22] Recall that the 2011 MTR calculations are based on components of income that are between 1.3 and 2.3 percent higher than in 2010, based on the G.I. forecast. Taxsim calculations assume that bracket thresholds grow at 2.5 percent per year. Thus some households will be in a lower bracket in 2011 than they were in 2010 due to bracket growth exceeding income growth. This column will reflect these households. To the extent this occurs, the comparison between columns (1) and (4) will understate the true effect of the MTR increases from EGTRRA and JGTRRA expiration.

[23] These differences in user cost are more modest than those found in Poterba (1992) from tax cuts in the 1980s, overwhelmingly due to the smaller changes in marginal tax rates over a much shorter time period. Whereas the expiration of EGTRRA and JGTRRA will increase marginal rates by only a few percentage points for each homeowner, marginal rates for some homeowners fell by as much as 31 percentage points from 1980 to 1990.

last-dollar user costs. Several studies have shown that the tax cuts contained in EGTRRA and JGTRRA were generally regressive, generating larger after-tax gains (as a percentage of income) for households with larger incomes (Gale and Potter, 2002; Leiserson and Rohaly, 2008). Therefore, their expiration should increase the progressivity of the federal individual income tax. However, these results suggest that the expiration would be regressive in terms of homeowner user costs. On average, a household with income over $250,000 in 2010 would receive 6.6 times the percentage reduction in user costs than a household with an income less than $40,000.

Columns (2) and (3) of Table 3.5 show how the long-term capital gains rate and marginal income tax rate increases each contribute to the change in user costs from 2010 to 2011, respectively. There are several conclusions that can be drawn from these results. First, increases in capital gains tax rates increase user costs, as mentioned above in the discussion of the user cost framework. Second, these increases contribute little to changes in aggregate homeowner costs since the majority of homeowners have an effective long-term rate of zero as a result of accumulating gains below the exclusion, increasing user costs by a maximum of 0.43 percent for any particular sub-group. Instead, most changes in homeowner user costs are driven by changes in the household's marginal tax rates, which are offset only slightly by the capital gains tax increases. Because of this, the effect of the marginal income tax rate increases follow the same regressive pattern as the overall effect of EGTRRA and JGTRRA expiration. Third, the effect of the capital gains rate increases is largest for households over the age of 65 and those with incomes over $250,000. Older households are more likely to have accrued gains in excess of the exclusion due to longer tenure and exposure to home price appreciation. Higher income households are likely to own more valuable homes, which generate larger nominal gains, on average, than less valuable homes. Since the exclusion is set at a nominal threshold, nominal appreciation on the last dollar of housing consumed is more likely to be taxable for these two groups of homeowners.

The number of homeowners with accrued gains in excess of the residential capital gains exclusion under a variety of calculations is shown in Table 3.6.[24] According to the 2007 SCF, there were over 6 million households with gains above their applicable exclusion, fairly evenly split between single homeowners with gains above $250,000 and married households with gains above $500,000. This represents over 5 percent of all households in the U.S. and over 7.5 percent of all homeowners. A disproportionate number of these households were either older or had high incomes. Over three quarters of these households were over the age of 50 and half had annual household incomes of

[24] The aggregates shown are based on the raw 2007 SCF and are not trimmed according to the criteria defined in Section 3.5.

at least $125,000. Furthermore, these households had tremendous gains. The average gain for married households above the exclusion was over $1.04 million, corresponding to a taxable gain of over $539,000.

However, this does not represent the number of households with excess gains used in the analysis. The home values reported in the 2007 SCF reflect the height of home prices, which have fallen substantially and are projected to fall even further by 2010. As discussed in Section 3.5, these declines are built into the data used for the analysis. After accounting for a projected 21.1 percent decline from 2007 to 2010, there is projected to be over 2.5 million fewer households with taxable gains in 2010. Had these price declines not occurred, a larger share of households would have been affected by the increase in capital gains tax rates in 2011, leading to larger increases in the user cost of housing reported in column (2) of Table 3.5. This would have offset a larger share of the user cost reductions from the higher marginal income tax rates, leading to a smaller average decline in user costs.

The user costs for only those households with gains in excess of the exclusion in 2010 are shown in Table 3.7, again divided into age and income groups and calculated under full and partial expiration of EGTRRA and JGTRRA. The first point to be made is that each user cost estimate is lower than the corresponding value for all households (Table 3.4). This is likely due to higher loan-to-value ratios for this subset of households than for the full sample as well as higher marginal tax rates.

While the values of the estimated user costs are useful, the primary concern is the percentage change in the values under current policy and post-EGTRRA and JGTRRA expiration. These percent changes are shown in Table 3.8. The most significant conclusion from this set of results is that the percentage reductions under the two tax regimes is much smaller for those with gains than for the overall population. If these households are wealthier, on average, than those with low levels of gain, even within the same income group, then EGTRRA and JGTRRA expiration is progressive in this respect. This is due in large part to the stronger effect of higher capital gains tax rates. Whereas the capital gains rate increases account for a 0.12 percent increase in the user cost for the average household for the entire sample, they account for a 3.04 percent increase for those with gains in excess of the exclusion.

Additionally, the percentage increases are smaller as income rises beyond $40,000 per year. This reflects the value of the capital gains rate resets. For those in the 10 and 15 percent marginal income tax brackets, the tax rate on long-term capital gains is zero in 2010 and 10 percent in 2011.

Therefore, under current policy, the tax rate on a marginal dollar of home price appreciation for households in the lowest two brackets is zero even if they have gains in excess of the exclusion. A move to a regime in which the marginal dollar of gain is taxed should be expected to generate a large percentage increase in user costs. Conversely, for households in higher tax brackets, the increase in long-term rates is only from 15 percent to 20 percent, a much smaller increase.

The last set of analyses involves a scenario in which housing values continued to grow after 2007 at a rate of 7.2 percent per year, the approximate average annual home price growth from 2002 to 2006, based on G.I.'s index of the average price of existing homes. The right-most panel of Table 3.6 shows the aggregate number of households with gains above the exclusion under this assumption. This sustained housing growth would have increased the number of homeowners with excess gains to over 10 million in 2010 and 11.7 million in 2011, increases of over 66 and 92 percent, respectively, from 2007. These numbers represent 12.6 to 14.5 percent of all owner-occupants in the 2007 SCF. The majority of the growth would have come from those in lower income brackets. The number of households with excess capital gains and income below $75,000 would have increased by 102 percent, bringing over 2 million more households above the exclusion and thus subject to taxes on residential gains.

The last-dollar user costs under this scenario are shown in Table 3.9. Overall, these values are not grossly different than those in the baseline user cost calculations, with an estimated average last-dollar user cost of 0.0559 for all households. The percent change in these values under EGTRRA and JGTRRA expiration are shown in Table 3.10. Again, the cumulative effect of the rollback decreases user costs, with larger declines for younger and higher-income households.

As discussed in the previous paragraph, under this scenario of continued home price appreciation, a larger share of households have gains in excess of the exclusion. Thus, the capital gains tax rate increases affect a larger share of households, offsetting the user cost effects of the marginal income tax rate increases more than four times that in the baseline scenario. For example, the capital gains rate increases raise user costs by 1.78 percent for households with income of $250,000 or more under continued home price appreciation. However, under the baseline calculations in Table 3.5, they only increase user costs by less than a fourth of that, or 0.43 percent. Across all households, the expiration of EGTRRA and JGTRRA would have decreased user costs by only 3.87 percent in this scenario, compared to 4.30 percent in the baseline. In this way, falling home prices have actually mitigated the effect of the coming tax rate increases on last-dollar user costs of owner-occupied housing by up to 11 percent.

3.7 Conclusions

In less than 20 months, assuming no new legislation, almost all taxpayers will face higher marginal income and capital gains tax rates. This paper and the lengthy line of literature it succeeds have shown that the cost of owner-occupied housing is inherently linked to income tax rates through the mortgage interest and property tax deductions and the exclusion of imputed rent from taxation. The existing literature has thus far ignored the effect of capital gains taxes on user costs, other than assuming them to be irrelevant. This paper has shown that models that fail to account for the taxation of gains in excess of the current exclusion will underestimate user costs and that the bias is systematically larger for those with larger incomes to the extent that those households have accrued a disproportionate share of excess gains. Specifically, although incorporating capital gains taxes increases average last-dollar user costs by only about one-third of one percent, it increases costs for those with excess gains by over 5 percent, particularly those with incomes greater than $250,000 (over 7 percent).

Further, despite much discussion regarding EGTRRA and JGTRRA expiration and continued attention on housing markets, the link between the two had yet to be firmly established in either political discourse or empirical research. This paper attempts to address both these shortcomings. Applying an augmented user cost model of owner-occupied housing that includes the current tax treatment of residential capital gains to the 2007 Survey of Consumer Finances, the last-dollar user cost for homeowners was calculated under several scenarios and tax regimes. Comparisons of user costs were made under current and post-EGTRRA and JGTRRA tax policy in order to determine the effect of the coming tax rate increases on homeowners.

While previous studies have shown that the 2001 and 2003 tax cuts were generally regressive, and thus their sunset will increase the progressivity of the federal income tax, the results from this paper indicate that the coming tax increases will actually have a *regressive* effect on the cost of homeownership. On average, user costs will fall in 2011 as the larger subsidies provided through the mortgage interest and property tax deductions from higher marginal income tax rates dominate higher capital gains tax rates. However, high-income households will enjoy a larger percentage drop in user costs despite being more likely to have taxable gains.

In particular, homeowners over the age of 65 and those with incomes below $75,000 are estimated to receive the lowest reduction in user costs, between 1.4 and 2.7 percent, driven by low itemization and marginal income tax rates while those households with incomes of $250,000 or more will experience reductions of over 9 percent for opposite reasons. Despite the fact that these households are most likely to have gains in excess of the exclusion, this reduction in user cost outweighs the relatively small increase in statutory capital gains tax rates from 15 percent to 20 percent.

While the overall effect of EGTRRA and JGTRRA expiration on homeowner user costs is regressive, the results highlight the fact that residential capital gains taxes have the potential to reduce the regressivity of the total tax subsidies provided to homeowners through the federal income tax. Higher long-term capital gains tax rates in the presence of an exclusion increase user costs disproportionally for higher income households since those households are much more likely to have accrued gains in excess of the exclusion. Therefore, policymakers may wish to target this tax as a means to reduce the regressivity of housing tax subsidies. However, in the current environment, any tax increase targeted towards owner-occupied housing is likely to be a political non-starter as policymakers actively seek to strengthen housing demand, even recently passing further tax breaks for home buyers. This paper shows that the expiration of EGTRRA and JGTRRA will lower the costs of homeownership, potentially achieving this goal without further legislation.

Appendix B

Table 3.1: Summary of EGTRRA and JGTRRA Expiration

Bracket	2010 Marginal Rate (%)	2010 LT Capital Gains (%)	2011 Marginal Rate (%)	2011 LT Capital Gains (%)
1	10	0	15	10
2	15	0	15	10
3	25	15	28	20
4	28	15	31	20
5	33	15	36	20
6	35	15	39.6	20

Table 3.2: Observations for User Cost Calculations

	2010 Obs.	2010 Households	2011 Obs.	2011 Households
Age				
25-34	1,135	8,377,483	1,145	8,472,869
35-49	4,369	22,388,006	4,408	22,613,976
50-64	5,863	22,868,327	5,869	22,841,394
65+	3,769	17,977,828	3,768	17,918,153
Income				
< \$40k	2,034	17,100,298	2,007	16,898,085
\$40-75k	2,308	16,689,891	2,302	16,717,373
\$75-125k	2,682	17,920,464	2,666	17,900,756
\$125-250k	2,894	14,782,535	2,943	15,224,098
> \$250k	5,218	5,118,465	5,272	5,220,876
Total	15,136	71,611,655	15,190	71,961,187

Note: These observations apply to all user cost estimates in the paper unless otherwise noted. The 2007 SCF replicate weights were used to determine the number of represented households. Strata subtotals may not sum to all households due to rounding.

