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THE CLIMATE AND ENERGY ECONOMICS PROJECT

CLIMATE AND ENERGY ECONOMICS DISCUSSION PAPER | OCTOBER 13, 2010

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* We gratefully acknowledge assistance from the U.S. Department of Energy. McKibbin acknowledges support from ARC Discovery Grant DP0988281. We thank Alison Stegman for technical support and Yiyong Cai and Hyejin Park for excellent research assistance. The views expressed in the paper are those of the authors and should not be interpreted as reflecting the views of any of the above collaborators or of the institutions with which the authors are affiliated including the trustees, officers or other staff of the Australian National University, The Lowy Institute for International Policy, Syracuse University, the U.S. Department of Energy, or Brookings.

Abstract

Current U.S. law offers a variety of tax credits for different kinds of energy efficient household capital. This study uses an intertemporal general equilibrium model to compare the environmental and economic performance of two policies: (1) a tax credit of 10 percent of the price of household capital that is 20 percent more energy efficient than its unsubsidized counterpart, assuming half of new household investment qualifies for the credit; and (2) a tax starting at $30 ($2007) per metric ton of carbon dioxide (CO_2) and rising 5 percent (inflation adjusted) each year. By 2040, the carbon tax reduces emissions by 60 percent while the investment tax credit for energy-efficient capital reduces emissions by about 1.5 percent. Under the assumption that other countries do not adopt a price on carbon, we find that although the carbon tax reduces U.S. GDP, it improves the welfare of U.S. households because it reduces the world price of fuels, strengthens U.S. terms of trade, and makes imported goods cheaper. The revenue neutral tax credit reduces welfare but boosts U.S. GDP growth slightly in the first few years. Both policies have similar impacts on the federal budget, but of opposite signs.

1. Introduction

Proponents of ambitious climate policy often support imposing both a price on carbon and “complementary policies” to provide incentives for the deployment of energy-efficient and low carbon technologies. Current U.S. law offers an extensive variety of tax benefits for certain kinds of energy production and conservation, including incentives for renewable electricity production, energy efficient household investments, and bio-fuel production.[1] The U.S. Congress expressed its continued enthusiasm for these measures in the American Recovery and

[1] Joint Committee on Taxation (2010)

Reinvestment Act of 2009 (Recovery Act), which extended many consumer energy-related tax incentives as part of the fiscal stimulus package.

In particular, the Recovery Act expanded two energy-related tax credits for households: the non-business energy property credit and the residential energy efficient property credit.[2] The non-business energy property credit equals 30 percent of homeowner expenditure on eligible investments, up to a maximum tax credit of $1,500 over 2009 and 2010. The capital and labor costs of certain high-efficiency heating and air conditioning systems, water heaters and stoves that burn biomass qualify, as does the capital (but not labor) cost of certain energy-efficient windows, doors, insulation and roofs. The residential energy efficient property credit equals 30 percent of the installed costs of solar electric systems, solar hot water heaters, geothermal heat pumps, wind turbines, and fuel cell systems.

Another potential expansion of subsidies for energy efficiency appears in HOME STAR, a bill designed to strengthen short-term incentives for energy efficiency improvements in residential buildings.[3] This proposal would establish a $6 billion rebate program for energy-efficient appliances, building mechanical systems and insulation, and whole-home energy efficiency retrofits. The program targets energy efficiency measures that would achieve an energy efficiency gain of 20 percent.

One key goal of subsidies for energy efficiency investments is to reduce electricity generation and thereby reduce carbon dioxide emissions and other air pollutants. Some analyses suggest that increasing energy efficiency is a relatively low, possibly negative, cost way to abate

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[2] U.S. Internal Revenue Service Newswire article IR-2009-98, Oct. 29, 2009, "Expanded Recovery Act Tax Credits Help Homeowners Winterize their Homes, Save Energy; Check Tax Credit Certification Before You Buy, IRS Advises." http://www.irs.gov/newsroom/article/0,,id=214873,00.html.

[3] We accessed the bill, S. 3434, on June 18, 2010 from the Senate Energy Committee website: http://energy.senate.gov/public/index.cfm?FuseAction=IssueItems.View&IssueItem_ID=24dea252-01ef-4d6a-a17d-03ac78eb0dfd.

greenhouse gas emissions and other air pollutants as well. However, adoption rates for energy efficient technologies fall short of levels that many believe are justified by the potential return on such investments. For example, the rates of return households apparently require for investments in energy efficiency are considerably higher than the rates of return used by electric utilities when investing in new generation. That difference in rates of return has spurred the development of utility-based demand side management (DSM) programs which often include subsidies for household energy efficiency. A growing economic literature explores this "energy-efficiency gap."[4]

Regardless of the net benefits from investments in energy efficient capital, recent expansions in policies to promote those investments raises the question of how much they reduce carbon emissions and how they compare to policies that target carbon more directly. This paper uses an intertemporal general equilibrium model called G-Cubed to compare and contrast the environmental and economic performance in the United States of a tax credit for energy efficient household capital and an economy-wide price signal on carbon from fossil fuels used in the energy sector. We choose the tax credit and carbon tax rates of those policies so that they have roughly comparable fiscal impact on the US government; that is, if the policies were implemented together, the revenue from the carbon tax would offset most of the reduction in revenue associated with the tax credit. When examining the policies individually, we use a lump sum tax or rebate in order to hold federal spending and the budget deficit constant.

A tax credit for energy-efficient household capital reduces its relative price to homeowners and induces them to invest more. As household capital turns over, the energy saving properties of the policy accrue along with the aggregate tax expenditure up to the point

[4] Jaffe and Stavins (1994) explain the energy-efficiency gap in more detail.

where households have adopted all the energy efficient capital that is cost-effective at the subsidized rate. Unless market conditions evolve to the contrary, the government must sustain the subsidy to prevent households from reverting to purchasing relatively lower efficiency capital. As a result, it will have permanent effects throughout the economy. By raising the rate of return on household capital relative to capital in other sectors, the subsidy permanently shifts the economy's overall portfolio of physical capital.

The empirical evidence on the effects of investment tax credits is limited and pertains primarily to the effect of tax credits on investment levels and energy savings. Gillingham et al. (2006) summarize the literature on tax credits to promote energy efficiency. Hassett and Metcalf (1995) show that a 10 percentage point change in the tax price for energy investment would lead to a 24 percent increase in the probability of energy conservation investment.

