



**BERGISCHE
UNIVERSITÄT
WUPPERTAL**

Schumpeter School
of Business and Economics



Household Taxation, Risk, and the Family

– An Incomplete Markets Perspective

Inauguraldissertation zur Erlangung des akademischen Grades eines
Doktors der Wirtschaftswissenschaft (doctor rerum oeconomicarum)

an der Fakultät für Wirtschaftswissenschaft

– Schumpeter School of Business and Economics –
der Bergischen Universität Wuppertal

vorgelegt von

Eva Marie Grün geb. Seeck, M. Sc.

aus Düsseldorf

Wuppertal, May 27, 2026

Acknowledgments

I would like to begin by thanking Christian Bredemeier for his supervision. He has been an outstanding mentor, consistently offering valuable feedback and thoughtful guidance at every stage of this work. I have learned immensely from him and am especially inspired by his infectious enthusiasm for research. I am equally grateful to Falko Jüßen for his support and insightful feedback, and especially for his constant encouragement throughout this process.

I gratefully acknowledge the financial support of the Eberhard-Robke-Fonds received during my Master's studies to attend the Barcelona GSE Summer School, which motivated me for this journey, and of the National Bank Essen which enabled me to participate at the Lindau Nobel Meeting on Economic Sciences. I would like to thank all the participants of the Brown Bag Seminar and the Ruhr Macro Day, and in particular my discussant Philip Jung, for their constructive discussions and helpful comments. I am also thankful to Kerstin Schneider, Hendrik Jürges, and Nils Crasselt for their willingness to serve on my dissertation committee.

Research would not be the same without supportive colleagues. A very special thanks goes to Jan Gravert, who is not only a co-author of Chapter 4 but has also been an important mentor and friend to me over the years. I am deeply grateful for the inspiring discussions and endless motivation. Along the way, I was fortunate to be accompanied by many other wonderful colleagues, including Julia Bahlmann, Jan Langguth, and Dorothee Bahn. Thank you Doro, for your support and for all the conversations we have shared over the years.

Of particular importance has been the encouragement and emotional support of my family and friends. Thank you for all the warming words and the genuine interest. I deeply want to thank my Mom for always being there, no matter what. Last, but not least, I want to thank Timo. Whether calming me down or cheering me up – thank you and the pack for being by my side.

Contents

	Page
List of Figures	IV
List of Tables	VI
1 Introduction	1
2 Public Insurance, Private Responses:	
Means-Tested Transfers and Phased-In Tax Credits	11
2.1 Incomplete-Markets Literature	17
2.2 The Tax-Transfer System in the U.S.	19
2.2.1 Components of the Tax-Transfer System	20
2.2.2 Structural Differences Between Credits and Transfers	21
2.3 Model	22
2.4 Parameterization and Quantitative Results of the Calibrated Model	26
2.4.1 Government	26
2.4.2 Stochastic Processes	27
2.4.3 Asset Markets and Preferences	29
2.4.4 Empirical Fit	30
2.4.5 Consumption Insurance in the Calibrated Model	33
2.5 Policy Experiments	36
2.5.1 Insurance Contributions of Individual Public Policies	36
2.5.2 Interactions Between Insurance Channels	39
2.5.3 Specific Features of Transfers and Credits	42
2.5.4 Either Transfers? Or Credits? Or Both?	46
2.6 Summary and Implications	47
3 Offsetting Reforms, Unequal Effects:	
U.S. Tax-Transfer Progressivity and Household Welfare	49
3.1 Literature on Tax-Transfer Reforms and Progressivity	53
3.2 Tax-Transfer Reforms in the United States, 2004-2019	56
3.3 Empirical Analysis of U.S. Tax-Transfer Progressivity	59
3.3.1 Estimation Approach	59
3.3.2 Data, Sample, and Variable Definitions	61

3.3.3	Results	63
3.4	Model	68
3.4.1	Maximization Problem	70
3.4.2	Parameterization	71
3.4.3	Model Fit	74
3.5	Model Results	75
3.5.1	Taxes Net of Transfers and Consumption Insurance	75
3.5.2	Choices	77
3.5.3	Welfare	80
3.5.4	Children	82
3.6	Summary and Implications	84
4	Child Tax Credits, Divorce Penalties, and Household Bargaining	86
4.1	Literature on Couple Taxation, Bargaining, and Marriage Penalties	90
4.2	Divorce Penalties in the Child Tax Credit	94
4.2.1	The U.S. Child Tax Credit	94
4.2.2	Divorce Penalties	95
4.3	Model	97
4.3.1	Model Setup	98
4.3.2	Household Maximization Problems	102
4.4	Parameterization	104
4.4.1	Externally Estimated and Pre-Set Parameters	104
4.4.2	Calibrated Parameters	106
4.4.3	Model Fit	108
4.5	Results	110
4.5.1	Differences in Consumption and Hours Worked	110
4.5.2	Heterogeneity by Number of Children	113
4.5.3	Inequality	115
4.6	Relation to Recent Child Tax Credit Reforms	117
4.7	Summary and Implications	119
5	Concluding Remarks	121
Appendix A		124
A.1	The U.S. Tax and Transfer System	124
A.2	Details on the Parameterization	132
A.3	Baseline Model: Life-Cycle Profiles and Insurance	135
A.4	Further Insurance Implications of Public Policies	140
A.5	Further Insurance Implications of Specific Features	143
A.6	Considering Budget-Neutral Model Versions	145

Appendix B	150
B.1 The U.S. Tax and Transfer System, 2004-2019	150
B.2 CPS Sample Selection	159
B.3 Properties of the Bénabou Tax-Transfer Function	161
B.4 Additional Estimation Results and Robustness Checks	162
B.5 Details on the Parameterization of the Model	165
B.6 Welfare	169
B.7 Further Model Results	172
Appendix C	177
C.1 The U.S. Tax and Transfer System by Filing Status	177
C.2 Divorce Bonuses and Penalties	184
C.3 Further Information on the Parameterization of the Model	186
C.4 Further Results	188
References	196

List of Figures

2.1	Structural differences between tax credits and transfers	22
2.2	Wage profiles by education group of the husband	29
2.3	Life-cycle profiles in data and model	31
2.4	Insurance in the baseline model	35
2.5	Decomposing consumption insurance via public policy	37
2.6	Insurance implications induced by public policy decomposed by channel	40
2.7	Impact of public policies on life-cycle profiles	41
2.8	Decomposing insurance via means-tested transfers	43
2.9	Insurance implications induced by asset means-testing and the EITC phase-in decomposed by channel	44
2.10	Decomposing insurance via the phased-in EITC	45
2.11	Insurance implications of expanding either transfers or the EITC . . .	47
3.1	Change of selected tax-transfer elements from 2004 to 2019	57
3.2	Changes in taxes net of transfers from 2004 to 2019	58
3.3	Overall level and progressivity of taxes net of transfers	64
3.4	Decomposition of the progressivity parameter τ	65
3.5	Estimates for the progressivity parameter τ ; Constant data (2004) + constant TY (2004) + one element varying over time	66
3.6	Changes due to tax-transfer reforms between 2004 and 2019	76
3.7	Total changes from 2004 to 2019	78
3.8	Welfare change	81
3.9	Changes by the presence of children in the household	83
4.1	The Child Tax Credit	94
4.2	CTC divorce penalties	96
4.3	Life-cycle profiles in data and model	109
4.4	Impact of the reform by wage share of the mother and number of children	115
A.1	Income and payroll taxes and their marginal rates	126
A.2	Tax credits and their marginal rates	127
A.3	Transfers and their marginal rates	131
A.4	Life-cycle profiles in the baseline model	136
A.5	Insurance in the baseline model in other education groups	136
A.6	Decomposition of insurance via labor supply in the baseline model . .	139

A.7	Implications of public policy on insurance via labor supply	140
A.8	Insurance implications induced by public policy, ages 41–57	141
A.9	Decomposing insurance via transfers in the <i>Some HS</i> group into the contributions from SNAP and TANF	142
A.10	Impact of specific features on life-cycle profiles in the <i>Some HS</i> group	144
A.11	Implications of specific features on insurance via labor supply	144
A.12	Insurance implications induced by specific features for households in the <i>Some HS</i> group considering different ages	145
A.13	Insurance implications induced by expanding either transfers or the EITC in the <i>Some HS</i> group considering different ages	146
A.14	Insurance implications of replacing the progressive income tax structure by a linear tax of either 10% or 18.7%	147
A.15	Insurance implications of removing specific features in the <i>Some HS</i> group when considering spending-neutrality	148
B.1	Parameters of the statutory tax code over time	152
B.2	EITC and CTC parameters in 2019-dollars over time	155
B.3	SNAP and TANF parameters in 2019-dollars over time	158
B.4	Scaling parameter χ over time	163
B.5	Robustness checks, progressivity parameter τ	165
B.6	Changes in insurance and saving	176
C.1	CTC and EITC by status and children	180
C.2	SNAP and TANF by household size	182
C.3	Divorce bonuses and penalties in various tax-transfer elements	185
C.4	Parameterization of the child distribution and deterministic wages . . .	187
C.5	Additional life-cycle profiles in data and model	189
C.6	Sample differences between model versions	190
C.7	Impact of the CTC phase-in on the CTC divorce penalty	194
C.8	Change of life-cycle profiles	195

List of Tables

2.1	Overview of model parameters	27
2.2	Empirical targets matched	30
2.3	Tax credits and transfers in model and data	32
2.4	Decomposing consumption insurance as in Wu and Krueger (2021) . .	34
3.1	Sample means for selected years	62
3.2	Progressivity by education type	67
3.3	Decomposition of changes in progressivity by education group and tax- transfer element, 2004 to 2019.	67
3.4	Overview of model parameters	72
3.5	Empirical targets matched	74
4.1	Overview of estimated and pre-set model parameters	105
4.2	Overview of calibrated model parameters	106
4.3	Empirical targets matched	108
4.4	Determinants of maternal consumption	112
4.5	Determinants of maternal hours	113
4.6	Within- and between-household consumption inequality	116
A.1	Bracket limits and marginal rates	125
A.2	EITC and CTC parameters	128
A.3	SNAP and TANF parameters	130
A.4	Parameters regarding pensions	133
A.5	Sample selection in CPS data 2019	134
A.6	Overview of parameters concerning the deterministic wage component	135
A.7	Decomposing insurance via public policy	137
A.8	Differences in government spending	146
B.1	Nominal parameter values of the income and payroll tax system	151
B.2	Nominal EITC and CTC parameters	154
B.3	Nominal SNAP and TANF parameters	157
B.4	Nominal parameter values concerning pensions	159
B.5	Share of couple-households receiving transfers	160

B.6	Decomposing the change in overall progressivity into effects of different tax-transfer elements, 2004-2019 – fixing tax-transfer determinants to 2013 and 2019	164
B.7	Progressivity by number of children in the household	166
B.8	Model parameters concerning wage components	167
B.9	Sample means in model and data	169
B.10	Aggregate changes in budget components by education group	173
B.11	Aggregate changes in specific tax-transfer elements by education group	175
C.1	Bracket limits and standard deductions	178
C.2	CTC parameters	179
C.3	EITC parameters	181
C.4	SNAP parameters	181
C.5	TANF parameters	183
C.6	Overview of estimated parameters for the deterministic wage component	188
C.7	Determinants of the maternal Pareto weight and consumption share	191
C.8	Determinants of consumption and hours worked by the mother of the average child	192
C.9	Determinants of maternal relative to paternal hours worked	193

1 Introduction

OECD countries spend on average 2.4% of GDP on family support, an amount comparable in size to public spending on interest payments or public investment. Most countries allocate a substantial part of these expenditures to cash transfers or tax breaks for families.¹ The design of these tax-transfer programs differs considerably across countries and can have important implications for household decision making and insurance against economic risk. For instance, family provisions that phase in with earnings may strengthen work incentives for secondary earners while providing less support when household earnings are very low. Similarly, means-tested transfers may target resources to households in need while affecting incentives to work or save. Features of the tax-transfer code that may appear small from the perspective of aggregate progressivity can therefore matter substantially for individual families and can interact with other elements of the system. This dissertation studies such specific tax-transfer elements and examines their implications for decision making within families.

Family-related taxes and transfers differ along several dimensions. Many countries provide some form of child support with a universal character, targeting a broad base of families. Such payments can be costly but often have only limited direct effects on household choices. In addition, targeted programs support families with low income. Means-testing can improve targeting precision but may discourage labor supply or asset accumulation. Other programs explicitly support working parents by conditioning financial aid on earned income. Beyond direct payments, the tax system itself often contains family-related provisions, such as child-related tax credits or allowances. Some countries also grant tax advantages to married couples, thereby potentially encouraging marriage while discouraging labor supply by secondary earners.

¹See OECD 2024 and OECD 2025. Part of the money is also used for child-related services such as child care. Only few countries, such as the Scandinavian ones, spend more than half of family benefits on such services.

These designs have been studied from different perspectives in the literature. One strand of the literature examines the advantages and disadvantages of joint taxation of couples in progressive income tax systems (e.g., Guner, Kaygusuz, and Ventura 2012, Bick and Fuchs-Schündeln 2018, and Holter, Krueger, and Stepanchuk 2026). Another strand studies consumption volatility and the extent to which households can insure consumption against unpredictable wage shocks, including the role of taxes and transfers relative to other insurance channels (e.g., Heathcote, Storesletten, and Violante 2014 and Wu and Krueger 2021). A further literature estimates tax-transfer progressivity across countries (e.g., Holter, Krueger, and Stepanchuk 2019 and Qiu and Russo 2026) and over time (e.g., Borella et al. 2023 and Heathcote, Storesletten, and Violante 2020), often distinguishing explicitly between singles and couples. Much of this work treats taxes and transfers as a whole, without a detailed analysis of individual program rules and their interactions.

A growing literature examines specific family-related tax-transfer elements and their welfare implications. Examples include comparisons of child-related benefits conditional on work with unconditional benefits (Guner, Kaygusuz, and Ventura 2020), social assistance with unemployment insurance (Haan and Prowse 2024), or the current U.S. system with a negative income tax or a universal basic income (Guner, Kaygusuz, and Ventura 2023). Bronson, Haanwinckel, and Mazzocco (2025) use a detailed version of the U.S. tax-transfer system to compare joint taxation, separate taxation, and mixed variants for couples. Blundell, Pistaferri, and Saporta-Eksten (2016) show that consumption insurance through transfer payments is particularly important for households at the bottom of the income distribution.

Other studies emphasize the importance of particular features within tax-transfer programs. For instance, Low et al. (2025) examine the implications of time limits in transfer programs. Ortigueira and Siassi (2022) analyze how taxes and transfers affect the marriage decisions of cohabiting couples. Like Wellschmied (2021), they emphasize the role of asset means-tested transfers in discouraging wealth accumulation. Garstenauer and Siassi (2025) examine labor supply responses to changes in specific

features of tax credits.² These studies show that individual elements and features of the tax-transfer system can have important implications for household decision making.

This dissertation extends work that studies family-related taxes and transfers as a whole and contributes to the recent literature on specific tax-transfer elements and their implications for families. First, I contribute to the consumption insurance literature. While recent work has emphasized insurance within families, often abstracting from the details of the tax-transfer system (e.g., Denderski and Obermeier 2025 and Bredemeier, Gravert, and Juessen 2026), I compare means-tested transfers and phased-in tax credits. I study how these forms of support stabilize consumption against unpredictable wage shocks and how they interact with private insurance channels. Second, I contribute to the literature estimating U.S. tax-transfer progressivity over time by focusing on the role of specific reforms and their effects on different population groups. The empirical progressivity analysis is complemented by a model-based welfare analysis of the tax-transfer systems before and after these reforms. Finally, in joint work with Christian Bredemeier, Jan Gravert, and Falko Jüken, we contribute to the literature on marriage bonuses and penalties implied by the tax-transfer system. Instead of considering the system as a whole, we focus on the phase-in of the U.S. Child Tax Credit (CTC), show how it creates divorce penalties, and analyze how these penalties affect within-household bargaining.³

This dissertation consists of three main parts. In Chapter 2, I contribute to the consumption insurance literature (e.g., Heathcote, Storesletten, and Violante 2014, Blundell, Pistaferri, and Saporta-Eksten 2016, Wu and Krueger 2021, and Bredemeier, Gravert, and Juessen 2026). Households make choices under uncertainty. In times of increasing labor-market risk (Heathcote, Storesletten, and Violante 2020), instruments that dampen the effect of wage shocks on consumption are valuable. The insurance literature has shown that the tax-transfer system contributes to stabilizing consumption against unpredictable wage shocks, while also crowding out private forms of insurance such as de-saving or labor supply adjustments within the family. Less is known, however,

²For instance, they examine the effects of considering only the primary earner's income instead of total household income when determining eligibility and the benefit amount of tax credits.

³Throughout this dissertation, CTC refers to the Child Tax Credit in its entirety, including both the refundable and the non-refundable portion. Where only one of the components is meant, this is explicitly stated. Both components together shape the phase-in of the credit – with slightly different phase-in rates – and imply one effective phase-in range of the credit.

about how specific programs affect overall insurance for families and how they interact with other insurance channels. I address this question by examining the insurance implications of asset means-tested transfers and phased-in tax credits, two structurally different programs that support low-income families.⁴ I distinguish between the insurance implications for the average household and for particularly vulnerable families, that is, households with low earnings, little wealth, and children.

To this end, I follow Wu and Krueger (2021) and build a Bewley (1986)-style incomplete-markets model in which households cannot perfectly insure against idiosyncratic risks. To account for different insurance channels and their interactions, the model includes endogenous saving and labor supply decisions, borrowing constraints, and a detailed representation of the U.S. tax-transfer system, including the rules for credits and transfers. Specifically, I consider the Earned Income Tax Credit (EITC) as the main tax credit targeted to low-income households in the U.S., as well as the Supplemental Nutrition Assistance Program (SNAP) and Temporary Assistance for Needy Families (TANF) as transfer programs. I focus on couple households and allow for heterogeneity in the number of children in the household. To capture the tails of the income distribution, I also allow for ex-ante heterogeneity in human capital. The model is calibrated to match empirical targets for the U.S. in 2019 and also replicates untargeted life-cycle moments.

I use the baseline model to first examine mechanical consumption insurance, abstracting from behavioral adjustment. Depending on age, between 60% and 80% of a permanent wage shock to the husband does not pass through to consumption and is therefore insured, which is in line with the literature (e.g., Wu and Krueger 2021). For the average household, transfers and credits play only a minor role in total consumption insurance, accounting jointly for about 2% of total insurance and for about 4% at younger working ages. For the most vulnerable households, these contributions are larger, reaching about 12% and 16%, respectively.

I then determine the net insurance contribution of transfers and credits using counterfactual model experiments in which I remove one component from the tax-transfer system while keeping the rest of the system fixed. Allowing for interactions with other channels, I find that the mechanical insurance contribution of tax credits is roughly

⁴While means-tested transfers, as implemented in the U.S., offer high payments even to households without own earnings, tax credits condition benefits on work. Transfers phase out at relatively high rates, while tax credits phase in with income and later phase out at moderate rates.

halved, whereas the contribution of transfers remains at about 90% of its mechanical component at younger working ages. Tax credits slightly crowd out insurance from other channels. Transfers, in contrast, strengthen insurance through de-saving and through interactions with other public policies at younger ages, while reducing self-insurance through labor supply adjustments within the family by a similar magnitude. Overall, the net insurance gain from transfers is roughly twice the contribution of the more costly tax credits. The analysis of program features shows that asset means-testing in transfer programs improves targeting toward households in need. Phase-in ranges of tax credits encourage labor force participation of secondary earners, making households less exposed to fluctuations in the primary earner's income. While policy debates often focus on tax credits, I find that combining transfers and credits provides more net insurance for the most vulnerable households than relying on either program alone. The results therefore emphasize the complementary roles of transfers and credits in providing consumption insurance.

After studying the insurance implications of specific family-related tax-transfer components, Chapter 3 examines how reforms to such components affected couple households as a whole and different subgroups of the population. Tax-transfer progressivity in 2019 was close to its level in 2004. Yet this aggregate stability masks several reforms to individual parts of the system, including the expansions of tax credits under the American Recovery and Reinvestment Act (ARRA) of 2009 and the income tax cuts under the Tax Cuts and Jobs Act (TCJA) of 2017. I therefore study empirically the evolution of tax-transfer progressivity between 2004 and 2019, explicitly considering the contribution of specific reforms and distinguishing households by educational attainment. I then use a partial-equilibrium life-cycle model with heterogeneous agents to compare welfare under the tax-transfer systems of 2004 and 2019.

Following the literature (e.g., Heathcote, Storesletten, and Violante 2020, Wu 2021, Borella et al. 2023, and Ferriere and Navarro 2025), I measure tax-transfer progressivity between 2004 and 2019 by estimating the progressivity parameter of a simple log-linear tax function in the spirit of Bénabou (2000). To do so, I use pre-government income data from the Current Population Survey (CPS) and calculate post-government income based on tax-transfer rules in the respective years. I first separate changes arising from

active tax-transfer reforms from passive changes in tax-transfer determinants, such as pre-government income, by fixing these determinants at the values observed in a given sample year. Abstracting from passive changes, I find that tax-transfer progressivity was largely the same in 2019 as in 2004. A decomposition of active changes in progressivity into the contributions of individual tax-transfer components shows that the 2017 tax cuts made the system less progressive, while expansions of tax credits, in particular the EITC and the CTC, made it more progressive. Across subgroups, the 2019 system is more progressive for households with low educational attainment but less progressive for highly educated households.

To analyze the welfare implications of the two tax-transfer systems, I use an incomplete-markets model similar to the one in Chapter 2. The model includes a detailed representation of the 2019 tax-transfer system and is also solved counterfactually under the 2004 system, with budget neutrality imposed between the two systems. Under the 2019 tax code, all education groups experience higher consumption levels, with an average increase of \$313. These consumption gains, however, are unequally distributed: the increase for highly educated households is 8.2 times larger than for households with lower levels of education. Consumption increases are also more pronounced among households with children and at older working ages. While higher consumption levels raise welfare, the increase in consumption inequality lowers it. The size of these effects varies by education, and welfare responses depend strongly on endogenous changes in labor supply. Overall, welfare declines by 0.2%. Households with low educational attainment and children experience welfare gains, whereas other groups experience welfare losses, which are particularly large among households without children and among those with medium levels of education.⁵ These results show that tax-transfer reforms can leave aggregate progressivity almost unchanged while substantially affecting individual families. A closer look at the underlying components of the system is therefore important.

⁵Those with lower levels of education and children are able to more than offset welfare losses stemming from increased consumption inequality. They do so by reducing their labor supply and taking advantage of expanded tax credits, ultimately experiencing net welfare gains. Highly educated households face small welfare losses due to increased labor supply under the 2019 system. Substantial gains from higher consumption largely compensate for these effects, resulting in only modest net losses. In contrast, consumption gains among households with intermediate levels of education or without children are only modest, hardly offsetting welfare losses from higher labor supply and consumption inequality. These households therefore incur the largest welfare losses.

The first two chapters of the dissertation treat the family as a single decision unit and abstract from intra-household bargaining. In Chapter 4, joint work with Christian Bredemeier, Jan Gravert, and Falko Jüssen, we examine a specific feature of family support in the U.S., the phase-in income range of the CTC, and study its implications for within-household bargaining. The literature has already discussed the effects of the effective CTC phase-in on employment and child poverty (e.g., Goldin and Micheltore 2022 and Bastian 2024). We focus on a further implication that has received less attention: the CTC phase-in creates *divorce penalties*, that is, a potential loss of the credit in the event of divorce. Consider a married couple with sufficiently high household income to qualify for the maximum credit. If the couple divorces and one spouse becomes the custodial parent, that spouse's income becomes the relevant income for determining the CTC.⁶ Whenever this income lies in the effective phase-in range of the credit, part of the credit is lost upon divorce.⁷ We examine how such divorce penalties affect the bargaining position of spouses within marriage.

To this end, we build a partial-equilibrium life-cycle model with incomplete markets and explicitly model within-household bargaining under limited commitment in marriages, ensuring that CTC divorce penalties feed back into the endogenous bargaining process.⁸ Intra-household allocations are determined by a cooperative collective decision problem with Nash bargaining, where the outside option of divorce is available to both spouses at any time. For simplicity, we assume that the mother takes custody of the children in the event of divorce. We allow for heterogeneity in the presence and number of children and explicitly model the CTC as implemented in the United States. We also model other tax-transfer components in detail to allow for interactions between CTC divorce penalties and the rest of the system. The model is calibrated to match marriage-related empirical targets as well as the economic situation of couples, including income. We then use the model for counterfactual analysis and solve a version in

⁶We use the term *custodial parent* to refer to the parent who claims the children as dependents when filing taxes. It is thus the parent with whom the children live for most of the tax year. The custody-arrangement itself (e.g., joint, sole, or split) is not relevant for our research question.

⁷As noted by Grall (2020), the large majority of custodial parents in the U.S. are mothers. Among married parents in CPS data, we find that around 50% of mothers have earnings in the effective phase-in range, which implies an average CTC loss of \$1,300 in the event of divorce and the mother being the custodial parent.

⁸The pioneering work of Becker (1973) emphasized the importance of explicitly considering both spouses' preferences instead of treating the family as one decision unit. The collective household model in Chiappori (1992) has provided the foundation for numerous family-economics models.

which we abolish the effective CTC phase-in, so that even households without or with little tax liabilities become eligible for the maximum credit. We thereby eliminate CTC divorce penalties.

Comparing the baseline and counterfactual models, we find that the effective CTC phase-in weakens the bargaining power of the custodial parent, typically the mother. Holding household consumption constant, the average mother consumes about \$120 less in the presence of the effective CTC phase-in and the associated divorce penalty. The effect is stronger when more children live in the household and when the wage difference between spouses is larger. Holding spouses' bargaining positions fixed reveals that almost the entire reduction in maternal consumption is driven by changes in bargaining power rather than income effects. We also find that the average mother works about 2.5 hours more per week in the presence of the CTC phase-in. This increase is partly due to the lower bargaining weight of the mother, but mostly reflects the labor supply incentives associated with the effectively negative marginal tax rates in the phase-in range. Finally, we show that consumption inequality, measured as the variance of log consumption across individuals, increases by 5%, driven by higher within-household consumption inequality. The effective phase-in of the CTC was temporarily abolished under the American Rescue Plan Act of 2021, and a permanent expansion has been widely discussed. Our analysis provides insights into the bargaining implications of a fully refundable credit without any phase-in, complementing the existing evidence on employment and child poverty effects.

The results in this dissertation have implications beyond the specific U.S. policy environment studied here. They should also be viewed in the context of long-run changes in family structures in OECD countries, including declining fertility and marriage rates and rising labor force participation among married mothers.⁹ The specific features of the U.S. tax-transfer system analyzed in this dissertation did not cause these broad changes in family composition.¹⁰ Nevertheless, understanding the incentives and disincentives created by specific features of the tax-transfer code is important, especially because

⁹See Greenwood, Guner, and Vandenbroucke (2017) and Doepke et al. (2023).

¹⁰The current Handbook of Labor Economics and the Handbook of Economics of the Family summarize how public policy has contributed to or dampened such trends; see Dahl and Loken (2024) and Albanesi, Olivetti, and Petrongolo (2023), respectively.

policymakers often seek to influence labor supply, family formation, or redistribution through the design of family policy.

A country's social safety net is often debated with reference to labor supply disincentives, targeting, and means-testing. The U.S. example in Chapter 2 emphasizes the complementary roles of transfers and credits. It shows that asset means-testing can target support to households in need, while phase-in ranges can preserve labor supply incentives more effectively. These trade-offs are relevant for broader debates about the design of social safety nets. The results also suggest that delays, interruptions, or uncertainty in benefit delivery can be especially consequential for households with thin private buffers, since strict asset tests may limit their ability to rely on savings when public support is disrupted.

In Chapter 3, I show that tax-transfer reforms between 2004 and 2019 were approximately neutral in terms of aggregate progressivity, while still changing the economic situation of individual households substantially. For the same period, Heathcote et al. (2023) document rising income and wealth inequality in the U.S., while Autor (2019), among others, documents job polarization in the context of globalization and digitization. The results in Chapter 3 show that tax-transfer reforms over this period further increased consumption and wealth inequality and worsened welfare particularly for households in the lower middle of the education distribution.

In Chapter 4, we show that the effective CTC phase-in weakens the bargaining position of custodial parents, who are most often mothers. These effects on within-household bargaining are relevant in light of empirical evidence that mothers devote a disproportionate share of resources to child-related expenditures (e.g., Lundberg, Pollak, and Wales 1997 and Duflo 2003). Similar mechanisms may arise outside the United States whenever family-related programs increase with earnings and thereby create divorce penalties. Examples include child allowances in Germany (*Kinderfreibetrag*) or non-refundable tax credits in Austria (*Familienbonus Plus*).¹¹

Taken together, this dissertation studies specific tax-transfer elements and features and analyzes their implications for consumption insurance, household choices, within-

¹¹These programs interact with other family-related benefits in the two countries. In Austria, for instance, other programs explicitly support single parents, such as the *Alleinerziehendenabsetzbetrag*. In Germany, families receive either a universal payment (*Kindergeld*) or, if more beneficial, child allowances. Thus, divorce penalties occur if the household receives the allowances during marriage, but the lower universal payment in the event of divorce.

household bargaining, inequality, and welfare. Among the broad range of family benefits in OECD countries, I focus on the U.S. tax-transfer system, but several of the mechanisms examined here are relevant beyond the U.S. case. The results show that technical features of tax and transfer programs can have sizable effects on family outcomes and should therefore be considered carefully in the design and evaluation of family policy.

The remainder of this dissertation is organized as follows. Chapter 2 examines the insurance effects of means-tested transfers and phased-in credits. Chapter 3 studies the welfare effects of specific tax-transfer reforms. Chapter 4 analyzes the bargaining implications of CTC divorce penalties. Chapter 5 concludes.

2 Public Insurance, Private Responses:

Means-Tested Transfers and Phased-In Tax Credits

Households make decisions under uncertainty. Earnings fluctuate with job loss and hours changes; family composition changes as children are born and later leave the household; and asset returns vary over time. In such environments, risk-averse households value mechanisms that limit the pass-through of shocks to consumption. Consumption insurance – the extent to which adverse idiosyncratic shocks do not translate into consumption fluctuations – therefore has important welfare implications. Even partial insurance can generate large gains when markets are incomplete, borrowing is constrained, or households face steep marginal utility at low consumption levels (see for instance Attanasio, Low, and Sánchez-Marcos 2005, Pijoan-Mas 2006, or more recently Wu and Krueger 2021). These considerations are especially relevant for households with low earnings, little wealth, and multiple children, whose need to smooth consumption is greatest precisely when private buffers are thin (Blundell, Pistaferri, and Saporta-Eksten 2016). This chapter contributes to the broader question of how effectively public policy insures households against idiosyncratic risk (e.g. Conesa and Krueger 2006, Krueger and Perri 2011, Krueger and Ludwig 2016, Heathcote, Storesletten, and Violante 2017, or Guner, Kaygusuz, and Ventura 2023). I focus on two central elements of the social safety net for vulnerable families: means-tested transfers and tax credits.

Public programs insure consumption directly by changing the mapping from pre-tax earnings to disposable resources. Their total insurance value, however, also depends on how they interact with private self-insurance. Households can smooth shocks through saving and de-saving, namely by accumulating buffer stocks in good times and drawing them down in bad times. This channel is powerful later in life but weak for young or borrowing-constrained households (e.g. Wu and Krueger 2021). Households can also adjust labor supply, especially through the intensive margin and through the labor-

market response of a secondary earner (e.g. Attanasio, Low, and Sánchez-Marcos 2005, Heathcote, Storesletten, and Violante 2014, or Blundell, Pistaferri, and Saporta-Eksten 2016).¹² For an overview of consumption-insurance channels, see Heathcote, Storesletten, and Violante 2009 or Crawley and Theloudis 2024. Because none of these channels is complete on its own, program design matters: eligibility rules, phase-ins, phase-outs, and asset tests shape both direct public insurance and the incentives to use private margins.

In a period of increasing labor-market risk (Heathcote, Storesletten, and Violante 2020), U.S. efforts to strengthen the safety net have often centered on tax credits. Prominent examples include the EITC, which has expanded repeatedly since the 1980s, and the CTC, which has been broadened – temporarily or permanently – under every administration since its introduction in 1997. The appeal of these instruments is clear: credits are visible at tax time, often enjoy broad political support, and connect benefits to work in ways that respond to incentive concerns. Yet visibility and political appeal need not coincide with effectiveness as consumption insurance. Because eligibility is tied to earnings in the filing year, credits may be least generous precisely when labor income falls sharply. Phase-in schedules create negative marginal rates that encourage earnings at low income levels, but they offer limited protection when income drops toward zero. Credits also reach households across a broad range of the income distribution, which can make them costly per unit of insurance delivered to the most vulnerable households.

Means-tested transfers such as SNAP and TANF operate differently. They are designed to respond asymmetrically when market income falls and provide a *direct insurance effect* by raising post-government resources in bad states, thereby increasing the consumption floor; see Blundell, Pistaferri, and Saporta-Eksten (2016). Because benefit formulas depend on current need and family structure, transfers can be targeted to households with low earnings, few assets, and children – the households for whom buffer stocks are smallest, marginal utilities are steepest, and potential welfare gains from insurance are largest (Hoynes and Schanzenbach 2016, Ziliak 2016, or Guner, Kaygusuz, and Ventura 2023). This targeting also makes transfer design politically salient. Eligibility criteria, asset tests, work requirements, and maximum benefit duration are

¹²A further channel, which is ignored in this chapter, is that families can draw on private transfers and informal risk sharing, as outlined for instance by Heathcote, Storesletten, and Violante (2009).

frequently debated and revised, and even modest rule changes can materially affect the insurance capacity of the tax-transfer system.¹³ Unlike tax credits, transfers have not experienced broad expansions of coverage or entitlement in recent decades.

Neither credits nor transfers operate in isolation. Asset tests can discourage buffer-stock accumulation and keep households close to borrowing constraints. This design increases the short-run importance of transfers by targeting assistance to households with little wealth, but it may weaken de-saving as an insurance margin later in life (see Wellschmied 2021). Removing asset tests can have the opposite effect: it may strengthen saving and de-saving at older ages while reducing contemporaneous targeting to the most constrained households. Labor supply creates a second interaction. A transfer-financed consumption floor can reduce the need for secondary-earner hours in bad states, weakening intra-household insurance. Conversely, when transfers are withdrawn, spousal labor supply may partially substitute for lost public insurance, especially in households with more elastic secondary-earner labor supply. By contrast, the negative marginal tax rates generated by partly refundable tax credits may encourage labor-supply responses to negative income shocks. Finally, programs interact with one another: expanding transfers can change credit eligibility or credit amounts, while removing transfers can move households into credit phase-ins that are too small to offset the lost protection.

These interactions imply that the insurance effect of a public program is an equilibrium object, not a mechanical implication of statutory rules. Measuring the insurance role of transfers and credits requires a framework that tracks saving, hours, program eligibility, and program participation jointly. This chapter provides such a framework. I build a heterogeneous-agent, life-cycle model with borrowing constraints, children who are born and later leave the household, endogenous labor supply of both spouses, and a detailed representation of the U.S. tax-transfer system. The system includes statutory income taxes, payroll taxes, the EITC and CTC, and the means-tested programs SNAP and TANF with asset tests where appropriate. The model contains the canonical

¹³In the U.S., asset tests for transfer programs vary substantially. While asset limits in TANF are set by states, there exists a federal limit for SNAP. Yet, Broad-Based Categorical Eligibility (BBCE) allows states to apply less strict state-specific limits for SNAP. Within political debate, BBCE is questioned and a reintroduction of the strict asset limit in 44 states might be possible; see Bergh, Rosenbaum, and Nchako (2025) from the Center on Budget and Policy Priorities.

self-insurance and labor-supply channels and makes their interactions with credits and transfers explicit.

A distinguishing feature of the analysis is the central role of endogenous labor supply in measuring and decomposing insurance. This margin is an empirically important buffer against labor-market shocks. Analyses that abstract from endogenous labor supply – such as Wellschmied (2021), who focuses on saving and participation under asset tests while holding hours choices fixed – cannot capture several interactions that the model identifies as quantitatively important. The model also includes two layers of heterogeneity. First, I introduce ex-ante heterogeneity in human capital by distinguishing education groups, which places sufficient mass in the tails of the income distribution, especially at the low end where insurance needs are largest. Second, I allow the number of children in the household to vary across households and over the life cycle, because children are central both for eligibility and benefit amounts and for the welfare relevance of protecting families from sharp declines in living standards. For this reason, I focus on two-adult households: as of 2022, seven in ten children – and two in three adults – live in such households (Federal Interagency Forum on Child and Family Statistics 2023).

I first use the calibrated model to quantify mechanical consumption insurance from public policy, abstracting from behavioral responses, and decompose public insurance into transfers, the EITC, and progressive income taxation. I then use counterfactual models to account for interactions across programs and channels. In separate experiments, I eliminate (1) transfers, (2) the EITC, and (3) progressivity in statutory income taxes, holding the rest of the system fixed. I also remove all three components jointly. To isolate specific design features, I solve two additional counterfactuals: one without asset tests in transfer programs and one without the EITC phase-in. Finally, I examine whether a system that abolishes either transfers or credits and uses the savings to expand the remaining program provides more consumption insurance than the current U.S. system, which contains both. In all counterfactuals, I compare the average household with households for whom policy is most consequential: families with low earnings, little wealth, and children, such as high-school dropouts in the data.

The results show that public policy provides between five and eight percentage points of mechanical income insurance to the average household. Most of this insurance comes

from the progressivity of the statutory income-tax schedule, which contributes about six percentage points. The EITC adds roughly 1–2 percentage points, while transfers play only a negligible role for the average household. For more vulnerable households, the public insurance contribution is much larger. Among high-school dropouts, public policy mechanically insures 8–24 percentage points of shocks. Credits and transfers become central insurance sources, each contributing about nine percentage points at young ages. The importance of the EITC declines as households age and children leave the household, whereas transfers remain substantial, at about four percentage points, even later in working life.

Behavioral responses substantially change this mechanical picture. When public insurance is reduced, private self-insurance strengthens, so total insurance falls by less than the mechanical calculation suggests. Conversely, additional public insurance can crowd out private insurance. Quantitatively, behavioral responses roughly halve the overall insurance effects implied by the mechanical decomposition. For the average household, the net insurance effect of progressive income taxation is about half its mechanical effect at young ages and close to zero at older ages. Among vulnerable households, net public insurance also declines with age. At young ages, however, the net insurance from transfers remains close to 90% of its mechanical contribution, whereas the mechanical contributions of progressive taxes and the EITC are more than halved. In the model, government spending on transfers is also about 25% lower than spending on the EITC, which makes transfers a relatively cost-effective source of insurance.

The decomposition reveals why these net effects differ across programs. Progressive income taxation primarily crowds out saving-based self-insurance. For vulnerable households, mechanical insurance from the EITC and from transfers at older working ages is also mitigated by lower de-saving. At younger ages, the EITC partly reduces reliance on other channels.¹⁴ Transfers are different: their total net effect is only weakly muted, but the composition of insurance changes sharply. Households de-save more in bad states to become eligible for transfers, and transfers interact positively with other

¹⁴With the EITC available, households rely less on transfer payments when hit by a shock and have a lower incentive to de-save to meet the strict asset tests. Additionally, the EITC encourages more married women not to work, thereby increasing the households' reliance on the husband's income. All channels together imply that the mechanical EITC insurance gain of about six percentage points is roughly halved.

public programs. At the same time, transfers reduce insurance through labor-supply adjustment because households lower labor supply to qualify for benefits.

I then examine two design features: asset means-testing in transfers and the EITC phase-in. Strict asset tests mechanically reduce the insurance value of transfers because households with too much wealth cannot rely on transfers after a shock. Nevertheless, the net effect of means-testing on insurance is positive because asset tests crowd in labor-supply insurance. Similarly, the EITC phase-in mechanically lowers the insurance contribution of the credit: households with very low income can lose credit amounts when a shock reduces earnings. But the phase-in encourages secondary earners to participate in the labor market, reducing reliance on the primary earner's income. This labor-supply response fully offsets the mechanical insurance loss from the phase-in.

As a final evaluation, I ask whether a tax-transfer system built around only transfers or only the EITC can deliver more insurance than the current system that combines both. For young high-school dropouts, abolishing transfers and using the savings to expand the EITC reduces net insurance by 5.9 percentage points. Eliminating the EITC and expanding transfers produces only a small insurance loss of 0.8 percentage points at young ages. Thus, although transfers provide more insurance per dollar, the most vulnerable households obtain the greatest consumption insurance from a combined system with means-tested transfers and phased-in tax credits.

The central message is therefore nuanced but clear. Well-designed transfers can be a cost-effective source of insurance for households whose private buffers are thin and whose shocks are most damaging. A phased-in credit such as the EITC adds insurance and induces labor-supply responses that can complement, rather than simply crowd out, other forms of insurance. The policy question is therefore not whether transfers or credits are categorically superior, but how the safety net should combine them to support consumption smoothing where it matters most.

The remainder of this chapter is organized as follows. Chapter 2.1 summarizes the incomplete-markets literature. In Chapter 2.2, I briefly describe the U.S. tax-transfer system and lay out structural differences between transfers and tax credits. Chapter 2.3 summarizes model details, and Chapter 2.4 discusses its parameterization, model fit, and consumption insurance in the calibrated model. In Chapter 2.5, I present the

insurance implications of means-tested transfers, phased-in tax credits, and progressive income taxes. Finally, Chapter 2.6 summarizes the main results and their implications.

2.1 Incomplete-Markets Literature

This chapter contributes first to the consumption-insurance literature, with a particular focus on the insurance role of the tax and transfer system. For comprehensive overviews, see Crawley and Theloudis (2024) and Heathcote, Storesletten, and Violante (2009).¹⁵ Empirical work in the 1990s established that household consumption is not perfectly insured against idiosyncratic risk (e.g. Nelson 1994, Hayashi, Altonji, and Kotlikoff 1996, Attanasio and Davis 1996, or Ham and Jacobs 2000) and that households do not rely only on saving and borrowing to smooth consumption (e.g. Dynarski and Gruber 1997). Subsequent work has quantified the extent of partial insurance and the importance of specific smoothing channels using incomplete-markets models with heterogeneous agents.¹⁶

Blundell, Pistaferri, and Preston (2008) provide an important methodological benchmark by estimating how transitory and permanent earnings shocks pass through to consumption. Comparing such empirical estimates with model-implied insurance measures has helped clarify the quantitative role of individual channels. For example, Kaplan and Violante (2010) show that self-insurance through saving and insurance through progressive taxes and transfers cannot by themselves explain the observed degree of insurance against permanent earnings risk. Heathcote, Storesletten, and Violante (2014) emphasize that endogenous labor supply and wage risk, rather than earnings risk alone, are central for measuring insurance.

The closest consumption-insurance benchmark is Wu and Krueger (2021), who show that an incomplete-markets model with two-earner households and endogenous labor supply can replicate the empirical estimates of insurance against transitory and permanent wage risk in Blundell, Pistaferri, and Saporta-Eksten (2016). Both studies empha-

¹⁵While most of the insurance literature, including this work, considers insurance against idiosyncratic risk, Busch et al. (2022) provide a complementary view by investigating insurance provided by the tax and transfer system against aggregate risk. A key point of their paper is that the effectiveness of spousal labor supply as an insurance device is considerably weakened in economic downturns.

¹⁶For instance, Pijoan-Mas (2006) focuses on self-insurance via labor supply, while Attanasio, Low, and Sánchez-Marcos (2005) analyze the role of the family and in particular the extensive labor supply margin of the wife. Krueger and Perri (2011) focus on the role of public insurance and its potential to crowd out private forms of insurance.

size the secondary earner as an insurance margin and show that family labor supply mitigates the insurance role of the tax-transfer system. At the same time, Blundell, Pistaferri, and Saporta-Eksten (2016) emphasize that credits and transfers are especially important for low-income households, suggesting that public insurance is highly heterogeneous across the income distribution. I build on this insight by studying the insurance implications of taxes, transfers, and asset-based means-testing for households with different income levels in a model with actual taxes and transfers.¹⁷

Recent contributions have extended the consumption-insurance framework to limited commitment between spouses (e.g., Denderski and Obermeier 2025 and Bredemeier, Gravert, and Juessen 2026) and to non-Gaussian income risk (e.g. De Nardi, Fella, and Paz-Pardo 2020, Guvenen, Ozkan, and Madera 2024 and Ghosh and Theloudis 2025), both of which I abstract from here. These studies typically approximate the tax-transfer system rather than examining specific program features.¹⁸ The same is true for Cho, Morley, and Singh (2026), who study the relationship between tax-transfer progressivity and consumption insurance against income risk by comparing the United States and Australia.

Second, this chapter contributes to work on the tax-transfer system and its implications for household choices and welfare, especially in two-earner households. Some studies approximate the tax-transfer system (e.g. Kaygusuz 2010 or Holter, Krueger, and Stepanchuk 2019), while more recent work models actual taxes and transfers, including Guner, Kaygusuz, and Ventura (2020), Moore and Pecoraro (2020), Low et al. (2025), and Bronson, Haanwinckel, and Mazzocco (2025). Closely related, Guner, Kaygusuz, and Ventura (2023) analyze the elimination of U.S. transfers and tax credits in an incomplete-markets model and study the welfare effects of replacing the current system with either a negative income tax or a universal basic income.¹⁹ My analysis differs by focusing on consumption insurance and by explicitly examining asset means-testing in transfer programs.

¹⁷Wu and Krueger (2021) use a simplified representation of the tax and transfer system, captured by a Bénabou (2000)-style tax function, with two parameters determining the level and the progressivity of effective taxation.

¹⁸One exception is a recent working paper by Athreya et al. (2023) who compare the labor supply incentives of the EITC and the CTC for single mothers without a college degree, explicitly modeling both programs in detail. Within their study, they investigate the effect of the two credits on the volatility of consumption, as measured by the coefficient of variation. While they find only small effects overall, they abstract from a deeper look at individual channels.

¹⁹They exactly model tax credits, while approximating income taxes and transfers.

Ortigueira and Siassi (2022) is also closely related. Their focus is not primarily the insurance provided by the tax-transfer system, but rather how the system affects household decisions that determine self-insurance, including saving, labor supply, and household formation. Their model shows how detailed tax-transfer rules distort marriage or cohabitation decisions among low-income single mothers. Their findings also illustrate why modeling the tax-transfer system in detail matters: asset limits in TANF and SNAP have strong effects on household saving decisions.

Finally, Wellschmied (2021) studies asset means-testing in transfer programs and its implications for saving and employment. He uses a structural life-cycle model in which household size varies by age and households face productivity, health, and employment risk. As in this chapter, he considers a counterfactual that removes asset tests from multiple transfer programs.²⁰ Although his focus is not consumption insurance, his results are directly informative: asset tests can keep some households in what he calls a *poverty trap*, so that households that become eligible for transfers remain persistently poor. For these households, eliminating asset tests increases hours and assets, indicating stronger self-insurance. The key distinction is that I allow both spouses' labor supply to respond endogenously, whereas Wellschmied (2021) assumes exogenous labor supply. The model can therefore capture interactions between the transfer floor, secondary-earner hours, and the timing of buffer-stock accumulation over the life cycle. This extension is central for interpreting the insurance effects of asset tests emphasized by Wellschmied (2021).

2.2 The Tax-Transfer System in the U.S.

The U.S. tax-transfer system combines federal income taxation, means-tested transfer programs, and tax credits. Chapter 2.2.1 summarizes these components. Throughout, I focus on tax year 2019, the final year before the Covid-19 recession. Appendix A.1 provides formal details and describes how each component enters the quantitative model.²¹

²⁰Next to SNAP and TANF, he also considers other asset means-tested programs such as Medicaid, the Supplemental Security Income (SSI), or the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). Such programs require a deeper modeling of health, which would also be interesting with respect to insurance, but goes beyond the scope of this work.

²¹Recent accounts of the U.S. tax-transfer system can be found in Bakija (2024), Guner, Rauh, and Ventura (2026), or Ortigueira and Siassi (2022). Bick et al. (2019) provide tax functions in MATLAB based on the OECD Taxing Wages modules. Moffitt (2016) presents details on the U.S. transfer

Chapter 2.2.2 then highlights the structural differences between tax credits and transfer payments.

2.2.1 Components of the Tax-Transfer System

Statutory federal income taxes. In tax year 2019, the federal income tax schedule had seven brackets, with marginal tax rates rising from 10% to 37%. Statutory federal income taxes are levied on taxable income, defined as total gross income net of allowances.²² Payroll taxes, formally Federal Insurance Contribution Act (FICA) taxes, finance Social Security and Medicare.

Transfer programs. TANF is a state-run welfare program for households with children that provides a guaranteed benefit floor. To qualify, households must meet state-specific income and resource tests and satisfy work or job-search requirements. In addition, states impose time limits on benefit receipt. I follow Ortigueira and Siassi (2022) and apply TANF rules for Delaware. Delaware raised the TANF asset limit from \$1,000 to \$10,000 in 2010, making it substantially higher than in many other states, where limits typically range from \$1,000 to \$3,000. A few states, such as Alabama, Ohio, and Virginia, have eliminated the TANF asset test entirely.

SNAP, formerly known as Food Stamps, helps low-income households purchase food. To qualify, households must pass a resource test, a gross income test, and a net income test. The federal resource limit for households without an elderly member was \$2,250 in 2019. However, states that use BBCE can set less restrictive asset rules. For instance, Delaware has eliminated the asset test for SNAP. In the baseline version of the model, I assume strict asset tests in transfer programs.

Tax credits. Tax credits reduce tax liabilities and, when refundable, can generate net payments to households. To be eligible for the fully refundable EITC, households must work, meet the age restriction, and pass income tests on investment income and gross income. The credit amount depends on the number of children in the household and

system, including a history of the programs and a literature overview of the implications for working incentives, inequality, and welfare.

²²I focus on the standard deduction and abstract from itemized deductions, as almost 90% of households claimed the standard deduction in 2018; see Gale, Hoopes, and Pomerleau (2024). In tax year 2019, the standard deduction was \$K 24.4.

features a phase-in, a plateau, and a phase-out. The CTC is a partly refundable tax credit with a maximum credit amount of \$2,000 per child.²³ The credit phases down once gross income exceeds \$K 400.

2.2.2 Structural Differences Between Credits and Transfers

This chapter illustrates the structural differences between tax credits and transfer payments for a married couple with two children. Panel (a) of Figure 2.1 illustrates benefits from transfer payments (red line) and tax credits (black line). Assuming a household passes the strict asset tests in transfers, it can receive substantial support through these programs. For instance, a married couple with two children and no earnings may receive roughly \$13,000 in transfer payments (\$8,000 in SNAP benefits and \$5,000 in TANF payments). These benefits remain at a fixed plateau for households with very low incomes and gradually phase out as earnings increase. Once household income reaches around \$32,000, eligibility for transfer payments ends.

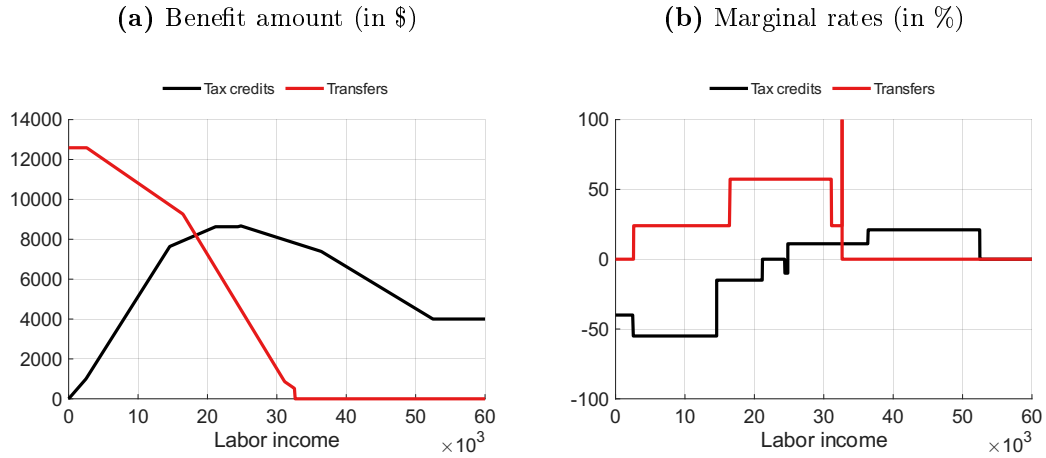
In contrast, tax credits provide no benefits to households without earnings but phase in as income rises. At their maximum, the EITC offers about \$6,000 to couples with two children, while the maximum CTC is \$4,000. These maximum credit amounts are therefore available only to households with sufficient earnings. Credits are phased out at higher income levels, around \$K 50 for the EITC and around \$K 480 for the CTC.

Panel (b) displays the corresponding effective marginal rates, following Maag et al. (2012). The combined phase-out of SNAP and TANF implies effective marginal rates of 57%. Households that qualify for transfer benefits therefore face steep phase-out rates that strongly reduce the return to labor income between \$K 15 and \$K 35. Tax credits, on the other hand, generate negative marginal tax rates for households earning less than \$K 25. These negative rates can be as large as -50% during the EITC and CTC phase-in periods. Once these credits no longer phase in and once the EITC begins to phase out, marginal rates rise sharply, implying moderate positive marginal rates of about 20%, when transfers are already phased out.²⁴

²³The refundable part is called the Additional Child Tax Credit (ACTC). The refundable amount equals 15% of earned income exceeding the minimum earnings threshold of \$2,500 but cannot exceed \$1,400 per child.

²⁴I do not illustrate the phase-out of the CTC here, which starts when earnings exceed \$K 400 with a relatively moderate phase-out rate of 5%; see Figure A.2 in the Appendix for a full picture.

Figure 2.1. Structural differences between tax credits and transfers



Notes: The figure compares tax credits and transfers by labor income for a married couple with two children. Panel (a) presents the benefit amount of each program and panel (b) effective marginal rates. Transfers include SNAP and TANF. Tax credits include the EITC, the CTC, and the ACTC. For the illustration, I assume that the household passes the asset tests of SNAP and TANF, as well as the investment income test of the EITC.

Importantly, Figure 2.1 presents marginal rates assuming that two children live in the household. For households without children, marginal rates are more moderate, as only the EITC and SNAP are available. Additionally, Figure 2.1 assumes that the household qualifies for the relevant programs. Because transfers are asset-tested, a modest \$K 10 increase in assets can substantially reduce marginal rates for low-income households that no longer qualify for transfer payments. Effective marginal rates become even more moderate when investment income exceeds the EITC limit of \$3,600 (corresponding to asset holdings of \$K 180 under a risk-free real interest rate of 2%), because only statutory marginal tax rates, payroll taxes, and CTC phase-in or phase-out rates remain.

2.3 Model

The model is a partial-equilibrium, incomplete-markets, life-cycle model of married couples with a detailed representation of U.S. tax credits and transfer payments. Capital markets are incomplete, so households cannot perfectly insure against idiosyncratic risk. The tax-transfer system absorbs part of wage risk and interacts with private self-insurance through precautionary saving and spouses' labor-supply choices.

Demographics. Married couples consist of one male and one female spouse, with gender denoted by $g \in \{m, f\}$. Spouses are the same age and remain married throughout the life cycle. The model period is denoted by t , $t \in \{1, \dots, T\}$. The life cycle is split into a working stage from period 1 to $R - 1$ and a retirement stage from period R to T .

Education. Following Guner, Kaygusuz, and Ventura (2020), households differ by five exogenous and time-invariant education types, determined by the husband's highest educational attainment, j : left high school without a degree (some high school, $j = 1$), completed high school but did not attend college (high school, $j = 2$), attended college without completing a degree (some college, $j = 3$), completed an associate's or bachelor's degree (college, $j = 4$), and completed a master or a professional or doctorate degree (college+, $j = 5$).

Children. Households enter the model childless and can have up to three children. The number of children, k , follows a first-order Markov process whose transition probabilities depend on age, education, and the number of children in the previous period. Retired couples have no children living in the household.

Preferences. The household's period felicity function is:

$$u_j(c_t, n_{mt}, n_{ft}) = \frac{c_t^{1-\sigma}}{1-\sigma} - \psi_{m,j} \cdot \frac{n_{mt}^{1+1/\eta_m}}{1+1/\eta_m} - \psi_{f,j} \cdot \frac{n_{ft}^{1+1/\eta_f}}{1+1/\eta_f} - \mathbf{1}(n_{ft} > 0) f_j,$$

where c_t is household-public consumption, n_{mt} and n_{ft} are spouses' labor supplies, and $\mathbf{1}(n_{ft} > 0)$ indicates whether the wife participates in the labor market.²⁵ During retirement, spouses no longer work and derive utility only from joint consumption. Households discount future utility with factor β .

Asset markets. Households have access to a non-state-contingent asset, a_t , with the risk-free interest rate r . Their income from capital investment is

$$i_t = ra_t, \tag{2.1}$$

²⁵I allow for the extensive labor supply margin of the wife, as a considerable share of married women do not participate in the labor market, as shown below in Chapter 2.4.

where borrowing is limited by $\underline{a}_{j,t}$, which depends on education and age. Households enter and leave the model without wealth.

Wages and labor income. During working age, market work by spouse g is paid the wage rate w_{gt} , measured in units of the consumption good, which is the numéraire. Individual log wages consist of three components: a transitory component, ε_{gt} , a permanent component, z_{gt} , and a deterministic life-cycle component, ℓ_{gt} . The permanent component follows a unit-root process. The wage rate in logs is given by:

$$\begin{aligned}\ln w_{gt} &= \ell_{gt} + z_{gt} + \varepsilon_{gt} \\ z_{gt} &= z_{gt-1} + \nu_{gt}\end{aligned}$$

The shocks $x \in \{\nu, \varepsilon\}$ are i.i.d. with mean zero. Shocks may be correlated across spouses, but are assumed to be independent of each other and over time. Their variances and covariances depend on the household's education type:

$$\begin{bmatrix} x_{mt} \\ x_{ft} \end{bmatrix} \sim \text{i.i.d. } N \left(0, \begin{bmatrix} \sigma_{x_{mj}}^2 & \sigma_{x_{mj}, x_{fj}} \\ \sigma_{x_{mj}, x_{fj}} & \sigma_{x_{fj}}^2 \end{bmatrix} \right)$$

Given wage rates, household labor income, e_t , in period t is

$$e_t = w_{mt}n_{mt} + w_{ft}n_{ft}. \quad (2.2)$$

Pensions. During retirement, households receive pension income that depends on each spouse's permanent wage component and life-cycle wage component in the last period before retirement, $b(z_{mR-1}, z_{fR-1}, \ell_{mR-1}, \ell_{fR-1})$.²⁶

Tax liabilities and transfer payments. Households are subject to income taxation and transfer payments during working and retirement age.²⁷ Following the institutional description in Chapter 2.2, I model statutory federal income taxes, payroll taxes, tax credits, and transfers.²⁸ Payroll taxes, $T^p(e_t)$, depend on earnings. Income tax lia-

²⁶See Equation (A.9) in Appendix A.1 for the exact formula and further details.

²⁷In the model, retired couples cannot be eligible for CTC, ACTC, or TANF (as I assume that no children live in their household), nor for the EITC (due to age and working restrictions).

²⁸The exact definitions can be found in Appendix A.1. Income tax liabilities are defined in Equation (A.1), payroll taxes in (A.2), the EITC in (A.3), the CTC in (A.4), and transfers in (A.8).

bilities, $T(e_t, i_t, b_t)$, depend on labor income, income from short-term capital investments, and pensions. Households may receive phased-in tax credits, i.e., the EITC, $Cr^{eitc}(e_t, i_t, k_t)$, and the CTC, $Cr^{ctc}(e_t, i_t, k_t)$. Both credits depend on earnings, income from short-term capital investments, and the number of children. Means-tested transfers, $Tr(e_t, i_t, b_t, a_t, k_t, n_{ft})$, consist of SNAP and TANF benefits and depend on labor and investment income, pensions, assets, the wife's labor-supply decision, and the number of children.²⁹ Post-government income, y_t^{post} , is given by

$$y_t^{post} = e_t + i_t + b_t - T^p(e_t) - [T(e_t, i_t, b_t) - Cr^{eitc}(e_t, i_t, k_t) - Cr^{ctc}(e_t, i_t, k_t)] \\ + Tr(e_t, i_t, b_t, a_t, k_t, n_{ft}).$$

Household maximization problems. During working age, the household state vector is $\Omega = (z_m, z_f, \varepsilon_m, \varepsilon_f, a, k)$ and the maximization problem is

$$V_j(\Omega, t) = \max_{c, n_m, n_f, a'} u_j(c, n_m, n_f) + \beta \cdot \mathbb{E}[V_j(\Omega', t+1)]$$

subject to

$$\begin{aligned} c + a' &= y_t^{post} + a, \\ y_t^{post} &= e + i + b - T^p(\cdot) - [T(\cdot) - Cr^{eitc}(\cdot) - Cr^{ctc}(\cdot)] + Tr(\cdot), \\ e &= w_m n_m + w_f n_f, \\ i &= r \cdot a, \\ b &= 0, \\ a' &\geq \underline{a'}, \text{ and} \\ c &\geq Tr^{snap}(e, i, b, a, k) \end{aligned}$$

where the last restriction ensures that SNAP benefits are used for consumption.

²⁹TANF benefits in Delaware depend on the number of workers in the household. In the model, the wife is the only household member with a participation decision. Therefore, transfer payments in the model depend on the wife's labor supply decision; see Appendix A.1 for details.

During retirement, the state vector becomes $\Omega^R = (z_{mR-1}, z_{fR-1}, a)$ and the household chooses (c, a') . The constraints for labor income, retirement benefits, and children become

$$\begin{aligned} e &= 0, \\ b &= b(z_{mR-1}, z_{fR-1}, \ell_{mR-1}, \ell_{fR-1}), \\ k &= 0. \end{aligned}$$

All other constraints remain the same as in the working period.

2.4 Parameterization and Quantitative Results of the Calibrated Model

The parameterization combines externally set, estimated, and internally calibrated parameters. The number of model periods, T , is 60. The initial period, $t = 1$, corresponds to age 21, so agents die with certainty at age 80. They retire at age 66, corresponding to model period $R = 46$.

2.4.1 Government

Taxes. I take statutory tax-code parameters, allowances, tax credits, and payroll taxes for tax year 2019 from the OECD (2020), cross-checking the inputs with data from the Internal Revenue Service (IRS) and the Social Security Administration (SSA). Appendix A.1 reports the data and formulas in detail.

Transfers. I take SNAP parameters from the Food and Nutrition Service (2018). I follow Ortigueira and Siassi (2022) and take TANF parameters from Delaware, which are provided by the Urban Institute (2020) in the Welfare Rules Database; see Appendix A.1 for details. Again, I focus on rules for 2019.

Pensions. I determine pensions using the Primary Insurance Amount (PIA) formula published by the U.S. Social Security Administration (2026). I scale counted earnings with parameter s , calibrated to match the average replacement rate of 27.9% computed from CPS data; see the last line of Table 2.1. To compute the replacement rate, I follow

Table 2.1. Overview of model parameters

Parameter	Symbol	Education group					Source
(Share in %)	j	1 (5.2)	2 (21.5)	3 (12.7)	4 (40.4)	5 (20.3)	
Stochastic wage component							estimated
Permanent shock							
Variance, men	$\text{var}(\nu_{m,j})$	.059	.030	.040	.031	.029	
Variance, women	$\text{var}(\nu_{f,j})$	.037	.025	.032	.047	.053	
Covariance	$\text{cov}(\nu_{m,j}, \nu_{f,j})$	.020	.006	-.004	.001	.002	
Transitory shock							
Variance, men	$\text{var}(\varepsilon_{m,j})$	.000	.017	.028	.011	.008	
Variance, women	$\text{var}(\varepsilon_{f,1})$	.018	.003	.012	.008	.011	
Covariance	$\text{cov}(\varepsilon_{m,j}, \varepsilon_{f,j})$	.000	.001	.015	.002	.008	
Intertemporal substitutability							BPS (2016)
Relative risk aversion	σ			1.730			
Frisch elasticity, men	η_m			0.528			
Frisch elasticity women	η_f			0.850			
Asset markets							
Interest rate	r			0.020			WK (2021)
Borrowing limit	$\underline{a}_j$	-0.034	-0.054	-0.063	-0.084	-0.115	KV (2014)
Preferences							calibrated
Labor disutility, men	ψ_{mj}	6.043	4.259	4.061	3.024	1.858	
Labor disutility, women	ψ_{fj}	6.155	3.199	3.330	1.445	0.941	
Utility loss LFP, women	f_j	0.336	0.161	0.083	0.050	0.048	
Discount factor	β			0.974			
Pensions							calibrated
Scaling parameter	s			0.675			

Wu and Krueger (2021) and divide average Social Security benefits observed in CPS waves 2000 to 2022 by average earnings.³⁰ I also account for the taxable portion of pensions following the Internal Revenue Service (2019); see Appendix A.1 for details.