Table 3.3: Last-Dollar User Cost With and Without Taxation of Excess Gains, 2007

	All homeowners			**Those with excess gains**		
	w/o tax	w/ tax	Difference	w/o tax	w/ tax	Difference
Age						
25-34	0.0624	0.0624	-0.01%	0.0529	0.0546	-3.06%
35-49	0.0595	0.0596	-0.26%	0.0476	0.0500	-4.87%
50-64	0.0551	0.0553	-0.44%	0.0449	0.0477	-5.86%
65+	0.0560	0.0564	-0.57%	0.0479	0.0502	-4.54%
Income						
$< \$40$k	0.0616	0.0616	-0.09%	0.0558	0.0568	-1.89%
$40-75k	0.0612	0.0613	-0.16%	0.0502	0.0519	-3.21%
$75-125k	0.0571	0.0573	-0.24%	0.0472	0.0497	-5.06%
$125-250k	0.0508	0.0512	-0.75%	0.0442	0.0474	-6.69%
$> \$250$k	0.0454	0.0466	-2.59%	0.0417	0.0449	-7.16%
All	0.0576	0.0578	-0.36%	0.0469	0.04934	-5.04%

Note: Calculations assume 4.63 percent yield on alternative assets, 2.5 percent annual maintenance and depreciation, and 2.15 percent nominal home price appreciation.

Table 3.4: Last-Dollar User Cost by Tax Regime

	2010 User cost (1)	**2011 User cost** (2)	**2011 User cost w/ 2010 MTR** (3)	**2011 User cost w/ 2010 LTCG** (4)
Age				
25-34	0.0675	0.0646	0.0675	0.0646
35-49	0.0612	0.0581	0.0612	0.0580
50-64	0.0523	0.0499	0.0524	0.0498
65+	0.0478	0.0465	0.0480	0.0464
Income				
< \$40k	0.0543	0.0536	0.0544	0.0535
\$40-75k	0.0601	0.0588	0.0602	0.0588
\$75-125k	0.0585	0.0552	0.0585	0.0552
\$125-250k	0.0529	0.0492	0.0530	0.0492
> \$250k	0.0448	0.0406	0.0449	0.0403
All	0.0557	0.0533	0.0558	0.0533

Note: Calculations assume 3.05 percent yield on alternative assets, 2.5 percent annual maintenance and depreciation, and 2.11 percent nominal home price appreciation.

Table 3.5: Percent Change in Last-Dollar User Cost from EGTRRA/JGTRRA Expiration

	All provisions (1)	**LTCG rate increases** (2)	**MTR increases** (3)
Age			
25-34	-4.40	0.00	-4.40
35-49	-5.09	0.07	-5.15
50-64	-4.70	0.12	-4.81
65+	-2.69	0.28	-2.94
Income			
$< \$40$k	-1.42	0.20	-1.47
\$40-75k	-2.09	0.23	-2.20
\$75-125k	-5.60	0.20	-5.67
\$125-250k	-6.93	0.25	-7.03
$> \$250$k	-9.38	0.43	-9.95
All	-4.30	0.12	-4.41

Note: All values are percent changes in user cost estimates under the various tax regimes in Table 3.4. Column (1) in this table is the change from column (1) to (2) in Table 3.4. Columns (2) and (3) are the changes from columns (1) to (3) and (1) to (4) in Table 3.4, respectively.

Table 3.6: Homeowners with Gains in Excess of the Exclusion

	2007		Forecasted 2010		Forecasted 2011		Alternative Home Price Growth 2010		Alternative Home Price Growth 2011	
	Households	Avg. Excess	Households	Avg. Excess	Households	Avg. Excess	Households	Avg. Excess	Households	Avg. Excess
Status										
Single	3,180,724	$261,612	2,034,726	$219,739	2,154,620	$219,467	4,996,886	$283,080	5,460,640	$306,012
Married	2,946,908	539,595	1,506,407	531,866	1,588,214	536,935	5,210,781	543,717	6,276,101	545,141
Age										
25-34	57,773	633,946	26,026	806,690	26,026	841,646	173,102	363,337	271,795	300,684
35-49	1,450,005	296,711	631,350	275,569	701,713	269,069	2,417,043	366,097	2,854,312	386,514
50-64	2,044,548	399,728	1,066,377	385,844	1,128,805	388,026	3,983,514	372,158	4,658,131	387,479
65+	2,575,306	441,941	1,817,380	353,192	1,866,290	358,861	3,634,008	500,122	3,952,503	531,941
Income										
< $40k	921,644	200,371	523,991	184,042	538,003	189,138	1,660,441	199,477	1,870,557	213,164
$40-75k	1,064,660	195,994	551,427	156,632	647,868	144,763	1,975,935	211,175	2,144,666	242,502
$75-125k	1,080,195	265,718	614,077	226,051	646,328	229,349	1,811,600	291,053	2,085,299	309,342
$125-250k	1,470,186	453,080	797,598	461,997	833,822	465,694	2,470,266	459,542	2,967,129	456,675
> $250k	1,590,948	676,186	1,054,040	529,588	1,076,813	551,211	2,289,426	802,280	2,669,092	814,313
All	6,127,632	395,300	3,541,133	352,518	3,742,834	354,180	10,207,668	416,129	11,736,742	433,884

Source: Author's calculations using 2007 SCF and Global Insight's May, 2009 forecast.
Note: Forecast home price growth is -21.1% from 2007 to 2010 and -19.45% from 2007 to 2011. Alternative scenario assumes 7.2% home price growth per year after 2007, the approximate average annual growth from 2002 to 2006.

Table 3.7: Last-Dollar User Cost for those with Excess Gains in 2010

	2010 User cost (1)	**2011 User cost** (2)	**2011 User cost w/ 2010 MTR** (3)	**2011 User cost w/ 2010 LTCG** (4)	**Obs.**	**Households**
Age						
25-34	-	-	-	-	0	0
35-49	0.0416	0.0404	0.0429	0.0391	419	631,350
50-64	0.0399	0.0385	0.0411	0.0372	1,240	1,014,712
65+	0.0399	0.0393	0.0411	0.0381	1,117	1,780,669
Income						
< \$40k	0.0432	0.0430	0.0441	0.0421	65	476,004
\$40-75k	0.0404	0.0409	0.0423	0.0391	111	546,092
\$75-125k	0.0409	0.0407	0.0427	0.0393	122	512,772
\$125-250k	0.0408	0.0395	0.0419	0.0384	265	704,638
> \$250k	0.0382	0.0363	0.0392	0.0352	2,213	1,187,227
All	0.0402	0.0392	0.0414	0.0380	2,776	3,426,732

Note: Calculations assume 3.05 percent yield on alternative assets, 2.5 percent annual maintenance and depreciation, and 2.11 percent nominal home price appreciation.

Table 3.8: Percent Change in User Cost, those with Excess Gains in 2010

	All provisions (1)	**LTCG rate increases** (2)	**MTR increases** (3)
Age			
25-34	-	-	-
35-49	-2.87	3.17	-5.93
50-64	-3.68	3.01	-6.70
65+	-1.51	3.01	-4.44
Income			
< \$40k	-0.33	2.18	-2.51
\$40-75k	1.27	4.59	-3.19
\$75-125k	-0.70	4.38	-3.96
\$125-250k	-3.22	2.86	-5.82
> \$250k	-5.11	2.38	-7.88
All	-2.41	3.04	-5.39

Note: All values are percent changes in user cost estimates under the various tax regimes in Table 3.7. Column (1) in this table is the change from column (1) to (2) in Table 3.7. Columns (2) and (3) are the changes from columns (1) to (3) and (1) to (4) in Table 3.7, respectively.

Table 3.9: User Cost by Tax Regime, Sustained Home Appreciation

	2010 User cost (1)	**2011 User cost** (2)	**2011 User cost w/ 2010 MTR** (3)	**2011 User cost w/ 2010 LTCG** (4)
Age				
25-34	0.0676	0.0647	0.0676	0.0646
35-49	0.0613	0.0584	0.0616	0.0583
50-64	0.0526	0.0505	0.0530	0.0502
65+	0.0480	0.0469	0.0483	0.0466
Income				
< \$40k	0.0543	0.0536	0.0545	0.0535
\$40-75k	0.0601	0.0590	0.0604	0.0588
\$75-125k	0.0586	0.0555	0.0588	0.0554
\$125-250k	0.0533	0.0500	0.0538	0.0497
> \$250k	0.0456	0.0420	0.0464	0.0414
All	0.0559	0.0538	0.0562	0.0535

Note: User costs are based on home values growing 7.2 percent per year after 2007. Calculations assume 3.05 percent yield on alternative assets, 2.5 percent annual maintenance and depreciation, and 2.11 percent nominal home price appreciation.

Table 3.10: Percent Change in User Cost, Sustained Home Appreciation

	All provisions (1)	**LTCG rate increases** (2)	**MTR increases** (3)
Age			
25-34	-4.27	0.13	-4.32
35-49	-4.69	0.43	-4.98
50-64	-4.08	0.73	-4.57
65+	-2.28	0.68	-2.87
Income			
< \$40k	-1.25	0.36	-1.47
\$40-75k	-1.83	0.49	-2.17
\$75-125k	-5.25	0.33	-5.54
\$125-250k	-6.19	0.91	-6.63
> \$250k	-7.85	1.78	-9.19
All	-3.87	0.53	-4.25

Note: All values are percent changes in user cost estimates under the various tax regimes in Table 3.9. Column (1) in this table is the change from column (1) to (2) in Table 3.9. Columns (2) and (3) are the changes from columns (1) to (3) and (1) to (4) in Table 3.9, respectively.

Chapter 4

Residential Capital Gains Taxes and the Dynamics of Housing Markets

Abstract

The Taxpayer Relief Act of 1997 essentially eliminated the taxation of capital gains on owner-occupied housing. Previous literature has shown that tax-free gains should increase housing consumption due to a higher after-tax return to home ownership. Accordingly, it is perhaps unsurprising that both single-family residential fixed (RFI) investment and housing prices grew at historical rates in the late 1990s and early 2000s. Since RFI has been shown to play a significant role in the business cycle, the capital gains tax change may have significant implications for the macroeconomy. Using a cointegrated vector-autoregression model, this paper explores whether the relationships between monetary policy, housing aggregates, and output have changed since the passage of TRA97. There is evidence that these relationships underwent a structural change after TRA97 was passed. Results indicate that housing variables, single-family RFI, and output behave differently in response to various shocks after the tax change. Specifically, increases in home values are found to increase residential investment under the current tax regime, potentially due to higher after-tax returns to owner-occupied housing. Results also suggest that in the post-TRA97 period, growth in the monetary base has slightly larger effects on GDP.

4.1 Introduction

The United States has a recent history of providing subsidies to taxpayers who own their own homes in the form of preferential tax treatment. Home ownership is generally considered desirable because of its positive social externalities, and thus may warrant a favored status. These social benefits are well-documented as homeowners tend to be relatively more active in their communities, keep their properties well-maintained, and even raise children that are more likely to complete high school than their renting counterparts (Galster, 1983; Shilling et al., 1991; Rossi and Weber, 1996; Green and White, 1997; DiPasquale and Glaeser, 1999; Harding et al., 2000; Haurin et al., 2002).

The first and most widely recognized home ownership-friendly tax provision is the deductibility of mortgage interest payments from federal taxable income. This is the largest of the tax expenditures on housing, and will cost an estimated $101 billion in the 2008 fiscal year according to U.S. Treasury.[1] Second, the net imputed rent of owner-occupied housing is not taxed. Just like other durable goods, homeowners may pay large upfront costs on the purchase of their homes (which may also be taxed), but are not taxed on the continuous stream of housing consumption provided by

[1] See Analytical Perspectives, Budget of the United States Government, Fiscal Year 2009.

the home throughout its useful life. Third, and most significant to this paper, is the tax exemption of essentially all capital gains from the sale of a principle residence. Current tax code permits the exclusion of up to $500,000 of capital gains on the sale of a primary residence. The annual forgone tax revenue attributed to this provision is estimated to be between $30 and $35 billion in 2009.[2]

Like other capital assets, the tax treatment of residential capital gains affects the demand for housing and thus residential fixed investment (RFI), particularly single-family homes. The Taxpayer Relief Act of 1997 (TRA97) essentially eliminated the capital gains taxation on the sale of owner-occupied housing, potentially altering the fluctuation of residential fixed investment. Since residential fixed investment plays a major role in the movement of output over time, this tax change may have broad macroeconomic consequences. Furthermore, it is plausible that the relationship between single-family RFI and other housing variables such as mortgage rates and home prices may have fundamentally changed in 1997. If so, the transmission of monetary policy through its impacts in the housing market may be different under the post-TRA97 regime than prior to the tax change. This paper examines that possibility through vector error-correction techniques, testing for structural breaks in the underlying dynamic models, and comparing the impacts of various shocks across the pre- and post-TRA97 time periods.