The degree to which households and firms anticipate policies can significantly affect the results, particularly in the early years of the policy. For example, if households anticipate a subsidy to capital then they will delay acquiring capital they would otherwise purchase in order to take advantage of the subsidy later. Similarly, Hassett and Metcalf (1995) and others point out that tax credits are unlikely to be efficient tools for reducing carbon emissions. Consumers who would have purchased energy efficient capital in the absence of the subsidy receive a windfall, and unless the subsidy is perceived to be permanent, the effect could be to induce an intertemporal substitution in investments more than a net increase. This intertemporal substitution can be an important real-world policy effect, and it is captured in the G-Cubed model via forward-looking behavior on the part of households and other investors.

2. Modeling Approach

The G-Cubed model is an intertemporal computable general equilibrium (CGE) model of the world economy.[5] A brief technical discussion of G-Cubed appears in McKibbin et al. (2009) and a more detailed description of the theory behind the model can be found in McKibbin and Wilcoxen (1999).

This study uses a version of the model that includes the nine geographical regions listed in Table 1 below. The United States, Japan, Australia, and China are each represented by a separately modeled region. The model aggregates the rest of the world into five composite regions: Western Europe, the rest of the OECD (not including Mexico and Korea); Eastern Europe and the former Soviet Union; OPEC oil exporting economies; and all other developing countries.

Table 1. Regions in the G-Cubed Model (Country Aggregation E)

Region Code	Region Description
USA	United States
Japan	Japan
Australia	Australia
Europe	Western Europe
ROECD	Rest of the OECD, i.e. Canada and New Zealand
China	China
EEFSU	Eastern Europe and the former Soviet Union
LDC	Other Developing Countries
OPEC	Oil Exporting Developing Countries

The Baseline Scenario

A model's assumptions (or in the case of G-Cubed, its endogenous projections) about future emissions and economic activity in the absence of climate policy is called the baseline

[5] The type of CGE model represented by G-Cubed, with macroeconomic dynamics and various nominal rigidities, is closely related to the dynamic stochastic general equilibrium models that appear in the macroeconomic and central banking literatures.

scenario. A detailed discussion of the baseline in G-Cubed appears in McKibbin, Pearce and Stegman (2009). The baseline in this study is calibrated to the Department of Energy's Updated *Annual Energy Outlook* Reference Case Service Report from April 2009.[6] It sets G-Cubed's projected productivity growth rates so that the model's baseline results approximate the report's forecasts for oil prices and real gross domestic product (GDP) as well as other key factors.

Along with the baseline for the U.S., we construct a baseline scenario for the entire world that reflects our best estimate of the likely evolution of each region's economy without concerted climate policy measures. To generate this scenario, we begin by calibrating the model to reproduce approximately the relationship between economic growth and emissions growth in the U.S. and other regions over the past decade. In the baseline, neither the U.S. nor other countries adopt an economy-wide price on carbon through 2050.

The Policy Scenarios

In this study we use the model to explore two potential ways to address greenhouse gas emissions: a tax credit for energy efficient household capital and a carbon tax. The key innovation of this paper is its analysis of a subsidy to energy-efficient household capital, but to better illustrate the subsidy's effects relative to standard alternatives we compare this with a straightforward carbon tax.

We model a household investment tax credit for energy-efficient household capital as follows. Household capital in G-Cubed includes housing and durable goods such as appliances and vehicles. The policy scenario requires assumptions about the share of total capital covered

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[6] The report appears at the DOE's Energy Information Administration website: http://www.eia.doe.gov/oiaf/servicerpt/stimulus/index.html.

by the credit, the relative energy efficiency of subsidized capital vs. non-subsidized capital, and the process by which new capital replaces old capital. To keep the analysis simple, we assume that the rate of credit offered by the government for qualifying capital is 10 percent. We assume that only half of the capital acquired by households after the policy takes effect qualifies for the subsidy. This means that the subsidy lowers the average price of all household investment by 5 percent. We assume that all capital that is eligible for the subsidy is 20 percent more efficient than its un-subsidized counterpart. Thus new investment after the policy takes effect is half high-efficiency and half conventional, and it is 10 percent more energy efficient overall than the capital households acquire in the baseline.

This investment tax credit scenario differs from actual policies that have been proposed or implemented in two respects: it applies a lower credit rate to a broader investment base, and it is permanent rather than temporary. Along with simplifying the modeling, the scenario is intended to reflect a policy meant to reduce emissions over the long run. In contrast, some of the actual policies were designed as much to produce short-run fiscal stimulus as they were to produce energy savings. For example, the Recovery Act's non-business energy property tax credit equals 30 percent of household spending on specific energy-saving investments, but only up to a maximum total credit per household of $1,500 and only for 2009 and 2010. Our scenario models a permanent tax credit and does not impose limits on the total credit per household or the overall tax expenditure, but it applies a lower subsidy rate (10 percent) than the Recovery Act.

In practice, the economic and environmental effects of a tax credit depend on which goods qualify, how many people take advantage of the credit, and how many would not have otherwise purchased the eligible goods. For example, the Recovery Act's non-business energy property credit and residential energy efficient property credit target very specific and distinctly different types of capital. In this study, we assume half of all new investment qualifies and that of that half, all of it is more energy efficient than it would otherwise be.

Some policies, such as the Home Star program, include point-of-sale rebates rather than (or in addition to) tax credits. We implicitly treat rebates and tax credits as equivalent from the household's point of view and assume that our subsidy rate roughly captures the effective benefit to households from choosing optimally among their options.

We assume that household capital depreciates at 10 percent per year, regardless of its energy efficiency. Thus the energy efficiency of capital in any year is a share-weighted sum of the capital left over from the previous year and the efficiency of the new capital investment. Both the tax and subsidy policies begin in 2010. We run the model from 2008, rewriting history a bit to see how households would have behaved had they known the new policies were to be implemented.

Next we model a carbon tax. The tax begins at $30 ($2007) per ton of carbon dioxide equivalent in 2010 and increases by 5% (inflation adjusted) each year thereafter. We assume the tax applies only to CO_2 from fossil fuel consumption from the energy sector, including combustion of coal, natural gas, and oil. CO_2 from energy-related fossil fuel consumption includes a large majority of total U.S. greenhouse gas emissions and the vast majority of emissions growth since 2000. For example, according to the U.S. Environmental Protection Agency, fossil fuel combustion comprised 94 percent of all U.S. CO_2 emissions in 2008, and over 80 percent of gross U.S. greenhouse gas emissions on a CO_2-equivalent basis.[7]

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7 U.S. Environmental Protection Agency (2010), *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2008*, p. ES-4, Table ES-2. Accessed on July 8, 2010: http://epa.gov/climatechange/emissions/downloads10/US-GHG-Inventory-2010_ExecutiveSummary.pdf.

