



# Counterbalancing the Effects of Climate Change on Public Budgets – The Case of Austria



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Klimatag

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## 1. Introduction and research question

## 2. Methodology

- Model of Austria's economy
- Climate change impacts and effects on public budget
- Counterbalancing instruments

## 3. Results

## 4. Conclusions

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# INTRODUCTION



Current projects:

(**COIN** – Costs of Inaction)

**PACINAS** – Public Adaptation to Climate Change

One of the research questions:

- **Effects of impacts on public budgets:**
  - **What are possible instruments to counterbalance climate change induced effects on public budgets to maintain the provision of public services?**
  - **What are the sectoral and macroeconomic consequences thereof?**



# METHODOLOGY



## Climate change impacts in a national framework

- 12 “impact fields”
  - According to Austria’s “National Adaptation Strategy” (NAS)
  - Detailed sectoral analyses (bottom-up)
- To ensure consistency:
  - Shared socioeconomic pathways (SSPs) developed for all impact fields
  - Consistent climate scenario(s): Ø 2016-2045 and Ø 2036-2065
- Macroeconomic (national) evaluation (top-down)
  - Feed in results from sectoral analyses (10 impact fields)
  - Integration of bottom-up and top-down
- Compare **Baseline scenario** (no climate change but socioeconomic development) to **Climate Change scenario**



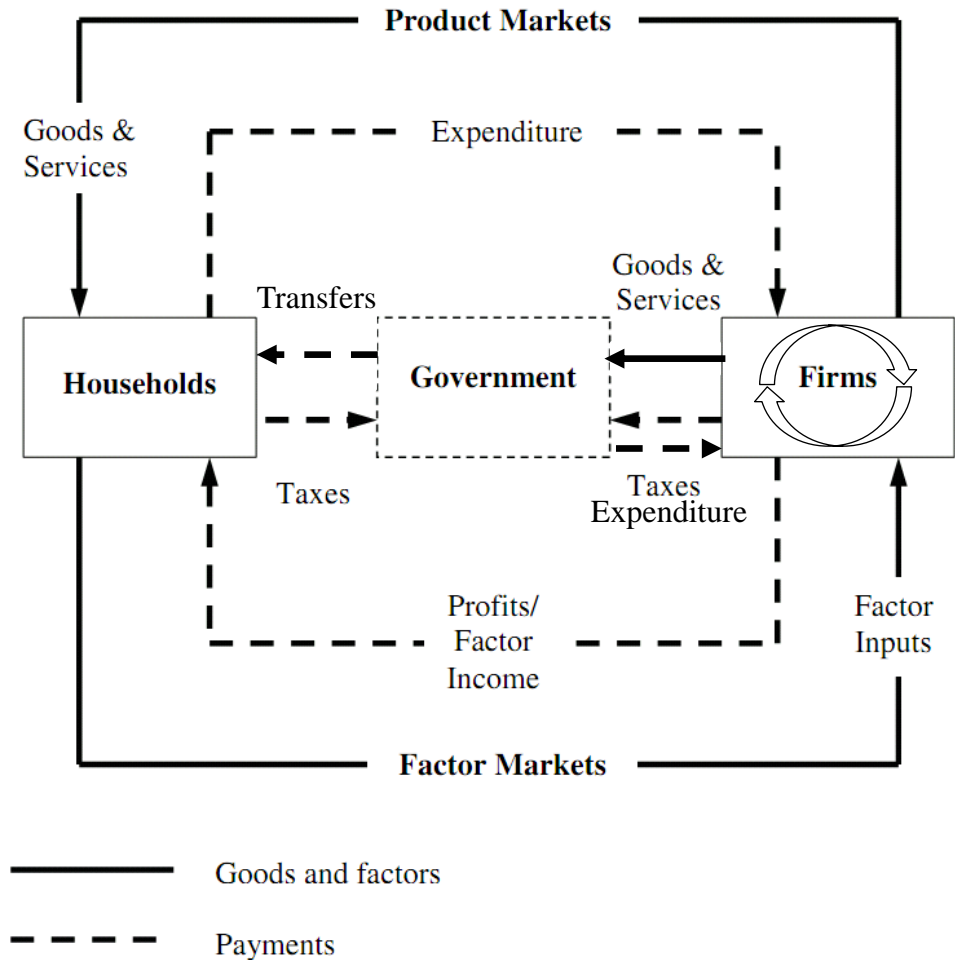
To assess the macroeconomic effects of climate change impacts:

→ Need to capture interlinkages within the economy:  
**computable general equilibrium (CGE) model**

# Methodology: CGE model



- Economy as closed system of monetary flows across production sectors and demand agents on a yearly basis (based on I-O tables)
- Flows in equilibrium (all markets are cleared)
- Shock equilibrium  
→ new equ. emerges