The rest of this paper continues as follows: Section 4.2 outlines the current treatment of capital gains taxation on owner-occupied housing, as well as a brief history. Section 4.3 includes a discussion of the theoretical effects of the current tax treatment on the demand for single-family housing and its predicted implications on residential fixed investment and the transmission of monetary policy. Section 4.4 reviews the previous literature on the effects of capital gains taxation on housing and the role of RFI in the transmission of monetary policy. Section 4.5 describes the data used in the analysis and discusses the pre-estimation procedures used to formulate the econometric model. Section 4.6 presents the estimation strategy and discusses the empirical results. Section 4.7 concludes, drawing any relevant policy implications and providing suggestions for future research.

4.2 Capital Gains Taxation of Owner-Occupied Housing

Most capital gains from the sale of a homeowner's primary residence are not subject to federal individual income tax. Specifically, married homeowners who have lived in a house for periods totaling at least two years during the five-year period preceding the sale of the house can exclude

[2]Based on tax expenditure estimates from the Joint Committee on Taxation and the Office of Management and Budget.

the first $500,000 of gain from taxation. The limit is half that ($250,000) for single filers. There is no limit to the number of times a taxpayer may claim this exemption throughout his or her lifetime. The only restriction is that it may be used only once every two years. Any long term gains in excess of the exclusion are taxed at the statutory rate. Currently, taxpayers in the 15 percent marginal income tax rate bracket or below are subject to a rate of 0 percent while those in higher brackets face a rate of 15 percent. These rates are considered favorable in the sense that they are lower than ordinary income tax rates. However, these rates are set to rise to 10 percent and 20 percent, respectively, in 2011 if current tax law remains unchanged.

In general, for a capital gain to be taxed at the long-term rate, the asset must have been owned at least one year. Short-term gains (on assets held less than a year) are taxed as regular income. That being said, the exemption on owner-occupied housing typically applies only to long-term gains since the major requirement is that the home must be a primary residence for any two of the previous five years. In the case of a home being owned for less than a year, and thus the taxpayer fails the occupancy test, the full gain is taxed at the higher short-term rates.[3]

Section (§) 1034 of the Internal Revenue Code (IRC) of 1954 first gave capital gains from owner-occupied housing preferential treatment. This statute allowed all taxpayers, regardless of age, to defer all of the gains from the sale of their homes as long as they purchased another home of equal or greater value to their old home within two years. Thus taxes on capital gains could be deferred forever, so long as the homeowner continued to "trade up" until death.

The Revenue Act of 1964 created the IRC §121, supplementing the benefits provided in 1034 and expanding the tax preference for owner-occupied housing. Previous to 1964, taxpayers aged 65 and older could exclude the entire gain from the sale of their primary residence, as long as the sale price was $20,000 or less and the home served as their primary residence for at least five of the eight years prior to the sale. Under 121, a taxpayer could only use the exclusion once in his or her lifetime.

Section 121 has undergone many changes since 1964. The Revenue Act of 1976 increased the maximum sale price from $20,000 to $35,000, to allow for normal home price appreciation since the cap was first implemented 12 years prior. The Revenue Act of 1978 removed the price limit and instituted a one-time exclusion of up to $100,000 of gain. In 1979, the residency requirement was reduced to three out of the five years preceding the sale of the home. The Economic Recovery Tax

[3]In some special cases, taxpayers who fail the occupancy test may qualify for a partial exemption provided that the sale of the home resulted from 1) a change in the place of employment, 2) health reasons, or 3) certain other unforeseen circumstances.

Act of 1981 lowered the age requirement by 10 years, from age 65 to 55 and increased the one-time exclusion from \$100,000 to \$125,000.

The Taxpayer Relief Act of 1997 (TRA97) significantly extended the capital gains treatment of owner-occupied housing in four ways. First, it repealed 1034, eliminating the rollover option. Second, it increased the capital gain threshold contained in 121 to \$500,000 and \$250,000 for married and single filers, respectively. This essentially exempted all capital gains from taxation, since in 1997 only 2 percent of home sales occurred at prices above \$500,000.[4] In order for a taxable gain to occur, the sales price would have to be significantly higher than that. Third, it made the exemption available to taxpayers of all ages, not just those 55 and older. Fourth, it decreased the residency requirement to two years out of the previous five. Each of these provisions applied to home transactions on or after May 6, 1997. Other than relatively minor decreases in statutory tax rates, there have been no significant changes regarding the capital gains taxation of housing since TRA97. Thus, the rules outlined above are currently in effect.

4.3 TRA97 and Residential Investment

There are several ways in which we ought to expect TRA97 to affect the behavior of current and prospective homeowners. First, even though residential capital gains enjoyed a degree of tax preference prior to 1997, the virtual exemption of gains from taxation due to the broader exclusion made owning a home even more attractive than before. This benefit is likely to have swayed some marginal home buyers. For many Americans, their homes are their largest asset. As such, they have often served as a primary savings vehicle, especially in the late 1990s and early 2000s. When allocating resources across several investment opportunities, the virtual tax-free gain on home equity is attractive relative to other alternatives with higher tax rates, such as corporate equities and bonds. Thus, some individuals may choose to purchase a home instead of continuing to rent, increasing the aggregate demand for housing. TRA97 is likely to have magnified this effect, increasing the relative attractiveness of owner-occupied housing.

Once an individual has decided to purchase a home rather then rent, tax considerations may also factor into how large or expensive of a home to buy. Since the exclusion is (and has always been) set at an absolute dollar threshold, the original purchase price of the home influences the

[4]Richard Woodbury, 1997. Statement to the House Committee on Ways and Means. Savings and Investment Provisions in the Administration's Fisal Year 1998 Budget proposal, Hearing, March 19, 1997 (Serial 105-43). Available at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=105_house_hearings&docid=f:48616.pdf; Accessed: 7/16/08.

probability of generating a taxable gain. Consider the following contrived example: Home A is purchased in 1985 for $300,000 and appreciates at an average annual rate of 4 percent for the next 10 years. It is then sold in 1995 (when the exclusion threshold is $125,000) for $444,000. The sale, therefore, represents a gain of $144,000. $19,000 of the gain is taxable after allowing for the exclusion. Home B is also purchased in 1985, but for $250,000 this time, and appreciates at the same 4 percent average annual rate. It sells in 1995 for $370,000 generating no taxable gain since the realized gain of $120,000 falls under the threshold. The only difference between Home A and Home B was the purchase price. However, they generated significantly different tax bills upon sale. More expensive homes are more likely to generate taxable gains since they will have larger absolute gains and the exclusion is a fixed dollar amount. Since TRA97 tripled the exclusion, expensive homes were less likely to generate a taxable gain. Since individuals may make decisions based on their anticipated gains when deciding how much housing to purchase, TRA97 may have made expensive housing more attractive relative to cheaper housing than was previously the case.

After an individual has already purchased a home, capital gains tax consequences arise when making selling decisions. If capital gains were not afforded any special treatment and were taxed as ordinary income, many homeowners would hold on to their homes longer than they otherwise would like to, creating what's known as the "lock-in" effect where capital is held in inefficient allocations based on tax treatment. Even though residential gains were not taxed fully prior to 1997, TRA97 lowered or eliminated the tax liability incurred from selling one's home as a result of the higher $500,000 threshold. As such, housing turnover might be expected to increase as homeowners were able to move from home to home more freely without the prospect of facing tax liability as a result of the sale.

Overall, these responses would be expected to increase the aggregate demand for owner-occupied housing. Overall, TRA97 made housing more attractive than before, as individuals had a stronger incentive to purchase more and larger homes. It also facilitated residential transactions through a reduction in the lock-in effect. Given these incentives, we ought to expect single-family residential fixed investment data to reflect these underlying behavioral responses. We do, in fact, observe this phenomenon. Figure 4.1 shows single-family RFI in billions of chained 2000 dollars for the period 1975Q1 to 2008Q4 (all tables and figures associated with this chapter are in Appendix C).

Starting in the early 1990s, single-family RFI began increasing more quickly than it had the previous two decades. However, the trend is noticeably steeper for the years subsequent to 1997, reflecting the inflating housing bubble potentially fueled by the liberalized capital gains tax rules contained in TRA97. Single-family RFI exhibits even more pronounced growth from 2001 to the height of the bubble in 2006. If this growth was indeed influenced by the lower effective tax rate on residential capital, then a lag may be expected if homeowner and home buyer behavior responded sluggishly in response to the new laws. It may have taken a while for widespread increases in single-family housing demand, since more and more taxpayers likely became aware of the policy over time rather than all at once. After an unsustainable buildup, the bubble popped in 2006 and RFI crashed. This steep decline in new housing investment marked the end of the housing bubble.

Over the same period, housing prices display a similar pattern. Figure 4.2 shows a housing price index constructed by the Office of Federal Housing Enterprise Oversight (OFHEO). From the mid-1970s to the mid-1990s, housing prices increased at a generally constant rate of about 1.2 percentage points per year relative to the index baseline. After 1997, housing prices began to rise exponentially. Again, the timing of rapid price increases coincide with the passage of TRA97 and the effective elimination of capital gains taxes on owner-occupied property. While it may be true that some of the run-up in residential investment and housing prices also coincided with a rise in the value of financial assets, a strong labor market, and thriving real economy, it should be pointed out that home prices continued to rise during the recession of 2001 while RFI declined only slightly.

4.4 Previous Literature

Previous research has suggested that the taxation of capital gains on housing does affect the demand for owner-occupied housing. Hoyt and Rosenthal (1990) develop a model of housing demand and show that taxes on capital gains kink a homeowner's budget constraint, influencing his housing demand. In a similar study Hoyt and Rosenthal (1992) expanded on their earlier work, running simulations to determine how capital gains tax changes contained in the Taxpayer Relief Act of 1986 (TRA86) altered housing demand. Their results indicate that TRA86 increased the effect of the kink, significantly altering the amount of housing demanded. In fact, they estimate that the previous rollover provision alone boosted demand by up to 15 percent. Dusansky and Koc (2007) develop a model of housing demand that makes an explicit dinstinction between the role of housing as both a consumption and investment good and find evidence of positively-sloped demand curves for owner-occupied housing in Florida.

Auerbach (1988) shows that decreasing capital gains tax rates significantly increase capital gains realizations as individuals sell their assets and unlock the gains. Eichner and Sinai (2000) use more recent data to arrive at the same conclusion. Their results also suggest that the Taxpayer Relief Act of 1986 (TRA86) increased the responsiveness of capital gains realizations to tax rates. It should be noted that the raised exclusion on housing capital gains in TRA97 significantly lowered the effective capital gains tax rates from some positive rate to a much smaller positive rate. Despite the overwhelming reforms in TRA97, there has been very little literature analyzing these same issues with respect to the most recent tax change.

Conversely, the channels through which monetary policy affects the macro economy are the subject of a great deal of research. Mishkin (1995) describes several of these channels; the most relevant (to this paper) of which are the asset price, interest rate, and credit channels. Shocks may potentially affect RFI and output through any or all of the three. A monetary stimulus may spur RFI through lower interest rates, a larger pool of available mortgage funds, or from increased demand for housing due to higher financial asset prices. While this study does not focus on any specific transmission mechanism, it is nonetheless important to keep these separate channels in mind.

The role that RFI plays in the business cycle has also been the subject of ample research. Green and White (1997) and Kim and Coulson (2000) point out that RFI, despite its small size relative to total economic activity, plays a disproportional role in fluctuations in the overall economy. Further, Shbikat (2001) shows that RFI reacts to a monetary stimulus much differently than other types of investment. These conclusions highlight the role of RFI and its unique behavior. If TRA97 positively affected housing investment demand we might expect the fluctuation of RFI, and thus GDP, to differ after 1997. The only study that attempts to address any possible structural breaks in aggregate housing markets and other variables due to TRA97 is Heuson (2009). Using a measure of housing turnover in twelve housing markets, she finds evidence that the tax change led to an almost immediate breakdown of existing relationships between home price growth, household income, and the cost of mortgage financing.