We run three scenarios with these policies: (1) the tax credit for more energy-efficient household capital alone; (2) the carbon tax alone; and (3) a combination the two policies. All three policies potentially affect government revenue. In the absence of compensating changes elsewhere in the tax system, they would affect government spending or the fiscal deficit. However, to focus our analysis on the key variables of interest and avoid introducing confounding macroeconomic effects, we hold government revenue constant by introducing a lump sum tax or rebate as necessary. Accordingly, the first scenario funds the household capital subsidy with lump sum taxes on households. The second scenario returns all revenues from the carbon tax to households on a lump-sum basis. The combination scenario uses revenues from the carbon tax to fund part of the household capital subsidy and any remaining revenue required is raised from households on a lump-sum basis.

The overall federal cost of the subsidy depends on the level of household investment and the subsidy rate. Suppose *I* is household investment in capital, *s* is the share of new investment eligible for the subsidy, *p* is the price of all goods, and p_I is the price of household capital without the subsidy. Then, the federal cost in foregone revenue, *E*, of the tax credit is equal to:

$$E_t = sI_t \times \frac{p_I}{p} \qquad (1)$$

For the parameters in the model, this means that *E* is approximately 4.5 percent of household investment spending. In practice, we iterate to calculate consistent equilibrium values of *E*, *I* and the prices of new capital and other goods.

3. Results

In comparing the results of the two policy scenarios it is convenient to start with the carbon tax and then proceed to the results for the energy efficiency policy. Our carbon tax results are consistent with numerous studies of the effect in the United States of an economy-wide price on carbon.[8] Figure 1 shows U.S. CO_2 emissions levels for the policy scenarios from 2008 to the imposition of the carbon price in 2010 and then on through 2040. The carbon tax, which is shown as a solid line, causes emissions to fall immediately when it is implemented in 2010. Anticipation of the carbon tax does not meaningfully change investment or emissions behavior prior to the imposition of the policy. Emissions continue to decline in subsequent years as the real value of the tax rises at 5 percent per year. By 2040, emissions are 60 percent below the reference case.

Emissions under the tax credit (shown as a dashed line) fall far less than under the carbon tax: approximately 1.5 percent relative to the baseline in each year. Although the energy efficiency of household capital increases by 10 percent in the long run, the household elasticity of substitution between energy and capital is -0.8, which causes households take part of that gain in the form of increased demand for energy services. For comparison, had the elasticity of substitution been equal to 0, energy consumption would have fallen by close to 10 percent; had it been equal to -1, energy consumption would not have fallen at all.

Finally, when the two policies are combined (shown by the dotted curve), emissions fall by about 61 percent.[9] Cumulative results and values for selected years are shown in Table 2.

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[8] See for example McKibbin et al (2009).

[9] The solution algorithm for the G-Cubed model uses mixed linearization, and its output satisfies the superposition principle: the results from running two policies together are equal to the sum of the results of running them

Figure 1: Effect of Policies on Annual U.S. CO_2 Emissions

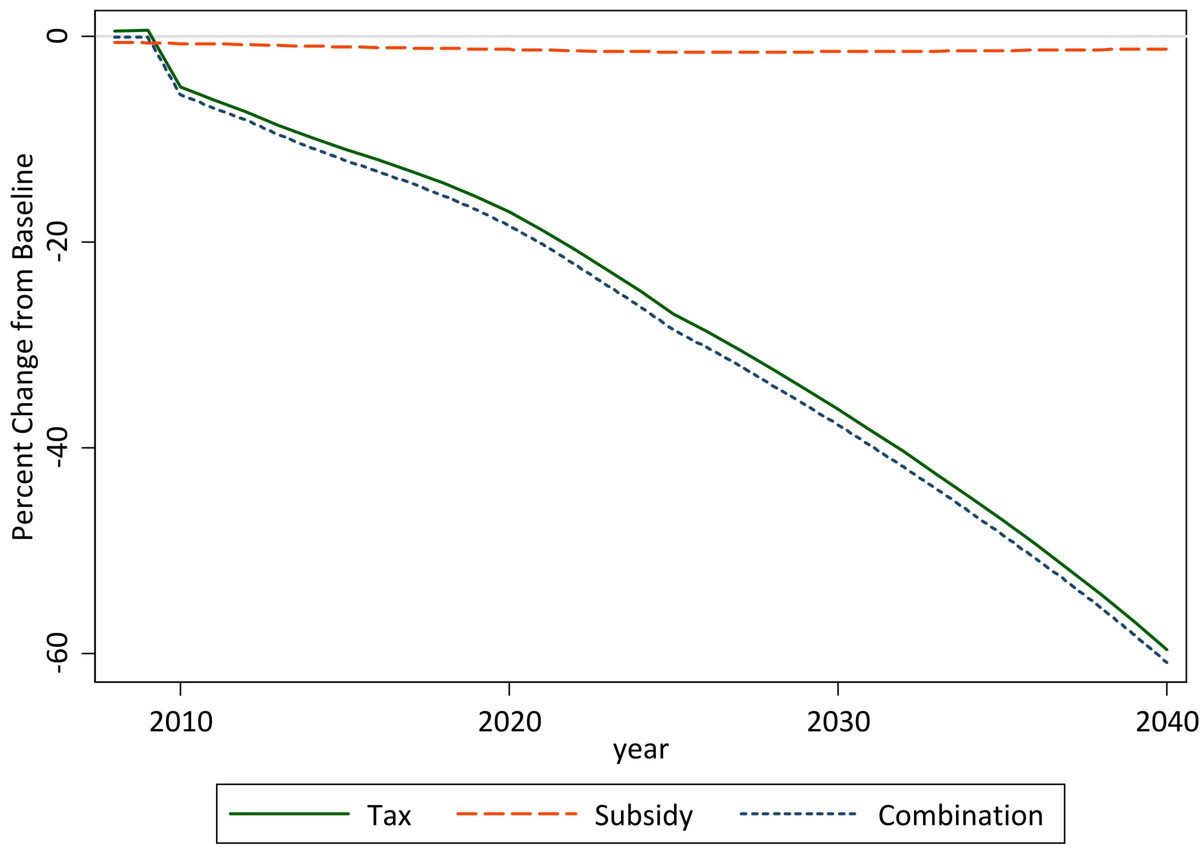


Table 2. Effect of Policies on Annual and Cumulative Emissions

All values are in billions of metric tons of CO_2

	Reductions Relative to the Reference Case			
	2020	**2030**	**2040**	**Cumulative 2008 to 2040**
Carbon Tax	0.9 (17%)	1.8 (36%)	3.7 (58%)	48.1 (26%)
Tax Credit	0.1 (1%)	0.1 (1%)	0.1 (1%)	2.2 (1%)
Combined Policy	1.0 (18%)	1.9 (38%)	3.7 (61%)	50.4 (28%)

separately. As a result, we cannot capture second-order interdependencies between the two policies, such as potentially more elastic response to the subsidy in the presence of a carbon tax.

