BROOKINGS | QUALITY. INDEPENDENCE. IMPACT.

Consequences of Cap and Trade

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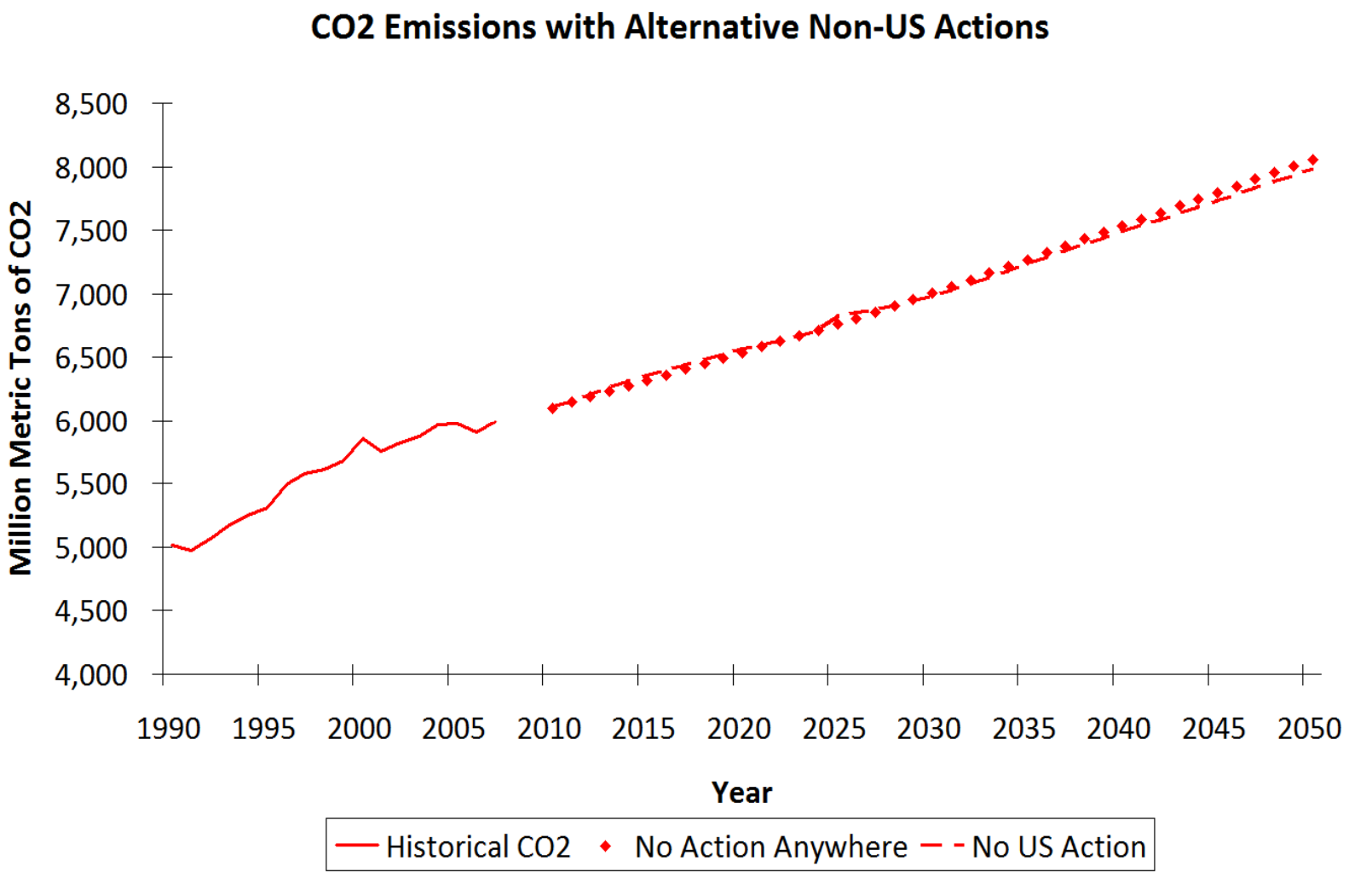
Analysis

- Not an analysis of particular bills
- Not a cost-benefit analysis
  - » Looking only at mitigation costs and emissions reductions
- Looking for ways to pursue environmental goals at lower cost

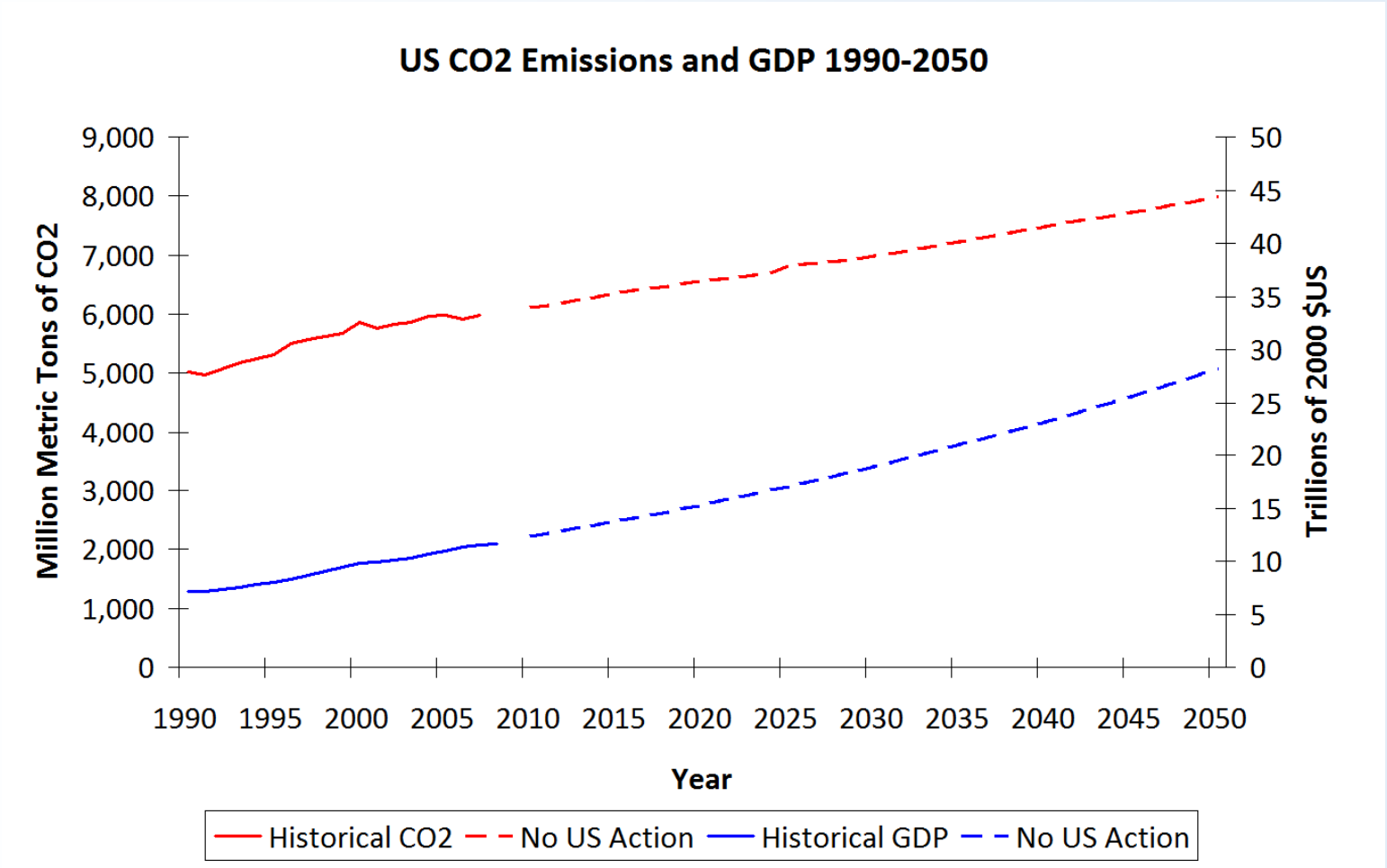
Scenarios

- Two Reference Scenarios
  - » No countries adopt a price on carbon ("take action")
  - » All countries except the U.S. take action
- Four Policy Scenarios
  - » "OA Targets" based loosely on Administration proposal
  - » "DD Targets" based loosely on targets in Waxman-Markey Discussion Draft
  - » "Hotelling 2050" cost-minimizing with same 2050 emissions
  - » "Hotelling Cumulative" cost-minimizing with same total emissions