Gauger and Coxwell-Snyder (2003) also show that RFI plays a potentially unique role in the business cycle. Their results strengthen the body of evidence suggesting that RFI leads other investment aggregates (most notably business fixed investment) and the overall economy. In addition, their results suggest that non-monetary policies can potentially affect the relationship between money supply, RFI, and output. Specifically, they find that the deregulation of financial markets in general and mortgage markets in particular may have increased the predictive power of RFI to fluctuations in GDP. Similarly, other studies show that financial innovation and deregulation have stabilized RFI and impacted the transmission of monetary policy through changes in the relationship of housing variables (Ryding, 1990; Wheeler and Chowdhury, 1993; Hasan and Taghavi, 2002; Iacoviello and Minetti, 2003). The general conclusion from this line of research is that changes in housing finance, most of which broadened access to and increased the affordability of mortgage funds, has smoothed fluctuations in RFI and slowed the effects of monetary policy.

Several of the above papers utilize vector autoregression (VAR) or vector error-correction (VEC) techniques to analyze the dynamic interaction of these variables without imposing any structure to the underlying relationships, as is common in the empirical macro literature. This paper follows a similar approach, applying conventional dynamic macro models to the housing market while also incorporating a fiscal aspect that is lacking in the current literature. Despite the volume of literature on the impacts of housing finance deregulation, there has been no work attempting to examine the possibility of similar effects resulting from broad fiscal policies impacting housing markets. This paper seeks to make a first step in that direction by examining how the impact of TRA97 affected the relationship between aggregate housing variables, RFI, and output. Just as deregulation affected these relationships, the incentives created by a capital gains exemption on owner-occupied housing may have done the same.

4.5 Data Description and Model Selection

4.5.1 Data

The data used in this study are from various publicly-available sources. Table 4.1 contains descriptions of all variables as well as the notation used in the subsequent tables and figures. Quarterly GDP data were obtained from the U.S. Bureau of Economic Analysis (BEA) and is available beginning in the first quarter of 1947. The series is seasonally adjusted and is in terms of chained year 2000 dollars. For ease of use and a more straightforward interpretation of the results, the series is transformed using the natural log.

M2 money stock data are from the Federal Reserve Board of Governors. There are well-documented issues regarding the differences in measurements of the monetary base (McCallum, 1985; Mehra, 1989; Gauger, 1991). M2 was chosen as the aggregate monetary measure since it is extensive and covers a broader base than M1, particularly checkable deposits. This is preferable since the goal is to examine how changes in the monetary stock, in a broad sense, is related to output and residential variables. These data are available monthly as opposed to quarterly and are also seasonally adjusted and transformed using the natural log. Lastly, the quarterly growth rate was calculated to use in the estimation since aggregate variables respond to changes in monetary growth rather than the absolute level of money supply.

Quarterly residential fixed investment is also available from BEA. Further, they break RFI down into subcategories, one of which is investment in single family structures. Given that this study focuses only on housing investment that may be affected by the sweeping capital gains tax changes in TRA97, only single-family RFI is included. Of course, many homeowners live in townhouses and other multi-family structures. Also, some investment in single-family homes will be for rental purposes. According to the most recent American Housing Survey data, almost 70 percent of existing housing units are owner occupied and over 76 percent are single-family units.[5] While this measure does not perfectly capture only that investment which was subject to TRA97, more detailed aggregate data are not available.

Unfortunately, the BEA only reports single-family RFI in real terms beginning in 1990. However, quarterly seasonally-adjusted nominal single-family RFI and a quarterly RFI deflator are reported prior to that. The nominal values were divided by the deflator to generate real single-family residential investment. The series was then transformed by taking the natural log.

The average mortgage rate on conventional fixed-rate 30-year loans has been collected on a weekly basis by the Federal Reserve Board since 1971. Recent evidence suggests that prior to 1980, short-term interest rates were more influential to RFI and GDP fluctuations than longer-term rates (Gauger and Coxwell-Snyder, 2003). However, the shift from credit-rationing behavior by lenders to price-based allocation mechanisms due to deregulation in financial markets led long-term rates to rise in their influence on the housing market. Much of the time period of this study occurs after 1980. Given this evidence and the belief that single-family residential investment decisions are driven by long-term rates, mortgage rates are included.

The last variable included in the model is an index of single-family house prices constructed by the Office of Federal Housing Enterprise Oversight (OFHEO). The index is a broad measure of home prices, calculated from data on conventional conforming mortgage transactions purchased or securitized by the Federal Home Loan Mortgage Corporation (Freddie Mac) and the Federal National Mortgage Association (Fannie Mae). This index preferable to other alternatives such as the national Case-Shiller home price index for the purposes of this study due to its focus only on single-family properties. Condominiums, co-ops, and other multi-unit properties are excluded.

[5]See U.S. Department of Housing and Urban Development (2008), page x.

The index begins in 1975, is based on the weighted-repeat sales methodology outlined by Case and Shiller (1989), and is reported both monthly and quarterly.[6]

Given that GDP and single-family residential fixed investment data are only available quarterly and that each series must be of common intervals for estimation purposes, it is necessary to convert money stock and mortgage rates into quarterly time periods as well. This involves a simple average of the monthly values within a given quarter. For example, averaging the M2 levels for January, February, and March gives a measure for first quarter money stock. Averaging the levels for April, May, and June gives a measure for second quarter money stock, and so on.

Since the OFHEO home price index begins in the first quarter of 1975, it is necessary to begin the sample at that point. The latest available period for which all variables are available is the fourth quarter of 2008. This yields 136 quarterly observations.

4.5.2 Model Selection

As mentioned above, previous studies have employed vector autoregression analysis (VAR), where a system of endogenous equations is estimated using lagged values of the endogenous variables themselves. These reduced-form models allow the researcher to impose no restrictions on the nature of the relationships between variables. In this sense, they are atheoretical. As this study is the first to examine this interaction of fiscal and monetary policy in the housing market, it seems appropriate to begin with a model that imposes no formal structure.

The first step in formalizing a model of this type is to determine the order of integration for each variable. The methods proposed by Dickey and Fuller (1979), Philips and Perron (1988) and Kwiatkowski et al. (1992) were used to test for the presence of a unit root in each series for the entire sample as well as in both the pre- and post-TRA97 time periods. The results of these tests are in Table 4.2. The first three columns present the tests using the full sample period. All tests indicate the presence of a unit root in the GDP, RFI, home price and mortgage rate series. The augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests reject the null hypothesis of non-stationarity in the M2 growth series at the 5 percent level while the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test indicates that M2 growth is non-stationary. Testing the first-difference of each series yields a rejection of the non-stationary null for the ADF and PP tests except for for home prices, for which the tests provide conflicting conclusions. The KPSS test results indicate that the first-difference of GDP, RFI, and money growth are stationary while home prices and mortgage rates are not.

[6]For more information on the home price index methodology, see Calhoun (1996).

Overall, these results suggest that over the entire sample, each series is likely integrated of order 1, or I(1), except money growth, which is I(0).

The middle columns of Table 4.2 display the unit root test results for the pre-TRA97 period. The tests indicate a unit root in the levels of each series except for money growth, but not in its first-difference. The tests provide conflicting results for money growth. The last two columns show that non-stationarity cannot be rejected for either the level or first-difference of the RFI and home price series in the post-TRA97 sub-sample.[7] Mortgage rates appear to be I(1) according to all tests. Money growth is I(0) or I(1) and GDP is likely I(1), depending on which test is used.

The next step is to find the optimal lag structure of the underlying VAR model, based on one of many test statistics that evaluate the balance between increasing the model's fit by incorporating more lags and the resulting loss of degrees of freedom. The results from the most common of these tests, the Akaike, Schwartz-Bayesian, and Hannan-Quinn Information Criteria (denoted AIC, SBIC, and HQIC, respectively) are reported in Table 4.3 for VAR models of various reasonable lag lengths. Given that the model improves as the statistic approaches negative infinity, each test indicates an optimal lag of 2 quarters for both the full sample and pre-TRA97 sub-sample. The AIC, HQIC, and SBIC suggest a lag length of 4, 3, and 1 quarters for the post-TRA97 subsample. It is well known that the SBIC and HQIC favor more parsimonious models than does the AIC, which tends to overstate the true order of autoregression. A lag length of 2 quarters was chosen as a compromise.

Since there is ample evidence that output, housing investment, home prices, and mortgage rates are non-stationary and VAR models require that the variables be I(0), it seems as though running a model of first-differences would satisfy necessary econometric assumptions. However, Engle and Granger (1987) show that this is inappropriate if the variables are cointegrated. This means that the variables share what Stock and Watson (1988) call a common stochastic trend, or long-run relationship. That is, the time paths of the variables are not independent. Therefore, the movement of the variables over time must be related to current deviations from the long-run equilibrium. A simple VAR of cointegrated variables will be misspecified because it ignores the long-run relationship between them. Therefore, any VAR-based model must address this possible cointegrating relationship.

The two most widely-used tests for a long-run cointegrating relationship are described in Engle and Granger (1987) and Johansen (1991). The proposed model includes five equations, yielding the possibility of more than one cointegrating vector. The Engle-Granger method does not allow

[7] The second difference for these series were tested and found to be stationary, suggesting that these variables are I(2) throughout this period.

for the separate estimation of more than one cointegrating equation, so the Johansen method is deemed superior in this application.[8] The results of this test are shown in Table 4.4, indicating the presence of two cointegrating equations in both full sample and pre-TRA97 periods and three cointegrating equations in the post-TRA97 sample. So, a multi-equation autrogressive model of money growth, output, single-family RFI, home prices, and long-term interest rates should include multiple error-correction terms to account for the long-run relationships between the variables. The variables share a common stochastic trend and thus their dynamic paths are functions of their deviations from the long-run equilibrium.

To summarize, the pre-estimation tests indicate that each of the variables, other than money growth, are non-stationary. A comparison of the Akaike, Schwartz-Bayesian, and Hannan-Quinn Information Criterion for models of various lag lengths suggest a model specification that includes two quarterly lags of each variable. Using this specification, applying a Johansen test indicated the presence of multiple cointegrating relationships. Thus, the 5-equation error-corrected model takes the form:

$$\Delta GDP_t = \alpha_1 + \lambda_1 \pi_{t-1} + \beta_1 \Delta X_{t-1} + \varepsilon_{1t}$$
$$\Delta RFI_t = \alpha_2 + \lambda_2 \pi_{t-1} + \beta_2 \Delta X_{t-1} + \varepsilon_{2t}$$
$$\Delta HPI_t = \alpha_3 + \lambda_3 \pi_{t-1} + \beta_3 \Delta X_{t-1} + \varepsilon_{3t}$$
$$\Delta RATE_t = \alpha_4 + \lambda_4 \pi_{t-1} + \beta_4 \Delta X_{t-1} + \varepsilon_{4t}$$
$$\Delta M_t = \alpha_5 + \lambda_5 \pi_{t-1} + \beta_5 \Delta X_{t-1} + \varepsilon_{5t}$$

where X is a vector containing all of the endogenous variables, π is the vector of error-correction terms, and α, β, and λ are vectors of coefficients to be estimated. Δ denotes the change in a variable from the previous quarter.

A primary goal of this paper is to determine whether the relationships between these variables changed significantly after the passage of TRA97. Therefore, it is appropriate to test for structural breaks in the data. Three methods were employed for this. First, Chow tests were used to test for structural breaks in each of the underlying equations, without the cointegrating terms, in the third quarter of 1997. The results from these tests are displayed in the first two columns of Table 4.5. The null-hypothesis of no break is rejected at the 5 percent level in both the housing price and

[8]Nonetheless, the Engle-Granger two-step method was conducted for completeness. The null hypothesis of no cointegration was rejected at the 0.05 level for both of the subsamples, but not for the entire sample. Unlike the Johansen test, this method does not allow for multiple cointegrating equations. Thus, the results are omitted.

mortgage rate equations. Second, each of the equations, again without the cointegration term, was estimated using the method proposed by Perron (1989). These results are in the right side of table. The null hypothesis of no structural break can be rejected in the money growth equation.[9]

Lastly, the error-correction model displayed above augmented to include a dummy variable for the tax change, was estimated across the full sample. The dummy variable takes a value of 0 for all observations prior to 1997Q2 and a value of 1 thereafter.[10] The results from this regression are in the third and fourth columns of Table 4.6. The dummy variable is denoted $TRA97_t$. The estimated coefficient for this variable is statistically different from zero in the home price and money growth equations, suggesting the short-term fluctuations in these variables are different across the two periods.

Considering the results from these three stability tests, there is some evidence that a statistically significant break occurred in this system at the time TRA97 was implemented. Furthermore, it is quite likely that the relationships evolved over time, beginning perhaps before the tax change as policy proposals surfaced leading up to the eventual legislation and continuing to evolve for a period of several years as the benefits of the new law became more widely known. To the extent this occurred, structural break tests at a given point in time will be less likely to yield statistically significant breaks.