2.4.2 Stochastic Processes

Children. During working age, children enter and leave households stochastically according to a finite first-order Markov process with states $\{K = 0, 1, 2, 3\}$, implying that couples can have up to three children. The transition probabilities, $\pi(t, j, k)$, depend on age, education, and the number of children in the previous period. By assumption, all

³⁰The CPS sample consists of married couples with up to three children in which the husband is of working age. I apply conventional outlier restrictions; see Appendix A.2 for details. For earnings, I use data on real labor income. For Social Security benefits, I use data for a sample of couples in which both spouses are at least 65 years old. To account for Medicare benefits in addition to Social Security benefits, I follow Wu and Krueger (2021) and scale observed Social Security benefits by 7.65% / 6.2%.

couples start out childless at age 21. I calibrate the transition probabilities such that, for each education-age combination between ages 30 and 65, the share of couples with a particular number of children matches the observed share in CPS data. All children leave the household with certainty when households reach retirement age. To determine these probabilities, I extend the CPS sample described in Appendix A.2 to include husbands aged 58 to 65 and use pooled data for 2000–2022. Details on the calibration are provided in Appendix A.2.

Wage process. I estimate the variances and covariances of the stochastic wage component using data from the Panel Study of Income Dynamics (PSID) and the estimation approach proposed by Blundell, Pistaferri, and Saporta-Eksten (2016).³¹ I use PSID waves from 1999 to 2019, applying a sample selection similar to that for the CPS.³² I estimate variances and covariances separately by household education type. The first part of Table 2.1 reports the results. Wage shocks are on average positively correlated between spouses, except for the *Some College* education group ($j = 3$). The variance of wage shocks is not monotone in education. For highly educated households, however, both transitory and permanent shock variances tend to be higher for women than for men, whereas the opposite pattern holds for less-educated households.

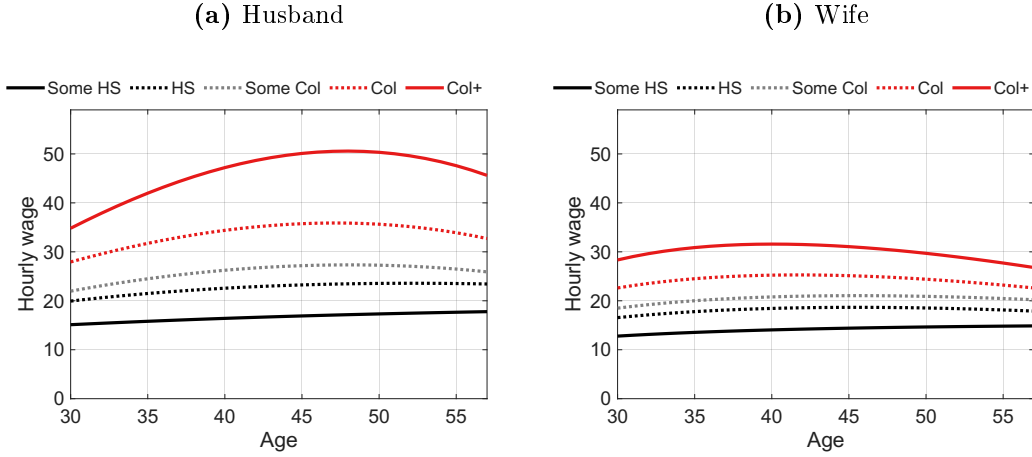
To determine the (deterministic) life-cycle wage component, I follow Rupert and Zanella (2015) and estimate hourly wages for wives and husbands over the life cycle using a second-order fractional polynomial. I employ the CPS sample with pooled survey years from 2000 to 2022. Nominal values are adjusted to 2019 dollars. I follow Rupert and Zanella (2015) in the calculation of annual hours and hourly wages.³³ Figure 2.2 displays the wage profiles of wife and husband and Table A.6 in the Appendix presents the estimated parameters.

³¹Their idea is to first regress wage growth on demographic information, considering the residuals of the regression as the sum of a transitory and a permanent wage shock and measurement errors, and, second, to estimate the variance-covariance matrix of the wage processes of spouses using the generalized-method-of-moments (GMM) approach.

³²I focus on married couples in which the household head is the husband, aged 30 to 57 and participating in the labor market. I exclude outliers with extremely high assets, households from the Survey of Economic Opportunity (SEO), and households with missing values for age, state, and education.

³³Annual hours are defined as hours worked per week multiplied by weeks worked per year. Hourly wages are defined as labor income divided by annual hours worked. I exclude households in which either spouse has an hourly wage above \$1,000.

Figure 2.2. Wage profiles by education group of the husband



Notes: This figure shows the deterministic life-cycle wage component used in the model. I follow Rupert and Zanella (2015) and estimate the hourly wage of wife and husband over the life cycle using a second-order fractional polynomial. The estimated powers are chosen from discrete choice sets.

2.4.3 Asset Markets and Preferences

Asset markets. The risk-free real interest rate, r , is set to 2%. Following Kaplan and Violante (2014), I set the education-specific borrowing limit in the first model period so that the average discounted borrowing limit for households aged 30–57 matches the median ratio of reported credit limits to labor income, equal to 12.5%.³⁴ The resulting limits are reported in Table 2.1. Borrowing limits in subsequent periods evolve according to:

$$\underline{a}_{t+1,j} = (1 + r) \cdot \underline{a}_{t,j}.$$

Preferences. As in Wu and Krueger (2021), I use the estimates from Blundell, Pistaferri, and Saporta-Eksten (2016) and set the coefficient of relative risk aversion to $\sigma = 1.730$, the Frisch labor-supply elasticity of men to $\eta_m = 0.528$, and the Frisch elasticity of women to $\eta_f = 0.85$.

I calibrate the male disutility weight of labor for education type j , $\psi_{m,j}$, to match the average household labor income of married couples in that education group. I set the

³⁴I use data from the 2019 Survey of Consumer Finances (SCF) and apply sample restrictions similar to those used for the CPS. Following Kaplan and Violante (2010), I additionally exclude the 5% of households with the highest wealth to ensure consistency with the PSID. All calculations use the SCF sampling weights.

Table 2.2. Empirical targets matched

Moment	Target	Model
Average household labor income		
Some HS	0.435	0.433
HS	0.685	0.685
Some Col	0.806	0.805
Col	1.069	1.070
Col+	1.461	1.461
Female-male ratio of average labor conditional on working		
Some HS	0.878	0.876
HS	0.878	0.878
Some Col	0.864	0.863
Col	0.876	0.877
Col+	0.855	0.855
Average female non-participation rate		
Some HS	0.437	0.437
HS	0.239	0.239
Some Col	0.215	0.216
Col	0.182	0.182
Col+	0.216	0.216
Average net worth-to-income ratio	2.810	2.810
Average replacement rate, age 65+	0.279	0.279
Mean labor income	1	0.999

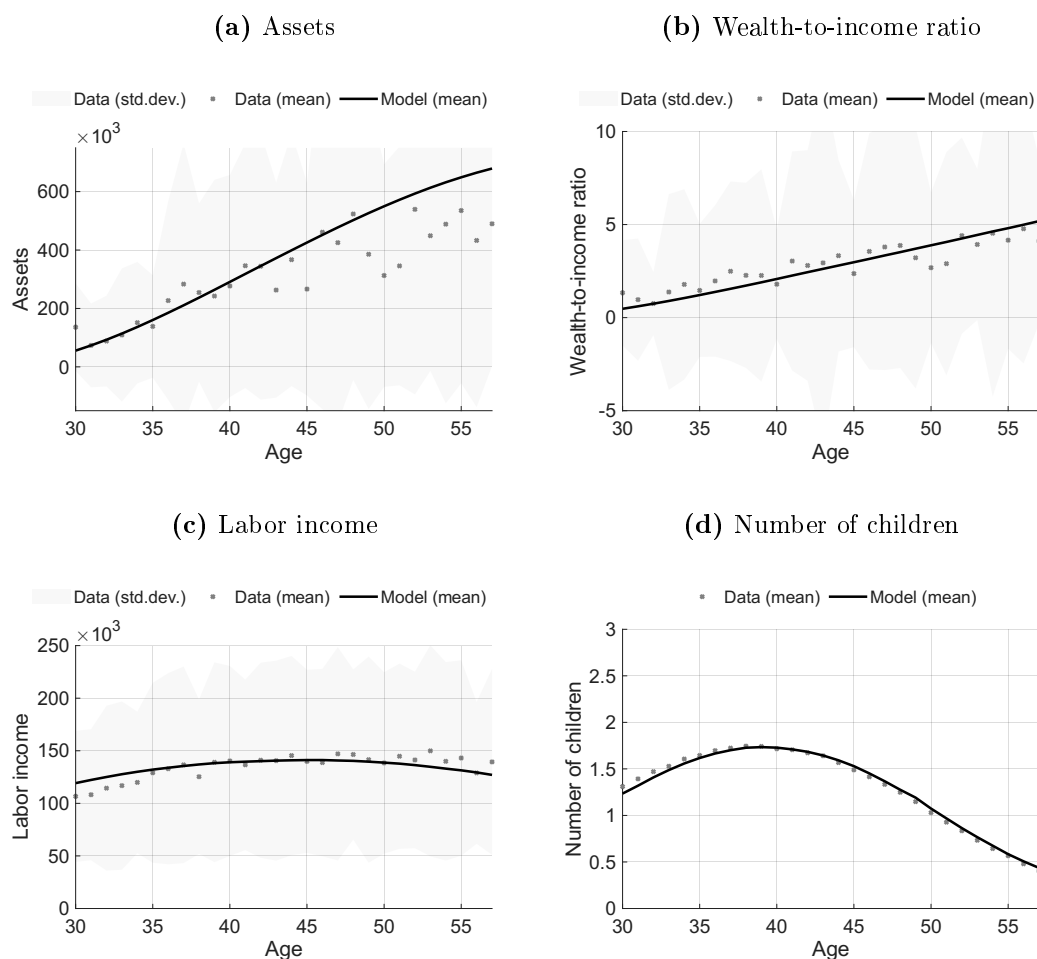
female disutility weight of labor, $\psi_{f,j}$, to match the female-to-male ratio of average labor supply conditional on working as observed in the CPS. This ratio is relatively stable across the husband's education groups. I determine the fixed utility cost of female participation, f_j , to match the average female non-participation rate among married couples of education type j in the CPS. Female non-participation is highest among high school dropouts.³⁵ The discount factor, β , is calibrated to match the ratio of average net worth to labor income among married couples in the SCF sample of husbands aged 30–57. The targeted value is 2.810. Table 2.1 summarizes all parameter values.

2.4.4 Empirical Fit

Column 1 of Table 2.2 reports the empirical targets, and Column 2 reports their counterparts in the calibrated model. The model matches the empirical targets closely. It also reproduces the untargeted increase in assets over the life cycle observed in the

³⁵Spouses choose labor supply from discrete choice sets. I set the options of the husband to $n_m \in \{n_{mi}/x : n_{mi} = 30, 40, 50, 60\}$ and the ones of the wife to $n_f \in \{n_{fi}/x : n_{fi} = 0, 20, 30, 40, 50\}$. The parameter x is calibrated and assures that overall household labor income in the model matches the empirical target of \$134,573, which corresponds to one unit in the model. The resulting value of x is 90.33.

Figure 2.3. Life-cycle profiles in data and model



Notes: The figure compares life-cycle profiles in the data (dots) for the sample described in Appendix A.2 to those generated by the model (solid line). Data on assets and the wealth-to-income ratio are taken from the SCF. Data on labor income and children are taken from the CPS. Shaded areas mark the standard deviation of mean values observed in the data.

SCF data (see Figure 2.3a). The same holds for the wealth-to-income ratio (see Figure 2.3b). As expected, assets are particularly low at younger ages, which likely increases the relevance of transfers and credits for households at the beginning of their working life. Figure 2.3c compares labor income over the life cycle in the model with CPS data. At younger ages, labor income in the model is slightly higher than in the data, whereas at older ages the opposite holds. Overall, the life-cycle profile aligns well with the

Table 2.3. Tax credits and transfers in model and data

	Share (%)			Mean \$K 2019, if eligible		
	Reported in data	Calculated from data	Model	Reported in data	Calculated from data	Model
EITC	9.3	9.4	8.9	2.9	3.0	3.4
CTC	73.0	73.2	71.2	3.5	3.7	3.5
TANF	0.3	2.8	2.7	4.6	2.6	3.9
SNAP	2.4	4.1	2.9	2.8	2.6	3.9

Notes: The table compares model-implied values to the data. *Reported in data* refers to mean values and shares based on direct CPS entries. *Calculated from data* refers to mean values and shares based on own tax-transfer calculations given CPS data on household characteristics. Details on the sample can be found in Appendix A.2. The model results refer to households aged 30 to 57 using the same tax-transfer code as used in the data.

data, despite not being explicitly targeted.³⁶ For completeness, Figure 2.3d presents the average number of children in the model and in the CPS data.³⁷

Because the analysis studies the insurance implications of credits and transfers, the model should accurately replicate the tax-transfer elements that affect married couples. Table 2.3 compares model-implied statistics with the data: the share of households receiving tax credits or transfer payments (left panel) and mean amounts among eligible households (right panel). The values from the data refer to the CPS sample described in Appendix A.2.³⁸ The first columns in both panels present data based on CPS entries. These reported shares likely underestimate the true number of households receiving transfers, because transfer payments are known to be underreported in CPS data; see Fox, Rothbaum, and Shantz (2022) and Meyer, Mok, and Sullivan (2015). I also calculate the corresponding shares and mean values from household characteristics in the data using the same tax-transfer code as in the model (shown in the second columns of

³⁶In Figure A.4 in the Appendix, I additionally present life-cycle profiles by the husband's education group. Saving is broadly U-shaped across all groups, with the highly educated saving the most. High school dropouts have notably lower labor force participation than other groups; their participation rises with age, in contrast to declining participation in all other groups.

³⁷The close fit between model and data is expected, since I estimate the transition probabilities such that the child distribution by age and education type matches the data.

³⁸Note that the numbers reported here refer to the household level, not the individual level. Also note that the sample only consists of married households in which husbands work and are aged 30 to 57. This subgroup of the population is less likely to receive transfer payments compared to other groups such as single parents or the elderly; see also Guner, Rauh, and Ventura (2026).

both panels). These calculated values also have limitations, so actual shares likely lie between the reported and calculated values.³⁹

As expected, the calculated share of households receiving transfers exceeds the reported share, with model-implied shares lying between the two.⁴⁰ At the same time, the calculated mean values of transfers are lower than the reported mean values, as they include more households with smaller transfers, with model-implied values broadly matching the empirical targets. The model also matches the share of households receiving tax credits and the mean credit amount when eligible. Overall, the model closely matches the empirical moments, even though these moments are not directly targeted.

2.4.5 Consumption Insurance in the Calibrated Model

I now quantify consumption insurance in the baseline model, which includes all tax-transfer components and strict asset tests. I first describe how insurance is estimated and decomposed into individual channels.

Throughout, I focus on consumption insurance against shocks to the husband's permanent wage, ν_{mt} . Following Wu and Krueger (2021), I use OLS regressions to estimate the percentage of wage shocks that pass through to consumption:

$$\Delta c_t = \kappa_{c_t, \varepsilon_{mt}} \cdot \Delta \varepsilon_{mt} + \kappa_{c_t, \varepsilon_{ft}} \cdot \Delta \varepsilon_{ft} + \kappa_{c_t, \nu_{mt}} \cdot \nu_{mt} + \kappa_{c_t, \nu_{ft}} \cdot \nu_{ft}, \quad (2.3)$$

where $\kappa_{c_t, \nu_{mt}}$ is the transmission coefficient of interest. I obtain the unexpected component of consumption growth, Δc_t , by regressing log consumption on age dummies and differencing the residuals. Overall consumption insurance against wage risk is measured as one minus the corresponding transmission coefficient, $\phi_{c_t, \nu_{mt}} = 1 - \kappa_{c_t, \nu_{mt}}$.

A similar approach decomposes consumption insurance into the roles of spouses' labor-supply adjustments, de-saving, and insurance provided by the tax-transfer system. Similar to Equation (2.3), I estimate the percentage of the permanent wage shock to the husband that is transmitted to male labor income, $\kappa_{e_{mt}, \nu_{mt}}$, household labor in-

³⁹Even the calculated values may underestimate the true shares, as they are based on yearly rather than monthly earnings data. On the other hand, they may overestimate the true shares, as I cannot infer any asset test due to the lack of wealth data in the CPS. Moreover, the calculated shares likely overestimate the share of households receiving TANF due to high non-take-up rates; see Moffitt, Buttenheim, and Beatty (2023). Finally, note that TANF rules are state-specific, while I consider the TANF implementation of Delaware.

⁴⁰The difference between reported and calculated values for tax credits is quite small.

Table 2.4. Decomposing consumption insurance as in Wu and Krueger (2021)

Male permanent wage shock, ν_{mt}		
↓	} Insured by male	$\phi_m = 1 - \kappa_{e_{mt}}$
Male labor income, e_{mt}		
↓	} Insured by female	$\phi_f = \kappa_{e_{mt}} - \kappa_{e_t}$
Household labor income, e_t		
↓	} Insured by asset income	$\phi_i = \kappa_{e_t} - \kappa_{y_t}$
Household total income, y_t		
↓	} Insured by public policy	$\phi_p = \kappa_{y_t} - \kappa_{y_t^{post}}$
Post-government income, y_t^{post}		
↓	} Insured by (de)saving	$\phi_s = \kappa_{y_t^{post}} - \kappa_{c_t}$
Household consumption, c_t		
Total consumption insurance, ϕ_{c_t} : $\sum = 1 - \kappa_{c_t}$		

come, $\kappa_{e_t, \nu_{mt}}$, total household income, $\kappa_{y_t, \nu_{mt}}$, and post-government income, $\kappa_{y_t^{post}, \nu_{mt}}$. The difference between two transmission coefficients identifies the role of the respective channel.⁴¹ Table 2.4 (closely following Wu and Krueger 2021) summarizes the decomposition approach.

Panel (a) of Figure 2.4 shows life-cycle consumption insurance in the baseline model for the average household.⁴² Panel (b) shows the results for the *Some HS* group. This group makes the most intensive use of transfers and the EITC and therefore provides the clearest perspective on the insurance role of the tax-transfer system.

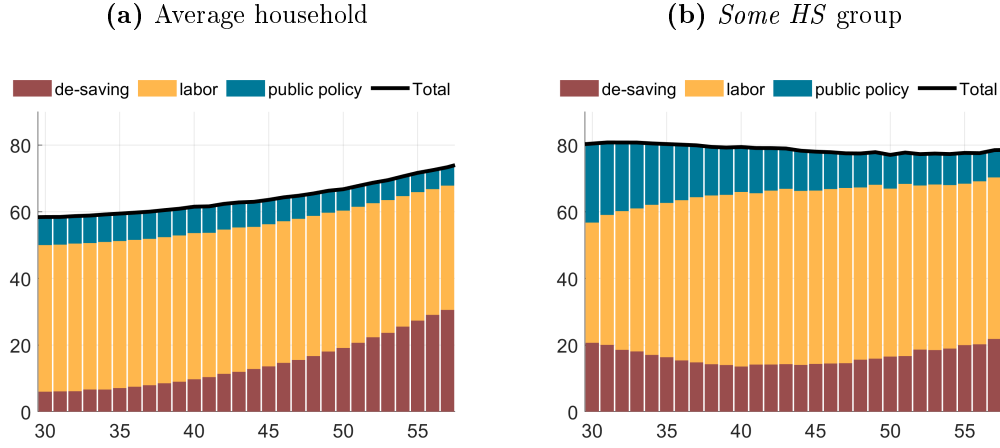
For the average household at age 30, about 58% of a permanent shock to the husband's wage is insured and does not pass through to consumption. Consistent with other studies, insurance rises over the life cycle, reaching 73% at age 57.⁴³ In line with Wu and Krueger (2021), this increase is driven by self-insurance through de-saving, which becomes a more important insurance channel as individuals grow older. Labor-supply adjustments by wife and husband together yield the largest contribution to insurance for the average household, amounting to about 40–45%. This contribution is driven by the presence of a secondary earner in the household. The husband, by contrast,

⁴¹For instance, I estimate the percentage of the shock transmitted to male labor income and the percentage transmitted to household labor income. The difference between these two pass-through values represents the fraction of the shock that is insured by the wife.

⁴²Households with higher levels of education tend to behave similarly to the average as shown in Figure A.5 in the Appendix.

⁴³For comparison, Wu and Krueger (2021) evaluate consumption insurance against male permanent wage shocks and find values of about 60% at age 30 and 75% at age 57.

Figure 2.4. Insurance in the baseline model



Notes: The figure shows total insurance (black line, measured in percent) and the decomposition of total insurance as described in Chapter 2.4.5. Panel (a) presents results over all education groups, while panel (b) concentrates on the *Some HS* group. The blue bars show the contribution of the tax-transfer system, $\phi_{p_{jt}}$. The orange bars show the role of husband and wife in providing insurance, i.e. $\phi_{m_{jt}} + \phi_{f_{jt}}$. The red bars refer to the role of de-saving, $\phi_{s_{jt}} + \phi_{i_{jt}}$.

reduces hours in response to negative wage shocks, thereby *increasing* consumption fluctuations.⁴⁴ The tax-transfer system provides additional insurance of about eight percentage points, which slightly decreases over the life cycle.

Compared to the average household, and as expected, the tax-transfer system is a considerably more important channel of insurance in the *Some HS* group, particularly early in working life; see panel (b) in Figure 2.4. At age 30, the tax-transfer system insures about 24% of the shock, which is three times as much as for the average household. At age 57, the fraction remains sizable at about 8% of the shock. Again, the presence of a secondary earner in the household is the most important driver of insurance. At age 30, wife and husband together insure about 36% of a shock to the husband's wage. Interestingly, insurance via de-saving is slightly U-shaped over the life cycle and does not show the typical rise observed for the average household. As a result, total insurance in the *Some HS* group is fairly constant and does not increase over the life cycle as observed for the average household.

Total consumption insurance in the *Some HS* group exceeds that of the average household, especially at younger working ages, because public policy insures low-income

⁴⁴Figure A.6 in the Appendix decomposes the labor supply channel into contributions by wife and husband, confirming this finding. Insurance via the female is further decomposed into a composition effect and the intensive and extensive labor-supply margin, following Wu and Krueger (2021).

households more strongly. Means-tested programs also encourage households to de-save in bad states, generating additional insurance at young ages. The next chapter examines this mechanism in more detail.

2.5 Policy Experiments

This chapter analyzes the insurance effects of public policy in the United States. Chapter 2.5.1 quantifies the role of individual tax-transfer components. Chapter 2.5.2 studies interactions with other private and public insurance mechanisms. Chapter 2.5.3 examines two specific design features: asset means-testing in transfers and the EITC phase-in. Finally, Chapter 2.5.4 asks whether abolishing transfers or credits while expanding the other program yields more insurance than the existing U.S. system.

2.5.1 Insurance Contributions of Individual Public Policies

To quantify the insurance role of individual public policies, I distinguish the *mechanical insurance contribution*, which reflects the direct effect of a policy holding behavior fixed, from the *net insurance contribution*, which also includes the interactions with other channels triggered by that policy. To this end, I consider three main policy experiments. First, I remove means-tested transfers, i.e. SNAP and TANF, from the system.⁴⁵ In a second counterfactual, I abolish the EITC. Third, I remove progressivity from the remaining tax elements: I remove the CTC and payroll taxes and replace progressive income taxes with a flat rate of 10%.⁴⁶ As an additional experiment, I remove progressivity from the entire system, retaining only a flat federal income tax of 10%.

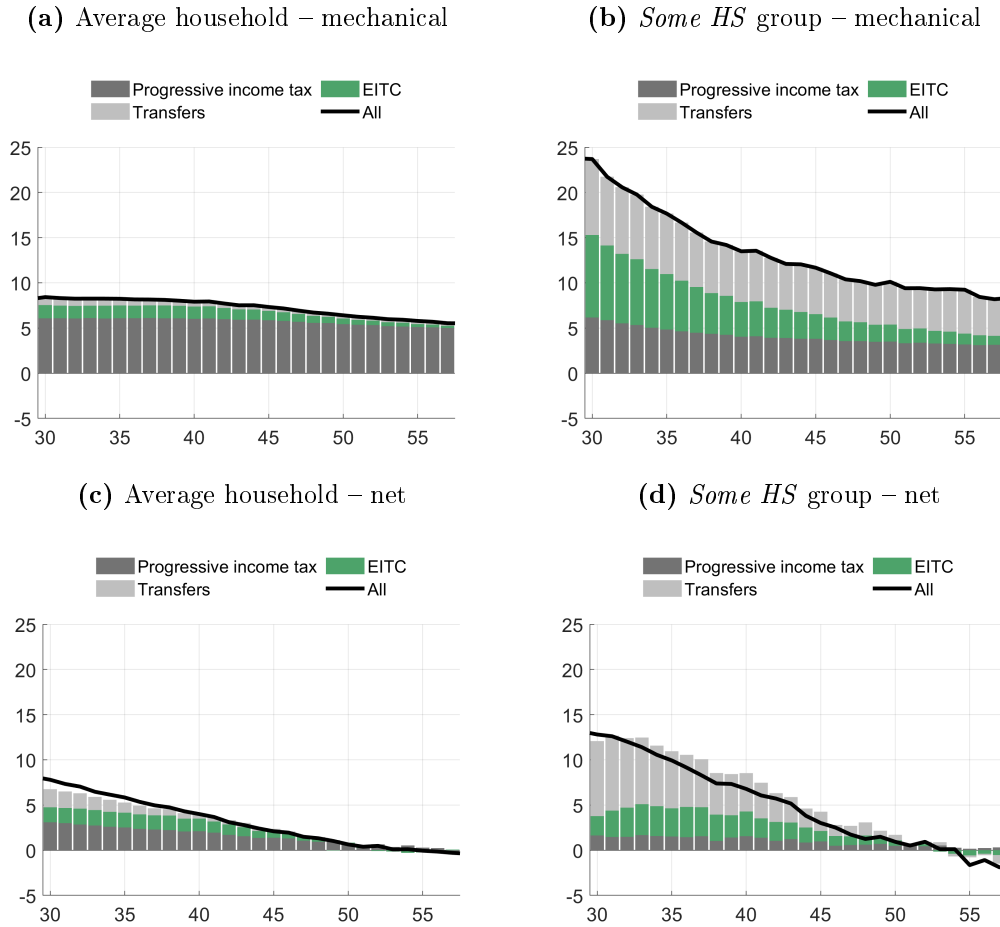
To determine the net insurance contribution of each element, I subtract overall insurance in the respective counterfactual model version from insurance in the baseline model.⁴⁷ The mechanical contribution is obtained by decomposing baseline public insurance, ϕ_p , from Figure 2.4 into the contributions of means-tested transfers, ϕ_{Tr} , the

⁴⁵During retirement, SNAP remains available to households. This modeling choice avoids distortions in household decision making during working age resulting from abolishing transfers during retirement.

⁴⁶Results are similar with a linear tax rate of 18.7% that assures budget neutrality, which is not surprising as no further progressivity is added to the system; see Figure A.14 in the Appendix. I treat the CTC – a tax credit – together with remaining progressivity from the system, as it does not explicitly target low-income households.

⁴⁷Resulting net insurance via transfers is $\phi_{c_{jt}} - \phi_{c_{jt}}^{NoTr}$, via the EITC is $\phi_{c_{jt}} - \phi_{c_{jt}}^{NoEitc}$, and via progressivity in the income tax code is $\phi_{c_{jt}} - \phi_{c_{jt}}^{LinInctax}$.

Figure 2.5. Decomposing consumption insurance via public policy



Notes: The figure shows the insurance contribution of individual public policies in the United States. The left panels present results for the average household. Right panels concentrate on households from the *Some HS* group. The panels at the top present the mechanical insurance contribution of the individual policies in percentage points, while those at the bottom summarize net contributions, accounting for behavioral responses. Chapter 2.5.1 describes the calculation.

EITC, ϕ_{EITC} , and remaining progressivity in the system, $\phi_T + \phi_{CTC}$.⁴⁸ In Figure 2.5, I present the results, first focusing on the mechanical insurance effects of each element (top panels) and then turning to net implications (bottom panels).

Mechanical insurance contributions. Panel (a) of Figure 2.5 reports results for the average household. Mechanical insurance from all public policies equals 8.4 percentage points at age 30 and declines slightly over the life cycle (black line).⁴⁹ Most of this insurance, 6.1 percentage points, comes from progressivity in the income tax code

⁴⁸The decomposition mirrors that of Chapter 2.4.5 and is summarized in Table A.7 in the Appendix.

⁴⁹Note that this is exactly the amount of consumption insurance provided by public policy as presented in Figure 2.4, panel (a) (blue bars).

(dark gray bars). The EITC adds 1.5 percentage points but becomes less important at older working ages, when most children have left the household (green bars). Transfers contribute only minimally to insurance for the average household (light gray bars).

Transfers and the EITC become much more important for households in the *Some HS* group, shown in panel (b). The overall insurance contribution of public policy amounts to 23.7 percentage points in young ages, declining to 8.2 percentage points at age 57. At age 30, transfers and the EITC each provide around nine percentage points of insurance, together accounting for roughly 75 percent of total public insurance. Among younger households in the *Some HS* group, both programs therefore play an equally important role. In later working years, the relevance of the EITC declines, but transfers continue to generate substantial amounts of consumption insurance (around four percentage points), making them the most important public insurance channel at that age.

Net insurance contributions. The mechanical insurance contributions interact with other private or public insurance channels. Panels (c) and (d) present the net insurance contribution of each element after accounting for these interactions.⁵⁰

For the average household in panel (c), net insurance effects differ most from their mechanical counterparts at older working ages. At these ages, the net contribution of each individual policy and of all policies together is approximately zero, implying that other channels fully offset positive mechanical insurance. In other words, public policy crowds out other forms of insurance at these ages. In younger working ages, however, crowding-out is much weaker. The small mechanical insurance amounts from the EITC and transfer payments are hardly affected by other channels, even minimally reinforced. Yet, the mechanical insurance contribution of progressive income taxes is roughly halved.

For the *Some HS* group in panel (d), older-age patterns are similar: insurance from all public programs together and from each individual program is fully offset by other channels. At younger working ages, however, the net contribution of all public policies is only about half of the mechanical contribution. Net insurance from the EITC and

⁵⁰When considering net insurance, the contribution of all public policies together (black line) may now vary from the sum of the individual components due to interaction effects. For instance, considering the average household, insurance from the whole system slightly exceeds the sum of individual components, as the latter imply stronger crowding-out of other channels, which is further discussed in Chapter 2.5.2.

progressive income taxes is substantially below the corresponding mechanical values, indicating crowding-out of other channels. The net insurance contribution of transfers, by contrast, remains at roughly 90% of its mechanical component at young ages. Transfers therefore provide substantial insurance for young households in the *Some HS* group even after accounting for behavioral and policy interactions. In this context, it is also interesting that, in the model, the government spends about 25% less on transfer programs than on the EITC; see Appendix A.6. Transfers thus deliver a larger amount of insurance per dollar spent than the EITC.

2.5.2 Interactions Between Insurance Channels

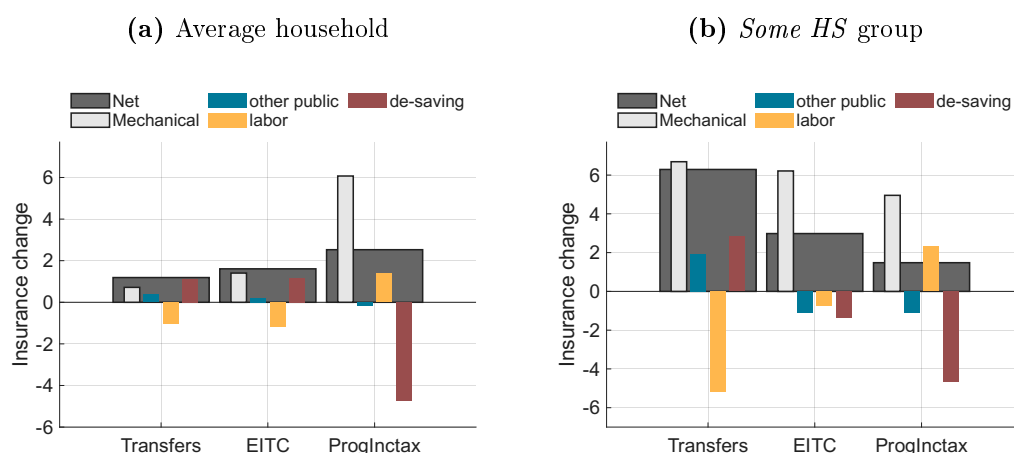
This chapter disentangles why the young-age patterns differ across experiments.⁵¹ I focus on households aged 30 to 40 and examine how different public policies affect other private and public insurance channels. In Figure 2.6, I explicitly show effects of either transfers, the EITC, or progressive income taxes on private forms of insurance such as de-saving (red bars) or labor supply adjustments by wife and husband (yellow bars), as well as on other public insurance channels (blue bars).⁵² The light (dark) gray bars present the mechanical (net) insurance effects in the respective experiments already shown in Figure 2.5, but averaging over ages 30 to 40. To interpret the results, I also discuss changes in the life-cycle profiles shown in Figure 2.7.

Average (young) household. Panel (a) of Figure 2.6 presents results for the average young household. Transfers and the EITC provide only small amounts of consumption insurance for this group, and their mechanical and net contributions are nearly identical. These policies therefore induce only small changes in other channels. By contrast, the net insurance gain from progressive income taxes is only about half of the mechanical effect of six percentage points. The difference is driven by a 4.7 percentage point reduction in self-insurance through de-saving after shocks. The life-cycle profiles in Figure 2.7, panel (a), confirm that households save on average \$6,800 less at young ages

⁵¹In older working ages, patterns are similar across experiments, i.e., insurance from public policy reduces self-insurance via de-saving from accumulated assets; see also Figure A.8 in the Appendix.

⁵²For the calculation, I consider one specific channel and then subtract insurance via that channel in each experiment from insurance via that channel in the baseline model. For instance, the insurance change in de-saving induced by transfers is calculated as $\phi_{s_{jt}} + \phi_{i_{jt}} - \phi_{s_{jt}}^{NoTr} - \phi_{i_{jt}}^{NoTr}$. Calculations for other channels (labor, other public insurance channels) or other experiments (no EITC, no progressivity in the income tax code) are determined analogously.

Figure 2.6. Insurance implications induced by public policy decomposed by channel



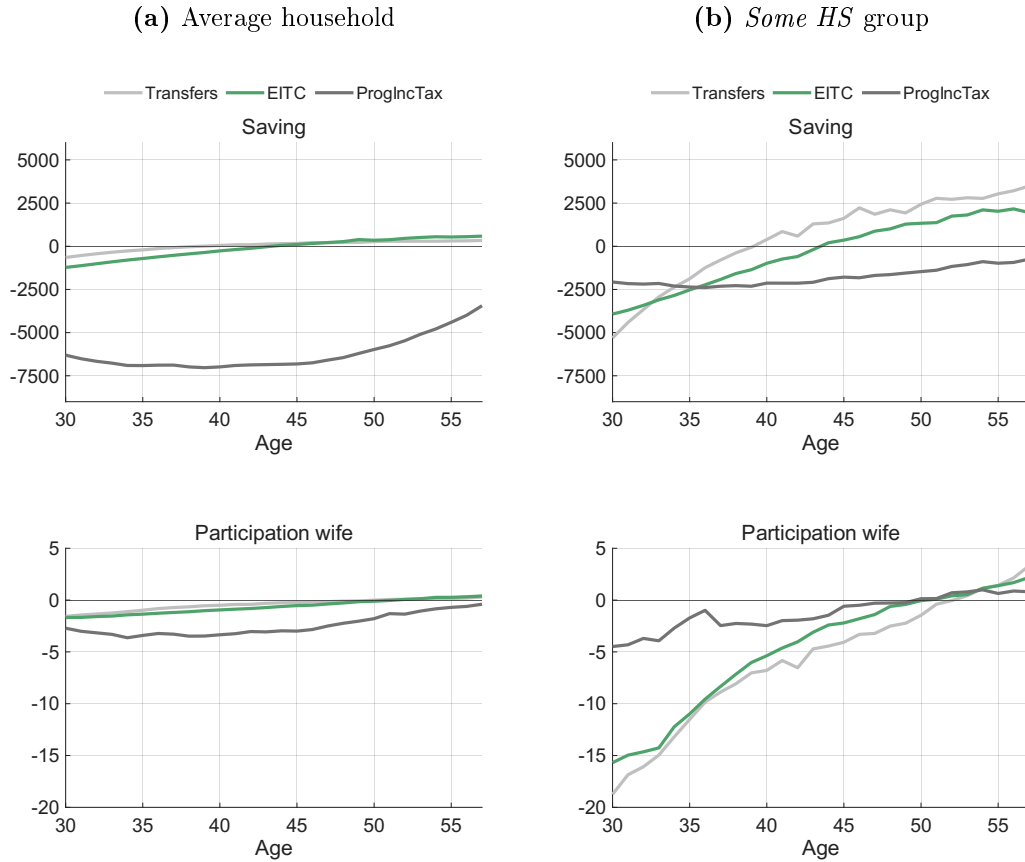
Notes: The figure shows insurance implications of either transfers, the EITC, and progressive income taxes for households aged 30 to 40. I present mechanical (light gray bars) and net insurance implications (dark gray bars) and the effects on other insurance channels, i.e. labor supply (yellow bars), de-saving (red bars), and other public policy (blue bars). Panel (a) presents results for the average household, while panel (b) focuses on households from the *Some HS* group. Chapter 2.5.2 describes the calculation of the insurance effects.

when progressive income taxes are present, leaving fewer resources to draw down in bad times. At the same time, wives' labor force participation declines slightly under progressive income taxation, generating small labor-supply insurance gains in bad states when women increase participation.

(Young) *Some HS* group. Figure 2.6, panel (b), presents results for the *Some HS* group. The implications of progressive income taxes are similar to those for the average household. For the EITC, the large mechanical insurance contribution of 6.2 percentage points is partly offset by lower insurance through all other channels. When the EITC is available, households need not rely as much on asset-tested transfers after a negative wage shock. This weakens incentives to de-save in bad times and reduces insurance from de-saving and transfers by about one percentage point each. The labor-supply contribution also declines because female labor force participation falls by 10.8 percentage points at young ages with the EITC in place; see Figure 2.7, panel (b).⁵³ With fewer women working, households become more exposed to changes in the husband's income. This effect is partly mitigated by more women raising their labor force participation in

⁵³At first glance, this result may sound surprising, as the EITC program is known to encourage work. Yet, the literature has shown that the EITC reduces labor supply among married women due to high marginal tax rates for secondary earners implied by the EITC phase-out; see Ellwood (2000), Eissa and Hoynes (2004), or Nichols and Rothstein (2016).

Figure 2.7. Impact of public policies on life-cycle profiles



Notes: The figure shows how transfers (light gray lines), the EITC (green lines), and progressive income taxes (dark gray lines) impact life-cycle profiles of the average households (panel a) and the *Some HS* group (panel b). Household saving is given in dollars. The labor market participation of wives is given in percent.

response to shocks; see also Figure A.7 in the Appendix. Overall, while the EITC's net insurance gain is smaller than its mechanical contribution, it still provides substantial insurance at young ages.

For transfers in the *Some HS* group, the strong mechanical insurance contribution of 6.7 percentage points at young ages is barely reduced by other channels. Transfers nevertheless induce important reallocations across channels. To receive transfers after a negative wage shock, households have incentives to de-save enough to satisfy asset tests and to reduce labor supply enough to satisfy income tests. This de-saving response provides an additional 2.8 percentage points of insurance.⁵⁴ At the same time, reduc-

⁵⁴In older working ages, this channel goes in the opposite direction as households accumulate fewer assets with transfers available, i.e., transfers crowd out self-insurance via de-saving in old age.

tions in labor supply after shocks lower insurance by 5.2 percentage points.⁵⁵ With transfers available, households also rely more on other public insurance channels in bad times, especially the EITC, which raises insurance by 1.9 percentage points. Overall, gains and losses from other channels approximately offset each other, leaving a strong net insurance gain of 6.3 percentage points from transfers. Among transfer programs, SNAP provides more insurance than TANF, as shown in the decomposition in Figure A.9 in the Appendix.

2.5.3 Specific Features of Transfers and Credits

This chapter studies the insurance implications of asset means-testing in transfers and of the EITC phase-in. I solve two additional model versions: one in which asset tests are removed from SNAP and TANF, and one in which the EITC does not phase in with earnings but starts at its plateau even at zero earnings.⁵⁶ Government spending on transfer programs increases by about \$70 per household and period without asset tests. Abolishing the EITC phase-in is less costly, increasing government spending by about \$6 per household and period.⁵⁷ I use these model versions to decompose the mechanical and net insurance gain from transfers into the contributions of asset tests and transfers per se. Analogously, I decompose the mechanical and net insurance gain from the EITC into the contributions of the phase-in and the EITC per se.⁵⁸

Means-tested transfers. Figure 2.8 decomposes insurance from transfers with strict asset tests (black line) into the contributions of means-testing (orange bars) and transfers per se (light orange bars). Patterns for the average household (left panels) are small, so I focus on households in the *Some HS* group (right panels), for whom transfers are central.

⁵⁵Similar to the labor supply adjustments implied by the EITC, transfers reduce insurance via the composition effect (due to a decline in female labor force participation in young ages of 12 percentage points) offset by more insurance via the extensive labor supply margin, such that reductions at the intensive margin drive the results; see Figure A.7 in the Appendix.

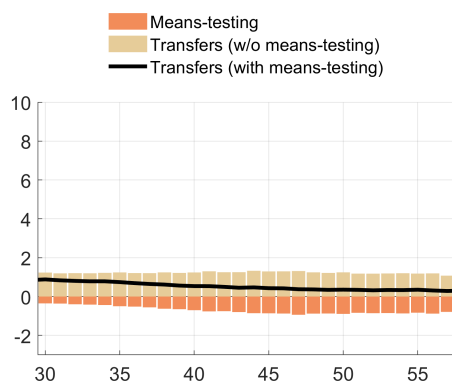
⁵⁶During retirement, asset means-testing in SNAP remains in place.

⁵⁷Figure A.15 in the Appendix considers model versions in which I keep government spending for transfers and the EITC constant. Net insurance implications are hardly affected, while the importance of individual channels changes.

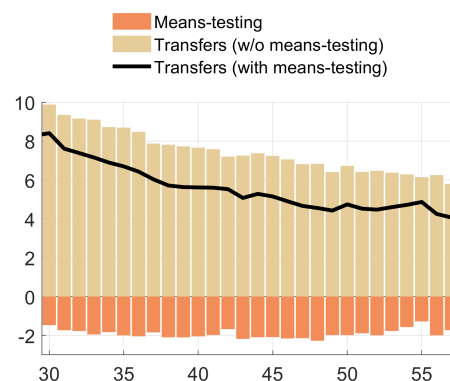
⁵⁸The decomposition works as follows. I first decompose the net insurance contribution of means-tested transfers, $\phi_{c_{jt}} - \phi_{c_{jt}}^{NoTr}$, into the roles of means-testing, $\phi_{c_{jt}} - \phi_{c_{jt}}^{NoAssetTest}$, and transfers per se, $\phi_{c_{jt}}^{NoAssetTest} - \phi_{c_{jt}}^{NoTr}$. To determine the mechanical insurance change induced by asset means-testing, I proceed analogously, but focus on insurance via the transfer channel, $\phi_{Tr_{jt}}$, instead of net insurance. The decomposition of insurance via the EITC works analogously.

Figure 2.8. Decomposing insurance via means-tested transfers

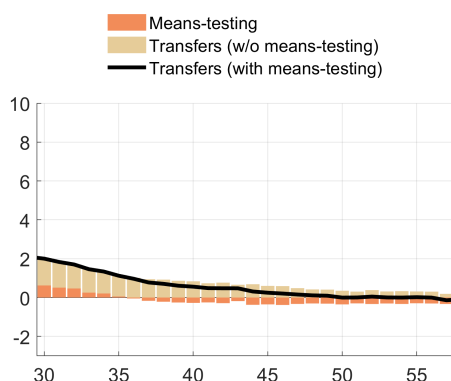
(a) Average household – mechanical



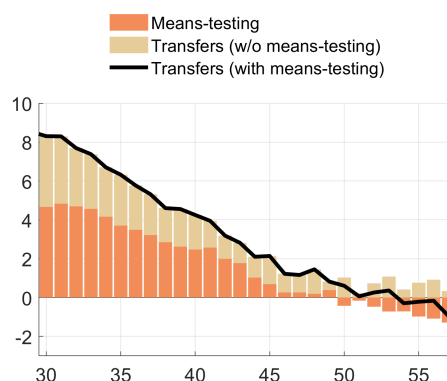
(b) *Some HS* group – mechanical



(c) Average household – net



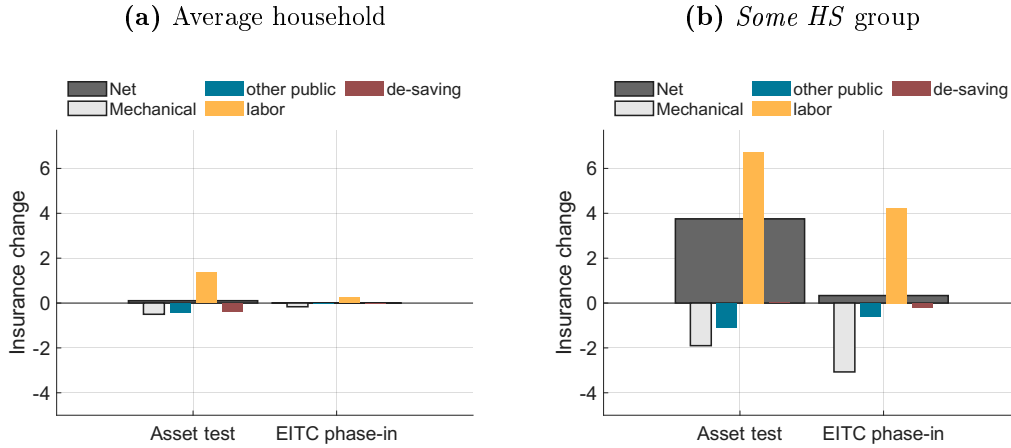
(d) *Some HS* group – net



Notes: The figure decomposes insurance via means-tested transfers (black line) into the contributions from asset means-testing (orange bars) and of transfers per se without asset tests (light orange bars). The panels at the top present the mechanical and those at the bottom the net insurance contribution of each channel in percentage points. Chapter 2.5.3 describes the calculation.

Panel (b) shows that, mechanically, means-testing lowers consumption insurance at all ages by about two percentage points. Households that experience a negative wage shock but hold too much wealth cannot receive transfer payments in bad states. Because of this negative mechanical effect, transfers provide more insurance in a world without asset tests than in a world with strict tests. Net insurance gains tell a different story. In panel (d), transfers provide more insurance when asset tests are present because asset means-testing has strong *positive* net insurance effects at young ages, exceeding four percentage points at age 30. Other public or private channels therefore more than offset the initial mechanical insurance loss.

Figure 2.9. Insurance implications induced by asset means-testing and the EITC phase-in decomposed by channel



Notes: The figure shows insurance implications of asset means-testing in transfers and the EITC phase-in for households aged 30 to 40. I present net (dark gray bars) and mechanical insurance effects (light gray bars) and the implications for other insurance channels, i.e. labor supply (yellow bars), de-saving (red bars), and other public policy (blue bars). Chapter 2.5.3 describes the calculation of the respective insurance effects.

To disentangle these interactions, Figure 2.9, panel (b), presents the implications of asset means-testing on other private and public insurance channels, again focusing on households in the *Some HS* group aged 30 to 40. The figure shows that asset tests crowd in insurance through couples' own labor supply.⁵⁹ Asset means-testing therefore targets transfers to households without private buffers while also strengthening labor-supply insurance.

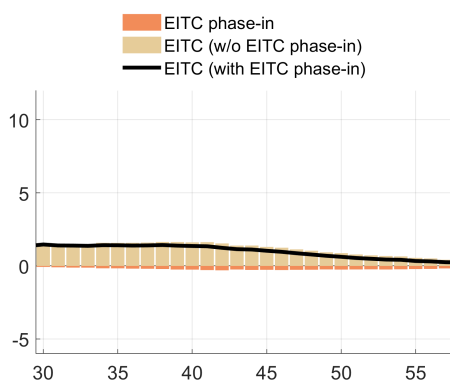
The aggregate view for households aged 30 to 40 masks important age variation. Asset tests raise insurance through de-saving by 2.7 percentage points at age 30 but reduce this channel by 2.0 percentage points at age 40. Thus, asset tests do create incentives for young, low-income households to de-save in bad times to become transfer-eligible. Because households accumulate fewer assets, they rely less on de-saving as an insurance channel from their mid-thirties onward.⁶⁰ These findings are consistent with Wellschmied (2021), who argues that asset tests prevent households from building their own buffer stocks. At the same time, asset tests strongly encourage labor-supply insurance at young and older ages, a channel not considered by Wellschmied (2021). The

⁵⁹Figure A.11 in the Appendix confirms that, in response to shocks, more wives start working and their husbands reduce their labor supply less strongly, contributing to the strong rise in insurance.

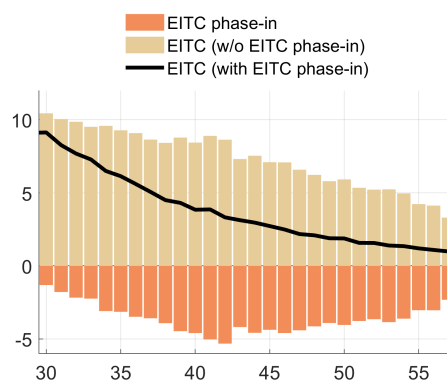
⁶⁰Between ages 41 and 57, asset tests crowd out self-insurance via de-saving by about five percentage points; see Figure A.12 in the Appendix.

Figure 2.10. Decomposing insurance via the phased-in EITC

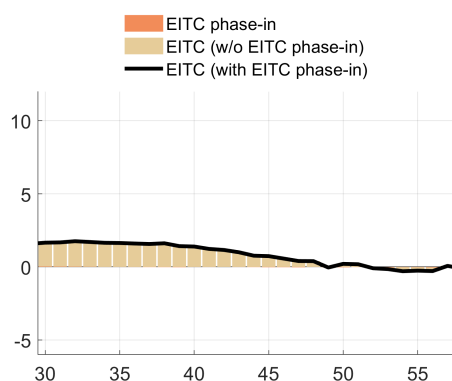
(a) Average household – mechanical



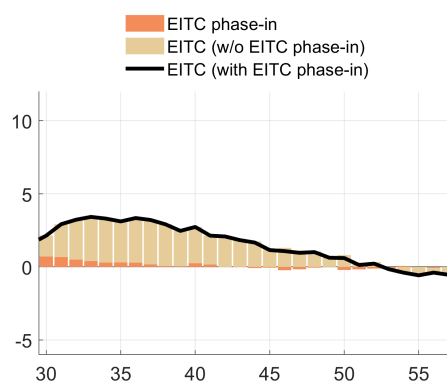
(b) *Some HS* group – mechanical



(c) Average household – net



(d) *Some HS* group – net



Notes: The figure decomposes insurance via the phased-in EITC (black line) into the contributions from the phase-in (orange bars) and of the EITC per se without the phase-in (light orange bars). The panels at the top present the mechanical and those at the bottom the net insurance contribution of each channel in percentage points. Chapter 2.5.3 describes the calculation.

net insurance gain from asset tests is close to zero at older working ages but positive at young ages.

EITC phase-in. Figure 2.10 presents the decomposition of mechanical and net insurance contributions from the EITC (black line) into the contribution of the phase-in (orange bars) and the EITC without a phase-in (light orange bars). Again, I focus on the *Some HS* group (right panels), as patterns for the average household (left panels) are less pronounced in size due to lower relevance of the credit.

For households in the *Some HS* group, the mechanical contribution of the EITC phase-in is negative, as shown in panel (b) of Figure 2.10. With the phase-in in place,

an unexpected earnings decline can imply a partial loss of the credit, lowering insurance. These losses are particularly large, at about five percentage points, between ages 40 and 50. Mechanically, the EITC therefore provides more insurance without the phase-in. Other channels, however, fully offset the insurance losses implied by the EITC phase-in, so the net insurance contribution of the phase-in is close to zero (panel d).

Figure 2.9, panel (b), shows that labor-supply adjustments by wives and husbands offset the mechanical insurance loss induced by the phase-in. With more women working, households rely less on the primary earner's income and are less vulnerable to changes in it.⁶¹ Overall, the negative mechanical insurance loss implied by the phase-in and the insurance gains implied by adjusted labor supply roughly cancel each other out. The phase-in therefore strengthens households' own resilience against shocks.

2.5.4 Either Transfers? Or Credits? Or Both?

This chapter asks whether expanding either transfers or the EITC, while abolishing the other program, provides more insurance than the current U.S. system that contains both. Abolishing transfer payments allows the EITC to expand by a factor of 1.52. Conversely, transfers can expand by a factor of 1.62 when the more expensive EITC is removed.⁶² Figure 2.11 presents the insurance implications for households aged 30 to 40. I focus on the *Some HS* group (panel b), because the average household (panel a) is hardly affected by the reforms.

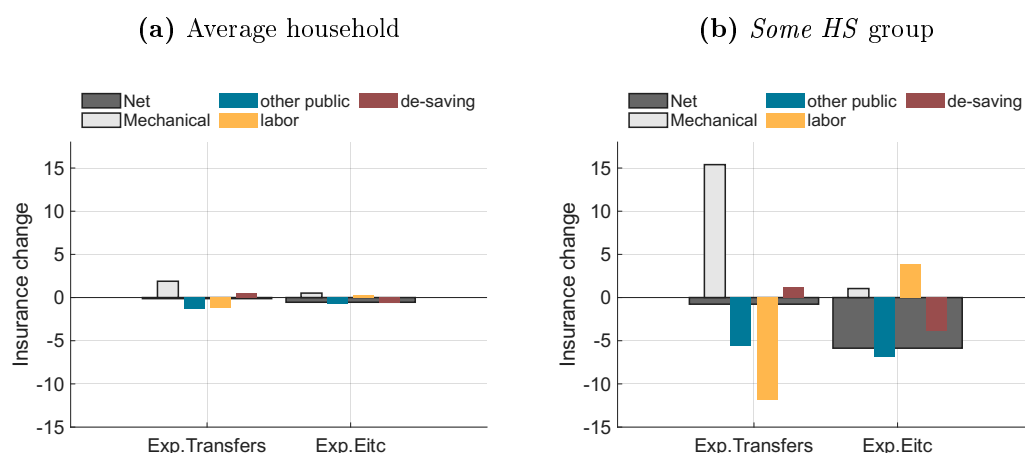
Expanding the EITC while abolishing transfer payments generates a net insurance loss of 5.9 percentage points. This loss arises because removing transfers, together with their interaction with de-saving, more than offsets the small mechanical insurance gain from the EITC expansion and its interaction with family labor-supply insurance.

Expanding transfer programs while eliminating the EITC reduces net insurance only slightly, by 0.8 percentage points. Expanded transfers generate a large mechanical insurance gain of 15.4 percentage points, reinforced by a 1.2 percentage point increase in insurance through de-saving. These gains are offset by the 5.6 percentage point me-

⁶¹The life-cycle profiles in Figure A.10 in the Appendix reveal that the phase-in increases female labor force participation by up to five percentage points, implying less insurance via the extensive labor supply margin of the wife in bad times, confirmed in Figure A.11 in the Appendix.

⁶²Table A.8 in the Appendix reports changes in government expenditures in the various experiments.

Figure 2.11. Insurance implications of expanding either transfers or the EITC



Notes: The figure shows insurance implications of expanding either transfers or the EITC, while abolishing the other program, focusing on households aged 30 to 40. I present net (dark gray bars) and mechanical insurance effects (light gray bars) and the implications for other insurance channels, i.e. labor supply (yellow bars), de-saving (red bars), and other public policy (blue bars). The calculation of the respective insurance effects is analogous to the one described in Chapter 2.5.2.

chanical insurance loss from removing the EITC and, especially, by an 11.8 percentage point reduction in family labor-supply insurance.

Although transfers provide more net insurance than the EITC, the combined system provides still more insurance. The reason is the positive interaction between transfers and the EITC documented in Chapter 2.5.2.⁶³ Thus, for the most vulnerable young households, a system that combines phased-in tax credits and means-tested transfers provides higher net consumption insurance than a system that spends the same resources on only one of the two programs.

2.6 Summary and Implications

Policy debates in the United States often center on tax credits, but the analysis shows that means-tested transfers and phased-in credits play complementary roles in insuring married couples' consumption. Transfers are a relatively cost-effective source of insurance for households with limited financial resources. Although the EITC is more costly and less precisely targeted to households with the greatest insurance needs, it provides substantial insurance for young parents and crowds out private insurance from labor

⁶³In older working ages, however, expanding transfers while removing the EITC implies an insurance gain of 1.1 percentage points since positive interactions with the EITC lose relevance when children leave the household; see Figure A.13 in the Appendix.

supply and de-saving only moderately. Specific features of the tax-transfer code, including asset tests and phase-in ranges, are quantitatively important because they shape both targeting and households' own insurance responses. For young couples, combining phased-in tax credits with means-tested transfers yields more insurance than allocating the same resources to either transfers or credits alone.

These results are relevant for policy settings in which transfer payments are delayed or interrupted. Affected households may find it difficult to bridge the shortfall with savings because strict asset tests discourage the accumulation of private buffers. The results suggest that such payment interruptions can weaken the function of transfers as an insurance mechanism. The trade-offs identified here are also informative beyond the United States. The German system, for instance, relies on means-tested transfers but does not use tax credits in the same way. Future work could examine whether adding a phased-in tax credit to such a system would increase consumption insurance.

The insurance value of public policy depends on the availability of other insurance channels. Recent work (Denderski and Obermeier 2025 and Bredemeier, Gravert, and Juessen 2026) shows that limited commitment within couples can reduce family insurance and thereby raise the welfare gains from tax-transfer progressivity. When family insurance is limited, transfers and the EITC may crowd out less private insurance, implying larger insurance gains from public policy. Similarly, asset tests and phase-in ranges may crowd in family labor supply less strongly. I leave these interactions for future research.

3 Offsetting Reforms, Unequal Effects:

U.S. Tax-Transfer Progressivity and Household Welfare

Recent research in family economics, e.g., Blundell, Pistaferri, and Saporta-Eksten (2016) or Wu and Krueger (2021), and the results in Chapter 2 emphasize that the progressivity of the tax-and-transfer system is central for consumption insurance through channels such as de-saving, labor supply adjustment, and within-family risk sharing. Over the past two decades, the U.S. tax-and-transfer system has undergone a sequence of reforms that alternately increased and reduced overall progressivity. Under President Obama, expansions of several welfare and tax-credit programs raised progressivity. During Donald Trump's first presidency, income tax cuts – especially for high-income households – reduced progressivity.⁶⁴ As I show below, standard measures of progressivity after the Trump tax cuts are close to their levels before the Obama reforms of 2009.

The progressivity-reducing reforms of the first Trump presidency, however, were not simple reversals of the earlier progressivity-enhancing reforms of the Obama era. They changed different components of the tax-and-transfer system and affected different groups of households. Although these reforms left aggregate progressivity largely unchanged, they may have had important distributional and behavioral consequences for specific population groups. Households may respond differently depending on their position in the income distribution and on whether children are present in the household. This chapter therefore compares the tax-transfer system after the Trump tax cuts with the system before the Obama reforms of 2009 and studies the implications for household choices, insurance, and welfare.

In the first part of this chapter, I empirically analyze the progressivity of the U.S. tax-and-transfer system for married working-age couples using IPUMS data from the

⁶⁴There were also progressivity-reducing tax cuts under President George W. Bush and progressivity-enhancing expansions of tax credits, especially for families with children, under President Biden.

Annual Social and Economic Supplement of the CPS for the years 2004 to 2019.⁶⁵ I measure progressivity using the progressivity parameter of a simple log-linear tax function in the spirit of Feldstein (1969) and Bénabou (2000), following Heathcote, Storesletten, and Violante (2020), Wu (2021), Borella et al. (2023) or Ferriere and Navarro (2025). I distinguish between different components of the tax-and-transfer system and separate changes in progressivity due to active policy reforms from passive changes that arise from changes in the distribution of pre-government income and other tax-transfer determinants.⁶⁶ I then decompose active changes in tax-transfer progressivity into the contributions of individual policy components and examine how these changes differ across households by educational attainment.

In the second part of the chapter, I study the welfare consequences of the tax-transfer reforms between 2004 and 2019. To do so, I use a standard Bewley model with endogenous labor supply by dual-earner households, as in Wu and Krueger (2021), and embed a detailed representation of the U.S. tax-transfer system under tax year (TY) 2019. I also solve the model under TY 2004. Because average taxes paid are lower in 2019 than in 2004, I introduce a linear earnings subsidy in 2004 to ensure budget neutrality across the two tax years. The detailed representation of the tax-transfer system is essential because the reforms changed specific components of the system and therefore affected households unevenly.⁶⁷ Two further model features are central for the analysis. First, I distinguish between several pre-determined education groups to capture heterogeneous effects along the income distribution. Second, I allow the number of children in the household to vary both across households and over the life cycle, because many reforms differently affected households with and without dependent children.

In the empirical progressivity analysis, average progressivity between 2004 and 2019 is 16.9%. Progressivity rises between 2004 and 2013 and declines thereafter.⁶⁸ The decomposition shows that much of the variation in aggregate progressivity reflects passive

⁶⁵As in Chapter 2, I focus on couple-households. About 70% of children live together with both parents and most tax-transfer reforms between 2004 and 2019 affected families with children; see Federal Interagency Forum on Child and Family Statistics (2023) and Chapter 3.2 for an overview.

⁶⁶The distinction between active and passive changes in progressivity has also been stressed by Dauchy, Navarro-Sanchez, and Seegert (2021) who document that the effects of active policy reforms can be confounded by concurrent passive changes in progressivity.

⁶⁷Specifically, I include statutory income taxes, the EITC and the CTC as well as transfer programs like SNAP and TANF.

⁶⁸The estimated average tax rate is 19.2%. Both numbers are in line with the literature (e.g., Heathcote, Storesletten, and Violante 2020), whereby the results crucially depend on the estimation sample or tax-transfer elements included.

changes in the distribution of income and other tax-transfer determinants. Active tax-transfer reforms leave progressivity broadly unchanged, except for two major reforms: the ARRA of 2009, which raises progressivity by about 1.1 percentage points, and the TCJA of 2017, which reduces progressivity by a similar amount. As a result, progressivity in 2019 is close to its level in 2004. This aggregate stability, however, masks important heterogeneity. The post-Obama-and-Trump tax-transfer system is more progressive for households with low educational attainment, mainly because of expanded tax credits, but less progressive for highly educated households, largely because of lower marginal tax rates.

Although the two tax years feature similar levels of aggregate progressivity, the model analysis reveals important differences in taxes net of transfers, insurance, household choices, and welfare. I first examine mechanical changes in taxes net of transfers and consumption insurance, that is, changes induced by the tax-transfer reforms between 2004 and 2019 that are not driven by behavioral adjustment. I study these mechanical effects by education and over the life cycle. Consumption insurance is measured as the share of a permanent wage shock to the husband that does not pass through to consumption, following Wu and Krueger (2021). I then examine how households adjust labor supply, saving, and consumption in response to the reforms. Finally, I study welfare effects, measured in consumption-equivalent variation, and analyze additional heterogeneity by the presence of children in the household.