Table 3 shows the effects of the three policies on industry output in a representative year, 2030. As expected, the industries that are most affected by the carbon tax are the energy sectors. Coal and crude oil and gas production both decline by about 31 percent relative to the reference case. Electricity production declines less, falling by about 10 percent. As shown in Figure 2, the input mix used by electric utilities changes significantly in the long run: fuel consumption drops considerably more than output—by nearly 30 percent in the long run—while capital input drops by less than output. The tax thus causes both an overall reduction in the size of the industry and a shift in its input mix away from fossil fuels and toward capital (greater use of renewables and nuclear power).

Among the non-energy sectors, durable goods production is most affected and output decreases by about 3 percent from the baseline. Output of services, in contrast, increases slightly. The industry effects under the tax credit are sharply different. Output of the energy sectors decline slightly—typically by about one percent—while the output of durable goods (a key component of household investment) rises by 0.7 percent. The effects under the combination policy are the sum of the others: large declines in the energy sectors, small declines in most other industries, and a small increase in services.

Table 3: Effect of Policies on Industry Output in 2030
Percentage changes from base case output

Num	Sector	Carbon Tax	Tax Credit	Combination
1	Electric Utilities	-9.9%	-0.9%	-10.8%
2	Gas Utilities	-4.5%	-1.0%	-5.5%
3	Oil Refining	-26.0%	-1.5%	-27.5%
4	Coal	-31.2%	-0.8%	-32.0%
5	Crude Oil and Gas	-31.8%	-1.5%	-33.4%
6	Other Mining	-3.0%	0.5%	-2.5%
7	Agriculture	-0.9%	0.0%	-1.0%
8	Forestry	-2.2%	0.4%	-1.8%
9	Durables	-3.3%	0.7%	-2.6%
10	Nondurables	-0.8%	-0.1%	-0.9%

11	Transportation	-1.1%	0.0%	-1.2%
12	Services	0.6%	-0.2%	0.5%

Figure 2: Effect of a Carbon Tax on Output and Key Inputs to Electric Utilities

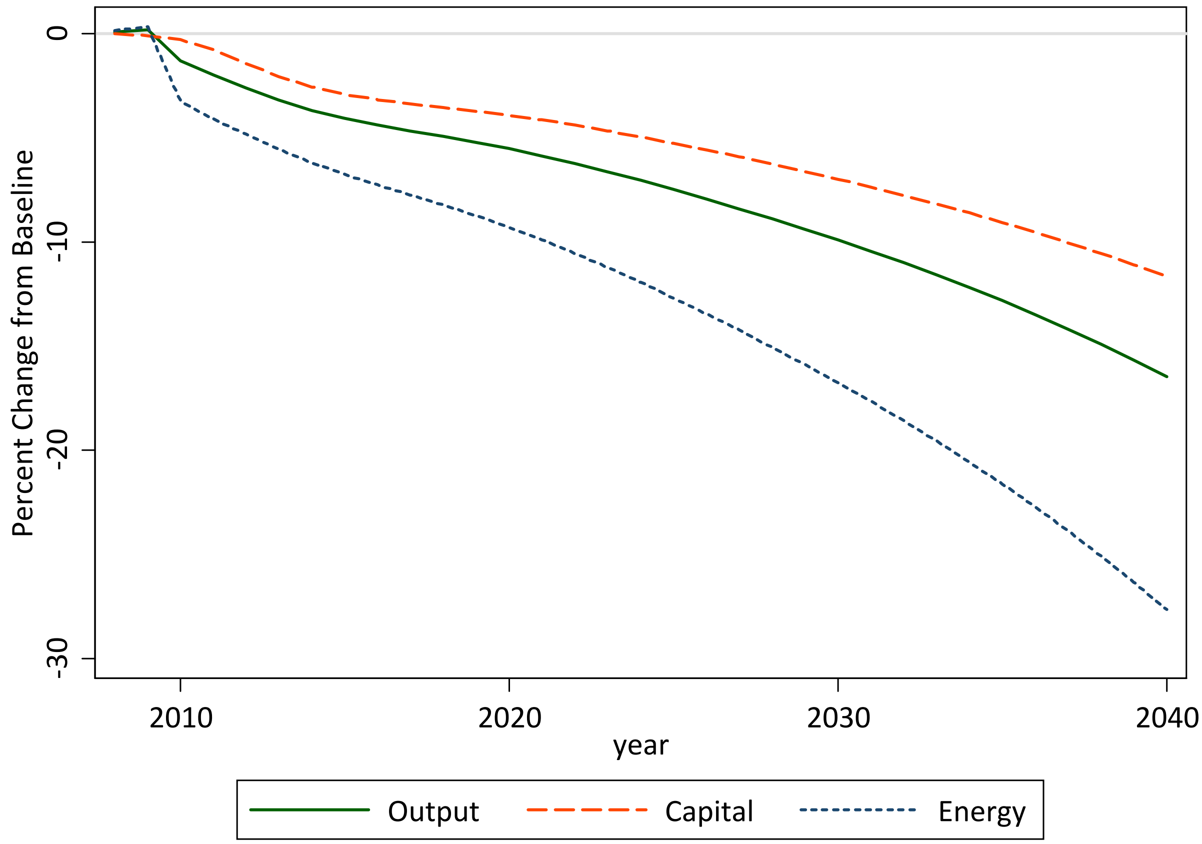
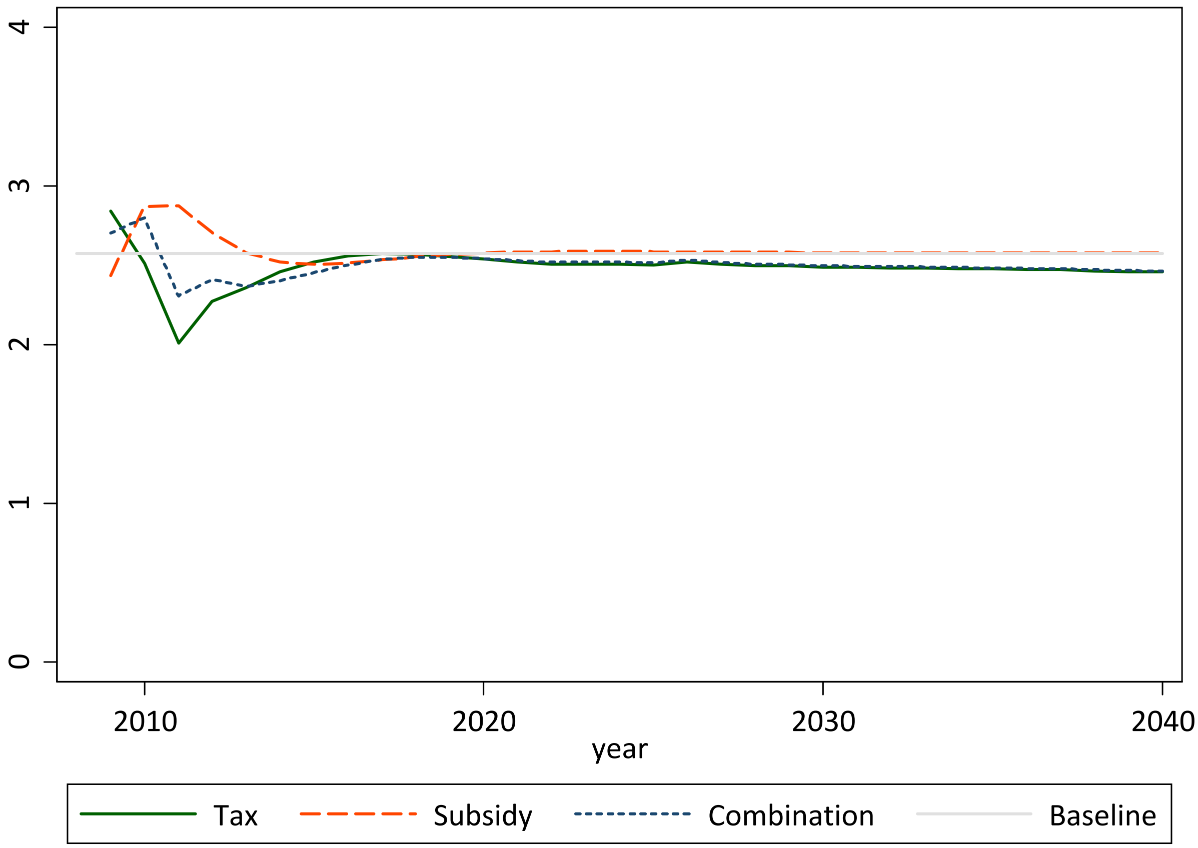


