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The Economic Effects of the Clinton Tax Proposal

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Abstract

Taxes impinge on individual and business decisions to work, save and invest. Using a dynamic computable general equilibrium model that we created for the National Center for Policy Analysis (the "NCPA-DCGE Model"), we simulate the effects on the U.S. economy of the tax proposal advanced by presidential candidate Hillary Clinton. The plan will generate $615 billion in tax revenue over 10 years. It will exert moderate negative impacts on output, investment, overall employment and household well-being. We briefly compare our findings with other published estimates and contrast the methodology underlying our model with that of other models.

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Executive Summary

Compared with other presidential election year cycles, the 2016 campaign takes place in a period of perplexingly slow economic growth. Secretary Hillary Clinton's tax proposal, the center of her campaign's fiscal policy, stresses fairness. To reach "broadly shared prosperity," in this slow-growth environment, the Clinton tax proposals seek to promote growth and equity by shifting the tax burden to high-income taxpayers. The proposals are clearly predicated on a normative objective to diminish income inequality and to bring greater equity to the tax code. In this report, we focus on the efficiency effects of the Clinton tax proposal, leaving the debate over equity for a separate analysis of distributional effects (Haughton et al. 2016).

The Clinton plan would increase federal revenue by $615 billion over 10 years, with personal income taxes comprising $548 billion of that amount. Over the same period, estate and gift taxes would increase by $75 billion. On the corporate tax front, the Clinton plan would reduce tax subsidies to the oil and gas industry, which would collect an additional $43 billion over a decade.

The NCPA-DCGE model finds that the higher tax rates would negatively affect the tax base for Social Security taxes, excise taxes, trade duties and other taxes and fees. As a result, revenues from these taxes would decrease by $51.5 billion over the ten-year period (Table ES-1). In total, the Clinton tax proposals would increase federal revenue by $54.1 billion in 2017, increase revenues by $70.5 billion in 2026, and increase revenues by $615 billion over the ten-year period. State and local taxes would decrease by $78 billion over the same period.

Table ES-1: Dynamic Revenue Effects of the Clinton Tax Proposals Relative to CBO Benchmark

	Change in revenue					
	2017		**2026**		**Cumulative, 2017-26**	
	$ billion	*%*	*$ billion*	*%*	*$ billion*	*%*
Federal Revenue	54.1	1.6	70.5	1.4	**615**	1.7
Social Security Tax	-2.5	-0.2	-7.0	-0.3	**-47**	-0.3
Personal Income Tax	47.6	2.9	63.0	3.0	**548**	3.4
Corporate Income Tax	3.6	1.1	5.3	1.0	**43**	1.2
Excise Taxes	-0.1	-0.1	-0.2	-0.2	**-1**	-0.2
Estate and Gift Taxes	5.7	26.1	9.7	25.9	**75**	30.8
Trade Duties	-0.0	-0.1	-0.1	-0.2	**-1**	-0.2
Other Taxes and Fees	-0.1	-0.1	-0.3	-0.2	**-2**	-0.2
State and Local Revenue	-4.6	-0.2	-10.7	-0.3	**-78**	-0.3
Total Government Revenue	**49.5**	**0.9**	**59.8**	**0.7**	**538**	**0.8**

Source: Based on NCPA-DCGE model simulations.

Table ES-2: Economic Effects of the Clinton Tax Proposals

	Change relative to CBO baseline			
	2017		2026	
	'000 jobs	*%*	*'000 jobs*	*%*
Total Employment	**-159**	**-0.1**	**-211**	**-0.1**
Private Employment	-207	-0.1	-265	-0.1
Public Employment	49	1.9	54	2.1
	$ billion	*%*	*$ billion*	*%*
Real GDP ($billion)	-103	-0.6	-184	-0.9
Personal Income	-47	-0.3	-103	-0.4
Business Investment	-19	-0.7	-48	-1.1
Imports	-2	-0.1	-7	-0.2
Exports	-2	-0.1	-8	-0.2

Source: NCPA-DCGE model.

These tax increases will set off changes in taxpayer behavior. While the public sector stands to gain under the Clinton plan (a boost of 54,000 jobs), the private sector would have 265,000 fewer jobs by 2026. According to the model, Real GDP in 2026 would be 0.9% lower than in the CBO benchmark projection. The higher tax rates would likely reduce economic growth relative to its current sluggish trend, while at the same time leading to a modest reduction in inequality.

1. Introduction

Compared with other presidential election year cycles, the 2016 campaign takes place in a period of perplexingly slow economic growth. The current election year is exhibiting the lowest economic growth of the last 15 election years (excluding the recession year of 2008). U.S. GDP grew at an annual rate of just 1.2 percent in the second quarter of 2016, far below the post-World War II average of 2.6 percent.[1]

To meet their policy objectives, presidential candidates have released tax proposals geared toward promoting growth and equity. In contrast to the Republican Donald Trump's plan, which emphasizes tax cuts and aims for tax efficiency, Democrat Hillary Clinton's plan stresses public investments, and aims for tax equity.

Both candidates face challenges on how best to bring growth back to its historical trend. Public spending and lower interest rates have done little to improve the labor force participation rate, GDP growth or productivity. The U.S. unemployment rate is down and most of the jobs lost since 2008 have been recovered, but wages remain mostly flat, with the historically low labor force participation remaining a major issue. While the low participation rate is explained in part by the advent of retirement among Baby Boomers, not all of it is demographic.