Consistent with the empirical progressivity results, the tax-transfer reforms between 2004 and 2019 mechanically increase consumption insurance for households with low educational attainment, while insurance declines for highly educated households. At the same time, highly educated households benefit most from the tax cuts, with average taxes net of transfers falling by almost \$470. By contrast, households with low and medium levels of education pay higher taxes net of transfers overall, with increases of \$22 and \$275, respectively, although those with low educational attainment benefit from expanded tax credits at young working ages.

Households adjust labor supply and saving in ways that partly offset the insurance losses or higher taxes net of transfers implied by the reforms. Households with higher educational attainment accumulate more assets to compensate for lower insurance. At age 45, their accumulated wealth is about \$13,000 higher under the 2019 system than

under the 2004 system. Households with low and medium levels of education reduce hours worked to take greater advantage of tax credits and accumulate fewer assets in response to higher taxes net of transfers. All education groups experience higher consumption under the 2019 system. The increase, however, is larger among highly educated households and at older working ages, implying a widening of consumption differences both within and across education groups.

Overall welfare declines by 0.2% in consumption-equivalent terms. Welfare changes are modest but negative for most education groups. Mechanically, the tax-transfer reforms reduce welfare in all education groups because they increase consumption inequality within groups. Behavioral adjustment raises consumption levels and partly mitigates these initial welfare losses. Reduced hours worked among households with low educational attainment generate a modest welfare gain of 0.07%, whereas higher hours worked in other groups imply net welfare losses, which are particularly large for households with medium levels of education (-0.3%).

As a final exercise, I consider additional heterogeneity by the presence of children in the household. Taxes net of transfers rise more strongly – or fall less strongly – among households that never had children. Even after accounting for behavioral adjustment, consumption rises 1.6 times less for households without children than for households with children. Accordingly, welfare declines by 0.57% among households that never had children, compared with 0.17% among households in which children ever lived in the household. These differences are especially pronounced among households with the lowest educational attainment: welfare rises by 0.2% for households with children but falls by 1.1% for households that never had children.

Taken together, the results show that similar levels of aggregate progressivity can conceal economically important differences in the structure of the tax-transfer system. The 2004 and 2019 systems imply different incentives, insurance properties, and welfare effects, with sharply different consequences across subgroups of the model population. Welfare losses are particularly large for households with medium levels of education and for households without children. These findings speak to broader evidence of rising income and wealth inequality over the period considered (e.g., Heathcote et al. 2023) and of job polarization associated with globalization and digitization (e.g., Autor 2019 and Autor, Dorn, and Hanson 2013). The results in this chapter show that tax-transfer

reforms over the past two decades have further contributed to inequality in income, wealth, and consumption and have worsened the economic position of the lower middle class.

This chapter proceeds as follows. Chapter 3.1 discusses the related literature. Chapter 3.2 documents the tax-transfer reforms between 2004 and 2019 and their effects on taxes net of transfers along the income distribution. Chapter 3.3 quantifies the evolution of aggregate tax-transfer progressivity from 2004 to 2019 and presents several decomposition exercises. Chapter 3.4 describes the model, its assumptions, and selected parameters. Chapter 3.5 presents the model results. Chapter 3.6 summarizes main results and their implications.

3.1 Literature on Tax-Transfer Reforms and Progressivity

I contribute to four related strands of literature: work on the evolution of tax-transfer progressivity; studies of specific tax-transfer reforms; incomplete-markets models with two-earner households; and the consumption insurance literature.

Tax-transfer progressivity. My empirical analysis adds to the literature on the evolution of tax-transfer progressivity in the United States, e.g., Piketty and Saez (2007), or Splinter (2020), and especially to studies that measure progressivity using the simple Bénabou tax(-transfer) function introduced above, e.g., Wu (2021), Heathcote, Storesletten, and Violante (2020), or Borella et al. (2023).⁶⁹ A key difference is that these studies do not explicitly separate changes in progressivity due to tax-transfer reforms from changes that arise from contemporaneous economic conditions.

The distinction between active policy changes and passive changes in the income distribution is central for my analysis. Ferriere and Navarro (2025) address this issue for federal income tax reforms between 1913 to 2014 by estimating the progressivity parameter using the fixed income distribution of 1984. Dauchy, Navarro-Sanchez, and Seeger (2021) focus on the evolution of consumption insurance rather than progressivity, but also hold the income distribution fixed in one specific year to isolate changes due to

⁶⁹Heathcote, Storesletten, and Violante (2017) have shown the good empirical fit of this function for the United States. Other studies estimate and compare the progressivity parameter across countries (e.g., Holter, Krueger, and Stepanchuk 2019, or Qiu and Russo 2026) or across U.S. states (e.g., Fleck et al. 2025).

tax reforms. In addition, they vary the income distribution while holding the tax year fixed to study the role of economic conditions.⁷⁰ I follow this approach and study how economic conditions and tax-transfer reforms between 2004 and 2019 affect progressivity for married couples.⁷¹ In particular, I examine the effects of the Great Recession and the subsequent recovery, as well as the effects of the ARRA of 2009 and the TCJA of 2017. I further decompose changes in progressivity by tax-transfer component and study heterogeneity by education.

Tax-transfer reforms between 2004 and 2019. A second strand of literature studies reforms to income taxes and transfers between 2004 and 2019, in particular those associated with the ARRA and the TCJA. For example, there is an ongoing debate about the employment effects of the 2009 EITC expansion, e.g., Bastian and Lochner (2022), Kleven (2024), or Schanzenbach and Strain (2021). Considering a longer horizon, the latter two find that behavioral responses to the 2009 reform were relatively modest compared with the EITC expansions of the 1990s. Behavioral responses also appear to have been small after the reintroduction of the top marginal tax rate of 39.6% in 2013, see Saez (2017). The distributional effects of the TCJA of 2017 have been studied by Gale, Hoopes, and Pomerleau (2024) or Kallen and Mathur (2021). Both find that the tax cuts reduced average tax rates and thereby reduced redistribution. In absolute terms, tax cuts were larger for households at the top of the income distribution and for households with dependent children. My empirical analysis contributes to this literature by decomposing changes in tax-transfer progressivity between 2004 and 2019. The model analysis further studies the implications of these reforms for household decisions, consumption insurance, and welfare.

Incomplete-markets models with two-earner households. The model analysis contributes to the literature that uses incomplete-markets models with two-earner households to study the implications of tax-transfer reforms. Much of this literature evaluates hypothetical reforms. For instance, Holter, Krueger, and Stepanchuk (2019) consider the

⁷⁰Dauchy, Navarro-Sanchez, and Seegert (2021) find that active tax reforms from 1968 to 2010 reduced consumption insurance against permanent shocks except for top-income households.

⁷¹Borella et al. (2023) among others have shown that tax progressivity among married couples is substantially higher compared to the one among single persons. They find that the tax system has become more progressive for married couples since the late 1980s, while being stable for single persons.

effects of raising U.S. tax progressivity to the level observed in Denmark. While they use a simple Bénabou tax function, other studies model parts of the actual tax-transfer system in greater detail. Garstenauer and Siassi (2025) and Ortigueira and Siassi (2022), for example, analyze household decision making in response to changes in the EITC, with the latter also allowing for endogenous marriage decisions. Guner, Kaygusuz, and Ventura (2023) examine the welfare implications of abolishing the transfer system and replacing it either with a negative income tax or with an unconditional basic income, distinguishing between singles and married couples. Guner, Kaygusuz, and Ventura (2020) focus on expansions of child-related programs. Bronson, Haanwinckel, and Mazzocco (2025) analyze the welfare effects of alternative ways to tax married couples, allowing for endogenous divorce decisions.

Several studies evaluate actual tax-transfer reforms in incomplete-markets models with two-earner households.⁷² Kaygusuz (2010) studies how far the tax reforms of the 1980s can explain the rise in female labor force participation during that period, using simple approximations of the tax system. Low et al. (2025) investigate how time limits in transfer programs affect household decision making and welfare, exploiting the introduction of these limits during the welfare reforms of the 1990s. Borella et al. (2023) extend their progressivity analysis discussed above by studying the labor supply implications of tax reforms between 1969 and 2016 using a structural model in the spirit of Borella, De Nardi, and Yang (2023). Their results show that tax reforms can have substantial implications for household decision making over the life cycle. I complement this literature by evaluating actual tax-transfer reforms between 2004 and 2019, studying their heterogeneous implications for insurance, inequality, and welfare, and linking these results to the empirical progressivity analysis.

Consumption insurance. More generally, this chapter contributes to the consumption insurance literature, i.e., Blundell, Pistaferri, and Preston (2008), Kaplan and Violante (2010), Heathcote, Storesletten, and Violante (2014), or Wu and Krueger (2021), for which Crawley and Theloudis (2024) provide a detailed literature overview. A particularly important contribution is Blundell, Pistaferri, and Saporta-Eksten (2016), who

⁷²Hotchkiss, Moore, and Rios-Avila (2024) consider the impact of the TCJA on labor supply and welfare using a simple static model. They find that married couples reduce their labor supply in response to the TCJA and that welfare increases, with the highest welfare gains for wealthy households with children.

study consumption insurance against permanent shocks to the gross wages of household heads and emphasize the importance of government programs, especially for low-income households. Policies that change progressivity may therefore affect low-income households differently from high-income households. My model analysis speaks directly to this mechanism: household choices, insurance, and welfare responses to reforms that are approximately neutral for aggregate progressivity depend strongly on the household's position in the income distribution and on family demographics.

3.2 Tax-Transfer Reforms in the United States, 2004-2019

This chapter describes the main reforms to the U.S. tax-transfer system between 2004 and 2019 and shows how they affected married couples along the income distribution.⁷³

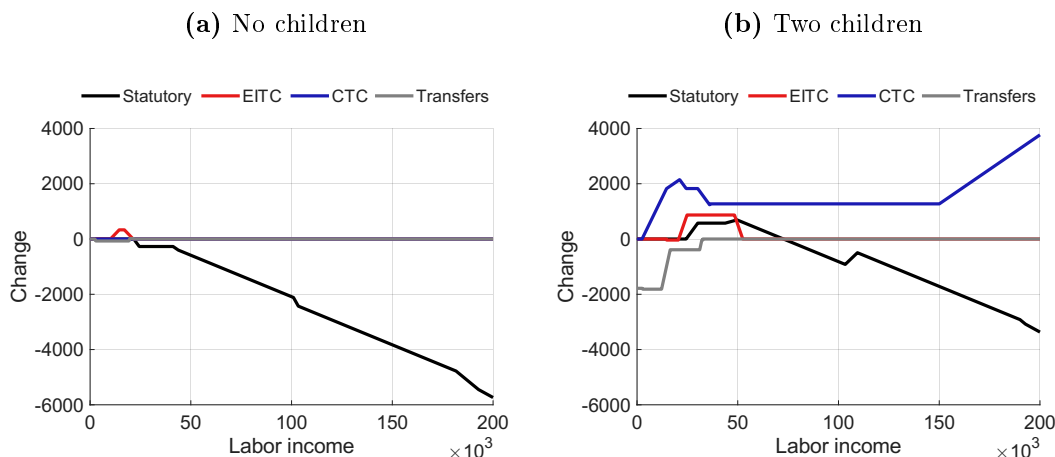
Statutory tax rates, allowances, and payroll taxes. The most important income tax changes occurred through the TCJA of 2017. The reform changed *bracket limits* and substantially reduced *marginal tax rates*, leading to lower income taxes particularly for high-income households; see the black lines in Figure 3.1. The reduction in statutory income taxes was larger for households without children (panel a) than for households with two children (panel b). This difference reflects changes in *allowances*: household-size-dependent exemptions were eliminated, while standard deductions were nearly doubled under the TCJA.⁷⁴ By contrast, *payroll taxes* changed little between 2004 and 2019, apart from relatively minor reforms such as the introduction of an additional hospital insurance tax in TY 2014.

EITC. The red lines in Figure 3.1 show that the EITC expanded for households with relatively low earnings of \$K20 – 50, especially for households with children. This expansion was achieved by widening the plateau region of the EITC in several steps between 2002 and 2009, that is, by raising the earnings threshold at which the phase-out begins. Under the ARRA of 2009, new rules were introduced for families with

⁷³In Appendix B.1, I provide more details on the elements listed here and their reforms. The U.S. tax-transfer system and its reforms were also recently documented by e.g., Howard (2025), Bakija (2024), Gale, Hoopes, and Pomerleau (2024), or Borella et al. (2023).

⁷⁴I focus on standard deductions and abstract from itemized deductions as a clear majority of households claim standard deductions, i.e., 70% in 2017 and almost 90% in 2018, see Gale, Hoopes, and Pomerleau (2024).

Figure 3.1. Change of selected tax-transfer elements from 2004 to 2019



Notes: The figure shows how selected elements of the U.S. tax-transfer system have changed due to tax-transfer reforms between 2004 and 2019 depending on household labor income, focusing on married couples filing jointly. Panel (a) presents results for a household without children and panel (b) for a household with two children. I consider changes in income and payroll taxes (black), the EITC (red), the CTC (blue), and transfers (gray). A positive value implies that the household pays more taxes or receives a higher credit/transfer in 2019 compared to 2004. A negative value implies lower taxes or lower credits/transfers. For the illustration, I assume households' assets to be zero. Parameters from the tax-transfer code are converted in 2019-dollars. All numbers are given in 2019-dollars.

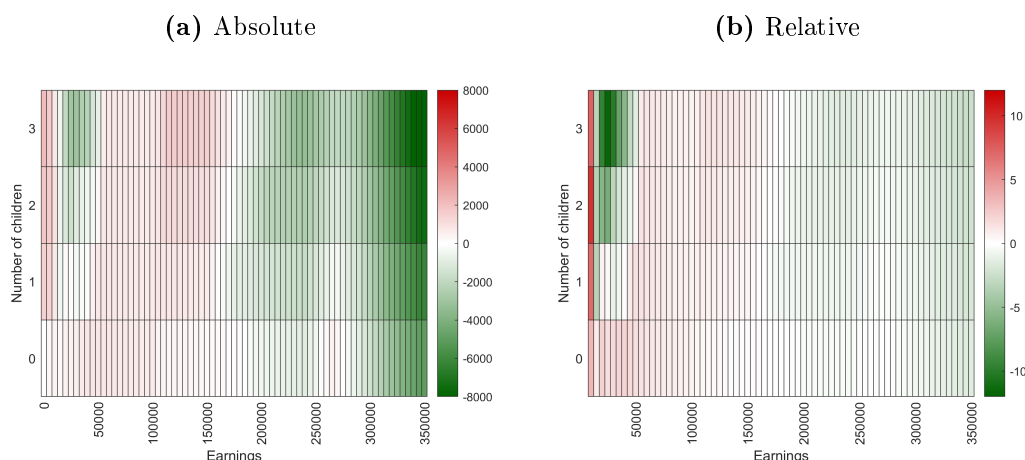
three or more children, which had previously been treated the same as families with two children. The TCJA of 2017 affected the EITC indirectly through the adoption of a more slowly growing chained price index, which implied a small de-facto reduction in the credit.

CTC. The tax-transfer reforms between 2004 and 2019 increased the CTC and its refundable component, the *ACTC*, as shown by the blue line in Figure 3.1(b). The main reforms were the nominal increase from \$1,000 to \$2,000 per child under the TCJA and changes to the phase-in and phase-out regions. Under the ARRA, the earnings minimum required to receive the credit was reduced by nearly 70%, extending eligibility to more low-income families. Under the TCJA, the starting point of the phase-out range was nearly quadrupled, making the full credit available to many more high-income households.⁷⁵

Transfer payments. The gray line in Figure 3.1 shows changes to transfer payments along the income distribution, focusing on *SNAP* and *TANF*. I follow Ortigueira and

⁷⁵The TCJA also introduced a cap for the ACTC and slightly reduced the earnings minimum.

Figure 3.2. Changes in taxes net of transfers from 2004 to 2019



Notes: The figure shows how taxes net of transfers have changed due to tax-transfer reforms between 2004 and 2019 depending on household labor income and the number of children, focusing on married couples filing jointly. Absolute changes are depicted in panel (a) (in 2019-dollars) and relative changes in panel (b) (in percent). Red fields imply an increase in taxes net of transfers, while green fields refer to reductions. For simplicity, I assume households' assets to be zero. Elements considered for the tax-transfer calculation are described in Chapter 3.2.

Siassi (2022) and use the TANF implementation of Delaware. A notable reform in Delaware was the increase in the asset resource limit from \$1,000 to \$10,000 in 2010. The maximum TANF benefit in Delaware declined in real terms because nominal benefits were not adjusted for inflation, reducing transfers to low-income households with children.⁷⁶ SNAP benefits were also temporarily expanded under the ARRA, although these expansions expired after a few years.

The reforms to individual tax-transfer components translate into heterogeneous changes in total taxes net of transfers. Figure 3.2 shows these changes by household earnings and the number of children in the household. To isolate the distributional impact of the reforms, I impose budget neutrality between the two tax years by applying a linear labor income subsidy of about 2.7% in TY 2004, calculated using the life-cycle model described in Chapter 3.4. In absolute terms, high-earning households experience the largest gains, with taxes net of transfers falling by between \$5,000 and 8,000. By contrast, households with low to medium labor income face an increase in taxes paid of approximately \$2,000. In relative terms, the reforms are most favorable to households

⁷⁶Note that it has been common across U.S. states not to automatically adjust TANF benefits for inflation, see Thompson, Azevedo-McCaffrey, and Carr (2023). Some states have increased maximum TANF benefits in context of the Covid recession. Yet, in the time period considered, most states have kept maximum TANF benefits at their nominal values.

with children and earnings between \$K20 and 50, whose gains amount to around 10% of income.

3.3 Empirical Analysis of U.S. Tax-Transfer Progressivity

This chapter quantifies the evolution of tax-transfer progressivity from 2004 to 2019 and decomposes this evolution along three dimensions: active policy reforms versus passive changes in progressivity, reforms to specific elements of the tax-transfer system, and heterogeneity across population groups. Chapter 3.3.1 presents the empirical approach. Chapter 3.3.2 describes the sample and variable construction. Chapter 3.3.3 reports the results.

3.3.1 Estimation Approach

Following related studies, e.g., Heathcote, Storesletten, and Violante (2020) or Wu (2021), I estimate an approximated tax-transfer function à la Bénabou (2000),

$$\mathcal{T}_t(Y_t) = Y_t - (1 - \chi_t) \cdot Y_t^{1-\tau_t}, \quad (3.1)$$

where t denotes the tax year, Y is pre-government (gross) income, $\mathcal{T}(Y)$ denotes tax liabilities net of transfers, and χ and τ determine the level and progressivity of effective taxation, respectively.⁷⁷ For each tax year t , I estimate χ_t and τ_t by regressing log post-government income on log pre-government income,

$$\log(Y_t - T_t(Y_t, \Xi_t)) = \log(1 - \chi_t) + (1 - \tau_t) \cdot \log(Y_t) + \nu_t, \quad (3.2)$$

where T_t denotes actual taxes net of transfers under the law of tax year t . In the actual tax-transfer system, taxes and transfers depend not only on income but also on additional determinants, collected in Ξ_t . These determinants include the number of children, which affects tax credits, allowances, and transfer payments; household wealth, which matters for asset limits in transfer programs and investment income limits in tax

⁷⁷In Appendix B.3, I summarize main properties of the approximated tax-transfer function and show that the system is progressive if $\tau > 0$. Determining effective tax liabilities as federal taxes minus federal transfers follows Heathcote, Storesletten, and Violante (2020), who use the terms *pre- and post-government income* to highlight the inclusion of transfers. Other previous studies, e.g., Guner, Kaygusuz, and Ventura (2014) or Borella et al. (2023), have concentrated on taxes alone.

credits; and employment status, which matters because some transfer programs impose work requirements.⁷⁸ The residual ν captures deviations between the actual tax-transfer system T_t and its approximation $\mathcal{T}_t$.

Decompositions. The analysis decomposes the evolution of tax-transfer progressivity along three dimensions. First, following related studies such as Dauchy, Navarro-Sanchez, and Seegert (2021), I distinguish between active and passive changes in progressivity. This distinction is useful because progressivity can change either through policy reforms or through changes in the income distribution that move households into parts of the tax-transfer schedule with different degrees of progressivity.⁷⁹ Formally, the estimate of τ_t depends on both the distribution of income and other tax-transfer determinants in year t , represented by the vectors Y_t and Ξ_t , and the tax-transfer system of that year, represented by the function T_t . To isolate the role of each component, I counterfactually hold either Y and Ξ or T fixed while varying the other component. In the baseline exercise, I use the first year of the sample, 2004, as the fixed reference year, i.e., I use $T_t(Y_{2004}, \Xi_{2004})$ or $T_{2004}(Y_t, \Xi_t)$, respectively.⁸⁰

In a second set of decompositions, I construct counterfactual tax-transfer functions T that hold selected elements of the system fixed at their initial, 2004, values. For example, in one counterfactual, I vary only the EITC parameters while keeping all other elements of the system at their 2004 values. This exercise identifies which policy components account for changes in aggregate progressivity.

In a third set of decompositions, I examine how changes in aggregate progressivity translate into effective progressivity for different population groups, for whom different parts of the tax-transfer system may be more or less relevant. To do so, I estimate the progressivity parameter on subsets $\tilde{Y}$ of the income distribution Y . Reforms of specific tax-transfer components may have small effects on aggregate progressivity while being highly consequential for particular groups.

⁷⁸Since I focus on married couples throughout, marital status, which matters for many elements of the tax-transfer system, is not included here. Similarly, age matters for certain transfers, but is not included in Ξ as the empirical analysis considers working-age adults only.

⁷⁹This exercise is not to be mistaken for an identification of the causal effect of the policy reforms as changes in the income distribution include endogenous responses to the tax reforms.

⁸⁰In a robustness check, I fix income and other tax-transfer determinants to their 2013 and 2019 values, i.e., $T_t(Y_{2013}, \Xi_{2013})$ and $T_t(Y_{2019}, \Xi_{2019})$. Table B.6 in Appendix B.4 shows that the results are largely the same.

3.3.2 Data, Sample, and Variable Definitions

I use IPUMS data from the Annual Social and Economic Supplement of the CPS for the years 2004 to 2019. The sample consists of married couples filing jointly with up to three children. I consider working husbands of ages 30 to 57 and apply conventional outlier restrictions. In Appendix B.2, I document the sample selection in detail.

To construct subsamples by husbands' education, I follow Guner, Kaygusuz, and Ventura (2020) and divide the sample into five categories: attended high school without graduating (some high school), completed high school but did not attend college (high school), attended college without earning a degree (some college), obtained an associate's or bachelor's degree (college), and obtained a master, professional, or doctoral degree (college+).

For the regressions, I define pre-government (gross) income Y and taxes net of transfers T , with post-government (net) income given by $Y - T$. Pre-government income is the sum of earned income from employment or self-employment and investment income from interest, dividends, and rent, as reported in the CPS. I aggregate husbands' and wives' incomes to household income. I express income in 2019 dollars using the unchained Consumer Price Index (CPI) and normalize it by average household labor income in 2019.⁸¹

I compute taxes net of transfers from the tax-transfer code using reported total income Y , the number of children $kids$, employment status emp , unearned income, i , and imputed information on whether household assets a fall below the limits relevant for transfer payments. The calculation includes statutory federal income taxes $stat_tax$, payroll taxes $fica$, the earned-income and child tax credits $eitc$ and ctc , and transfers $snap$ and $tanf$.⁸² Formally, when computing taxes net of transfers for tax year t_1 using household information from year t_2 , I calculate

$$T_{t_1}(Y_{t_2}, \Xi_{t_2}) = stat_tax_{t_1}(Y_{t_2}, kids_{t_2}) + fica_{t_1}(Y_{t_2}) - eitc_{t_1}(Y_{t_2}, kids_{t_2}) \\ - ctc_{t_1}(Y_{t_2}, kids_{t_2}) - snap_{t_1}(Y_{t_2}, a_{t_2}) - tanf_{t_1}(Y_{t_2}, emp_{t_2}, a_{t_2}).$$

⁸¹Thus, χ_t refers to the average tax rate for households with this amount of real income in year t , also see Appendix B.3.

⁸²I also account for the payroll taxes paid by self-employed persons, i.e., Self-Employment Contribution Act (SECA) taxes. Yet, I do not account for temporary credits, i.e., the Making Work Pay (MWP) credit. In Figure B.5, panel (a) in the Appendix, I present estimates in which I include the credit for the calculation of post-government income. Results are similar but somewhat less visible due to the effects of transitory reforms.

Table 3.1. Sample means for selected years

	2004	2006	2009	2013	2019
No. of households (thousands)	17.2	16.5	15.4	14.0	10.5
Some high school (%)	7.6	7.7	6.7	6.5	5.2
High school (%)	27.7	27.2	26.7	24.7	21.4
Some College (%)	16.2	15.8	15.8	14.6	12.7
College (%)	34.3	34.1	35.3	36.6	40.4
College + (%)	14.3	15.2	15.5	17.5	20.3
Household earned inc. from employment (\$K 2019)	117.5	120.6	117.9	115.9	134.6
Household earned inc. from self-employment (\$K 2019)	1.6	1.7	0.9	1.0	1.1
Household investment income (\$K 2019)	3.8	4.5	3.3	4.3	9.2
Taxes net of transfers (\$K 2019)	24.5	25.9	23.9	24.4	27.4
Statutory taxes (\$K 2019)	18.2	19.4	18.3	17.9	21.0
FICA taxes (\$K 2019)	8.1	8.2	8.1	8.2	9.4
SNAP eligibility (%)	1.2	1.2	2.1	2.6	1.2
TANF eligibility (%)	0.2	0.1	0.2	0.2	0.1
EITC eligibility (%)	9.6	9.7	13.1	13.3	9.4
CTC eligibility (%)	66.2	63.9	61.5	57.9	73.2
SNAP amount (\$K 2019, if eligible)	3.6	3.6	5.4	4.6	3.1
TANF amount (\$K 2019, if eligible)	4.2	4.6	4.5	3.4	3.3
EITC amount (\$K 2019, if eligible)	2.7	2.6	3.0	3.0	3.0
CTC amount (\$K 2019, if eligible)	2.3	2.2	2.0	1.9	3.7

Notes: Taxes, transfers, and eligibility according to own calculations based on tax-transfer code and observed tax-transfer determinants Y and Ξ . Calculation of transfer payment only for households who actually received it in the data.

I take the functions `stat_tax`, `fica`, `eitc`, `ctc`, `snap`, and `tanf`, from the laws and regulations that apply in the respective tax year; see Appendix B.1 for an overview.

Computing transfer payments requires identifying households that pass asset tests, but the CPS does not report household wealth. The CPS does, however, report whether a household actually declared to receive these transfers. I therefore infer that transfer recipients passed the relevant asset tests and compute transfer benefits only for households that report to receive the respective transfer in the data.⁸³

Sample means. Table 3.1 reports sample means for selected years. The sample initially contains about 17 thousand households and declines over time. Husbands in the sample become more educated in later years. Household earned and unearned income fall during the financial crisis and its aftermath and then increase through 2019. Households

⁸³ As a robustness check, I additionally calculate transfer payments without applying any form of wealth test. Figure B.5, panel (b) presents the results. Overall progressivity is higher if more people benefit from transfer payments. Yet, the evolution of progressivity is similar to my baseline analysis.

effectively pay about one fifth of their income in taxes net of transfers, with somewhat lower rates after the tax cuts during the Trump presidency. About one third of effective taxes are social security taxes. Relatively few households are eligible for transfer payments, although eligible households may receive sizable amounts.⁸⁴ Eligibility for the EITC and CTC is more common, and eligible households receive combined credits between four and seven thousand dollars, with larger amounts in more recent years.

3.3.3 Results

I begin with the specification that estimates the parameters using observed pre-government income and post-government income computed under the tax-transfer system in place in the same year. Averaging across yearly estimates gives 19.2% for χ and 16.9% for τ . These estimates imply, first, that a household with average 2019 employment income keeps about 81% of this income and, second, that a ten percent increase in pre-government income is associated, on average, with an 8.3% increase in post-government income. The implied average income-weighted marginal tax rate is 32.6%.⁸⁵ These estimates are in line with the literature. For example, Heathcote, Storesletten, and Violante (2020) find a progressivity parameter of 18.6% for the period 2012–2016 when including similar tax-transfer elements.⁸⁶

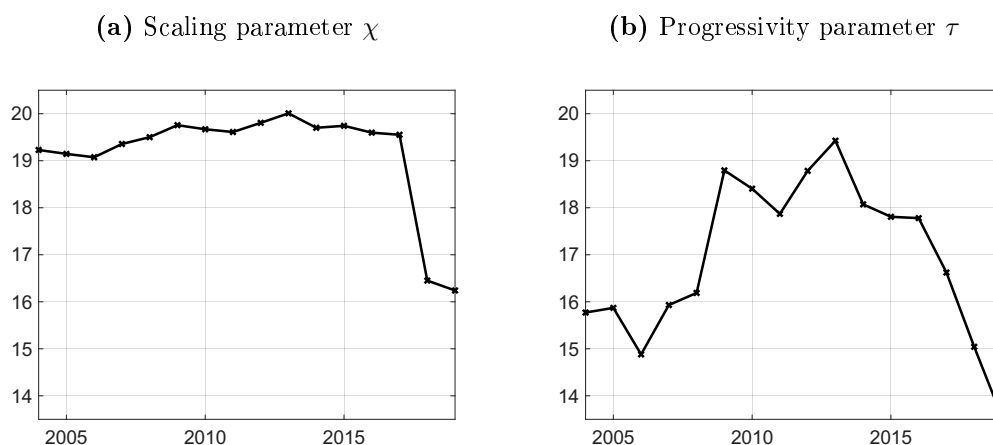
Panel (a) of Figure 3.3 shows the yearly estimates of χ . Tax rates for the average household are relatively stable over most of the sample period, with the main exception being the sharp decline between 2017 and 2018 following the TCJA. By contrast, the ARRA of 2009 had little effect on the tax liabilities of the average household. Panel (b) of Figure 3.3 presents the estimates of the progressivity parameter τ . Overall progressivity is 15.8% in 2004. It then tends to rise, reaching a peak of 19.4% in 2013. The

⁸⁴In Appendix B.2, I compare the relatively low shares found in this study to the study by Guner, Rauh, and Ventura (2026). The comparison confirms that married couples exhibit relatively low rates of transfer recipients. Deviations to their study can be attributed to different data sources and samples considered.

⁸⁵It can be shown that the average income-weighted marginal tax rate is $1 - (1 - \tau) \cdot (1 - g)$, where g measures government spending for consumption and investment relative to GDP, see Heathcote, Storesletten, and Violante (2017) or Heathcote, Storesletten, and Violante (2020). In Appendix B.3, I explain this relationship in detail. The reported marginal tax rate is calculated based on $g = 0.189$, which is the average government spending share between 2004 and 2019, taken from the U.S. Bureau of Economic Analysis (2025).

⁸⁶A direct comparison to the literature is difficult, since the estimated parameters depend on the definitions of pre- and post-government income, the estimation sample, the individual tax-transfer elements included, and the economic conditions in specific years, see also Heathcote, Storesletten, and Violante (2020). The scaling parameter depends additionally on the normalization of income.

Figure 3.3. Overall level and progressivity of taxes net of transfers



Notes: Results of year-by-year estimations of Equation (3.2), full sample. Numbers are given in %.

sharpest increase occurs between 2008 and 2009, when overall progressivity rises by almost three percentage points.⁸⁷ Progressivity subsequently declines, especially after 2016, and reaches a sample-period low of 13.6% in 2019.

Decompositions. I now decompose the documented changes in overall progressivity.

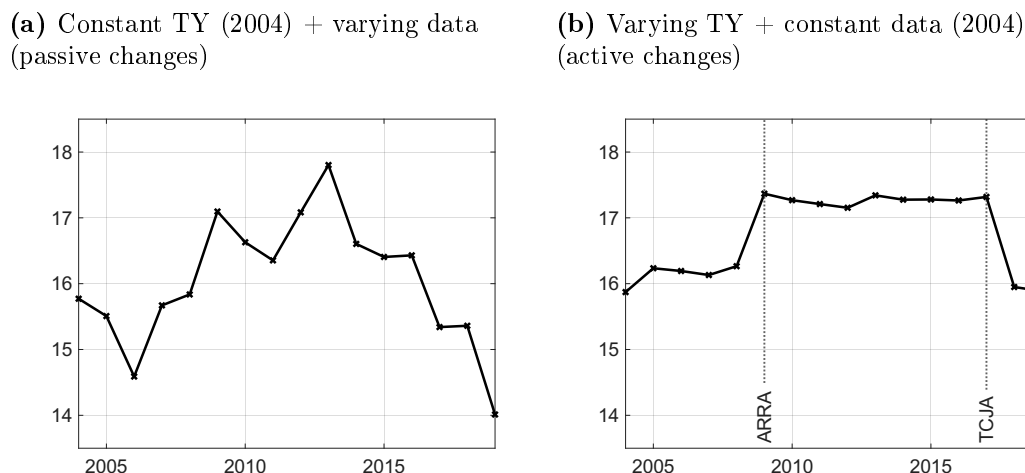
Active and passive changes in progressivity. The first decomposition asks how much of the variation in overall progressivity is due to changes in the income distribution and other tax-transfer determinants (panel a of Figure 3.4) and how much is due to active tax-transfer reforms (panel b of Figure 3.4).⁸⁸

The decomposition shows that much of the variation in overall progressivity reflects changes in the distribution of income and other tax-transfer determinants. When the tax-transfer system is held fixed at its 2004 rules while the distributions of Y and Ξ vary over time, the estimates reproduce a substantial part of the rise in progressivity until 2013 and its subsequent decline. When instead only active policy reforms are allowed to vary, overall progressivity is less volatile. This perspective nevertheless reveals two clear reform effects. Progressivity increases by about 1.1 pp. around the ARRA and falls by a similar amount around the TCJA. Between these major reforms, progressivity

⁸⁷Recent literature also finds rising overall progressivity between 2008 and 2009 with the tendency of returning to pre-recession levels thereafter. For instance, Wu (2021) argues that the rise is only temporary due to the aggregate shock and the high unemployment rate in 2009. Heathcote, Storesletten, and Violante (2020) concur that overall progressivity is higher in times of recession due to a higher share of low-income households.

⁸⁸Figure B.4 in the Appendix repeats the same exercise for the scaling parameter.

Figure 3.4. Decomposition of the progressivity parameter τ



Notes: Estimated slope coefficients in regressions of log predicted post-government income on log pre-government income. Left panel: dependent variable is $\log(Y_t - T_{2004}(Y_t, \Xi_t))$, independent variable is $\log(Y_t)$. Right panel: dependent variable is $\log(Y_{2004} - T_t(Y_{2004}, \Xi_{2004}))$, independent variable is $\log(Y_{2004})$. Numbers are given in percent.

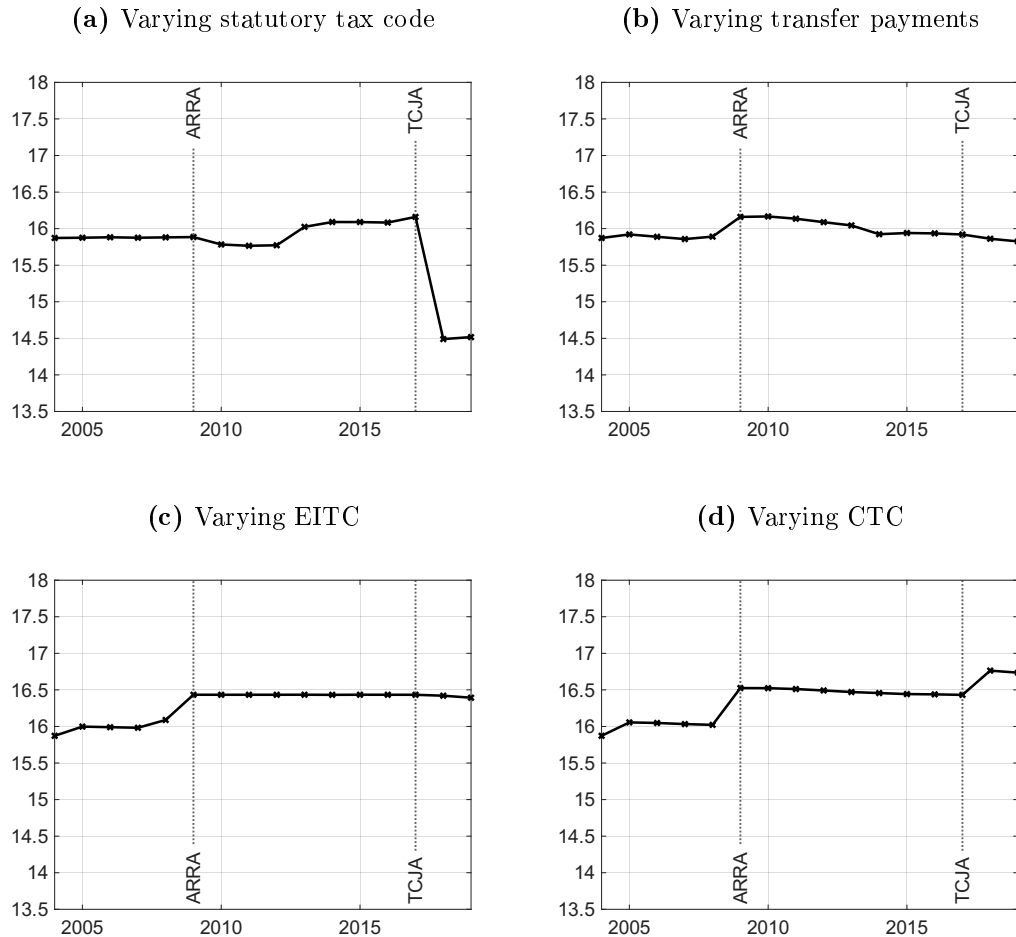
is nearly constant in the right panel; the remaining variation reflects smaller reforms, such as the introduction of the seventh marginal tax rate in 2013, and differences in the inflation adjustment of individual elements of the system.

Specific elements of the tax-transfer system. Figure 3.5 decomposes the active changes in panel (b) of Figure 3.4 into the contributions of reforms to specific tax-transfer components. The increase in progressivity around the ARRA of 2009, about 1.1 pp., is driven by reforms to transfer payments and tax credits; see panels (b) to (d) of Figure 3.5. The largest contribution comes from expanding the CTC to more low-income households, which raises overall progressivity by about 0.6 pp. EITC reforms raise progressivity by about 0.4 pp., and increased SNAP transfers add another 0.2 pp.

Under the TCJA of 2017, progressivity falls back to its pre-ARRA level. This decline does not reflect a reversal of the ARRA-era expansions of tax credits and transfer payments. Instead, it is driven by reductions in marginal tax rates. Panel (a) of Figure 3.5 shows that these statutory tax changes reduce overall progressivity by slightly more than the total TCJA-induced decline of 1.4 pp. This effect is partly offset by a small increase in progressivity due to the expansion of the child tax credit.⁸⁹

⁸⁹Splinter (2020) or Kallen and Mathur (2021) examine changes in progressivity in context of the TCJA. They explicitly account for household size by using equivalence scales within their analysis. They find increased levels of progressivity after the TCJA driven primarily by the expansions in

Figure 3.5. Estimates for the progressivity parameter τ ;
Constant data (2004) + constant TY (2004) + one element varying over time



Notes: Estimated slope coefficients in regressions of log predicted post-government income on log pre-government income. Independent variable is $\log(Y_{2004})$ in all panels. Dependent variable is $\text{stat_tax}_t(Y_{2004}, \text{kids}_{2004}) + \text{fica}_t(Y_{2004}) - \text{eitc}_{2004}(Y_{2004}, \text{kids}_{2004}) - \text{ctc}_{2004}(Y_{2004}, \text{kids}_{2004}) - \text{snap}_{2004}(Y_{2004}, a_{2004}) - \text{tanf}_{2004}(Y_{2004}, \text{emp}_{2004}, a_{2004})$ in panel (a), $\text{stat_tax}_{2004}(Y_{2004}, \text{kids}_{2004}) + \text{fica}_{2004}(Y_{2004}) - \text{eitc}_{2004}(Y_{2004}, \text{kids}_{2004}) - \text{ctc}_{2004}(Y_{2004}, \text{kids}_{2004}) - \text{snap}_t(Y_{2004}, a_{2004}) - \text{tanf}_t(Y_{2004}, \text{emp}_{2004}, a_{2004})$ in panel (b), $\text{stat_tax}_{2004}(Y_{2004}, \text{kids}_{2004}) + \text{fica}_{2004}(Y_{2004}) - \text{eitc}_t(Y_{2004}, \text{kids}_{2004}) - \text{ctc}_{2004}(Y_{2004}, \text{kids}_{2004}) - \text{snap}_{2004}(Y_{2004}, a_{2004}) - \text{tanf}_{2004}(Y_{2004}, \text{emp}_{2004}, a_{2004})$ in panel (c), and $\text{stat_tax}_{2004}(Y_{2004}, \text{kids}_{2004}) + \text{fica}_{2004}(Y_{2004}) - \text{eitc}_{2004}(Y_{2004}, \text{kids}_{2004}) - \text{ctc}_t(Y_{2004}, \text{kids}_{2004}) - \text{snap}_{2004}(Y_{2004}, a_{2004}) - \text{tanf}_{2004}(Y_{2004}, \text{emp}_{2004}, a_{2004})$ in panel (d). Numbers are reported in percent.

Viewed through aggregate progressivity, the 2004–2008 tax-transfer system and the 2018–2019 system appear very similar; see panel (b) of Figure 3.4. Yet this aggregate similarity masks important institutional differences. The reforms expanded tax credits

the CTC. In Table B.7 in Appendix B.4, I present estimates by number of children living in the household, showing that progressivity has risen in households with two or three children, while it decreased in other groups, particularly so for households without children. This finding is in line with the results from the literature.

Table 3.2. Progressivity by education type

Education group	TY 2004 (%)	TY 2019 (%)	Difference (pp.)
All	15.9	15.9	+0.0
Some high school (8%)	22.8	24.6	+1.9
High school (28%)	18.7	19.3	+0.5
Some College (16%)	14.9	15.0	+0.1
College (34%)	14.0	13.4	-0.6
College+ (14%)	12.4	11.6	-0.8

Notes: Estimated slope coefficients in regressions of log predicted post-government income on log pre-government income for the whole sample and for subsamples by education group of the husband. Dependent variable is $\log(Y_{2004} - T_t(Y_{2004}, \Xi_{2004}))$ for $t \in \{2004, 2019\}$, independent variable is $\log(Y_{2004})$. Numbers in parentheses give 2004 sample shares.

Table 3.3. Decomposition of changes in progressivity by education group and tax-transfer element, 2004 to 2019.

Education group	Tax-Transfer element				
	All	Statutory taxes	Transfers	EITC	CTC
All	+0.0	-1.4	-0.0	+0.5	+0.9
Some high school (8%)	+1.9	-0.6	-0.2	+0.8	+1.8
High school (28%)	+0.5	-1.2	-0.1	+0.7	+1.1
Some College (16%)	+0.1	-1.4	-0.0	+0.5	+0.9
College (34%)	-0.6	-1.6	-0.0	+0.4	+0.5
College+ (14%)	-0.8	-1.5	-0.0	+0.2	+0.5

Notes: Difference (in pp.) in estimated slope coefficients between TY 2004 and TY 2019 in regressions of log predicted post-government income on log pre-government income for the whole sample and for subsamples by education group of the husband. The independent variable is $\log(Y_{2004})$. The dependent variable in the first column is $\log(Y_{2004} - T_t(Y_{2004}, \Xi_{2004}))$ for $t \in \{2004, 2019\}$. Dependent variables in columns 2 - 5 are defined in the description of Figure 3.5. Numbers in parentheses give 2004 sample shares.

while lowering tax rates, and these changes offset each other in their aggregate effect on progressivity. Because they operate through different parts of the tax-transfer schedule, however, they may have substantially different effects across population groups.

Education groups. Table 3.2 reports results by education group, with the first row repeating the full-sample estimate. As before, I hold the distribution of income and other tax-transfer determinants fixed at their 2004 values. For the full sample, active policy changes between 2004 and 2019 have virtually no net effect on progressivity. Across education groups, however, the effects are more pronounced. Progressivity increases by almost 2 pp. among high-school dropouts and also rises for high-school graduates. By contrast, progressivity falls for households with college or advanced degrees.

Group-by-element perspective. As a final decomposition, I examine how reforms to specific elements of the system affected each education group. Table 3.3 decomposes the progressivity changes in the rightmost column of Table 3.2 into the contributions of the reformed tax-transfer elements. Changes to statutory tax rates reduce progressivity for all education groups, with the largest declines among more highly educated households. Tax-credit expansions have the opposite effect: they increase progressivity for all groups, with the largest effects among the less educated. Changes in transfer rules have only minor effects on progressivity for households without college education.

3.4 Model

The empirical analysis shows that overall tax-transfer progressivity is similar in TY 2004 and TY 2019, but that the underlying reforms changed incentives differently across the income distribution. I therefore use a partial-equilibrium life-cycle model of married couples to study how these reforms affect household labor supply, saving, consumption insurance, and welfare. I solve the model separately under the TY 2004 and TY 2019 tax-transfer systems.

Demographics. I consider opposite-sex married couples of the same age, with gender denoted by $g \in \{m, f\}$. A period, t , corresponds to one year. The life cycle consists of a working stage, from period 1 to $R - 1$, and a retirement stage, from period R to the final period T . Households differ ex ante by the education type of the husband, $j \in \{\text{Some HS}=1, \text{HS}=2, \text{Some Col}=3, \text{Col}=4, \text{Col}+=5\}$, and enter the model without children, k .⁹⁰ During working age, up to three children may enter and leave the household one at a time according to a first-order Markov process. Transition probabilities depend on age, education, and the number of children in the previous period.

Wages. During working age, market work by spouse g is remunerated at wage rate w_{gt} ,

$$\begin{aligned}\ln w_{gt} &= \ell_{gt} + z_{gt} + \varepsilon_{gt} \\ z_{gt} &= z_{gt-1} + \nu_{gt},\end{aligned}$$

⁹⁰I consider the same education groups as in the empirical analysis in Chapter 3.3.

where ε_{gt} is a transitory component, z_{gt} is a permanent component, and ℓ_{gt} is a deterministic life-cycle component. The permanent component follows a unit-root process. For each shock $x \in \{\nu, \varepsilon\}$,

$$\begin{bmatrix} x_{mt} \\ x_{ft} \end{bmatrix} \sim \text{i.i.d. } N \left(0, \begin{bmatrix} \sigma_{x_m,j}^2 & \sigma_{x_m,j,x_f,j} \\ \sigma_{x_m,j,x_f,j} & \sigma_{x_f,j}^2 \end{bmatrix} \right),$$

with mean zero. Shocks may be correlated across spouses but are independent across shock types and over time. Their variances and covariances depend on the household's education type. Given wage rates, household labor income in period t is

$$e_t = w_m n_{mt} + w_f n_{ft}.$$

Asset markets. Households enter the model without wealth. They have access to a non-state-contingent asset that pays the risk-free interest rate r . Borrowing is subject to a limit $\underline{a}_{j,t}$, which depends on the husband's education type and on age. Given the interest rate, income from capital investment is

$$i_t = r a_t.$$

Gross income. Household gross income is the sum of labor income during working age, e_t , income from short-term capital investment, i_t , and pension income during retirement, b_t :

$$y_t = e_t + i_t + b_t(z_{mR-1}, z_{fR-1}, \ell_{m,R-1}, \ell_{f,R-1}).$$

Pensions depend on each spouse's permanent wage component and deterministic life-cycle wage component in the last period before retirement.

Tax liabilities and transfer payments. Households are subject to taxes and transfers during both working age and retirement. Following the empirical analysis in Chapter 3.3, I model statutory federal income taxes, payroll taxes, the EITC, the CTC, and transfers. All elements depend on the tax year, TY . Payroll taxes, $T^p(e_t, TY)$, depend further on earnings and income tax liabilities, $T(e_t, i_t, b_t, k_t, TY)$, on labor income, in-

come from short-term capital investment, pensions, and the number of children.⁹¹ Tax credits consist of the EITC, $Cr^{eitc}(e, i, k, TY)$, and the CTC, $Cr^{ctc}(e, i, k, TY)$, including its refundable component, the ACTC. Both credits depend on earnings, income from short-term capital investment, and the number of children. Households may also receive transfer payments, $Tr(e_t, i_t, b_t, a_t, k_t, n_{ft}, TY)$, consisting of SNAP and TANF benefits. These transfers depend on labor and investment income, pensions, assets, the wife's labor-supply decision, the number of children, and the tax year.⁹² Finally, I include an additional linear tax rate on labor income, $\tau(TY)$, to impose budget neutrality across the two tax years.

Taxes net of transfers, tt_t , are

$$tt_t = T^p(e_t, TY) + [T(e_t, i_t, b_t, k_t, TY) - Cr^{eitc}(e_t, i_t, k_t, TY) - Cr^{ctc}(e_t, i_t, k_t, TY)] - Tr(e_t, i_t, b_t, a_t, k_t, n_{ft}, TY) + \tau(TY) \cdot e_t.$$

3.4.1 Maximization Problem

Households have additively separable preferences over consumption and spouses' labor supply:

$$u_j(c_t, n_{mt}, n_{ft}) = \frac{c_t^{1-\sigma}}{1-\sigma} - \psi_{m,j} \cdot \frac{n_{mt}^{1+1/\eta_m}}{1+1/\eta_m} - \psi_{f,j} \cdot \frac{n_{ft}^{1+1/\eta_f}}{1+1/\eta_f} - \mathbf{1}_{(n_{ft}>0)} f_j, \quad (3.3)$$

where c_t is household-public consumption, n_{mt} and n_{ft} are spouses' labor supplies during working age, and $\mathbf{1}_{(n_{ft}>0)}$ is an indicator equal to one if the wife participates in the labor market in working period t . Households discount future utility with discount factor β .

During working age, the household's state vector is $\Omega = (z_m, z_f, \epsilon_m, \epsilon_f, a, k)$ and the choice vector is $\Xi = (c, n_m, n_f, a')$. During retirement, spouses no longer work and derive utility only from joint consumption. The retirement state vector is $\Omega = (z_{m,R-1}, z_{f,R-1}, a)$ and the choice vector is $\Xi = (c, a')$.

⁹¹ Appendix B.1 provides the exact definitions of income taxes, Eq.(B.1); payroll taxes, Eq.(B.2); the EITC, Eq.(B.3); the CTC, Eq.(B.4); and transfers, Eq.(B.6).

⁹² Actual TANF benefits in Delaware depend on the number of workers in the households. In the model, the wife is the only member of the household with an extensive margin labor supply decision. Therefore, transfer payments in the model depend on the labor supply decision of the wife; see also Appendix B.1 for more details.

The household's maximization problem is

$$V_j(\Omega, t, TY) = \max_{\Xi_j} u_j(c, n_m, n_f) + \beta \cdot \mathbb{E}[V_j(\Omega', t+1, TY)]$$

subject to

$$\begin{aligned} c + a' &= y^{post} + a, \\ y^{post} &= y - tt, \\ y &= e + i + b, \\ e &= w_m n_m + w_f n_f, \\ i &= r \cdot a, \\ b &= b(z_{m,R-1}, z_{f,R-1}, \ell_{m,R-1}, \ell_{f,R-1}), \\ tt &= T^p(e, TY) + [T(e, i, b, k, TY) - Cr^{etic}(e, i, k, TY) - Cr^{ctc}(e, i, k, TY)] \\ &\quad - Tr(e, i, b, a, k, n_{ft}, TY) + \tau(TY) \cdot e, \\ a' &\geq \underline{a'}, \text{ and} \\ c &\geq Tr^{snap}(e, i, b, a, k), \end{aligned}$$

where the last restriction ensures that SNAP benefits are used for consumption.

3.4.2 Parameterization

Externally set parameters. The model has $T = 60$ annual periods. The first period, $t = 1$, corresponds to age 21, so agents die with certainty at age 80. Retirement begins at age 66, corresponding to model period $R = 46$.

I calculate taxes, transfers, and pensions under the rules for TY 2004 and TY 2019, with all nominal parameters converted to 2019 dollars. Appendix B.1 summarizes the relevant parameters, data sources, and formulas.

The risk-free real interest rate, r , is set to 2%. To calculate education-specific borrowing limits in the first model period, I follow the strategy in Kaplan and Violante (2014) and use data from the SCF.⁹³ The resulting limits range from five to fifteen thousand

⁹³The borrowing limit in the first model period is set such that the average discounted borrowing limit for households aged 30-57 matches the median ratio of reported credit limit relative to labor income of 12.5%.

Table 3.4. Overview of model parameters

Parameter	Symbol	Education group					Source
	j	1 (5.2)	2 (21.5)	3 (12.7)	4 (40.4)	5 (20.3)	
(Share in %)							
Asset markets							
Interest rate	r			0.020			WK (2021)
Borrowing limit	$\underline{a}_j$	-0.034	-0.054	-0.063	-0.084	-0.115	KV (2014)
Preferences							
Labor disutility, men	ψ_{mj}	6.043	4.259	4.061	3.024	1.858	calibrated
Labor disutility, women	ψ_{fj}	6.155	3.199	3.330	1.445	0.941	
Utility loss LFP, women	f_j	0.336	0.161	0.083	0.050	0.048	
Discount factor	β			0.974			
Relative risk aversion	σ			1.730			BPS (2016)
Frisch elasticity, men	η_m			0.528			
Frisch elasticity, women	η_f			0.850			
Government							
Pension, scaling parameter	s			0.675			calibrated
Linear tax rate 2004	τ			-0.027			calibrated

dollars, depending on education; see Table 3.4. Borrowing limits in subsequent periods evolve according to

$$\underline{a}_{j,t+1} = (1 + r) \cdot \underline{a}_{j,t}.$$

For household preferences, I follow Blundell, Pistaferri, and Saporta-Eksten (2016) and set relative risk aversion to $\sigma = 1.730$, the Frisch labor-supply elasticity of men to $\eta_m = 0.528$, and the Frisch labor-supply elasticity of women to $\eta_f = 0.85$. Spouses choose labor supply from discrete choice sets.⁹⁴

Estimated parameters. I estimate education-specific variances and covariances of wage shocks by GMM using PSID data, following Blundell, Pistaferri, and Saporta-Eksten (2016). For the deterministic wage component, I estimate education-specific hourly wages of wives and husbands over the life cycle using a fractional polynomial, following Rupert and Zanella (2015). Appendix B.5 provides details on both estimation procedures and Table B.8 reports the estimated parameters.

⁹⁴I set the options of the husband to $n_m \in \{n_{mi}/x : n_{mi} = 30, 40, 50, 60\}$ and the ones of the wife to $n_f \in \{n_{fi}/x : n_{fi} = 0, 20, 30, 40, 50\}$. The parameter x is calibrated and assures that overall household labor income in the model matches the empirical target of \$134,573, which corresponds to one unit in the model. The resulting value of x is 90.33.

For the child process, I estimate transition probabilities, $\pi(t, j, k)$, so that, for each education-age cell from age 30 to 65, the model matches the CPS share of couples with each number of children; see also Appendix B.5.

Calibrated parameters. I calibrate the TY 2019 model to match moments from 2019. I adapt the estimation strategy of Wu and Krueger (2021), but allow the labor-disutility weights of husbands and wives, $\psi_{m,j}$ and $\psi_{f,j}$, and the fixed participation cost of wives, f_j , to vary by education. The targeted moments are average household labor income, the female-to-male ratio of average hours conditional on working, and the average female non-participation rate. The data moments are computed from the 2019 CPS sample described in Chapter 3.3.2.

Table 3.4 reports the calibrated parameters, and the first column of Table 3.5 reports the corresponding empirical targets. Household labor income ranges from 60 to 195 thousand dollars across education groups. Female non-participation is highest in the *Some HS* group, at 44%, compared with 18–24% in the remaining education groups.

Two calibrated parameters are not education-specific. First, the discount factor, β , is calibrated to match the average net-worth-to-labor-income ratio of 2.81 in the SCF. Second, the pension scaling parameter, s , is calibrated to match the average replacement rate of 27.9% computed from CPS data.⁹⁵

TY 2004. The TY 2004 model uses the same parameter values as the TY 2019 model, except for the tax-transfer rules and the additional linear tax rate on labor income used to impose budget neutrality. I calibrate this tax rate, τ , so that the present discounted value of taxes net of transfers during working age is the same across the two tax years. The resulting value is $\tau = -0.0268$, corresponding to a subsidy of about 2.7% of labor income in TY 2004. In TY 2019, this tax rate is zero.

⁹⁵I follow Wu and Krueger (2021) and calculate the replacement rate as average social security benefits relative to average earnings using data from CPS waves 2000 to 2022. The sample selection is similar to the one discussed above. Yet, to determine social security benefits in the data, I consider couples where both spouses are at least 65 years old. I follow Wu and Krueger (2021) to account for Medicare benefits.

Table 3.5. Empirical targets matched

	Data	Model	
		2019	2004
Average household labor income			
Some HS	0.435	0.433	0.436
HS	0.685	0.685	0.685
Some Col	0.806	0.805	0.806
Col	1.069	1.070	1.070
Col+	1.461	1.461	1.462
Female-male ratio of average labor conditional on working			
Some HS	0.878	0.876	0.868
HS	0.878	0.878	0.875
Some Col	0.864	0.863	0.864
Col	0.876	0.877	0.880
Col+	0.855	0.855	0.856
Average female non-participation rate			
Some HS	0.437	0.437	0.433
HS	0.239	0.239	0.234
Some Col	0.215	0.216	0.216
Col	0.182	0.182	0.187
Col+	0.216	0.216	0.222
Average net worth-to-income ratio	2.810	2.810	2.781
Average replacement rate, age 65+	0.279	0.279	0.263
Mean labor income	1	0.999	0.999

Notes: One unit of income in the model corresponds to \$134,573 in 2019 dollars.

3.4.3 Model Fit

The first two columns of Table 3.5 show that the TY 2019 model closely matches the targeted moments. Table B.9 in the Appendix further shows that the model also performs well on untargeted moments, including the CPS sample means for income, taxes, and transfers reported in Table 3.1.

The largest discrepancy between model and data concerns transfer payments. In particular, the model overstates TANF receipt: 2.7% of households receive TANF in the model, compared with 0.1% in the data. This discrepancy is consistent with low take-up of TANF benefits; see Moffitt, Bottenheim, and Beatty (2023). Explicitly modeling transfer claiming, as in Haan and Prowse (2024) for Germany, would allow the model to target low take-up rates but is beyond the scope of this work. Overall, the model provides a good fit to both targeted and untargeted moments.

The last column of Table 3.5 reports the corresponding moments under TY 2004.⁹⁶ The TY 2004 model is broadly similar to the TY 2019 model, with modest differences such as a lower average net-worth-to-income ratio. The next chapter analyzes these differences and decomposes them into mechanical effects of the tax-transfer reforms and endogenous household responses.

3.5 Model Results

This chapter presents the model results. I distinguish three components of changes in model outcomes: mechanical effects of the tax-transfer reforms between 2004 and 2019 (*due to reforms*), effects induced by households' behavioral adjustments (*due to behavior*), and total changes (*Total*).⁹⁷ Chapter 3.5.1 first reports mechanical changes in average taxes net of transfers and consumption insurance induced by the reforms. Chapter 3.5.2 then describes households' adjustments in assets, labor income, and consumption. Chapter 3.5.3 evaluates the welfare implications, and Chapter 3.5.4 examines heterogeneity by the presence of children in the household.

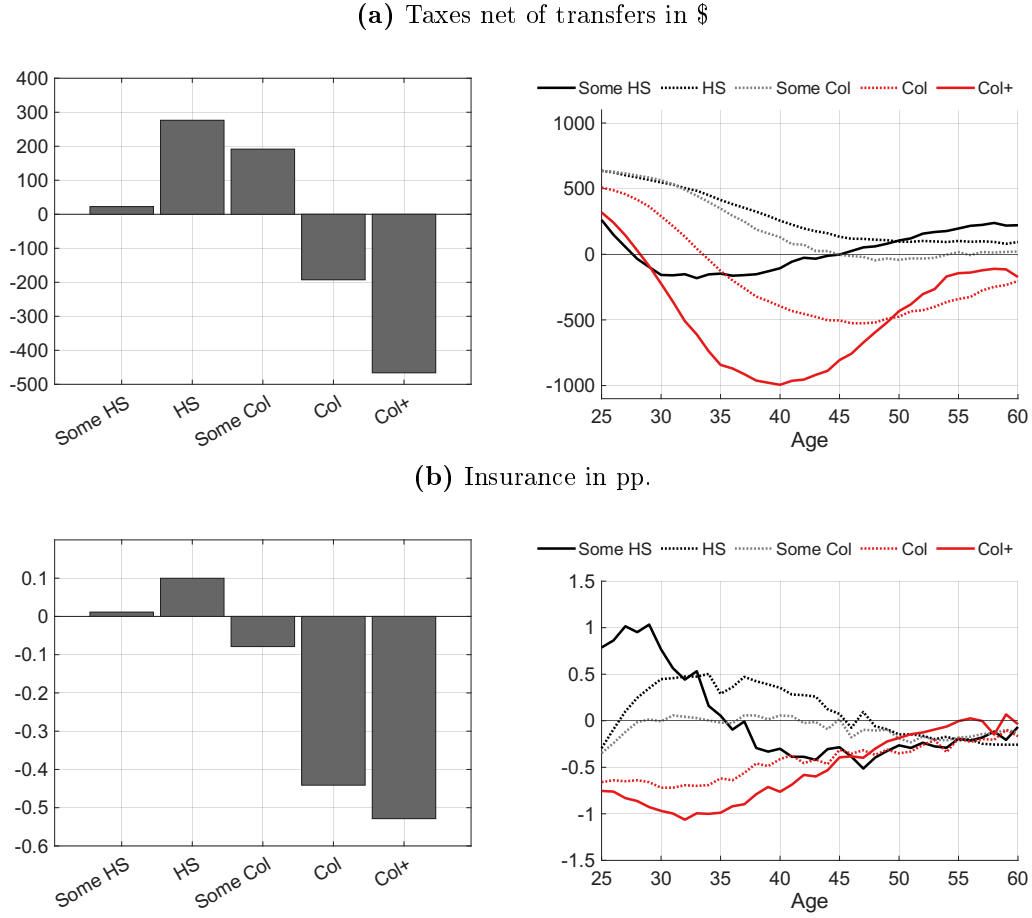
3.5.1 Taxes Net of Transfers and Consumption Insurance

Figure 3.6 reports the mechanical effects of the 2004–2019 tax-transfer reforms, holding households' choices fixed at their TY 2004 policy rules. Panel (a) shows changes in taxes net of transfers, both by education group and over the life cycle. Panel (b) reports the corresponding changes in consumption insurance. Following Wu and Krueger (2021), I measure the pass-through of a permanent wage shock to the husband, ν_{mj} , to household consumption, c_j , from an OLS regression of unexpected consumption growth, Δc_j ,

⁹⁶Table B.10 in the Appendix presents a full picture of 2004-mean values and total changes between 2004 and 2019, decomposed into mechanical responses to the tax-transfer reforms and behavior adjustments.

⁹⁷To do so, I consider three model versions. (1) I solve and simulate the model for TY 2004. (2) I solve the model for TY 2004, but simulate it for TY 2019. Thus, households make choices based on TY 2004, but are then confronted with the 2019 tax system. I adjust household consumption to ensure that the household budget constraint holds. (3) I solve and simulate the model for TY 2019. Comparing model version (2) with version (1) identifies mechanical changes in model outcomes that are *due to reforms*. Comparing model version (3) with version (1) gives total changes in model outcomes (*Total*). The difference between the total effect and the effect due to reforms identifies changes that are *due to behavior* adjustments. A variable x^{04} refers to results from model version (1), $x^{04,19}$ refers to results from model version (2), and x^{19} refers to model version (3).

Figure 3.6. Changes due to tax-transfer reforms between 2004 and 2019



Notes: The figure presents mechanical changes induced by the tax-transfer reforms between 2004 and 2019 in working ages (25-60). Left panels show changes by education type j . Right panels additionally differentiate by age. Panel (a) presents changes in taxes net of transfers in 2019 dollars, i.e., $tt_j^{04,19} - tt_j^{04}$. Panel (b) presents changes in consumption insurance in percentage points, i.e., $\kappa_{c_j, \nu_{mj}}^{04} - \kappa_{c_j, \nu_{mj}}^{04,19}$.

on the wage shocks faced by the household.⁹⁸ Consumption insurance against the husband's permanent wage risk is one minus the transmission coefficient, $\kappa_{c_j, \nu_{mj}}$.