U.S. Reference Emissions Levels



Reference Emissions and GDP



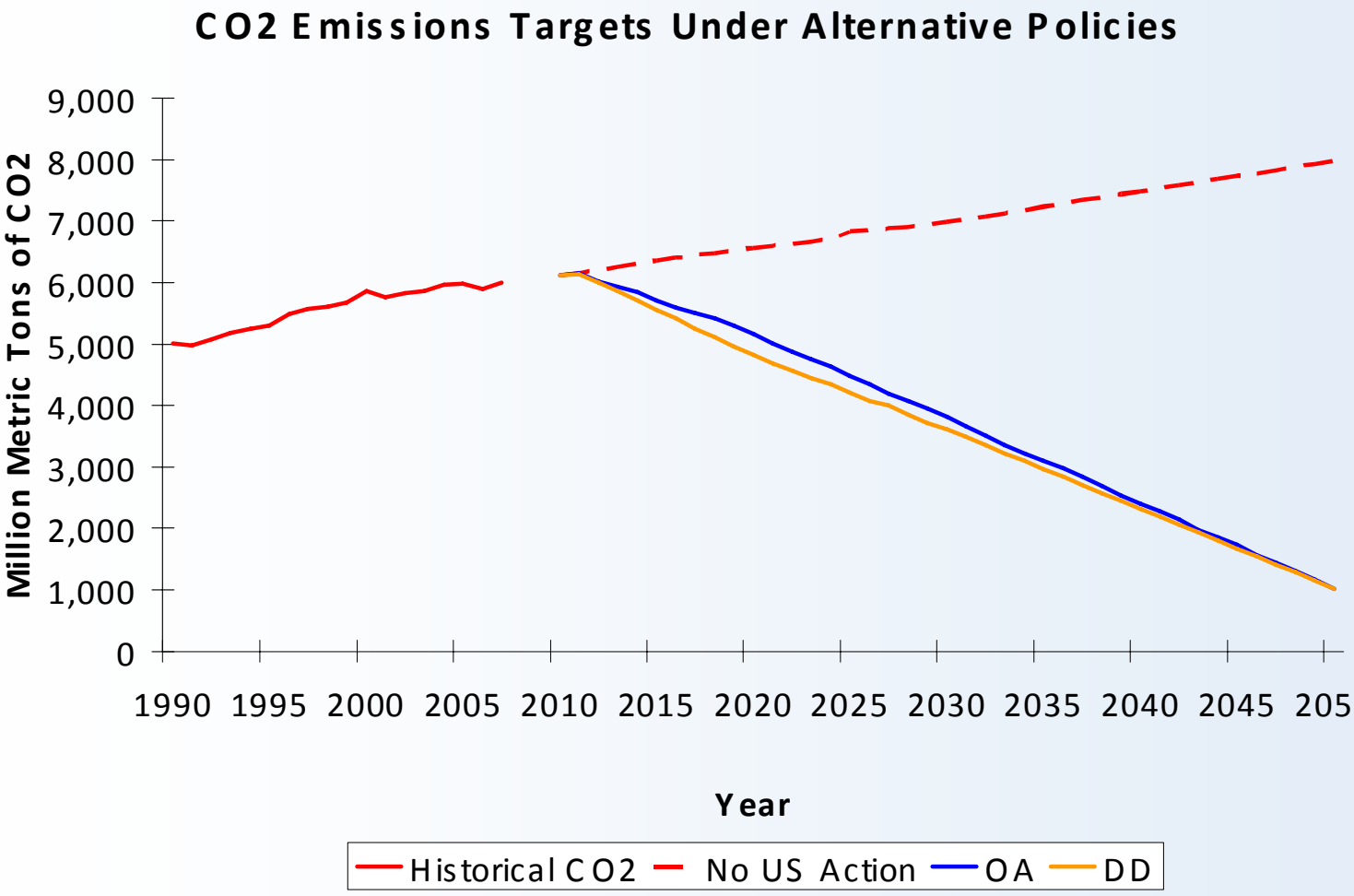
All US Policy Scenarios

- Targets relative to 2005 emissions levels
- U.S. emissions reduced 83% by 2050

Scenario Differences

- OA Targets
  - » 14% lower by 2020
- DD Targets
  - » 20% lower by 2020
  - » 40% lower by 2030
- Hotelling 2050
  - » Least cost path to 83% reduction by 2050
- Hotelling Cumulative
  - » Least cost path with same cumulative emissions as OA

U.S. Emissions With Action



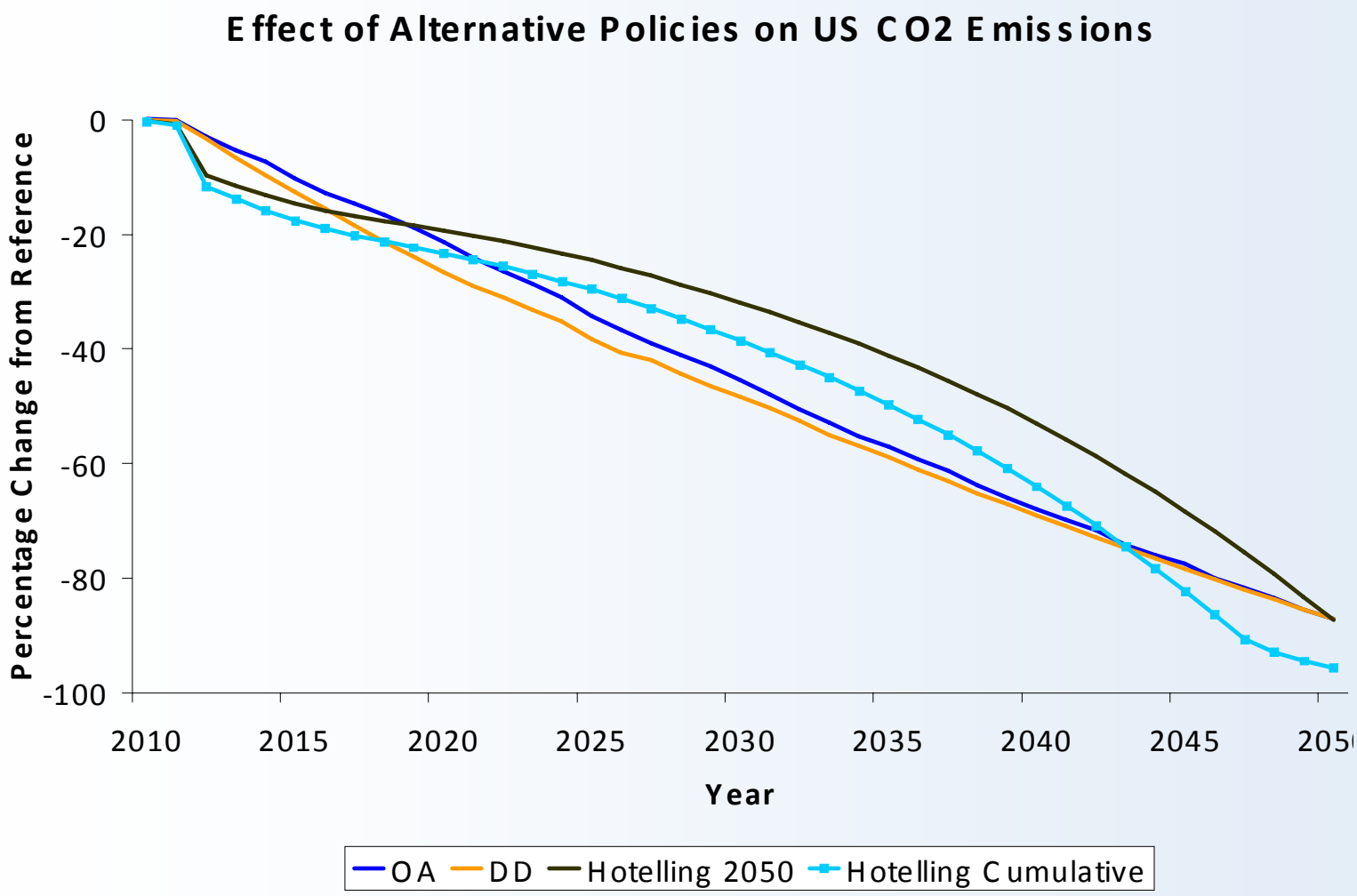
Assumptions for all scenarios

- No banking or borrowing
- Caps apply only to fossil energy sectors
- No offsets
- Allowance value finances additional government spending
- Results relative to other countries taking action without the US

The G-Cubed Model

- General equilibrium model with 9 Regions, 12 sectors in each
- Forward looking – firms see a carbon constraint coming
- Financial capital is fully mobile, but physical capital isn't
- Reports trade and investment flows
- Employment adjusts gradually to new policies
- Includes only CO_2 from fossil energy, about 85% of total U.S. greenhouse emissions

Emissions trajectories



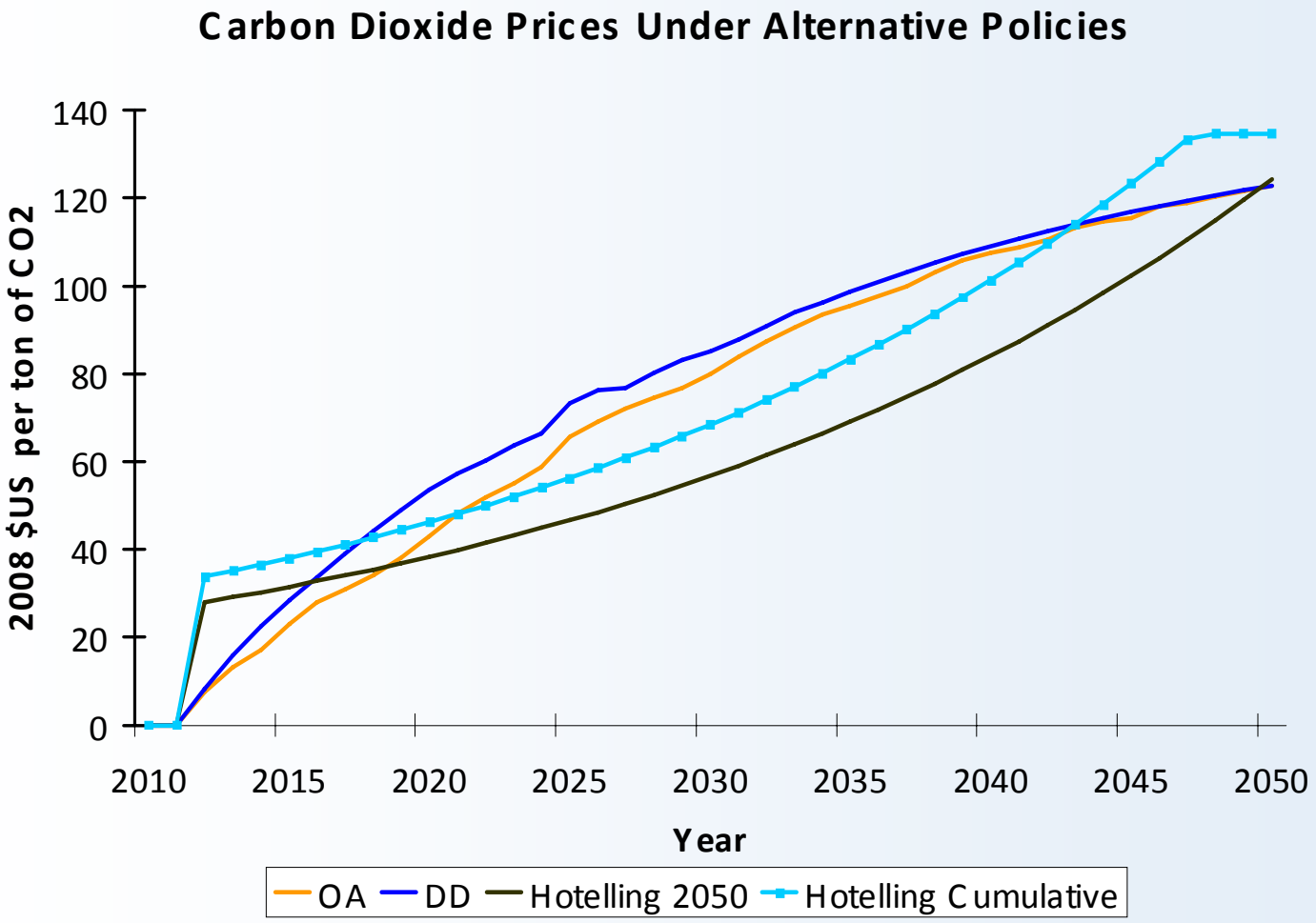
Cumulative US Emissions

Scenario	Billion Metric Tons of CO_2	Percent Reduction
Reference	288	N/A
OA Targets	154	47%
DD Targets	148	49%
Hotelling 2050	176	39%
Hotelling Cumulative	154	47%