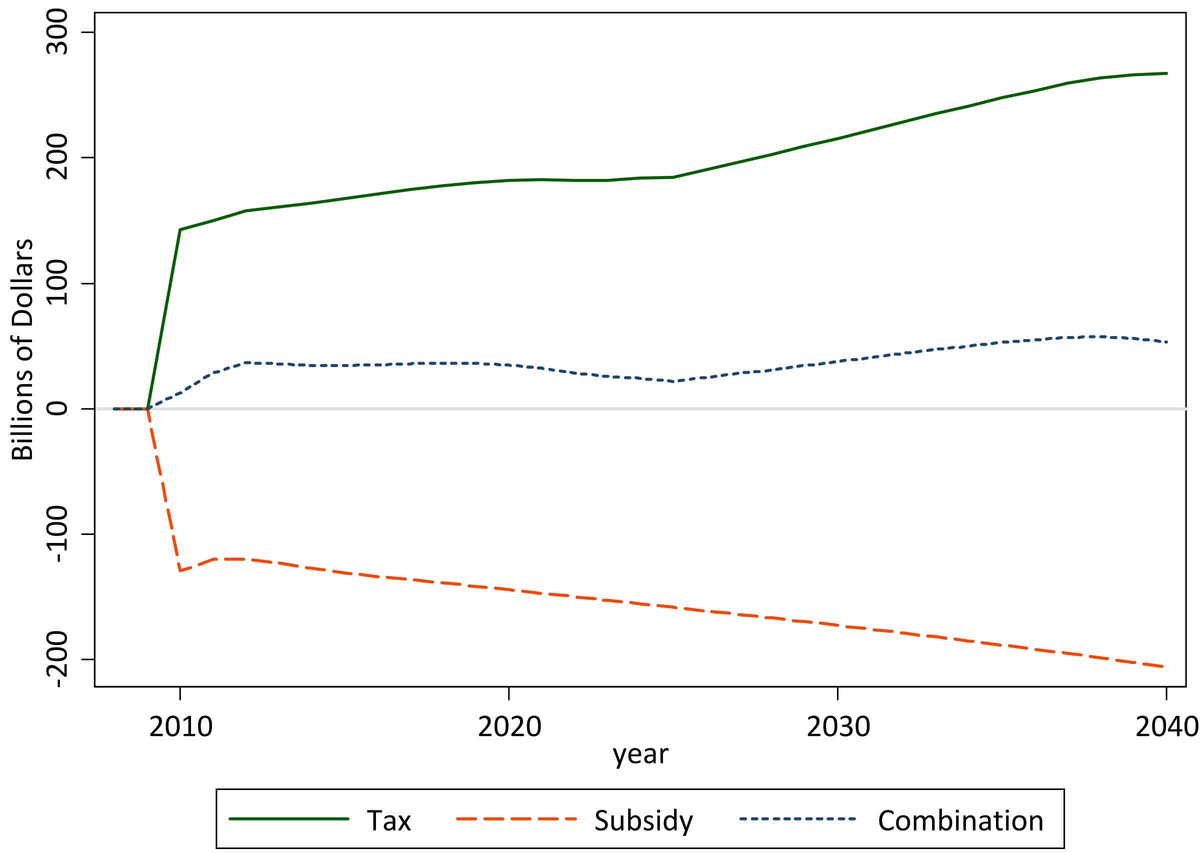
Figure 3 shows the effect of the scenarios on annual GDP growth rates. From 2008 to 2040, the average annual rate of GDP growth in the baseline simulation is 2.6 percent. Under the carbon tax, the growth rate would drop somewhat in the first few years of the policy, with the peak reduction being about half a percent per year. In contrast, under the tax credit, the growth rate would drop slightly between 2008 and 2010 as households postpone investment in order to take advantage of the tax credit available in the future. After 2010, growth would exceed the baseline rate for several years before eventually falling back. Under the combination policy, the effects largely offset one another and the growth rate would be reduced by less than 0.1 percent.