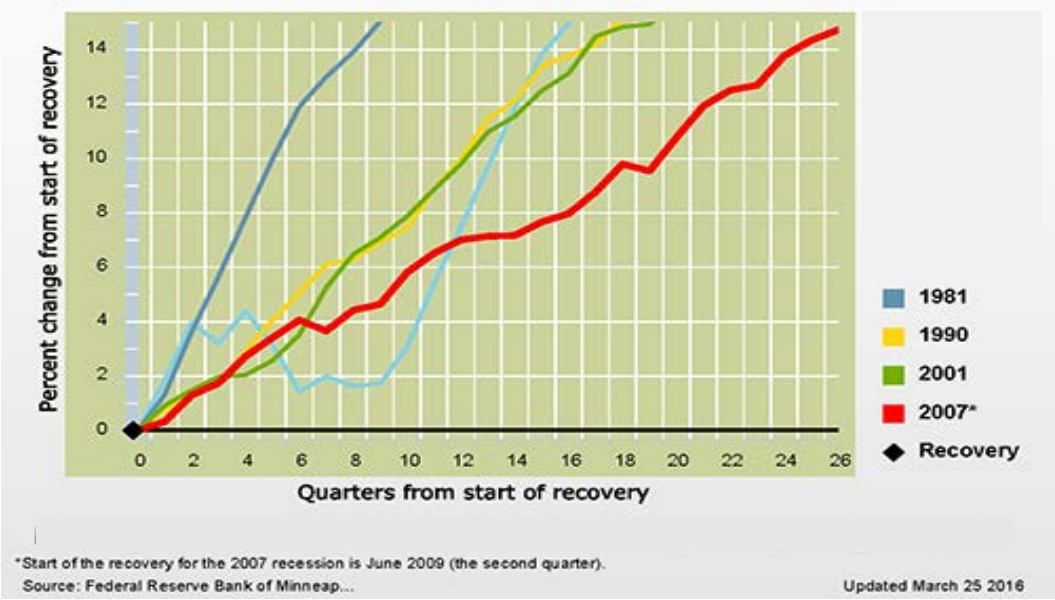
Real GDP measured in 2009 dollars is only 11% higher than the pre-crisis peak of 2007.[2] Other indicators also point to a sluggish recovery: As of July 2016, the number of employees had

[1] MarketWatch, Economcy, Economic Calendar, http://www.marketwatch.com/economy-politics/calendars/economic.
[2] FRED economic data, Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/GDPC1 [Accessed August 17, 2016.]

increased by just 4.6% since July 2007.[3] Nearly seven years after the end of the Great Recession, voters continue to believe that the economy is the foremost issue facing the next president.[4]

The recovery from the latest Great Recession has been exceptionally weak in terms of economic growth, compared with the previous 10 recessions. Figure 1, from the Federal Reserve Bank of Minneapolis,[5] contrasts the recoveries from the 1980, 1981, 1990, 2001 and 2007 recessions. Post-Great Recession employment growth shows similar lagging trends.

Figure 1. Changes in U.S. Output after Recoveries



[3] Bureau of Labor Statistics. http://beta.bls.gov/dataViewer/view/timeseries/CES0000000001 [Accessed Aug 12, 2016.]
[4] Suffolk University Political Research Center, "Suffolk University/USA Today Poll Shows 61 Percent Alarmed about Presidential Election," (June/July 2016) http://www.suffolk.edu/documents/SUPRC/7_11_2016_corrected_final_national_marginals.pdf
[5] Federal Reserve Bank of Minneapolis. (2014). The Recession and the Recovery in Perspective. Retrieved from https://www.minneapolisfed.org/publications_papers/studies/recession_perspective/

While the deepest previous recession took 46 months to restore employment to its previous peak, it took 76 months for employment to return to its previous highest level in the most recent recession.[6]

To reach "broadly shared prosperity" in this slow-growth environment, the Clinton tax proposals seek to promote growth and equity by increasing the tax burden to high-income taxpayers. The proposals affix on a normative objective to diminish income inequality, and to bring greater "fairness" to the tax code. In this report, we focus on the efficiency effects of the Clinton tax proposal, leaving the debate over equity for a separate analysis of distributional effects (Haughton et al. 2016).

We rely on standard, mainstream economic methods to perform our analysis. In pursuing this approach, we apply a computer model to simulate the behavioral responses to tax changes, as those responses flow through the U.S. economy. This paper summarizes the results of our application of that model to the Clinton proposals, and offers a brief contrast to previously published analyses.

The Debate over Federal Tax Policy

The debate over federal tax policy ties into the broader debate over how best to satisfy three competing goals:

(1) to increase economic efficiency, as measured by the performance of standard economic indicators, such as GDP and private-sector employment;

(2) to increase equity, as measured by the proposal's fairness toward low-income earners; and

(3) to provide revenues to finance government expenditures.

[6] FRED data set, Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/PAYEMS/ [Accessed August 17, 2016.]

While tension between these objectives is unavoidable, there is a growing consensus that the existing U.S. tax system is highly inefficient, particularly for how it discourages business investment and household work effort. Thus, a key goal of the analysis is to answer the question: How will the Clinton plan improve upon the inefficiencies attributable to the existing tax code?

The debate over the short and long-term effects of taxation and its relationship to economic growth is at the center of public finance scholarship.[7] A recent and extensive literature review notes the deleterious effects of taxes – particularly corporate and personal income taxes – on economic performance.[8]

Tax rates are critical for explaining the comparative performance of national economies (Prescott, 2003). In a widely quoted paper, Prescott (2002) argues that lower American tax rates induce workers to allocate more time to work than their European counterparts. This conclusion follows from an understanding of the sensitivity of labor supply (the "elasticity" of labor supply) to taxes on labor income.[9]

The economy does not remain in its current state when governments raise or lower taxes. Taxes influence behavior and set into action a series of events that change economic behavior. Consider the work-leisure calculus. Taxpayers divide their time between work and non-work, which we

[7] Cecil E. Bohanan, John B. Horowitz and James E. McClure, "Saying too Little Too Late: Public Finance Textbooks and the Excess Burdens of Taxation." Econ Journal Watch 11(3), September 2014: 277-296.
[8] William McBride, "What Is the Evidence on Taxes and Growth?" Tax Foundation (December 18, 2012) http://taxfoundation.org/article/what-evidence-taxes-and-growth.
[9] Edward C. Prescott, and Johanna Wallenius, (2008). "The Modern Theory of Aggregate Labor Supply and the Consequences of Taxes," in *Cutting Taxes to Increase Prosperity*, (Reykjavik, RSE, Icelandic Research Center of Social and Economic Affairs, 2008) 9-24.

call “leisure.” Lower tax rates on work make leisure less attractive and thus induce taxpayers to work more. Higher tax rates make leisure more attractive and thus induce taxpayers to work less.