Taxes net of transfers. Panel (a) shows that the reforms reduce taxes net of transfers for households with high educational attainment by up to \$465, while households with low to medium levels of education experience increases of up to \$275. The increase is much smaller for households in the lowest education group: for the *Some HS* group, the average rise is only about one tenth of that for households with medium levels of education. The life-cycle profile in the right panel shows that tax reductions among the

⁹⁸The unexpected growth of consumption is estimated by regressing the log of consumption on age dummies and taking the difference of the residuals.

highly educated (red line) reach roughly \$1,000 around age 40. By contrast, the modest increase in taxes net of transfers for the *Some HS* group (black line) is concentrated at older working ages. At younger working ages, households in this group pay less in taxes net of transfers because they benefit from more generous tax credits when children are present in the household. These patterns are consistent with the distributional analysis in Chapter 3.2: the reforms primarily benefit households at the two ends of the income distribution. Across all households, 73% face higher taxes net of transfers after the reforms, despite the average change being zero by construction.

Consumption insurance. Panel (b) presents the mechanical changes in consumption insurance. The average effects are small, but the cross-education pattern mirrors the progressivity results in Chapter 3.3. Households with less formal education experience a modest increase in consumption insurance, reaching +0.10 pp. among high-school graduates, whereas households with higher educational attainment experience an insurance loss of up to 0.53 pp.⁹⁹ The right panel shows that these education-specific gains and losses are most pronounced at young ages, when households have not yet accumulated substantial buffer-stock wealth. At these ages, insurance gains for less-educated households and insurance losses for highly educated households reach about one percentage point. At older ages, the reform-induced changes in consumption insurance are close to zero.

3.5.2 Choices

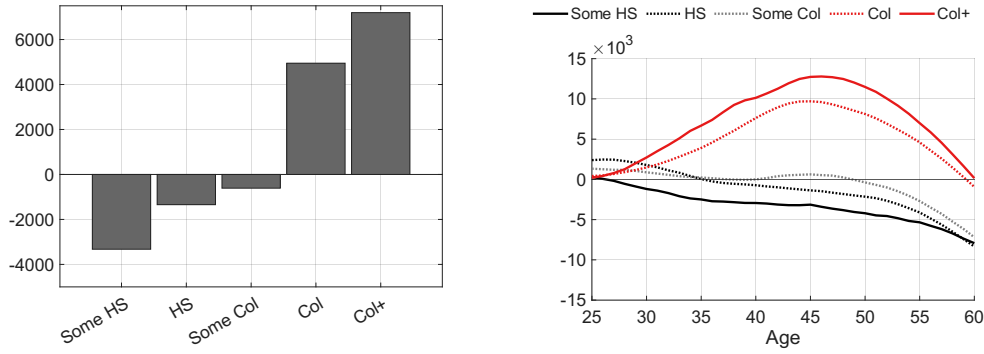
I next examine how households adjust their choices in response to the changes in tax-transfer levels and insurance. Figure 3.7 reports total changes in assets (panel a), labor income (panel b), and consumption (panel c), both by education group (left panels) and over the life cycle (right panels).

Asset accumulation. Households with higher educational attainment accumulate substantially more assets under the 2019 tax-transfer system (red lines in panel a of Figure 3.7). This additional saving mitigates the insurance losses generated by the

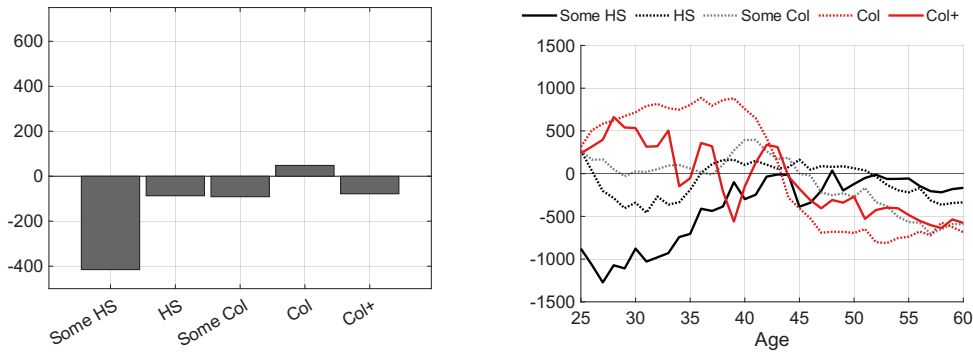
⁹⁹To put this number into perspective, Wu and Krueger (2021) decompose consumption insurance in their model and find that the extensive margin of the secondary earner delivers a small insurance gain of 0.5pp., which is similar to the presented number regarding the insurance loss arising from the tax-transfer reforms between 2004 and 2019 for a household with high educational attainment.

Figure 3.7. Total changes from 2004 to 2019

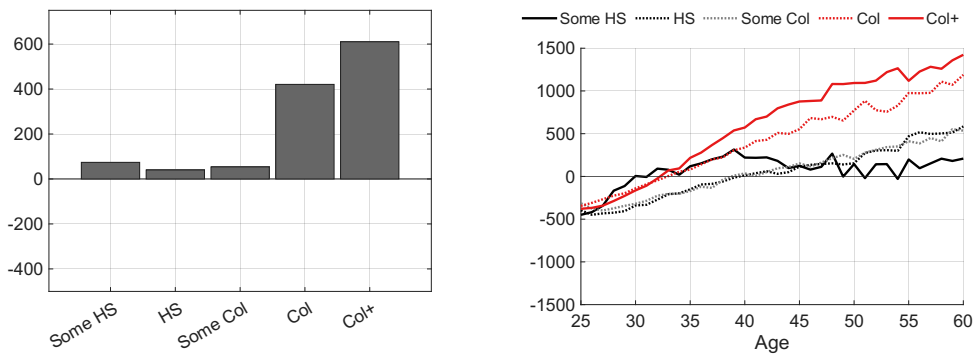
(a) Assets in \$



(b) Labor income in \$



(c) Consumption in \$



Notes: The figure presents total changes in response to the tax-transfer reforms between 2004 and 2019 considering households of ages 25-60. All numbers are given in 2019 dollars. Left panels present changes by education type of the husband, while right panels additionally differentiate by age. Panel (a) focuses on changes in asset holdings, $a_j^{19} - a_j^{04}$. Panel (b) and (c) repeat the exercise, but for household labor income, i.e., $e_j^{19} - e_j^{04}$, and household consumption, i.e., $c_j^{19} - c_j^{04}$, respectively.

reforms.¹⁰⁰ By age 45, wealth in this group is approximately \$13,000 higher under TY 2019 than under TY 2004. Households with low and medium levels of education, in

¹⁰⁰In Figure B.6 in Appendix B.7, I demonstrate that this behavior partially offsets the reduction in consumption insurance caused by the tax-transfer reforms shown in Chapter 3.5.1.

contrast, save less and accumulate fewer assets over the life cycle (black lines in panel a), which helps offset the increase in taxes net of transfers. As asset accumulation rises among highly educated households and falls among less-educated households, the wealth gap across education groups widens by about \$11,000 on average.

Labor income. Among households with high educational attainment, labor income increases at younger working ages as spouses work more in response to lower marginal tax rates. This increase is roughly offset – and for the *Col+* group more than offset – by lower labor income at older ages (red lines in panel b of Figure 3.7). Households with low to medium levels of education adjust labor supply toward regions of the tax-transfer schedule with higher EITC benefits.¹⁰¹ In the *Some HS* group, husbands reduce hours at the intensive margin and wives reduce labor force participation, lowering household labor income by up to \$1,000 per year at young ages. Among households with medium education levels, labor income tends to rise and fall at different stages of the life cycle, leaving aggregate labor income almost unchanged. Overall, the decline in labor income is largest for the *Some HS* group, where it is about 5.3 times as large as the decline for the *Col+* group.

Consumption. All education groups experience higher average consumption under the 2019 tax-transfer system (panel c of Figure 3.7). This is true even for households with low and medium levels of education, despite the mechanical increase in their taxes net of transfers documented in Chapter 3.5.1. The consumption gains are largest among households with high educational attainment: at older working ages, their annual consumption is up to \$1,500 higher, and their average gain is 8.2 times as large as that of less-educated households. The life-cycle profile is important, however. Consumption increases occur only at older working ages. At younger ages, all education groups consume less on average, reflecting higher asset accumulation among the highly educated, lower labor income in the *Some HS* group, and higher taxes net of transfers among households with medium levels of education. Thus, the reforms increase consumption inequality both across education groups and over the life cycle.

¹⁰¹Table B.11 in the Appendix confirms that behavior adjustments of the spouses increase benefits from the EITC, particularly among households with low educational attainment.

3.5.3 Welfare

I now turn to the welfare consequences of the reforms and the associated behavioral adjustments. Following Conesa, Kitao, and Krueger (2009), I measure the welfare change from TY 2004 to TY 2019 using consumption-equivalent variation, CEV ,

$$W((1 + CEV)c^{04}, n_m^{04}, n_f^{04}) = W(c^{19}, n_m^{19}, n_f^{19}), \quad (3.4)$$

where $(c^{04}, n_m^{04}, n_f^{04})$ denotes the allocation of consumption and labor supply under TY 2004, and $(c^{19}, n_m^{19}, n_f^{19})$ the allocation under TY 2019. The CEV is the percentage change in lifetime consumption under TY 2004 required to make the household indifferent between the two tax years. Positive values imply welfare gains; negative values imply welfare losses.

I report two decompositions. First, following Conesa, Kitao, and Krueger (2009), I decompose the total welfare change into the contribution of adjusted hours and the contribution of consumption, separating changes in the consumption level from changes in the consumption distribution.¹⁰² Second, I decompose the total welfare change into the mechanical effect of the tax-transfer reforms and the effect of behavioral adjustments.¹⁰³

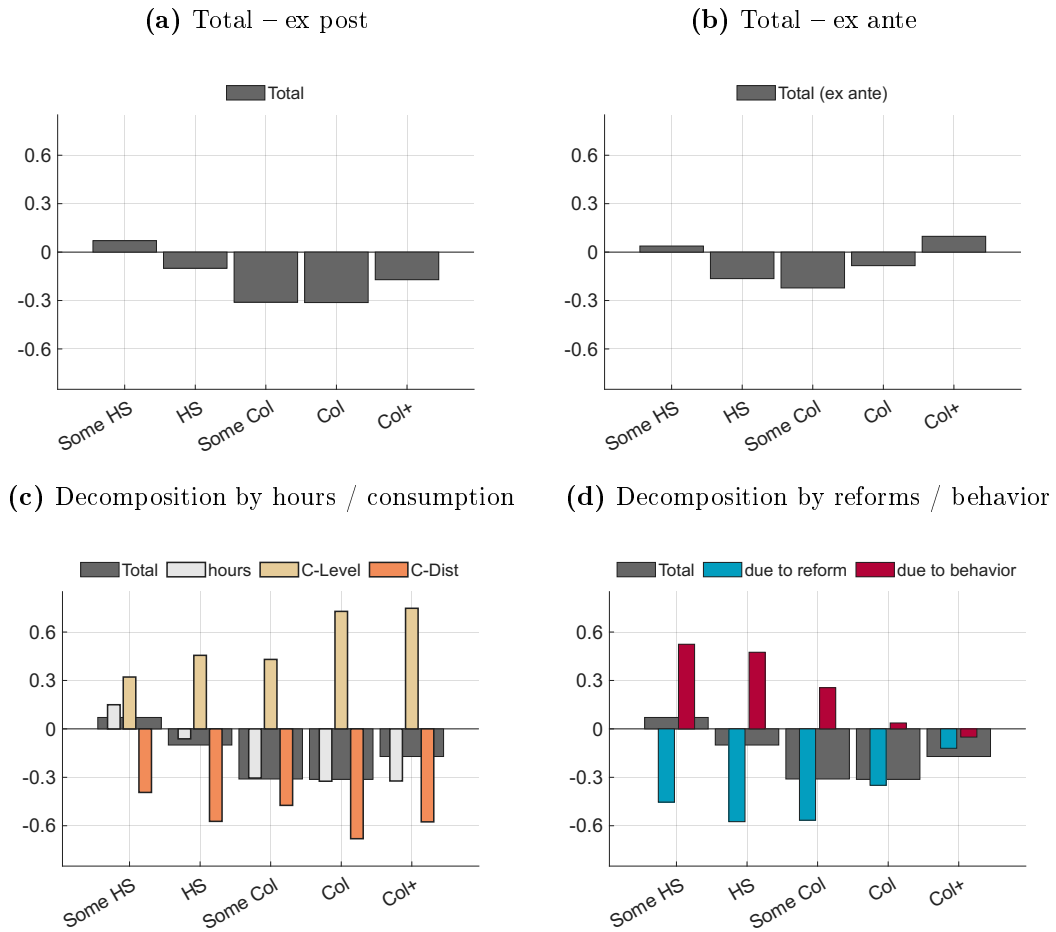
Ex-post results. The dark gray bars in panel (a) of Figure 3.8 show the total ex-post welfare change by education group, incorporating both the reforms and households' adjusted choices. Aggregate welfare falls by 0.21%. Losses are largest for households with medium to high levels of education, at about 0.3%. The *Some HS* group is the only group with a positive welfare effect, although the gain is modest at 0.07%.

Ex-ante results. Panel (a) measures ex-post welfare changes for currently living couples, based on their realized histories. Panel (b) instead reports ex-ante welfare changes from the perspective of a newborn household that has not yet realized wage shocks or the number of children. The ex-ante results broadly resemble the ex-post patterns, but losses are smaller for households with high educational attainment. For the *Col +*

¹⁰² Appendix B.6 presents further details on these decompositions.

¹⁰³ To identify the welfare change due to reforms, I solve Equation (3.4) with the allocation $(c^{04,19}, n_m^{04,19}, n_f^{04,19})$ on the right hand side, i.e., the model version in which agents make decisions based on TY 2004, but are then confronted with the 2019 tax system: $W((1 + CEV^{reform})c^{04}, n_m^{04}, n_f^{04}) = W(c^{04,19}, n_m^{04,19}, n_f^{04,19})$.

Figure 3.8. Welfare change



Notes: All changes are given in percent. Welfare as measured in consumption-equivalent variation following Conesa, Kitao, and Krueger (2009) as described in Appendix B.6. Panel (a) presents ex-post welfare changes by education types, based on actual consumption and hours allocations. Panel (b) presents ex-ante welfare changes by a newborn for each education type. Panel (c) decomposes ex-post welfare changes presented in panel (a) into the effects of hours (white bars) and consumption (level and distribution, orange bars). Panel (d) decomposes ex-post welfare changes into the mechanical effect of the reforms (blue bars) and the result of behavior adjustments (red bars).

group, the ex-ante effect is slightly positive, suggesting that these households expect the 2019 system to be more favorable ex ante, even though realized states in the simulated economy receive less insurance and therefore generate ex-post welfare losses.

Contribution of consumption and hours. Panel (c) decomposes the ex-post welfare changes from panel (a) into the contributions of hours, the consumption level, and the consumption distribution. Two opposing forces emerge. Higher average consumption raises welfare for all education groups, with the largest gains among the highly educated. At the same time, higher within-group consumption inequality lowers welfare in

every group, again most strongly among households with high educational attainment. The *Col+* group is the only group for which the welfare gains from higher average consumption exceed the losses from greater consumption inequality. In all other groups, the two consumption components roughly offset each other.

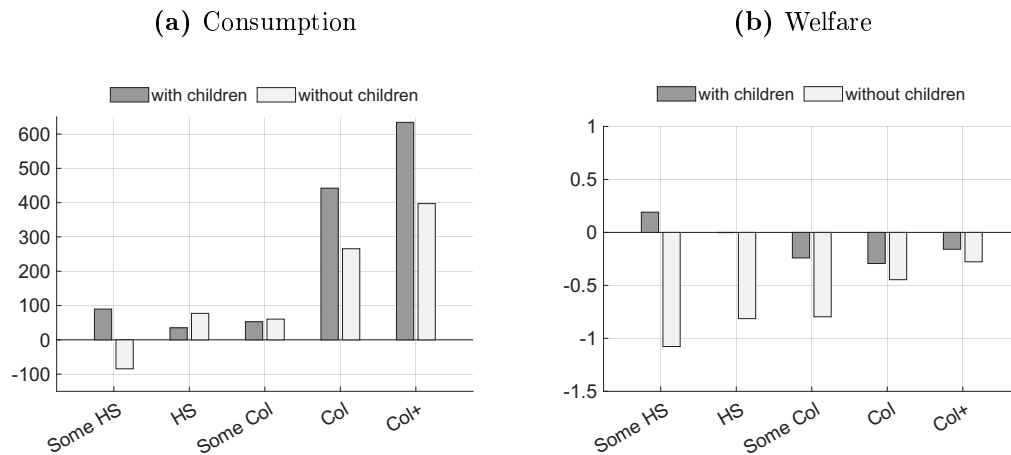
Given this offset, changes in hours account for most of the total welfare variation across education groups. Hours increase among households with medium and high levels of education, generating welfare losses in total. These losses are smaller for the *Col+* group because this group also experiences net welfare gains from consumption. In the *Some HS* group, spouses reduce hours worked when adjusting toward higher tax-credit benefits, which generates a small welfare gain.

Contribution of reforms and behavioral adjustment. Panel (d) decomposes the total ex-post welfare change from panel (a) into the mechanical effect of the reforms and the effect of behavioral adjustments. Mechanically, the reforms reduce welfare in every education group, with the largest losses among households with low to medium levels of education. Behavioral adjustments mitigate these losses for the lower and middle education groups. The *Some HS* group is the only group for which behavioral responses more than offset the mechanical welfare loss. For the *Col+* group, behavioral responses instead slightly reinforce the initial welfare loss.

3.5.4 Children

Finally, I examine heterogeneity by the presence of children in the household. I distinguish households that never have children from those that have children at some point in the life cycle. The latter group accounts for 88.5% of the model population. The distributional analysis in Chapter 3.2 showed that households with children benefit more from the reforms, especially at low income levels, because of the expansion of child-related tax credits. The model delivers the same pattern. Across education groups, taxes net of transfers increase more strongly – or fall less – for households without children than for households with children. The gap is largest in the *Some HS* group: taxes net of transfers rise by more than \$400 for households that never have children, but fall slightly for households with children.

Figure 3.9. Changes by the presence of children in the household



Notes: The figure shows changes in consumption (in dollars, panel a) and welfare (in percent, panel b), given the 2004- and 2019-tax-transfer systems. I consider households in working age and differentiate by education group of the husband and whether children were ever present in the household.

Panel (a) of Figure 3.9 shows average changes in household consumption by education group and child status. Consumption gains are larger for households with children (dark gray bars) than for households that never have children (light gray bars). For example, in the *Col+* group, consumption rises by about \$397 for households without children, which is only 60% of the increase among households with children. For households with medium levels of education, consumption changes are more similar across the two groups. Overall, however, consumption rises 1.6 times less for households that never have children. The *Some HS* households without children are the only group with an average decline in consumption. All other household types adjust labor supply and saving in a way that raises average consumption.

Consistent with these consumption patterns, panel (b) shows substantially larger welfare losses for households without children. Average welfare falls by 0.17% among households with children, compared with 0.57% among households that never have children. The gap is again largest in the *Some HS* group. Welfare rises by 0.2% for households that have children at some point in the life cycle, but falls by 1.1% for households that never have children.

3.6 Summary and Implications

In this chapter, I examine tax-transfer reforms in the United States between 2004 and 2019 and their effects on the level and progressivity of the tax-transfer system, as well as their implications for household choices, inequality, and welfare. The empirical analysis shows that, holding the income distribution fixed, the reforms were approximately neutral with respect to overall progressivity. This aggregate stability, however, masks offsetting changes across the income distribution. Expanded tax credits increased progressivity at the lower end, whereas reductions in marginal tax rates reduced progressivity at the upper end.

The model analysis shows that the reforms raise average consumption, which generates welfare gains. At the same time, they increase consumption inequality across states and over the life cycle, which lowers welfare. Because these two consumption effects largely offset each other, the remaining welfare differences are mainly driven by labor-supply responses. Households with medium and high levels of education and households without children experience welfare losses because they supply more labor. By contrast, households with low educational attainment and children reduce labor supply and benefit from the expansion of tax credits.

The results have three broader implications. First, aggregate measures of tax-transfer progressivity can conceal economically important heterogeneity. Evaluating reforms therefore requires examining how different population groups are affected, not only how the system changes on average. Second, a large literature documents rising inequality in the United States over recent decades (e.g., Hoffmann, Lee, and Lemieux 2020, Meyer and Sullivan 2023, or Heathcote et al. 2023), with several studies emphasizing the role of government redistribution (e.g., Heathcote, Storesletten, and Violante 2020, or Auten and Splinter 2024). My results indicate that the tax-transfer reforms studied here contributed further to this increase in inequality. Third, although the reforms between 2004 and 2019 did not fundamentally redesign the U.S. tax-transfer system, they had meaningful implications for household behavior, inequality, and welfare. These reforms have received less attention than the welfare reforms of the 1990s or the Reagan tax cuts of the 1980s (Blank 2002), but their distributional and welfare consequences are nevertheless quantitatively relevant.

The analysis treats education and the number of children in the household as exogenous. Yet the reforms affected incentives along both dimensions. Future work could therefore study how tax-transfer reforms influence human-capital investment, fertility, and household composition. Extending the analysis to include household types beyond married couples is an important direction for future research.

4 Child Tax Credits, Divorce Penalties, and Household Bargaining

The Child Tax Credit is one of the largest U.S. policies directed at families with children. It has an annual fiscal volume above \$100 billion, reaches roughly 90% of families, and provides benefits of up to \$2,200 per child.¹⁰⁴ Its objective is to provide financial support to households raising children. It is not, however, implemented as a universal child benefit. The effective value of the credit rises with income. Low-income households can use the non-refundable part of the credit only to offset what little tax liabilities they have, making this part of the credit more valuable when income is higher. Further, the refundable component, the ACTC, phases in with earnings up to a statutory cap. A family therefore receives the full per-child credit only if its earnings are sufficiently high.

This work studies a consequence of this design that has received little attention: the literal phase-in of the ACTC and the de-facto phase-in stemming from the non-refundable part generate divorce penalties in the CTC. While married, the credit is calculated on the basis of joint household income. After divorce, if the secondary earner becomes the custodial parent, as is commonly the case, the relevant income for the CTC is the secondary earner's income alone.¹⁰⁵ If that income lies in the effective CTC phase-in range, divorce reduces the value of the credit.¹⁰⁶

¹⁰⁴See Congressional Research Service statistics by McDermott (2025). These numbers refer to both the non-refundable portion and the refundable ACTC. Throughout this work, "CTC" is used to denote the Child Tax Credit as comprising both components.

¹⁰⁵For tax purposes, the custodial parent is the parent the child lives with for the greater number of nights during the year. About 80% of custodial parents in 2017 were mothers, see Grall (2020), and women are primary breadwinners in only 15% of married couples with children, according to data from the CPS. The custodial parent is generally entitled to claim the child as a dependent for tax purposes and thus to receive the CTC. This entitlement can in principle be transferred to the noncustodial parent, but such transfers are uncommon in practice.

¹⁰⁶Strictly speaking, a phase-in alone does not mechanically generate systematic divorce penalties, since phase-outs can offset the effect. In the CTC, however, the plateau range extends over most of the income distribution and the phase-out begins only at very high income levels. As a result, the phase-in dominates for the large majority of households, making CTC divorce penalties widespread. By contrast, programs such as the EITC combine phase-ins with comparatively short plateaus and substantial phase-outs, making the net effect of divorce on benefits less systematic.

Divorce penalties are a common feature under the current CTC design. As of 2019, they affected 34% of married couples with one child, 47% of married couples with two children, and 62% of married couples with three children. Among non-college married parents, the corresponding shares were 52%, 71%, and 84%. The loss can be large: when the husband earns between \$40,000 and \$350,000 per year but the wife does not work, the CTC divorce penalty amounts to the full per-child credit. If the wife earns \$10,000, the penalty is still between 40% and 85% of the full credit, depending on the number of children.¹⁰⁷ In other words, for many low- and moderate-income families, the CTC does not only transfer resources to households with children. It also changes the financial value of divorce for the parent who is most likely to live with the children after separation.

Our central question is how this outside-option effect changes allocations inside marriage. A CTC divorce penalty lowers the outside option of the custodial spouse relative to a credit that would be paid independently of the parent's own earnings. This weakens the custodial spouse's bargaining position added within marriage. Prior work has shown that outside options matter for intra-household allocation (Chiappori and Mazzocco 2017) and that changes in divorce law or alimony rules can alter bargaining and labor supply by shifting spouses' threat points (Voena 2015, Reynoso 2024, Foerster 2025). We apply this logic to another key element of family policy, child tax credits.

We quantify the mechanism in a partial-equilibrium life-cycle model with heterogeneous agents, endogenous labor supply, savings, marriage, divorce, and household bargaining under limited commitment. Couples solve a cooperative collective problem with Nash bargaining, and either spouse can unilaterally divorce. Pareto weights therefore evolve endogenously when participation constraints bind, as in Marcet and Marimon (2019). The model includes heterogeneity in children across households and over the life cycle. This structure is essential because CTC divorce penalties depend jointly on marital status, child custody, the number of children, and the distribution of earnings within the couple. The institutional detail is equally important. We code the 2019

¹⁰⁷Divorce penalties are strongly linked to not being eligible for the full credit, such that the credit amount would fall further if married parents separated or would rise if a single parent married a person with a positive income. Goldin and Michelmore (2022) show that the vast majority of children living in households in the bottom half of the income distribution are not eligible for the full credit. This is also true for almost every child in the bottom quintile as well as for majorities of Black and Hispanic children.

U.S. tax-transfer system into the model, including federal income taxes, payroll taxes, the EITC, the non-refundable CTC and the ACTC, SNAP, TANF, and Social Security rules, with the relevant kinks, plateaus, phase-ins, phase-outs, refundability rules, and means tests. This allows us to measure CTC divorce penalties at the household level and to account for interactions with other programs. Progressive joint taxation, the EITC, and means-tested transfers generate their own marriage and divorce bonuses or penalties, and these can amplify or offset the CTC channel when households adjust labor supply and savings.¹⁰⁸

Our main policy experiment is deliberately simple. The baseline model implements the actual 2019 tax-transfer system, including the literal and de-facto phase-ins of the CTC. The counterfactual holds all other tax-transfer rules fixed but removes any CTC phase-in. Comparing the two economies isolates the consequences of the phase-in-induced divorce penalties.

The first result is that CTC divorce penalties shift resources in marriages away from mothers. In a baseline sample of married mothers aged 30–42, the effective phase-in lowers the average mother’s private consumption by about \$90 per year. This effect is almost entirely driven by within-household redistribution to the disadvantage of mothers: total household consumption is slightly higher with the phase-ins because they raise effective marginal after-tax wages at the bottom, which increases labor supply. Conditional on total household consumption, the reduction in maternal consumption is even stronger with \$120. When we hold mothers’ Pareto weights fixed, nearly all of the consumption effect disappears, indicating that the main channel is bargaining rather than an income effect.

The second result is that maternal labor supply rises. Mothers work about 2.6 additional hours per week in the average family due to the phase-ins. This response combines direct labor supply incentives from the CTC phase-ins with the bargaining channel. Holding Pareto weights fixed reduces the hours response to about 2 hours, implying that roughly three quarters of the response reflects the phase-ins’ marginal incentives and about one quarter reflects weakened bargaining positions of mothers.

¹⁰⁸In Appendix C.2, we decompose total divorce bonuses and penalties into contributions from the CTC, income taxes, the EITC, and transfers, by income level and earnings split. This decomposition shows that, for low- and moderate-income couples with several children and strongly unequal earnings, CTC divorce penalties can dominate divorce penalties from progressive income taxation, while transfer programs often generate offsetting divorce bonuses.

Thus, the current CTC design induces mothers both to work more but to consume a smaller share of household resources.

The third result is that the effects are sharply heterogeneous by family size and relative wages within the household. Conditional on total household consumption, the CTC phase-ins lower maternal consumption by about \$30 in one-child families, \$72 in two-child families, and \$310 in three-child families. Among mothers with very low wages relative to their husbands, the consumption loss in three-child families reaches about \$800.¹⁰⁹ The nonlinearity is more than the mechanical consequence of the increase in the CTC penalty with the number of children. It is amplified by interactions with transfer programs: in three-child families, higher labor supply and asset accumulation induced by the phase-ins often reduce transfer eligibility, worsening the mother's outside option further.

Finally, the CTC phase-ins increase consumption inequality. Following Lise and Seitz (2011), we decompose individual consumption inequality into between-household and within-household components. Between-household inequality is essentially unaffected by the CTC phase-ins. Within-household inequality rises by about 9% due to the phase-ins, raising overall individual consumption inequality by about 5%. The design of the CTC therefore affects not only how much support families receive, but also how resources are allocated across family members.

The broader implication of our results is that phase-ins and refundability rules are distributional rules inside the household. A fully refundable CTC without phase-ins, such as the one temporarily implemented under the American Rescue Plan Act (ARPA) of 2021, would expand coverage at the bottom and remove the divorce-penalty channel. Conversely, a phased-in child credit can weaken the bargaining position of the parent who is most likely to care for the children after separation. Similar mechanisms may arise outside the U.S. whenever child-related benefits rise with parental earnings (as in, e.g., Germany or Austria) or depend on household income in ways that change outside options. Systems with phase-outs but no phase-ins (as in, e.g., the UK), or universal child benefits independent of parental income (as in Scandinavian countries), do not create the same mechanism.

¹⁰⁹In contrast to these non-linear effects, the divorce penalty itself increases roughly linearly in the number of children.

Although we do not model child outcomes directly, our findings point to a potential tension in child-benefit design. A policy intended to support children may, through an effective phase-in and resulting divorce penalties, reduce the control over resources by the mother and increase her labor supply without directly expanding childcare options. This matters because a large empirical literature links maternal bargaining power to spending on children and child outcomes (e.g., Duflo 2003, Duflo and Udry 2004, Attanasio and Lechene 2010, Thomas 1990, Lundberg, Pollak, and Wales 1997, Ringdal and Sjursen 2021, Li and Sun 2023).

The chapter proceeds as follows. Chapter 4.1 relates this work to existing work. Chapter 4.2 describes the institutional details of the U.S. Child Tax Credit and documents the resulting divorce penalties. Chapter 4.3 presents the model. Chapter 4.4 explains the parameterization and model fit. Chapter 4.5 contains the quantitative results. Chapter 4.6 relates our analysis to recent CTC reforms. Chapter 4.7 summarizes the main results and their implications.

4.1 Literature on Couple Taxation, Bargaining, and Marriage Penalties

This chapter connects three literatures that are usually studied separately: the taxation of couples, dynamic household bargaining, and marriage or divorce penalties in tax-transfer systems. Our contribution is to show that the phase-ins and refundability rules of a child benefit sit at the intersection of these literatures. They change marginal incentives, but they also change the value of marital dissolution for the likely custodial parent and therefore affect bargaining within marriage.

Taxation of married couples. This work first contributes to the literature on the taxation of married couples. Early work by Boskin and Sheshinski (1983), Piggott and Whalley (1996), and Apps and Rees (1999) uses static models to compare the distortions associated with joint and separate taxation.¹¹⁰ Quantitative work documents that

¹¹⁰Boskin and Sheshinski (1983) argue that secondary earners tend to have relatively high labor supply elasticities, which should not be taxed at high marginal rates, as implied by Ramsey's inverse elasticity rule. Piggott and Whalley (1996) emphasize that the literature has overlooked distortions of separate taxation on home production decisions within the household and thereby overstated welfare benefits from separate taxation. Apps and Rees (1999) demonstrate that, when trading off both forms of distortions, separate taxation is the second-best optimum.

joint taxation reduces female labor supply, using cross-country variation and structural models, see, e.g. Bick and Fuchs-Schündeln (2017), Bick and Fuchs-Schündeln (2018), Bick et al. (2019), and Chakraborty, Holter, and Stepanchuk (2015). Recent life-cycle models reach similar conclusions for the U.S., e.g. Guner, Kaygusuz, and Ventura (2012), Borella, De Nardi, and Yang (2023), and Holter, Krueger, and Stepanchuk (2026).¹¹¹ Our analysis also relates to jointness, since CTC benefits depend on total household income while spouses are married. But the mechanism differs from the standard joint-taxation channel. The CTC phase-ins strengthen labor supply incentives for low-earning mothers and at the same time weaken their outside option in divorce. Capturing both effects requires a detailed tax-transfer system and endogenous bargaining, rather than a stylized tax function with fixed marital status.

Two studies are especially close. Ortigueira and Siassi (2022) develop a dynamic structural model with actual U.S. taxes and transfers and endogenous decisions to remain single, cohabit, or marry.¹¹² They show that marriage-related tax penalties discourage marriage. In their model, however, bargaining positions within marriage are exogenous. In our setting, the endogenous response of bargaining power to divorce penalties is the central object.

Bronson, Haanwinckel, and Mazzocco (2025) also combine limited commitment, endogenous household formation and dissolution, as well as a detailed tax-transfer system. They study broad tax-design questions, including joint versus individual taxation and optimal progressivity. We instead isolate one institutional feature of one policy instrument: the effective CTC phase-ins. This narrower focus matters because the effective phase-in directly changes the custodial parent's threat point and therefore generates within-household, and gendered, distributional effects.

¹¹¹Guner, Kaygusuz, and Ventura (2012) were the first to use a life-cycle model with two-earner households to analyze a switch from joint to separate taxation. Crucial for their results is the wife's endogenous choice of labor force participation and the direct consequences for human capital. Borella, De Nardi, and Yang (2023) find strong labor supply disincentives for wives resulting from social security benefits, while Holter, Krueger, and Stepanchuk (2026) find higher tax revenues when combining a progressive tax with individual taxation of couples.

¹¹²Siassi (2019) also models endogenous household formation decisions, but without accounting for children and employing a simple tax function approximation. He uses this model to study inequality between married and single individuals. Garstenauer (2025) employs a similar model, but allows for cohabitation. She studies the welfare implications of taxing married and cohabiting couples equally.

Household bargaining with limited commitment. The model builds on collective dynamic household models with limited commitment (Kocherlakota 1996, Ligon, Thomas, and Worrall 2002, Marcet and Marimon 2019). This framework has been used to study the empirical relevance of commitment constraints, e.g. Mazzocco (2007), Lise and Yamada (2019), and Theloudis et al. (2025), also see Chiappori and Mazzocco (2017) for a review. It has been applied to study, e.g., divorce laws (Voena 2015, Reynoso 2024) and labor supply elasticities (Bredemeier, Gravert, and Juessen 2023).

It has also been applied specifically to taxes and transfers. Low et al. (2025) study how time limits in welfare programs affect single and married women, while Denderski and Obermeier (2025) and Bredemeier, Gravert, and Juessen (2026) examine progressive taxation and consumption insurance.

Two papers in this literature are particularly related because they study policies tied to children. Foerster (2025) analyzes child support and alimony payments after divorce and their effects inside marriage. This complements our focus on government child benefits rather than private transfers between ex-spouses.¹¹³

Verriest (2024) studies the CTC in comparison with daycare subsidies. His analysis treats the CTC as a universal benefit and therefore abstracts from the phase-ins that generate divorce penalties in our model. Our results imply that this abstraction misses a channel through which current CTC design reduces female bargaining power.

Marriage and divorce penalties in tax-transfer systems. A large empirical literature measures U.S. tax-transfer bonuses and penalties associated with marriage or divorce (e.g. Alm, Dickert-Conlin, and Whittington 1999), either for specific components of the system (e.g. Dickert-Conlin and Houser 1998, or Holtzblatt and Rebelein 2000) or over time (e.g. Eissa and Hoynes 2000, or Alm and Whittington 1996). Other studies estimate how these bonuses and penalties affect marriage and divorce decisions, often finding modest average effects (Dickert-Conlin 1999, Ellwood 2000, and more recently Moffitt, Phelan, and Winkler 2020). Marriage bonuses can nevertheless affect the timing of marriage (Alm and Whittington 1997, Sjoquist and Walker 1995, and Fink 2020).

¹¹³Methodologically, Foerster (2025) employs a dynamic structural model with limited commitment of married couples and explicitly models the behavior of ex-spouses, which we abstract from in our model, as the CTC does not depend on the behavior of ex-spouses, in contrast to maintenance payments. On the other hand, Foerster (2025) simplifies the tax-transfer system to one single marginal tax rate, while we allow for all the particularities of the U.S. tax-transfer system and their interactions.

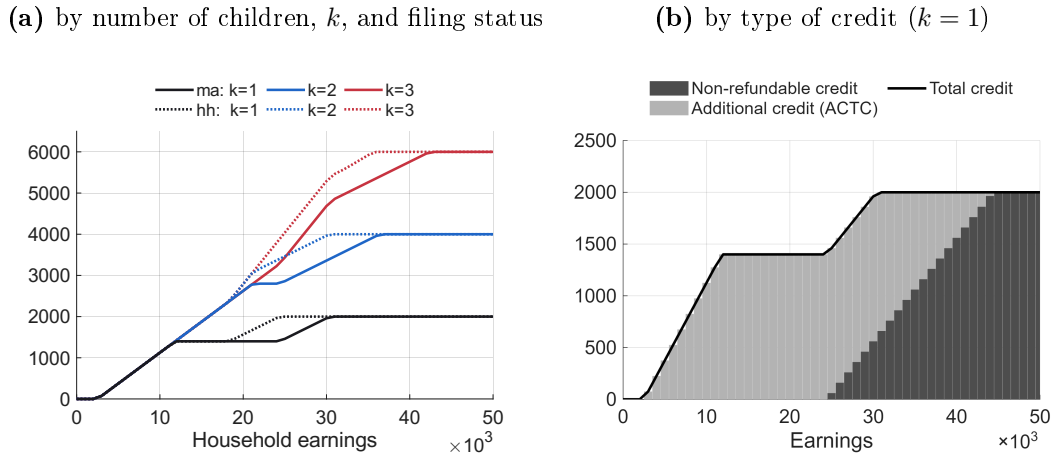
Because much of this literature predates the modern CTC, it could not capture the substantial divorce penalties we study. More recent work such as Alm, Leguizamon, and Leguizamon (2023) or Alm and Leguizamon (2015) includes the CTC but does not focus on it and assumes that the primary earner files as head of household after divorce. That assumption misses the empirically dominant case in which children live with the secondary earner after their parents' divorce. Lin and Tong (2012) study cohabiting couples and find small CTC effects on marriage tax bonuses or penalties. This is consistent with our argument: CTC penalties from *becoming married* can be small if the primary earner already claims the children before marriage, while penalties from *divorce* can be large if custody then shifts to the secondary earner.

Child Tax Credits. Finally, this chapter contributes to work on the CTC itself. Guner, Kaygusuz, and Ventura (2020) study the CTC and other child-related transfers, including childcare credits and subsidies, examining their implications for female labor force participation and welfare in a life-cycle model with singles and married couples with children.¹¹⁴ Hannusch (2025) compares U.S. and Danish child-related transfers, considering their effects on maternal labor supply.

Bastian (2024) simulates the poverty and employment effects of permanently implementing the temporary CTC expansions under the ARPA of 2021.¹¹⁵ He finds that a fully refundable CTC without phase-ins strongly reduces child poverty and lowers employment, especially among single parents. Goldin and Michelmore (2022) document how the CTC varies by income and race. Our analysis complements this work by showing that refundability also matters for bargaining and allocation inside married-couple households.

¹¹⁴Similarly, Moschini and Tran-Xuan (2025) compare the welfare effects of expanding either the CTC or childcare subsidies. While abstracting from saving decisions, they focus on the role of parental time investments into child skill.

¹¹⁵Several recent studies, i.e., Enriquez, Jones, and Tedeschi (2023) and Ananat et al. (2024), examine the labor supply effects of the temporary CTC expansion 2021 using CPS data. They find very small, statistically insignificant, and inconsistently signed effects on both, employment and hours worked.

Figure 4.1. The Child Tax Credit

Notes: Panel (a) depicts the CTC by earnings, number of children, and filing status. Solid lines refer to the CTC for a married couple (ma) and dotted lines for a head of household (hh). Panel (b) focuses on households with one child and presents the components of the total credit (black line), namely the non-refundable credit (dark gray bars) and the refundable component, the ACTC (light gray bars). For the illustration, we abstract from other income sources than earnings. All amounts are measured in dollars.

4.2 Divorce Penalties in the Child Tax Credit

This chapter shows how the 2019 CTC rules create divorce penalties. We choose 2019 for consistency with the model calibration, described in Chapter 4.4. Despite minor adjustments, the current CTC retains the same basic structure: partial refundability, income-based phase-ins at the bottom, and phase-outs that begin only at high income levels.¹¹⁶ We first describe the credit schedule for married couples and heads of household. We then compute the loss in the credit when the secondary earner becomes the custodial parent after divorce.

4.2.1 The U.S. Child Tax Credit

CTC for married couples. The solid lines in Figure 4.1, panel (a), show the total CTC for married couples by household earnings and number of children. At low earnings, below roughly \$40,000, the credit phases in. At intermediate earnings, married couples receive the full amount of \$2,000 per child. At gross income above \$400,000, the credit phases out. The phase-in is generated by two features. First, the CTC is per se

¹¹⁶The CTC underwent a temporary restructuring under the ARPA of 2021, including the removal of the phase-ins and credit expansions. Yet, it has largely returned to the pre-ARPA design. Some parameters have changed since 2019, such as slightly higher nominal credit amounts and refundable caps. The One Big Beautiful Bill Act of 2025 introduced inflation indexing of these parameters.

non-refundable: a household with tax liability below the maximum credit can use the credit only up to its tax liability.¹¹⁷ Second, since 2001, households with insufficient tax liability can claim the ACTC, which is refundable but does have a literal phase-in. As of 2019, the ACTC equals 15% of earnings above \$2,500, subject to a maximum of \$1,400 per child. Figure 4.1, panel (b), shows the non-refundable credit (dark gray bars), the ACTC (light gray bars), and the total credit amount (black line) for a married couple with one child and earnings below \$50,000.

CTC for a head of household. After divorce, the custodial parent can claim the CTC and file as head of household. The rules are nearly identical to those for married couples, with two differences. First, the phase-out threshold is \$200,000, half the threshold for married couples. Second, the de-facto phase-in through non-refundability depends on filing status because the standard deduction is \$18,350 for heads of household and \$24,400 for married couples filing jointly. The dotted lines in Figure 4.1, panel (a), show the corresponding schedule for heads of household. Because the standard deduction is lower, heads of household can reach the full credit at lower income levels than married couples.

4.2.2 Divorce Penalties

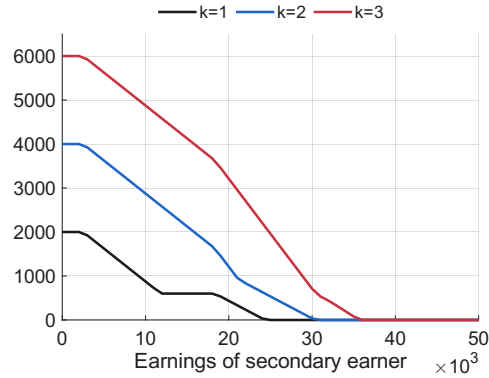
We define the CTC divorce penalty, P , as

$$P = CTC^{married} - CTC^{divorced}, \quad (4.1)$$

where $CTC^{married}$ is the credit received by the married household and $CTC^{divorced}$ is the credit received after divorce. A positive value means that divorce reduces the credit; a negative value means that divorce increases it.

Figure 4.2 plots the penalty by the secondary earner's earnings and by the number of children. For the illustration, the primary earner has earnings of \$50,000, so the

¹¹⁷ Due to the allowance of \$24,400 for married couples, a household with income below this amount does not pay any income taxes and therefore does not receive any of the non-refundable credit. For income above this threshold, the non-refundable credit phases in at the first marginal tax rate of 10%.

Figure 4.2. CTC divorce penalties

Notes: The figure shows divorce penalties, P , from the CTC by the number of children in the household and by earnings of the secondary earner who is assumed to take custody of the children after divorce. Details for the calculation can be found in Chapter 4.2; CTC divorce penalties are defined in Equation (4.1). We assume that the primary earner has an income of \$50,000, which makes the household eligible for the full credit during marriage. For the illustration, we assume that earnings are the only income source of the household. All numbers are reported in dollars.

married household receives the full credit.¹¹⁸ After divorce, the secondary earner is assumed to take custody, claim the children, and files as head of household, while the primary earner files as single.¹¹⁹ The household has no income other than earnings.

The penalties in the figure result from the effective phase-in. When the custodial spouse's own earnings lie in the phase-in region, divorce replaces joint income with the custodial parent's lower individual income and part of the credit is lost. The penalty is largest when the custodial spouse earns less than \$2,500, because then the entire credit is lost. As custodial earnings rise, the head-of-household credit phases in and the divorce penalty declines.

The figure isolates phase-in penalties. The CTC phase-out can also generate marriage or divorce bonuses and penalties, but those are relevant only for households with very high incomes beyond the phase-out threshold. There is also a small countervailing possibility. Since heads of household have a lower standard deduction, they can reach the full credit at lower income levels than married couples. For some income combinations,

¹¹⁸As long as income values of the primary earner are below \$K 350 and above roughly \$K 40, the penalty looks exactly the same as illustrated in Figure 4.2. Appendix C.2 additionally presents CTC divorce penalties by income of both spouses.

¹¹⁹Note that our findings rely heavily on this assumption. If the children stay with the primary earner after divorce, the divorce penalty is zero. As noted by Grall (2020) from the U.S. Census Bureau, about 80% of custodial parents in 2017 were mothers, which are more likely to be the secondary earner within marriage.

divorce can therefore increase the CTC.¹²⁰ These cases are narrow and empirically less central.

Finally, CTC penalties interact with the rest of the tax-transfer system. Progressive joint taxation can generate divorce penalties when earnings are unequally split, while means-tested transfers can generate divorce bonuses. Appendix C.2 decomposes these components.

4.3 Model

The quantitative framework is a life-cycle model in which taxes and transfers affect household behavior through two channels. They change budget sets and labor supply incentives directly. They also change the value of remaining married relative to divorce and therefore the bargaining weights that determine the intra-household allocation. This second channel is the one through which CTC divorce penalties matter.

The model is Bewley-style, with heterogeneous agents, uninsurable wage risk, endogenous labor supply and savings, marriage and divorce decisions, and bargaining within married households. Potential spouses decide whether to marry and bargain over initial decision weights. Once married, either spouse can leave unilaterally. This limited commitment implies that Pareto weights may change over time when a spouse's participation constraint binds. Because the tax-transfer system is fully coded in the model, the CTC loss that the mother would face as custodial parent after divorce enters directly into her outside option and therefore into bargaining inside marriage.

The model is closely related to the framework in Bredemeier, Gravert, and Juessen 2026, which studies optimal taxation when families provide incomplete insurance against labor market risk. This chapter uses the same broad household structure but differs in two important respects. First, the calibration targets non-college households, for whom CTC divorce penalties are especially prevalent. Second, the tax-transfer system is represented institutionally rather than approximated by a reduced-form tax function.

¹²⁰For instance, in a household with one child, total household income must be above \$18,350 and below roughly \$30,000. At the same time, income of the spouse taking custody of the children also needs to be in this income range.

We use the following notation. Households are indexed by j , and gender is denoted by $g \in \{m, f\}$ (m = male, f = female), so that gj identifies an individual of gender g in household j . The marital status is denoted by $ms_{gj} \in \{S, M\}$ (S = single, M = married couple). Age is denoted by h , and next-period values are denoted by a prime, i.e., $x'_j(h) = x_j(h+1)$. Where possible, we suppress the age index for better readability.

4.3.1 Model Setup

Demographics. Agents enter the economy as singles at age 25, work until they retire at age 66, and die with certainty at age 85. During working age, they meet potential partners and possibly marry, divorce, or re-marry. When married, spouses are the same age.

Preferences. The period felicity function of agent gj is

$$u_g(c_{gj}, q_j, n_{gj}) = \varrho \cdot \frac{c_{gj}^{1-\sigma}}{1-\sigma} + (1-\varrho) \cdot \frac{q_j^{1-\sigma}}{1-\sigma} - \alpha_g \cdot \frac{n_{gj}^{1+1/\eta_g}}{1+1/\eta_g} - \mathbb{I}_{n_{gj}>0} \cdot \theta_g,$$

where c_{gj} is a private consumption good, q_j is a household-public good, and n_{gj} is labor supply. Agents pay a fixed utility cost, θ_g , when they participate in the labor market. The Frisch labor-supply elasticities are denoted by η_g , the inverse elasticity of intertemporal substitution by σ , and the discount factor by β . The parameter α_g governs the gender-specific disutility of hours, and ϱ governs the weight on private consumption.

In addition to consumption and labor supply, married spouses receive utility Φ_j from the match to their spouse. Initially, match quality is drawn from a normal distribution with mean $\bar{\Phi}$ and variance σ_ξ^2 for any potential match $\tilde{j}$ between two agents. Subsequently, match quality evolves according to

$$\Phi'_j = \Phi_{\tilde{j}} + \xi'_j,$$

where match quality shocks are normally distributed with mean zero and variance σ_ξ^2 . Once a couple reaches retirement age, the variance of ξ becomes zero, such that match quality no longer changes.

When married, the target function of a couple is

$$v(c_{mj}, c_{fj}, q_j, n_{mj}, n_{fj}, \mu_{mj}, \mu_{fj}) = \sum_{g \in \{m, f\}} \mu_{gj} \cdot [u_g(c_{gj}, q_j, n_{gj}) + \Phi_j],$$

where μ_{gj} is the Pareto weight of spouse gj . Initial Pareto weights are determined by symmetric Nash bargaining. Thereafter, weights evolve endogenously through the limited-commitment problem described in Chapter 4.3.2.

Children. Fertility is deterministic. Children always live with their mother, whether she is single or married, so within marriage the mother is the potential custodial parent in the event of divorce. Women enter the economy at age 25 with k_{fj} children, $k_{fj} \in \{0, 1, 2, 3\}$, and have no additional children thereafter. Children leave the household when the mother is 43 (first child), 45 (second child), and 47 (third child).¹²¹ These assumptions create a period during which family size is fixed. During that period, variation in CTC benefits comes from income and filing status rather than from changes in the number of children.

The number of children in household j , k_j , and household size, N_j , are summarized by

$$k_j = \begin{cases} k_{fj} & (ms_j = S \wedge g = f) \vee ms_j = M \\ 0 & (ms_j = S \wedge g = m) \end{cases} \quad \text{and} \quad N_j = \begin{cases} 1 + k_j & ms_j = S \\ 2 + k_j & ms_j = M. \end{cases}$$

Wages and labor income. During working age, agent gj earns wage rate w_{gj} . Individual log wage rates, i.e.,

$$\ln w_{gj} = \ell_g + z_{gj}, \text{ with}$$

$$z'_{gj} = z_{gj} + \varepsilon'_{gj},$$

¹²¹We focus on individuals with at most a high school diploma. Using CPS data, we find that children begin to leave parents with this level of education when those parents are in their forties. We assume a two-year difference in leaving home, which is consistent with an average age gap of about one to two years between subsequent children.

consist of a permanent component, z_{gj} , and a deterministic life-cycle component, ℓ_g , where ε_{gj} is agent gj 's permanent wage shock, normally distributed with variance $\sigma_{\varepsilon_g}^2$. Shocks may be correlated across spouses but are independent over time.

Labor income of agent gj is $e_{gj} = w_{gj}n_{gj}$ in working age and $e_{gj} = 0$ in retirement age. Household earnings are

$$e_j = \begin{cases} e_{gj} & ms_j = S \\ e_{mj} + e_{fj} & ms_j = M. \end{cases} \quad (4.2)$$

Pensions. During retirement, agents receive a pension, $b_{gj}(\tilde{e}_{gj})$, which depends on pensionable earnings, $\tilde{e}_{gj}$. For simplicity, we assume that counted earnings consist of the permanent wage and the life-cycle component of the agents in the last period before retirement, i.e.

$$\tilde{e}_{gj} = \min \left[\bar{e}^{ss}, \exp \left(z_{gj}^{h_j=65} \cdot \ell_{gj}^{h_j=65} \right) \cdot s \right],$$

where s assures that the average replacement rate observed in the data is matched and $\bar{e}^{ss}$ is the earnings limit for Social Security payments. Pensions are then calculated using the PIA formula; see Appendix C.1 for details. In working age, i.e. $h_j \leq 65$, pensions are zero.

Asset markets. Agents start their lives without wealth. They have access to non-state contingent assets with risk-free interest rate r , but borrowing is not allowed. The capital-investment income of household j is

$$i_j = r \cdot a_j. \quad (4.3)$$

Potential partners are expected to have the same amount of assets upon marriage. In couple households, assets are held jointly, implying that there is no private saving of spouses.

Tax liabilities and transfer payments. During working age, households are subject to income taxation and transfer payments. Specifically, income tax liabilities before ap-

plying credits, $T_j(e_j, i_j, fs_j)$, are a function of household labor income, e_j , income from short-term capital investments, i_j , and the household's filing status, fs_j , which is defined as

$$fs_j(k_j, ms_j) = \begin{cases} \text{single (si)} & ms_j = S \wedge k_j = 0 \\ \text{head of household (hh)} & ms_j = S \wedge k_j > 0 \\ \text{married (ma)} & ms_j = M. \end{cases}$$

Additionally, households have to pay a linear payroll tax on their labor income at rate τ_p . The CTC, $Cr_j^{ctc}(e, i, k, fs)$, including its refundable component, depends on household incomes, the number of children, and the filing status, just like the EITC, $Cr_j^{eitc}(e, i, k, fs)$, which is another tax credit available to low-income households. Households may be eligible for transfer payments, $Tr_j(e_j, i_j, a_j, N_j, ms_j, g, n_{fj})$, which consist of SNAP and TANF, and depend on household incomes, assets, household size, marital status, gender, and hours worked of the wife.¹²² Appendix C.1 provides details on the specific tax-transfer functions.¹²³ In sum, the net income of household j is

$$y_j^{net} = (1 - \tau_p) \cdot e_j + i_j + b_j(\tilde{e}_j) - T_j(e_j, i_j, fs_j) \\ + Cr_j^{ctc}(e, i, k, fs) + Cr_j^{eitc}(e, i, k, fs) + Tr_j(e_j, i_j, a_j, N_j, ms_j, g, n_{fj}),$$

where income taxes, credits, and transfers are assumed to be zero in retirement.

Marriage-market matching. During working age, a single individual meets with probability $\Pi(h_j)$ a potential partner, which is expressed as an order-Z polynomial, i.e.,

$$\Pi(h_j) = \sum_{z=0}^Z \pi_z \cdot (h_j - 40)^z,$$

with $\forall h_j \leq 65$. In retirement, $\Pi(h_j) = 0 \forall h_j > 65$.

¹²²Actual transfer payments depend on the number of workers in a household. In the model, the wife is assumed to be the only household member with an extensive labor supply decision. Therefore, transfer payments in the model depend on the labor supply decision of the wife.

¹²³In particular, income taxes are defined in Equation (C.3), the CTC is defined in Equation (C.4) and the EITC in Equation (C.8). Transfer payments are defined in Equation (C.9).

Divorce. In the event of divorce, the mother takes custody of the children living in the household. Ex-spouses equally split assets and a one-time pecuniary divorce cost of ω .

4.3.2 Household Maximization Problems

Timing of events. Agents enter a period with a marital status, number of children, asset holdings, permanent wage components, and, if married, match quality and Pareto weights. Wage shocks, match-quality shocks for couples, and meeting opportunities for singles then realize.

For agents entering the period as singles, three paths are possible. If no match occurs, the individual remains single and solves the single-agent problem S_{gj} . If a match occurs, the potential spouses determine jointly whether marriage generates a surplus, meaning that expected lifetime utility as a couple exceeds the sum of the two outside values as singles. If the surplus is positive, the agents marry, pool assets, bargain over initial Pareto weights, and solve the married-couple problem V_j . If not, they remain single.

For agents entering the period in a married couple, three paths are likewise possible. If the surplus from marriage becomes negative after shocks are realized, the couple separates, assets are split, each spouse pays half of the divorce cost, and each afterwards solves the single problem. If the surplus remains positive and both participation constraints are slack, the couple remains married with unchanged Pareto weights. If one participation constraint binds while the total marriage surplus remains positive, the couple re-bargains over Pareto weights and solves V_j with these new weights.

Single problem. The maximization problem for singles at the end of a period is

$$S_{gj}(\Theta_{gj}, h_j) = \max_{c, q, n} u_g(c_{gj}, q_j, n_{gj}) + \beta \cdot E S_{gj}(\Theta'_{gj}, h'_j),$$

subject to the budget constraint

$$a'_{gj} + c_{gj} + q_j = y_j^{net}(e_j, i_j, b_j, a_{gj}, k_j, fs_j, N_j, ms_j, g, n_{fj}) + a_{gj},$$

and the borrowing constraint $a'_{gj} \geq 0$. The vector of state variables is defined as $\Theta_{gj} = (z_{gj}, a_{gj}, k_j)$. $S_{gj}(\Theta'_{gj}, h'_j)$ is the continuation value of entering the next period as a single, recognizing the possibility of future marriage, i.e.,

$$S_{gj}(\Theta'_{gj}, h'_j) = S_{gj}(\Theta'_{gj}, h'_j) + \Phi(h_j) \cdot \mathbb{E} \left[\mathbb{M}_{j,j^\dagger} \cdot \left\{ V_{g\tilde{j}}(\Omega'_{\tilde{j}}, h'_j) - S_{gj}(\Theta'_{gj}, h'_j) \right\} \right],$$

where $\tilde{j}$ denotes the potential new household formed by j and the potential partner $j^\dagger$. $\mathbb{M}_{j,j^\dagger}$ is an indicator equal to 1 if the potential partners decide to marry. $\mathbb{E}$ is the expectation over potential partners. $V_{g\tilde{j}}(\Omega'_{\tilde{j}}, h'_j)$ is the value function of agent gj in the newly formed couple household. Initial Pareto weights are determined in symmetric Nash bargaining,

$$\max_{\mu'_{m\tilde{j}}, \mu'_{f\tilde{j}}} \left\{ V_{m\tilde{j}}(\Omega'_{\tilde{j}}, h'_j) - S_{mj}(\Theta'_{mj}, h'_j) \right\} \cdot \left\{ V_{f\tilde{j}}(\Omega'_{\tilde{j}}, h'_j) - S_{fj}(\Theta'_{fj}, h'_j) \right\}$$

subject to the participation constraint $V_{g\tilde{j}}(\Omega'_{\tilde{j}}, h'_j) \geq S_{gj}(\Theta'_{gj}, h'_j)$ and $\mu'_{m\tilde{j}} + \mu'_{f\tilde{j}} = 1$.

Couple problem. The maximization problem of a couple household

$$V_j(\Omega_j, h_j) = \max_{c_m, c_f, q, n_m, n_f} v(c_{mj}, c_{fj}, q_j, n_{mj}, n_{fj}, \mu_{mj}, \mu_{fj}) + \beta \cdot \mathbb{E} \mathcal{V}_j(\Omega'_j, h'_j),$$

subject to the joint budget constraint

$$a'_j + c_{mj} + c_{fj} + q_j = y_j^{net}(e_j, i_j, b_j, a_j, k_j, fs_j, N_j, ms_j, g, n_{fj}) + a_j,$$

and the borrowing constraint $a'_j \geq 0$.

The vector of state variables is $\Omega_j = (z_{mj}, z_{fj}, a_j, k_j, \mu_{mj}, \mu_{fj})$. The continuation value $\mathcal{V}_j(\Omega'_j, h'_j)$ of entering the next period as a married couple takes into account the possibility for future divorce and is given by

$$\mathcal{V}_j(\Omega'_j, h'_j) = \mathbb{D}_j \cdot \left[\mu_{mj} \cdot S_{m\tilde{j}}(\Theta'_{g\tilde{j}}, h'_j) + \mu_{fj} \cdot S_{fj^\dagger}(\Theta_{gj^\dagger}, h'_j) \right] + (1 - \mathbb{D}_j) \cdot V_j(\Omega'_j, h'_j),$$

where $\mathbb{D}_j$ is an indicator equal to 1 if spouses divorce. Here, $\tilde{j}$ and $j^\dagger$ denote the two potential new households in the event of divorce. The vector of state variables for an individual agent as divorcee is given by Θ_{gj} as defined above, but with $a_{gj} = a_j/2 - \omega/2$.

Pareto weights in couples that remain married evolve according to

$$\mu'_{gj} = \mu_{gj} + \zeta_{gj},$$

where ζ_{gj} is the Kuhn-Tucker multiplier on the participation constraint

$$V_{gj}(\Omega'_j, h'_j) \geq S_{gj}(\Theta'_{gj}, h'_j).$$

4.4 Parameterization

We parameterize the model in three steps. Some parameters are set externally, some are estimated directly from data, and the remaining parameters are calibrated internally to match key moments. Chapter 4.4.1 describes the externally set and estimated parameters; Chapter 4.4.2 describes the calibrated parameters; Chapter 4.4.3 evaluates the model fit. We use CPS data to construct empirical targets and estimate deterministic life-cycle wage profiles. We use PSID data to estimate the moments of stochastic wage shocks. The main empirical sample consists of working-age married couples after conventional outlier restrictions. We focus on households without a college degree because CTC divorce penalties are particularly relevant in this group.¹²⁴ Appendix C.3 provides details on the sample selection.

4.4.1 Externally Estimated and Pre-Set Parameters

Government. The base year is 2019, so the model applies the 2019 U.S. tax and transfer system. We use data on the statutory tax code, allowances, and tax credits from the

¹²⁴In Chapter 4.2, we have demonstrated that CTC divorce penalties are relatively large if earnings are unequally split or if one spouse does not work. Empirically, non-participation in the labor market is particularly high among married women with low education (see also Garstenauer and Siassi 2025 or Hannusch 2025). In our CPS sample for year 2019, we find a female non-participation rate of 31.6% in households without a college degree, compared to a non-participation rate of 16.8% in households with a college degree.

Table 4.1. Overview of estimated and pre-set model parameters

Parameter	Symbol	Value	Comment
Preferences			
Discount factor	β	0.98	set
Relative risk aversion	σ	1.730	
Frisch elasticity, men	η_m	0.528	
Frisch elasticity women	η_f	0.850	
Stochastic wage component			
Variance, men	$\text{var}(\varepsilon_m)$	0.036	estimated
Variance, women	$\text{var}(\varepsilon_f)$	0.027	
Covariance	$\text{cov}(\varepsilon_m, \varepsilon_f)$	0	
Interest rate and monetary divorce costs			
Interest rate	r	0.02	set
Monetary divorce costs	ω	0.062	set

OECD (2020). Parameters for SNAP are taken from the Food and Nutrition Service (2018). TANF parameters are taken from the Welfare Rules Database offered by the Urban Institute (2020). The linear payroll tax, τ_p , is set to 7.65%, which corresponds to the combined Medicare and Social Security tax rates in the U.S. before the cap. Appendix C.1 presents all parameters and formulas of the U.S. tax and transfer system. To calculate pensions, we use the PIA formula and parameters published by the U.S. Social Security Administration (2026). Further details can be found in Appendix C.1.

Preferences. We use estimates from Blundell, Pistaferri, and Saporta-Eksten (2016) for the Frisch consumption and labor-supply elasticities, $1/\sigma = 0.578$, $\eta_m = 0.528$ and $\eta_f = 0.85$. The discount factor is set to a standard value from the literature, $\beta = 0.98$ (e.g., Attanasio, Low, and Sánchez-Marcos 2008, Voena 2015, and Low et al. 2025).

Wages. We estimate the deterministic, life-cycle component of wages (expressed in 2019 dollars) following Rupert and Zanella (2015). We use CPS data with pooled survey years from 2000 to 2019 and estimate hourly wages over the life cycle for each spouse using a second-order fractional polynomial. We estimate the moments of stochastic wage shocks using a GMM approach and PSID data for the period 1999–2019. Since the estimated covariance between spousal wage shocks turns out to be insignificant, we set the covariance to zero in our model, for simplicity. The second part of Table 4.1 summarizes the estimated parameters. Details on both wage estimations can be found in Appendix C.3.