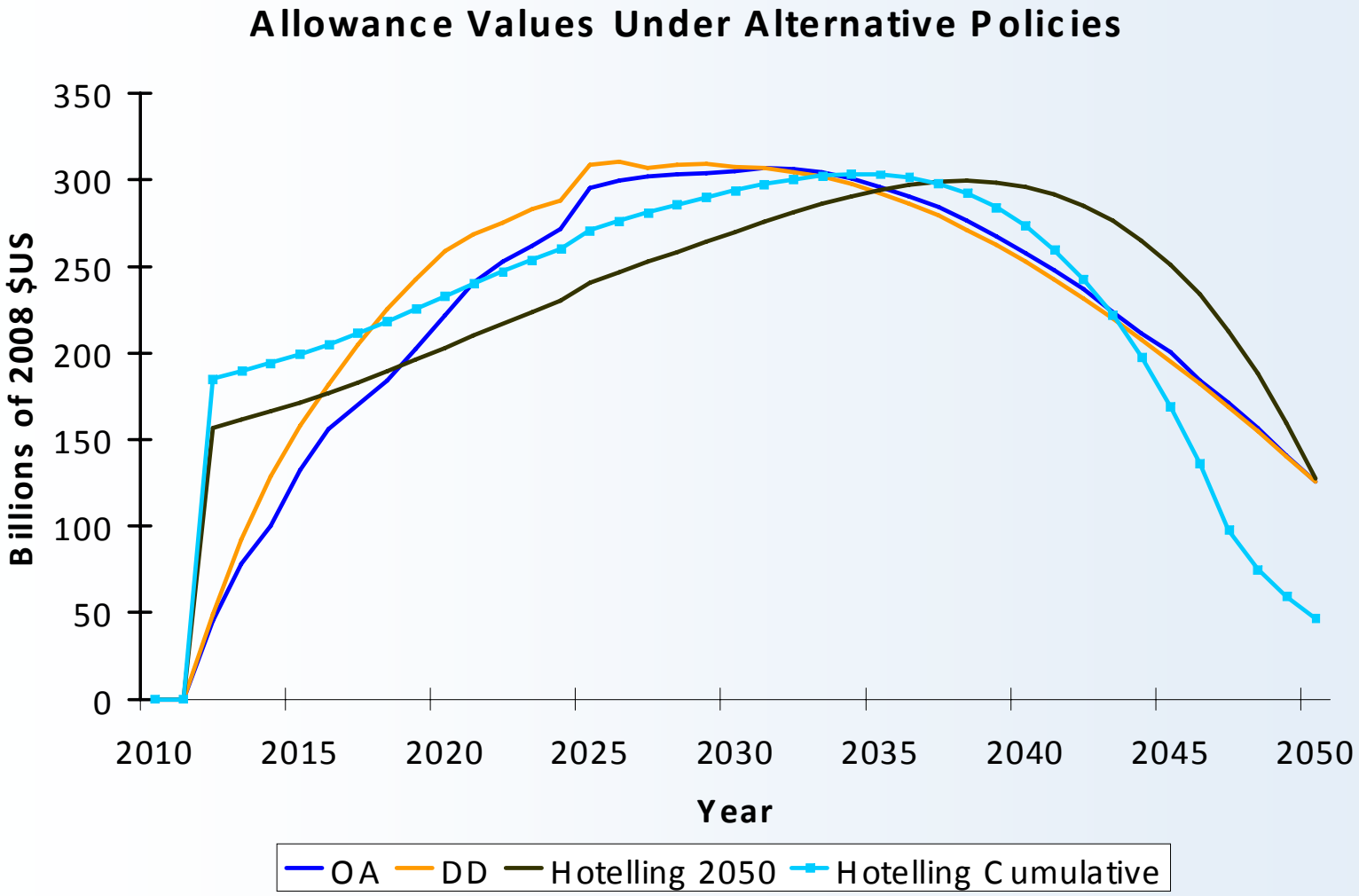
Present Discounted Personal Consumption 2010 to 2050 in 2008 dollars

Scenario	2.2% discount rate	4% discount rate
OA Targets	-0.45% $1.9 trillion	-0.36% $1.1 trillion
DD Targets	-0.49% $2.0 trillion	-0.39% $1.3 trillion
Hotelling 2050	-0.28% $1.1 trillion	-0.23% $0.6 trillion
Hotelling Cumulative	-0.38% $1.6 trillion	-0.31% $0.9 trillion