Figure 3: Effect of Policies on the Growth Rate of Real GDP



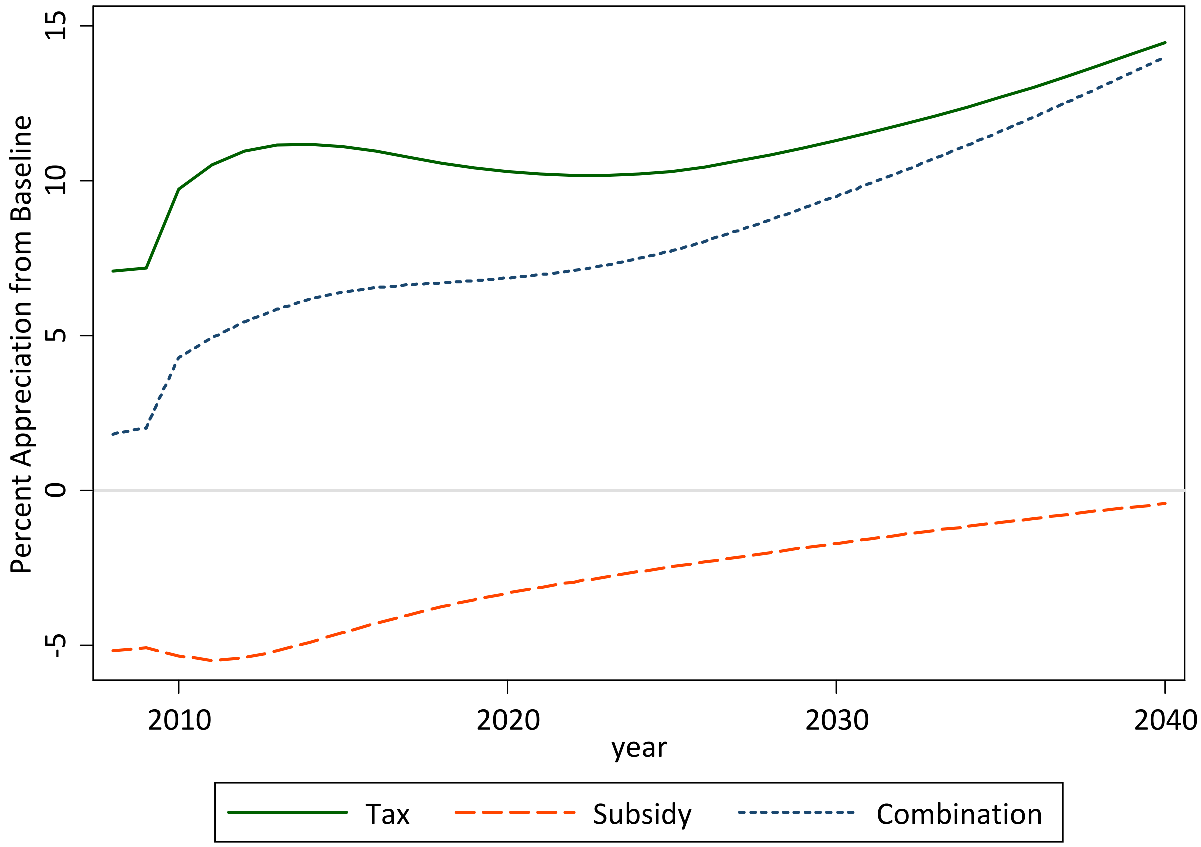
The fiscal effects of the policies are shown in Figure 4. The carbon tax, shown as a solid line, raises $143 billion of revenue when it is implemented in 2010. The amount of revenue rises gradually: the increase in the tax rate is largely offset by the decline in emissions. All of the revenue is returned to households as a matching lump sum rebate. The tax credit, in contrast, reduces income tax revenue by almost $130 billion in 2010, and by more than $200 billion in 2040. Under the combined policy, the net revenue gain from the carbon tax and tax credit is $12 billion in 2010 and rises to $53 billion by 2040. In both the tax credit and combined scenarios, the government returns the excess each year with a lump sum rebate to households.

Figure 4: Effect of Policies on the U.S. Fiscal Balance



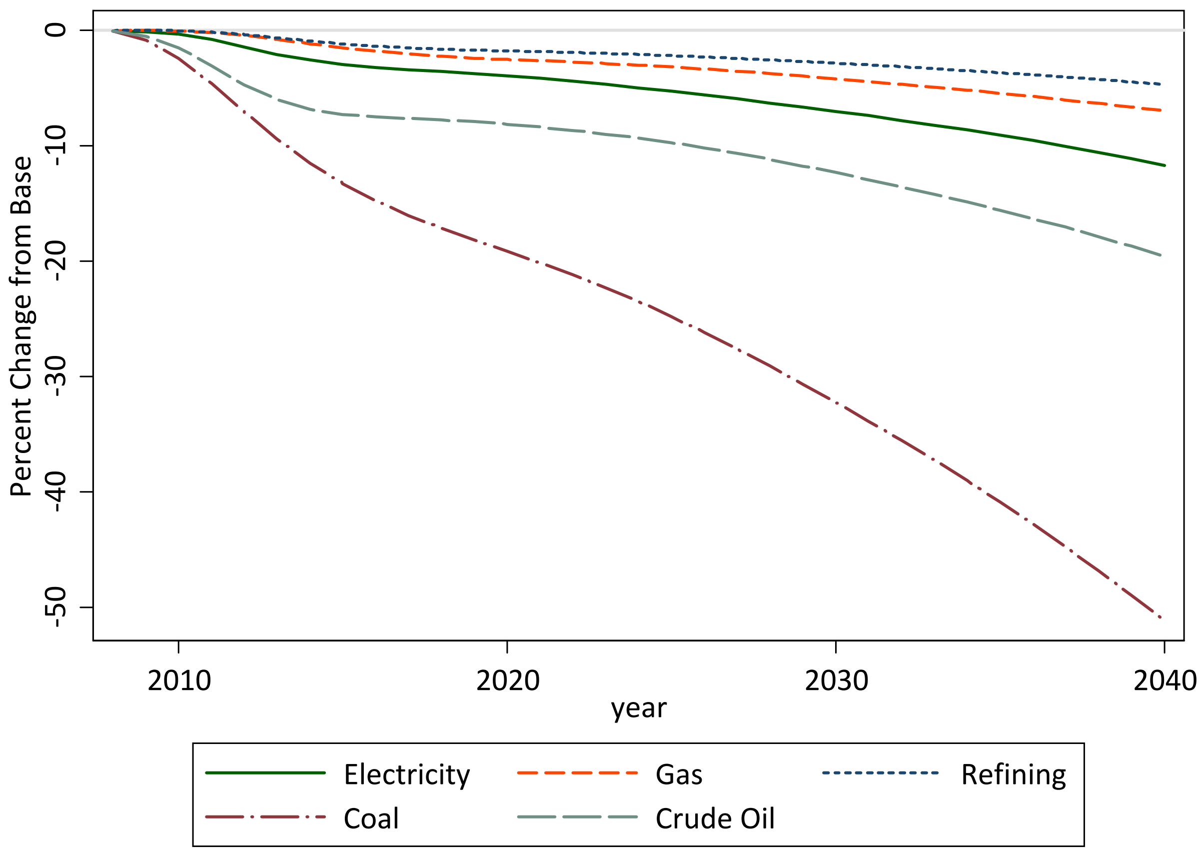
Exploring the results in more detail, the carbon tax sharply raises the after-tax price of imported and domestic fossil fuels, reducing demand for both. Imports of crude oil fall substantially, causing the U.S. trade account to move toward surplus and the U.S. dollar to appreciate against other currencies. In addition, because the U.S. is a large consumer on the world oil market, the world price of oil falls, augmenting the improvement in U.S. terms of trade. In contrast, under the tax credit the dollar initially depreciates and then gradually recovers to its baseline value. Under the combination policy, the short run effects of the carbon tax and the investment subsidy offset one another and there is little change in the exchange rate. In the long term, the carbon tax dominates and the exchange rate appreciates. The real effective trade-weighted exchange rate is shown in Figure 5 for all three policies.