Consider also the saving-consumption calculus. Taxpayers must decide how to allocate their after-tax income between consumption and saving. That matters to the economy because saving drives capital spending, and capital spending increases production and raises the demand for labor. Lower tax rates on the return to saving induce taxpayers to save more, thus fueling investment. Higher tax rates have the opposite effect.

Clearly, economic “agents” (taxpayers) respond to incentives and disincentives to work and save brought about by tax law changes. Lower tax rates usually reduce government revenues, but less so to the extent that they encourage work and saving. Higher tax rates usually increase revenues, but less than a mechanical computation would show, because they also discourage work and saving.

It is important, in analyzing tax policy, to avoid the fallacies that often beset this issue. One of these is the notion of “trickle-down economics.” No competent economist defends tax cuts for high-income earners on the argument that the benefits to those earners will somehow trickle down to low-income earners. Rather, insofar as tax cuts raise after-tax profits, they induce taxpayers to expand investment and, in so doing, wages, and jobs. Insofar as they raise after-tax wages, they induce taxpayers to enter the labor force and work longer hours. This is not the result of money “trickling down” from one person to another but of the reduction of disincentives to invest and work that are inherent to any tax code.

Finally, it is never acceptable to assume that tax revenues move in proportion to tax rate increases or decreases. On the contrary, the only legitimate approach to tax policy analysis is to take into account the "dynamic," behavioral changes, particularly changes in the willingness of taxpayers to invest and work induced by tax law changes. Indeed, it is essential to estimate these behavioral changes in order to assess the desirability, from the public's point of view, of making changes in tax law.

The Clinton tax proposals seek to make the tax code more progressive. Because that means introducing further distortions into the price system, particularly into how that system rewards work, saving and innovation, a priori reasoning leads us to expect that it would restrain work, saving and investment. The challenge is to measure the size of these effects, and for this, we use a dynamic computable general equilibrium model that the Beacon Hill Institute has built under contract with the National Center for Policy Analysis – the "NCPA-DCGE Model."

The purpose of the NCPA-DCGE Model is to quantify the effects of changes in U.S. tax policy on major economic indicators, including gross domestic product (GDP), capital investment, private sector employment, and government tax revenues, employment, and spending.

Dynamic CGE models are the most appropriate tools for assessing the impacts of taxes.[10] In an earlier study, we found significant benefits from the implementation of a national retail sales tax, (Bhattarai, Haughton and Tuerck, 2007; see also Jokisch and Kotlikoff, 2005). That study utilized a tax model developed to show only how a particular tax proposal would affect the economy. This study is based on micro-consistent data from a Social Accounting Matrix (SAM) that we

[10] For a useful primer on CGE models see "Taxes in a CGE Model," Mary E. Burfisher in *Introduction to Computable General Equilibrium Models,* (New York: Cambridge University Press, 2011) 174-207.

extrapolate to 2017, for benchmarking a model that can be applied to a wide variety of proposed tax changes.

We provide an explanation of our approach to the Clinton tax proposal in the sections that follow. After describing her plan, we make several assumptions in running the NCPA-DCGE model. In analyzing the Clinton proposal, we assume that its components go into effect in calendar year 2017. All changes are against a baseline, no-tax-change scenario.

2. The Clinton Tax Proposal

The details of the Clinton proposal are dispersed among several policy discussions on the campaign web site.[11] Essentially the plan calls for higher taxes on high-income earners and on estates and gifts. It also includes restrictions on corporate inversions, the abolition of tax incentives for coal, oil and gas industries.

Personal Income Tax

The current Federal personal income tax has seven distinct non-zero tax rates, ranging from 10% to 39.6%. Income from labor and capital is adjusted for certain expenses to give adjusted gross income, which is then reduced by subtracting personal exemptions as well as deductions (either at

[11] Hillary for America "Raising incomes and fighting inequality: A plan to raise American incomes, https://www.hillaryclinton.com/issues/plan-raise-american-incomes/ Accessed July 12, 2016. https://www.hillaryclinton.com/briefing/factsheets/2016/06/22/stronger-together-hillary-clintons-plan-for-an-economy-that-works-for-everyone-not-just-those-at-the-top/ We also refer to plan details outlined by the Tax Policy Center http://www.taxpolicycenter.org/publications/analysis-hillary-clintons-tax-proposals/full and the Tax Foundation, http://taxfoundation.org/article/details-and-analysis-hillary-clinton-s-tax-proposals

a standard rate, or itemized) to give taxable income. Somewhat lower tax rates (shown in square brackets) are applicable to capital gains. For relatively high-income taxpayers – with modified adjusted gross income of over $250,000 per year for married taxpayers filing jointly – there is an additional 3.8% tax on investment income (which includes dividends and royalties as well as capital gains). The amount of tax payable may then be further reduced if the taxpayer is eligible to claim tax credits, such as the earned income credit.[12]

Clinton would alter the personal income tax in a number of ways. The most important proposed changes are these:

1. Add a surcharge of 4% on adjusted gross annual income above $5 million.
2. Limit the value of deductions (except for contributions to charity) to no more than 28% of their value.[13]
3. Ensure that every taxpayer with a modified adjusted gross income of $1 million or more would pay at least 30% of their income in taxes (the "Buffett Rule").
4. Increase the tax rates applicable to capital gains for those in the top income tax bracket, by applying the standard tax rate to capital gains on assets held less than two years (rather than the current one year); and phasing in the preferential capital gains rates gradually so that they would only apply completely to assets held for six or more years.