Allowance Prices

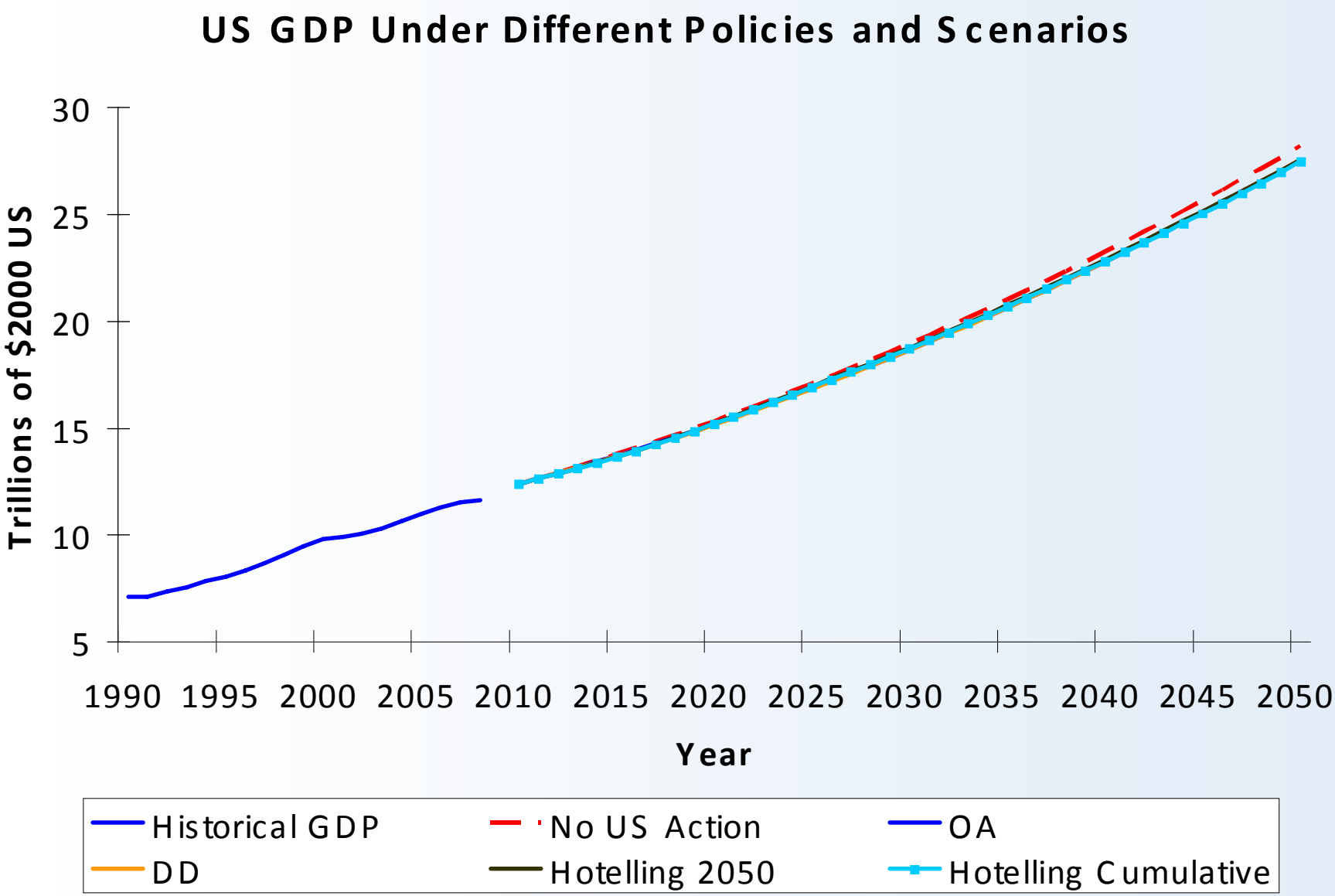


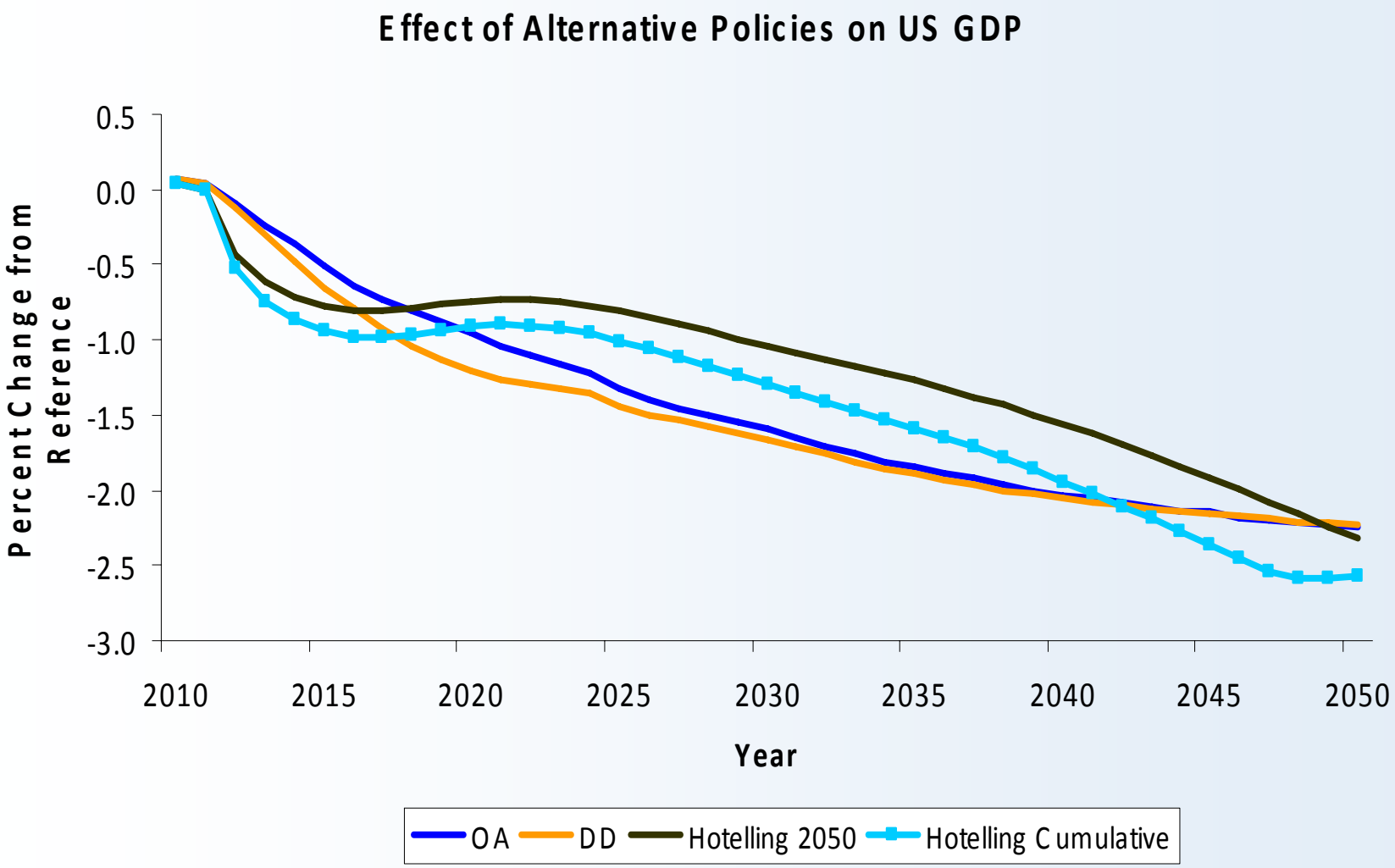
Total Value of Allowances

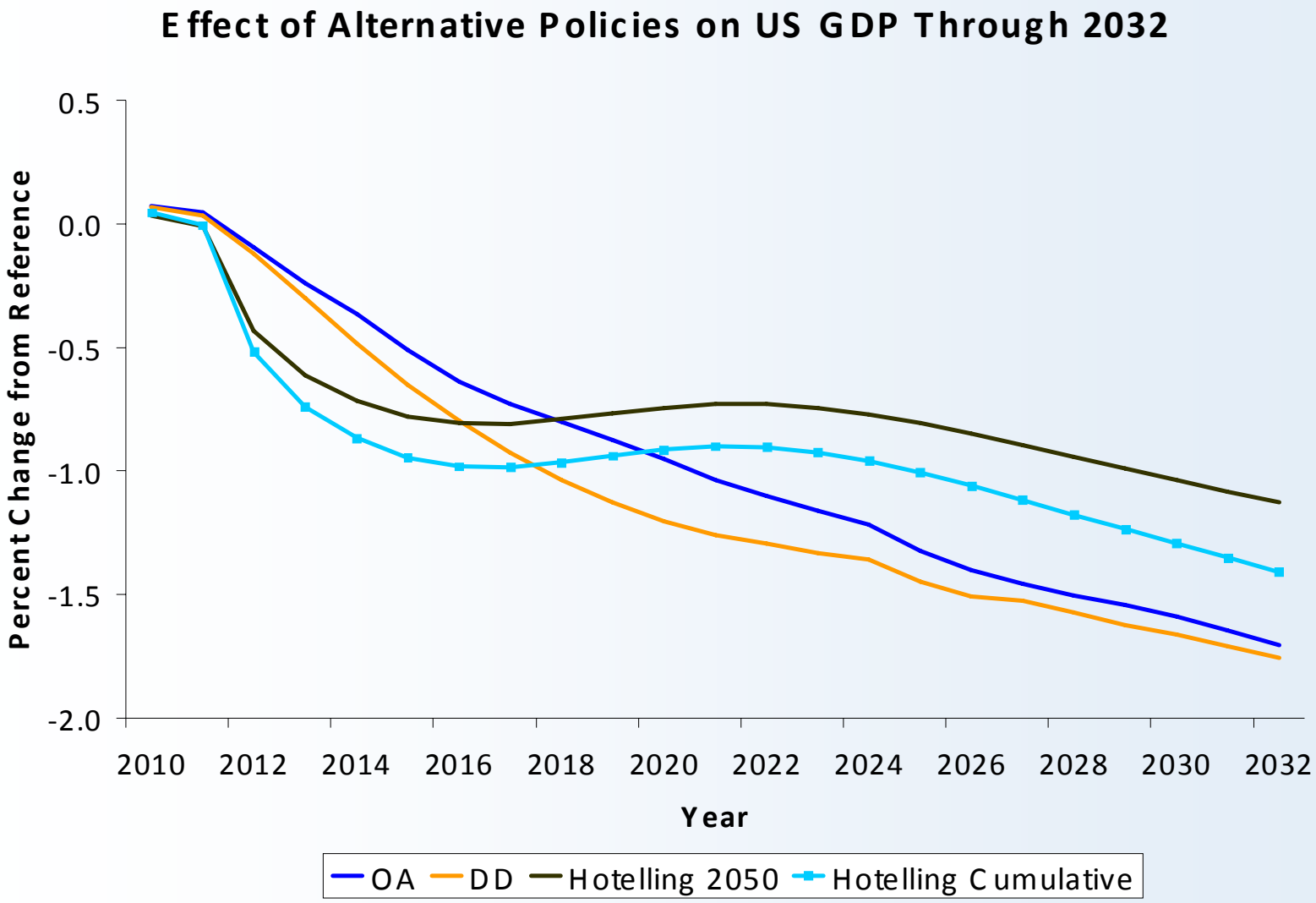


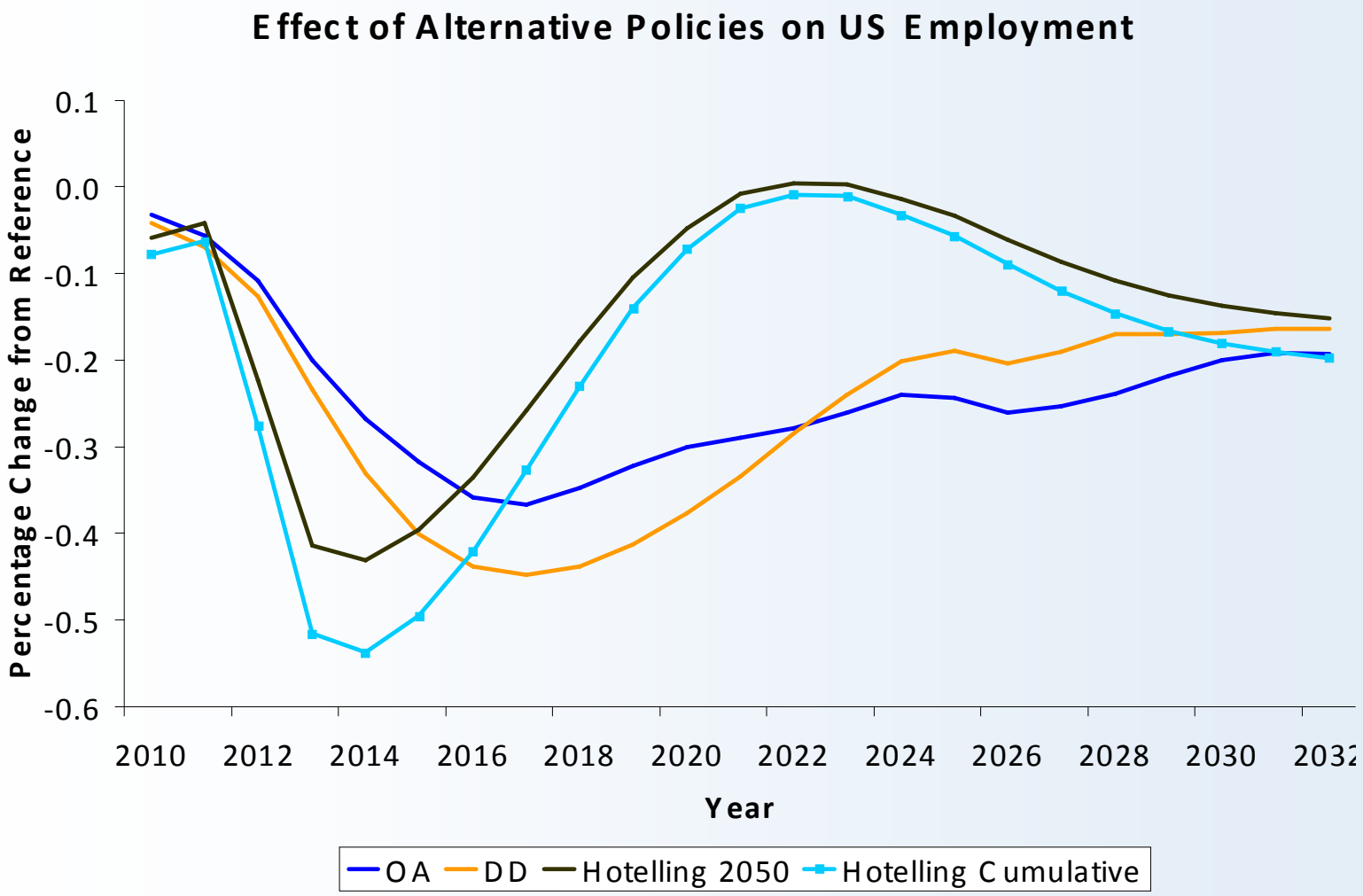
Cumulative Undiscounted Allowance Value 2012 to 2050 in 2008 dollars