To analyze any potential differences in the responsiveness of single-family RFI to various monetary and interest rate shocks as a result of the capital gains tax changes in 1997, I follow the same strategy used in McCarthy and Peach (2002) and Gauger and Coxwell-Snyder (2003). Those studies examined the effects of financial market deregulation on the transmission of monetary policy through RFI, which they accomplished by splitting their datasets into two time periods around the time of the deregulation. They then compare impulse response functions of various variables to shocks across the periods.

This study utilizes the same method, separating the data into two periods. The first period contains data from 1975Q1 to 1997Q2, or 90 consecutive quarters. Recall that the new capital gains laws became effective on home sales on or after May 6, 1997 (midway through the second quarter).

[9]For completeness, the above procedures were tested using a variety of breakpoints around mid-1997. Overall, the results (which are not reported in this paper) suggested breaks could have occurred in a number of periods. This may not be surprising if individuals changed their behavior in advance of the tax change or if adjustents ocurred over time. This paper is testing for a hypothesized breakpoint at the time of TRA97's implementation. Thus, the most relevant tests should be on this "known" breakpoint.

[10]Heuson (2009) uses a similar approach to test for structural breaks in housing markets in 1997, finding that a TRA97 dummy variable as well as its interaction with other housing-related variables is statistically significant in a regression of house price appreciation in many local markets.

The second period contains 46 quarters (10 years); from 1997Q3 to 2008Q4, the last period for which data are available.

4.6 Empirical Results

The estimated results of the VEC models for all samples are reported in Table 4.6. As mentioned in the previous section, the full-sample model contains a TRA97 dummy variable to account for structural change. The full sample and pre-TRA97 models contain two error-correction terms, denoted by λ, and the post-TRA97 contains three. The variable ordering listed in the table is the order in which the variables were included in the model. The results for the estimated cointegrating equations containing the long-run relationships are in Table 4.7.[11] However, the discussion that follows focuses on the short-run dynamics.

While an analysis of the estimated coefficients may be of some use, the primary tools used to determine if TRA97 had any relevant impacts on monetary policy through changes in the housing market are impulse response functions (IRFs) and forecast error variance decompositions (FEVDs). Impulse response functions are found in Figures 4.3 through 4.7. Each show the dynamic effect on one variable from a positive one-time, one-unit shock to another. One-unit shocks are shown due to their comparability across time periods. Since many of the functions do not contain particularly interesting or useful information, such as the response of variables to their own shocks, the discussion that follows will focus on items of particular interest.[12]

Figure 4.3 shows the response of each of the other four variables to real GDP shocks in the pre- and post-TRA97 time periods. In the post-TRA97 sample, both single-family residential fixed investment and home prices respond negatively to positive output shocks and much more strongly relative to the pre-TRA97 period, as shown in panels (a) and (b).

Figure 4.4 contains the IRFs for residential investment shocks. Panel (a) shows the effect of an RFI shock on GDP. Under the previous regime, the effect was relatively large and positive, peaking four quarters after the shock. After one year, the effect begins to diminish, remaining positive but leveling out after about ten quarters. In the post-TRA97 period, the response is almost a mirror image, falling for the first two quarters before eventually rising. The effect on GDP becomes positive after ten quarters before plateauing. This may reflect the nature of the housing bubble,

[11] The cointegrating equations are estimated simultaneously with the parameters for the main equations, which is preferred to estimating the model in two steps.

[12] For this reason, the responses of variables to own-shocks are not shown.

with unprecedented increases in housing investment pulling resources out of other sectors of the economy, leading to an overall decline in aggregate output over relatively short horizons. However, after about three years, the effect on GDP is positive and similar across the two subsamples.

The results in panel (b) indicate why this may be the case. It shows that home prices increase dramatically in response to RFI shocks under the current regime, whereas they had relatively small response in the pre-TRA97 period. High returns in the housing market likely shifted non-residential capital into the residential sector, fueling the recent housing bubble. Another interesting result, shown in panel (c), is that RFI shocks increased mortgage rates in the pre-1997 sample almost immediately but decreased them initially in the second sample, only causing them to increase after eight quarters.

The reponses of other variables to positive home price shocks are shown in Figure 4.5. Panel (a) indicates that in both periods, rising home prices increase GDP, although there is a conspicuous spike in the pre-TRA97 period in the first few quarters after the shock. This positive effect may be explained from a wealth effect perspective if households developed expectations of permanently high (and virtually untaxed) home price appreciation. Increased consumer spending would provide a short-term boost to aggregate output. While output paths beyond four or six quarters are similar across the two periods, the effect is slightly larger in the current tax regime, suggesting that medium-term wealth effects may be stronger due to virtually untaxed appreciation.

Much of the initial spike in GDP in the pre-TRA97 period can be attributed to the response of RFI to the home price shock, shown in panel (b). There is a similar spike in RFI that period. However, after three quarters, housing investment decreases dramatically, remaining negative throughout the rest of the forecast horizon. Conversely, RFI increases in reponse to positive home price shocks under the current tax regime. In this sample, RFI grows relatively slowly but steady as the horizon is extended, reaching a peak after about two-and-a-half years.

This result is consistent with the upward sloping housing demand curves estimated by Dusansky and Koc (2007) as well as the view that TRA97 shifted the public perception of housing away from its value as a consumption good and towards it being an investment opportunity. As capital gains tax rates fall and the after-tax return to homeownership rises, we might expect new home buyers to be less sensitive to increases in prices, especially if prices are expected to continue to rise. In a regime where virtually all residential capital faces an effective tax rate of zero on gains, rising prices might actually encourage more investment as home buyers attempt to buy on the way up and earn a potentially tax-free return.

Panels (a) and (b) of Figure 4.6 show the impact of mortgage rates on GDP and RFI, respectively. Across both periods, shocks to 30-year mortgage rates decrease housing investment by roughly the same degree for four quarters after the shock. However, RFI stabilizes after that in the pre-TRA97 period while it continues to fall under the current regime. This suggests that housing markets are now more responsive to mortgage rates, which is perhaps not surprising since average down payments as a share of the purchase price have steadily fallen over the past decade. More highly leveraged home buyers would be expected to be more responsive to borrowing costs. It is conceivable that TRA97 changed Americans' tastes for leverage by increasing the potential upside from owning residential property and altering the risk-reward tradeoff. If RFI is more responsive to long-term interest rates in the current period, then we might expect it to be less responsive to short term rates.

Panel (a) of Figure 4.7 shows the path of output after a monetary shock. A one-unit increase in the monetary growth rate is associated with a slight increase in real GDP in the pre-TRA97 period for the second and third quarters after the shock. After the fourth quarter, GDP decreases for an additional two quarters, after which it remains relatively steady. However, in the post-TRA97 period, GDP falls rapidly and throughout the entire forecast horizon of 16 quarters. Panel (b) indicates that single-family residential fixed investment also falls for a number of quarters in response to monetary expansion, although the decline takes several quarters longer to reach its maximum response in the post-TRA97 period.

Declining investment and output in response to positive monetary shocks contradicts the predictions of many traditional macroeconomic models. There are two potential explanations for this. First, as Thoma (1994) notes, money growth can cause interest rates to rise if the increase in nominal interest rates due to anticipated inflation exceeds the fall required to induce agents to increase real money holdings. In that case, a money growth shock could lead to decreased investment and output. Second, this empirical finding may be reflecting the fact that the relatively short time span of the post-TRA97 sample is dominated by two significant recessions, during which the economy contracted despite expansion of the monetary base.

Monetary growth is also shown to affect home prices and mortgage rates much differently across the two periods. In the pre-TRA97 period, money growth shocks appear to increase mortgage rates by a much larger degree than in the post-TRA97 period, while having a relatively small negative effect on house prices. While the response of 30-year mortgage rates to monetary shocks follow similar patterns across the two time periods, the effect is much larger for the pre-1997 period.

Perhaps the smaller effect for the more recent period reflects financial market globalization and increased capital mobility across countries.

Tables 4.8 through 4.12 contain the forecast error variance decompositions of each variable in the model for various forecast horizons, by sample period. The values in each table represent the percentage of the forecast error variance explained by innovations in each variable for a given forecast horizon. For example, Table 4.8 indicates that in the pre-TRA97 period, 25 percent of the error variance of a four-quarter forecast of real GDP can be attributed to innovations in single-family RFI.

Comparing the figures across time periods, it appears that innovations in residential investment account for a large share of the forecast error variance of GDP in the early period, particularly in shorter forecast horizons, while they contribute very little in the more recent period, suggesting that housing investment is not driving post-TRA97 fluctuations in GDP. This result is particularly interesting in light of exponential growth in the housing construction sector in the late 1990s and early 2000s. This may indicate that housing investment now plays less of a role in determining output fluctuations due to the increase in the relative size of the housing sector potentially driven by the prospect of tax-free capital gains. Also, the share jumps from 9 percent to 25 percent when the forecast horizon is increased from two to four quarters, indicating that output lags the housing sector in the earlier period. In the later period, the effect is small in all forecast horizons.

The results also show that in the first subsample, innovations in housing prices play a relatively small role in GDP while accounting for a growing share of the forecast error variance in the later period as the forecast horizon is extended, further suggesting that wealth effects due to essentially untaxed home price appreciation may be stronger under the current tax regime.

Just as with overall output, innovations in house prices play a much larger role in single-family housing investment in the post-TRA97 period compared to the earlier period, as shown in Table 4.9, accounting for only about 2 percent of the forecast error variance in the early period and up to 13 percent in the later period. Taken with the evidence from the impulse response functions, which showed a sustained positive impact of housing price shocks in residential investment, this further advances the claim that Americans have fundamentally changed their view of owner-occupied housing, shifting the focus away from its role as a durable consumption good and towards its role as a highly tax-advantaged asset.

Also, these innovations account for a larger share of the error variance in the post-TRA97 as the forecast horizon is extended beyond one year. This indicates that the responsiveness of housing investment to price shocks may be rather sluggish. We also see that mortgage rate innovations contribute more heavily to housing investment as the forecast horizon is extended (in both periods), which also demonstrates housing sector sluggishness.

Some of the relative increase in the error variance attributed to home prices is due to a smaller share for mortgage rates, particularly in shorter forecast horizons, suggesting that housing markets have become less responsive to long-term interest rates. This is perhaps unsurprising considering the recent surge in adjustable-rate mortgages, which have introductory rates often based on short-term interest rates such as the London Interbank Offered Rate (LIBOR) or federal funds rate.

While the results show that mortgage rate innovations contribute less to future movements in housing investment after 1997, they appear to contribute more to future innovations in house prices, as shown in Table 4.10. Innovations in mortgage rates contribute to up to 35 percent of movements in home prices after TRA97, compared to up to 6 percent in the earlier period. Comparing innovations in housing investment on home prices across the two periods also presents interesting results. After 1997, single-family RFI accounts for a large share of the house price forecast error variance almost immediately, whereas it took much longer in the first period.

The interesting result from Table 4.11 is that innovations in residential investment contribute less to innovations in mortgage rates after TRA97, particularly in short term forecasts. In other words, average long-term interest rates are driven less by movements in the domestic housing market. As discussed previously, this may also reflect globalization of credit markets.

Lastly, the results in Table 4.12 yield similar conclusions regarding the interaction of money growth and housing markets as the impulse response functions. The relative composition of the forecast error variance of money growth has shifted from home prices to residential investment, mortgage rates, and GDP, particularly in the short run. Perhaps this reflects more aggresive actions by policymakers in response to housing market conditions.

4.7 Conclusions

Overall, the results presented in this paper suggest that the dynamics of housing markets are quite different in the post-TRA97 era than they were in the prior two decades. The results also indicate that shocks to the aggregate housing market have different effects on output across the two periods. It is found that increases in the monetary base have a larger negative effect on GDP in the current time period. The evidence suggests that much of this decline can be attributed to decreases in housing investment.

Rising home prices are shown to significantly decrease new housing investment over medium and longer-term horizons prior to TRA97. However, higher prices are shown to increase housing investment under current law. Since the bill effectively eliminated the taxation of residential capital gains, the capital gains effect found by Dusansky and Koc (2007), where the investment aspect of owner-occupied housing dominates the consumption value, might be amplified. Further, higher after-tax returns on rising home values may have enhanced the traditional wealth effect in two ways. First, the higher return net of taxes could lead homeowners to feel wealthier, thus saving less of their current income and consuming more. Second, the higher wealth may lead homeowners to borrow more to finance current consumption, particularly out of housing equity. And since home equity loans are typically amortized over much shorter periods than primary mortgages, they may be more easily influenced by short-term interest rates.