Table 4.2. Overview of calibrated model parameters

Parameter	Symbol	Value
Marriage and divorce		
Match probability, coefficients	π_0	0.426
	π_1	-0.034
	π_2	0.001
	π_3	-0.000
Mean match quality	$\bar{\Phi}$	-0.302
Variance, match-quality shocks	σ_ξ^2	0.01
Consumption goods		
Utility weight of private consumption in %	ϱ	53.986
Preferences		
Labor disutility, men	α_m	13.069
Labor disutility, women	α_f	27.314
Utility loss LFP, women	θ_f	1.371
Government		
Scaling parameter for pensions	s	0.176

Interest rate and monetary divorce costs. The risk-free real interest rate r is set to 2%, which is a standard value in the literature (e.g., Blundell, Pistaferri, and Saporta-Eksten 2016 and Wu and Krueger 2021). To set the monetary divorce costs, we follow results from a Martindale-Nolo survey of divorcees from 2019 summarized by Gjeltén and Barrett (2026), which found a median cost of \$7,000, amounting to 6.3% of median household labor income in our CPS sample when considering households of any education. Applying the same share to our non-college sample gives a dollar value of about \$5,000, corresponding to $\omega = 0.062$.

4.4.2 Calibrated Parameters

Given the pre-set and estimated parameters from Chapter 4.4.1, we calibrate eleven parameters. In particular, we calibrate six parameters governing marriage markets, three preference parameters, one parameter matching the average replacement rate, and one parameter matching the utility weight of private consumption. Table 4.2 summarizes all calibrated parameters.

Marriage and divorce. Marriage markets have frictions in our model and the probability of meeting a potential spouse is modeled as age dependent. We assume that the matching probability follows a cubic polynomial, which implies four parameters to calibrate. The period utility gain from being married, $\bar{\Phi}$, and the variance of the match quality shock, σ_ξ^2 , add two further parameters related to marriage and divorce. We cal-

ibrate these six parameters using moments of the distribution of ever married and ever divorced agents at specific ages. To do so, we use data from the Survey of Income and Program Participation (SIPP) provided by the U.S. Census Bureau in Kreider and Ellis (2011), which are reported in Table 4.3. We use their results and construct life-cycle moments of ever married and ever divorced agents. At age 30, about 71% of households have ever been married, while on average about 15% of households have ever been divorced. These numbers increase to a value of 85% having ever been married at age 40 compared to 28% of households having ever been divorced at that age.

Preferences. We calibrate the male disutility weight of labor, α_m , to match average household labor income of married couples observed in our CPS sample.¹²⁵ Similarly, we set the female disutility weight of labor, α_f , to match average female labor income conditional on employment, which is 0.4376. We choose the fixed utility costs of participation of women, θ_f , to match the average female non-participation rate in married couples in the CPS, which is 31.55%. We assume that men do not face utility costs of participation since the vast majority of men (95%) in the CPS between ages 25 and 60 participate in the labor market.¹²⁶

Pensions. We calibrate a scaling parameter s to match the average replacement rate of 30%, which is a standard value in the literature (e.g., Ortigueira and Siassi 2013).

Consumption. We set the utility weight of private consumption, ϱ , such that two households of singles have to pay about 141% as much as a couple household would pay for the same amount of consumption, in line with the OECD square-root equivalence scale.

Children. To determine the share of households with 0, 1, 2, or 3 children, we consider a subsample of married couples from the CPS. We apply the same sample restrictions as above except for age and year. Here, we restrict the sample to couples with husbands born between 1959 and 1964, i.e., the cohorts who exit prime working age in 2019 or

¹²⁵ Average household labor income is normalized to one both in our model and in the CPS data. The corresponding value in 2019 dollars is 80,468.

¹²⁶ Agents choose labor supply from a discrete set of options, i.e., $n_m \in \{10, 20, 30, 40, 50\}$ and $n_f \in \{0, 10, 20, 30, 40\}$.

Table 4.3. Empirical targets matched

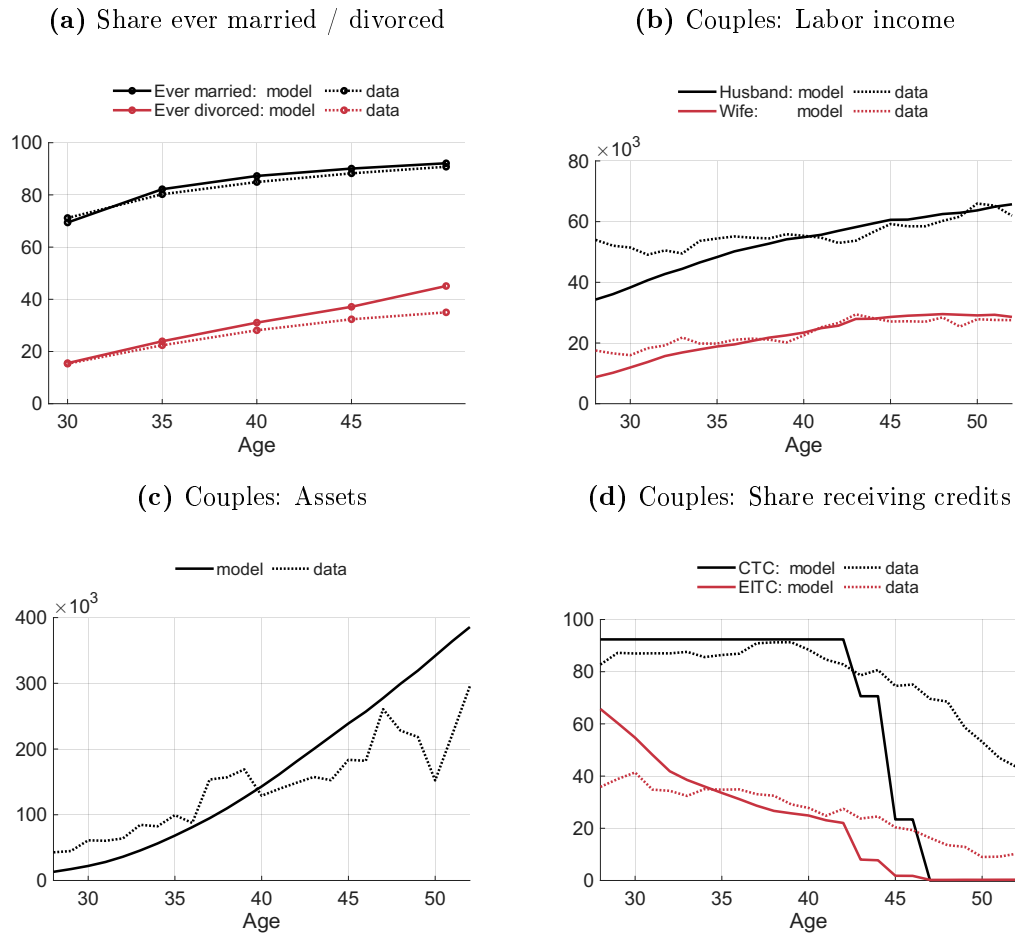
Target	Data	Model
Income and employment		
Average household labor income	1	0.988
Average female labor income work	0.438	0.450
Average non-participation rate females	0.316	0.349
Consumption		
OECD square-root scale	1.414	1.414
Pension		
Average replacement rate	0.3	0.300
Marriage, divorce		
Ever married in...		
... at age 30	0.712	0.694
... at age 35	0.803	0.822
... at age 40	0.849	0.873
Ever divorced...		
... at age 30	0.153	0.155
... at age 35	0.224	0.239
... at age 40	0.281	0.311
Children		
Share of married households, aged 25 - 45, with...		
... one child	0.242	0.242
... two children	0.421	0.421
... three children	0.200	0.200

shortly before. Since agents enter the model at age 25 and the median child leaves the household at parental age 45, we target the distribution of family size in married couples with husbands aged 25-45. The resulting shares are summarized in Table 4.3. Most households have two children (about 42%). The proportions of households with one or three children are similar, each accounting for roughly 20-25%. We set the share of households with either 0, 1, 2, or 3 children in the model such that the empirical shares are matched for married households aged 25 to 45 with the endogenous equilibrium marriage rates.

4.4.3 Model Fit

Table 4.3 shows that the calibrated model matches the targeted moments closely. Panel (a) of Figure 4.3 shows the life-cycle profiles of ever-married and ever-divorced households. The model captures both levels and age gradients, including ages not directly targeted.¹²⁷

¹²⁷In Figure C.5 in the Appendix, we additionally present the share of households married twice or more in model and data at certain ages. We find that the model reproduces untargeted values and the rise of this share over the life cycle quite closely.

Figure 4.3. Life-cycle profiles in data and model

Notes: The figures compare life-cycle profiles in data (dotted lines) and model (solid lines). Data values in panel (a) are based on SIPP data for marked ages. In all other panels, we focus on a sample of married couples and present data values for ages 28 – 52 (using a 5-year-moving average). Data on labor income and credits is taken from the CPS, while data on assets is taken from the SCF.

Panels (b)–(d) focus on married couples and show labor income, assets, and realized credit benefits between ages 28 and 52, although the main analysis uses ages 30 to 42.¹²⁸ The model reproduces the level and life-cycle increase of husbands' and wives' labor income.¹²⁹ Asset holdings are not targeted; the model nevertheless matches them reasonably well, slightly underestimating assets at young ages and overestimating them after age 40. The model also matches the share of couples receiving the CTC and EITC reasonably well, though it overestimates benefits at younger ages and underestimates

¹²⁸To calculate life-cycle means in the data, we use a 5-year moving average. We use CPS data on the labor income of wives and husbands and on tax credits, while data on assets is taken from the SCF. Appendix C.3 describes the data sources and their samples in detail.

¹²⁹The model also matches well labor force participation by the wife as shown in Figure C.5 in the Appendix.

them later because children leave the model household over a shorter age interval than in the data.

4.5 Results

This chapter compares the calibrated economy with the actual CTC phase-ins to the counterfactual economy without any phase-ins (full refundability and no ACTC phase-in). We first show how the phase-ins change maternal consumption and hours. We then study heterogeneity by family size and maternal wage share. Finally, we quantify the implications for within- and between-household inequality.

4.5.1 Differences in Consumption and Hours Worked

We begin with the two outcomes most directly linked to bargaining: maternal private consumption and maternal hours worked. We focus on mothers because, in the model, they are the custodial parent after divorce and therefore the spouse whose outside option is weakened by the CTC phase-ins.

We pool observations from both model economies and compare them using regression techniques. We consider parents who have been married in two subsequent periods and are aged 30 to 42, during which the number of children in a household is constant.¹³⁰ The overall sample consists of 2,470,219 family-year observations, with 1,241,967 observed in the model version with CTC phase-ins compared to 1,228,252 families in the model without it.¹³¹ The CTC phase-in economy contains slightly more married families because the phase-ins create a CTC marriage gain for some single women. These sample differences are quantitatively small, as shown in Figure C.6 in the Appendix.

Using the pooled sample, we regress maternal private consumption, c_{fj} , and maternal hours, n_{fj} , on an indicator $D_j^{phase-in}$ for the CTC phase-in economy:

¹³⁰In addition, we consider only households with income below the start of the phase-out of the credit, which hardly affects our sample.

¹³¹Per model version and possible number of children, we simulate 50,000 women and 50,000 men. Over 13 age years, this gives 3.9 million mother-year combinations, of which around 63% are married in two subsequent years.

$$\begin{aligned}
x_{fj} = & \beta_0 + \beta_1 \cdot \left(\frac{w_{fj}}{w_j} - \bar{w}_{fj} \right) \cdot 100 + \beta_2 \cdot D_j^{\text{phase-in}} + \beta_3 \cdot D_j^{\text{phase-in}} \cdot \left(\frac{w_{gj}}{w_j} - \bar{w}_{gj} \right) \cdot 100 \\
& + \beta_4 \cdot X_j + \sum_a \gamma_a \mathbf{1}\{h_{gj} = a\} + \epsilon_{gj},
\end{aligned} \tag{4.4}$$

with $x_{fj} \in \{c_{fj}, n_{fj}\}$. The term w_{fj}/w_j is the mother's wage share in the household. We interact this share with the phase-in dummy because the penalty is largest when the mother has low earnings relative to the father. As we simulate equally many households per number of children to capture the respective distributions equally well, we need to use weights to make the regression results representative. To describe the average mother, we weight observations by the population shares of households with different numbers of children. To describe the mother of the average child, we additionally weight by the number of children, giving larger families more weight.

All regressions include age dummies (with the median age of 36 being the omitted category). The first specification includes no additional control. The second one controls for total household consumption, $X_j = c_j + q_j - \overline{c_j + q_j}$, to separate within-household redistribution from changes in aggregate household resources in a mediator analysis. The third specification controls for the mother's Pareto weight, $X_j = (\mu_{fj} - \bar{\mu}_{fj}) \cdot 100$, to assess how much of the effect operates through bargaining.¹³²

Tables 4.4 and 4.5 report the results. The first three columns refer to the average mother under different controls. The last column refers to the mother of the average child and controls for household consumption.

Maternal consumption. A 36-year-old mother with the average wage share of 44% consumes about \$11,700 in private goods in the counterfactual economy without CTC phase-ins (column 1 of Table 4.4). This is roughly one fifth of total household consumption. A one percentage point higher maternal wage share is associated with \$82 more in maternal private consumption, reflecting the link between earnings capacity and bargaining power. The CTC phase-ins lower maternal consumption by \$91 at the mean wage share. The interaction term shows that the loss is larger when the mother's wage share is lower: a ten percentage point lower wage share increases the consumption loss by another \$56.

¹³²We center total household consumption and the Pareto weight of the mother by their respective average values, i.e. $\overline{c_j + q_j}$ and $\bar{\mu}_{fj}$, which are \$52,500 and 32%, respectively.

Table 4.4. Determinants of maternal consumption

	Average mother			Average child
Intercept	11,700.4***	11,680.2***	11,677.8***	11,756.3***
Maternal wage share	82.4***	143.1***	-8.3***	141.1***
CTC phase-in	-90.9***	-121.0***	-15.2***	-155.6***
CTC phase-in $\times$ mat. wage share	5.6***	5.6***	3.7***	6.8***
Household consumption	—	0.2***	—	0.2***
Pareto weight mother	—	—	131.2***	—
age dummies	yes	yes	yes	yes
R ² (in %)	15.3	77.3	21.3	77.1
N	2,470,219	2,470,219	2,470,219	2,470,219

Notes: The table shows determinants of maternal consumption. The estimation equation and further details can be found in Chapter 4.5.1. For the estimation, we use OLS and a sample of households aged 30 to 42 who have been married in two subsequent periods. In the first three columns, we use weights to target average maternal consumption and include different sets of controls. In the fourth column, we use weights to target the average child. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This reduction is not an aggregate resource effect. In fact, household consumption is about \$270 higher in the baseline phase-in economy because hours worked rise. Yet, maternal private consumption falls.¹³³ When we control for total household consumption, the phase-ins lower maternal consumption by \$121. The higher household resource level therefore masks an even stronger redistribution away from mothers. When we instead control for the mother's Pareto weight, the effect falls to \$15. This is the key mechanism: the effective phase-in reduces maternal consumption primarily because it changes bargaining positions, not because it mechanically lowers household resources.

For the mother of the average child, the effect is larger. The phase-ins lower her consumption by \$156, and a ten percentage point lower maternal wage share increases the loss by another \$68.¹³⁴ This reflects the fact that the CTC is more important in larger families, where more children are attached to the potential custodial parent.

Maternal hours worked. Table 4.5 shows that the effective phase-in also changes labor supply. A mother in the reference group works about 18 hours per week in the counterfactual no-phase-in economy. The CTC phase-ins raise her hours by roughly three hours. Controlling for household consumption barely changes the estimate, implying that the effective phase-in does not simply scale all household choices. Instead, it in-

¹³³In Table C.7 in the Appendix, we directly consider the consumption share of the mother as a dependent variable, which displays very similar patterns.

¹³⁴In Table C.8 in the Appendix, we present results for the average child in the other specifications. Results are analogous to the ones of the average mother.

Table 4.5. Determinants of maternal hours

	Average mother			Average child
Intercept	18.3***	18.3***	18.5***	16.4***
Maternal wage share	0.2***	0.3***	1.1***	0.3***
CTC phase-in	2.7***	2.6***	2.0***	3.1***
CTC phase-in $\times$ maternal wage share	0.1***	0.1***	0.1***	0.1***
Household consumption	—	0.0***	—	0.0***
Pareto weight mother	—	—	-1.3***	—
R ² (in %)	11.1	13.7	36.0	15.4
N	2,470,219	2,470,219	2,470,219	2,470,219

Notes: The table shows determinants of maternal hours. The estimation equation and further details can be found in Chapter 4.5.1. For the estimation, we use OLS and a sample of households aged 30 to 42 who have been married in two subsequent periods. In the first three columns, we use weights to target the average mother and include different sets of controls. In the fourth column, we use weights to target the mother of the average child. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

creases the share of household consumption financed by maternal work. Mothers work more both in absolute terms and relative to fathers.¹³⁵

The hours response has two components. First, the CTC phase-ins lower effective marginal tax rates in the phase-in region and therefore directly increase labor supply incentives. Second, weaker bargaining positions can induce mothers to work more. Holding the mother's Pareto weight fixed reduces the phase-in effect from 2.7 to about 2 hours. Roughly three quarters of the maternal hours response therefore reflects direct incentives, while the remaining quarter reflects bargaining. The mother of the average child increases hours by 3.1 rather than 2.6 hours, again pointing to stronger effects in larger families.

4.5.2 Heterogeneity by Number of Children

The average effects conceal pronounced heterogeneity. Figure 4.4, panel (a), repeats the consumption regression separately by the number of children and shows how the phase-in effect varies with the maternal wage share by showing the respective marginal effect. At the average maternal wage share of 44%, the phase-ins lower maternal consumption by \$30 in one-child families, \$72 in two-child families, and \$310 in three-child families. At the minimum maternal wage share of 2%, the loss in three-child families reaches about \$800. While the effect is roughly linear in the maternal wage share, it is highly

¹³⁵In Table C.9 in the Appendix, we use hours worked by the mother relative to hours worked by the father as a dependent variable. The results confirm that relative hours worked by the mother increase.

nonlinear in the number of children: the consumption loss in three-child families is much larger than in smaller families.

To understand whether this reflects the mechanical size of the CTC penalty, we replace the dependent variable in Equation (4.4) with the CTC divorce penalty.¹³⁶ Panel (b) shows that the phase-ins create average CTC divorce penalties of \$700, \$1,900, and \$3,200 for families with one, two, and three children. A ten percentage point lower maternal wage share increases the penalty by \$240, \$500, and \$820, respectively. The penalty thus rises roughly linearly with family size. This mechanical increase alone therefore cannot explain why maternal consumption falls so much more in three-child families.

Panels (a) and (b) nevertheless align closely: maternal consumption falls most where CTC divorce penalties are highest and is almost unchanged where penalties are absent. The average redistribution of roughly \$120 may appear modest in levels, but it equals about 6% of the CTC divorce penalty in the average family.

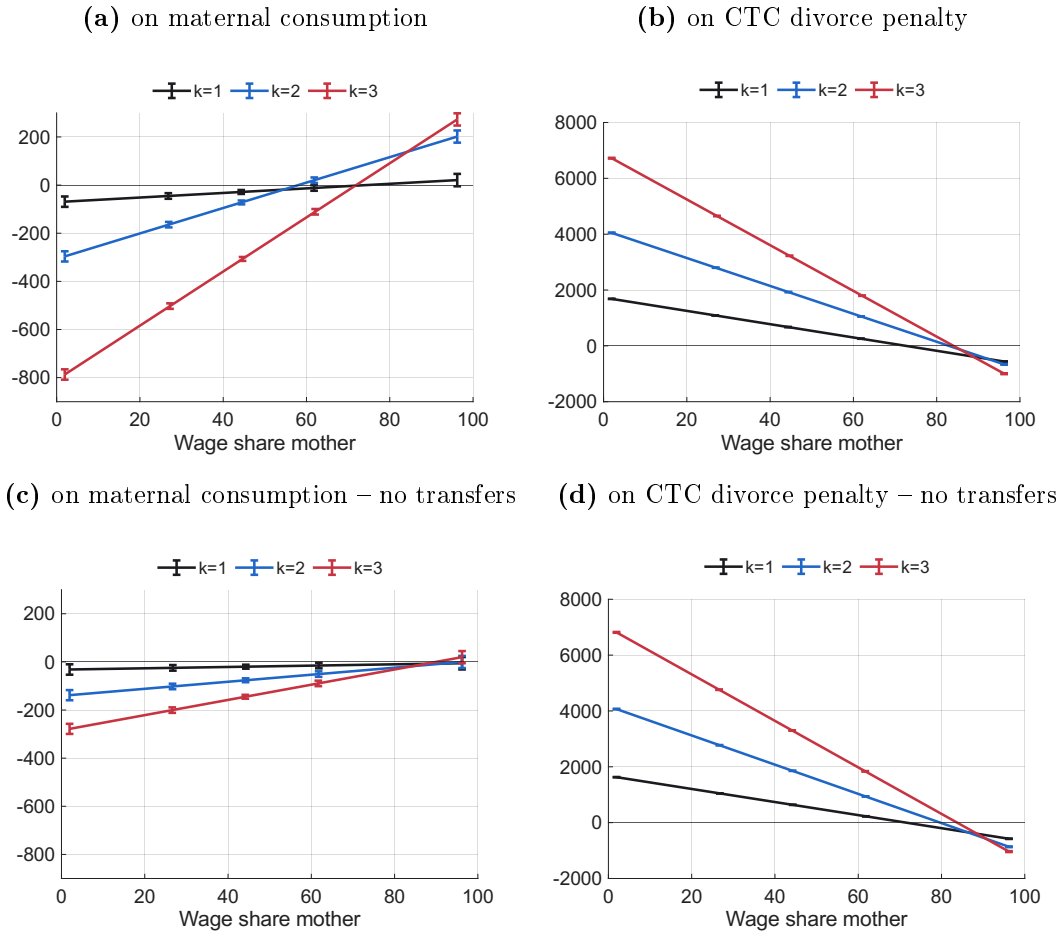
The role of transfers. The large effect in three-child families comes from interactions with transfers. The CTC phase-ins raise maternal labor supply and asset accumulation. In three-child families, these responses often reduce transfer eligibility, which changes the mother's outside option beyond the direct CTC penalty.¹³⁷ To isolate this interaction, we solve two additional model versions, with and without CTC phase-ins, but without transfer payments.¹³⁸

Panel (c) presents the maternal consumption effects without transfers; panel (d) presents the corresponding CTC divorce penalties. Removing transfers barely affects the CTC divorce penalty, but it substantially reduces the nonlinearity of the consumption response. At the average maternal wage share, the phase-ins lower maternal consumption by \$20, \$76, and \$145 in families with one, two, and three children. At the

¹³⁶We define the CTC divorce penalty as $Cr_j^{ctc}(e_j, i_j, k_j, ma) - Cr_{jj}^{ctc}(e_{jj}, i_{jj}, k_j, hh)$ conditional on the mother's choices within marriage. $Cr_j^{ctc}(e_j, i_j, k_j, ma)$ is the CTC for a married couple given household earnings, interest income and the number of children in the household. $Cr_{jj}^{ctc}(e_{jj}, i_{jj}, k_j, hh)$ denotes the CTC of the mother when filing as head of household, given her income from labor supply and capital investment, assuming that the mother does not adjust her hours worked in the outside option. Actual CTC penalties depend on hours worked by the mother in the outside option. As presented in Figure C.7 in the Appendix, average effective CTC penalties are slightly below the presented CTC penalties.

¹³⁷The change in mean life-cycle profiles documented in Figure C.8 in the Appendix confirms this point.

¹³⁸We use the same parameter values as in the baseline model.

Figure 4.4. Impact of the reform by wage share of the mother and number of children

Notes: Panel (a) presents the estimated coefficient for $\hat{\beta}_2$ (the dummy indicating a CTC phase-in) in Equation (4.4) for different wage shares of the mother, considering a sample of households with either one (black line), two (blue line), or three (red line) children. For specific values, we additionally present confidence intervals, i.e. when the wage share of the mother is at its mean, at the mean plus/minus the standard deviation, or at its minimum or maximum value. Panel (b) repeats the exercise, but presents estimates of a regression in which we use the CTC divorce penalty as a dependent variable. Panels (c) and (d) present results analogous to (a) and (b), but for model versions in which we abstract from transfer payments.

minimum wage share, the corresponding losses are \$32, \$138, and \$278. The three-child effect remains larger, but no longer dominates the other family-size groups. Transfer rules thus amplify the bargaining consequences of CTC divorce penalties for larger families.

4.5.3 Inequality

The main implication so far is that the CTC phase-ins reallocate consumption within families. We now investigate how this channel affects individual consumption inequality.

Table 4.6. Within- and between-household consumption inequality

	No CTC phase-in	With CTC phase-ins	Change in %
Between-household inequality	0.087	0.087	-0.039
Within-household inequality	0.096	0.104	+8.763
Overall	0.182	0.191	+4.573

Notes: The table presents overall consumption inequality as well as its decomposition into between-household and within-household consumption inequality. The first column presents results for the model version without a CTC phase-in. The second column presents results for the calibrated model version with the CTC phase-in. The last column shows the change in %. Consumption inequality is defined in Equation (4.5).

ity. Following Lise and Seitz (2011), we decompose individual consumption inequality into between-household inequality, measured as the variance of average log household consumption, and within-household inequality, measured as the average variance of log individual consumption within households:

$$\text{var}(\log c_{gj}) = \text{var}(\text{E}(\log c_{gj}|g \in j)) + \text{E}(\text{var}(\log c_{gj}|g \in j)) \quad (4.5)$$

Table 4.6 presents the results. Without the CTC phase-ins, overall individual consumption inequality is 0.18, with roughly similar contributions of between- and within-household inequality. This differs from studies such as Lise and Seitz (2011), who find a larger between-household component. The difference reflects our sample: among non-college households, between-household consumption inequality is relatively low, while within-household inequality is relatively high because female non-participation is common.

The CTC phase-ins leave between-household inequality essentially unchanged. By contrast, within-household inequality rises by 9%, driving the increase in overall inequality of 5%. The rise of 0.01 in within-household inequality is roughly 6% of the reduction in within-household consumption inequality between 1970 and 2010 estimated by Lise and Seitz (2011) for the UK. The effect is therefore quantitatively meaningful: the effective phase-in changes inequality mainly by changing who controls resources inside the household.

4.6 Relation to Recent Child Tax Credit Reforms

This chapter relates the model's mechanisms to recent policy variation and clarifies the scope for empirical identification. Two sets of reforms are particularly relevant. First, the ARPA made the federal CTC fully refundable for tax year 2021 and thereby eliminated CTC phase-ins and divorce penalties. In principle, this reform generated variation directly related to the mechanism emphasized in our model. In practice, however, the ARPA changed several policy dimensions at once: Next to making the credit fully refundable and removing phase-ins, it increased the maximum benefit and expanded the credit for households with young children. Further, the reform was implemented only temporarily. These features make it difficult to separate bargaining effects operating through outside options from direct income and liquidity effects making the ARPA expansion of the CTC an imperfect natural experiment for our question. Second, several U.S. states have recently expanded or introduced state-level CTCs. These reforms may create useful cross-state variation for empirical work, but they typically combine changes in refundability, benefit levels, eligibility rules, and payment timing, and many remain recent or administratively evolving.

Several recent papers study the ARPA expansion of the CTC empirically. Ananat et al. (2024) and Enriquez, Jones, and Tedeschi (2023) examine labor-supply responses, while Parolin et al. (2023) and Pilkauskas et al. (2024) focus on material hardship. Most relevant for our purposes is Schild et al. (2023), who use Consumer Expenditure Survey (CEX) data to study the effect of the ARPA on household consumption.¹³⁹ They find that households allocate a substantial share of the additional resources from the expanded CTC, about 75%, to goods closely associated with children's well-being and basic household needs. This pattern is consistent with the broad idea that CTC design may affect expenditures on goods that are particularly relevant for mothers and children. However, it does not by itself identify the bargaining channel emphasized in our model.¹⁴⁰

Two limitations are central. First, Schild et al. (2023) estimate the total effect of the ARPA expansion rather than separately identifying the effects of increased generosity

¹³⁹Their earlier study, Collyer et al. (2022), provides preliminary evidence for the first two months of payments, July and August 2021, with broadly similar findings.

¹⁴⁰Our research question requires a sample of couple households, whereas Schild et al. (2023) consider all households with children, irrespective of the number of adults or marital status.

and removed phase-ins. A direct empirical test of our mechanism would need to isolate the latter, because only the removal of the phase-ins maps closely into the counterfactual reform studied in the model and directly affects CTC divorce penalties. The other studies cited above rely on similar identifying variation and therefore face the same limitation for our purposes.

Second, the temporary nature of the ARPA limits what can be learned from short-run empirical responses about the longer-run effects of phase-ins as a persistent policy regime. Our analysis is designed to study a permanent move to full refundability without any phase-ins, which is the relevant counterfactual for understanding the effects of the phase-ins that typically govern the federal CTC. Under limited commitment, bargaining weights adjust only when participation constraints bind. As a result, even a permanent reduction in divorce penalties affects primarily couples close to the relevant constraint. A temporary reform has an even smaller effect on lifetime outside options and is therefore less likely to induce widespread re-bargaining. While any bargaining adjustments that are triggered may persist beyond the policy's expiration, they are likely to arise only for a limited subset of households and need not coincide exactly with the timing of payments. This implies that standard empirical designs exploiting variation around the introduction or expiration of the ARPA are well suited to identify liquidity and short-run income effects, but less informative about the persistent bargaining responses that are central to our question.

Beyond the federal ARPA reform, recent state-level activity may provide additional empirical variation. Several states have introduced or expanded CTCs through changes in benefit levels, eligibility rules, refundability, and payment timing. Reforms in states such as Minnesota, Oregon, Maryland, and Vermont target low-income households, extend eligibility to families with limited tax liability, or introduce more flexible payment structures. Such variation may be useful for future work that compares families across states and over time.

Maine is especially relevant because it recently made its state-specific Child Tax Credit fully refundable, effectively removing the phase-in, so that eligible families can receive the full state credit regardless of tax liability. This reform is closely related to the phase-in margin emphasized in our model. At the same time, it illustrates the empirical challenges of using state-level reforms to identify bargaining effects. The Maine credit

has changed frequently, often on an annual basis, which makes it difficult to separate persistent changes in household bargaining from short-run responses to changing benefit rules. Moreover, sample sizes for small states such as Maine are limited in household-expenditure datasets such as the CEX. These constraints do not make empirical analysis impossible, but they imply that state-level reforms are better viewed as promising future variation than as a clean direct test of the mechanism quantified in this chapter.

4.7 Summary and Implications

This chapter shows that phase-ins in the Child Tax Credit, either literal ones or ones arising de-facto through nonrefundable credits, create divorce penalties with consequences inside marriage. When the secondary earner becomes the custodial parent after separation and has earnings in the effective CTC phase-in range, divorce lowers the family credit. This weakens the custodial spouse's outside option and shifts bargaining power toward the primary earner.

We have found quantitative effects that are economically meaningful. Relative to a counterfactual CTC without phase-ins, the current phase-in lowers mothers' private consumption by about \$120 in the average family and about \$150 for the mother of the average child. It increases maternal labor supply by roughly 2.5 hours per week. The consumption losses are driven primarily by bargaining rather than by lower household resources. They are largest in families with more children and in families where the mother's wage is low relative to the father's. Through this channel, the effective CTC phase-in raises within-household inequality by about 9% and overall individual consumption inequality by about 5%, while leaving between-household inequality essentially unchanged.

The policy implication is simple but often missed: child-benefit design affects the distribution of resources not only across households, but also within households. A fully refundable CTC without phase-ins would expand support at the bottom and remove the phase-in-induced divorce penalties studied here. A partially refundable and phased-in credit, by contrast, reduces control over resources of the parent most likely to care for children after separation. Evaluating family policy therefore requires models and

evidence that account for detailed tax-transfer rules, marital status, custody practices, and household bargaining.

More broadly, the results suggest that seemingly technical design features – refundability thresholds, phase-in rates, and filing-status-specific rules – can shape family dynamics even when aggregate benefit levels are held fixed. Future work can use similar frameworks to compare alternative CTC designs, study interactions with childcare subsidies and other child-related programs, and examine analogous mechanisms in countries with different benefit systems.

5 Concluding Remarks

This dissertation has examined specific family-related tax-transfer programs in the United States and their implications for consumption insurance, household choices, welfare, and intra-household bargaining. Chapter 2 shows that means-tested transfers and phased-in tax credits play complementary roles in insuring families against labor-market risk. Transfers are targeted toward households with low earnings, little wealth, and children, while phased-in credits preserve labor supply incentives for secondary earners more effectively. Chapter 3 shows that tax-transfer reforms between 2004 and 2019 left aggregate progressivity close to its initial level, but nevertheless changed incentives, insurance, inequality, and welfare for different household groups. Chapter 4 shows that the effective phase-in of the Child Tax Credit creates divorce penalties that weaken the bargaining position of the custodial parent, typically the mother, within marriage.

A common theme across the three chapters is that the effects of family policy depend on the detailed design of tax-transfer programs. Program features such as asset tests, benefit phase-ins and phase-outs, refundability rules, bracket limits, and standard deductions affect households not only through disposable income, but also through saving, labor supply, program eligibility, and bargaining positions within the family. These mechanisms are difficult to capture when the tax-transfer system is summarized by a single progressivity parameter or treated only at an aggregate level. The results therefore point to the value of analyzing individual policy components and their interactions.

The analysis in Chapter 2 shows that the insurance value of transfers and credits cannot be inferred from their mechanical effects alone. Households adjust saving and labor supply in response to policy rules, and these behavioral responses can either dampen or reinforce the direct insurance effects of public programs. For vulnerable households, transfers provide sizable insurance, despite partly reducing labor-supply-based self-insurance. Phased-in credits provide less direct insurance, but they preserve

incentives for secondary earners to remain attached to the labor market. A system that combines both instruments provides more net insurance for young couples than a system that relies on either transfers or credits alone.

Chapter 3 shows that similar levels of aggregate progressivity can mask differences in the structure of the tax-transfer system. Between 2004 and 2019, expansions of tax credits increased progressivity at the lower end of the income distribution, while reductions in marginal tax rates lowered progressivity at the upper end. These reforms raised average consumption in all education groups, but the gains were larger among highly educated households and at older working ages. As a result, consumption and wealth inequality increased, and welfare declined on average, with the largest losses among households without children and households with medium levels of education.

Chapter 4 adds an intra-household perspective. It shows that the partial refundability and phase-in of the CTC affect not only employment incentives and benefit eligibility, but also the distribution of resources within marriage. When the custodial parent would lose part of the credit in the event of divorce, her outside option deteriorates. In the model, this shifts bargaining power toward the primary earner, reduces maternal private consumption, increases maternal labor supply, and raises within-household consumption inequality. These results suggest that the evaluation of child-related tax credits should account not only for household-level outcomes, but also for the allocation of resources within the household.

Although the dissertation focuses on the U.S. tax-transfer system, several mechanisms are relevant more broadly. Many countries combine universal child benefits, means-tested transfers, work-contingent support, and family-related tax provisions. The trade-offs identified here therefore speak to general questions in the design of family policy: how to target support to households with limited private buffers, how to preserve labor supply incentives, how to evaluate reforms that offset each other in aggregate measures, and how to account for within-household distributional effects?

The results also indicate several directions for future research. One avenue is to study whether similar complementarities between means-tested transfers and phased-in credits arise in other institutional settings, including countries that currently rely more heavily on transfers than on tax credits. Another is to examine how benefit interruptions, administrative delays, or uncertainty about eligibility affect households with limited

assets, for whom public transfers are an important insurance device. Finally, future work could further analyze in how far family-related tax provisions in other countries affect bargaining, child-related expenditures, and the distribution of resources within households.

Taken together, this dissertation shows that family-related tax-transfer programs affect households through several connected channels. They insure consumption, shape saving and labor supply, change the distribution of welfare across household types, and influence bargaining positions within families. Seemingly technical features of tax and transfer programs can therefore have sizable effects on individual families. Understanding these mechanisms is essential for evaluating existing policies and for designing reforms that support families while accounting for incentives, insurance, and within-household distribution.

Appendix A

This appendix provides further information on Chapter 2 of the dissertation. Appendix A.1 presents details on the U.S. income tax and transfer system in tax year 2019, focusing on married couples.¹⁴¹ Appendix A.2 describes the parameterization of the model. I then present further results of the baseline model (Appendix A.3), of the main policy experiments (Appendix A.4), of specific features (Appendix A.5), and discuss budget-neutral model versions (Appendix A.6).

A.1 The U.S. Tax and Transfer System

Allowances. The relevant income measure to determine tax liabilities is taxable income, $\tilde{y}$, which is defined as gross income net of deductions allowed,

$$\tilde{y}(e, i, b) = \max \left(0, e + i + \tilde{b}(b, i) - d \right),$$

with earnings e and interest income i as defined in Equation (2.2) and (2.1), respectively. d denotes the standard deduction and $\tilde{b}(b, i)$ is the taxable part of pensions which is defined below in Equation (A.10). Table A.1 presents the parameter values.

Statutory tax rates. Income taxes, $T(e, i, b)$,

$$T(e, i, b) = \max \left[0, \tau_j \cdot \max(0, \tilde{y}(e, i, b) - lb_j) + \sum_{i=1}^{j-1} \tau_i \cdot (ub_i - lb_i) \right], \quad (\text{A.1})$$

depend on the married couple's taxable income, $\tilde{y}(e, i, b)$. τ_j denotes the marginal tax rate of the highest tax bracket, j , which the household's taxable income reaches and applies to all taxable income above the lower limit of the current tax bracket, lb_j .

¹⁴¹The presented tax-transfer parameters are reported in dollars. Within the model, I divide those values by the average household labor income of \$134,573.

Table A.1. Bracket limits and marginal rates

PANEL A: Allowances			
Standard deduction in \$K (retired households)	d	24,4 (27)	
PANEL B: Statutory income taxes			
Bracket	Lower limit (\$)	Upper limit (\$)	Marginal tax rate (%)
1	0	19,400	10
2	19,400	78,950	12
3	78,950	168,400	22
4	168,400	321,450	24
5	321,450	408,200	32
6	408,200	612,350	35
7	612,350	∞	37
PANEL C: Payroll taxes			
Social Security tax rate in %	τ^{ss}	6.2	
Social Security cap in \$K	$\bar{e}^{ss}$	132.9	
Additional hospital tax rate in %	τ^{add}	0.9	
Additional hospital tax, limit in \$K	$\underline{e}^{add}$	250	
Medicare tax rate in %	τ^m	1.45	

Source: OECD (2020) iLibrary Taxing Wages modules

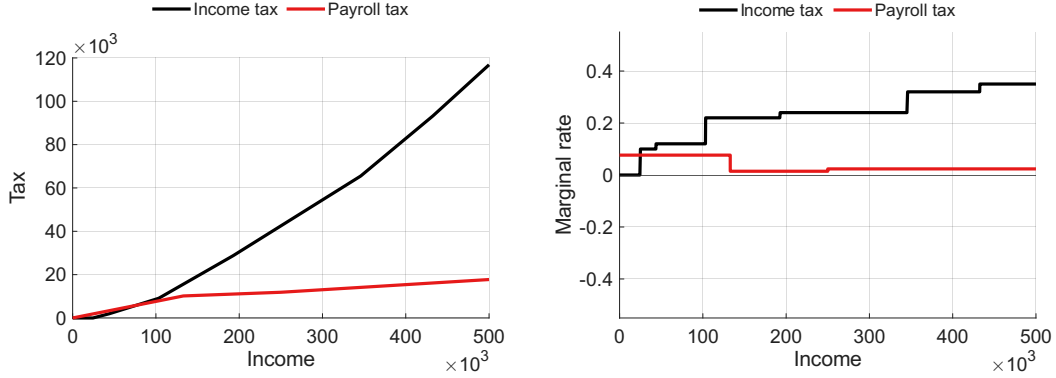
Taxable income up to this limit is taxed with lower marginal tax rates, τ_i , from brackets 1 to $j - 1$, documented in Table A.1.

Figure A.1 illustrates a married couple's gross income and the implied income taxes (black line in panel a), as well as the corresponding marginal tax rate (black line in panel b). The latter remains at zero for incomes up to \$K 24,4 due to allowances. Beyond this threshold, the marginal rate rises sharply – by 10 percentage points – just above this income level and again around \$K 100. Other increases in the marginal rate are more gradual, with constant rates in between.

Payroll taxes. Payroll taxes finance Social Security and Medicare,

$$T^p(e) = \tau^{ss} \cdot \min(e, \bar{e}^{ss}) + \tau^m \cdot e + \tau^{add} \cdot \max(0, e - \underline{e}^{add}), \quad (\text{A.2})$$

where τ^{ss} is the Social Security tax rate paid on earnings below the cap $\bar{e}^{ss}$. τ^m is the Medicare tax rate. An additional hospital tax, τ^{add} , is paid by households with earnings above the limit, $\underline{e}^{add}$. Table A.1 presents the parameter values, and Figure A.1 shows payroll taxes and their marginal rates (red lines). The sharp 6.2 percentage point drop in the marginal rate at earnings of \$K132.9 is particularly noteworthy.

Figure A.1. Income and payroll taxes and their marginal rates

Notes: Numbers are given in 2019 dollars. The left panel shows the level of federal income taxes (black) and payroll taxes (red). The right panel shows corresponding marginal rates. For simplicity, income on the horizontal axis refers to earnings only. Note that federal income taxes actually depend on earnings, income from short-term capital investment, and pensions, while payroll taxes depend on earnings only; see also Equation (A.1) and (A.2), respectively.

Earned Income Tax Credit. The EITC, if the household is eligible, is

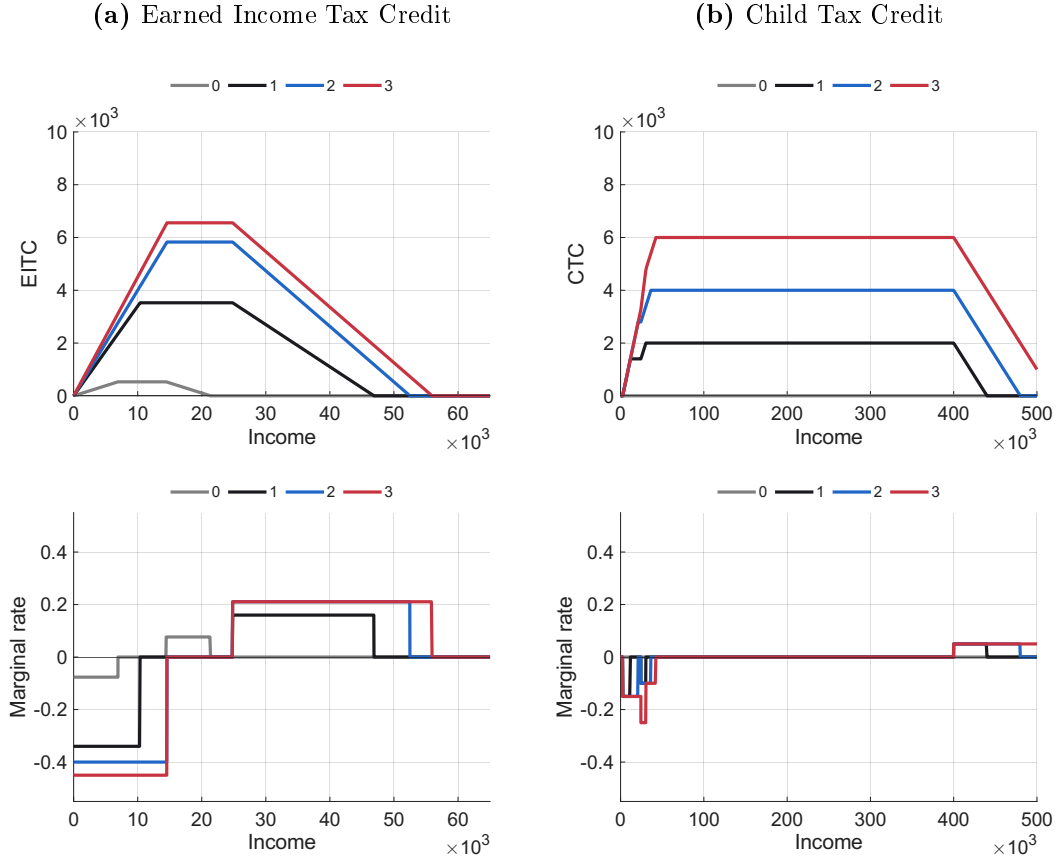
$$Cr^{eitc}(e, i, k) = \max \left[0, \tau_1^{eitc}(k) \cdot \min(e, \bar{e}_1^{eitc}(k) - \tau_2^{eitc}(k) \cdot \max(0, e - \bar{e}_2^{eitc}(k))) \right], \quad (\text{A.3})$$

where $\tau_1^{eitc}(k)$ is the child-specific phase-in rate and $\bar{e}_1^{eitc}(k)$ the child-specific earnings threshold, marking the end of the phase-in. The starting point of the phase-out is denoted by $\bar{e}_2^{eitc}(k)$ and the phase-out rate by $\tau_2^{eitc}(k)$. Married couples are eligible for the EITC if

$$i \leq \bar{i}^{eitc} \quad \wedge \quad y(e, i) \leq \bar{y}^{eitc}(k),$$

i.e., the households' asset income, i , and gross income, $y(e, i)$, must not exceed the limits $\bar{i}^{eitc}$ and $\bar{y}^{eitc}(k)$.

Figure A.2a illustrates the three ranges of the EITC, i.e., the phase-in, the plateau, and the phase-out. The maximum possible credit amount varies from \$530 for households without children to \$6,560 for households with three or more children. The panel at the bottom presents marginal rates implied by the EITC. During the phase-in, marginal rates are negative and vary from -7.65% to -45%. In contrast, during the phase-out, marginal rates become positive but vary from 7.65% to only 21.06%. Table A.2 presents EITC parameter values.

Figure A.2. Tax credits and their marginal rates

Notes: Numbers are given in 2019 dollars. Upper panels show the level of tax credits by number of children living in the household and panels at the bottom present corresponding marginal rates. For simplicity, income on the horizontal axis refers to earnings only. Note that both credits additionally depend on income from short-term capital investments; see Equation (A.3) and (A.4).

Child Tax Credit. The CTC consists of a non-refundable component, $ctc(e, i, k)$, and a refundable component, $actc(e, i, k)$; see Equation (A.4). The non-refundable credit amount, as defined in Equation (A.5), is the maximum credit per child, cr^{max} , times the number of children in the household, k . There is a de-facto phase-in region when household tax liability, $T(e, i, b)$, is below the maximum credit amount. The credit phases down at rate τ^{ctc} for gross income above $\bar{y}^{ctc}$.

$$Cr^{ctc}(e, i, k) = ctc(e, i, k) + actc(e, i, k) \quad (A.4)$$

$$ctc(e, i, k) = \max \left[0, \min \left\{ T(e, i, b), k \cdot cr^{max} - \tau^{ctc} \cdot \max \left(0, y(e, i) - \bar{y}^{ctc} \right) \right\} \right] \quad (A.5)$$

Table A.2. EITC and CTC parameters

PANEL A: EITC parameters					
Asset income limit in \$	$\bar{\tau}^{eitc}$	3,600			
Number of children in the household	k	0	1	2	≥ 3
Gross income limit in \$	$\bar{y}^{eitc}$	21,370	46,884	52,493	55,952
Earned income limit, phase-in end in \$	$\bar{e}_1^{eitc}$	6,920	10,370	14,570	14,570
Earned income limit, phase-out start in \$	$\bar{e}_2^{eitc}$	14,450	24,820	24,820	24,820
Phase-in rate in %	τ_1^{eitc}	7.65	34	40	45
Phase-out rate in %	τ_2^{eitc}	7.65	15.98	21.06	21.06
PANELB: CTC parameters					
Credit per child in \$K	cr^{max}	2			
Gross income threshold in \$K	$\bar{y}^{ctc}$	400			
Phase-out rate in %	τ^{ctc}	5			
ACTC earnings minimum in \$K	$\bar{e}^{actc}$	2.5			
ACTC phase-in rate in %	τ^{actc}	15			
ACTC maximum value in \$K	$actc^{max}$	1.4			

Source: OECD (2020) iLibrary Taxing Wages modules

$$actc(e, i, k) = \min \begin{cases} \min \{ctc^{hypo}(e, i, k, fs) - ctc(e, i, k, fs), k \cdot actc^{max}\}, \\ \max \begin{cases} 0, \tau^{actc} \cdot (e - \bar{e}^{actc}) \\ [T^p(e) - Cr^{eitc}(e, i, k)] \mathbb{I}_{k=3} \end{cases} \end{cases} \quad (A.6)$$

$$ctc^{hypo}(e, i, k) = \max [0, k \cdot cr^{max} - \tau^{ctc} \cdot \max (0, y(e, i) - \bar{y}^{ctc})] \quad (A.7)$$

Equation (A.6) and (A.7) summarize the calculation of the refundable component, where τ^{actc} denotes the ACTC phase-in rate for earnings above the limit $\bar{e}^{actc}$. The ACTC cannot exceed the cap $k \cdot actc^{max}$. Special rules apply for households with three or more children, indicated by $\mathbb{I}_{k=3}$. Table A.2 reports the parameter values.

Figure A.2b presents the credit amount and the associated marginal rates. The amount of the CTC is comparable to that of the EITC (based on the number of children in the household). However, child tax credits benefit a broader range of households, primarily because they phase out at higher income levels. This phase-out results in modest increases in marginal rates for households with relatively high incomes. For the majority of households, the marginal rates associated with the credit are zero. At lower income levels, during the phase-in period, marginal rates are slightly negative.

Transfer payments. Transfer payments in the model encompass SNAP and TANF, i.e.

$$Tr(e, i, b, a, k, n_f) = Tr^{snap}(e, i, b, a, k) + Tr^{tanf}(e, i, k, a, n_f). \quad (\text{A.8})$$

Parameter values are reported in Table A.3.¹⁴²

SNAP. Conditional on eligibility, SNAP claims are given by

$$Tr^{snap}(e, i, b, a, k) = \max \left[snap^{min}(k), snap^{max}(k) - \max(0, \tau^{snap} \cdot y^{c,net}(e, i, b)) \right],$$

where $snap^{min}(k)$ and $snap^{max}(k)$ denote the child-specific minimum and maximum allotment, and τ^{snap} the phase-out rate. Counted net income is defined as

$$y^{c,net}(e, i, b) = 0.8 \cdot e + i + b - d^{snap},$$

where d^{snap} is the standard deduction. Married couples are eligible for SNAP if

$$a \leq \bar{a}^{snap} \quad \wedge \quad e + i + b \leq \bar{y}^{snap}(k) \quad \wedge \quad y^{c,net}(e, i, b) \leq \bar{y}^{c,net}(k),$$

i.e. their total wealth, their gross income, and their counted net income must not exceed the thresholds $\bar{a}^{snap}$, $\bar{y}^{snap}(k)$, and $\bar{y}^{c,net}(k)$, respectively. SNAP has no age restriction, so retirees may qualify for SNAP.¹⁴³

TANF. Conditional on eligibility, TANF benefits are calculated as

$$Tr^{tanf}(e, i, k, a, n_f) = \max \left[0, \min \left\{ tanf^{max}(k), \tau^{tanf} \cdot \left(y^{need}(k) - y^{c,net,t}(e, i, n_f) \right) \right\} \right]$$

¹⁴²SNAP and TANF parameters are commonly tied to household size. As I focus on married couples, the parameters documented here depend on the number of children in the household.

¹⁴³Special rules apply for households with at least one person older than 60. First, there is a higher wealth limit, $\bar{a}^{snap,60+}$. Second, there is no limit for counted net income. In the model, I apply these rules to households aged older than 65.

Table A.3. SNAP and TANF parameters

PANEL A: SNAP parameters					
Phase-out rate in %	τ^{snap}			30	
Wealth limit in \$	$\bar{a}^{snap}$			2,250	
	$\bar{a}^{snap,60+}$			3,500	
Number of children in the household	k	0	1	2	3
Standard deduction in \$	d^{snap}	1,968	1,968	2,088	2,448
Gross income limit in \$	$\bar{y}^{snap}$	21,408	27,024	32,640	38,256
Counted net income limit in \$	$\bar{y}^{c,net}$	16,464	20,784	25,104	29,424
Maximum allotment in \$	$snap^{max}$	4,236	6,060	7,704	9,144
Minimum allotment in \$	$snap^{min}$	180	0	0	0
PANEL B: TANF parameters					
TANF phase-out rate in %	τ^{tanf}			50	
Labor income share	$\tau^{tanf,e}$			2/3	
Labor income disregard per worker in \$	d^{work}			1,440	
Asset limit in \$	$\bar{a}^{tanf}$			10,000	
Number of children in the household	k		1	2	3
Standard of need in \$	y^{need}		15,588	18,828	22,068
Payment standard in \$	$tanf^{max}$		4,056	4,884	5,700

Sources: Food and Nutrition Service (2018) for SNAP and the Welfare Rules Database offered by the Urban Institute (2020) for TANF, cross-checked with numbers from the Division of Social Services of the state of Delaware, whom I thank for their support. Numbers here are converted to a yearly basis, while official data refer to a monthly basis.

where $tanf^{max}$ is the child-dependent maximum payment, also referred to as payment standard, and $y^{need}(k)$ is the child-dependent standard of need.¹⁴⁴ TANF payments phase out at rate τ^{tanf} depending on the household's counted net income,

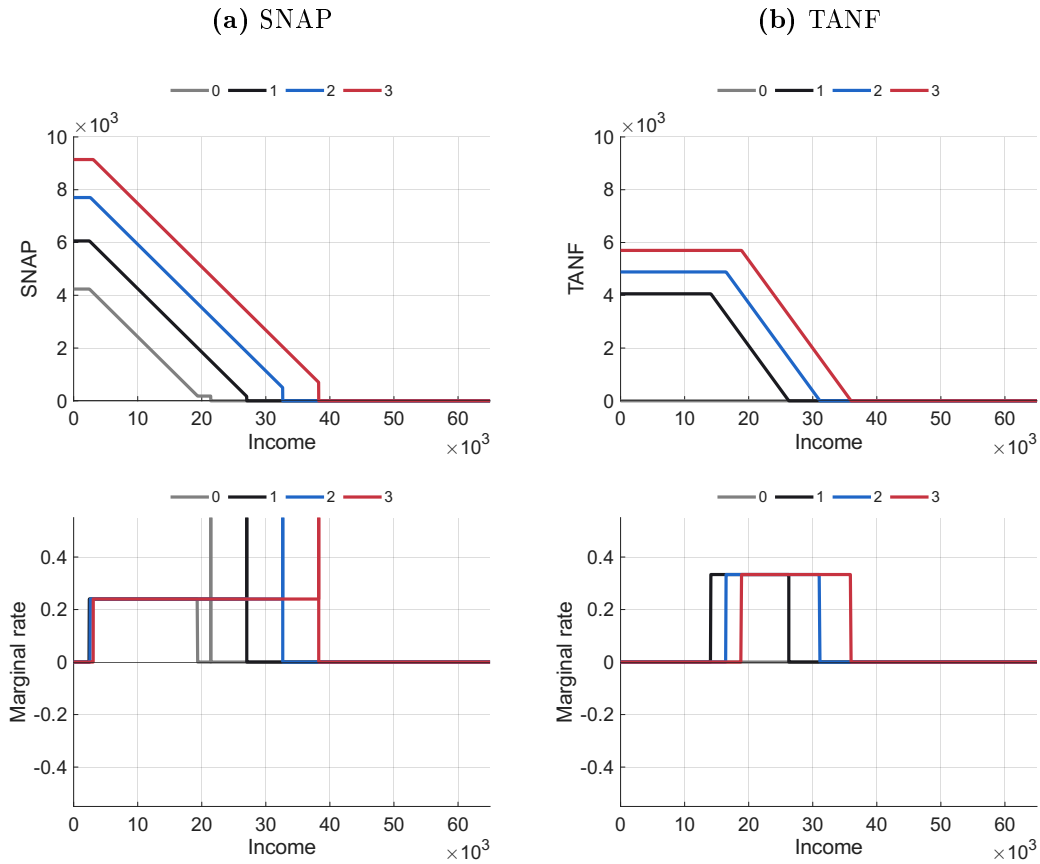
$$y^{c,net,t}(e, i, n_f) = i + \tau^{tanf,e} \cdot (e - n^{worker}(n_f) \cdot d^{work}),$$

where $\tau^{tanf,e}$ is the labor income share accounted for, and d^{work} is a disregard on labor income.¹⁴⁵ The allowance depends on the number of working members in the household, $n^{worker}(n_f) = 1$ if $n_f = 0$, else 2, which depends on the wife's labor supply, given that the wife is the only person in the household with an extensive labor-supply margin in the model. A household is eligible for TANF if

$$k > 0 \quad \wedge \quad a \leq \bar{a}^{tanf} \quad \wedge \quad y^{c,net,t}(e, i, n_f) \leq y^{need} \quad \wedge \quad e + i \leq 1.85 \cdot y^{need},$$

¹⁴⁴Compared to other states, the maximum payment in Delaware falls into the lower middle range.

¹⁴⁵There is a \$90 monthly labor income disregard, plus an additional \$30 for the first twelve months of earnings. I assume a total disregard of \$120 per month.

Figure A.3. Transfers and their marginal rates

Notes: Numbers are given in 2019 dollars. Upper panels show the level of transfer payments by number of children living in the household and panels at the bottom show corresponding marginal rates. For simplicity, income on the horizontal axis refers to earnings only. Note that transfers may actually also depend on income from investments and retirement benefits; see also Equation (A.8). Additionally, I assume that the household passes the asset tests.

i.e. to be eligible, children must be members of the household and the household must pass a resource test. Counted net income must not exceed 100% of the standard of need, while gross income must not exceed 185% of it.¹⁴⁶ Additionally, households must fulfill work requirements and respect a time limit, for which I abstract from in the model.

Figure A.3 shows SNAP and TANF benefits and marginal rates by labor income and by number of children living in the household. Households can receive considerable amounts of SNAP varying from a maximum of \$K 4.2 for households without children up to \$K 9.1 for households with three children. During phase-out of the program, marginal rates reach a value of 24% – which could reach up to 30% the lower the labor

¹⁴⁶In Delaware, eligibility rules differ for recipients and applicants. I focus on the less strict rules for recipients, which are more comparable to other states.

income share. TANF maximum benefits vary from \$4,060 for a household with one child to \$5,700 for a household with three children. Under the assumption that the household's only income source are earnings, marginal rates during phase-out reach about 33%. Assuming that the household has income only from sources other than earned income, the phase-out rate can reach a value of 50%.

Pensions. In the model, households receive pension income, $b_t(\tilde{e})$, during retirement, $t \geq R$. I determine pension benefits using the PIA formula:

$$b_t(\tilde{e}) = \begin{cases} 0.9 \cdot \tilde{e} & \tilde{e} \leq BP_1 \\ 0.9 \cdot BP_1 + 0.32 \cdot (\tilde{e} - BP_1) & BP_1 < \tilde{e} \leq BP_2 \\ 0.9 \cdot BP_1 + 0.32 \cdot (BP_2 - BP_1) + 0.15 \cdot (\tilde{e} - BP_2) & BP_2 < \tilde{e}, \end{cases} \quad (\text{A.9})$$

where BP_1 and BP_2 denote bend points. $\tilde{e}$ denotes counted earnings, which are constructed from the permanent wage component and the deterministic life-cycle component of the spouses in the last period before retirement:

$$\tilde{e}(z_{mR-1}, z_{fR-1}, \ell_{mR-1}, \ell_{fR-1}) = \sum_{g \in \{m, f\}} \min[\bar{e}^{ss}, \exp(z_{gR-1} \cdot \ell_{gR-1}) \cdot s],$$

where $\bar{e}^{ss}$ is the earnings cap for Social Security contributions and s is a scaling parameter ensuring that the average replacement rate of 27.9% is matched. Table A.4 documents the parameter values. Additionally, it presents parameters regarding the taxable part of pensions, which is:

$$\tilde{b}(b, i) = \begin{cases} 0 & i + b < \bar{y}_1^b \\ 0.5 \cdot b & \bar{y}_1^b \leq i + b < \bar{y}_2^b \\ 0.85 \cdot b & \bar{y}_2^b \leq i + b. \end{cases} \quad (\text{A.10})$$

A.2 Details on the Parameterization

CPS data and sample. To calculate the empirical targets regarding labor income and labor market participation, I use IPUMS data from the Annual Social and Economic

Table A.4. Parameters regarding pensions

Parameter	Value	Parameter	Value
Bend points (in \$)	BP_1 11,112 BP_2 66,996	Income thresholds for taxable part of pension (in \$)	$\bar{y}_1^b$ 32,000 $\bar{y}_2^b$ 44,000

Notes: Bend points, BP , are taken from the U.S. Social Security Administration (2026). Numbers are converted to a yearly basis, while official data are reported monthly. For the taxable part of pensions, $\tilde{b}(b, i)$, I use information from the *Tax Guide for Seniors* provided by the Internal Revenue Service (2019).

Supplement of the CPS for year 2019. Since reported income refers to the previous year, I use data from wave 2020 of the survey.

The sample consists of opposite-sex married couples who file jointly and have up to three children. Husbands must work and be between ages 30 and 57, while wives can be of any age and working status. I drop households with additional household members other than the two spouses and children aged 18 or younger. In addition, I apply conventional outlier restrictions.¹⁴⁷ As outlined in Chapter 2.4, when needed, I extend this sample to also include years 2000 to 2022.

Table A.5 shows how each sample restriction affects the sample size in the order applied. In total, CPS wave 2020 contains 60,460 households. The largest reductions come from focusing on opposite-sex married couples filing jointly (about 5,000 households), restricting husbands to ages 30 to 57 (about 34,000 households), retaining households with one family and only one mother and one father (about 4,000 households), and retaining households with up to three children whose oldest child is no older than 18 (about 3,000 households). Other restrictions have smaller effects on sample size.

Children. During working age, children enter and leave the household stochastically following a Markov chain with four states, $K = \{0, 1, 2, 3\}$. The transition matrix is

$$M_{jt} = \begin{bmatrix} m_{00} & m_{01} & 0 & 0 \\ m_{10} & m_{11} & m_{12} & 0 \\ 0 & m_{21} & m_{22} & m_{23} \\ 0 & 0 & m_{32} & m_{33} \end{bmatrix},$$

¹⁴⁷I exclude households in which wife or husband work more than 80 hours, households who report positive hours worked without any earnings, and households who work in the armed forces. I drop top-coded households where the head's or spouse's earned income exceeds one million dollars.

Table A.5. Sample selection in CPS data 2019

Number of households in CPS data	60,460
Exclusion of households with...	
... more or less than one family	- 2,540
... more than one mother in HH	- 1,564
... more than one father in HH	- 263
... male aged below 30 or above 57	- 34,388
... marital status not married	- 4,897
... filing status not jointly	- 348
... children or armed forces as respondent	- 163
... children or armed forces as spouse	- 143
... more than three children	- 1,083
... oldest child older than 18	- 2,353
... non-working male	- 535
... hours worked by male above 80	- 53
... hours worked by female above 80	- 61
... positive hours, but no earnings by male	- 691
... positive hours, but no earnings by female	- 372
... labor income above one million	- 75
... other HH members than head, spouse, children	- 435
Final number of households in CPS sample	10,496

where $m_{kk'}$ denotes the probability to go from state k to state k' in the next period, with maximum one child entering or leaving the household per period. The probabilities are age- and education-specific. In period 1 to t_j^* , children enter but do not leave the household, while in period $t_j^* + 1$ to 45, children leave but no longer enter the household. The education-specific thresholds, t_j^* , are set to $t_j^* = (15, 18, 17, 20, 22)$ with $j \in \{1, 2, 3, 4, 5\}$, corresponding to ages (35, 38, 37, 40, 42).