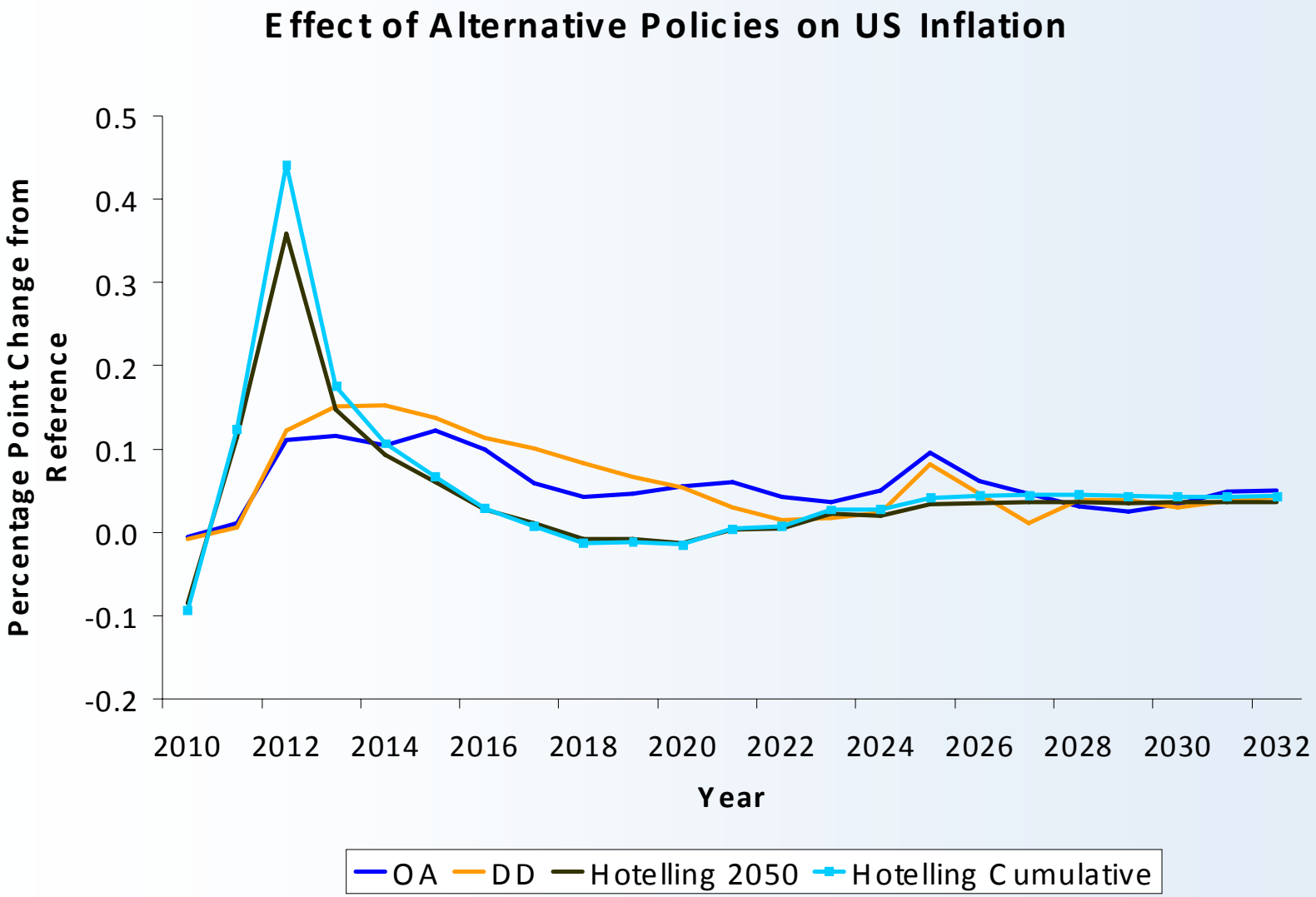
Scenario	2012 to 2050	2012 to 2020
OA Targets	$8.9 trillion	$1.3 trillion
DD Targets	$9.2 trillion	$1.5 trillion
Hotelling 2050	$9.2 trillion	$1.6 trillion
Hotelling Cumulative	$9.0 trillion	$1.9 trillion


US GDP Under Different Policies and Scenarios
Trillions of $2000 US
30
25
20
15
10
5
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
Year
Historical GDP
No US Action
OA
DD
Hotelling 2050
Hotelling Cumulative

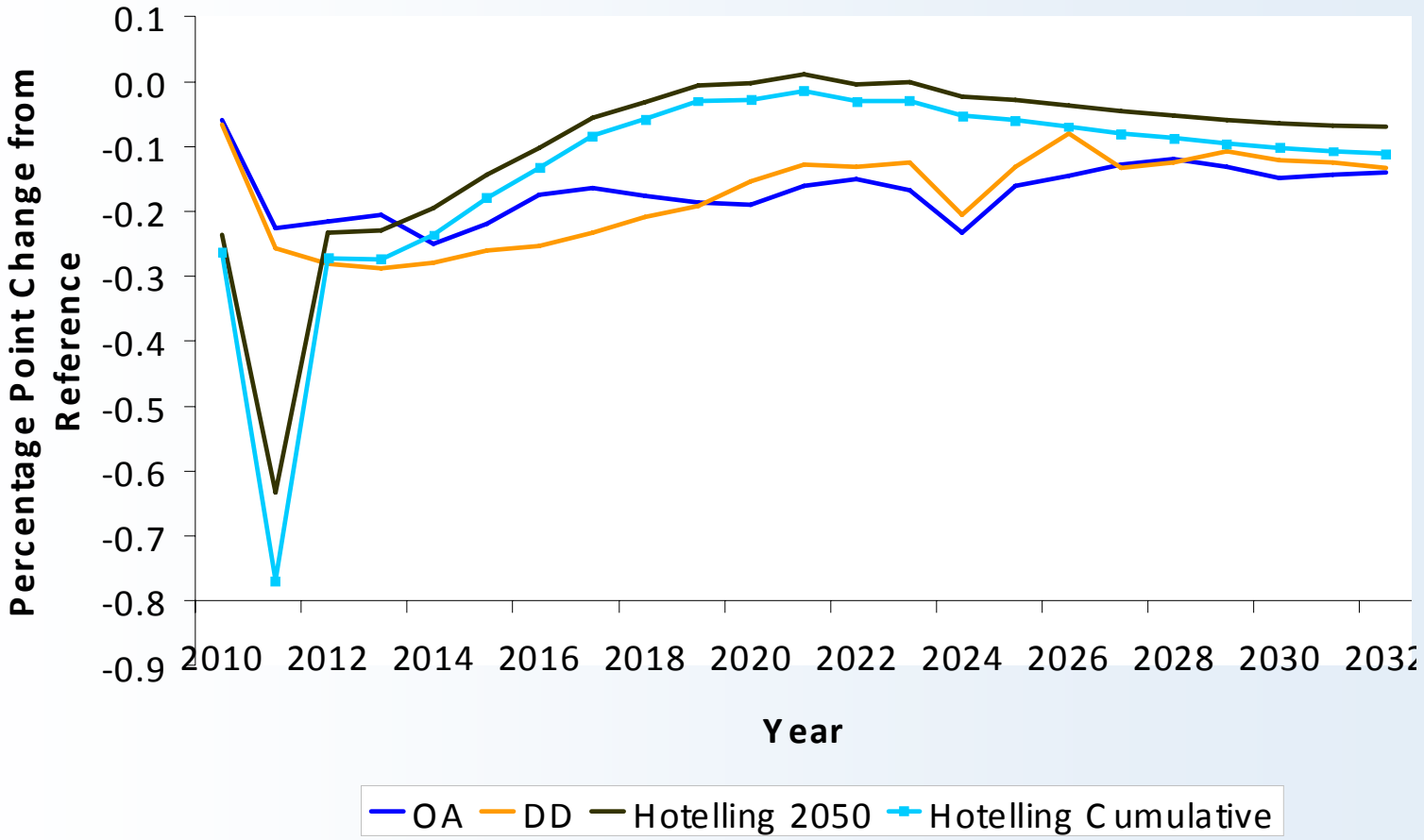

Effect of Alternative Policies on US GDP
Percent Change from Reference
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
2010
2015
2020
2025
2030
2035
2040
2045
2050
Year
OA
DD
Hotelling 2050
Hotelling Cumulative


Effect of Alternative Policies on US GDP Through 2032
Percent Change from Reference
0.5
0.0
-0.5
-1.0
-1.5
-2.0
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
Year
OA
DD
Hotelling 2050
Hotelling Cumulative

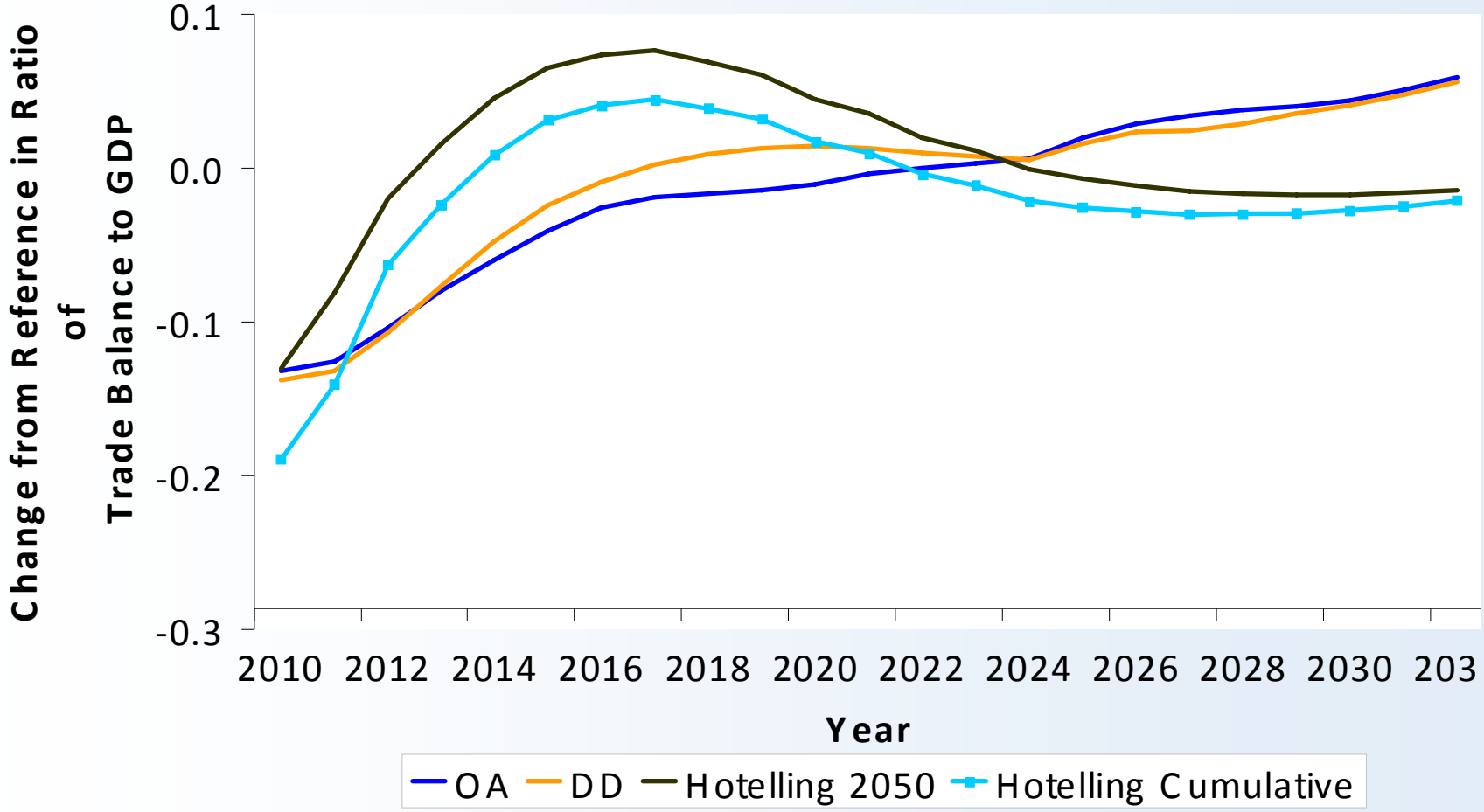

Effect of Alternative Policies on US Employment
Percentage Change from Reference
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
Year
OA
DD
Hotelling 2050
Hotelling Cumulative