Adopted from Sue Wing (2004)



# Methodology: CGE model



- Regional and temporal scope
  - Austria as regional entity (NUTS-0 level)
  - Base year 2008
  - Baseline modeled up to 2050 according to SSP
- Production
  - 40 sectors according to major sectoral activities
- Final demand
  - 1 representative private household
  - 1 government entity; collects taxes and provides transfers
- Labor market: unemployment
- International trade
  - small open economy

# Methodology: CGE model and impacts



## Impact field

Agriculture

Forestry

Water Supply and Sanitation

Buildings: Heating & Cooling

Electricity

Transport

Manufacturing and Trade

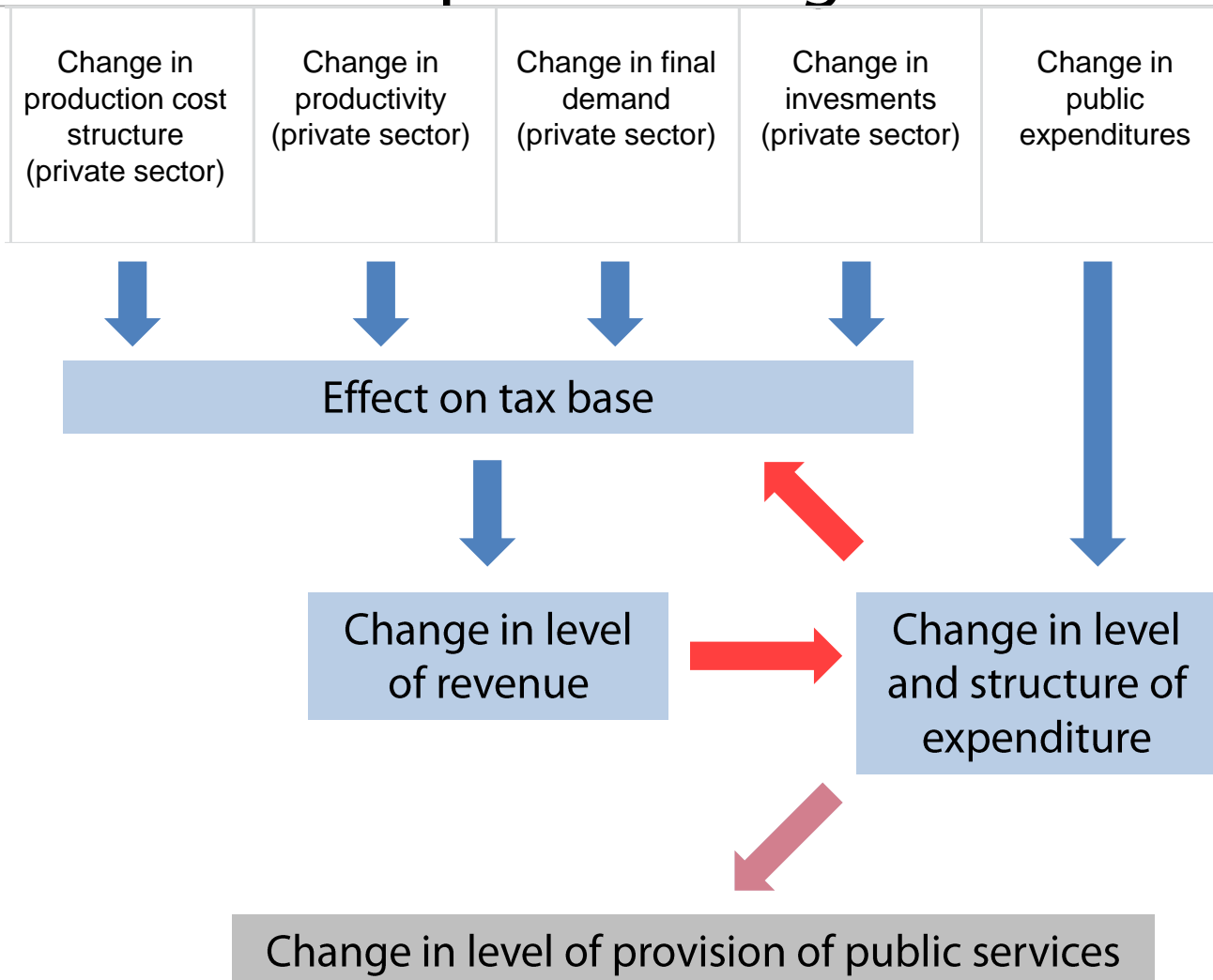
Cities and Urban Green

Catastrophe Management

Tourism

The modeled impacts (“x”) come from *impact chains* as we have them available from bottom-up models