The transition matrices are estimated to match the observed distribution of couples by the number of children in the household in the data, accounting for ages 30 to 65:

$$D_{jt} \times \widehat{M}_{jt} = \widehat{D}_{j,t+1} \quad \text{and} \quad \widehat{D}_{j,t+1} - D_{j,t+1} = 0,$$

Table A.6. Overview of parameters concerning the deterministic wage component

Parameter	Symbol	Education group					Source
		1	2	3	4	5	
(Share in %)	j	(5.2)	(21.5)	(12.7)	(40.4)	(20.3)	
Deterministic wage component							
Constant, men	$b_{0,m,j}$	20.251	-10.574	-25.991	-9.666	-14.798	estimated
Coefficient 1, men	$b_{1,m,j}$	12.078	17.368	29.188	14.489	11.766	
Coefficient 2, men	$b_{2,m,j}$	-53.056	-6.551	-.096	-.217	-5.692	
Power 1, men	$p_{1,m,j}$	-.2	1	.5	1	2	
Power 2, men	$p_{2,m,j}$	-.2	1	3	3	2	
Constant, women	$b_{0,f,j}$	0.893	-92.782	51.576	84.480	-42.742	
Coefficient 1, women	$b_{1,f,j}$	-1.257	91.833	62.955	103.499	107.076	
Coefficient 2, women	$b_{2,f,j}$	19.896	-26.128	-59.028	-101.361	-38.565	
Power 1, women	$p_{1,f,j}$	-.5	.5	0	0	0	
Power 2, women	$p_{2,f,j}$	-.5	.5	.5	.5	0	

where D_{jt} represents the distribution observed in the data at each age and for each education type.¹⁴⁸ Using the shares $D_{j,t}$ and $D_{j,t+1}$, I estimate the probabilities $m_{kk'}$, such that the predicted distribution, $\hat{D}_{j,t+1}$, matches the observed distribution closely.¹⁴⁹

Deterministic wage component. Table A.6 reports the estimated parameters regarding the deterministic wage component. To be consistent with the stochastic wage component, I first regress log hourly wages, $\log w_{g,j}$, on household characteristics and then use average predicted wages by age and the husband's education type in levels, $\hat{w}_{g,j}$, to estimate the constant $b_{0,g,j}$, coefficients $b_{1,g,j}$ and $b_{2,g,j}$, and powers $p_{1,g,j}$ and $p_{2,g,j}$ in the fractional polynomial,

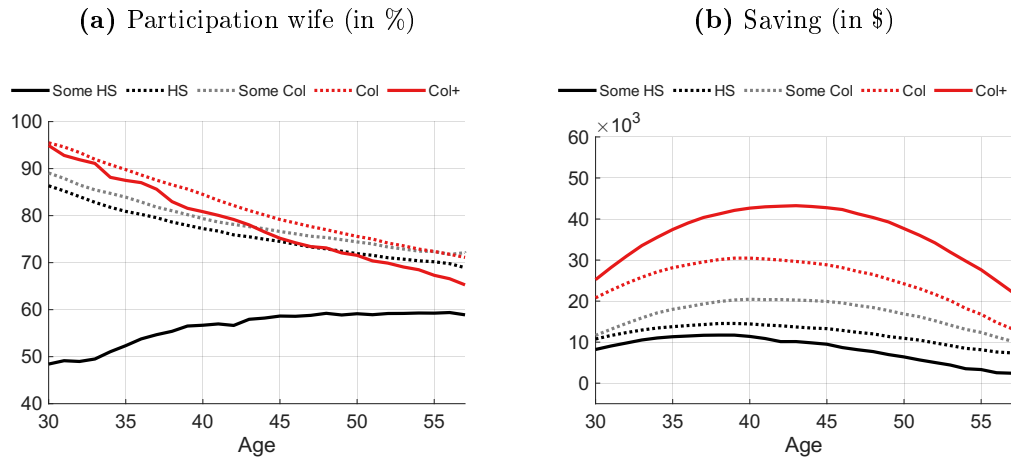
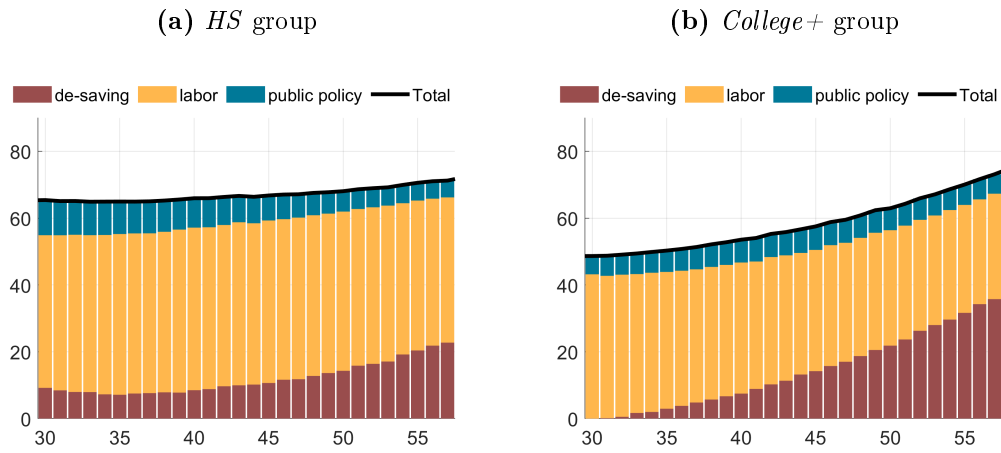
$$\hat{w}_{g,j}(age) = b_{0,g,j} + b_{1,g,j}(age)^{(p_{1,g,j})} + b_{2,g,j}(age)^{(p_{2,g,j})}.$$

A.3 Baseline Model: Life-Cycle Profiles and Insurance

Life-cycle profiles by education. Figure A.4 illustrates life-cycle profiles by education in the baseline model. Panel (a) shows that wives in the *Some HS* group have notably

¹⁴⁸As described above, I employ pooled CPS data from 2000-2022 and add husbands aged 58-65 to the sample. To smooth the age patterns, I determine the share at a given age from observations at the two adjacent ages on each side.

¹⁴⁹Households enter the model childless. For ages 21 to 30, the transition probabilities are estimated such that the households end up with the observed shares at age 30. When reaching retirement age, all children leave the household with certainty.

Figure A.4. Life-cycle profiles in the baseline model**Figure A.5.** Insurance in the baseline model in other education groups

Notes: The figure shows total insurance (black line, measured in percent) and the decomposition of total insurance as described in Chapter 2.4.5 by education group. The blue bars show the contribution of the tax-transfer system, $\phi_{p_{jt}}$. The orange bars show the role of husband and wife in providing insurance, i.e. $\phi_{m_{jt}} + \phi_{f_{jt}}$. The red bars refer to the role of de-saving, $\phi_{s_{jt}} + \phi_{i_{jt}}$.

lower labor force participation. Their participation rises with age, in contrast to the declining participation observed among higher-educated groups. Panel (b) shows saving behavior to be broadly inverted U-shaped across all groups, with the highly educated saving the most, thereby accumulating considerable amounts of wealth.

Insurance in other education groups. In Figure 2.4 in the main text, I decompose consumption insurance over the life cycle into the contributions from de-saving, labor, and public policy with a focus on the average household and the *Some HS* group.

Table A.7. Decomposing insurance via public policy

Household total income, y_t		
↓	} Insured by income taxes	$\phi_T = \kappa_{y_t} - \kappa_{y_t^{at}}$
After-tax income, y_t^{at}		
↓	} Insured by the EITC	$\phi_{EITC} = \kappa_{y_t^{at}} - \kappa_{y_t^{at,eitc}}$
After-tax, after-EITC income, $y_t^{at,eitc}$		
↓	} Insured by the CTC	$\phi_{CTC} = \kappa_{y_t^{at,eitc}} - \kappa_{y_t^{at,cr}}$
After-tax, after-credits income, $y_t^{at,cr}$		
↓	} Insured by transfers	$\phi_{Tr} = \kappa_{y_t^{at,cr}} - \kappa_{y_t^{post}}$
Post-government income, y_t^{post}		
Total public insurance, ϕ_p :		$\sum = \kappa_{y_t} - \kappa_{y_t^{post}}$

Figure A.5 additionally shows results for the *HS* and *College+* groups.¹⁵⁰ Compared to the *Col+* group, those in the *HS* group exhibit higher levels of insurance in younger ages, driven by the incentive to de-save in bad times to become eligible for transfer payments. In older working ages, the total insurance level among the two groups is similar, with labor supply adjustments being more important in the *HS* group and de-saving playing a stronger role in the *Col+* group.

Decomposing insurance via public policy. The decomposition of insurance via public policy, ϕ_p , into the contributions from the EITC, ϕ_{EITC} , from transfers, ϕ_{Tr} , and from remaining progressivity of the system, $\phi_T + \phi_{CTC}$, works as follows. Similar to Equation (2.3), I estimate the percentage of the permanent wage shock to the husband that is transmitted to total household income, $\kappa_{y_t, \nu_{mt}}$, after-tax income, $\kappa_{y_t^{at}, \nu_{mt}}$, income after taxes and after the EITC, $\kappa_{y_t^{at,eitc}, \nu_{mt}}$, income after taxes and all credits, $\kappa_{y_t^{at,cr}, \nu_{mt}}$, and post-government income, $\kappa_{y_t^{post}, \nu_{mt}}$. The difference between two transmission coefficients identifies the role of the respective channel.¹⁵¹ Table A.7 summarizes the decomposition approach that again follows Wu and Krueger (2021).

Decomposing insurance via labor supply. In the main text, I present the insurance contribution from labor supply adjustments by wife and husband, $\phi_m + \phi_f$. I further de-

¹⁵⁰Insurance patterns for households in the *Some College* and the *College* group are somewhere in between the two displayed profiles. Insurance among households with a college degree most closely resembles that of the average household.

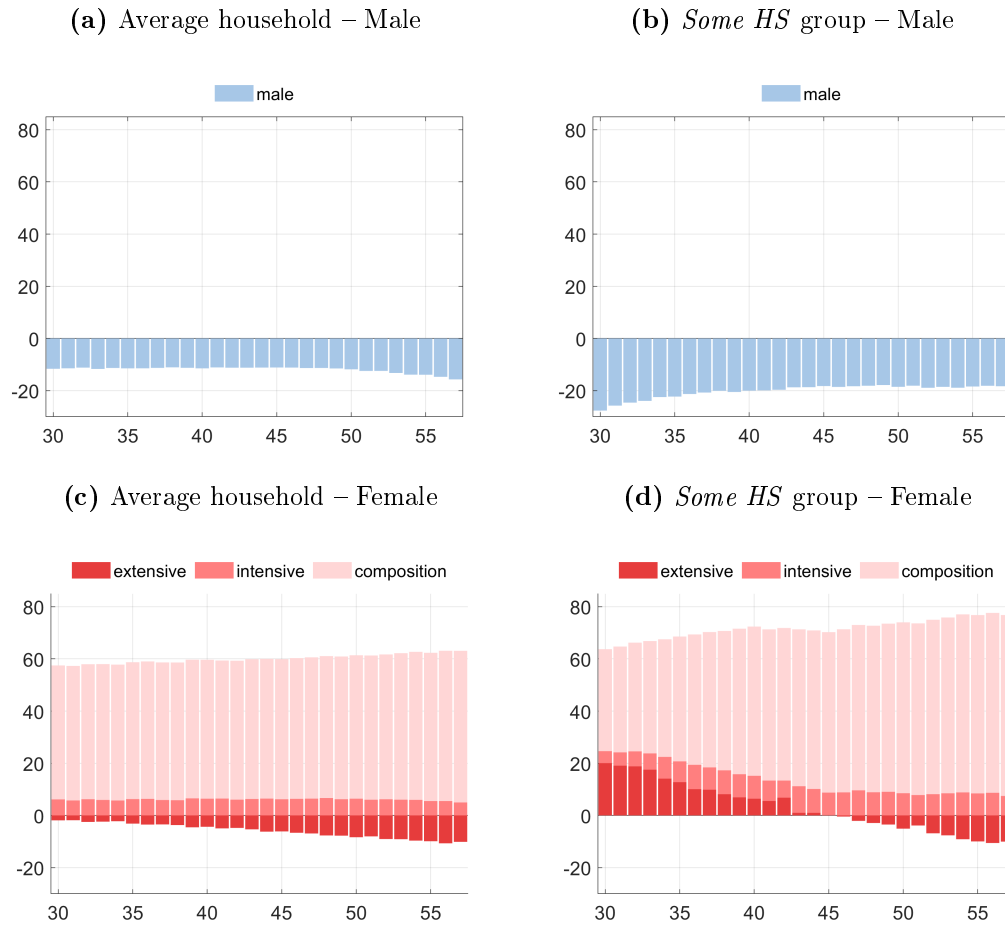
¹⁵¹For instance, I estimate the percentage of the shock transmitted to total household income and the percentage transmitted to after-tax income. The difference between these two pass-through values represents the fraction of the shock that is insured by income taxes.

compose insurance via the wife following Wu and Krueger (2021) (Online Appendix A). They consider the average response of household earnings to a wage shock x , $E[\Delta e_t]$, which is the sum of each spouse's response, accounting for the extensive labor supply margin of the wife. They rearrange this response to the shock and decompose it into the individual contributions, i.e., the contribution of the male, K_m , the composition effect of female income, K_{comp} , and additionally into the contribution of the female intensive, K_{int} , and extensive, K_{ext} , labor supply margin, i.e.,

$$\begin{aligned}
E[\Delta e_t] &\approx E\left[\underbrace{\frac{e_{m,t-1}}{e_{t-1}}}_{K_{comp}} \cdot \underbrace{\kappa_{e_m,x}}_{K_m} \cdot x + E\left[\frac{e_{f,t-1}}{e_{t-1}}\right] \cdot \kappa_{e_f,x} + \Pr_{e_{f,t-1}=0} \cdot E\left[\frac{\Delta e_{f,t}}{e_{t-1}} \mid e_{f,t-1}=0\right]\right] \\
&\approx \left(1 + \underbrace{\frac{E\left[\frac{e_{f,t-1}}{e_{t-1}}\right] \cdot \kappa_{e_f,x}}{K_{comp} \cdot K_m \cdot x}}_{K_{int}} + \frac{\Pr_{e_{f,t-1}=0} \cdot E\left[\frac{\Delta e_{f,t}}{e_{t-1}} \mid e_{f,t-1}=0\right]}{K_{comp} \cdot K_m \cdot x}\right) \cdot K_{comp} \cdot K_m \cdot x \\
&\approx \left\{1 + \underbrace{\frac{\Pr_{e_{f,t-1}=0} \cdot E\left[\frac{\Delta e_{f,t}}{e_{t-1}} \mid e_{f,t-1}=0\right]}{K_{int} \cdot K_{comp} \cdot K_m \cdot x}}_{K_{ext}}\right\} \cdot K_{int} \cdot K_{comp} \cdot K_m \cdot x \\
&\approx \underbrace{K_{ext} \cdot K_{int} \cdot K_{comp} \cdot K_m}_{\kappa_e} \cdot x.
\end{aligned}$$

The values for K_m , K_{comp} , K_{int} can be calculated from the simulated data. K_{ext} is calculated using $K_{ext} = \kappa_{e_t}/(K_m \cdot K_{comp} \cdot K_{int})$. Given these results, one can easily identify how much of the wage shock is insured via each channel, i.e.,

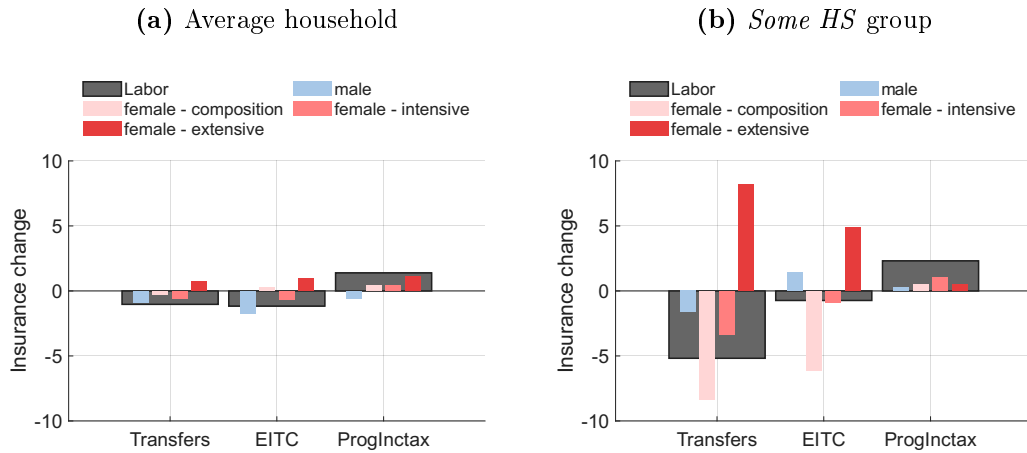
$$\begin{aligned}
\phi_f &= \kappa_{e_{mt}} - \kappa_{e_t} \\
&= K_m - K_m \cdot K_{comp} \cdot K_{int} \cdot K_{ext} \\
&= K_m - K_m \cdot K_{comp} && \text{Composition effect} \\
&\quad + K_m \cdot K_{comp} - K_m \cdot K_{comp} \cdot K_{int} && \text{Intensive margin} \\
&\quad + K_m \cdot K_{comp} \cdot K_{int} - K_m \cdot K_{comp} \cdot K_{int} \cdot K_{ext} && \text{Extensive margin}
\end{aligned}$$

Figure A.6. Decomposition of insurance via labor supply in the baseline model

Notes: The figure shows the decomposition of insurance via labor supply as described in Appendix A.3. The panels at the top show the contribution of the male, $\phi_{m_{jt}}$, while the panels at the bottom refer to the role of the female, $\phi_{f_{jt}}$. This channel is further decomposed into a composition effect, an intensive, and an extensive labor supply channel. Again, the left panels present results for the average household, while the right panels focus on the *Some HS* group.

Figure A.6 presents the results. The decomposition reveals that the husband, in response to a negative shock to his own wage, reduces his hours worked and thereby increases earnings volatility (upper panels). The pattern for the average household (panel a) is similar to that for households with lower educational attainment (panel b), although the effect is somewhat larger in absolute value in the *Some HS* group, especially at younger ages.

Insurance through the wife (bottom panels) is driven largely by the presence of a secondary earner, which reduces the household's reliance on the primary earner's income. The contribution of the intensive margin is small but positive, while the extensive-margin contribution is negative, especially at older ages, because some women stop

Figure A.7. Implications of public policy on insurance via labor supply

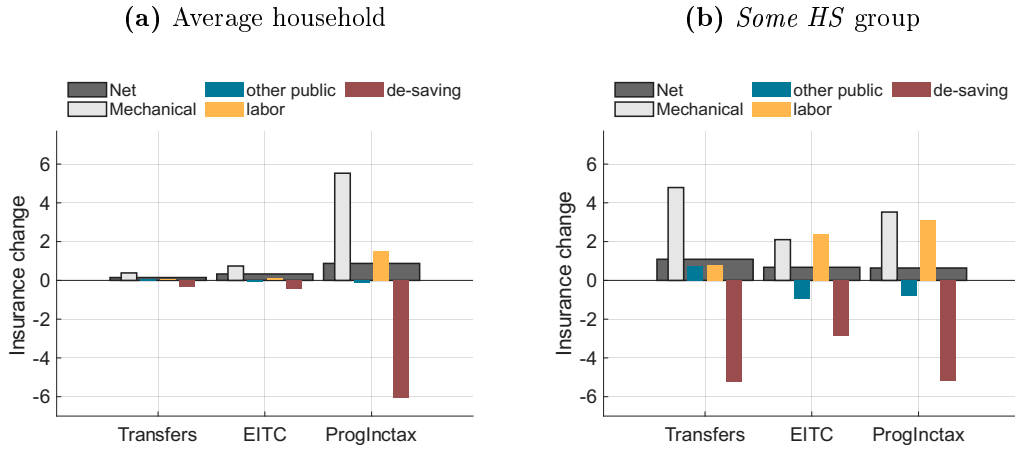
Notes: The figure shows insurance implications of either transfers, the EITC, and progressive income taxes for households aged 30 to 40 with a special focus on labor. I present how the respective public policies affect insurance via labor supply overall (dark gray bars), decomposed into the contributions of male labor supply (light blue bars), the existence of a secondary earner, i.e., the composition effect (light red bars), the intensive margin (medium light red bars), and the extensive margin (dark red bars). Appendix A.4 describes how the respective insurance effects are determined.

working after a shock to become eligible for credits or transfers. The overall pattern for the average household (panel c) is similar to that for households with lower education (panel d). Differences arise because female labor force participation in the *Some HS* group is relatively low at young ages. As a result, the composition effect is substantially smaller, while more women start working in response to a shock.

A.4 Further Insurance Implications of Public Policies

Decomposing how public policies affect insurance via labor supply. In the main text, I show how transfers, the EITC, and progressive income taxes affect labor-supply insurance; see the yellow bars for households aged 30 to 40 in Figure 2.6. Figure A.7 decomposes these effects into the labor-supply responses of wives and husbands. Because public policies have little effect on labor-supply self-insurance for the average household (panel a), I focus on the *Some HS* group (panel b).

Progressive income taxes generally discourage labor supply. In bad times, however, wives increase labor supply more strongly, so progressive income taxes crowd in labor-supply insurance. The EITC, by contrast, slightly crowds out labor-supply insurance. Female labor force participation falls substantially at young ages with the EITC in

Figure A.8. Insurance implications induced by public policy, ages 41–57

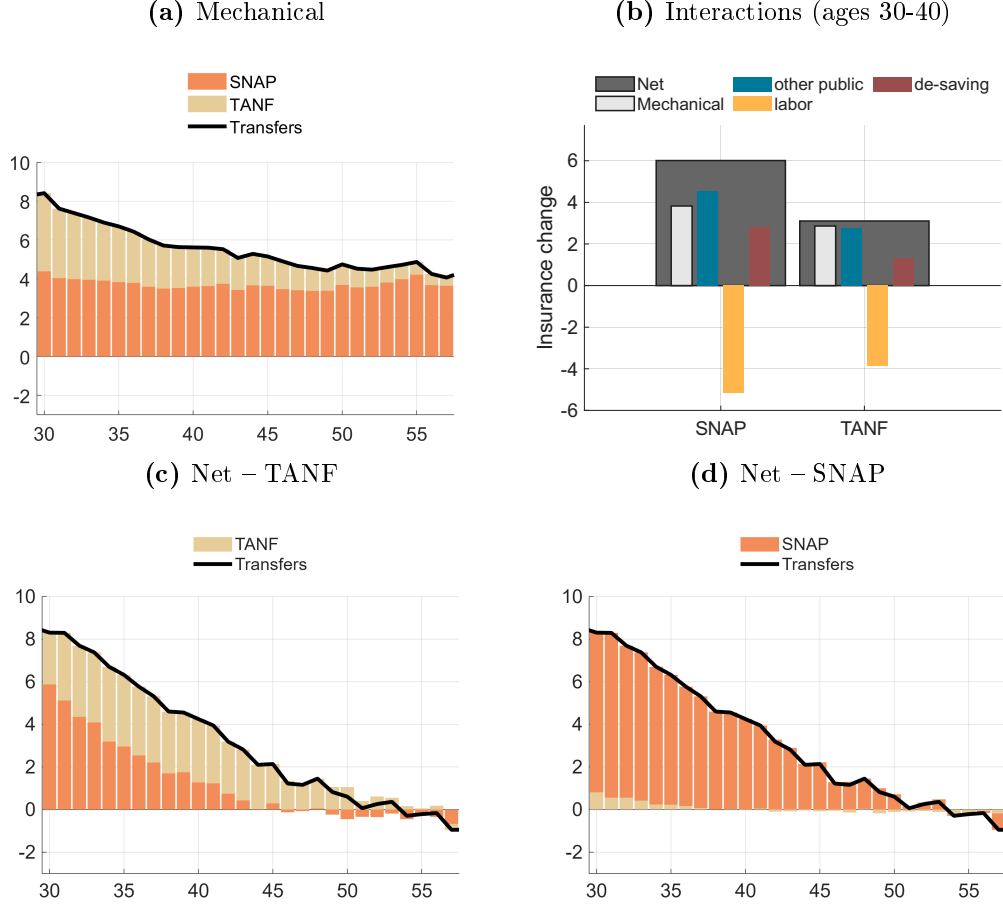
Notes: The figure shows insurance implications of either transfers, the EITC, and progressive income taxes for households aged 41 to 57. I present mechanical (light gray bars) and net insurance implications (dark gray bars) and the effects on other insurance channels, i.e. labor supply (yellow bars), de-saving (red bars), and other public policy (blue bars). Chapter 2.5.2 describes the calculation of the insurance effects.

place. With fewer women working, households become more vulnerable to changes in the husband's income, so insurance from the existence of a secondary earner declines. This effect is largely mitigated because more women enter the labor market in response to shocks. Transfers generate similar but larger effects. They also reduce insurance through the intensive labor-supply margins of wives and husbands, as spouses reduce labor supply to qualify for transfers in bad times. In sum, transfers strongly crowd out labor-supply insurance.

Considering households aged 41 to 57. The main text argues that progressive income taxes, transfers, and the EITC each crowd out de-saving insurance at older working ages. Figure A.8 confirms this pattern for households aged 41 to 57. Transfers strongly reduce de-saving insurance at older ages, whereas the opposite holds at young ages, when transfers encourage households in the *Some HS* group to de-save in bad times to become eligible. Because these households accumulate considerably fewer assets when transfers are available, their opportunities for de-saving insurance are sharply reduced later in working life.

Insurance contribution of SNAP and TANF. Figure A.9 decomposes the mechanical and net insurance gains from transfers in the *Some HS* group into the contributions from

Figure A.9. Decomposing insurance via transfers in the *Some HS* group into the contributions from SNAP and TANF



Notes: The figure shows the insurance contribution of transfers (black line) and individual programs, i.e. SNAP (orange bars) and TANF (light orange bars) in the *Some HS* group. Panel (a) presents mechanical insurance contributions (in percentage points). Panel (c) and (d) present the net insurance contribution of TANF and SNAP, respectively. Appendix A.4 describes the calculation. Panel (b) presents how SNAP and TANF affect other insurance channels, focusing on ages 30 to 40.

SNAP and TANF.¹⁵² Panel (a) shows that in younger working age, both transfer programs are equally important in providing mechanical insurance. Yet, insurance via TANF declines with age when children leave the household, while that of SNAP remains rather constant. Panel (c) and (d) present the net insurance gains of TANF

¹⁵²To determine the mechanical insurance contribution, I further decompose insurance via transfers in the baseline model, ϕ_{Tr} , into the contribution from SNAP, ϕ_{snap} and TANF, ϕ_{tanf} following the strategy explained above. To determine the net insurance contribution, I solve two additional model versions in which I either abolish SNAP or TANF from the system, implying total insurance of ϕ_{cjt}^{NoSnap} and ϕ_{cjt}^{NoTanf} , respectively. Net insurance from introducing TANF to a system without any transfers is $\phi_{cjt}^{NoSnap} - \phi_{cjt}^{NoTr}$ and thereafter introducing SNAP yields net insurance of $\phi_{cjt} - \phi_{cjt}^{NoSnap}$. Similarly, net insurance from introducing SNAP to a system without any transfers is $\phi_{cjt}^{NoTanf} - \phi_{cjt}^{NoTr}$ and thereafter introducing TANF yields net insurance of $\phi_{cjt} - \phi_{cjt}^{NoTanf}$.

(light orange bars) and SNAP (orange bars), respectively, and panel (b) decomposes the net insurance gains in young age into the implications for individual insurance channels.

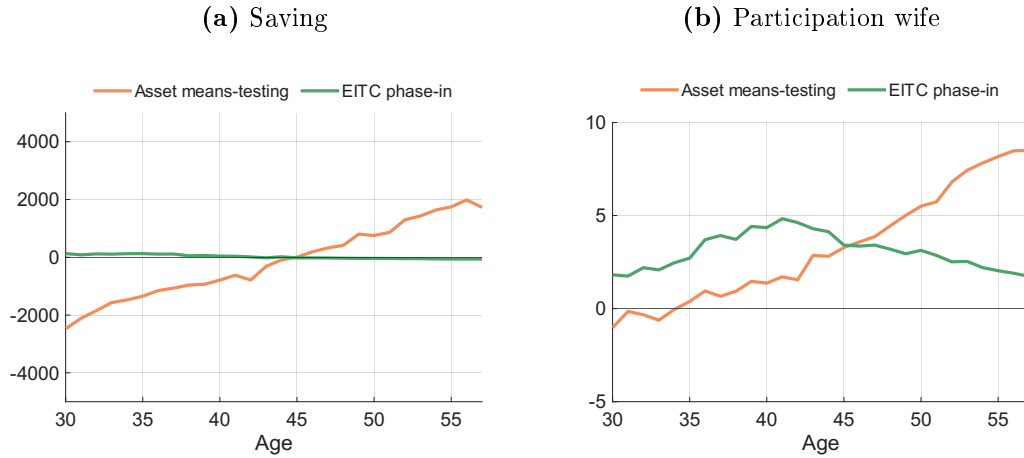
Introducing SNAP into a system that already contains TANF generates a relatively large net insurance gain of six percentage points. In a system without SNAP, insurance through TANF is limited and barely visible (light orange bars in panel d), because TANF payments alone do not induce households to de-save in bad times to satisfy the strict asset test. Introducing SNAP (orange bars in panel d) strengthens incentives to qualify for transfer programs in bad times, namely to de-save, reduce labor supply, and benefit from both programs jointly. Panel (b) confirms that SNAP strongly increases insurance through other public policies, namely TANF and the EITC, and through de-saving, while reducing insurance through labor supply.

Introducing TANF into a system that already contains SNAP yields roughly half the net insurance gain of introducing SNAP. SNAP alone already provides substantial insurance (orange bars in panel c), because benefits are large enough to encourage households to qualify in bad times. Introducing TANF (light orange bars in panel c) adds some insurance, but panel (b) shows that it only slightly increases insurance through other public policies.

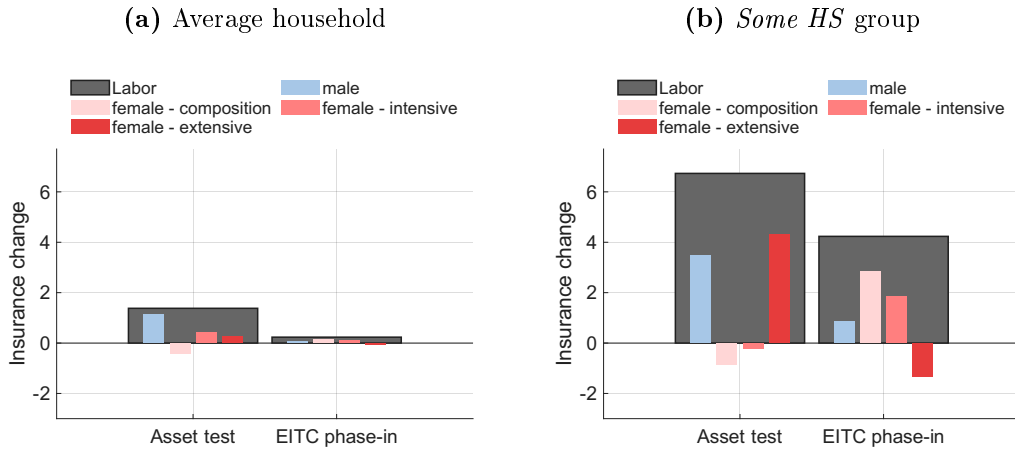
A.5 Further Insurance Implications of Specific Features

Change in life-cycle profiles. Figure A.10 shows how asset means-testing in transfers (orange lines) and the EITC phase-in (green lines) affect saving and wives' participation. Because life-cycle profiles for the average household change little, I report results only for the *Some HS* group. The EITC phase-in increases wives' participation strongly, by almost five percentage points when wives are in their forties. Asset means-testing implies that households save about \$2,000 less at young ages but save more at older working ages. At those older ages, wives' labor force participation is almost ten percentage points higher than without asset tests.

Insurance via labor supply. Figure A.11 shows how asset means-testing and the EITC phase-in crowd in insurance through wives' and husbands' labor supply. Asset tests ensure that households with sufficient wealth rely on self-insurance in bad times: hus-

Figure A.10. Impact of specific features on life-cycle profiles in the *Some HS* group

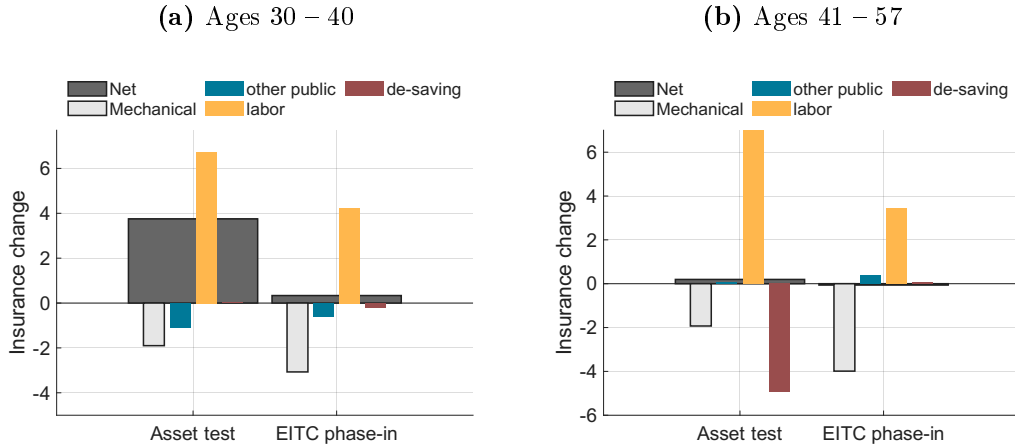
Notes: The figure shows how asset means-testing (orange lines) and the EITC phase-in (green lines) impact life-cycle profiles of the *Some HS* group. Household saving is given in 2019 dollars. The labor market participation of wives is given in percent.

Figure A.11. Implications of specific features on insurance via labor supply

Notes: The figure shows insurance implications of asset means-testing and the EITC phase-in for households aged 30 to 40 with a special focus on labor supply (dark gray bars). I present the contribution via male labor supply (light blue bars) and via the female, which is further decomposed into a composition effect (light red bars), the intensive margin (medium light red bars), and the extensive margin (dark red bars). The calculation of respective insurance effects is analogous to that in Figure A.7.

bands reduce hours less after a shock, while wives increase labor force participation. The EITC phase-in encourages more women to participate in the labor market, thereby increasing the composition effect. Insurance through the intensive labor-supply margin also rises in bad times. These positive effects are only slightly offset by lower insurance through the extensive margin, because more women already work.

Figure A.12. Insurance implications induced by specific features for households in the *Some HS* group considering different ages



Notes: The figure shows insurance implications of asset tests in transfer payments and the phase-in of the EITC for households in the *Some HS* group aged 30 - 40 (left panel) and those aged 41 to 57 (right panel). I present mechanical (light gray bars) and net insurance implications (dark gray bars) and the effects on other insurance channels, i.e. labor supply (yellow bars), de-saving (red bars), and other public policy (blue bars). The calculation of the respective insurance effects is analogous to that in Figure 2.9.

Households aged 41 to 57. Figure A.12 compares how asset means-testing and the EITC phase-in affect other insurance channels for households in the *Some HS* group aged 30 to 40 (panel a) and 41 to 57 (panel b). The EITC phase-in affects other channels at older working ages much as it does at younger ages. The effect of asset tests differs by age: de-saving insurance at older ages is substantially lower when asset tests are present. As emphasized by Wellschmied (2021), asset tests prevent households from building buffer stocks, limiting this insurance channel later in working life. Figure A.12 shows, however, that family labor-supply adjustments can fully offset this insurance loss.

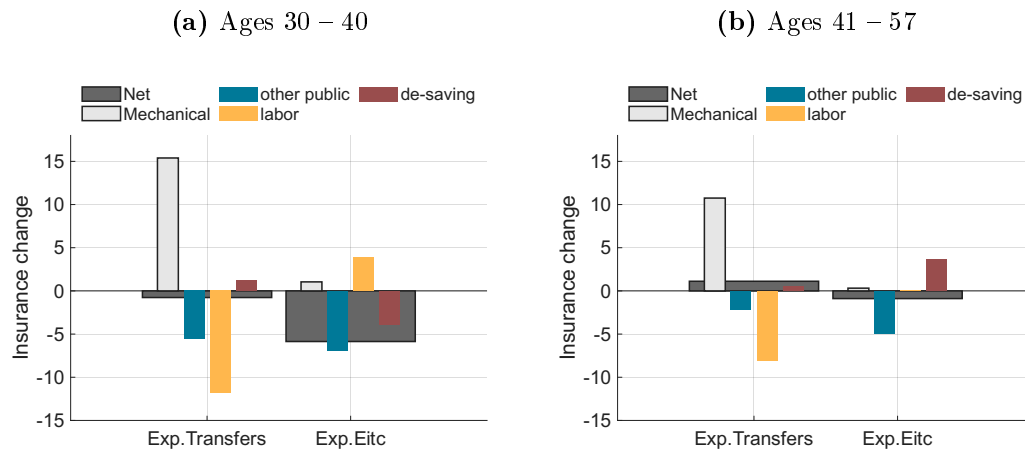
A.6 Considering Budget-Neutral Model Versions

The left panel of Table A.8 summarizes how the different model versions affect government spending on transfers, the EITC, and all programs net of taxes. In the baseline model, the government spends \$165 per household and period on transfer payments and \$224 on the EITC, and receives \$24,722 in taxes net of transfers. The right panel reports spending for budget-neutral versions of the experiments.

Table A.8. Differences in government spending

Model versions	Spending for...		Net gov. spend.	Budget-neutral versions		
	...transfers	...EITC		Spending for...	Net gov. spend.	
	...transfers	...EITC		...transfers	...EITC	spend.
No Transfers	-165.2	-28.0	-211.7	-165.2	141.6	0.0
No EITC	-58.6	-224.1	-342.5	253.0	-224.1	-0.0
Linear income tax	8.5	-21.8	11,627.2	57.0	4.9	0.0
No asset tests	70.2	9.8	84.0	-0.0	-1.6	-4.1
No EITC phase-in	2.9	6.6	9.2	1.4	-0.0	-0.5

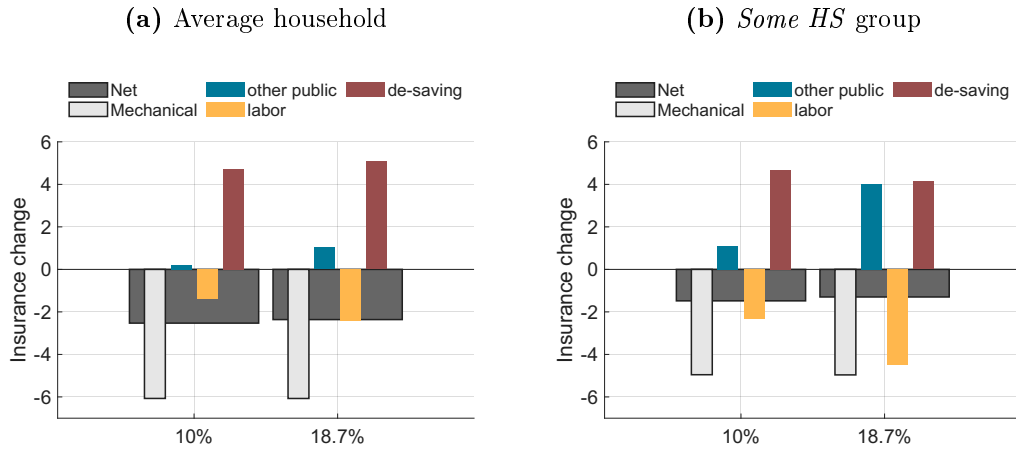
Notes: All numbers are given in dollars. The table shows differences in government spending for transfers, the EITC, and all benefits net of taxes in the different model versions compared to the baseline model. Spending differences refer to per period and per household values considering households in working age only.

Figure A.13. Insurance implications induced by expanding either transfers or the EITC in the *Some HS* group considering different ages

Notes: The figure shows insurance implications of expanding either transfers or the EITC, while abolishing the other program, focusing on households in the *Some HS* group. I compare implications for households aged 30 to 40 (panel a) to households aged 41 to 57 (panel b). I present net (dark gray bars) and mechanical insurance effects (light gray bars) and the implications for other insurance channels, i.e. labor supply (yellow bars), de-saving (red bars), and other public policy (blue bars). The calculation of the respective insurance effects is analogous to the one described in Chapter 2.5.2.

Transfers and the EITC. Abolishing transfers or the EITC reduces net government spending by \$212 and \$343, respectively, implying that the EITC is more expensive than transfer programs in my sample of couple households. In Figure 2.11 in the main text, I consider model versions that abolish either transfers or the EITC and expand the remaining program to balance net government spending. Table A.8 shows that abolishing transfers (the EITC) while expanding the EITC (transfers) by a factor of 1.52 (1.62) increases EITC (transfer) spending by \$142 (\$253) per period and household.

Figure A.14. Insurance implications of replacing the progressive income tax structure by a linear tax of either 10% or 18.7%

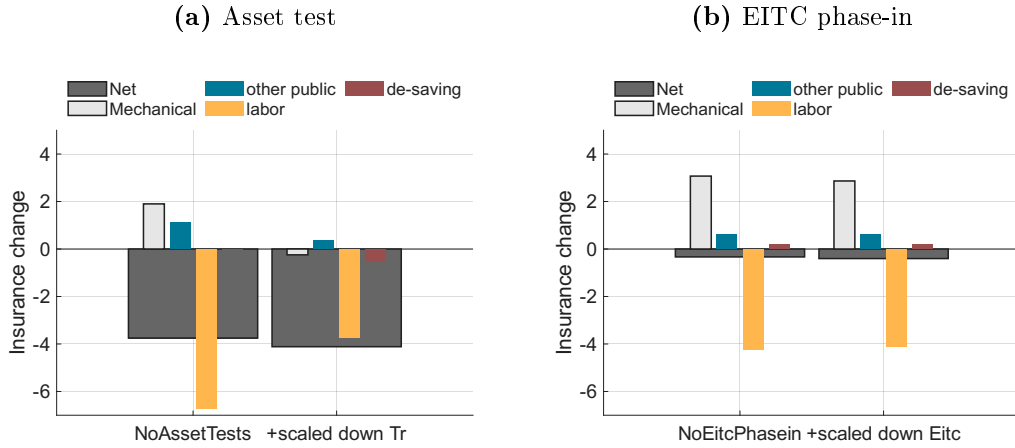


Notes: The figure shows insurance implications of either a linear income tax of 10% or 18.7% for households aged 30 to 40. I present mechanical (light gray bars) and net insurance implications (dark gray bars) and the effects on other insurance channels, i.e. labor supply (yellow bars), de-saving (red bars), and other public policy (blue bars). The calculation of the respective insurance effects is analogous to that in Figure 2.6, but of reverse sign.

Figure A.13 presents insurance implications for the *Some HS* group, comparing households aged 30 to 40 to those aged 41 to 57. The figure shows that abolishing the EITC while expanding transfers generates small net insurance gains at older working ages, in contrast to small insurance losses at young ages. At young ages, eliminating the EITC also removes positive insurance interactions among transfers, the labor-supply channel, and the credit. These interactions become less important once children leave the household. Expanding the EITC while abolishing transfers generates net insurance losses even at older ages, although the losses are smaller. The reason is that removing transfers increases insurance through de-saving at older ages.

Linear income tax. Replacing the actual U.S. progressive income tax structure, including payroll taxes and the CTC, with a linear income tax of 10% increases net government spending by \$11,627 as government incomes from taxes decline. Figure A.14 compares the insurance implications of a 10% linear income tax with those of an 18.7% linear tax, which generates net government spending similar to the baseline. Panel (a) focuses on the average household and panel (b) on the *Some HS* group.

Figure A.15. Insurance implications of removing specific features in the *Some HS* group when considering spending-neutrality



Notes: The figure shows insurance implications of abolishing asset tests in transfers (panel a) or the phase-in of the EITC (panel b), comparing their initial and their spending-neutral versions. I focus on households in the *Some HS* group aged 30 to 40. I present mechanical (light gray bars) and net insurance implications (dark gray bars) and the effects on other insurance channels, i.e. labor supply (yellow bars), de-saving (red bars), and other public policy (blue bars). The calculation of the respective insurance effects is analogous to that in Figure 2.9, but of reverse sign.

Importantly, mechanical and net insurance losses from removing progressivity of the system hardly change when considering a tax rate of 18.7% instead of 10%.¹⁵³ Compared to the actual system, a tax rate of 18.7% implies a particularly high marginal tax rate for households with low income, discouraging their labor supply. Accordingly, in bad times, these households rely more strongly on transfer payments (spending for transfers increases by \$57 per period and household), while insurance via labor supply within the family declines.

Specific features. I next compare the insurance implications of abolishing asset tests in transfers without accounting for spending-neutrality to a model version that scales down transfers by factor 0.85 such that spending for transfers remains unchanged compared to the baseline model. The left panel of Figure A.15 presents the results for households in the *Some HS* group, aged 30 to 40. The right panel repeats the exercise when removing the EITC phase-in while at the same time minimally scaling down the credit by factor 0.98. In this latter experiment, insurance implications hardly change compared to a version without such an adjustment in payments.

¹⁵³In the main text, I consider the reverse perspective, i.e., I examine the insurance effects of introducing progressivity in the income tax code to a system with a linear tax of 10%.

As discussed in the main text, abolishing asset tests without imposing spending neutrality generates a small mechanical insurance gain because more households receive transfer payments in bad times.¹⁵⁴ At the same time, labor-supply self-insurance falls substantially. When asset tests are abolished and transfer payments are scaled down by a factor of 0.85 to maintain spending neutrality, the mechanical insurance gain from removing asset tests disappears. The reduction in labor-supply insurance also becomes less pronounced. Net insurance implications, however, remain unchanged: removing asset tests implies net insurance losses at young ages.

¹⁵⁴ Again note that in the main text, I consider the insurance implications of introducing the asset tests. Here, I take the reverse perspective.

Appendix B

This appendix provides further information on Chapter 3 of the dissertation. Appendix B.1 describes the U.S. tax and transfer system for married couples in TY 2004 and TY 2019 and summarizes the main reforms in between.¹⁵⁵ I then provide further information on the empirical progressivity analysis. Appendix B.2 reports the sample used, Appendix B.3 summarizes main properties of the Bénabou tax-transfer function, and Appendix B.4 presents additional estimation results and robustness checks. I then turn to the model analysis and present details on the parameterization in Appendix B.5 and on the welfare decomposition in Appendix B.6. Appendix B.7 presents further model results.

B.1 The U.S. Tax and Transfer System, 2004-2019

Allowances. Taxable income,

$$\tilde{y}(e, i, b, k) = \max \left[0, e + i + \tilde{b}(b, i) - d - Ex \left(e, i, \tilde{b}(b, i), k \right) \right],$$

is gross income net of the standard deduction, d , and personal and dependency exemptions, $Ex \left(e, i, \tilde{b}(b, i), k \right)$. Gross income consists of earnings, asset income, and the taxable component of pension income, $\tilde{b}(b, i)$, which is defined in Equation (B.7). Exemptions,

$$Ex \left(e, i, \tilde{b}(b, i), k \right) = \max \left[0, (2 + k) \cdot ex - (2 + k) \cdot ex \cdot \tau^{ex} \cdot \max \left(0, e + i + \tilde{b}(b, i) - \bar{y}^{ex} \right) \right],$$

¹⁵⁵The tax-transfer parameters reported in this appendix are expressed in dollars. In the model, I divide these values by average household labor income of \$134,573. I convert all tax-transfer parameters into 2019 dollars using the average Consumer Price Index for All Urban Consumers (CPI-U) at the end of the 12-month period ending on August 31 of the respective year, following the convention used to determine the tax parameters. For readability, I suppress the tax year TY as an explicit function argument.

Table B.1. Nominal parameter values of the income and payroll tax system

PANEL A: Allowances				TY	2004	2019
Standard deduction in \$ (retired households)				d	9,700 (11,600)	24,400 (27,000)
Personal and dependency exemption in \$				ex	3,100	–
Exemption phase-out rate				τ^{ex}	0.02/2500	–
Exemption threshold in \$				$\bar{y}^{ex}$	214,050	–
PANEL B: Statutory income tax rates						
TY	2004			2019		
Bracket	Limits (\$)		Tax rate (%)	Limits (\$)		Tax rate (%)
1	0	14,300	10	0	19,400	10
2	14,300	58,100	15	19,400	78,950	12
3	58,100	117,250	25	78,950	168,400	22
4	117,250	178,650	28	168,400	321,450	24
5	178,650	319,100	33	321,450	408,200	32
6	319,100	∞	35	408,200	612,350	35
7	–	–	–	612,350	∞	37
PANEL C: Payroll taxes				TY	2004	2019
Social Security tax rate in %				τ^{ss}	6.2	6.2
Social Security cap in \$K				$\bar{e}^{ss}$	87.9	132.9
Additional hospital tax rate in %				τ^{add}	–	0.9
Additional hospital tax, limit in \$K				$\bar{e}^{add}$	–	250
Medicare tax rate in %				τ^m	1.45	1.45

Notes: Parameter values are taken from the OECD iLibrary Taxing Wages modules. The official tax rules state that bracket limits, the standard deduction, and personal and dependency exemptions including their threshold are annually adjusted for inflation, rounded to the next lowest multiple of 50. The Social Security cap develops with the national average wage index. The threshold for the additional hospital tax is not adjusted for inflation.

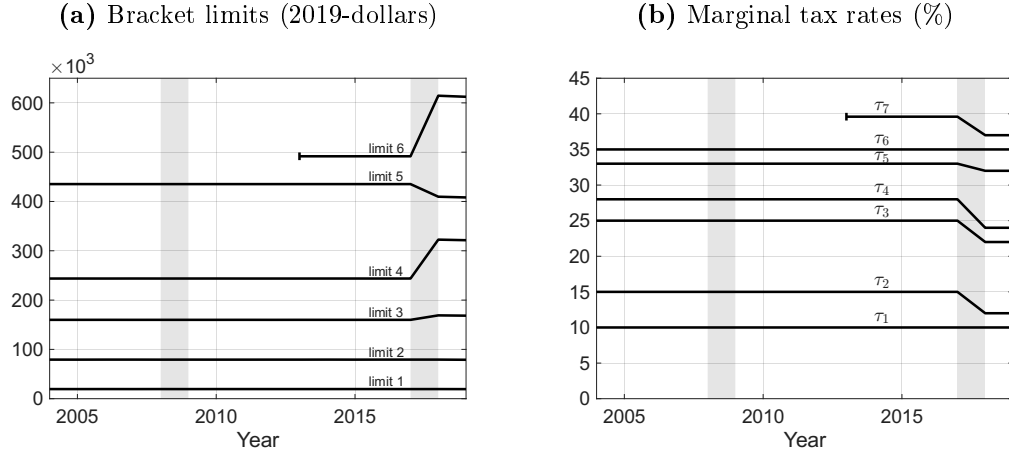
phase out at rate τ^{ex} once gross income exceeds the threshold $\bar{y}^{ex}$.¹⁵⁶ Nominal parameter values are reported in Table B.1.

Allowances 2004–2019. Allowances changed substantially over the sample period. First, the exemption phase-out was extended in TY 2006 and TY 2008 and temporarily removed from the tax code between 2010 and 2012. Second, the TCJA eliminated exemptions entirely, making allowances independent of household size. At the same time, it nearly doubled the standard deduction.

Statutory tax rates. Income taxes are given by

$$T(e, i, b, k) = \max \left[0, \tau_j \cdot \max(0, \tilde{y}(e, i, b, k) - lb_j) + \sum_{i=1}^{j-1} \tau_i \cdot (ub_i - lb_i) \right], \quad (\text{B.1})$$

¹⁵⁶Exemptions depend on household size, given by the number of children k plus the two parents.

Figure B.1. Parameters of the statutory tax code over time

Notes: The gray bars mark the two major tax-transfer reforms, i.e., the ARRA of 2009 and the TCJA of 2017. All dollar values are converted to 2019-dollars.

where τ_j denotes the marginal tax rate of the highest tax bracket, j , reached by the household's taxable income. This marginal tax rate applies to taxable income above the lower limit of the current bracket, lb_j . Taxable income below this limit is taxed at the lower marginal tax rates, τ_i , in brackets 1 to $j - 1$. Table B.1 reports the statutory parameters.

Statutory tax rates 2004–2019. The Bush tax cuts of 2001/03 were originally scheduled to expire in 2010 but were later made permanent, preserving lower marginal tax rates in the system. In addition, a new seventh marginal tax rate of 39.6% was introduced in TY 2014. Figure B.1b shows the evolution of marginal tax rates between 2004 and 2019. The most important changes occurred under the TCJA of 2017, which reduced most marginal tax rates and adjusted bracket limits; see Figure B.1a. These changes lowered income taxes particularly for high-income households.

Payroll taxes. Payroll taxes, formally FICA taxes, finance Social Security and Medicare and are given by

$$T^p(e) = \tau^{ss} \cdot \min(e, \bar{e}^{ss}) + \tau^m \cdot e + \tau^{add} \cdot \max(0, e - \bar{e}^{add}), \quad (\text{B.2})$$

where τ^{ss} is the Social Security tax rate, $\bar{e}^{ss}$ is the Social Security earnings cap, and τ^m is the Medicare tax rate. Since TY 2014, households with earnings above the threshold $\underline{e}^{add}$ have also paid an additional hospital insurance tax at rate τ^{add} . Between TY 2011 and TY 2012, the Social Security tax rate was temporarily reduced from 6.2% to 4.2% to stimulate the economy. Table B.1 reports the parameter values.

EITC. The EITC, if the household is eligible, is given by

$$Cr^{eitc}(e, i, k) = \max [0, \tau_1^{eitc}(k) \cdot \min(e, \bar{e}_1^{eitc}(k) - \tau_2^{eitc}(k) \cdot \max(0, e - \bar{e}_2^{eitc}(k)))] \quad (\text{B.3})$$

and has three regions: a phase-in region, a plateau, and a phase-out region. The thresholds $\bar{e}_1^{eitc}(k)$ and $\bar{e}_2^{eitc}(k)$ denote the end of the phase-in region and the beginning of the phase-out region, respectively. In the phase-in region, the credit increases with earnings at rate $\tau_1^{eitc}(k)$. In the phase-out region, the credit declines at rate $\tau_2^{eitc}(k)$. Married couples are eligible for the credit if

$$i \leq \bar{i}^{eitc} \quad \wedge \quad y(e, i) \leq \bar{y}^{eitc}(k),$$

that is, if asset income, i , and gross income, $y(e, i)$, do not exceed the limits $\bar{i}^{eitc}$ and $\bar{y}^{eitc}(k)$, respectively. Table B.2 documents the parameters.

EITC 2004–2019. Major reforms to the EITC occurred in the context of the Bush tax cuts and the Great Recession.¹⁵⁷ First, to reduce the marriage penalty, the plateau region was widened for married couples. As shown in Figure B.2a for households with two children, the threshold for the start of the phase-out region, $\bar{e}_2^{eitc}(k)$, was increased several times between 2004 and 2009.¹⁵⁸ Second, beginning in 2009, families with three or more children were no longer treated the same as families with two children.

CTC. The CTC,

$$Cr^{ctc}(e, i, k) = ctc(e, i, k) + actc(e, i, k), \quad (\text{B.4})$$

¹⁵⁷The TCJA affected the EITC only indirectly by changing the CPI measure, which implied slower growth of EITC parameters under annual inflation adjustment.

¹⁵⁸The earnings limit marking the end of the phase-in, $\bar{e}_1^{eitc}(k)$, and the asset income limit, $\bar{i}^{eitc}$, were not reformed during the period considered and evolved with inflation.

Table B.2. Nominal EITC and CTC parameters

PANEL A: EITC		TY			2004				2019			
Asset income limit in \$	$\bar{i}^{eitc}$				2,650				3,600			
Number of children	k		0	1	≥ 2		0	1	2	≥ 3		
Gross income limit in \$	$\bar{y}^{eitc}$	12,490	31,338	35,458		21,370	46,884	52,493	55,952			
Earned income limits												
...phase-in end in \$	$\bar{e}_1^{eitc}$	5,100	7,660	10,750		6,920	10,370	14,570	14,570			
...phase-out start in \$	$\bar{e}_2^{eitc}$	7,390	15,040	15,040		14,450	24,820	24,820	24,820			
Phase-in rate in %	τ_1^{eitc}	7.65	34	40		7.65	34	40	45			
Phase-out rate in %	τ_2^{eitc}	7.65	15.98	21.06		7.65	15.98	21.06	21.06			
PANEL B: CTC						TY	2004	2009	2019			
Credit per child in \$						cr^{max}	1,000	1,000	2,000			
Gross income threshold in \$						$\bar{y}^{ctc}$	110,000	110,000	400,000			
Phase-out rate in %						τ^{ctc}	5	5	5			
ACTC earnings minimum in \$						$\bar{e}^{actc}$	10,750	3,000	2,500			
ACTC phase-in rate in %						τ^{actc}	10	15	15			
ACTC maximum value in \$						$actc^{max}$	-	-	1,400			

Notes: Parameter values are taken from the OECD iLibrary Taxing Wages modules. The official tax rules state that EITC parameters are inflation adjusted to the nearest multiple of \$10. As to tax rules 2004-2019, CTC parameters are not adjusted for inflation, except for the ACTC earnings minimum, which has been inflation-adjusted until TY 2009.

is the sum of the non-refundable component, $ctc(e, i, k)$, and the refundable component, $actc(e, i, k)$. The non-refundable component,

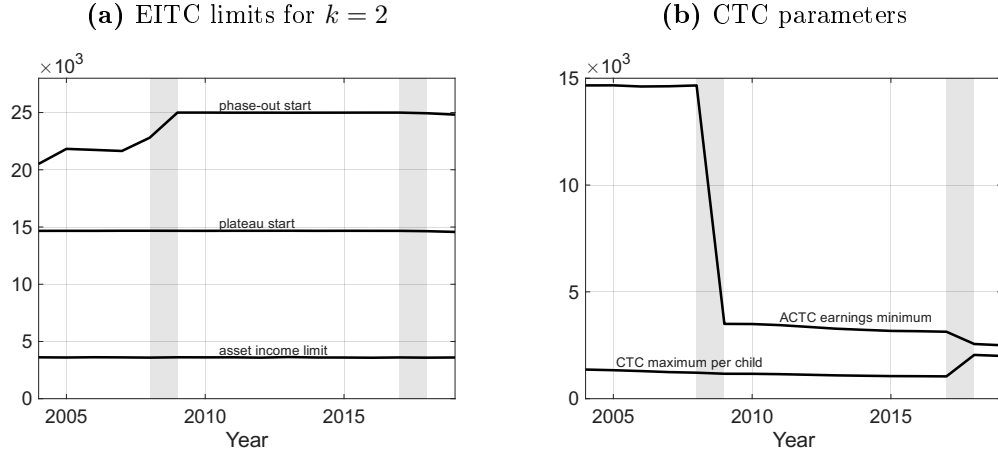
$$ctc(e, i, k) = \max \left[0, \min \left\{ T(e, i, b, k), k \cdot cr^{max} - \tau^{ctc} \cdot \max \left(0, y(e, i) - \bar{y}^{ctc} \right) \right\} \right],$$

generates three regions. First, there is a de-facto phase-in region when household tax liability, $T(e, i, b, k)$, is below the maximum credit amount. Second, in the plateau region, households receive the maximum credit per child, $k \cdot cr^{max}$. Third, the credit phases out at rate τ^{ctc} when gross income exceeds the threshold $\bar{y}^{ctc}$. To extend the credit to households whose tax liabilities are below the maximum credit amount, the CTC includes a refundable component,

$$actc(e, i, k) = \min \left[\min \left\{ ctc^{hypo} - ctc(e, i, k), k \cdot actc^{max} \right\}, \max \left\{ 0, \tau^{actc} \cdot (e - \bar{e}^{actc}) \right\} \right], \quad (\text{B.5})$$

with

$$ctc^{hypo}(e, i, k) = \max \left[0, k \cdot cr^{max} - \tau^{ctc} \cdot \max \left(0, y(e, i) - \bar{y}^{ctc} \right) \right],$$

Figure B.2. EITC and CTC parameters in 2019-dollars over time

Notes: The figure presents parameters of the EITC (for $k = 2$) and the CTC over time. All dollar values are converted to 2019-dollars. The gray bars mark the ARRA and the TCJA.

which phases in at rate τ^{actc} for earnings above the threshold $\bar{e}^{actc}$. The refundable component is capped at $k \cdot actc^{max}$.¹⁵⁹ Table B.2 documents the parameters.

CTC 2004–2019. The CTC changed through several reforms. First, the ACTC phase-in rate increased from 10% to 15% in TY 2005 in the context of the Bush tax cuts. The ARRA under President Obama expanded eligibility among low-income households by reducing the minimum earnings threshold from nominal \$12,050 to \$3,000, as shown in Figure B.2b. The TCJA under President Trump expanded eligibility among high-income households by nearly quadrupling the phase-out threshold. It also doubled the credit amount, slightly reduced the ACTC earnings threshold, and introduced a maximum ACTC value. Because many CTC parameters are not indexed to inflation, their real value declined over time outside reform years.

Transfer payments. Transfer payments,

$$Tr(e, i, b, a, k, n_f) = Tr^{snap}(e, i, b, a, k) + Tr^{tanf}(e, i, k, a, n_f), \quad (B.6)$$

¹⁵⁹Special rules apply for households with three or more children. Then, Equation (B.5) becomes:

$$actc(e, i, k) = \min \left[\min \{ctc^{hypo} - ctc(e, i, k), k \cdot actc^{max}\}, \max \{T^p(e) - Cr^{eitc}(e, i, k), \max(0, \tau^{actc} \cdot (e - \bar{e}^{actc}))\} \right].$$

consist of SNAP and TANF. Table B.3 reports nominal parameter values.¹⁶⁰

SNAP. Conditional on eligibility, SNAP benefits received via an electronic benefit card are given by

$$Tr^{snap}(e, i, b, a, k) = \max [snap^{min}(k), snap^{max}(k) - \max(0, \tau^{snap} \cdot y^{c,net}(e, i, b))] ,$$

where $snap^{min}(k)$ and $snap^{max}(k)$ denote the minimum and maximum allotments, respectively. SNAP benefits phase out at rate τ^{snap} with counted net income,

$$y^{c,net}(e, i, b) = 0.8 \cdot e + i + b - d^{snap} ,$$

where d^{snap} is the standard deduction. Married couples are eligible for SNAP if

$$a \leq \bar{a}^{snap} \quad \wedge \quad e + i + b \leq \bar{y}^{snap}(k) \quad \wedge \quad y^{c,net}(e, i, b) \leq \bar{y}^{c,net}(k),$$

that is, if assets, gross income, and counted net income do not exceed the thresholds $\bar{a}^{snap}$, $\bar{y}^{snap}(k)$, and $\bar{y}^{c,net}(k)$, respectively. SNAP has no age restriction, so retirees may also qualify.¹⁶¹

SNAP 2004–2019. SNAP changed only modestly during the period considered. First, the Food and Nutrition Act of 2008 increased the standard deduction and introduced inflation adjustment for this parameter beginning in 2009. Second, the ARRA increased the maximum allotment and kept it at a higher constant level between 2009 and 2013. Figure B.3a shows this pattern for households with two children.

TANF. TANF benefits, conditional on eligibility, are given by

$$Tr^{tanf}(e, i, k, a, n_f) = \max \left[0, \min \left\{ tanf^{max}(k), \tau^{tanf} \cdot \left(y^{need}(k) - y^{c,net,t}(e, i, n_f) \right) \right\} \right]$$

¹⁶⁰ All SNAP and TANF parameters generally depend on the number of household members. Because I focus on married couples, the parameters shown here vary only with the number of children in the household.

¹⁶¹ In retirement age, there is a higher wealth limit, $\bar{a}^{snap,60+}$ and no limit for counted net income.

Table B.3. Nominal SNAP and TANF parameters

PANEL A: SNAP		2004				2019			
Phase-out rate in %	τ^{snap}	30				30			
Wealth limit	$\bar{a}^{snap}$	2,000				2,250			
	$\bar{a}^{snap,60+}$	3,000				3,500			
Number of children	k	0	1	2	3	0	1	2	3
Standard deduction	d^{snap}	1,608	1,608	1,608	1,788	1,968	1,968	2,088	2,448
Gross income limit	$\bar{y}^{snap}$	15,756	19,848	23,928	28,008	21,408	27,024	32,640	38,256
Count. net inc.limit	$\bar{y}^{c,net}$	12,120	15,264	18,408	21,540	16,464	20,784	25,104	29,424
Maximum allotment	$snap^{max}$	3,108	4,452	5,652	6,720	4,236	6,060	7,704	9,144
Minimum allotment	$snap^{min}$	120	0	0	0	180	0	0	0
PANEL B: TANF		2004				2019			
Phase-out rate in %	τ^{tanf}	50				50			
Labor inc.share	$\tau^{tanf,e}$	2/3				2/3			
Labor inc.disregard	d^{work}	120				1,440			
Asset limit	$\bar{a}^{tanf}$	1,000				10,000			
Number of children	k	0	1	2	3	0	1	2	3
Standard of need	y^{need}	–	11,448	13,806	16,155	–	15,588	18,828	22,068
Payment standard	$tanf^{max}$	–	4,056	4,884	5,700	–	4,056	4,884	5,700

Notes: Numbers for SNAP are taken from the Food and Nutrition Service. Parameter values for TANF are taken from the Welfare Rules Database offered by the Urban Institute. If not otherwise stated, numbers are reported in dollars. Official rules state that inflation adjustments of the SNAP income limits and the standard deduction, and the TANF standard of need are based on the inflation adjustment of the poverty guidelines, i.e., adjustments are based on the average CPI-U values for the period from January to December, which differs from the period used for inflation adjustments of taxes. Since 2009, the SNAP maximum allotment is adjusted for inflation following the increase in food-related items, specified in the Thrifty Food Plan. Other TANF parameters are not inflation-adjusted and have depreciated in real terms.