These results have significant implications for policy makers. This paper, as well as other recent research, suggests that over time, residential investment has become somewhat less responsive to domestic short-term interest rates, and thus conventional monetary policy. However, the results presented here also indicate that widespread changes in housing markets over the past 15 years, including the Taxpayer Relief Act of 1997, have somewhat decreased the effectiveness of monetary policy on total GDP. Home prices rather than interest rates are shown to play a much larger role in the fluctuation of residential fixed investment and the results suggest a stronger housing equity wealth effect. However, recent declines in housing values may mitigate the effects found here.

Most importantly, this study has laid the groundwork for further research. Using a reduced-form cointegrated VAR model, evidence has been presented that indicates a structural change in the short-run dynamics of housing markets around the time of TRA97, which reduced effective tax rates on residential capital to near zero. While this study has not formally examined specific structural relationships, it has identified potential interactions that warrant further consideration, particularly the effect of home prices on housing investment and household consumption. Future research should focus on building structural models of the aggregate housing market that incorporate the current tax treatment of residential gains as well as examining the long-run implications of the current tax policy.

Appendix C

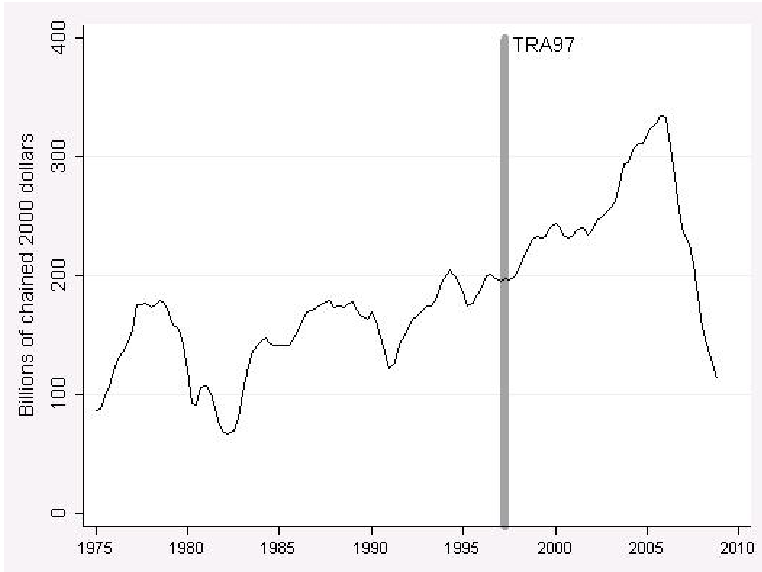


Figure 4.1: Single-Family Residential Fixed Investment

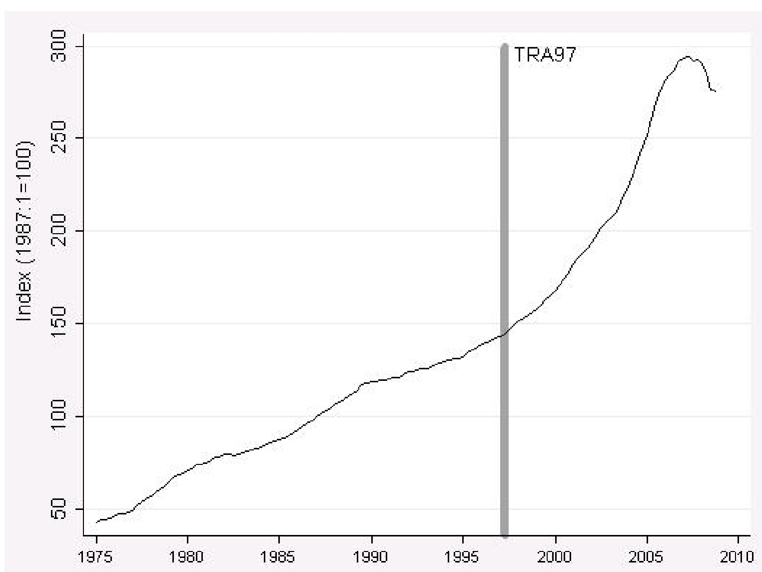


Figure 4.2: OFHEO Housing Price Index

Table 4.1: Variable Descriptions

Variable	**Description**
GDP	Natural log of real GDP, in chained 2000 dollars
RFI	Natural log of real residential fixed investment, in chained 2000 dollars
HPI	OFHEO home price index
RATE	Interest rate on conventional 30-year fixed-rate mortgage
M	Growth rate of M2 money supply

Table 4.2: Unit Root Tests

	Full Sample			**Pre-TRA97**			**Post-TRA97**		
Series	ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS
				Level					
GDP	−1.38	−1.63	6.86*	−0.45	−0.72	4.53*	−2.03	−2.51	2.33*
RFI	−1.90	−2.01	4.11*	−2.06	−2.13	1.65*	−0.15	0.97	0.39
Home price	−0.52	1.65	6.16*	−1.12	−0.94	4.55*	−1.52	−0.90	2.33*
Mortgage rate	−1.20	−1.02	4.32*	−1.46	−1.21	1.59*	−1.69	−1.79	1.38*
Money growth	−3.30*	−5.44*	1.72*	−2.53	−4.02*	2.91*	−2.67	−4.60*	0.20
				1st-Difference					
GDP	−4.96*	−8.06*	0.26	−4.37*	−6.79*	0.10	−1.76	−4.11*	0.51*
RFI	−4.38*	−4.74*	0.38	−4.42*	−4.41*	0.09	−0.13	−0.88	1.25*
Home price	−1.46	−3.34*	0.61*	−3.37*	−6.19*	0.19	−0.56	−1.88	0.39
Mortgage rate	−5.54*	−8.76*	1.70*	−4.49*	−6.98*	0.24	−3.04*	−5.79*	0.08
Money growth	−9.53*	−17.66*	0.07	−8.04*	−15.05*	0.02	−4.97*	−9.35*	0.12
5% Critical Value	−2.89	−2.89	0.46	−2.89	−2.89	0.46	−2.89	−2.89	0.46

Note: ADF, PP, and KPSS denote Augmented Dickey-Fuller, Phillips-Perron, and Kwiatkowski-Phillips-Schmidt-Shin tests, respectively. The null-hypothesis for the ADF and PP tests is that the series contains a unit-root. The null-hypothesis for the KPSS test is that the series is stationary. * denotes a rejection of the null-hypothesis at the 0.05 level. All tests include 2 lags.

Table 4.3: Lag Length Selection

	Full Sample			**Pre-TRA97**			**Post-TRA97**		
Lags	AIC	HQIC	SBC	AIC	HQIC	SBC	AIC	HQIC	SBC
0	13.81	13.90	14.03	9.10	9.15	9.24	9.18	9.25	9.37
1	−3.18	−2.87	−2.41	−4.93	−4.58	−4.07	−6.23	−5.78	−5.03∗
2	−4.55∗	−4.02∗	−3.24∗	−5.65∗	−5.02∗	−4.08∗	−6.38	−5.56	−4.20
3	−4.54	−3.79	−2.69	−5.51	−4.60	−3.23	−7.05	−5.86∗	−3.87
4	−4.54	−3.56	−2.13	−5.33	−4.13	−2.34	−7.15∗	−5.59	−2.98

Note: Underlying VAR for full sample contains TRA97 time dummy. * denotes preferred lag length for given information criterion.

Table 4.4: Johansen Trace Statistics

Rank	**Critical Value**	**Full Sample**	**Pre-TRA97**	**Post-TRA97**
0	68.52	133.56∗	109.21∗	194.70∗
At most 1	47.21	66.43∗	58.27∗	101.35∗
At most 2	29.68	18.10	23.04	45.20∗
At most 3	15.41	6.38	10.28	14.03
At most 4	3.76	0.00	0.02	2.35

Note: Each row displays the result of a test for the maximum rank of the five-equation system. Lag lengths in the underlying models were chosen based on Shwartz-Bayesian IC. Critical values at the 0.05 level are shown. * denotes a rejection of the null-hypothesis at this level.

Table 4.5: Structural Break Tests

	Chow		**Perron (1989)**	
Equation	F-Stat.	Prob.	Test Stat.	Crit. Val.
ΔGDP_t	1.429	0.171	−1.58	
ΔRFI_t	0.928	0.517	−0.22	
ΔHPI_t	5.858∗	0.000	−1.49	-3.80
$\Delta RATE_t$	2.372∗	0.012	−2.03	
ΔM_t	1.832	0.059	−7.77∗	

Note: The null hypothesis for the Chow tests is structural stability in VARs of first-differences across pre- and post-TRA97 time periods. The null for the Perron-type test is that $\beta_1 = 1$ in a full-sample regression of the form $y_t = \alpha + \beta_1 y_{t-1} + \beta_2 t + \beta_3 D_t + \epsilon_t$ where $D_t = 1$ beginning in 1997Q3 and $= 0$ otherwise. Critical value according to Perron (1989). * denotes a rejection of the respective null hypotheses at the 0.05 level.

Table 4.6: Results of VEC Models

Equation	Variable	Full Sample Coef.	S.E.	Pre-TRA97 Coef.	S.E.	Post-TRA97 Coef.	S.E.
ΔGDP_t	α	0.008∗	0.001	0.003	0.002	0.024∗	0.007
	ΔGDP_{t-1}	−0.018	0.106	−0.156	0.134	0.051	0.183
	ΔRFI_{t-1}	0.060∗	0.012	0.078∗	0.017	−0.066	0.038
	ΔHPI_{t-1}	0.000	0.000	0.003∗	0.001	0.001	0.001
	$\Delta Rate_{t-1}$	−0.001	0.001	−0.001	0.001	0.009∗	0.004
	ΔM_{t-1}	−0.000	0.001	−0.001	0.001	0.001	0.001
	$\lambda_{1,t-1}$	−0.001	0.006	−0.003	0.027	−0.038∗	0.015
	$\lambda_{2,t-1}$	0.005	0.005	0.005	0.006	−0.002	0.009
	$\lambda_{3,t-1}$					−0.000	0.000
	$TRA97_t$	−0.003	0.003				
ΔRFI_t	α	−0.017∗	0.009	0.052∗	0.013	0.102∗	0.029
	ΔGDP_{t-1}	−0.207	0.565	0.257	0.774	−0.392	0.809
	ΔRFI_{t-1}	0.643∗	0.065	0.532∗	0.097	0.314	0.169
	ΔHPI_{t-1}	0.010∗	0.002	0.010	0.007	0.003	0.003
	$\Delta Rate_{t-1}$	−0.037∗	0.007	−0.045∗	0.008	0.010	0.016
	ΔM_{t-1}	−0.001	0.005	−0.003	0.007	−0.001	0.006
	$\lambda_{1,t-1}$	0.078∗	0.030	−0.352∗	0.155	−0.156∗	0.067
	$\lambda_{2,t-1}$	−0.136∗	0.026	−0.097∗	0.032	0.014	0.040
	$\lambda_{3,t-1}$					−0.001∗	0.000
	$TRA97_t$	−0.001	0.014				
ΔHPI_t	α	0.644∗	0.292	−0.041	0.196	0.014	2.038
	ΔGDP_{t-1}	−40.073∗	19.362	−12.173	11.458	−59.683	56.171
	ΔRFI_{t-1}	7.294∗	2.221	0.734	1.442	9.867	11.750
	ΔHPI_{t-1}	0.566∗	0.078	0.251∗	0.111	0.162	0.182
	$\Delta Rate_{t-1}$	0.090	0.239	−0.238∗	0.121	1.418	1.118
	ΔM_{t-1}	0.370∗	0.167	0.030	0.097	1.037∗	0.413
	$\lambda_{1,t-1}$	−3.700∗	1.034	7.241∗	2.290	2.662	4.672
	$\lambda_{2,t-1}$	2.844∗	0.907	1.335∗	0.478	8.890∗	2.774
	$\lambda_{3,t-1}$					−0.023	0.012
	$TRA97_t$	1.094∗	0.474				