[12] Kelly Phillips Erb. IRS Announces 2016 Tax Rates, Standard Deductions, Exemption Amounts and More. *Forbes*, October 21, 2015. http://www.forbes.com/sites/kellyphillipserb/2015/10/21/irs-announces-2016-tax-rates-standard-deductions-exemption-amounts-and-more/2/#20029a871e5d

[13] Consider a household that pays $20,000 annually in interest on a mortgage. If the household itemizes its deductions, this would effectively save $5,000 in taxes for someone whose top tax bracket is 25%. However, if the top tax bracket were 39.6%, this person might save as much as $7,920 in taxes. Clinton would limit the benefit of the deduction to a maximum of $5,600 (= 28% of $20,000).

5. Repeal carried interest, which is a provision that allows general partners in some businesses to book most of their earnings as (low-taxed) capital gains rather than labor income.

Corporate Income Tax

Under current rules, the income of C corporations is taxed on a sliding scale that rises from 15% (for taxable income below $50,000 per year) and eventually levels off at 35% (for profit – i.e. "corporate income" – above $18.3 million annually). Most of the taxable income is earned by large firms, so in 2013 the average tax rate was 34.8% (IRS-SOI 2016, Table 5). When state and local corporation income taxes are included, the U.S. has, on paper, one of the highest tax rates in the world, and this has led to widespread calls for reforming the tax (Angelini and Tuerck 2015).

The Clinton proposal would make modest changes to the tax code that applies to corporations – eliminating some tax incentives for fossil fuels, and making it harder to avoid U.S. taxes by holding profits overseas. It would disallow certain deductions for insurance companies and "cut the billions of wasteful tax subsidies oil and gas companies have enjoyed for too long and invest in clean energy."[14]

Here, we only model the cut to subsidies for oil and gas companies. We use the Joint Committee on Taxation's report *Estimates of Federal Tax Expenditures for Fiscal Years 2015 – 2019* for fossil fuel subsidies. Table 3 displays the results. The tax expenditures for oil and gas companies total $38.3 billion over ten years, which translates into corporate tax rate changes of 0.9 percentage points in 2017, rising to 1.41 percentage points in 2026.

[14] Hillary Clinton, The Issues, Climate Change, https://www.hillaryclinton.com/issues/climate/.

Table 3: Revenue Effects of Clinton Proposal to Cut Subsidies for Oil and Gas Companies, $ billion, 2017-2026.

	$ billion, 2017-2026
Expensing of exploration and development costs	12.6
Excess Percentage over Cost Depletions	19.6
Amortization of geological and geophysical expenditures	1.2
Amortization of air pollution control facilities	3.6
Depreciation recovery 15-year MACRS for natural gas distribution line	1.3
Total	**38.3**

Source: Joint Committee on Taxation, *Estimates of Federal Tax Expenditures for Fiscal Years 2015-2019.*

Estate Tax

Upon death, the estate of the deceased may be subject to an estate tax if the amount exceeds $5.45 million. The tax rate begins at 18% but the statutory rates rise quickly, reaching 40% on the value of estates in excess of $6.45 million. There are numerous ways to avoid all or most of the tax, so that only an estimated 0.2% of estates pay this tax (Huang and Debot 2015). The Clinton proposals call for a reduction of the threshold to $3.5 million, and a new top statutory rate of 45%, which would return the tax structure to the one in effect in 2009.

3. Revenue Estimates

Based on our tax-calculator model, we estimate that on a static basis, the Clinton personal income tax proposals would raise $39 billion in new revenue in 2017, rising to $96 billion in 2026. When changes to the estate tax, and corporation tax, are included, revenues are expected to rise by $816 billion over the decade 2017-2026, with 85% of the additional revenue coming from the proposed changes in the personal income tax. The details are shown in Table 4. The 4% surtax on very high incomes would raise $117 billion over ten years, but the biggest revenue gain would come

from limiting the tax value of non-charitable deductions to 28% of their total value. The proposed changes in the capital gains tax would reduce revenue in the short-term, as high-income individuals delay realizing their capital gains, but would increase revenue over the long run.

Table 4: Static Revenue Estimates of the Clinton Tax Proposals Relative to Benchmark

	2017	2026	2017 – 2026
		billions of dollars	
Personal Income Tax			
Surtax only	9	14	117
Limited value of deductions	36	55	449
Buffett rule	5	8	65
Capital gains tax	-10	20	75
Subtotal, PIT	**39**	**96**	**693**
Estate tax	6	11	81
Corporate tax changes	4	6	42
Total	**49**	**113**	**816**

Source: Authors' calculations, and Haughton et al. 2016.

The tax calculator model provides static estimates of the change in tax rates that apply to the personal income tax for each decile, and we use these in the NCPA-DCGE model to arrive at the impact on economic magnitudes such as GDP and employment. This also allows us to measure the "dynamic" revenue changes, which are reported in Table 5. We assume the Clinton tax plan would come into effect in 2017, and report the results for 2017 and 2026. We also report changes in tax revenue over the ten-year period 2017 – 2026.

In 2017, the Clinton proposals personal income tax hikes would increase U.S. federal tax revenue by $54.1 billion (measured against baseline), and federal revenues would increase by $70.5 billion in 2026. Because the tax increases would restrain economic growth, there would be some

reduction in state tax collections, so that overall government revenue – including federal, state, and local levels – would rise by just under $49.5 billion in 2017 and almost $59.8 billion in 2026.