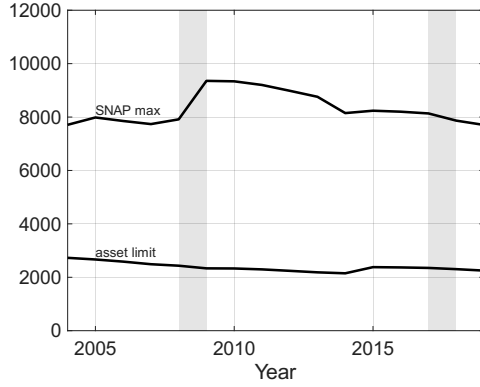
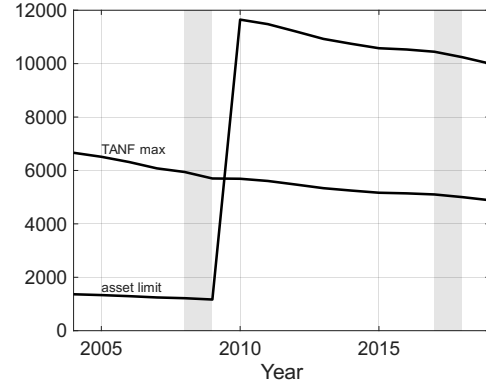
where $tanf^{max}$ is the child-dependent maximum payment, also referred to as the payment standard, and $y^{need}(k)$ is the child-dependent standard of need. I apply TANF rules from Delaware. TANF benefits phase out at rate τ^{tanf} with counted net income,

$$y^{c,net,t}(e, i, n_f) = i + \tau^{tanf,e} \cdot (e - n^{worker}(n_f) \cdot d^{work}),$$

where $\tau^{tanf,e}$ is the share of labor income counted toward eligibility and d^{work} is the labor-income disregard. The allowance applies to all working household members, $n^{worker}(n_f)$,

$$n^{worker}(n_f) = \begin{cases} 1 & \text{if } n_f = 0 \\ 2 & \text{if } n_f > 0, \end{cases}$$

which depends on the wife's labor supply in the model because the wife is assumed to be the only household member with an extensive labor-supply margin.

Figure B.3. SNAP and TANF parameters in 2019-dollars over time**(a)** SNAP parameters for $k = 2$ **(b)** TANF parameters for $k = 2$ 

Notes: The figures present SNAP and TANF parameters in 2019 dollars between 2004 and 2019, exemplary for households with two children. The gray bars mark the ARRA of 2009 and the TCJA of 2017. Note that the presented TANF parameters and the SNAP asset limit slightly decrease over time, as they have not been adjusted for inflation. The SNAP maximum allotment is adjusted for inflation following food-related items, which differs from the inflation adjustment used in my tax-transfer calculator, explaining why the line is not perfectly constant in non-reform years.

A household is eligible for TANF if

$$k > 0 \quad \wedge \quad a \leq \bar{a}^{tanf} \quad \wedge \quad y^{c,net,t}(e, i, n_f) \leq y^{need} \quad \wedge \quad e + i \leq 1.85 \cdot y^{need},$$

that is, if children are present in the household, the household passes the asset test, counted net income is below 100% of the standard of need, and gross income is below 185% of the standard of need.¹⁶² Households must also satisfy work requirements and time limits, which I abstract from in the model.

TANF 2004–2019. The main TANF reform in Delaware during the period considered was the increase in the asset limit from nominal \$1,000 to nominal \$10,000 in 2010, shown in Figure B.3b. Because the parameter is not indexed to inflation, it declines in real terms over time, just like the payment standard.

Pensions. In the model, households receive pension income, $b_t(\tilde{e})$, during retirement, $t \geq R$. I determine pension benefits using the PIA formula and assume that benefits depend on counted earnings, $\tilde{e}$, which are constructed from the permanent wage com-

¹⁶²In Delaware, eligibility rules differ for recipients and applicants. I focus on the rules for recipients.

Table B.4. Nominal parameter values concerning pensions

Parameter	TY	2004	2019	Parameter	TY	2004	2019
Bend points	BP_1	7,344	11,112	Income thresholds for taxable	$\bar{y}_1^b$	32,000	32,000
(in \$)	BP_2	44,268	66,996	part of pension (in \$)	$\bar{y}_2^b$	44,000	44,000

Notes: Data on the bend points is taken from the U.S. Social Security Administration (2026). Note that official data refers to monthly earnings. Regarding the taxable part of pensions, $\tilde{b}(b, i)$, I take information from the *Tax Guide for Seniors* provided by the IRS.

ponent and the deterministic life-cycle component of both spouses in the last period before retirement:

$$\tilde{e}(z_{mR-1}, z_{fR-1}, \ell_{mR-1}, \ell_{fR-1}) = \sum_{g \in \{m, f\}} \min[\bar{e}^{ss}, \exp(z_{gR-1} \cdot \ell_{gR-1}) \cdot s],$$

where $\bar{e}^{ss}$ is the earnings cap for Social Security contributions and s is a scaling parameter chosen to match the average replacement rate of 27.9%. The PIA formula is

$$b_t(\tilde{e}) = \begin{cases} 0.9 \cdot \tilde{e} & \tilde{e} \leq BP_1 \\ 0.9 \cdot BP_1 + 0.32 \cdot (\tilde{e} - BP_1) & BP_1 < \tilde{e} \leq BP_2 \\ 0.9 \cdot BP_1 + 0.32 \cdot (BP_2 - BP_1) + 0.15 \cdot (\tilde{e} - BP_2) & BP_2 < \tilde{e}. \end{cases}$$

Table B.4 reports the bend points, BP_1 and BP_2 , and the income thresholds, $\bar{y}_1^b$ and $\bar{y}_2^b$, determining the taxable component of pension income. The taxable component is given by

$$\tilde{b}(b, i) = \begin{cases} 0 & i + b < \bar{y}_1^b \\ 0.5 \cdot b & \bar{y}_1^b \leq i + b < \bar{y}_2^b \\ 0.85 \cdot b & \bar{y}_2^b \leq i + b. \end{cases} \quad (\text{B.7})$$

B.2 CPS Sample Selection

For the progressivity analysis in Chapter 3.3, I use CPS data for 2004–2019. I restrict the sample to opposite-sex married couples filing jointly, with husbands aged 30 to 57. Families consist only of one mother, one father, and up to three children, with the oldest child no older than 18. I exclude households with non-working husbands, while wives

Table B.5. Share of couple-households receiving transfers

Share of households (%) with...	... SNAP	... TANF
CPS data 2019, my sample		
calculated transfers; asset test inferred	1.2	0.1
calculated transfers; no asset test	4.1	2.8
reported data on transfers	2.4	0.3
Sample of Guner, Rauh, and Ventura (2026) (reported data on transfers)		
CPS data 2019	4.5	0.5
CPS data 2013-2016	7.2	0.8
SIPP data 2013-2016	10.1	0.7

may have any labor-market status. I also drop households with additional household members beyond the two spouses and their children. Finally, I apply conventional outlier restrictions.¹⁶³ The final sample contains $K17.2$ households in 2004 and $K10.5$ households in 2019.

Share of households receiving transfers. In Chapter 3.3.2, I noted that relatively few households in my sample receive transfer payments. This is consistent with Guner, Rauh, and Ventura (2026), who document low transfer receipt among married couples.¹⁶⁴ Using SIPP data, however, Guner, Rauh, and Ventura (2026) find that 10.1% of married couples receive SNAP, compared with 1.2% in my sample.

Several factors account for the difference. First, the progressivity analysis does not use reported transfer receipt, but calculates transfers from self-reported household characteristics, such as pre-government income and the number of children, combined with an inferred asset test.¹⁶⁵ The upper part of Table B.5 shows that transfer receipt is somewhat higher when using reported data.¹⁶⁶ Second, Guner, Rauh, and Ventura (2026) consider the years 2013–2016 rather than 2019 and use a slightly different sample.¹⁶⁷ Applying their sample selection and time period to CPS data raises the share

¹⁶³I exclude households in which spouses work more than 80 hours, households that report positive hours worked but no earnings, and households in which either spouse works in the armed forces. I also drop top-coded households for which labor income of the head and spouse exceeds \$1 million.

¹⁶⁴The share of households receiving TANF is particularly low because TANF take-up is low. Moffitt, Buttenheim, and Beatty (2023) report a take-up rate of 28% for TANF, compared with 82% for SNAP.

¹⁶⁵For the progressivity analysis, I cannot rely on reported transfer benefits because I fix income and other tax-transfer determinants and then vary the tax-transfer system between 2004 and 2019.

¹⁶⁶One reason is that actual transfer payments are based on monthly pre-government income, whereas my calculation uses annual household pre-government income.

¹⁶⁷In particular, they consider husbands aged 25 to 54, compared with ages 30 to 57 in my analysis, and impose no additional restrictions on family structure. By contrast, I restrict the sample to

of households reporting SNAP receipt to 7.2% and the share receiving TANF to 0.8%, much closer to the corresponding values in Guner, Rauh, and Ventura (2026). Third, Guner, Rauh, and Ventura (2026) use SIPP data rather than CPS data. As noted by Fox, Rothbaum, and Shantz (2022), among others, transfer payments are underreported in the CPS, which may explain the remaining gap.

These differences imply that the progressivity analysis may understate the share of married couples receiving SNAP. This issue has little effect on the estimated evolution of progressivity, however, as shown by the robustness check in Figure B.5.

B.3 Properties of the Bénabou Tax-Transfer Function

This appendix summarizes the main properties of the tax-transfer function à la Bénabou (2000),

$$\mathcal{T}(Y) = Y - (1 - \chi) \cdot Y^{1-\tau},$$

which is introduced in Equation (3.1) in Chapter 3.3.¹⁶⁸ The average tax rate is

$$\frac{\mathcal{T}(Y)}{Y} = 1 - (1 - \chi) \cdot Y^{-\tau},$$

so that $\mathcal{T}(Y)/Y = \chi$ if $Y = 1$. Thus, χ is the average tax rate at the normalization point. In Chapter 3.3, I normalize income such that $Y = 1$ corresponds to average household income. The parameter χ can therefore be interpreted as the tax rate faced by a household with average income.

The marginal tax rate is

$$\mathcal{T}'(Y) = 1 - (1 - \tau) \cdot (1 - \chi) \cdot Y^{-\tau}.$$

The parameter τ measures progressivity. The tax-transfer system is progressive if the marginal tax rate exceeds the average tax rate, $\mathcal{T}'(Y) > \mathcal{T}(Y)/Y$, which holds if $\tau > 0$.

households with up to three children and exclude households with members other than the head, spouse, and children.

¹⁶⁸These properties have been discussed by, for instance, Heathcote, Storesletten, and Violante (2017), Heathcote, Storesletten, and Violante (2020), Wu (2021), Borella et al. (2023), and Ferriere and Navarro (2025).

It is regressive if $\mathcal{T}'(Y) < \mathcal{T}(Y)/Y$, which holds if $\tau < 0$. If $\tau = 0$, the system is flat: the marginal tax rate is constant and equal to the average tax rate, $\mathcal{T}'(Y) = \mathcal{T}(Y)/Y = \chi$.

The progressivity parameter τ has two useful interpretations. First, $1 - \tau$ is the elasticity of post-government income with respect to pre-government income. Rearranging Equation (3.1) in terms of post-government income, $Y - \mathcal{T}(Y)$, and taking logs gives

$$\log(Y - \mathcal{T}(Y)) = \log(1 - \chi) + (1 - \tau) \cdot \log Y.$$

Taking the derivative with respect to $\log Y$ yields

$$\frac{\partial \log(Y - \mathcal{T}(Y))}{\partial \log Y} = 1 - \tau.$$

Second, following for instance Ferriere and Navarro (2025), the estimated progressivity parameter can be used to recover the average income-weighted marginal tax rate in the spirit of Barro and Sahasakul (1983). Specifically,

$$\begin{aligned} \frac{\mathcal{T}'(Y) - \mathcal{T}(Y)/Y}{1 - \mathcal{T}(Y)/Y} &= \frac{1 - (1 - \tau) \cdot (1 - \chi) \cdot Y^{-\tau} - (1 - (1 - \chi) \cdot Y^{-\tau})}{1 - (1 - (1 - \chi) \cdot Y^{-\tau})} \\ &= \frac{(1 - \chi) \cdot \tau \cdot Y^{-\tau}}{(1 - \chi) \cdot Y^{-\tau}} \\ &= \tau. \end{aligned}$$

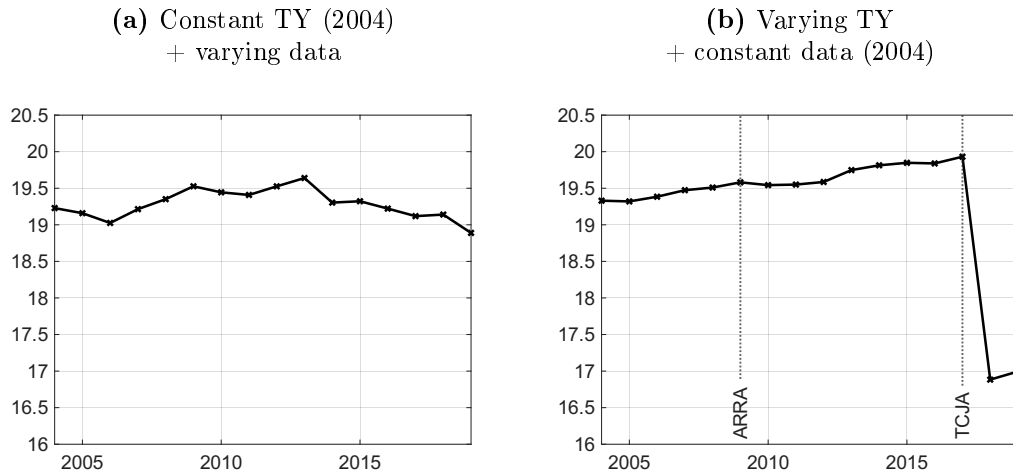
Rearranging with respect to the marginal tax rate gives

$$\begin{aligned} \mathcal{T}'(Y) &= \tau \cdot (1 - \mathcal{T}(Y)/Y) + \mathcal{T}(Y)/Y \\ &= 1 - (1 - \tau) \cdot (1 - \mathcal{T}(Y)/Y). \end{aligned}$$

Inserting the ratio of government purchases to GDP for $\mathcal{T}(Y)/Y$, as in Heathcote, Storesletten, and Violante (2017) and Heathcote, Storesletten, and Violante (2020), yields the average income-weighted marginal tax rate.

B.4 Additional Estimation Results and Robustness Checks

Decomposing variation in the scaling parameter. Figure 3.3, panel (a), in the main text shows the time-series variation in the scaling parameter χ . Figure B.4 decomposes

Figure B.4. Scaling parameter χ over time

Notes: Estimated intercept in regressions of log predicted post-government income on log pre-government income. Left panel: dependent variable is $\log(Y_t - T_{2004}(Y_t, \Xi_t))$, independent variable is $\log(Y_t)$, so year- t inputs are evaluated under the 2004 tax-transfer function. Right panel: dependent variable is $\log(Y_{2004} - T_t(Y_{2004}, \Xi_{2004}))$, independent variable is $\log(Y_{2004})$, so taxes net of transfers are computed using the year- t tax-transfer system, while income and other tax-transfer determinants are fixed at their 2004 values. Numbers are reported in %.

this variation into changes induced by the income distribution and other tax-transfer determinants (panel a) and changes induced by active tax-transfer reforms (panel b). The decomposition shows that the decline in the average tax rate from about 19.5% to 17.5% between 2017 and 2018 in Figure 3.3 is driven by the TCJA tax reductions. Passive changes generate only modest variation in the average tax rate.

Fixing tax-transfer determinants to other years. In the baseline decomposition of active reforms, I fix the income distribution and other tax-transfer determinants at their 2004 values. As a robustness check, Table B.6 compares this baseline with otherwise identical decompositions that instead fix these determinants at their 2013 and 2019 values. The results are very similar. Changes in statutory taxes alone would have reduced progressivity by 1.4 percentage points using 2004 data and by 1.3 and 1.6 percentage points using 2013 and 2019 data, respectively. Expansions of tax credits work in the opposite direction. The CTC increases progressivity by 0.9 percentage points using 2004 data and by 0.8 and 0.6 percentage points using 2013 and 2019 data, respectively. Overall, the decompositions using 2013 and 2019 data imply only a small decline in progressivity

Table B.6. Decomposing the change in overall progressivity into effects of different tax-transfer elements, 2004-2019 – fixing tax-transfer determinants to 2013 and 2019

	All	Statutory taxes	Transfers	EITC	CTC
Data from 2004	+0.0	-1.4	-0.0	+0.5	+0.9
Data from 2013	-0.1	-1.3	-0.1	+0.5	+0.8
Data from 2019	-0.5	-1.6	-0.0	+0.5	+0.6

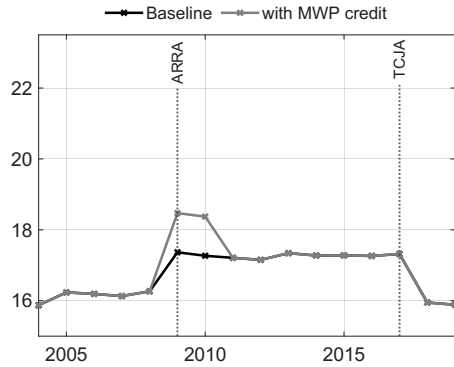
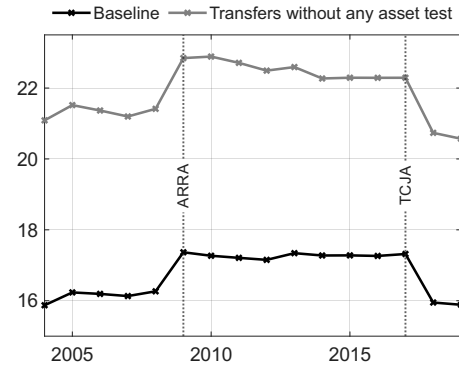
Notes: Change (in pp.) in estimated slope coefficients in regressions of log predicted post-government income on log pre-government income, 2004-2019. Independent variable is $\log(Y_{2004})$ in first row, $\log(Y_{2013})$ in second row, and $\log(Y_{2019})$ in third row. See notes to Figure 3.5 for definitions of dependent variables in upper row. In the second and third row, Y_{2004} and Ξ_{2004} are replaced by Y_{2013} and Ξ_{2013} , and Y_{2019} and Ξ_{2019} , respectively.

between 2004 and 2019, confirming that overall progressivity remained approximately constant.

Temporary tax credits. The baseline analysis excludes temporary tax credits. Figure B.5, panel (a), reports a robustness check that includes the Making Work Pay (MWP) credit, which was introduced during the Great Recession and available to taxpayers in TY 2009 and TY 2010. I focus on active changes in progressivity, holding income and other tax-transfer determinants fixed at their 2004 values. With the MWP credit included (gray line), progressivity rises from about 16% in 2009 to almost 19% in 2010, roughly two percentage points above the baseline without the MWP credit (black line). After the credit expires, progressivity returns to the baseline path.

Asset tests in transfers. In the baseline calculation of post-government income, I compute transfer payments only for households that report receiving transfers.¹⁶⁹ As discussed in Appendix B.2, this procedure may understate the true share of households receiving transfers. As a robustness check, I therefore estimate progressivity after removing all asset-test restrictions from the transfer calculation. Under this alternative, the share of households receiving transfers rises to 4.1% for SNAP and 2.8% for TANF. Figure B.5, panel (b), shows that broader transfer eligibility (gray line) raises the level of progressivity by about five percentage points relative to the baseline (black line). The evolution of progressivity, however, is essentially unchanged: progressivity rises around

¹⁶⁹The reason is that the CPS does not provide data on asset holdings.

Figure B.5. Robustness checks, progressivity parameter τ **(a)** Including the MWP credit**(b)** No asset test inferred

Notes: The figures present active changes in the progressivity parameter. The black lines show the baseline results from Figure 3.4 (b), i.e., the slope coefficient from regressions of log predicted post-government income on log pre-government income, fixing determinants to 2004 values. As an additional robustness check, the gray line in panel (a) presents results when the temporary MWP credit is added in the calculation of post-government income. The gray line in panel (b) shows results when excluding all forms of asset tests within the calculation of post-government income. Numbers are reported in percent.

the ARRA, falls around the TCJA, and is similar in 2019 to its 2004 level, with a small decline of 0.5 percentage points.

Number of children. Table B.7 reports estimated progressivity in TY 2004 and TY 2019, holding tax-transfer determinants fixed, separately by the number of children in the household. Progressivity increases with the number of children. Although overall progressivity changes little between 2004 and 2019, it rises by 2.0 percentage points for households with three children and falls by 1.2 percentage points for households without children. Thus, differences in tax-transfer progressivity by the number of children in the household widened between 2004 and 2019.

B.5 Details on the Parameterization of the Model

Data sources and sample selection. For the parameterization of the model, I use CPS, SCF, and PSID data. For the CPS, I apply the same restrictions as in the progressivity analysis described in Appendix B.2, focusing on the year 2019. To estimate the deterministic wage component and the stochastic child process, I use an extended sample

Table B.7. Progressivity by number of children in the household

	TY 2004 (%)	TY 2019 (%)	Difference (pp.)
All	15.9	15.9	+0.0
No children (24%)	10.2	9.0	-1.2
One child (24%)	15.5	14.9	-0.6
Two children (36%)	18.3	18.6	+0.3
Three children (15%)	18.8	20.8	+2.0

Notes: Estimated slope coefficients in regressions of log predicted post-government income on log pre-government income for the whole sample and for subsamples by number of children in the household. Dependent variable is $\log(Y_{2004} - T_t(Y_{2004}, \Xi_{2004}))$ for $t \in \{2004, 2019\}$, independent variable is $\log(Y_{2004})$. Numbers in parentheses give 2004 sample shares.

that pools CPS data from 2000 to 2022 and additionally includes husbands aged 58 to 65. To estimate the stochastic wage component, I use PSID waves from 1999 to 2019 and apply a sample selection similar to that used for the CPS and in Blundell, Pistaferri, and Saporta-Eksten (2016).¹⁷⁰

To construct empirical targets for wealth and the borrowing limit in the first model period, I use SCF data and apply sample restrictions similar to those used for the CPS. In addition, following Kaplan and Violante 2010, I exclude the top five percent of households by wealth. The resulting sample contains 1,227 couples, which I expand using SCF weights following Ortigueira and Siassi (2022).

Children. Households start life without children. During working age, children enter and leave the household stochastically according to a Markov chain with four states, $K = \{0, 1, 2, 3\}$. The transition matrix is

$$M_{jt} = \begin{bmatrix} m_{00} & m_{01} & 0 & 0 \\ m_{10} & m_{11} & m_{12} & 0 \\ 0 & m_{21} & m_{22} & m_{23} \\ 0 & 0 & m_{32} & m_{33} \end{bmatrix},$$

where $m_{kk'}$ denotes the probability of moving from state k to state k' in the next period. At most one child can enter or leave the household in a given period. The transition probabilities are age- and education-specific. From period 1 to t_j^* , children can enter

¹⁷⁰The sample includes married couples in which the household head is the husband, aged 30 to 57, and participating in the labor market. I further restrict the sample to non-SEO households with non-missing information on age, state, and education, and exclude outliers with more than 20 million dollars in assets.

Table B.8. Model parameters concerning wage components

Parameter	Symbol	Education group					Source
	j	1	2	3	4	5	
Stochastic wage component							
Permanent shock							estimated
Variance, men	$\text{var}(\nu_{m,j})$	.059	.030	.040	.031	.029	
Variance, women	$\text{var}(\nu_{f,j})$	.037	.025	.032	.047	.053	
Covariance	$\text{cov}(\nu_{m,j}, \nu_{f,j})$	.020	.006	-.004	.001	.002	
Transitory shock							
Variance, men	$\text{var}(\epsilon_{m,j})$	.000	.017	.028	.011	.008	
Variance, women	$\text{var}(\epsilon_{f,1})$	.018	.003	.012	.008	.011	
Covariance	$\text{cov}(\epsilon_{m,j}, \epsilon_{f,j})$	.000	.001	.015	.002	.008	
Deterministic wage component							
Constant, men	$b_{0,m,j}$	20.251	-10.574	-25.991	-9.666	-14.798	estimated
Coefficient 1, men	$b_{1,m,j}$	12.078	17.368	29.188	14.489	11.766	
Coefficient 2, men	$b_{2,m,j}$	-53.056	-6.551	-.096	-.217	-5.692	
Power 1, men	$p_{1,m,j}$	-2	1	.5	1	2	
Power 2, men	$p_{2,m,j}$	-2	1	3	3	2	
Constant, women	$b_{0,f,j}$	0.893	-92.782	51.576	84.480	-42.742	
Coefficient 1, women	$b_{1,f,j}$	-1.257	91.833	62.955	103.499	107.076	
Coefficient 2, women	$b_{2,f,j}$	19.896	-26.128	-59.028	-101.361	-38.565	
Power 1, women	$p_{1,f,j}$	-.5	.5	0	0	0	
Power 2, women	$p_{2,f,j}$	-.5	.5	.5	.5	0	

but not leave the household. From period $t_j^* + 1$ to 45, children can leave but not enter the household. The education-specific thresholds, t_j^* , are set to $t_j^* = (15, 18, 17, 20, 22)$ with $j \in \{1, 2, 3, 4, 5\}$, corresponding to ages (35, 38, 37, 40, 42).

The transition matrices are estimated to match, for each education-age cell between ages 30 and 65, the observed distribution of couples by the number of children in the household:

$$D_{jt} \times \widehat{M}_{jt} = \widehat{D}_{j,t+1} \quad \text{and} \quad \widehat{D}_{j,t+1} - D_{j,t+1} = 0,$$

where D_{jt} is the observed distribution across child states at age t for education type j .¹⁷¹ Using $D_{j,t}$ and $D_{j,t+1}$, I estimate the probabilities $m_{kk'}$ so that the predicted distribution tomorrow, $\widehat{D}_{j,t+1}$, matches the observed distribution as closely as possible.¹⁷² At retirement, all children leave the household with certainty.

¹⁷¹ As described above, I use pooled CPS data for 2000–2022 and extend the sample to include husbands aged 58 to 65. To smooth the age profiles, I calculate the shares at a given age using observations from the two preceding and two following ages.

¹⁷² For ages 21 to 30, transition probabilities are estimated so that households reach the observed distribution at age 30.

Stochastic wage component. To estimate the moments of the stochastic wage shocks, I follow Blundell, Pistaferri, and Saporta-Eksten (2016). Their estimation procedure has two steps. First, I estimate the unexpected wage growth, by regressing wage growth on demographic information and considering the residuals of this regression as the sum of a transitory and a permanent wage shock and measurement errors. Second, I use a GMM approach to estimate the variance-covariance matrix of the wage processes of spouses.¹⁷³ The first part of Table B.8 reports the results.

Deterministic wage component. To estimate the deterministic wage component, I again proceed in two steps. First, consistent with the estimation of the stochastic wage component, I regress log hourly wages, $\log w_g$, on household characteristics.¹⁷⁴ Second, I use average predicted wages by age and husband's education type in levels, $\widehat{w}_{g,j}$, to estimate the constant $b_{0,g,j}$, coefficients $b_{1,g,j}$ and $b_{2,g,j}$, and powers $p_{1,g,j}$ and $p_{2,g,j}$ in the fractional polynomial

$$\widehat{w}_{g,j}(age) = b_{0,g,j} + b_{1,g,j}(age)^{(p_{1,g,j})} + b_{2,g,j}(age)^{(p_{2,g,j})}.$$

The second part of Table B.8 reports the estimated parameters for husbands and wives by the husband's education type.

Model fit. Table B.9 compares sample means from CPS data for 2019, already shown in Table 3.1, with the calibrated model solved under TY 2019. The model generates slightly fewer households with two or three children than observed in the data and slightly more households without children or with one child. Income and taxes are closely matched, because labor income is targeted directly and taxes in the data are computed using the same tax-transfer calculator as in the model. The shares of households eligible for tax credits and the amounts received are also close to the data. The remaining discrepancies are consistent with the modest differences between the model and the data in the distribution of children across households. As discussed in the main

¹⁷³I consider the following moments: $E[(\Delta \log w_m)^2]$, $E[(\Delta \log w_f)^2]$, $E[\Delta \log w_m \Delta \log w_f]$, $E[\Delta \log w'_m \Delta \log w_m]$, $E[\Delta \log w'_f \Delta \log w_f]$, $E[\Delta \log w'_{m,t} \Delta \log w_f]$, and $E[\Delta \log w'_f \Delta \log w_m]$.

¹⁷⁴To do so, I use CPS data as mentioned above. I follow Rupert and Zanella (2015) and define annual hours as the product of hours worked per week and weeks worked per year. Hourly wages are defined as labor income divided by annual hours worked. I omit households in which either spouse has an hourly wage above \$1,000.

Table B.9. Sample means in model and data

	Data	Model
Households without children (%)	25.1	27.2
Households with one child (%)	23.6	27.3
Households with two children (%)	36.4	33.4
Households with three children (%)	14.9	12.1
Household earned income (\$K 2019)	134.6	134.4
Household investment income (\$K 2019)	9.2	7.6
Taxes net of transfers (\$K 2019)	27.4	26.8
Statutory taxes (\$K 2019)	21.0	20.8
FICA taxes (\$K 2019)	9.4	9.0
SNAP eligibility (%)	1.2	2.9
TANF eligibility (%)	0.1	2.7
EITC eligibility (%)	9.4	8.9
CTC eligibility (%)	73.2	71.2
SNAP amount (\$K 2019, if eligible)	3.1	3.9
TANF amount (\$K 2019, if eligible)	3.3	3.9
EITC amount (\$K 2019, if eligible)	3.0	3.4
CTC amount (\$K 2019, if eligible)	3.7	3.5

Notes: Data refers to the sample of married couples aged 30 to 57 in CPS data for year 2019 as in Table 3.1. Taxes, transfers, and eligibility according to own calculations based on tax-transfer code. Calculation of transfer payment only for households who actually received it in the data. The model results refer to the same sample and are solved under TY 2019.

text, the model somewhat overstates TANF receipt, a program for which non-take-up is relatively high; see Moffitt, Buttenheim, and Beatty (2023).

B.6 Welfare

This appendix provides additional details on the welfare analysis in Chapter 3.5.3. As the baseline measure, I consider ex-post welfare changes evaluated at the realized allocations of consumption and hours under the two tax years, $(c^{04}, n_m^{04}, n_f^{04})$ and $(c^{19}, n_m^{19}, n_f^{19})$. Let $W(c^{TY}, n_m^{TY}, n_f^{TY})$ denote lifetime utility given the allocation of consumption and hours under the tax-transfer system of year TY . Following Conesa, Kitao, and Krueger (2009), I measure welfare changes using consumption-equivalent variation, CEV , defined as the percentage change in household lifetime consumption under TY 2004 required to equalize lifetime utility under the two tax years:

$$W((1 + CEV) \cdot c^{04}, n_m^{04}, n_f^{04}) = W(c^{19}, n_m^{19}, n_f^{19}). \quad (\text{B.8})$$

Given the additively separable preferences in Equation (3.3), this expression can be rearranged following Wu and Krueger (2021) as

$$\begin{aligned}
 W(c^{19}, n_m^{19}, n_f^{19}) &= \frac{((1 + CEV) \cdot c^{04})^{1-\sigma}}{1-\sigma} - W_n(n_m^{04}, n_f^{04}) \\
 W(c^{19}, n_m^{19}, n_f^{19}) &= \frac{((1 + CEV) \cdot c^{04})^{1-\sigma}}{1-\sigma} - \frac{(c^{04})^{1-\sigma}}{1-\sigma} + \underbrace{\frac{(c^{04})^{1-\sigma}}{1-\sigma} - W_n(n_m^{04}, n_f^{04})}_{W(c^{04}, n_m^{04}, n_f^{04})} \\
 \underbrace{\frac{(c^{04})^{1-\sigma}}{1-\sigma}}_{W_c(c^{04})} \cdot [(1 + CEV)^{1-\sigma} - 1] &= W(c^{19}, n_m^{19}, n_f^{19}) - W(c^{04}, n_m^{04}, n_f^{04}) \\
 CEV &= \left(1 + \frac{W(c^{19}, n_m^{19}, n_f^{19}) - W(c^{04}, n_m^{04}, n_f^{04})}{W_c(c^{04})} \right)^{\frac{1}{(1-\sigma)}} - 1,
 \end{aligned}$$

where $W_c(c^{TY})$ and $W_n(n_m^{TY}, n_f^{TY})$ denote lifetime utility from consumption and labor supply, respectively.

Decomposition into hours and consumption. To decompose the total welfare change, CEV , into the contribution of consumption, CEV_C , and the labor-supply choices of husbands and wives, CEV_{NM} and CEV_{NF} , I follow Conesa, Kitao, and Krueger (2009). The term CEV_C is the percentage change in household lifetime consumption under TY 2004 needed to equalize utility when labor supply is held fixed at its TY 2004 allocation and only consumption changes. The term CEV_{NM} is the percentage change in household lifetime consumption under TY 2019 needed to equalize utility when the wife's labor supply is held fixed at its TY 2004 allocation and only the husband's hours change. Similarly, CEV_{NF} captures the welfare effect of changes in the wife's labor supply:

$$\begin{aligned}
 W((1 + CEV_C) \cdot c^{04}, n_m^{04}, n_f^{04}) &= W(c^{19}, n_m^{04}, n_f^{04}) \\
 W((1 + CEV_{NM}) \cdot c^{19}, n_m^{04}, n_f^{04}) &= W(c^{19}, n_m^{19}, n_f^{04}) \\
 W((1 + CEV_{NF}) \cdot c^{19}, n_m^{19}, n_f^{04}) &= W(c^{19}, n_m^{19}, n_f^{19}).
 \end{aligned}$$

These definitions imply

$$(1 + CEV) = (1 + CEV_{NF}) \cdot (1 + CEV_{NM}) \cdot (1 + CEV_C),$$

which follows by substituting the three decomposition equations into Equation (B.8):

$$\begin{aligned} W((1 + CEV) \cdot c^{04}, n_m^{04}, n_f^{04}) &= W(c^{19}, n_m^{19}, n_f^{19}) \\ &= W((1 + CEV_{NF}) \cdot c^{19}, n_m^{19}, n_f^{19}) \\ &= W((1 + CEV_{NF}) \cdot (1 + CEV_{NM}) \cdot c^{19}, n_m^{04}, n_f^{04}) \\ &= W((1 + CEV_{NF}) \cdot (1 + CEV_{NM}) \cdot (1 + CEV_C) \cdot c^{04}, n_m^{04}, n_f^{04}). \end{aligned}$$

In the main analysis in Chapter 3.5.3, I report the welfare effect of overall labor-supply changes, CEV_N , defined by

$$(1 + CEV_N) = (1 + CEV_{NM}) \cdot (1 + CEV_{NF}).$$

Decomposition into consumption level and distribution. I also follow Conesa, Kitao, and Krueger (2009) in decomposing the welfare effect of altered consumption into a level effect, CEV_{CL} , and a distribution effect, CEV_{CD} . These two components are defined by

$$\begin{aligned} W((1 + CEV_{CL}) \cdot c^{04}, n_m^{04}, n_f^{04}) &= W\left(\frac{\bar{c}^{19}}{\bar{c}^{04}} \cdot c^{04}, n_m^{04}, n_f^{04}\right) \\ W((1 + CEV_{CD}) \cdot (1 + CEV_{CL}) \cdot c^{04}, n_m^{04}, n_f^{04}) &= W(c^{19}, n_m^{04}, n_f^{04}), \end{aligned}$$

where $\bar{c}^{TY}$ denotes average household consumption under tax year TY . The level effect equals the percentage change in average consumption induced by the tax-transfer reforms between 2004 and 2019:

$$\begin{aligned} W((1 + CEV_{CL}) \cdot c^{04}, n_m^{04}, n_f^{04}) &= W\left(\frac{\bar{c}^{19}}{\bar{c}^{04}} \cdot c^{04}, n_m^{04}, n_f^{04}\right) \\ (1 + CEV_{CL})^{1-\sigma} \cdot \frac{(c^{04})^{1-\sigma}}{1-\sigma} - W_n(nm^{04}, nf^{04}) &= \left(\frac{\bar{c}^{19}}{\bar{c}^{04}}\right)^{1-\sigma} \cdot \frac{(c^{04})^{1-\sigma}}{1-\sigma} - W_n(nm^{04}, nf^{04}) \\ CEV_{CL} &= \frac{\bar{c}^{19}}{\bar{c}^{04}} - 1. \end{aligned}$$

The consumption component of welfare can be written as

$$(1 + CEV_C) = (1 + CEV_{CL}) \cdot (1 + CEV_{CD}).$$

B.7 Further Model Results

Budget. Table B.10 reports key components of the household budget constraint by education group. For households aged 25–60, the table first reports mean values in the model simulated under the 2004 tax-transfer system. It then decomposes the change from the 2004 to the 2019 system into a mechanical reform component, which holds hours and saving decisions fixed, and a behavioral component, which captures the additional change induced by endogenous household responses.

Some high school. Households in the *Some HS* group face a small mechanical increase in taxes net of transfers of about \$20. Expanded tax credits, however, induce reductions in labor supply that lower taxes net of transfers by about \$300 overall. The wife’s labor force participation is low by construction in this group and declines by an additional 0.6 percentage points under the 2019 tax-transfer system. Lower labor income (of slightly more than \$400) is accompanied by a reduction in saving of about \$250 and by a decline in accumulated wealth of almost \$3,500. Overall, lower expenditures on saving and taxes more than offset the decline in incomes, raising consumption by about \$70.

High school and some college. For households with medium levels of education, the 2004–2019 reforms mechanically raise taxes net of transfers by about \$240. Behavioral responses offset roughly one third of this increase. Labor income falls by about \$90, mainly because husbands reduce labor supply slightly. These households also save about \$300 less, which helps absorb the higher tax burden and yields a net increase in consumption of about \$50.

College and college+. Highly educated households benefit from lower marginal tax rates, with a mechanical reduction in taxes net of transfers of about \$330. Behavioral adjustments, mainly small reductions in husbands’ labor supply, lower taxes net of transfers by an additional \$20. Wives’ labor force participation, by contrast, rises by 0.5 percentage points. As discussed in the main text, the reforms reduce consumption insurance for highly educated households. In response, they save more at younger ages

Table B.10. Aggregate changes in budget components by education group

PANEL A: Some high school							
	Participation	Labor income in		Asset income	HH expenditures		
	Wife	Wife	Husband		t&T	Cons.	Saving
Mean 2004	55.8	17,677	39,462	3,133	3,695	49,223	7,353
Due to reform	0	0	0	0	+22	-22	0
Due to behavior	-0.6	-268	-148	-67	-333	+96	-245
Total change	-0.6	-268	-148	-67	-311	+74	-245
PANEL B: High school							
	Participation	Labor income in		Asset income	HH expenditures		
	Wife	Wife	Husband		t&T	Cons.	Saving
Mean 2004	78.1	33,287	57,130	4,030	13,552	69,779	11,117
Due to reform	0	0	0	0	+276	-276	0
Due to behavior	-0.5	-13	-74	-27	-104	+316	-326
Total change	-0.5	-13	-74	-27	+172	+40	-326
PANEL C: Some college							
	Participation	Labor income in		Asset income	HH expenditures		
	Wife	Wife	Husband		t&T	Cons.	Saving
Mean 2004	80.1	39,583	64,765	5,061	17,707	76,864	14,838
Due to reform	0	0	0	0	+192	-192	0
Due to behavior	+0.1	+24	-115	-12	-83	+245	-266
Total change	+0.1	+24	-115	-12	+109	+54	-266
PANEL D: College							
	Participation	Labor income in		Asset income	HH expenditures		
	Wife	Wife	Husband		t&T	Cons.	Saving
Mean 2004	82.6	52,431	86,467	8,040	28,557	96,108	22,273
Due to reform	0	0	0	0	-193	+193	0
Due to behavior	+0.4	+110	-61	+99	-3	+228	-77
Total change	+0.4	+110	-61	+99	-196	+421	-77
PANEL E: College +							
	Participation	Labor income in		Asset income	HH expenditures		
	Wife	Wife	Husband		t&T	Cons.	Saving
Mean 2004	79.5	64,716	122,552	10,427	44,156	122,088	31,450
Due to reform	0	0	0	0	-466	+466	0
Due to behavior	+0.5	+57	-135	+144	-33	+144	-45
Total change	+0.5	+57	-135	+144	-499	+610	-45

Notes: Rows labeled *Mean 2004* report sample means for households aged 25–60 in the model solved and simulated under TY 2004. Rows labeled *Due to reform* report aggregate changes from 2004 to 2019 holding hours and saving decisions fixed. Rows labeled *Total change* report aggregate changes from 2004 to 2019 allowing households to adjust their choices. Rows labeled *Due to behavior* are the residual between the total change and the mechanical reform effect. The wife's labor force participation is reported in percent, and changes are reported in percentage points. All other entries are expressed in 2019 dollars.

and accumulate about \$6,000 more in assets. Later in the life cycle, higher asset holdings allow these households to rely more on dissaving, so average saving falls by about \$60 overall (see also Figure B.6, panel b). Combining lower taxes net of transfers with lower average saving expenditures, highly educated households consume about \$515 more under the 2019 tax-transfer system.

Changes in tax-transfer elements. Table B.11 decomposes the changes in taxes net of transfers into changes in income taxes, payroll taxes, tax credits, and transfer payments. As in Table B.10, the table separates mechanical reform effects from changes induced by households' endogenous choices.

Mechanical changes. Mechanical reductions in income taxes are concentrated among highly educated households. The average reduction is \$4,820 in the *Col+* group, compared with \$680 in the *Some HS* group. All education groups benefit on average from the expansion of the CTC. The differences across groups are smaller than for income taxes, but benefits are again largest for households with high educational attainment, who gain from the higher income threshold at which the CTC phases out. By contrast, gains from the expanded EITC are largest in the *Some HS* group, where the average benefit is close to \$160. This increase reflects both a larger share of households receiving the credit and a higher average credit among eligible households. Reforms to transfer programs are quantitatively modest over the period considered. Because TANF benefits are not indexed to inflation, however, their real value declines over time, generating an average loss of about \$220 in the *Some HS* group.

Changes due to behavior adjustment. Behavioral changes in income taxes closely track the labor income responses discussed in Chapter 3.5.2. Labor supply reductions in the *Some HS* and *Col+* groups lower income taxes by about \$70 and \$40, respectively. The CTC changes little in response to endogenous household choices. The EITC is the tax-transfer element most affected by behavioral responses. Households with low and medium levels of education adjust hours so as to receive larger credits, with increases of up to \$183. As for the mechanical EITC change, this increase reflects both a larger share of eligible households and a higher average credit conditional on eligibility. Transfer payments rise modestly for households with low educational attainment, by about \$40, because married women reduce labor force participation.

Table B.11. Aggregate changes in specific tax-transfer elements by education group

PANEL A: Some high school							
	Taxes			Tax credits		Transfers	
	Income	Payroll	Linear	EITC	CTC	SNAP	TANF
Mean 2004	6,362	4,012	-1,529	1,458	998	1,347	1,346
Due to reform	-676	+67	+1,529	+158	+975	-14	-220
Due to behavior	-67	-36	0	+183	+6	+3	+38
Total change	-743	+31	+1,529	+341	+980	-11	-182

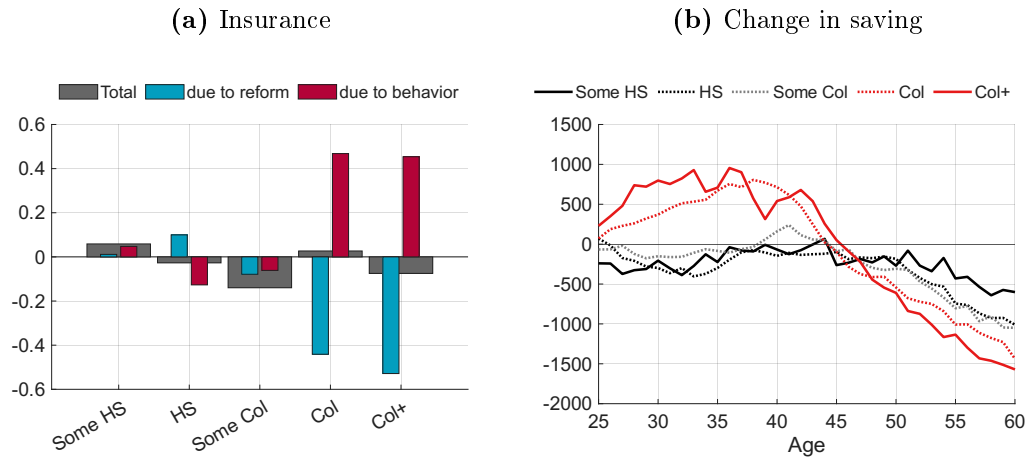
PANEL B: High school							
	Taxes			Tax credits		Transfers	
	Income	Payroll	Linear	EITC	CTC	SNAP	TANF
Mean 2004	11,349	6,464	-2,420	268	1,349	110	115
Due to reform	-1,348	+93	+2,420	+69	+834	-1	-13
Due to behavior	-6	-8	0	+71	-8	+15	+12
Total change	-1,354	+85	+2,420	+141	+826	+14	-1

PANEL C: Some college							
	Taxes			Tax credits		Transfers	
	Income	Payroll	Linear	EITC	CTC	SNAP	TANF
Mean 2004	14,974	7,129	-2,793	169	1,338	47	50
Due to reform	-1,809	+161	+2,793	+53	+907	-1	-6
Due to behavior	-32	+2	0	+46	-2	+4	+4
Total change	-1,841	+163	+2,793	+99	+905	+4	-2

PANEL D: College							
	Taxes			Tax credits		Transfers	
	Income	Payroll	Linear	EITC	CTC	SNAP	TANF
Mean 2004	24,336	9,160	-3,718	68	1,136	9	9
Due to reform	-3,095	+300	+3,718	+21	+1,097	-0	-1
Due to behavior	-13	+28	0	+15	+6	-2	-2
Total change	-3,108	+328	+3,718	+36	+1,103	-2	-3

PANEL E: College +							
	Taxes			Tax credits		Transfers	
	Income	Payroll	Linear	EITC	CTC	SNAP	TANF
Mean 2004	38,845	11,228	-5,012	27	875	2	2
Due to reform	-4,822	+630	+5,012	+8	+1,279	-0	-0
Due to behavior	-37	+14	0	+7	+4	-1	-1
Total change	-4,860	+644	+5,012	+15	+1,283	-1	-1

Notes: Rows labeled *Mean 2004* report sample means for households aged 25–60 in the model solved and simulated under TY 2004. Rows labeled *Due to reform* report aggregate changes from 2004 to 2019 holding hours and saving decisions fixed. Rows labeled *Total change* report aggregate changes from 2004 to 2019 allowing households to adjust their choices. Rows labeled *Due to behavior* are the residual between the total change and the mechanical reform effect. All entries are expressed in 2019 dollars.

Figure B.6. Changes in insurance and saving

Notes: Panel (a) reports changes in consumption insurance, measured in percentage points, for households aged 25–60. Gray bars show the total change in consumption insurance from 2004 to 2019 by the husband's education group, $\kappa_{c_j^{04}, \nu_{mj}^{04}} - \kappa_{c_j^{19}, \nu_{mj}^{19}}$. Blue bars show the mechanical change due to tax-transfer reforms, $\kappa_{c_j^{04}, \nu_{mj}^{04}} - \kappa_{c_j^{04,19}, \nu_{mj}^{04,19}}$, as in Chapter 3.5.1. Red bars are the residual and capture the change in consumption insurance induced by households' behavioral responses. Panel (b) reports the change in household saving in dollars by education group and age.

Consumption insurance. Chapter 3.5.1 reports the mechanical changes in household consumption insurance against permanent wage shocks to the husband that arise from the 2004–2019 tax-transfer reforms. Figure B.6, panel (a), reproduces these mechanical effects in blue and adds two further components: the behavioral contribution to insurance changes in red and the resulting total change in gray. Households with higher educational attainment partly offset the initial mechanical loss in insurance by accumulating more assets. Households with medium levels of education save less under the 2019 tax-transfer system, which further reduces insurance. In the *Some HS* group, interactions with tax credits allow households to slightly amplify the small insurance gain generated mechanically by the reforms. Panel (b) confirms the underlying saving responses: highly educated households save substantially more at younger working ages under the 2019 tax-transfer system, whereas households with lower educational attainment save slightly less.

Appendix C

This appendix provides further details and results concerning Chapter 4 in the dissertation. We first report income taxes, tax credits, and transfer payments in the United States in Appendix C.1. We detail tax formulas, filing status-specific parameters, and their sources.¹⁷⁵ We then present divorce bonuses and penalties by tax-transfer element in Appendix C.2. Appendix C.3 provides further information on the parameterization of the model and Appendix C.4 presents further results.

C.1 The U.S. Tax and Transfer System by Filing Status

Income taxes. Household income during working age (Equation C.1) consists of income from employment, e , and income from short-term capital investment, i , as defined in Equation (4.2) and (4.3), respectively. To calculate taxable income, $\tilde{y}$ (Equation C.2), we consider the filing status-specific standard deduction, $d(fs)$, abstracting from itemized deductions.¹⁷⁶ The income tax, $T(e, i, fs)$, for taxable income falling into bracket j is defined in Equation (C.3). While the marginal tax rate, τ_j , in the respective bracket applies for all household types, the bracket limit, $lb_j(fs)$, is filing-status specific. The parameters of income taxation are summarized in Table C.1.

$$y(e, i) = e + i \tag{C.1}$$

$$\tilde{y}(e, i, fs) = \max(0, y(e, i) - d(fs)) \tag{C.2}$$

$$T(e, i, fs) = \max \left[0, \tau_j \cdot \max(0, \tilde{y}(e, i, fs) - lb_j(fs)) + \sum_{i=1}^{j-1} \tau_i \cdot (ub_i(fs) - lb_i(fs)) \right] \tag{C.3}$$

¹⁷⁵The presented tax parameters in this appendix are reported in dollars. Within our model, we divide those values by the average household labor income of \$80,468.

¹⁷⁶Since the vast majority of tax filers in 2019 chose the standard deduction, this is a legitimate simplification, see Gale, Hoopes, and Pomerleau (2024).

Table C.1. Bracket limits and standard deductions

Upper bracket limits (\$)		Marginal tax rates (%)			
		Filing status fs			
		si	hh	ma	
Bracket 1	ub_1	9,700	13,850	19,400	τ_1 10
Bracket 2	ub_2	39,475	52,850	78,950	τ_2 12
Bracket 3	ub_3	84,200	84,200	168,400	τ_3 22
Bracket 4	ub_4	160,725	160,700	321,450	τ_4 24
Bracket 5	ub_5	204,100	204,100	408,200	τ_5 32
Bracket 6	ub_6	510,300	510,300	612,350	τ_6 35
					τ_7 37
Standard deduction (\$)	d	12,200	18,350	24,400	

Notes: Income tax brackets and standard deductions referring to tax year 2019, depending on the household's filing status, i.e. single (si), head of household (hh) and married filing jointly (ma). The upper limit of bracket j is equal to the lower limit of bracket $j + 1$, i.e. $ub_j = lb_{j+1}$. The lower limit of the first limit is zero, i.e. $lb_1 = 0$.

Source: OECD Taxing Wages modules, OECD (2020)

Payroll taxes. To determine payroll taxes, we take the sum of the Social Security tax rate and the Medicare tax rate, which results in a payroll tax rate, τ_p , of 7.65%. As we focus on low-income households, we abstract from the additional hospital Social Security tax and the earnings limit in Social Security taxes.

CTC. The CTC consists of a non-refundable and a partially refundable component (Equation C.4). The non-refundable component equals the maximum credit per child, cr^{max} , multiplied by the number of children in the household, k . When household gross income exceeds the threshold $\bar{y}^{ctc}(fs)$, the credit begins to phase out at rate τ^{ctc} (Equation C.5). If the credit exceeds the household's tax liability, $T(e, i, fs)$, the household may qualify for the refundable ACTC, provided earnings exceed the minimum threshold $\bar{e}^{actc}$. The ACTC is calculated as a fraction τ^{actc} of income above this minimum, subject to the cap $actc^{max}$ (Equation C.6 and C.7). A special rule applies to households with three children, captured by the indicator $\mathbb{I}_{k=3}$. All CTC parameters are summarized in Table C.2. Figure C.1, panel (a), illustrates the total credit as a function of earnings, filing status, and number of children.

$$Cr^{ctc}(e, i, k, fs) = ctc(e, i, k, fs) + actc(e, i, k, fs) \quad (C.4)$$

Table C.2. CTC parameters

Filing status	fs	ma	hh
Credit per child in \$	cr^{max}	2,000	2,000
Gross income threshold in \$	$\bar{y}^{ctc}$	400,000	200,000
Phase-out rate in %	τ^{ctc}	5	5
ACTC earnings minimum in \$	$\bar{e}^{actc}$	2,500	2,500
ACTC phase-in rate in %	τ^{actc}	15	15
ACTC maximum value in \$	$actc^{max}$	1,400	1,400

Notes: CTC parameters referring to tax year 2019. Two filing statuses are considered, i.e. head of household (hh) and married filing jointly (ma). *Source:* OECD Taxing Wages modules, OECD (2020)

$$ctc(e, i, k, fs) = \max \left[0, \min \left\{ T(e, i, fs), k \cdot cr^{max} - \tau^{ctc} \cdot \max(0, y(e, i) - \bar{y}^{ctc}(fs)) \right\} \right] \quad (C.5)$$

$$ctc^{hypo}(e, i, k, fs) = \max \left[0, k \cdot cr^{max} - \tau^{ctc} \cdot \max(0, y(e, i) - \bar{y}^{ctc}(fs)) \right] \quad (C.6)$$

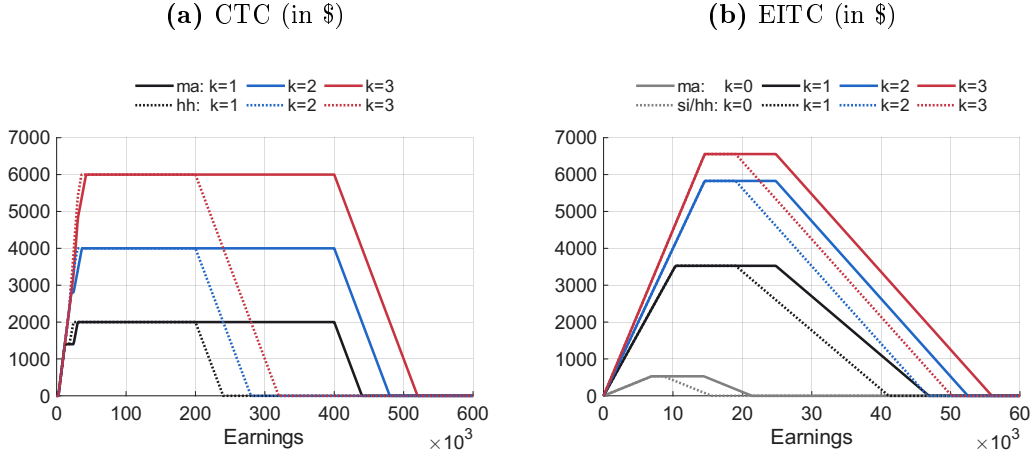
$$actc(e, i, k, fs) = \min \left\{ \begin{array}{l} \min \left\{ ctc^{hypo}(e, i, k, fs) - ctc(e, i, k, fs), k \cdot actc^{max} \right\}, \\ \max \left\{ \begin{array}{l} \max \left\{ 0, \tau^{actc} \cdot (e - \bar{e}^{actc}) \right\} \\ [\tau_p \cdot e - Cr^{eitc}(e, i, k, fs)] \mathbb{I}_{k=3} \end{array} \right\} \end{array} \right. \quad (C.7)$$

EITC. The EITC formula, given eligibility, is

$$Cr^{eitc}(e, i, k, fs) = \max \left[0, \tau_1^{eitc}(k) \cdot \min \left\{ e, \bar{e}_1^{eitc}(k) - \tau_2^{eitc}(k) \cdot \max(0, e - \bar{e}_2^{eitc}(k, fs)) \right\} \right], \quad (C.8)$$

where $\tau_1^{eitc}(k)$ and $\tau_2^{eitc}(k)$ denote the child-specific EITC phase-in and phase-out rate, respectively. The child-specific earnings limit for the end of the phase-in is denoted by $\bar{e}_1^{eitc}(k)$ and the child- and filing status-dependent earnings limit for the start of the phase-out by $\bar{e}_2^{eitc}(k, fs)$. To be eligible for the EITC, household income must be below the child- and filing status-specific income limit, $\bar{y}^{eitc}(k, fs)$, and investment income must be below the limit, $\bar{i}^{eitc}$, i.e.

$$i \leq \bar{i}^{eitc} \quad \wedge \quad y(e, i) \leq \bar{y}^{eitc}(k, fs).$$

Figure C.1. CTC and EITC by status and children

Notes: The figure presents the CTC (panel a) and the EITC (panel b) by earnings, filing status, and number of children in the household. The filing status is either married (solid lines) or single / head of household (dotted line). For the illustration, we assume that the household does not have any income from short-term capital investment.

Table C.3 summarizes all EITC parameter values and Figure C.1, panel (b), shows the EITC amount by household earnings, filing status, and number of children.

Transfer payments. Transfer payments comprise SNAP and TANF, i.e.

$$Tr(e, i, a, N, ms, g, n_f) = Tr^{snap}(e, i, a, N) + Tr^{tanf}(e, i, a, N, ms, g, n_f). \quad (C.9)$$

SNAP. To qualify for SNAP, households must pass a wealth test, a gross income test, and a counted net income test, i.e.

$$a \leq \bar{a}^{snap} \quad \wedge \quad e + i \leq \bar{y}^{snap}(N) \quad \wedge \quad y^{c, net}(e, i, N) \leq \bar{y}^{c, net}(N),$$

where $\bar{a}^{snap}$ is the wealth limit, $\bar{y}^{snap}(N)$ is the household size-specific gross income limit, and $\bar{y}^{c, net}(N)$ is the household size-specific counted net income limit. Counted net income is defined as

$$y^{c, net}(e, i, N) = 0.8 \cdot e + i - d^{snap}(N),$$

Table C.3. EITC parameters

Filing status	fs	ma				s/hh			
No. of children	k	0	1	2	3	0	1	2	3
Limits in \$ on									
Asset income	$\bar{i}^{eitc}$	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600
Earned income									
phase-in end	$\bar{e}_1^{eitc}$	6,920	10,370	14,570	14,570	6,920	10,370	14,570	14,570
phase-out start	$\bar{e}_2^{eitc}$	14,450	24,820	24,820	24,820	8,650	19,030	19,030	19,030
Gross income									
phase-out end	$\bar{y}^{eitc}$	21,370	46,884	52,493	55,952	15,570	41,094	46,703	50,162
Rates in %									
phase-in	τ_1^{eitc}	7.65	34	40	45	7.65	34	40	45
phase-out	τ_2^{eitc}	7.65	15.98	21.06	21.06	7.65	15.98	21.06	21.06

Notes: EITC parameters referring to tax year 2019. Three filing statuses are considered, i.e. single (*si*), head of household (*hh*) and married filing jointly (*ma*). *Source:* OECD Taxing Wages modules, OECD (2020)

Table C.4. SNAP parameters

Number of household members	N	1	2	3	4	5
Phase-out rate in %	τ^{snap}	30	30	30	30	30
Wealth limit in \$	$\bar{a}^{snap}$	2,250	2,250	2,250	2,250	2,250
Standard deduction in \$	d^{snap}	1,968	1,968	1,968	2,088	2,448
Gross income limit in \$	$\bar{y}^{snap}$	15,792	21,408	27,024	32,640	38,256
Counted net income limit in \$	$\bar{y}^{c,net}$	12,144	16,464	20,784	25,104	29,424
Maximum allotment	$snap^{max}$	2,304	4,236	6,060	7,704	9,144
Minimum allotment	$snap^{min}$	180	180	0	0	0

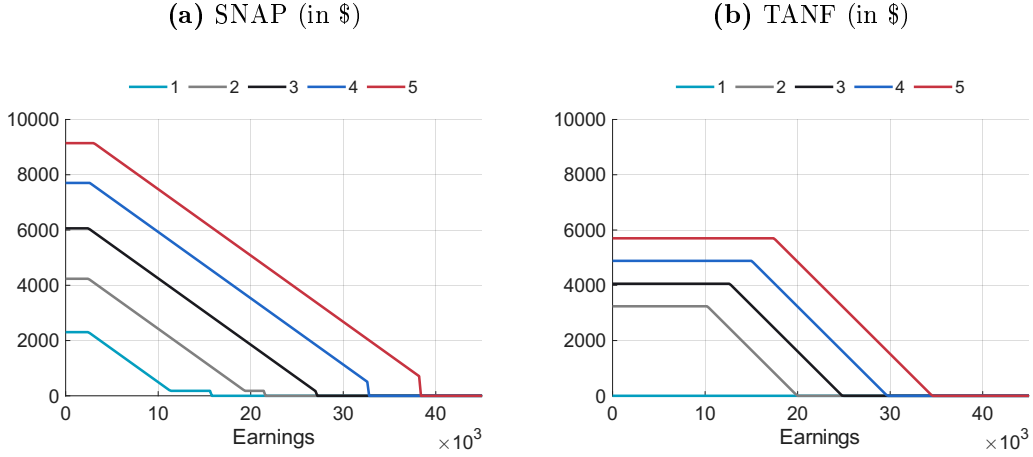
Notes: SNAP parameters referring to fiscal year 2019. All presented parameters are on a yearly basis. *Source:* Food and Nutrition Service (2018)

where $d^{snap}(N)$ is a household size-specific standard deduction. If the household passes the eligibility test, SNAP payments are calculated as

$$Tr^{snap}(e, i, a, N) = \max [snap^{min}(N), snap^{max}(N) - \max(0, \tau^{snap} \cdot y^{c,net}(e, i, N))] ,$$

where $snap^{min}(N)$ is the household size-specific minimum allotment, $snap^{max}(N)$ is the household size-specific maximum allotment, and τ^{snap} is the phase-out rate. All parameter values are summarized in Table C.4. Figure C.2, panel (a), presents SNAP payments by earnings and household size.