Figure 5: Effect of Policies on the U.S. Real Effective Exchange Rate



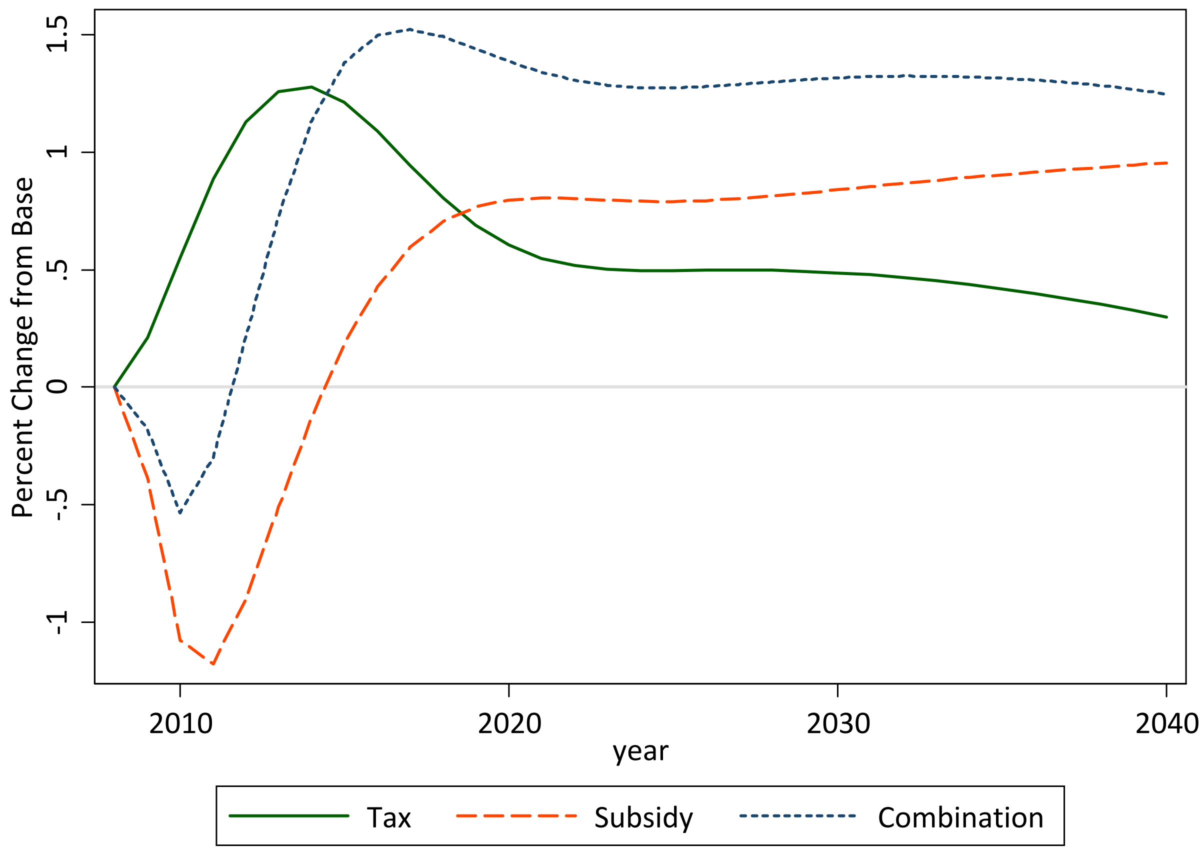
The improvement in U.S. terms of trade under the carbon tax reduces the cost of imported goods other than fuels. Particularly important, it reduces the relative domestic price of imported durables, a significant component of household investment. At the same time, the contraction in demand for energy goods reduces investment in those sectors, lowering the capital stock in the energy sectors as shown in Figure 6.