Table 5: Dynamic Revenue Effects of the Clinton Tax Proposals Relative to CBO Benchmark

	Change in revenue					
	2017		2026		Cumulative, 2017-26	
	$ billion	*%*	*$ billion*	*%*	*$ billion*	*%*
Federal Revenue	54.1	1.6	70.5	1.4	**615**	1.7
Social Security Tax	-2.5	-0.2	-7.0	-0.3	**-47**	-0.3
Personal Income Tax	47.6	2.9	63.0	3.0	**548**	3.4
Corporate Income Tax	3.6	1.1	5.3	1.0	**43**	1.2
Excise Taxes	-0.1	-0.1	-0.2	-0.2	**-1**	-0.2
Estate and Gift Taxes	5.7	26.1	9.7	25.9	**75**	30.8
Trade Duties	-0.0	-0.1	-0.1	-0.2	**-1**	-0.2
Other Taxes and Fees	-0.1	-0.1	-0.3	-0.2	**-2**	-0.2
State and Local Revenue	-4.6	-0.2	-10.7	-0.3	**-78**	-0.3
Total Government Revenue	**49.5**	**0.9**	**59.8**	**0.7**	**538**	**0.8**

Source: Based on NCPA-DCGE model simulations.

It is clear from Table 5 that most of the incremental revenue would come from the proposed changes in the Federal personal income tax. Over the 2017-2026 period, receipts from the federal personal income tax would rise by a total of $548 billion; the expansion of the estate and gift tax would bring in an additional $75 billion, and the elimination of corporate tax incentives for fossil fuel development would yield a further $43 billion. Since the higher tax rates would negatively affect the tax base for Social Security taxes, excise taxes, trade duties and other taxes and fees, revenues from these taxes would decrease by $51 billion over the ten-year period.

As discussed earlier, tax policy proposals create changes in economic activity, through the effects they have on work and saving. The NCPA-DCGE model works through these effects in a consistent way, with the results that are shown in Table 6.

In 2017, the Clinton tax changes would lead to 207,000 fewer private sector jobs, which represents a reduction of 0.14 percent against the baseline (i.e. no-change) projections. This would be offset to some extent by an expansion in public employment of 49,000 jobs; the net effect would be a reduction of 159,000 jobs in 2017, and 211,000 jobs in 2026.

Table 6: Economic Effects of the Clinton Tax Proposals

	Change relative to CBO baseline			
	2017		2026	
	'000 jobs	*%*	*'000 jobs*	*%*
Total Employment	**-159**	**-0.1**	**-211**	**-0.1**
Private Employment	-207	-0.1	-265	-0.1
Public Employment	49	1.9	54	2.1
	$ billion	*%*	*$ billion*	*%*
Real GDP ($billion)	-103	-0.6	-184	-0.9
Personal Income	-47	-0.3	-103	-0.4
Business Investment	-19	-0.7	-48	-1.1
Imports	-2	-0.1	-7	-0.2
Exports	-2	-0.1	-8	-0.2

Source: NCPA-DCGE model.

Real GDP would decrease by $103 billion in 2017, or by 0.59 percent, and there would be measurable reductions in personal income (down $47 billion) and private business investment (down $19 billion). By 2026, real GDP would be $184 billion lower than it would have been in the absence of the tax changes, representing a reduction of 0.9%.

Revenue Estimates Compared

In Table 7, we compare our estimates of the revenue effects of the Clinton tax proposals with those of the Tax Foundation and the Tax Policy Center. All three estimates report the cumulative revenue effects over about a decade. The Tax Policy Center reports revenues over 11 years, including the year before the changes are implemented, arguing that there would be a (modest) early and temporary boost to revenue as some high-income taxpayers realize their capital gains in advance of the increase in tax rates on short-term capital gains.

The Tax Foundation arrives at a remarkably low estimate of expected revenue. In part this is because it largely ignores the effects of the changes on revenue from the corporate income tax. But mainly it is because the Foundation believes that the changes in the personal income tax will not raise much revenue, and even these changes will have a major effect in slowing economic growth and reducing revenue from other sources (such as the payroll tax).

Like the Tax Foundation, we also estimate the dynamic effects of the tax changes, but our extensive CGE model finds that the incorporation of the effects of slower economic growth would lower expected revenue by a quarter (and not by 60%, as the Tax Foundation claims). The differences in the estimates may be ascribed to the assumptions that are used on the behavioral responses in each model. The Tax Foundation uses an elasticity calculated by the Congressional Budget Office and the Joint Committee on Taxation, while our NCPA-DGCE model draws from a wider group of estimates from the economic literature – further details are given in the Appendix below. [15]

[15] http://www.taxpolicycenter.org/publications/analysis-hillary-clintons-tax-proposals/full

The Tax Policy Center discusses the possibility of dynamic effects, but does not seek to quantify them, which goes some way to explaining their high revenue estimate. Their static measure of revenue from the changes in the personal income tax ($781 billion over a decade) is not dramatically different from our estimate ($693 billion). On the other hand, they are more optimistic about the revenue effects of changes to the estate tax, and they take a stab at estimating more of the revenue effects of changes to the corporate tax code, even if some of these estimates are somewhat speculative.

Table 7. Revenue Estimates Compared

	Tax Foundation 2016-25	Tax Policy Center 2016-26	NCPA- DCGE 2017-26
		$ billions	
Individual	173	781	548
Corporate	12	136	43
Estate	102	161	75
Other taxes	-95	0	-51
Total	**191**	**1,077**	**615**

Sources: Tax Foundation: Pomerleau and Schuyler (2016), dynamic estimates; Tax Policy Center: Auxier et al. (2016); NCPA-DCGE: Table 3.3, dynamic estimates.