Effect of Alternative Policies on US Inflation
Percentage Point Change from Reference
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
Year
OA
DD
Hotelling 2050
Hotelling Cumulative

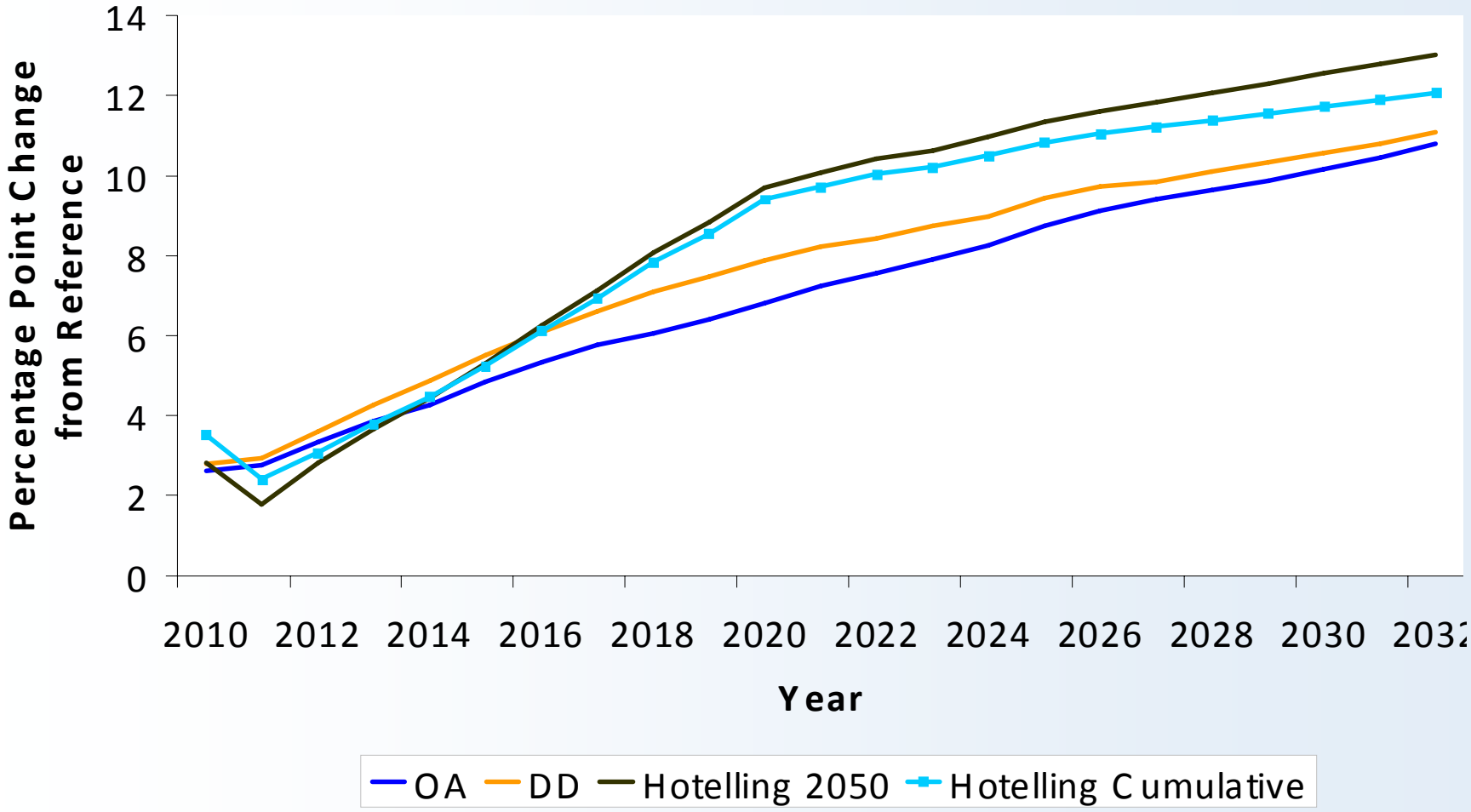
Effect of Alternative Policies on US Real Interest Rates