Table 4.6: Continued

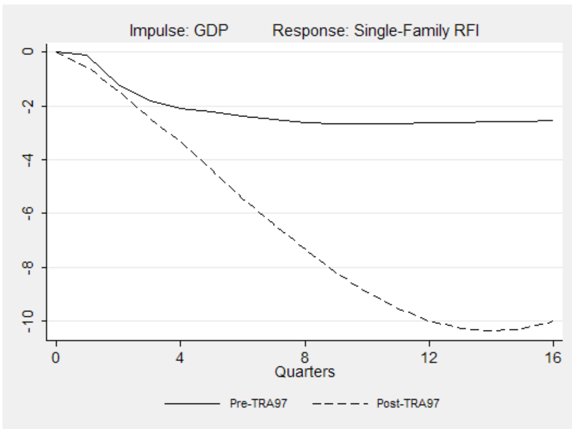
Equation	Variable	Full Sample Coef.	Full Sample S.E.	Pre-TRA97 Coef.	Pre-TRA97 S.E.	Post-TRA97 Coef.	Post-TRA97 S.E.
$\Delta RATE_t$	α	-0.093	0.123	-0.317	0.191	-0.148	0.362
	ΔGDP_{t-1}	17.068*	8.176	16.396	11.165	18.126	9.980
	ΔRFI_{t-1}	-0.776	0.938	-0.570	1.405	-3.987*	2.088
	ΔHPI_{t-1}	0.041	0.033	0.313*	0.108	-0.016	0.032
	$\Delta Rate_{t-1}$	0.258*	0.101	0.307*	0.118	0.207	0.199
	ΔM_{t-1}	-0.043	0.070	-0.126	0.095	0.007	0.073
	$\lambda_{1,t-1}$	0.627	0.437	-3.808	2.231	0.819	0.830
	$\lambda_{2,t-1}$	-0.014	0.383	0.047	0.467	0.884	0.493
	$\lambda_{3,t-1}$					-0.005*	0.002
	$TRA97_t$	-0.357	0.200				
ΔM_t	α	-0.230	0.159	-0.055	0.218	-0.026	0.750
	ΔGDP_{t-1}	-19.125	10.518	-20.405	12.742	-60.833*	20.686
	ΔRFI_{t-1}	0.700	1.206	2.478	1.604	12.118*	4.327
	ΔHPI_{t-1}	-0.147*	0.042	-0.055	0.123	-0.175*	0.067
	$\Delta Rate_{t-1}$	-0.340*	0.130	-0.213	0.135	-1.029*	0.412
	ΔM_{t-1}	0.040	0.090	0.058	0.108	0.120	0.152
	$\lambda_{1,t-1}$	-4.199*	0.562	16.282*	2.546	-3.846*	1.720
	$\lambda_{2,t-1}$	0.746	0.493	-1.371*	0.533	-0.144	1.022
	$\lambda_{3,t-1}$					0.014*	0.004
	$TRA97_t$	1.820*	0.257				
	N	134		88		46	
	AIC	-4.523		-5.613		-6.307	

Note: Lambda denotes cointegrating equations, alpha is a constant, and TRA97 denotes a dummy variable that equals 1 for 1997Q3 and after and 0 otherwise. * denotes statistical significance at the 0.05 level.

Table 4.7: Estimated Cointegrating Equations

		Full Sample		Pre-TRA97		Post-TRA97	
C.E.	**Variable**	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
λ_1	α	-9.099	-	-7.999	-	-9.415	-
	GDP_t	1.000	-	1.000	-	1.000	-
	RFI_t	0.000	-	0.000	-	0.000	-
	HPI_t	-0.001	0.001	$-0.007*$	0.000	0.000	-
	$RATE_t$	-0.008	0.008	$0.008*$	0.002	$0.036*$	0.014
	M_t	$0.237*$	0.024	$-0.042*$	0.008	$0.140*$	0.024
λ_2	α	-6.055	-	-5.268	-	-4.563	-
	GDP_t	0.000	-	0.000	-	0.000	-
	RFI_t	1.000	-	1.000	-	1.000	-
	HPI_t	$0.001*$	0.001	0.000	0.001	0.00	-
	$RATE_t$	$0.051*$	0.010	$0.045*$	0.009	0.026	0.038
	M_t	0.143	0.028	$0.135*$	0.039	$-0.294*$	0.064
λ_3	α					-266.632	-
	GDP_t					0.000	-
	RFI_t					0.000	-
	HPI_t					1.000	-
	$RATE_t$					$43.313*$	7.599
	M_t					-52.227	12.734

Note: Johansen normalization restrictions are imposed. Alpha is a constant. * denotes statistical significance at the 0.05 level.



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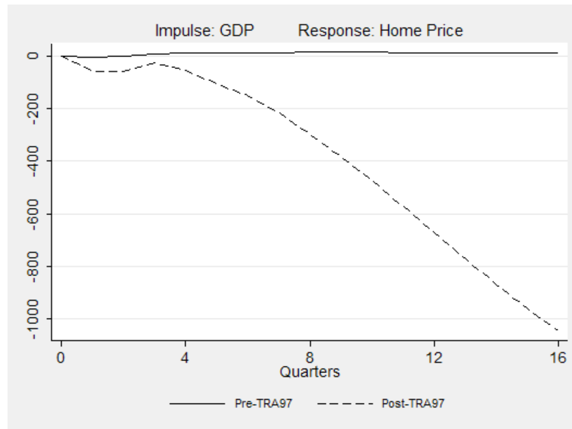

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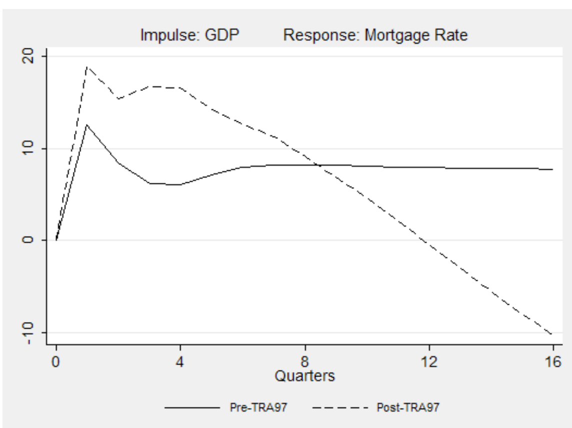

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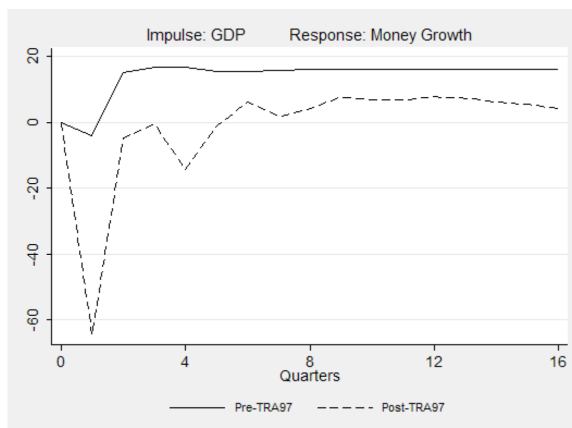
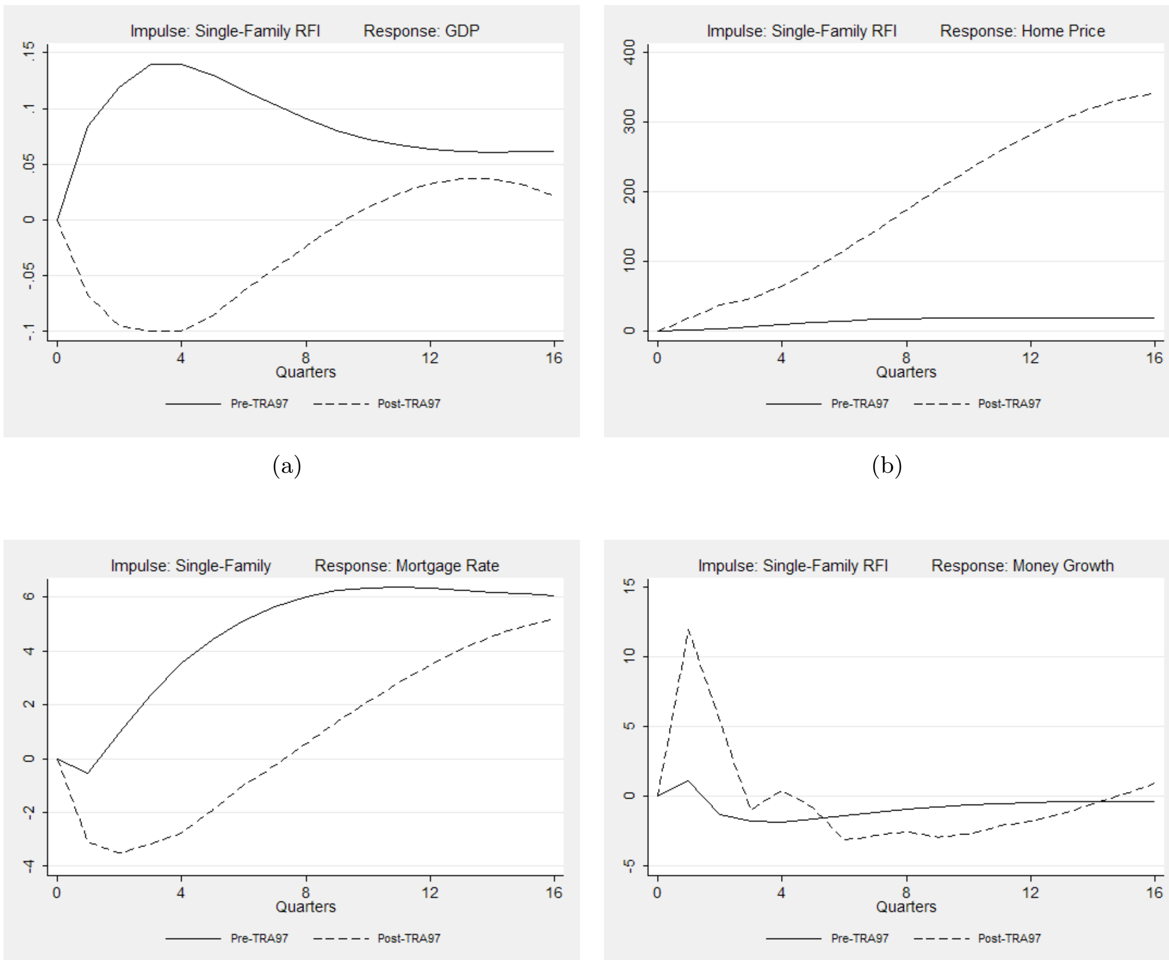


(d)

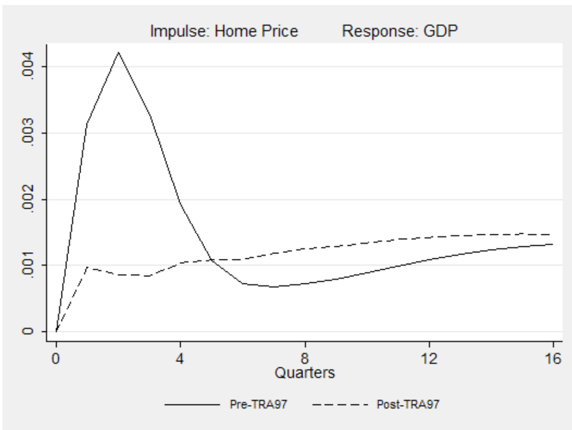
Figure 4.3: Impulse Response Functions - GDP



(a) (b)

(c) (d)

Figure 4.4: Impulse Response Functions - Single-Family RFI



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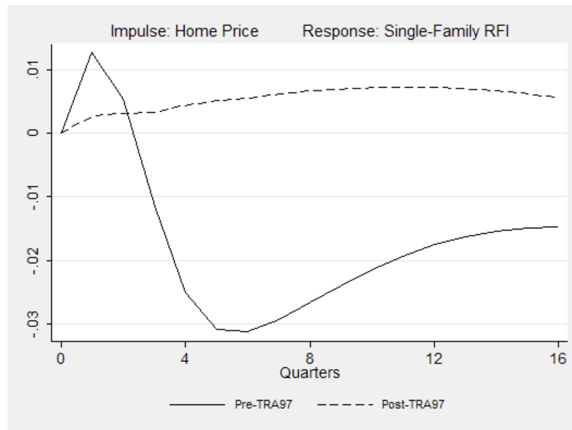