4. Conclusion

As currently presented, the Clinton tax proposals would increase taxes on high-income earners, reduce the exceptions to the corporate income tax, and increase estate taxes, in an effort to raise more revenue and bring greater equity to the current U.S. tax system. According to our NCPA-DCGE model, the plan would generate $615 billion in revenue over 10 years, with most of that increase coming from the federal personal income tax. The cost to the economy would be a net loss of 211,000 jobs by 2026, and a reduction in real GDP of 0.9 percent.

We began this paper by documenting the slowness of the U.S. economic recovery since the 2007-08 recession, and asked whether the tax changes proposed by Hillary Clinton might speed up further recovery. On this, our conclusion is clear: the higher tax rates would likely reduce economic growth, while at the same time leading to a modest reduction in inequality.

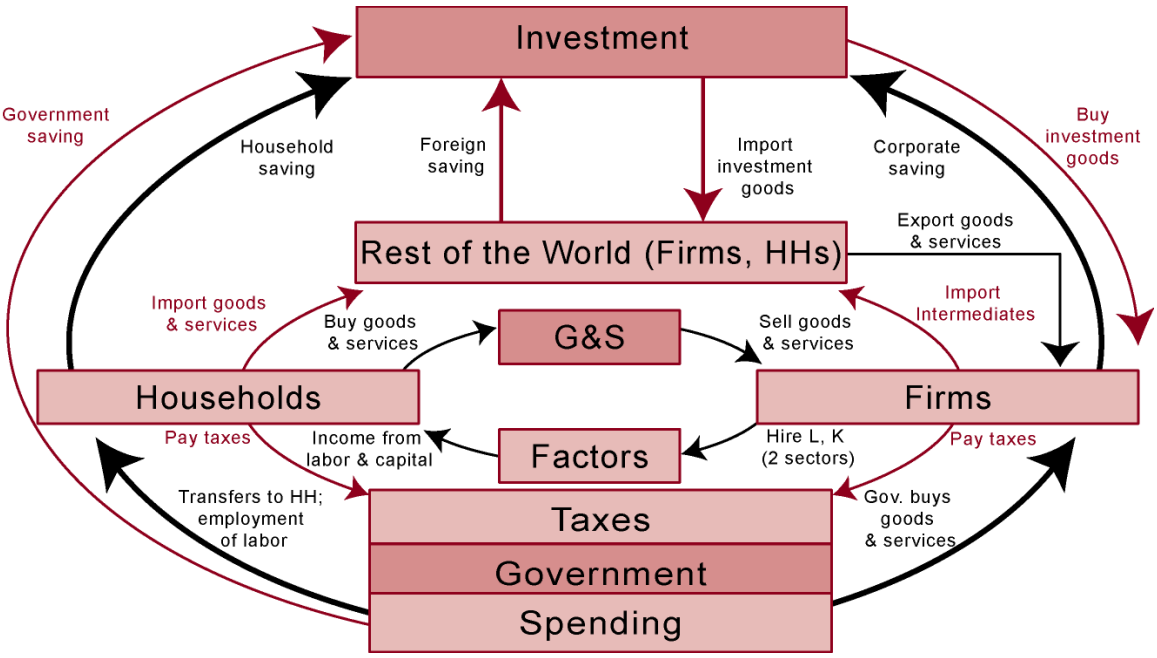
Appendix A: Overview of the BHI Model

The most appropriate tool for quantifying the effects of major tax changes is a Dynamic Computable General Equilibrium (DCGE) model. Since their beginnings in the 1970s, CGE models have been used for this purpose, and they are routinely used by government agencies such as the U.S. Treasury, the Congressional Budget Office, and International Trade Commission for policy analysis. Shoven and Whalley (1984, 1992) provide a very clear explanation.

Basic Model Structure

We have constructed a large, 60,000-variable, disaggregated national DCGE model of the United States economy. The essence of our model is shown in Figure A-1, which is heavily inspired by Berck et al. (1996), and where arrows represent flows of money (for instance, households buying goods and services) and goods (for instance, households supplying their labor to firms).

Figure A-1: Circular Flow in a CGE Model



Households own the factors of production – land and capital – and are assumed to maximize their lifetime "utility", which they derive from consumption (paid for out of after-tax income) and leisure, both now and in the future. Households must decide how much to work, and how much to save. They are also forward-looking, so that if they see a tax change in the future, they may react by changing their decisions even now. By eliminating the personal income tax, corporate income tax, payroll taxes and estate taxes at the federal level, the proposed tax reforms would raise lifetime utility.

The other major actor is the government, which imposes taxes and uses the revenue to spend on goods and services, as well as to make transfer payments to households. We have calibrated the model to the micro-consistent benchmark equilibrium from the base year data in a social accounting matrix (SAM) for 2017.

There is a production sector where producers/firms buy inputs (labor, capital, and intermediate goods that are produced by other firms), and transform them into outputs. Producers are assumed to maximize profits and are likely to change their decisions about how much to buy or produce depending on the (after-tax) prices they face for inputs and outputs. Capital depreciates over time. Thus, it is reconstituted through investment, which is undertaken in anticipation of future profits. A tax policy can increase the levels of investment and capital stock by removing the sector-specific distortions caused by the existing tax system in the benchmark economy.

To complete the model, there is a rest-of-the world sector that sells goods (U.S. exports) and purchases goods (U.S. imports). Trade is represented by the standard Armington assumption,

which uses a constant-elasticity-of-transformation function to determine the allocation between domestic sales and exports. The model assumes a steady-state growth rate for quantities of all goods and services.

Complex as it may seem, Figure A-1 is still relatively simple, because it lumps all households into one group, and all firms into another. To provide further detail it is necessary to create *sectors*; our model has 55 economic sectors. Each sector is an aggregate that groups together segments of the economy. We separate households into ten deciles classes and firms into 27 industrial sectors. In addition, we distinguish between 11 types of taxes and funds (eight at the federal level and three at the state and local level) and two categories of government spending. To complete the model, there are three factor sectors (labor, capital and retained earnings), an investment sector, and a sector that represents the rest of the world. The choice of sectors was dictated by the availability of suitably disaggregated data (for households and firms), and the purposes of the model. The underlying data are gathered into a 55 by 55 social accounting matrix, which includes an input-output table as one of its components.