Effect of Alternative Policies on US Trade Balance to GDP Ratio

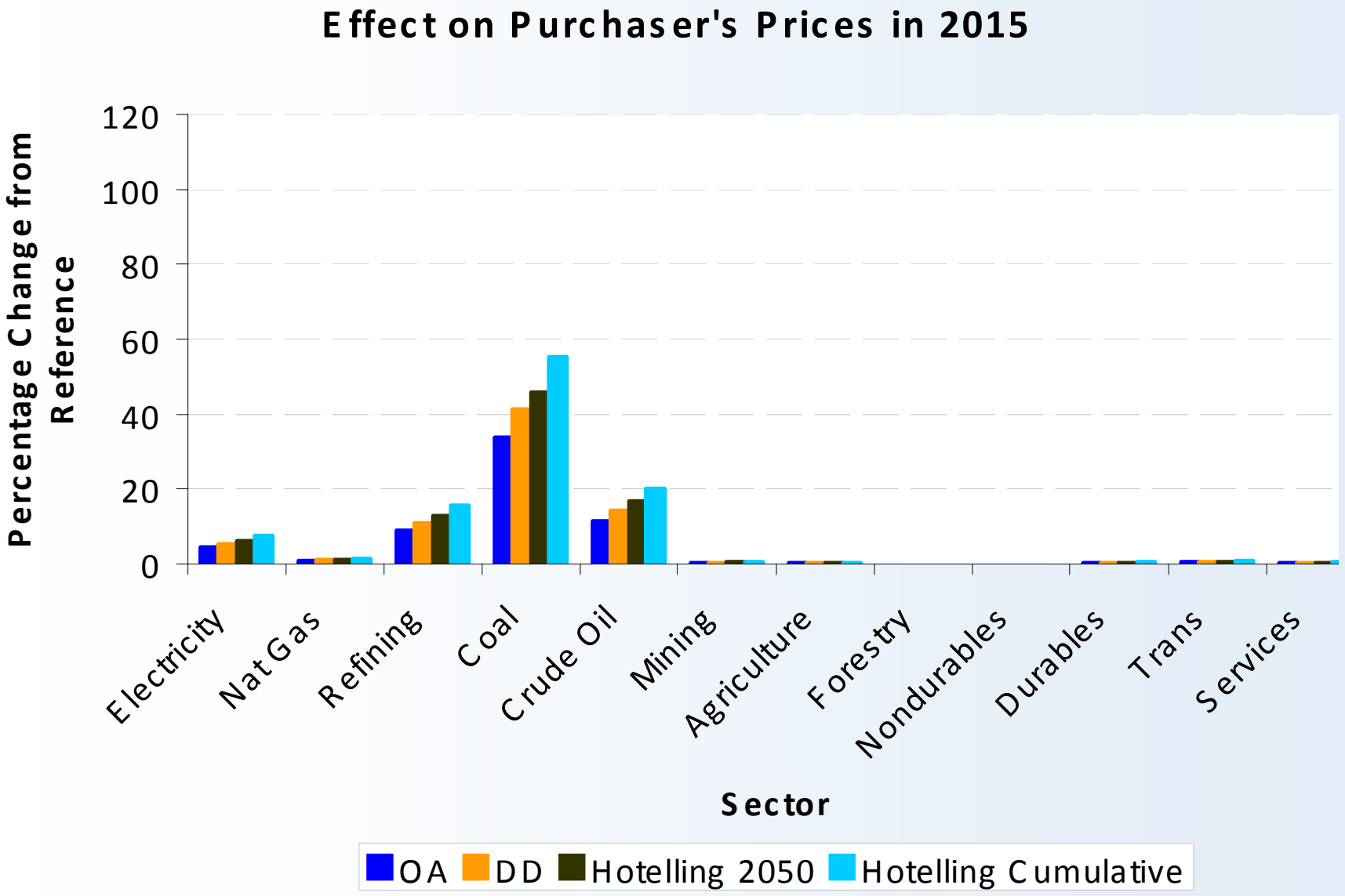


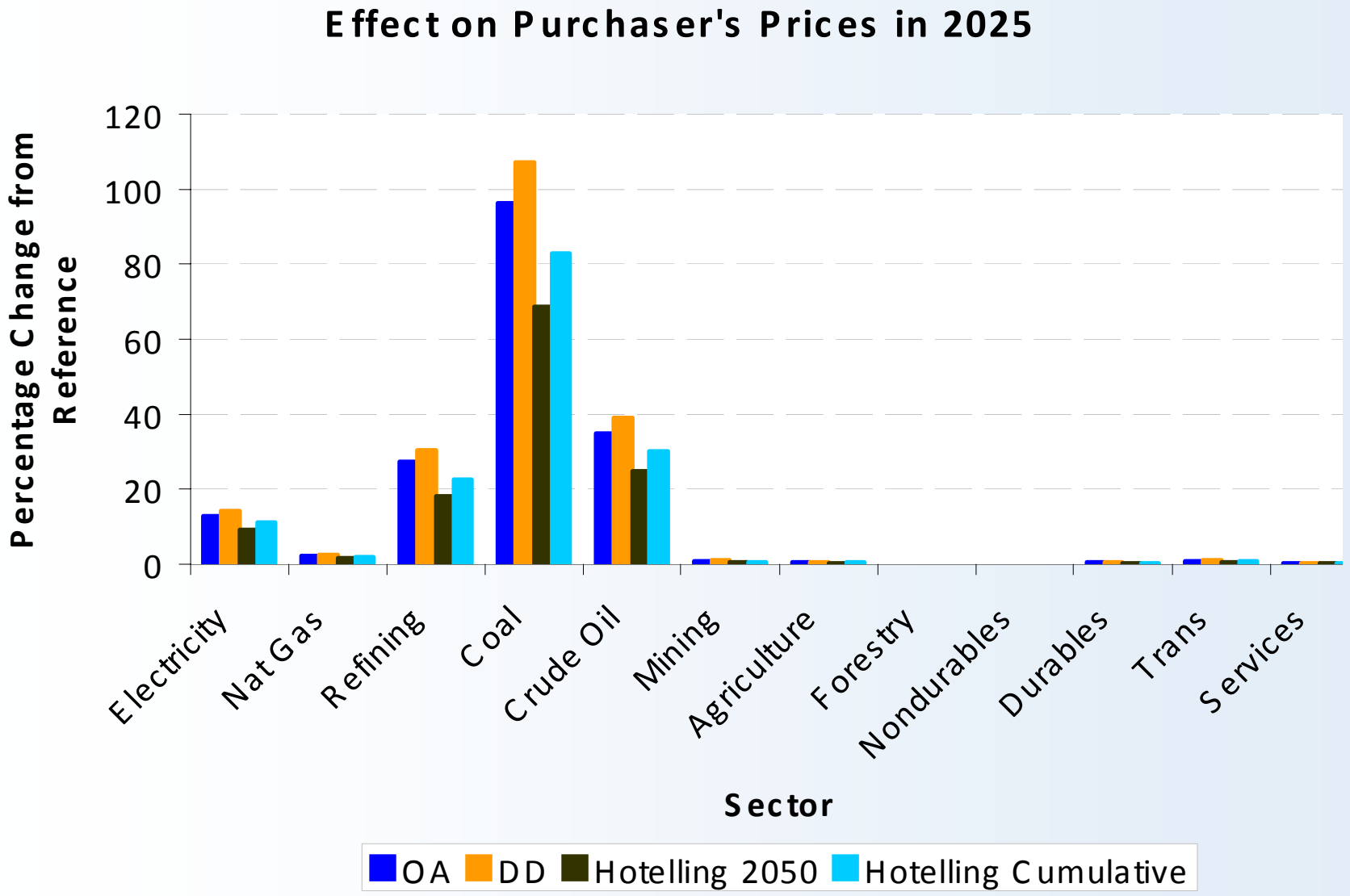
Effect of Alternative Policies on US Real Effective Exchange Rate



Effects on Sectors

Num	Name	Num	Name
1	Electricity	7	Agriculture
2	Natural Gas	8	Forestry
3	Petroleum Refining	9	Nondurables
4	Coal	10	Durables
5	Crude Oil	11	Transportation
6	Mining	12	Services


Effect on Purchaser's Prices in 2015
Percentage Change from Reference
120
100
80
60
40
20
0
Electricity
Nat Gas
Refining
Coal
Crude Oil
Mining
Agriculture
Forestry
Nondurables
Durables
Trans
Services
Sector
OA
DD
Hotelling 2050
Hotelling Cumulative


Effect on Purchaser's Prices in 2025
Percentage Change from Reference
120
100
80
60
40
20
0
Electricity
Nat Gas
Refining
Coal
Crude Oil
Mining
Agriculture
Forestry
Nondurables
Durables
Trans
Services
Sector
OA
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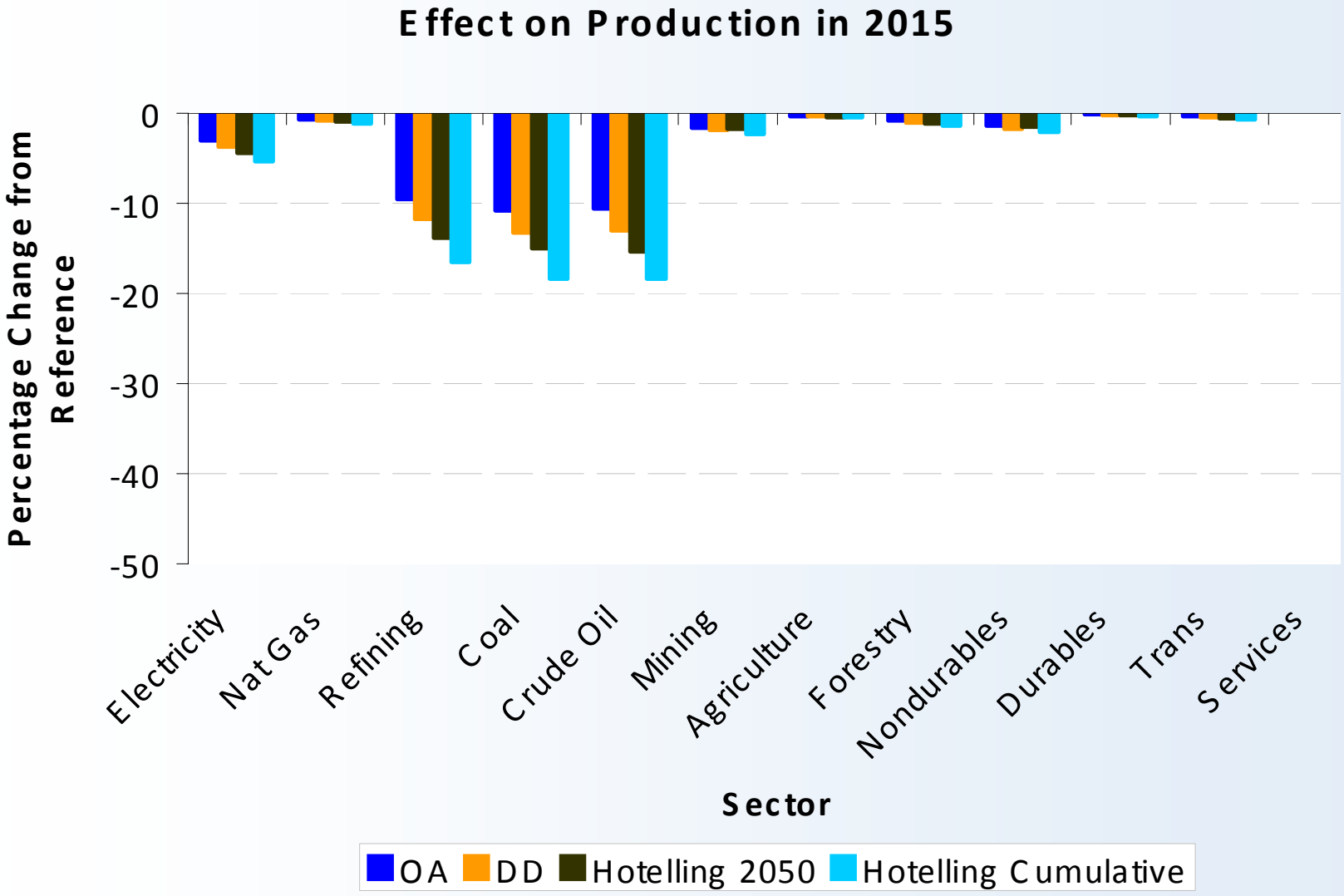
Hotelling 2050
Hotelling Cumulative


Effect on Production in 2015
Percentage Change from Reference
0
-10
-20
-30
-40
-50
Electricity
Nat Gas
Refining
Coal
Crude Oil
Mining
Agriculture
Forestry
Nondurables
Durables
Trans
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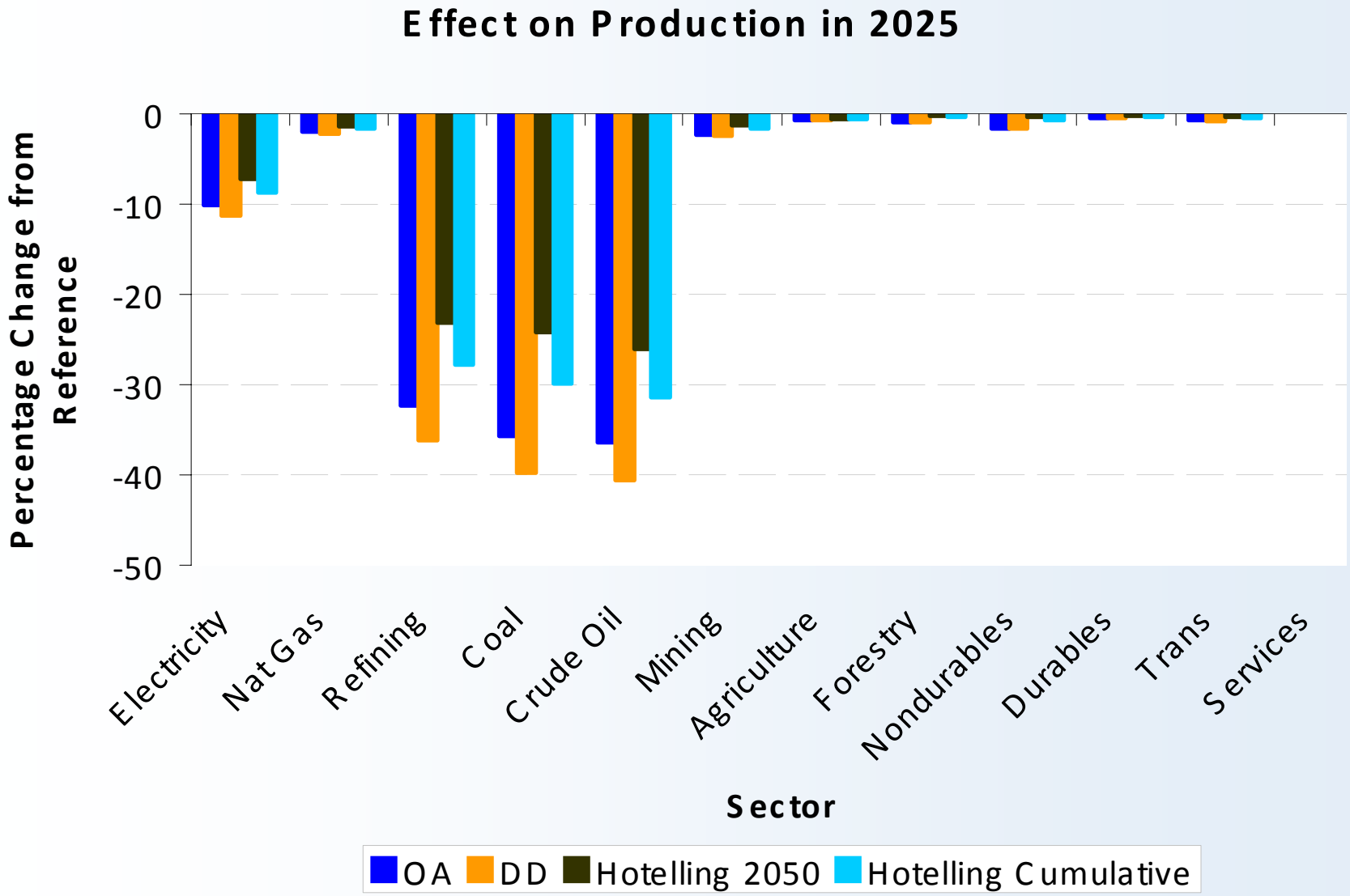
Hotelling Cumulative