Figure 6: Effect of a Carbon Tax on Energy Sector Capital Stocks



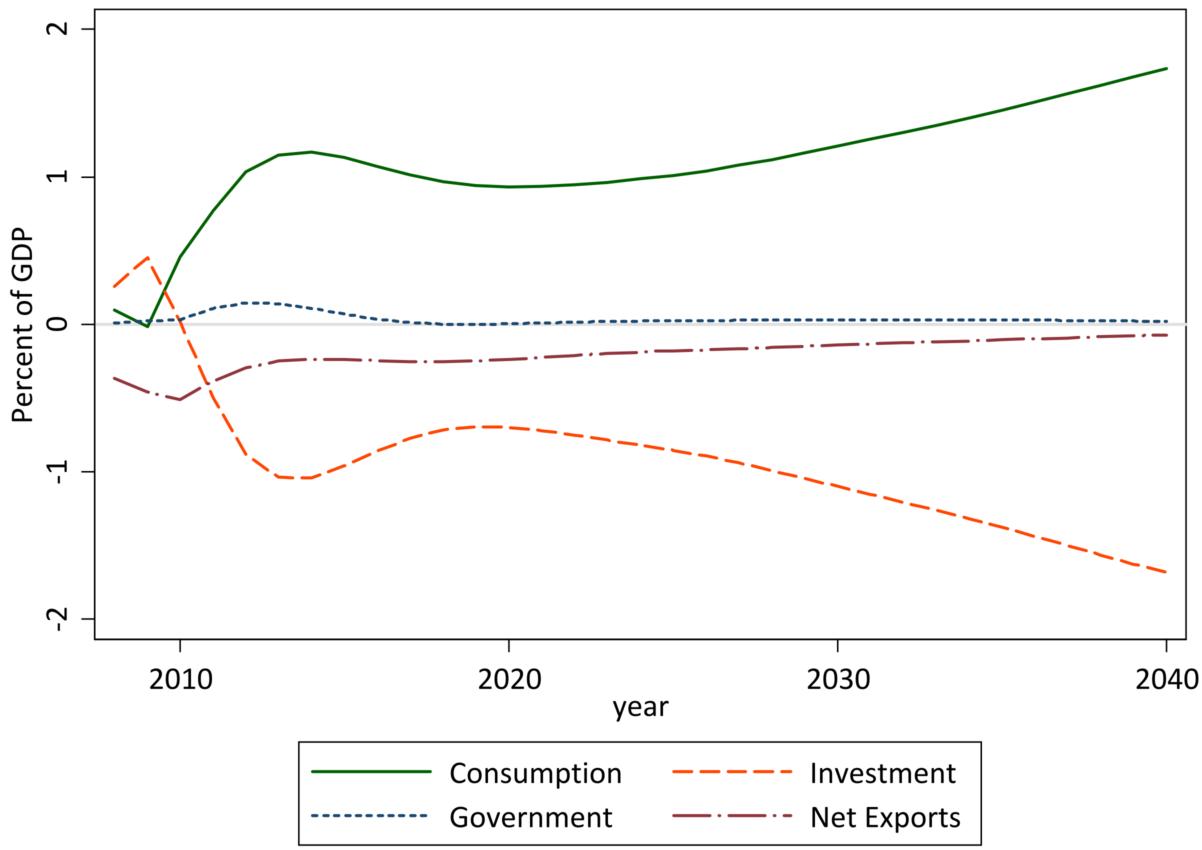
The general strengthening of U.S. terms of trade and the decline in the relative price of imported durables together sharply reduce the relative price of household capital, even in the absence of a tax credit. As a result, shown by the solid line in Figure 7, the carbon tax causes the stock of household capital to begin rising immediately, reach a peak about 1.2 percent above baseline around 2014, and remain almost 0.5 percent higher than baseline in the long run. The tax credit, shown by the dashed line, also increases the long-run capital stock but by a somewhat larger magnitude: about one percent. However, the short run effects of the two policies are sharply different. Beginning immediately in 2008, household capital falls under the tax credit policy as households postpone investment until the credit comes into effect in 2010. Household capital is more than one percent lower than baseline by 2011. After that, household investment rises sharply and the capital stock rapidly approaches its long term value. The combination policy has short run effects between the others: a milder investment drop from 2008 to 2010 as the effect of the carbon tax partially offsets the decline due to anticipation of the tax credit. After the credit takes effect in 2010, the capital stock rises rapidly to a long run value almost 1.5 percent higher than the reference case.

Figure 7: Effect of Policies on Household Capital Stock



The relative price faced by households for non-energy goods falls as well. As a result, the composition of U.S. GDP shifts toward household consumption and away from investment and net exports. Changes in GDP shares over time appear in Figure 8. The share of consumption in GDP gradually rises by 1.7 percent relative to baseline while the shares of investment and net exports fall by about 1.6 and 0.1 percent, respectively.

Figure 8: Effect of a Carbon Tax on the Composition of GDP



Although important, GDP effects don't directly capture how the policies affect the economic well-being of households. One way to measure the overall welfare effect of each policy is to compute its equivalent variation (EV). Because household behavior in G-Cubed is derived from an intertemporal optimization problem, the EV for a given policy is the change in lifetime wealth that would be needed to achieve the utility obtained under the policy at the prices that prevailed under the base case. A positive EV means the policy makes people better off, and a negative EV means that the policy makes people worse off, not counting environmental or other non-monetized benefits the policy accrues. A convenient way to express an intertemporal EV, or the welfare effect of the policy over its duration, is as a percentage of baseline wealth.

Measured that way, we find that the EV of the carbon tax is 0.6 percent: that is, the policy creates a gain for U.S. households from 2008 to 2040 equivalent to receiving about half a percent of additional wealth in 2008. As noted above, the gain is due largely to the improvement in U.S. terms of trade. In contrast, the EV of the subsidy is -0.3 percent; households would be slightly worse off than under the base case. The combination policy lies between the two with an EV of 0.3; across the duration of the policy, households gain slightly.

Conclusion

Our results have several clear implications. First, a carbon tax would be far more effective at reducing U.S. emissions than an investment tax credit for energy efficient household capital. By 2040, a carbon tax reduces emissions by 60 percent while the reduction due to an investment tax credit for energy-efficient capital would be about 1.5 percent. U.S. emissions do fall under the tax credit scenario, but the total reduction is very small compared to the baseline. Second, combining the policies potentially offsets short run GDP effects that would occur under either of the policies in isolation. The carbon tax alone reduces the rate of GDP growth in the short to medium run while the tax credit increases it. Adopting both policies simultaneously leaves overall GDP growth very close to its baseline rate. However, direct measures of household welfare suggest that a carbon tax alone would consistently make households better off than either the combination policy or the tax credit alone. This is because the tax strengthens U.S. terms of trade and makes imported goods cheaper, which more than offsets the burdens to households of the tax. In contrast, the tax credit lowers welfare by reducing consumption and increasing saving and investment.

Our findings are subject to several important caveats. The first is that our tax credit results are sensitive to the elasticity of substitution between energy and capital. A smaller substitution elasticity would cause the credit to be more effective in reducing energy consumption. Our elasticity is based on the historical record, but it might be possible to design the tax credit in a way that limits substitution possibilities by households.

A second caveat is that the welfare benefits of a carbon tax for U.S. households hinge critically on the policy's effects on U.S. terms of trade, particularly as a result of a fall in world oil prices. Strategic or monopolistic behavior by major oil exporting countries may dampen the terms of trade benefits and make the carbon tax more costly for U.S. households than the results here suggest. In addition, our results are likely to be specific to policies implemented by the U.S. because it is such a large consumer in the world oil market. Actions taken by smaller countries would have much smaller effects on world oil prices.

Finally, our terms of trade results could change if other countries adopt more stringent climate policies than are implied by our baseline. The magnitude and direction of the change is an empirical question and would be a fruitful topic for future research. On one hand, action by other countries would push world oil prices down further, enhancing the terms of trade effect. On the other hand, carbon policies implemented abroad would raise the U.S. price of imported goods other than fuels, offsetting part of the terms of trade gain.

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