The Formal Specification of the Model

Infinitely-lived households allocate lifetime income to maximize the present value of lifetime utility (LU^h), which itself is a time-discounted Constant-Elasticity-of Substitution (CES) aggregation of a composite consumption good (C_t^h) and leisure (L_t^h), with an elasticity of substitution between consumption and leisure given by σ_u^h (as in Bhattarai 2001, 2007). Note that the composite consumption good is in turn a Cobb-Douglas aggregation of 27 domestically-produced, and 27 imported, goods and services.

The representative household faces a wealth constraint where the present value of consumption and leisure cannot exceed the present value of its full disposable income (J_t^h), which gives lifetime wealth (W^h). Under current tax rules, this implies

$$\sum_{t=0}^{\infty} \mu(t)(P_t(1+t^{vc})C_t^h + w_t^h(1-t_l)L_t^h) = W^h \quad (1)$$

where $\mu(t)$ is a discount factor, P_t is the price of consumption, C_t^h is composite consumption, t^{vc} is the sales tax on consumption, t_l represents taxes on labor income, and w_t^h is the wage rate.

The structure of production is summarized in Figure A-2. Starting at the bottom, and for each of the 27 production sectors, producers combine labor (which comes from seven different categories of households) and capital (using a CES production function, with elasticity of substitution σ_v) to create value-added, which is in turn combined with intermediate inputs – assumed to be used in fixed ("Leontief") proportions – to generate gross output. This output may be exported or sold domestically, modelled with a constant elasticity of transformation (CET) export function between the U.S. markets and all other economies. The domestic supply is augmented by imports, where we use a CES function between domestically supplied goods and imports.

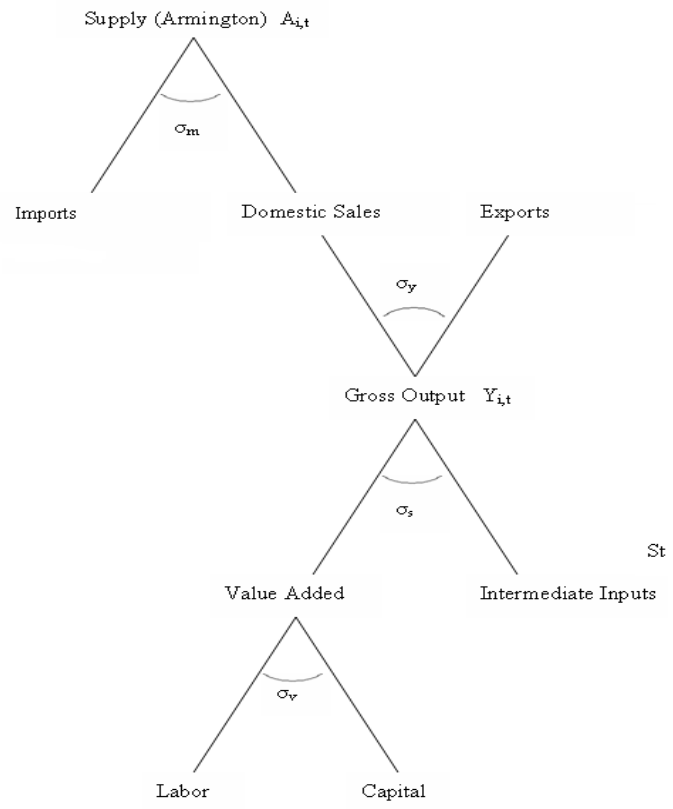
The underlying growth rate in the NCPA-DCGE model is determined by the growth rate of labor and capital. Labor supply, which is equivalent to the household labor endowment less the demand for leisure, rises in line with population. The capital stock (*K*) for any sector in any period is given by the capital stock in the previous period (after depreciation) plus net investment (*I*). On a balanced-growth path, where all prices are constant and all real economic variables grow at a

constant rate, the capital stock must grow at a rate fast enough to sustain growth. This condition can be expressed as:

$$I_{i,T} = K_{i,T}(g_i + \delta_i), \tag{2}$$

where the subscript *T* denotes the terminal period of the model, δ_i is the depreciation rate, and g_i is the steady state growth rate for sector *i* and is assumed uniform across sectors for the benchmark economy.

Figure A-2. Nested Structure of Production and Trade



Although the time horizon of households and firms is infinite, in practice the model must be computed for a finite number of years. Our model is calibrated using data for 2015 and stretches out for 35 years (i.e. through 2050). To ensure that households do not eat into the capital stock

prior to the (necessarily arbitrary) end point, a "transversality" condition is needed, characterizing the steady state that is assumed to reign after the end of the time period under consideration. We assume, following Ramsey (1928) that the economy returns to the steady state growth rate of three percent at the end of the period.

The model also requires a number of identities. After-tax income is either consumed or spent on savings. Net consumption is defined as gross consumption spending less any consumption tax. The flow of savings is defined as the difference between after-tax income and gross spending on consumption, and gross investment equals national saving plus foreign direct investment.

A zero trade balance is a property of a Walrasian general equilibrium model; export or import prices adjust until the demand equals supply in international markets. However, foreign direct investment (FDI) plays an important role in the U.S. economy, as exports and imports are not automatically balanced by price adjustments. Therefore, our Walrasian model is modified here to incorporate capital inflows so that the FDI flows in whenever imports exceed exports. Thus

$$FDI_t = \sum_i PM_{i,t} M_{i,t} - \sum_i PE_{i,t} E_{i,t} \qquad (3)$$

where for period t, FDI_t is the amount of net capital inflows into the U.S. economy, $\sum_i PM_{i,t} M_{i,t}$ is the volume of imports and $\sum_i PE_{i,t} E_{i,t}$ is the volume of exports. For the base run we assume inflows and outflows of FDI to balance out to zero intertemporally by the last year of the model horizon.