TANF. TANF payments are state specific. We apply the TANF implementation of Delaware. To qualify for TANF, children must be members of the household, the

Figure C.2. SNAP and TANF by household size

Notes: The figure shows SNAP (panel a) and TANF (panel b) by earnings and household members. For the illustration, we assume that the household does not have any asset holdings.

household needs to pass a wealth test, a counted net income test, and a gross income test, i.e.

$$k > 0 \quad \wedge \quad a \leq \bar{a}^{tanf} \quad \wedge \quad y^{c,net}(e, i, ms, g, n_f) \leq y^{need}(N) \quad \wedge \quad e + i \leq 1.85 \cdot y^{need}(N),$$

where $\bar{a}^{tanf}$ is the wealth limit, $y^{need}(N)$ is the household size-specific standard of need based on the poverty guidelines. The counted net income limit equals the standard of need, while the gross income limit is 1.85 times the standard of need. Counted net income, $y^{c,net}(e, i, ms, g, n_f)$ is defined as

$$y^{c,net}(e, i, ms, g, n_f) = i + \tau^{tanf,e} \cdot (e - N^w(ms, g, n_f) \cdot d^{work}),$$

where $\tau^{tanf,e}$ is the labor income share that is taken into account for the TANF calculation, d^{work} is a labor income disregard per worker in the household, implying that TANF depends on the number of workers in the household, $N^w(ms, g, n_f)$, i.e.,

$$N^w(\cdot) = \begin{cases} 0 & \text{if } (ms = S \wedge g = f \wedge n_f = 0) \\ 1 & \text{if } (ms = S \wedge g = f \wedge n_f > 0) \vee (ms = S \wedge g = m) \vee (ms = M \wedge n_f = 0) \\ 2 & \text{if } (ms = M \wedge n_f > 0), \end{cases}$$

Table C.5. TANF parameters

Number of household members	N	2	3	4	5
Phase-out rate in %	τ^{tanf}	50	50	50	50
Labor income share in %	$\tau^{tanf,e}$	2/3	2/3	2/3	2/3
Labor income disregard per worker in \$	d^{work}	1,440	1,440	1,440	1,440
Asset limit in \$	$\bar{a}^{tanf}$	10,000	10,000	10,000	10,000
Standard of need in \$	y^{need}	12,348	15,588	18,828	22,068
Payment standard in \$	$tanf^{max}$	3,240	4,056	4,884	5,700

Notes: TANF parameters referring to fiscal year 2019. All parameters are presented here on a yearly basis. Actual values are given on a monthly basis. Since TANF is only available for families with children, the minimum number of household members to be eligible for TANF in the model is two. *Source:* Welfare Rules Database offered by the Urban Institute (2020)

which depends on marital status, ms , gender, g , and the labor supply decision of the wife, n_f . If eligible, TANF payments are calculated as

$$Tr^{tanf}(e, i, a, N, ms, g, n_f) = \max \left[0, \min \left\{ \begin{array}{l} tanf^{max}(N), \\ \tau^{tanf} \cdot (y^{need}(N) - y^{c,net}(e, i, ms, g, n_f)) \end{array} \right\} \right],$$

where $\tau^{tanf^{max}}(N)$ is the household size-specific maximum amount, also known as the payment standard. Table C.5 summarizes all TANF parameters, while Figure C.2, panel (b), shows TANF payments by earnings and household size.

Pensions. To calculate pensions, we use the PIA formula,

$$b_t(\tilde{e}) = \begin{cases} 0.9 \cdot \tilde{e} & \tilde{e} \leq BP_1 \\ 0.9 \cdot BP_1 + 0.32 \cdot (\tilde{e} - BP_1) & BP_1 < \tilde{e} \leq BP_2 \\ 0.9 \cdot BP_1 + 0.32 \cdot (BP_2 - BP_1) + 0.15 \cdot (\tilde{e} - BP_2) & BP_2 < \tilde{e}, \end{cases}$$

where earnings up to a first bend point are credited at 90%. Earnings between the first and second bend point count towards 32% and earnings above the second bend point are credited at 15%. We adjust the bend points documented by the U.S. Social Security Administration (2026) to a yearly basis. Accordingly, the first bend point, BP_1 , is \$11,112 and the second one, BP_2 , is \$66,996. The social security cap for earnings, $\bar{e}^{ss}$, is \$K 132,9.

C.2 Divorce Bonuses and Penalties

In Figure C.3, we present divorce bonuses (green) and penalties (red) by tax-transfer element for various combinations of earnings by wife and husband, always considering households with three children. We assume that in case of divorce, the mother takes custody of the children and files as head of household, while the father files as single.

CTC. Panel (a) of Figure C.3 presents gains and penalties from divorce resulting from the CTC (including the refundable ACTC). For most income combinations, the CTC is independent of marriage. As discussed in Chapter 4.2, CTC divorce penalties arise if household income is unequally split between spouses and income of the mother is relatively low. Additionally, the CTC phase-out creates divorce bonuses and penalties.¹⁷⁷

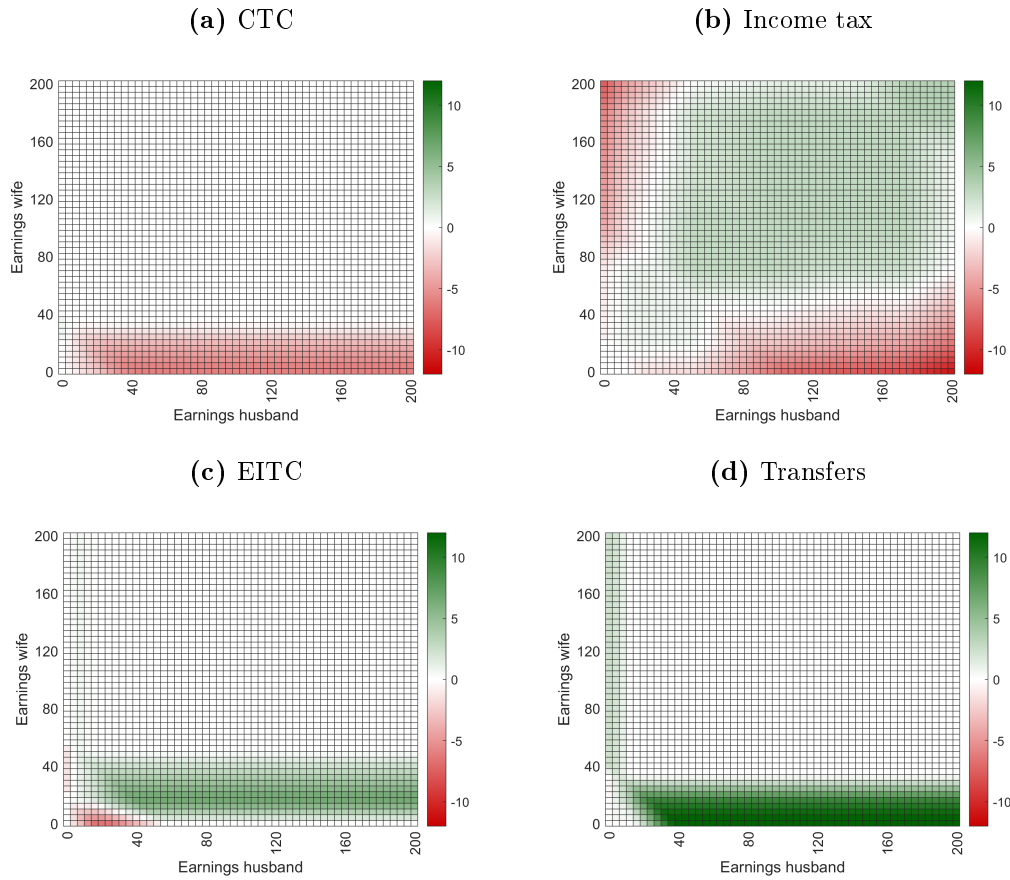
Importantly, CTC divorce penalties do not operate in isolation, but interact with gains and penalties arising from other tax-transfer elements.¹⁷⁸

Income taxes. The progressive income tax schedule (panel b of Figure C.3) implies divorce penalties if income is unequally split, increasing with total household income (known as a marriage bonus in the literature). In a household with three children and an income of \$K 50 that is split 100:0 (which corresponds to the extreme case in which the secondary earner is assumed not to participate in the labor market), CTC divorce penalties exceed penalties arising from the income tax by a factor of roughly 3.6. Yet, with increasing household income, divorce penalties from the income tax outweigh those from the CTC. Progressive income taxes imply small divorce bonuses given an equal split of earnings. The reason is the filing status *head of household* that implies tax benefits for one spouse in the event of divorce.

EITC. The EITC (panel c of Figure C.3) implies a divorce bonus if the wife's income is below the EITC phase-out limit and the husband's income is sufficiently high, making

¹⁷⁷The CTC phase-out threshold for married couples (\$K 400) is twice the limit of a single parent (\$K 200). This can lead to a divorce penalty if income of the spouse taking custody of the children exceeds \$K 200, but the sum of both spouses' incomes does not exceed \$K 400. On the other hand, there may also be a divorce gain if both spouses' incomes summed up exceed the threshold of \$K 400, but income of the spouse taking custody of the children does not (or only slightly) exceed the threshold of \$K 200.

¹⁷⁸These gains and penalties have been well documented in the empirical literature (e.g. Dickert-Conlin and Houser 1998, Holtzblatt and Rebelein 2000, or Alm and Leguizamon 2015).

Figure C.3. Divorce bonuses and penalties in various tax-transfer elements

Notes: The figure presents bonuses/penalties from divorce for households with three children, where green indicates a gain, red indicates a penalty, and white implies neutrality. In each panel, we focus on one specific element of the tax-transfer system, i.e. the CTC, income taxes, the EITC, and transfer payments (SNAP and TANF). For the illustration, we assume that the household does not have any income from short-term capital investment and no asset holdings. We assume that the mother claims the children as dependents and files as head of household in case of divorce, while the father files as single. All numbers are given in thousand dollars.

the couple ineligible for the credit. In the event of divorce, however, the wife becomes eligible, implying a divorce bonus. In some instances, due to the phase-in of the credit, EITC divorce penalties are possible. Similar to the CTC, this is the case when the couples' income falls into the plateau range, but the wife's income alone falls into the phase-in range. Yet, since the EITC plateau range is relatively small compared to the CTC, these penalties are less relevant compared to CTC divorce penalties.

Transfers. Transfers (panel d of Figure C.3) imply a divorce bonus if income is unequally split. The bonus roughly equals the sum of divorce penalties from the CTC

and income taxes.¹⁷⁹ Given an equal split of earnings, however, there is only a small divorce benefit or even neutrality. Importantly, the bonus only occurs in households with assets below the strict wealth limit in transfers. In households with assets above the respective threshold, divorce penalties are predominantly driven by the CTC and progressive income taxes.

C.3 Further Information on the Parameterization of the Model

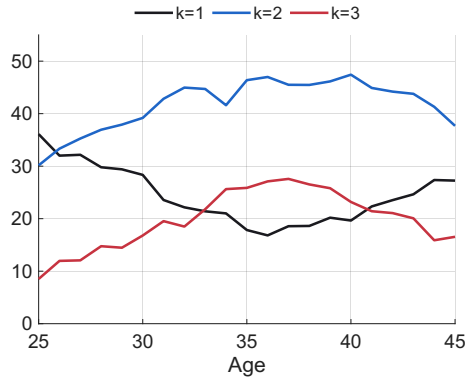
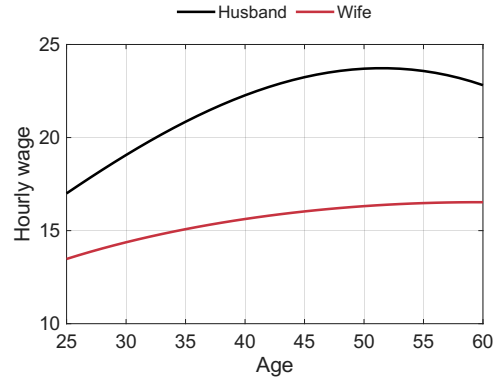
Data and sample selection. To determine empirical targets regarding income and labor force participation, we use IPUMS data from the Annual Social and Economic Supplement of the CPS. Our main sample consists of opposite-sex married couples observed in 2019 who file jointly and have up to three children. As argued in Chapter 4.4, we exclude households in which either the wife or the husband has a college degree. We further restrict the sample as follows. Husbands have to work and to be between ages 25 and 60, while wives aged 25-60 can be of any working status. The age difference between spouses must not exceed six years. We drop households with additional household members other than the two spouses and their children. In addition, we apply conventional outlier restrictions.¹⁸⁰ Our sample consists of 2,745 households.

To determine the deterministic wage profiles of husband and wife, we need more data. We therefore extend our 2019 sample to include all years from 2000 until 2019 and apply the same sample restrictions as for the 2019 sample. This leaves us with a sample of 104,302 households.

As discussed in the main text, to determine the share of households with either 0, 1, 2, or 3 children, we follow exactly the same sample selection as for our other CPS samples, but consider husbands born between 1959 and 1964, i.e., the cohorts who exit prime working age in 2014-2019. We then target the distribution of family size in married couples with husbands aged 25-45. For each age, we have sufficient data, ranging from 800 to 1,400 couples. Figure C.4, panel (a), presents the share of couples with k children by age.

¹⁷⁹Ortigueira and Siassi (2022) have discussed the marriage penalty arising from transfer payments in the U.S. and its disincentives for cohabiting couples to get married.

¹⁸⁰We exclude households in which either the wife or the husband work more than 80 hours per week, households in which labor income of head and spouse exceeds one million dollars, households that report positive hours worked without any earnings, and households employed in the armed forces.

Figure C.4. Parameterization of the child distribution and deterministic wages**(a)** Share of couples with k children**(b)** Wage profiles

Notes: Panel (a) presents the share of couples (in percent) with a specific number of children by age in the discussed sample of married couples created from CPS data; see Appendix C.3. Panel (b) presents wage profiles by wife and husband determined following Rupert and Zanella (2015) as described in Appendix C.3.

Deterministic wage components. To estimate the deterministic life-cycle wage profiles, we follow Rupert and Zanella (2015) and estimate the parameters of a fractional polynomial. To do so, we use our CPS sample with pooled survey years from 2000 to 2019 and calculate annual hours and hourly wages.¹⁸¹ We first regress the log of hourly wages, $\log w_g$, on household characteristics, as also done within the estimation of the stochastic components (see below). We secondly use average predicted values by age, h , $\hat{w}_g(h)$, to estimate the constant, b_{0g} , the coefficients, b_{1g} and b_{2g} , and the powers, p_{1g} and p_{2g} in the fractional polynomial

$$\hat{w}_g(h) = b_{0g} + b_{1g}(h)^{(p_{1g})} + b_{2g}(h)^{(p_{2g})}.$$

Table C.6 summarizes the parameters for husband and wife and Figure C.4, panel (b), shows the wage profiles for wife and husband.

Stochastic wage component. To estimate the moments of the stochastic wage shocks, we use PSID data for the period 1999-2019 and apply the same sample selection criteria as described above. The estimation procedure has two steps. First, we regress wage growth on demographic information and interpret the residuals as the sum of a

¹⁸¹The definition of annual hours and hourly wages follows Rupert and Zanella (2015). Hourly wages are defined as labor income divided by annual hours, which are defined as weekly hours times the number of weeks worked in a year.

Table C.6. Overview of estimated parameters for the deterministic wage component

Parameter	Symbol	Value	Parameter	Symbol	Value
Men			Women		
Constant	b_{0m}	7.852	Constant	b_{0f}	8.619
Coefficient 1	b_{1m}	2.561	Coefficient 1	b_{1f}	5.449
Coefficient 2	b_{2m}	-1.197	Coefficient 2	b_{2f}	-0.009
Power 1	p_{1m}	2	Power 1	p_{1f}	0
Power 2	p_{2m}	2	Power 2	p_{2f}	3

permanent stochastic wage component and measurement errors. We assume that measurement errors are i.i.d. Second, we use a GMM approach to estimate the variance-covariance matrix of the joint wage processes of spouses. In particular, we use an overidentified system with an identity weighting matrix. We consider the following moments: $E[(\Delta \log w_m)^2]$, $E[(\Delta \log w_f)^2]$, $E[\Delta \log w_m \Delta \log w_f]$, $E[\Delta \log w'_m \Delta \log w_m]$, $E[\Delta \log w'_f \Delta \log w_f]$, $E[\Delta \log w'_{m,t} \Delta \log w_f]$, and $E[\Delta \log w'_f \Delta \log w_m]$. The resulting variances of the permanent shocks are $\text{var}(\varepsilon_m) = 0.036$ and $\text{var}(\varepsilon_f) = 0.027$. We find an insignificant covariance $\text{cov}(\varepsilon_m, \varepsilon_f)$.

Empirical fit. In Figure C.5, we present further life-cycle profiles in model and data. At age 30, less than 10% of households in the SIPP data are married twice or more (panel a). Over the life cycle, this number increases to a value of roughly 25% at age 50. The model matches this untargeted share plus the increase over the life cycle quite well. Panel (b) presents wives' labor force participation in the CPS data. In their thirties, about 60% of married women participate in the labor market; by their forties, the share rises to about 70%. The model produces a steeper age profile and therefore underestimates participation at younger ages. Since the calibration targets only the average share over ages 30 to 57, the overall shape nevertheless aligns well with the data.

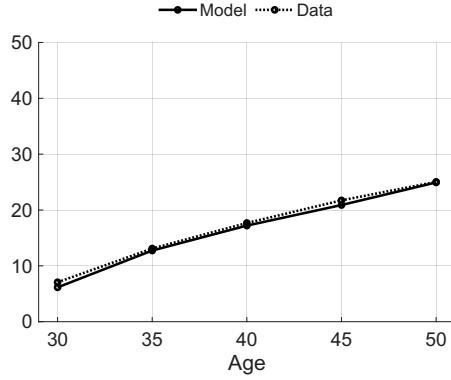
C.4 Further Results

First-order conditions. The first-order conditions for a single household imply the following optimal relation between the private and public consumption good

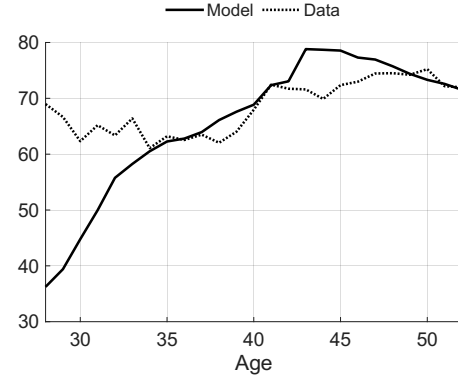
$$q = \left(\frac{\varrho \cdot c_g^{-\sigma}}{(1 - \varrho)} \right)^{-\frac{1}{\sigma}},$$

Figure C.5. Additional life-cycle profiles in data and model

(a) Share married twice or more



(b) Couples: Participation wife



Notes: The figures compare life-cycle profiles in data (dotted line) and model (solid line). Data values in panel (a) are based on SIPP data for marked ages. In panel (b), we focus on a sample of married couples and present CPS data values for ages 28-52 (using a 5-year-moving average).

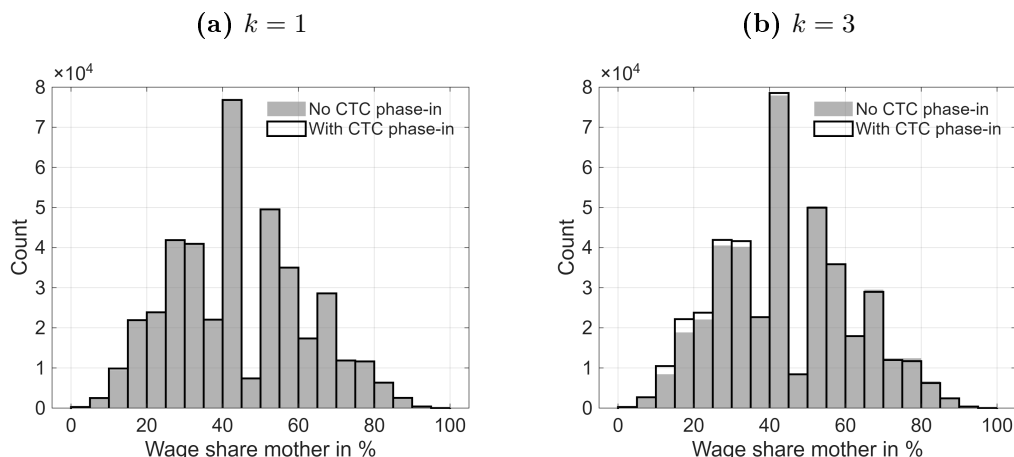
where household public consumption depends positively on private consumption given the utility weight of the private good, ϱ , and the relative risk aversion, σ . For couples, the first-order conditions imply the following relation between the optimal private consumption ratio of spouses and between private and public consumption, i.e.,

$$\frac{c_m}{c_f} = \left(\frac{\mu_m}{\mu_f} \right)^{\frac{1}{\sigma}}$$

$$q = \left(\frac{\varrho \cdot \mu_m \cdot c_m^{-\sigma}}{(1 - \varrho) \cdot (\mu_m + \mu_f)} \right)^{-\frac{1}{\sigma}},$$

where the first equation shows that the (private) consumption ratio between spouses is a function of the Pareto weight of the father relative to that of the mother and the Frisch consumption elasticity. Thus, an increase in the relative Pareto weight of the mother, keeping all other variables constant, increases her private consumption share relative to that of the father. The second equation implies that a decrease in the father's private consumption level, keeping all else constant, is associated with a fall in consumption of the public good.

Sample differences. One concern within our regression analysis in Chapter 4.5 affects the sample of married couples considered. In the model version with the CTC phase-ins, one might expect a higher share of married couples in which the wage share of the

Figure C.6. Sample differences between model versions

Notes: The figure presents sample differences in the two model versions considered for our regression analysis in Chapter 4.5 by the wage share of the mother and by the number of children in the household. Gray bars present the count of families in the model version without CTC phase-ins and white, framed bars present the count of families in the model version with CTC phase-ins.

mother is relatively low compared to the model version without the CTC phase-ins. The intuition is that the CTC phase-ins may encourage marriage among single mothers with relatively low income (and thus low bargaining power within marriage), thereby lowering the overall bargaining power of mothers. In Figure C.6, we examine sample differences quantitatively. In each panel, we present the count of families by the wage share of the mother in the two model versions, i.e., the one without the CTC phase-ins (gray bars) and with the CTC phase-ins (white, framed bars). Panel (a) represents households with one child and panel (b) with three children. Sample differences are hardly visible among households with one child. In households with three children, the intuition described above is true and there are more families with a relatively low wage share of the mother in the sample with the CTC phase-ins compared to the one without. Nevertheless, even for households with three children, sample differences are small and quantitatively negligible.¹⁸²

Determinants of the maternal Pareto weight and the maternal consumption share. In the main text, we consider female consumption as a dependent variable in Equation (4.4). Here, we check whether main results hold if we use the maternal Pareto weight, $x_{fj} = \mu_{fj}$ or the maternal consumption share of total household consumption, $x_{fj} =$

¹⁸²In households with two children, results are somewhere in between the two presented cases, i.e., small sample differences are visible, but negligible for the results.

Table C.7. Determinants of the maternal Pareto weight and consumption share

	Pareto weight	Consumption share	
Intercept	32.64***	22.97***	22.90***
Maternal wage share	0.69***	0.28***	0.01***
CTC phase-in	-0.58***	-0.25***	-0.03***
CTC phase-in $\times$ maternal wage share	0.01***	0.01***	0.00***
Pareto weight mother	—	—	0.39***
R ² (in %)	73.12	73.44	98.72
N	2,470,219	2,470,219	2,470,219

Notes: The table shows determinants of the maternal Pareto weight (first column) and for the maternal consumption share (second and third column) for the average mother, i.e. $x_{fj} = \mu_{fj}$ and $x_{fj} = c_{fj}/(c_j + q_j)$, respectively. The estimation equation and further details can be found in Chapter 4.5.1. For the estimation, we use OLS and a sample of households aged 30 to 42 who have been married in two subsequent periods. In each specification, we use different sets of controls. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

$c_{fj}/(c_j + q_j)$ instead. Table C.7 presents the results. A mother aged 36 with a wage share of 44% in the model without the CTC phase-ins has a Pareto weight of on average 32.6%. Considering the model with the CTC phase-ins, her Pareto weight decreases, ceteris paribus, by 0.6 percentage points. There is a positive, but small interaction of the effective CTC phase-in and the maternal wage share.

Considering the consumption share of the mother instead (second column of Table C.7), we find that a mother aged 36 with a wage share of 44% consumes on average 23% of total household resources. The CTC phase-ins reduce the mother's consumption share, ceteris paribus, by 0.3 percentage points. There is a positive, but small interaction of the CTC phase-ins and the maternal wage share. In the third column, we additionally control for the Pareto weight of the mother. Analogously to our results in the main text, the observed reduction in the consumption share of the mother implied by the CTC phase-ins disappears, implying that the effect is a result of within-household bargaining.

The mother of the average child. In the main text, we present results for the average mother. Within our baseline specification, we show the results for the mother of the average child, indicating that the effect on the mother of the average child is somehow higher than the effect of the average mother, since households with three children receive more weight. Here, we also present the results for the mother of the average child using the same variation in the set of controls as in the main text. Panel A of Table C.8

Table C.8. Determinants of consumption and hours worked by the mother of the average child

PANEL A: Consumption			
	(1)	(2)	(3)
Intercept	11,772.4***	11,756.3***	11,706.4***
Maternal wage share	80.9***	141.1***	-6.7***
CTC phase-in	-115.6***	-155.6***	-19.3***
CTC phase-in $\times$ maternal wage share	6.5***	6.8***	4.3***
Household consumption	—	0.2***	—
Pareto weight mother	—	—	127.9***
R ² (in %)	15.1	77.1	20.9
N	2,470,219	2,470,219	2,470,219
PANEL B: Hours worked			
	(1)	(2)	(3)
Intercept	16.4***	16.4***	17.0***
Maternal wage share	0.2***	0.3***	1.0***
CTC phase-in	3.2***	3.1***	2.3***
CTC phase-in $\times$ maternal wage share	0.1***	0.1***	0.1***
Household consumption	—	0.0***	—
Pareto weight mother	—	—	-1.2***
R ² (in %)	11.8	15.4	35.1
N	2,470,219	2,470,219	2,470,219

Notes: The table shows determinants of consumption and hours worked by the mother of the average child, i.e. within the regression, we use weights to target the average child. The estimation equation and further details can be found in Chapter 4.5.1. For the estimation, we use OLS and a sample of households aged 30 to 42 who have been married in two subsequent periods. In each specification, we use different sets of controls. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

presents the results using maternal consumption of the mother of the average child as a dependent variable and Panel B presents the results for maternal hours. Results and patterns for the mother of the average child are in line with our main findings from Chapter 4.5.

Hours ratio. In the main text, we present the determinants of hours worked by the average mother. Here, we additionally present the determinants of the hours ratio, i.e. hours worked by the mother relative to hours worked by the father. Table C.9 presents the results. In the first column, we do not include any additional control. A 36-year-old mother with a wage share of 44% living in the model version without the effective CTC phase-in works on average 43% relative to hours worked by the father. A ten percentage points increase in the mother's wage share increases the hours ratio by six percentage points. The CTC phase-ins increase the ratio by 6.5 percentage

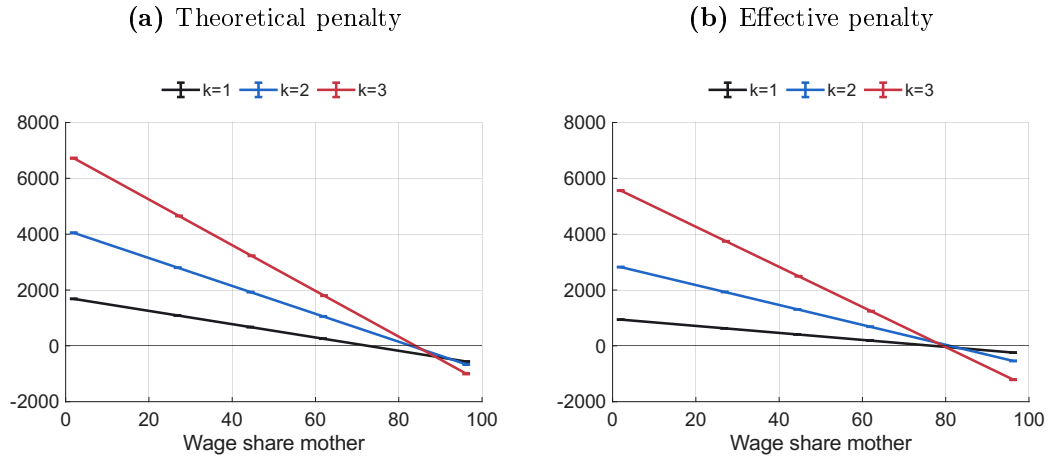
Table C.9. Determinants of maternal relative to paternal hours worked

	(1)	(2)	(3)
Intercept	43.4***	43.4***	44.0***
Maternal wage share	0.6***	0.8***	3.0***
CTC phase-in	6.5***	6.4***	4.5***
CTC phase-in $\times$ maternal wage share	0.1***	0.1***	0.2***
Household consumption	—	0.0***	—
Pareto weight mother	—	—	-3.4***
R ² (in %)	11.4	15.0	41.4
N	2,470,219	2,470,219	2,470,219

Notes: The table shows determinants of maternal hours worked relative to paternal hours worked for the average mother, i.e. $x_{fj} = n_{fj}/n_{mj}$. The estimation equation and further details can be found in Chapter 4.5.1. For the estimation, we use OLS and a sample of households aged 30 to 42 who have been married in two subsequent periods. In each specification, we use different sets of controls. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

points. When controlling for household consumption, results are similar, indicating that the average consumed dollar is financed more strongly through higher maternal hours worked (second column of Table C.9). In the last column, we control for the Pareto weight of the mother. The CTC phase-ins increase the hours ratio by 4.5 percentage points. In line with the results from above, the CTC phase-ins increase hours worked by the mother relative to hours worked by the father since the bargaining power of the mother declines. The dominant effect however is that CTC phase-ins reduce effective marginal rates incentivizing particularly mothers to increase their labor supply.

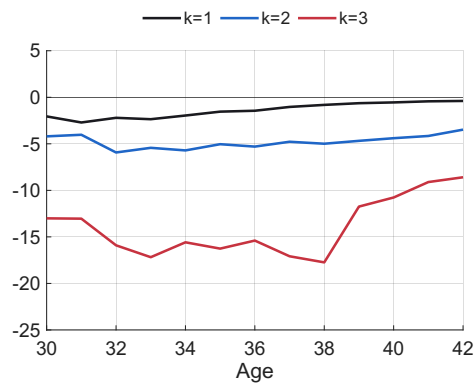
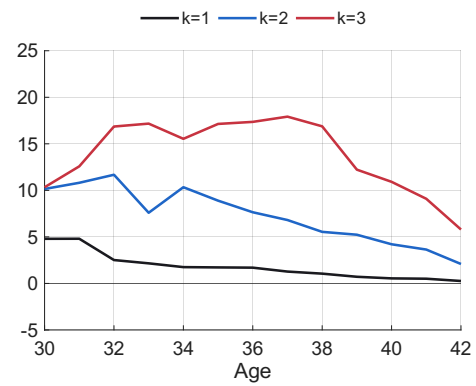
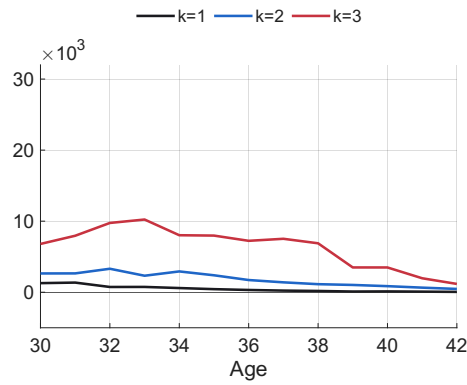
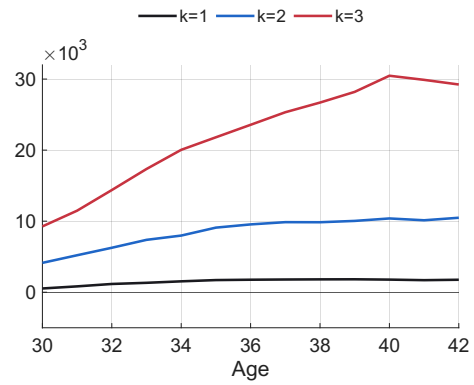
CTC divorce penalties. In Figure C.7, panel (a), we repeat our analysis from Chapter 4.5.2 in the main text and present estimated CTC divorce penalties by the wage share of the mother and by the number of children living in the household. As discussed in the main text, we calculate CTC divorce penalties given the choices of the mother within marriage, i.e. we replace the left hand side of Equation (4.4) by $x_{fj} = Cr_j^{ctc}(e_j, i_j, k_j, ma) - Cr_{fj}^{ctc}(e_{fj}, i_{fj}, k_j, hh)$. Yet, actual effective penalties depend on the choices of the mother in the outside option. In panel (b), we consider the effective CTC divorce penalty, i.e. we subtract the hypothetical CTC of a mother in the outside option (as a divorcee) from the CTC received as a married couple. Effective CTC divorce penalties in panel (b) are slightly below their counterparts in panel (a). The reason is that mothers in the outside option work more than mothers during marriage. Thus, effective CTC divorce penalties are slightly below their theoretical construct.

Figure C.7. Impact of the CTC phase-in on the CTC divorce penalty

Notes: The figure presents the estimated coefficient for $\hat{\beta}_2$ (the dummy indicating a CTC phase-in) in Equation (4.4) using the CTC phase-in as a dependent variable. In panel (a), we consider CTC divorce penalties given the household's choices within marriage. In panel (b), we consider adjusted choices in the outside option of the mother. The exact definitions can be found in Appendix C.4. We show results for different wage shares of the mother, considering a sample of households with either one (black line), two (blue line), or three (red line) children. For specific values, we additionally present confidence intervals, i.e. when the wage share of the mother is at its mean, at the mean plus/minus the standard deviation, or at its minimum or maximum value.

Life-cycle profiles. Figure C.8 presents the change in life-cycle profiles implied by the CTC phase-ins. We focus on married couples that have been married in two subsequent periods. The differences are strongest for households with three children, modest for those with two children, and small for those with one child.

The share of households receiving transfer payments (panel a) decreases substantially, by up to 18 percentage points. We observe that labor income by married couples increases by up to \$10,000 (panel c), which is driven by more wives (up to 18 percentage points) participating in the labor market (panel b). We also observe an increase in household asset holdings of up to \$30,000 (panel d). The reason is that increased household earnings imply fewer households receiving transfer payments, and thus lower incentives to hold few assets to meet the strict asset tests.

Figure C.8. Change of life-cycle profiles**(a)** Share of households with transfers in pp.**(b)** Participation wife in pp.**(c)** Labor income in \$**(d)** Assets in \$

Notes: The figure presents the difference in life-cycle profiles of married couples between the model with the effective CTC phase-in and the one without it by number of children in the households. Differences in panel (a) and (b) are given in percentage points, while panel (c) and (d) present differences in dollars.

References

- Albanesi, Stefania, Claudia Olivetti, and Barbara Petrongolo. 2023. "Families, labor markets, and policy." In *Handbook of the Economics of the Family, Volume 1*, edited by Shelly J. Lundberg and Alessandra Voena, 1: 255–326. Handbook of the Economics of the Family. Elsevier.
- Alm, James, Stacy Dickert-Conlin, and Leslie A. Whittington. 1999. "Policy Watch: The Marriage Penalty." *Journal of Economic Perspectives* 13 (3): 193–204.
- Alm, James, and Sebastian Leguizamon. 2015. "Whither the Marriage Tax?" *National Tax Journal* 68 (2): 251–280.
- Alm, James, Sebastian Leguizamon, and Susane Leguizamon. 2023. "Race, Ethnicity, and Taxation of the Family: The Many Shades of the Marriage Penalty/Bonus." *National Tax Journal* 76 (3): 525–560.
- Alm, James, and Leslie A. Whittington. 1996. "The Rise and Fall and Rise ... of the Marriage Tax." *National Tax Journal* 49 (4): 571–589.
- Alm, James, and Leslie A. Whittington. 1997. "Income taxes and the timing of marital decisions." *Journal of Public Economics* 64: 219–240.
- Ananat, Elizabeth, Benjamin Glasner, Christal Hamilton, Zachary Parolin, and Clemente Pignatti. 2024. "Effects of the expanded Child Tax Credit on employment outcomes." *Journal of Public Economics* 238: 105168.
- Apps, Patricia F., and Ray Rees. 1999. "Individual versus Joint Taxation in Models with Household Production." *Journal of Political Economy* 107 (2): 393–403.
- Athreya, Kartik, Roisin McCord, Devin Reilly, and Nicole Simpson. 2023. *Single Mothers and Tax Credits*. Working Paper.
- Attanasio, Orazio, and Steven J. Davis. 1996. "Relative wage movements and the distribution of consumption." *Journal of Political Economy* 104 (6): 1227–1262.

- Attanasio, Orazio, and Valérie Lechene. 2010. *Conditional Cash Transfers, Women and the Demand for Food*. IFS Working Paper 10/17.
- Attanasio, Orazio, Hamish Low, and Virginia Sánchez-Marcos. 2005. "Female Labor Supply as Insurance against Idiosyncratic Risk." *Journal of the European Economic Association* 3: 755–764.
- Attanasio, Orazio, Hamish Low, and Virginia Sánchez-Marcos. 2008. "Explaining Changes in Female Labor Supply in a Life-Cycle Model." *American Economic Review* 98 (4): 1517–1552.
- Auten, Gerald, and David Splinter. 2024. "Income Inequality in the United States: Using Tax Data to Measure Long-Term Trends." *Journal of Political Economy* 132 (7): 2179–2227.
- Autor, David H. 2019. "Work of the Past, Work of the Future." *AEA Papers and Proceedings* 109: 1–32.
- Autor, David H., David Dorn, and Gordon H. Hanson. 2013. "The China Syndrome: Local Labor Market Effects of Import Competition in the United States." *American Economic Review* 103 (6): 2121–2168.
- Bakija, Jon. 2024. "The US Individual Income Tax: Recent Evolution and Evidence." *Journal of Economic Perspectives* 38 (3): 33–60.
- Barro, Robert J., and Chaipat Sahasakul. 1983. "Measuring the Average Marginal Tax Rate from the Individual Income Tax." *Journal of Business* 56: 419–452.
- Bastian, Jacob. 2024. "How would a permanent 2021 child tax credit expansion affect poverty and employment?" *National Tax Journal* 77 (2): 263–311.
- Bastian, Jacob, and Lance Lochner. 2022. "The Earned Income Tax Credit and Maternal Time Use: More Time Working and Less Time with Kids?" *Journal of Labor Economics* 40 (3): 573–611.
- Becker, Gary S. 1973. "A Theory of Marriage: Part I." *Journal of Political Economy* 81 (4): 813–846.
- Bénabou, Roland. 2000. "Unequal Societies: Income Distribution and the Social Contract." *American Economic Review* 90 (1): 96–129.

- Bergh, Katie, Dottie Rosenbaum, and Catlin Nchako. 2025. *Republican SNAP Proposals Could Take Food Away From Millions of Low-Income Individuals and Families*. Edited by Center on Budget and Policy Priorities. Washington, DC.
- Bewley, Truman F. 1986. "Stationary Monetary Equilibrium with a Continuum of Independently Fluctuating Consumers." In *Contributions to Mathematical Economics in Honor of Gerard Debreu*, edited by Werner Hildenbrand and Andreu Mas-Colell, 79–102. Amsterdam: North-Holland.
- Bick, Alexander, Bettina Brüggemann, Nicola Fuchs-Schündeln, and Hannah Paule-Paludkiewicz. 2019. "Long-term changes in married couples' labor supply and taxes: Evidence from the US and Europe since the 1980s." *Journal of International Economics* 118: 44–62.
- Bick, Alexander, and Nicola Fuchs-Schündeln. 2017. "Quantifying the Disincentive Effects of Joint Taxation on Married Women's Labor Supply." *American Economic Review: Papers and Proceedings* 107 (5): 100–104.
- Bick, Alexander, and Nicola Fuchs-Schündeln. 2018. "Taxation and Labour Supply of Married Couples across Countries: A Macroeconomic Analysis." *The Review of Economic Studies* 85 (3): 1543–1576.
- Blank, Rebecca M. 2002. "Evaluating Welfare Reform in the United States." *Journal of Economic Literature* 40 (4): 1105–1166.
- Blundell, Richard, Luigi Pistaferri, and Ian Preston. 2008. "Consumption Inequality and Partial Insurance." *American Economic Review* 98 (5): 1887–1921.
- Blundell, Richard, Luigi Pistaferri, and Itay Saporta-Eksten. 2016. "Consumption Inequality and Family Labor Supply." *American Economic Review* 106 (2): 387–435.
- Borella, Margherita, Mariacristina De Nardi, Michael Pak, Nicolo Russo, and Fang Yang. 2023. "The Importance of Modeling Income Taxes Over Time: U.S. Reforms and Outcomes." *Journal of the European Economic Association* 21 (6): 2237–2286.
- Borella, Margherita, Mariacristina De Nardi, and Fang Yang. 2023. "Are Marriage-Related Taxes and Social Security Benefits Holding Back Female Labour Supply?" *Review of Economic Studies* 90: 102–131.

- Boskin, Michael J., and Eytan Sheshinski. 1983. "Optimal Tax Treatment of the Family: Married Couples." *Journal of Public Economics* 20: 281–297.
- Bredemeier, Christian, Jan Gravert, and Falko Juessen. 2023. "Accounting for limited commitment between spouses when estimating labor-supply elasticities." *Review of Economic Dynamics* 51: 547–578.
- Bredemeier, Christian, Jan Gravert, and Falko Juessen. 2026. *Marriage instability, consumption insurance, and optimal tax progressivity*. Unpublished manuscript.
- Bronson, Mary Ann, Daniel Haanwinckel, and Maurizio Mazzocco. 2025. *Taxation and Household Decisions: an Intertemporal Analysis*. Working Paper.
- Busch, Christopher, David Domeij, Fatih Guvenen, and Rocio Madera. 2022. "Skewed Idiosyncratic Income Risk over the Business Cycle: Sources and Insurance." *American Economic Journal: Macroeconomics* 14 (2): 207–242.
- Chakraborty, Indraneel, Hans A. Holter, and Serhiy Stepanchuk. 2015. "Marriage stability, taxation and aggregate labor supply in the U.S. vs. Europe." *Journal of Monetary Economics* 72: 1–20.
- Chiappori, Pierre-Andre. 1992. "Collective Labor Supply and Welfare." *Journal of Political Economy* 100 (3): 437–467.
- Chiappori, Pierre-Andre, and Maurizio Mazzocco. 2017. "Static and Intertemporal Household Decisions." *Journal of Economic Literature* 55 (3): 985–1045.
- Cho, Yunho, James Morley, and Aarti Singh. 2026. *Insurance Effects of Tax-and-Transfer Progressivity*. Working Paper.
- Collyer, Sophie M., Thesia Garner, Neeraj Kaushal, Jiwan Lee, Jake Schild, Jane Waldfogel, and Christopher T. Wimer. 2022. "Effects of the Expanded Child Tax Credit on Household Expenditures during the Interview Survey Reference Period: Preliminary Evidence from the Consumer Expenditure Survey." *BLS Working Papers* 549.
- Conesa, Juan Carlos, Sagiri Kitao, and Dirk Krueger. 2009. "Taxing Capital? Not a Bad Idea After All!" *American Economic Review* 99 (1): 25–48.
- Conesa, Juan Carlos, and Dirk Krueger. 2006. "On the optimal progressivity of the income tax code." *Journal of Monetary Economics* 53 (7): 1425–1450.

- Crawley, Edmund, and Alexandros Theloudis. 2024. *Income Shocks and their Transmission into Consumption*, 2024-038. Finance and Economics Discussion Series, Board of Governors of the Federal Reserve System.
- Dahl, Gordon, and Katrine V. Loken. 2024. "Families, public policies, and the labor market." In *Handbook of Labor Economics, Vol.5*. Edited by Christian Dustmann and Thomas Lemieux, 5: 581–617. Handbook of Labor Economics. Elsevier.
- Dauchy, Estelle, Francisco Navarro-Sanchez, and Nathan Seegert. 2021. "Taxation and inequality: Active and passive channels." *Review of Economic Dynamics* 42: 156–177.
- De Nardi, Mariacristina, Giulio Fella, and Gonzalo Paz-Pardo. 2020. "Nonlinear Household Earnings Dynamics, Self-Insurance, and Welfare." *Journal of the European Economic Association* 18 (2): 890–926.
- Denderski, Piotr, and Tim Obermeier. 2025. *Marriage, Intra-Household Inequality, and Wage Risk*. Working Paper.
- Dickert-Conlin, Stacy. 1999. "Taxes and transfers: their effects on the decision to end a marriage." *Journal of Public Economics* 73: 217–240.
- Dickert-Conlin, Stacy, and Scott Houser. 1998. "Taxes and Transfers: A New Look at the Marriage Penalty." *National Tax Journal* 51 (2): 175–217.
- Doepke, Matthias, Anne Hannusch, Fabian Kindermann, and Michèle Tertilt. 2023. "The economics of fertility: a new era." In *Handbook of the Economics of the Family, Volume 1*, edited by Shelly J. Lundberg and Alessandra Voena, 1: 151–254. Handbook of the Economics of the Family. Elsevier.
- Duflo, Esther. 2003. "Grandmothers and Granddaughters: Old-Age Pensions and Intra-household Allocation in South Africa." *The World Bank Economic Review* 17 (1): 1–25.
- Duflo, Esther, and Christopher Udry. 2004. *Intrahousehold Resource Allocation in Côte d'Ivoire: Social Norms, Separate Accounts and Consumption Choices*. NBER Working Paper 10498.
- Dynarski, Susan, and Jonathan Gruber. 1997. "Can Families Smooth Variable Earnings?" *Brookings Papers on Economic Activity* 1: 229–303.

- Eissa, Nada, and Hilary Williamson Hoynes. 2000. "Explaining the Fall and Rise in the Tax Cost of Marriage: The Effect of Tax Laws and Demographic Trends, 1984-97." *National Tax Journal* 53 (3): 683-712.
- Eissa, Nada, and Hilary Williamson Hoynes. 2004. "Taxes and the labor market participation of married couples: the earned income tax credit." *Journal of Public Economics* 88: 1931-1958.
- Ellwood, David T. 2000. "The Impact of the Earned Income Tax Credit and Social Policy Reforms on Work, Marriage, and Living Arrangements." *National Tax Journal* 53 (4): 1063-1105.
- Enriquez, Brandon, Damon Jones, and Ernie Tedeschi. 2023. "The Short-Term Labor Supply Response to the Expanded Child Tax Credit." *AEA Papers and Proceedings* 113: 401-405.
- Federal Interagency Forum on Child and Family Statistics. 2023. *America's Children: Key National Indicators of Well-Being, 2023*. Washington, DC: U.S. Government Printing Office.
- Feldstein, Martin S. 1969. "The Effects of Taxation on Risk Taking." *Journal of Political Economy* 77: 755-764.
- Ferriere, Axelle, and Gaston Navarro. 2025. "The Heterogeneous Effects of Government Spending: It's All About Taxes." *Review of Economic Studies* 92: 1061-1125.
- Fink, Alexander. 2020. "German income taxation and the timing of marriage." *Applied Economics* 52 (5): 475-489.
- Fleck, Johannes, Jonathan Heathcote, Kjetil Storesletten, and Giovanni L. Violante. 2025. *Fiscal Progressivity of the U.S. Federal and State Governments*. Working Paper.
- Foerster, Hanno. 2025. "Untying the Knot: How Child Support and Alimony Affect Couples' Dynamic Decisions and Welfare." *Review of Economic Studies* 92: 3029-3066.
- Food and Nutrition Service. 2018. *SNAP - Fiscal Year 2019 Cost-of-Living Adjustments*. Alexandria: United States Department of Agriculture.

- Fox, Liana, Jonathan Rothbaum, and Kathryn Shantz. 2022. "Fixing Errors in a SNAP: Addressing SNAP Underreporting to Evaluate Poverty." *AEA Papers and Proceedings* 112: 330–334.
- Gale, William G., Jeffrey L. Hoopes, and Kyle Pomerleau. 2024. "Sweeping Changes and an Uncertain Legacy: The Tax Cuts and Jobs Act of 2017." *Journal of Economic Perspectives* 38 (3): 3–32.
- Garstenauer, Viola. 2025. *Cohabitation, Marriage, and Tax Policy in the United States*. Working Paper.
- Garstenauer, Viola, and Nawid Siassi. 2025. *Low-Income Families, Maternal Labor Supply, and Welfare Reform*. Working Paper.
- Ghosh, Anisha, and Alexandros Theloudis. 2025. "Consumption Partial Insurance in the Presence of Tail Income Risk." *Working Paper*.
- Gjeltén, E. A., and Stacy Barrett. 2026. *How Much Will My Divorce Cost?* Available online at: <https://www.nolo.com/legal-encyclopedia/ctp/cost-of-divorce.html>, accessed May 2, 2026.
- Goldin, Jacob, and Katherine Michelmore. 2022. "Who benefits from the child tax credit?" *National Tax Journal* 75 (1): 123–147.
- Grall, Timothy. 2020. *Custodial Mothers and Fathers and Their Child Support: 2017*. Current Population Reports, P60-269. Washington, DC: U.S. Census Bureau.
- Greenwood, Jeremy, Nezih Guner, and Guillaume Vandenbroucke. 2017. "Family Economics Writ Large." *Journal of Economic Literature* 55 (4): 1346–1434.
- Guner, Nezih, Remzi Kaygusuz, and Gustavo Ventura. 2012. "Taxation and Household Labour Supply." *Review of Economic Studies* 79 (3): 1113–1149.
- Guner, Nezih, Remzi Kaygusuz, and Gustavo Ventura. 2014. "Income taxation of U.S. households: Facts and parametric estimates." *Review of Economic Dynamics* 17 (4): 559–581.
- Guner, Nezih, Remzi Kaygusuz, and Gustavo Ventura. 2020. "Child-Related Transfers, Household Labour Supply, and Welfare." *Review of Economic Studies* 87 (5): 2290–2321.

- Guner, Nezih, Remzi Kaygusuz, and Gustavo Ventura. 2023. "Rethinking the Welfare State." *Econometrica* 91 (6): 2261–2294.
- Guner, Nezih, Christopher Rauh, and Gustavo Ventura. 2026. *Means-Tested Transfers in the US: Facts and Parametric Estimates*. Working Paper.
- Guvonen, Fatih, Serdar Ozkan, and Rocio Madera. 2024. "Consumption dynamics and welfare under non-Gaussian earnings risk." *Journal of Economic Dynamics and Control* 169: 1–21.
- Haan, Peter, and Victoria Prowse. 2024. "The Heterogeneous Effects of Social Assistance and Unemployment Insurance: Evidence from a Life Cycle Model of Family Labor Supply and Savings." *American Economic Journal: Macroeconomics* 16 (2): 127–181.
- Ham, John C., and Kris Jacobs. 2000. "Testing for Full Insurance Using Exogenous Information." *Journal of Business and Economic Statistics* 18 (4): 387–397.
- Hannusch, Anne. 2025. *Taxing Families: The Impact of Child-related Transfers on Maternal Labor Supply*, 067. Discussion Paper Series, Collaborative Research Center Transregio.
- Hayashi, Fumio, Joseph Altonji, and Laurence Kotlikoff. 1996. "Risk-Sharing between and within Families." *Econometrica* 64 (2): 261–294.
- Heathcote, Jonathan, Fabrizio Perri, Giovanni L. Violante, and Lichen Zhang. 2023. "More unequal we stand? Inequality dynamics in the United States, 1967–2021." *Review of Economic Dynamics* 50: 235–266.
- Heathcote, Jonathan, Kjetil Storesletten, and Giovanni L. Violante. 2009. "Quantitative Macroeconomics with Heterogeneous Households." *Annual Review of Economics* 1: 319–354.
- Heathcote, Jonathan, Kjetil Storesletten, and Giovanni L. Violante. 2014. "Consumption and Labor Supply with Partial Insurance: An Analytical Framework." *American Economic Review* 104 (7): 2075–2126.
- Heathcote, Jonathan, Kjetil Storesletten, and Giovanni L. Violante. 2017. "Optimal Tax Progressivity: An Analytical Framework." *The Quarterly Journal of Economics* 132 (4): 1693–1754.

- Heathcote, Jonathan, Kjetil Storesletten, and Giovanni L. Violante. 2020. "Presidential Address 2019: How Should Tax Progressivity Respond to Rising Income Inequality?" *Journal of the European Economic Association* 18 (6): 2715–2754.
- Hoffmann, Florian, David S. Lee, and Thomas Lemieux. 2020. "Growing Income Inequality in the United States and Other Advanced Economies." *Journal of Economic Perspectives* 34 (4): 52–78.
- Holter, Hans A., Dirk Krueger, and Serhiy Stepanchuk. 2019. "How do tax progressivity and household heterogeneity affect Laffer curves?" *Quantitative Economics* 10 (4): 1317–1356.
- Holter, Hans A., Dirk Krueger, and Serhiy Stepanchuk. 2026. *Till the IRS Do Us Part: (Optimal) Taxation of Households*. Working Paper.
- Holtzblatt, Janet, and Robert Rebelein. 2000. "Measuring the Effect of the EITC on Marriage Penalties and Bonuses." *National Tax Journal* 53 (4): 1107–1133.
- Hotchkiss, Julie L., Robert E. Moore, and Fernando Rios-Avila. 2024. "Impact of the 2017 Tax Cuts and Jobs Act on Household Labor Supply and Welfare across the Income Distribution." *National Tax Journal* 77 (2): 313–348.
- Howard, Christopher. 2025. "Two Histories of the Public Safety Net." *Journal of Economic Perspectives* 39 (1): 77–100.
- Hoynes, Hilary, and Diane Whitmore Schanzenbach. 2016. "US Food and Nutrition Programs." In *Economics of Means-Tested Transfer Programs in the United States*, edited by Robert A. Moffitt, 219–301. Chicago: University of Chicago Press.
- Internal Revenue Service. 2019. *Tax Guide for Seniors: For use in preparing 2019 Returns*. Edited by Department of the Treasury.
- Kallen, Cody, and Aparna Mathur. 2021. "Estimating the Distributional Implications of the Tax Cuts and Jobs Act." *National Tax Journal* 74 (3): 721–759.
- Kaplan, Greg, and Giovanni L. Violante. 2010. "How Much Consumption Insurance Beyond Self-Insurance?" *American Economic Journal: Macroeconomics* 2 (4): 53–87.
- Kaplan, Greg, and Giovanni L. Violante. 2014. "A Model of the Consumption Response to Fiscal Stimulus Payments." *Econometrica* 82 (4): 1199–1239.

- Kaygusuz, Remzi. 2010. "Taxes and female labor supply." *Review of Economic Dynamics* 13: 725–741.
- Kleven, Henrik. 2024. "The EITC and the extensive margin: A reappraisal." *Journal of Public Economics* 236: 105135.
- Kocherlakota, Narayana R. 1996. "Implications of Efficient Risk Sharing without Commitment." *Review of Economic Studies* 63: 595–609.
- Kreider, Rose M., and Renee Ellis. 2011. *Number, Timing, and Duration of Marriages and Divorces: 2009*. Current Population Reports, P70-125. Washington, DC: U.S. Census Bureau.
- Krueger, Dirk, and Alexander Ludwig. 2016. "On the optimal provision of social insurance: Progressive taxation versus education subsidies in general equilibrium." *Journal of Monetary Economics* 77: 72–98.
- Krueger, Dirk, and Fabrizio Perri. 2011. "Public versus private risk sharing." *Journal of Economic Theory* 146 (3): 920–956.
- Li, Chao, and Daoming Sun. 2023. "Women's bargaining power and spending on children's education: Evidence from a natural experiment in China." *International Journal of Educational Development* 100: 102787.
- Ligon, Ethan, Jonathan P. Thomas, and Tim Worrall. 2002. "Informal Insurance Arrangements with Limited Commitment: Theory and Evidence from Village Economies." *Review of Economic Studies* 69: 209–244.
- Lin, Emily Y., and Patricia K. Tong. 2012. "Marriage and Taxes: What Can We Learn from Tax Returns Filed by Cohabiting Couples?" *National Tax Journal* 65 (4): 807–826.
- Lise, Jeremy, and Shannon Seitz. 2011. "Consumption Inequality and Intra-household Allocations." *Review of Economic Studies* 78 (1): 328–355.
- Lise, Jeremy, and Ken Yamada. 2019. "Household Sharing and Commitment: Evidence from Panel Data on Individual Expenditures and Time Use." *Review of Economic Studies* 86 (5): 2184–2219.

- Low, Hamish, Costas Meghir, Luigi Pistaferri, and Alessandra Voena. 2025. *Marriage, Labor Supply and the Dynamics of the Social Safety Net*, 24356. National Bureau of Economic Research, Cambridge.
- Lundberg, Shelly J., Robert A. Pollak, and Terence J. Wales. 1997. "Do Husbands and Wives Pool Their Resources? Evidence from the United Kingdom Child Benefit." *The Journal of Human Resources* 32 (3): 463–480.
- Maag, Elaine, C. Eugene Steuerle, Ritadhi Chakravarti, and Caleb Quakenbush. 2012. "How marginal tax rates affect families at various levels of poverty." *National Tax Journal* 65 (4): 759–782.
- Marcet, Albert, and Ramon Marimon. 2019. "Recursive Contracts." *Econometrica* 87 (5): 1589–1631.
- Mazzocco, Maurizio. 2007. "Household Intertemporal Behaviour: A Collective Characterization and a Test of Commitment." *Review of Economic Studies* 74 (3): 857–895.
- McDermott, Brendan. 2025. *The Child Tax Credit: How It Works and Who Receives It*. CRS Report R41873. Congressional Research Service.
- Meyer, Bruce D., Wallace K. C. Mok, and James X. Sullivan. 2015. "Household Surveys in Crisis." *Journal of Economic Perspectives* 29 (4): 199–226.
- Meyer, Bruce D., and James X. Sullivan. 2023. "Consumption and Income Inequality in the United States since the 1960s." *Journal of Political Economy* 131 (2): 247–284.
- Moffitt, Robert A. 2016. "Introduction to Economics of Means-Tested Transfer Programs in the United States, Volume 1." In *Economics of Means-Tested Transfer Programs in the United States*, edited by Robert A. Moffitt, vol. 1. Chicago: University of Chicago Press.
- Moffitt, Robert A., Alison Buttenheim, and Alexandra Beatty. 2023. "Social Safety Net Benefits." In *Behavioral Economics: Policy Impact and Future Directions*, edited by National Academies of Sciences, Engineering, and Medicine, 127–138. Washington, DC: The National Academies Press.
- Moffitt, Robert A., Brian J. Phelan, and Anne E. Winkler. 2020. "Welfare Rules, Incentives, and Family Structure." *Journal of Human Resources* 55 (1): 1–42.

- Moore, Rachel, and Brandon Pecoraro. 2020. "Macroeconomic implications of modeling the Internal Revenue Code in a heterogeneous-agent framework." *Economic Modelling* 87: 72–91.
- Moschini, Emily G., and Monica Tran-Xuan. 2025. "Family policies and child skill accumulation." *Review of Economic Dynamics* 56: 1–22.
- Nelson, Julie A. 1994. "On Testing for Full Insurance Using Consumer Expenditure Survey Data." *Journal of Political Economy* 102 (2): 384–394.
- Nichols, Austin, and Jesse Rothstein. 2016. "The Earned Income Tax Credit." In *Economics of Means-Tested Transfer Programs in the United States*, edited by Robert A. Moffitt, 137–218. Chicago: University of Chicago Press.
- OECD. 2020. *Taxing Wages 2020*. Paris: OECD Publishing.
- OECD. 2024. *Society at a Glance 2024: OECD Social Indicators*. Paris: OECD Publishing.
- OECD. 2025. *Government at a Glance 2025*. Paris: OECD Publishing.
- Ortigueira, Salvador, and Nawid Siassi. 2013. "How important is intra-household risk sharing for savings and labor supply?" *Journal of Monetary Economics* 60: 650–666.
- Ortigueira, Salvador, and Nawid Siassi. 2022. "The U.S. tax-transfer system and low-income households: Savings, labor supply, and household formation." *Review of Economic Dynamics* 44: 184–210.
- Parolin, Zachary, Elizabeth Ananat, Sophie M. Collyer, Megan Curran, and Christopher T. Wimer. 2023. "The Effects of the Monthly and Lump-Sum Child Tax Credit Payments on Food and Housing Hardship." *AEA Papers and Proceedings* 113: 406–412.
- Piggott, John, and John Whalley. 1996. "The Tax Unit and Household Production." *Journal of Political Economy* 104 (2): 398–418.
- Pijoan-Mas, Josep. 2006. "Precautionary savings or working longer hours?" *Review of Economic Dynamics* 9 (2): 326–352.

- Piketty, Thomas, and Emmanuel Saez. 2007. "How Progressive is the U.S. Federal Tax System? A Historical and International Perspective." *Journal of Economic Perspectives* 21 (1): 3–24.
- Pilkauskas, Natasha V., Katherine Micheltore, Nicole Kovski, and H. Luke Shaefer. 2024. "The expanded Child Tax Credit and economic wellbeing of low-income families." *Journal of Population Economics* 37 (4): 1–35.
- Qiu, Xincheng, and Nicolò Russo. 2026. "Income taxation across countries." *The Economic Journal*.
- Reynoso, Ana. 2024. "The Impact of Divorce Laws on the Equilibrium in the Marriage Market." *Journal of Political Economy* 132 (12): 4155–4204.
- Ringdal, Charlotte, and Ingrid Hoem Sjursen. 2021. "Household Bargaining and Spending on Children: Experimental Evidence from Tanzania." *Economica* 88 (350): 430–455.
- Rupert, Peter, and Giulio Zanella. 2015. "Revisiting wage, earnings, and hours profiles." *Journal of Monetary Economics* 72: 114–130.
- Saez, Emmanuel. 2017. "Taxing the Rich More: Preliminary Evidence from the 2013 Tax Increase." *Tax Policy and the Economy* 31 (1): 71–120.
- Schanzenbach, Diane Whitmore, and Michael R. Strain. 2021. "Employment Effects of the Earned Income Tax Credit: Taking the Long View." *Tax Policy and the Economy* 35: 87–129.
- Schild, Jake, Sophie M. Collyer, Thesia Garner, Neeraj Kaushal, Jiwan Lee, Jane Waldfogel, and Christopher T. Wimer. 2023. "Effects of the expanded child tax credit on household spending: Estimates based on U.S. consumer expenditure survey data." *NBER Working Paper Series* 31412, 1–41.
- Siassi, Nawid. 2019. "Inequality and the marriage gap." *Review of Economic Dynamics* 31: 160–181.
- Sjoquist, David L., and Mary Beth Walker. 1995. "The Marriage Tax and the Rate and Timing of Marriage." *National Tax Journal* 48 (4): 547–558.
- Social Security Administration. 2026. *Benefit Formula Bend Points*. Available online at: <https://www.ssa.gov/OACT/COLA/bendpoints.html>, accessed May 2, 2026.

- Splinter, David. 2020. "U.S. Tax Progressivity and Redistribution." *National Tax Journal* 73 (4): 1005–1024.
- Theloudis, Alexandros, Jorge Velilla, Pierre-André Chiappori, José-Ignacio Giménez-Nadal, and José Alberto Molina. 2025. "Commitment and the Dynamics of Household Labour Supply." *The Economic Journal* 135 (665): 354–386.
- Thomas, Duncan. 1990. "Intra-Household Resource Allocation: An Inferential Approach." *The Journal of Human Resources* 25 (4): 635–664.
- Thompson, Gina Azito, Diana Azevedo-McCaffrey, and Da'Shon Carr. 2023. *Increases in TANF Cash Benefit Levels Are Critical to Help Families Meet Rising Costs*. Edited by Center on Budget and Policy Priorities. Washington, DC.
- Urban Institute. 2020. *The Welfare Rules Databook: State TANF Policies as of July 2019*. OPRE Report 2020-141. Washington, DC.
- U.S. Bureau of Economic Analysis. 2025. *Shares of gross domestic product: Government consumption expenditures and gross investment: [A822RE1Q156NBEA]*. Edited by FRED, Federal Reserve Bank of St. Louis.
- Verriest, Ewout. 2024. *Household Labor Supply, Child Development and Childcare Policies in the United States*. Working Paper.
- Voena, Alessandra. 2015. "Yours, Mine, and Ours: Do Divorce Laws Affect the Intertemporal Behavior of Married Couples?" *American Economic Review* 105 (8): 2295–2332.
- Wellschmied, Felix. 2021. "The welfare effects of asset mean-testing income support." *Quantitative Economics* 12: 217–249.
- Wu, Chunzan. 2021. "More unequal income but less progressive taxation." *Journal of Monetary Economics* 117: 949–968.
- Wu, Chunzan, and Dirk Krueger. 2021. "Consumption Insurance against Wage Risk: Family Labor Supply and Optimal Progressive Income Taxation." *American Economic Journal: Macroeconomics* 13 (1): 79–113.
- Ziliak, James P. 2016. "Temporary Assistance for Needy Families." In *Economics of Means-Tested Transfer Programs in the United States*, edited by Robert A. Moffitt, 303–393. Chicago: University of Chicago Press.