Effect on Production in 2025
Percentage Change from Reference
0
-10
-20
-30
-40
-50
Electricity
Nat Gas
Refining
Coal
Crude Oil
Mining
Agriculture
Forestry
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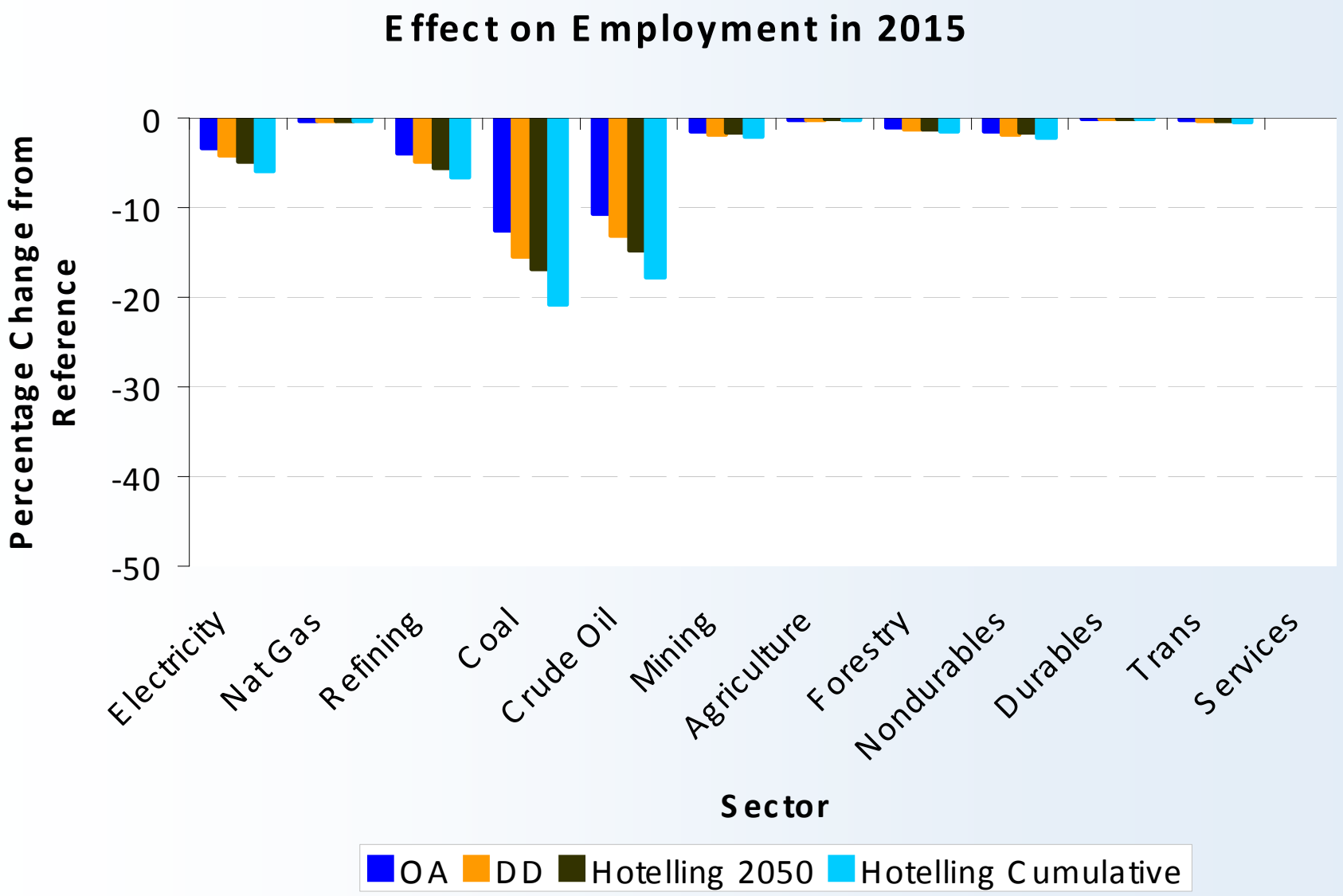
Effect on Employment in 2015
Percentage Change from Reference
0
-10
-20
-30
-40
-50
Electricity
Nat Gas
Refining
Coal
Crude Oil
Mining
Agriculture
Forestry
Nondurables
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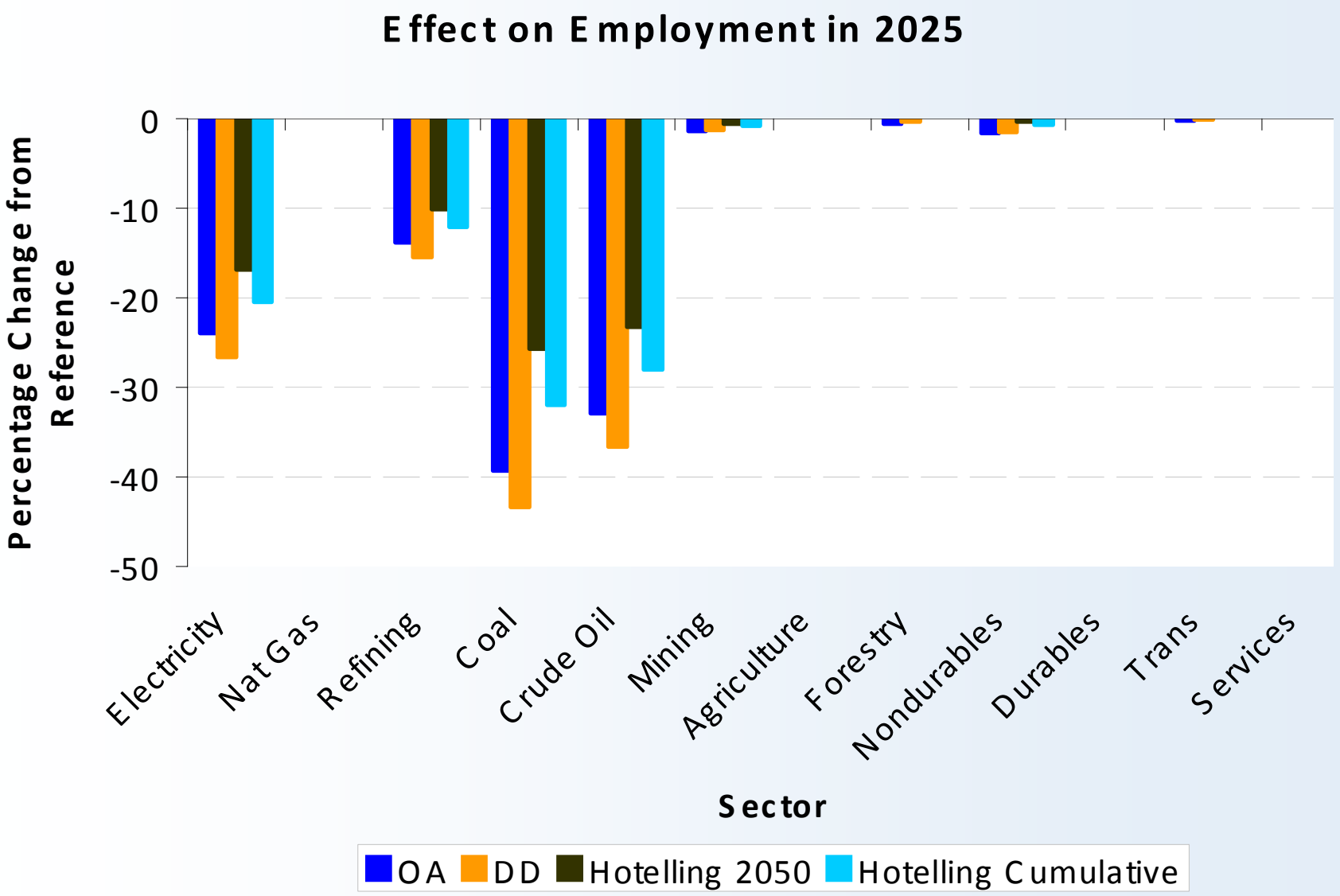
Effect on Employment in 2025
Percentage Change from Reference
0
-10
-20
-30
-40
-50
Electricity
Nat Gas
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Hotelling 2050
Hotelling Cumulative

Summary: Effects Relative to Reference

- Emissions effects
  - » Modeled policies reduce cumulative US emissions 38% to 49%
  - » 110 to 140 billion metric tons CO_2 fewer emissions
- Welfare effects
  - » Loss in total personal consumption of 0.3% to 0.5%, or about $1 to $2 trillion in discounted present value from 2010 to 2050
  - » Incremental stringency produces relatively high incremental cost, e.g. extra 8% reduction increases costs by 45%

Summary, continued

- US GDP in 2050 lower by 2.5%
- Employment effect
  - -0.5% at peak in first decade
- Allowance value
  - About $300 billion at peak during 2030-2040
  - $9 trillion in total
- OA and DD targets vs. Hotelling Paths
  - Without banking, CO_2 prices rise more gradually
  - More stringent in medium run