Calibration to Steady State

The model is truly "dynamic" in that it is optimized over time, and is calibrated using data for 2015. The model is programmed in GAMS (General Algebraic Modeling System), a specialized program that is widely used for solving CGE models (Brooke et al. 1998). The core of the model is programmed in the mathematical programming for system of Arrow–Debreu type general equilibrium (MPSGE) code, which was written by Thomas Rutherford (1995) to facilitate the development of market-clearing dynamic CGE models; see also Lau et al. (2002).

The model is calibrated to ensure that the baseline grows along a balanced growth path. In the benchmark equilibrium, all reference quantities grow at the rate of labor force growth, and reference prices are discounted because of the benchmark rate of return. The balance between investment and earnings from capital is restored here by adjustment in the growth rate g_i that responds to changes in the marginal productivity of capital associated with changes in investment. Readjustments of the capital stock and investment continue until this growth rate and the benchmark interest rates become equal.

If the growth rate in sector *i* is larger than the benchmark interest rate, then more investment will be drawn to that sector. The capital stock in that sector rises as more investment takes place, leading to diminishing returns on capital. Eventually the declining marginal productivity of capital retards growth in that sector.

To solve the model, we allow for a time horizon sufficient to approximate the balanced-growth path for the economy. Currently the model uses a 35-year horizon, which can be increased if the model economy does not converge to the steady state.

Behavioral Elasticities of Substitution in Consumption and Production

Our DCGE model simulates the effects of tax changes. The structure of the model depends not only on the magnitudes in the social accounting matrix, but also on the behavioural parameters, which reflect how consumers and producers react to changes in prices. These parameters are mainly in the form of elasticities of substitution, but also include depreciation and discount rates, share parameters, and an assumed steady state growth rate. The parameters we use are set out in Table A-1, and are comparable to those found in the existing literature; including Tuerck et al. (2006), Bhattarai and Whalley (1999), Killingsworth (1983), Kotlikoff (1993, 1998), Kydland and Prescott (1982), Ogaki and Reinhart (1998a, 1998b), Piggott and Whalley (1985), and Reinert and Roland-Holst (1992).

Table A-1. Basic Parameters of the NCPA-DCGE Model

Steady state growth rate for sectors (g)	0.03
Net interest rate in non-distorted economy (r *or* ϱ)	0.03
Sector specific depreciation rates (δ_i)	0.02 – 0.19
-	-
Elasticity of substitution for composite investment, σ	1.5
Elasticity of transformation between U.S. domestic supplies and exports to the Rest of the World (ROW), σ_ε (can be sector-specific)	2.0
Elasticity of substitution between U.S. domestic products and imports from the Rest of the World (ROW), σ_m	0.5 -1.5
Inter-temporal elasticity of substitution, σ_{Lu}	0.98
Intra-temporal elasticity of substitution between leisure and composite goods, σ_u	1.5
Elasticity of substitution in consumption goods across sectors, σ_C	2.5
Elasticity of substitution between capital and labor, σ_v	1.2
Reference quantity index of output, capital and labor for each sector, Q_{rf}	$(1+g)^{t-1}$
Reference index of price of output, capital and labor for each sector, P_{rf}	$1/(1+r)^{t-1}$

A few further comments are in order. The *intertemporal elasticity of substitution* (σ_{Lu}) measures the responsiveness of the composition of a household's current and future demand for the composite consumption good to relative changes in the rate of interest, and is a crucial determinant of household savings. There is little consensus in the literature about a reasonable value for this elasticity: Ogaki and Reinhart (1998a,1998b) estimate it to be between zero and 0.1 in the case of durable goods; Hall (1988) finds it to be very small, even negative, while Hansen and Singleton (1983) note the lack of precision in the estimates of σ_{Lu}. Auerbach and Kotlikoff (1998) assume it to be about 0.25; Kydland and Prescott (1982) assume it to be 1.0. We have 0.98 value in this model.

The *intratemporal elasticity of substitution between consumption and leisure* (σ_u) determines how consumers' labor supply responds to changes in real wages. Indirect evidence on this elasticity is derived from various estimates of labor supply elasticities that are available in the literature (Killingsworth 1983). Here we adopt a value of 1.5 for this substitution elasticity. Further discussion on how to derive numerical values of substitution elasticities from labor supply elasticities is provided in earlier studies on tax incidence analysis (Bhattarai and Whalley 1999).

The *intratemporal elasticity of substitution among consumption goods* (σ_C) captures the degree of substitutability among goods and services in private final consumption. A higher value implies more variation in consumption choices when the relative prices of goods and services change. Consistent with Piggott and Whalley (1985), we specify a value of 2.5 for this parameter.

The *Armington elasticity of transformation* (σ_e) determines the sale of domestically-produced goods between the home and foreign markets in response to relative prices between these two markets. The *Armington substitution elasticity* (σ_m) determines how the domestic and import prices affect the composition of demand for home and foreign goods. Higher values of these elasticities mean a greater impact of the foreign exchange rate in domestic markets. Reinert and Roland-Holst (1992) report estimates of substitution elasticities for 163 U.S. manufacturing industries and find these elasticities to be between 0.5 and 1.5. Piggott and Whalley (1985) suggest central tendency values of these elasticities to be around 1.25.

Early estimates of the *elasticity of substitution between capital and labor* (σ_v) may be found in Arrow, Chenery, Minhas, and Solow (1961). They estimated constant elasticities of substitution for U.S. manufacturing industries using a pooled cross-country data set of observations on output per man-hour and wage rates for a number of countries; we use a value of 1.2.

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