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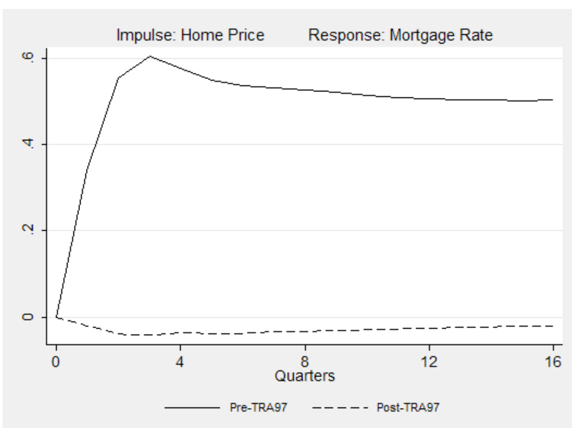

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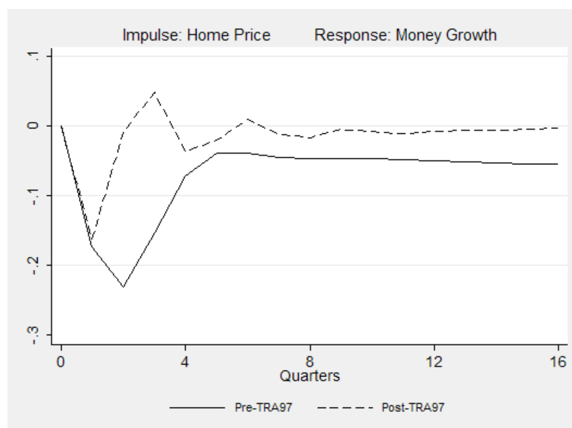

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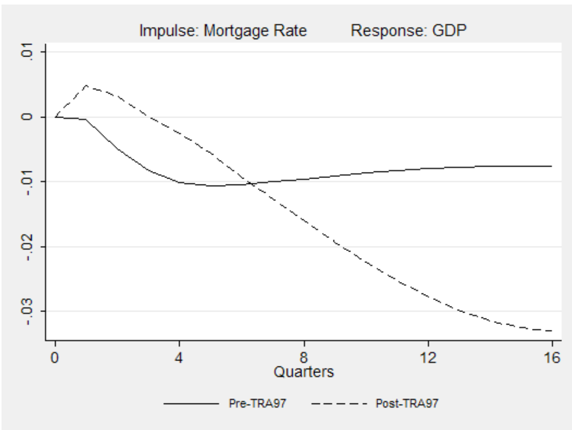
Figure 4.5: Impulse Response Functions - Home Price



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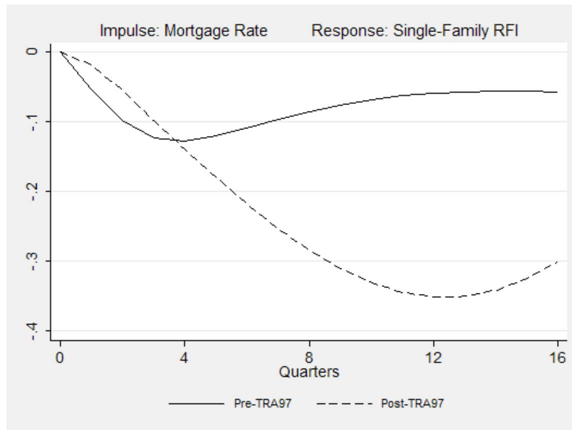

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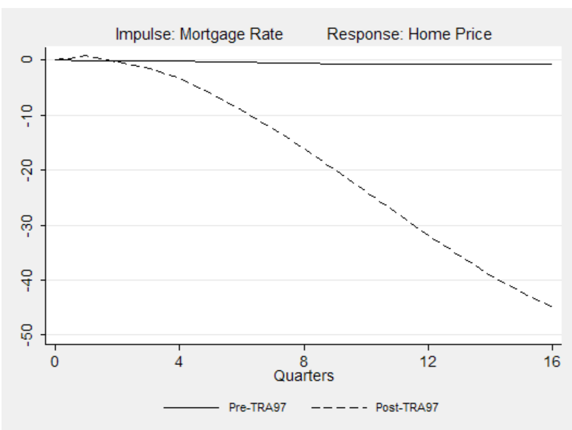

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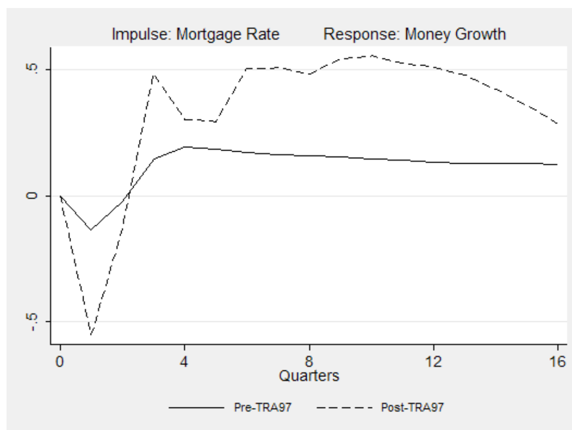

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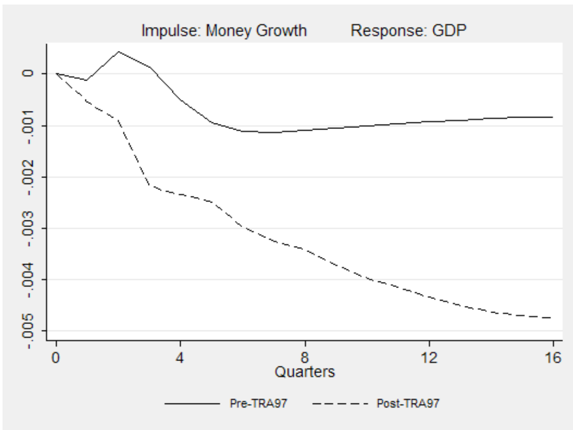
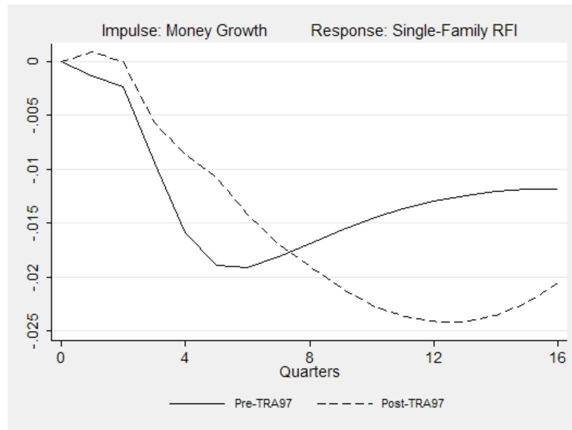
Figure 4.6: Impulse Response Functions - Mortgage Rate



(a)



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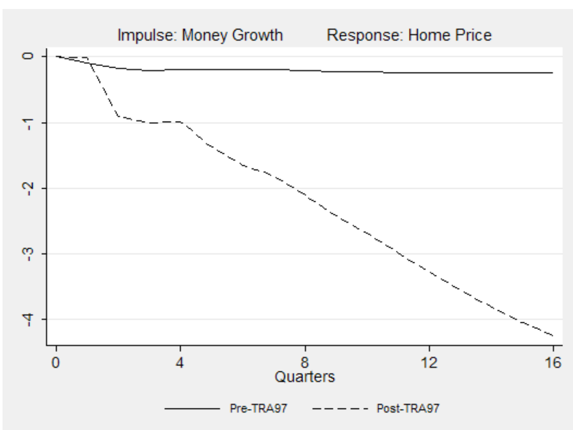

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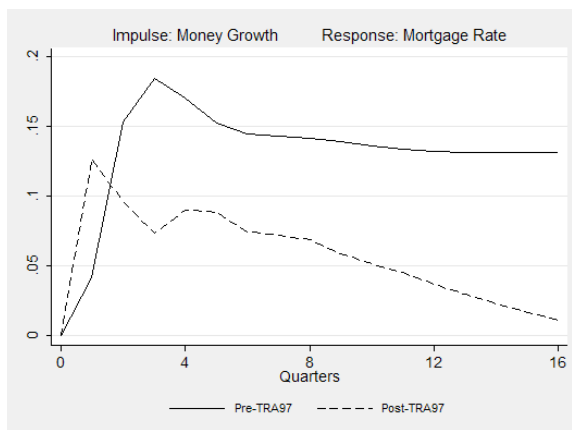

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Figure 4.7: Impulse Response Functions - Money Growth

Table 4.8: FEVD - GDP

	Pre-TRA97					Post-TRA97				
Horizon	GDP	RFI	HPI	RATE	M	GDP	RFI	HPI	RATE	M
2	88	9	3	0	0	95	2	1	2	0
4	62	25	6	7	0	89	6	2	1	1
6	51	31	4	13	0	82	8	5	3	3
8	48	32	4	16	0	71	7	9	9	4
10	47	32	3	18	0	56	5	14	19	5
12	46	31	3	19	0	41	4	19	30	6
14	46	31	3	20	0	30	3	22	39	6
16	47	30	3	20	0	23	2	23	45	6

Note: Values may not sum to 100 for each horizon and period due to rounding.

Table 4.9: FEVD - Single-Family RFI

	Pre-TRA97					Post-TRA97				
Horizon	GDP	RFI	HPI	RATE	M	GDP	RFI	HPI	RATE	M
2	13	75	2	10	0	1	95	2	1	0
4	4	66	1	28	0	6	74	7	13	0
6	3	59	1	36	1	12	53	10	25	0
8	4	54	2	40	1	17	40	11	31	1
10	6	49	2	42	1	20	32	12	35	1
12	8	46	2	42	1	23	26	13	37	1
14	10	44	2	42	2	26	22	13	39	1
16	12	41	2	43	2	28	19	13	39	1

Note: Values may not sum to 100 for each horizon and period due to rounding.

Table 4.10: FEVD - Home Price

	Pre-TRA97					Post-TRA97				
Horizon	GDP	RFI	HPI	RATE	M	GDP	RFI	HPI	RATE	M
2	0	2	97	0	0	24	11	65	0	0
4	1	8	89	0	1	16	24	56	1	3
6	4	18	75	1	2	14	28	47	8	3
8	6	28	62	2	1	14	28	38	17	3
10	8	35	53	3	1	16	26	31	24	2
12	8	39	47	4	1	18	24	27	29	2
14	8	42	43	5	1	19	21	24	33	2
16	9	44	41	6	1	21	19	23	35	2

Note: Values may not sum to 100 for each horizon and period due to rounding.

Table 4.11: FEVD - Mortgage Rate

	Pre-TRA97					Post-TRA97				
Horizon	GDP	RFI	HPI	RATE	M	GDP	RFI	HPI	RATE	M
2	4	15	2	79	0	19	2	16	61	2
4	4	11	8	75	1	23	2	19	54	2
6	6	8	10	74	1	24	2	20	51	2
8	7	7	12	73	2	25	2	21	50	2
10	9	6	12	72	2	26	2	21	49	3
12	10	5	13	71	2	26	3	21	48	3
14	11	4	13	70	2	25	4	21	27	3
16	11	4	14	70	2	25	6	21	46	3

Note: Values may not sum to 100 for each horizon and period due to rounding.

Table 4.12: FEVD - Money Growth

	Pre-TRA97					Post-TRA97				
Horizon	GDP	RFI	HPI	RATE	M	GDP	RFI	HPI	RATE	M
2	0	1	12	7	80	19	11	7	5	57
4	3	3	16	7	70	18	12	7	8	55
6	6	7	15	9	63	17	12	8	10	53
8	9	8	14	10	59	17	12	9	14	49
10	12	9	13	11	55	17	11	9	17	45
12	15	9	13	12	52	17	11	10	21	42
14	18	9	12	12	49	17	10	10	23	39
16	20	9	12	12	47	17	10	11	25	38

Note: Values may not sum to 100 for each horizon and period due to rounding.

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Vita

Zachary William Richards was born in Brandywine, MD on April 1, 1982. He graduated from St. Mary's Ryken High School in Leonardtown, Maryland in 2000 and proceeded to Salisbury University in Salisbury, Maryland. There, he received a Bachelor of Arts degree in Economics in December 2003. He then began graduate work at the University of Tennessee. In August, 2006 he received a Master of Arts degree in Economics and is currently completing his Doctoral degree. Zach accepted an Economist position with the Joint Committee on Taxation, U.S. Congress, beginning in late summer of 2009.