# Methodology: effects on public budget



# Methodology:

## counterbalancing instruments



Instruments introduced for counterbalancing revenues/expenditures to keep provision of public services in **Climate Change scenario** at **Baseline** level:

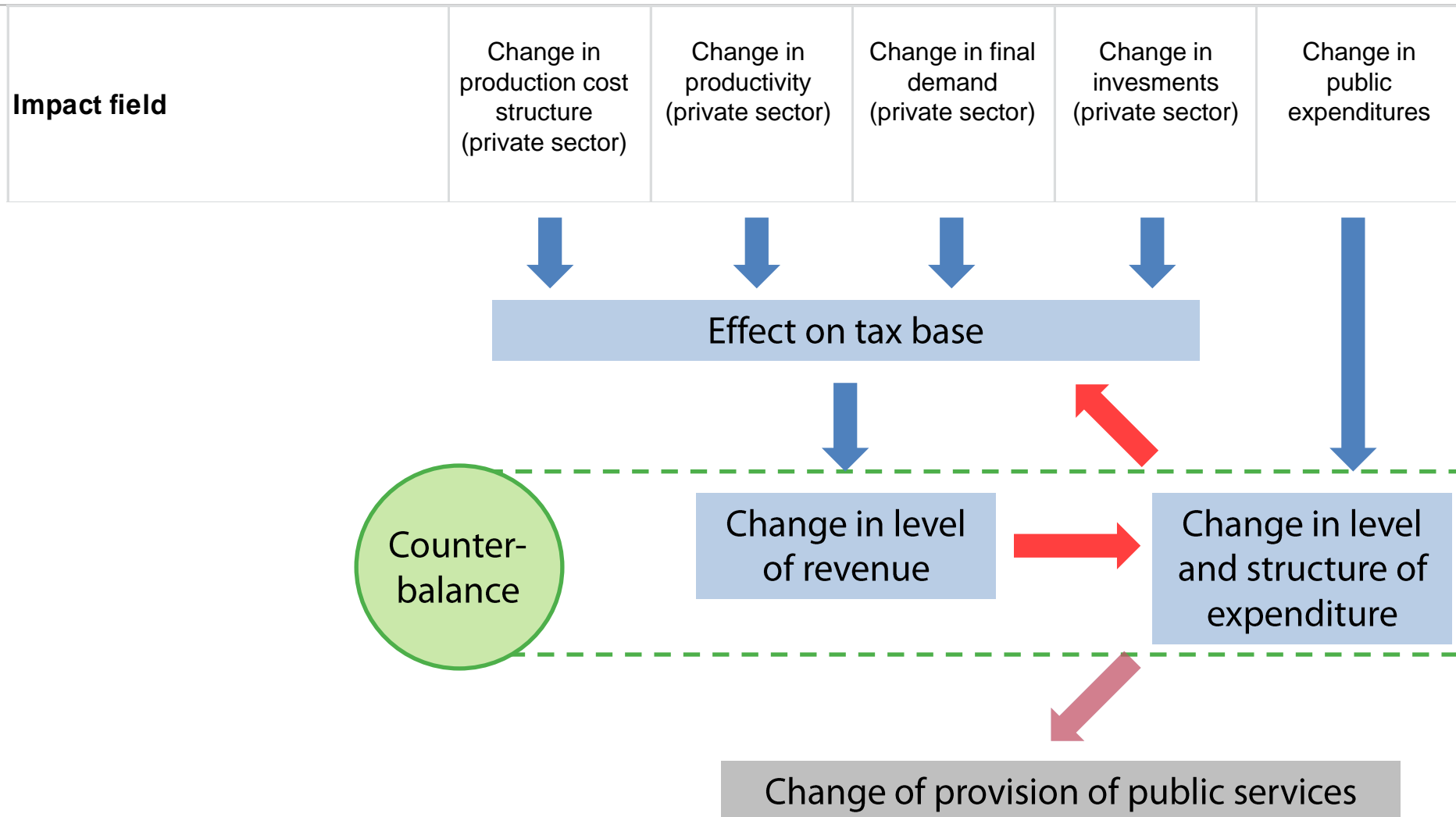
Two possible ways:

- Increase tax revenue
- Decrease expenditure elsewhere

Counterbalancing instruments:

1. **OUTTAX**: Increase output tax → increases revenues
2. **LABTAX**: Increase labor tax → increases revenues
3. **CAPTAX**: Increase capital tax → increases revenues
4. **CUTTRA**: Cut transfers to private households → decreases expenditure
5. **FORLEN**: Foreign lending → increases income ("revenues")

# CGE model: effects on public budget





# RESULTS

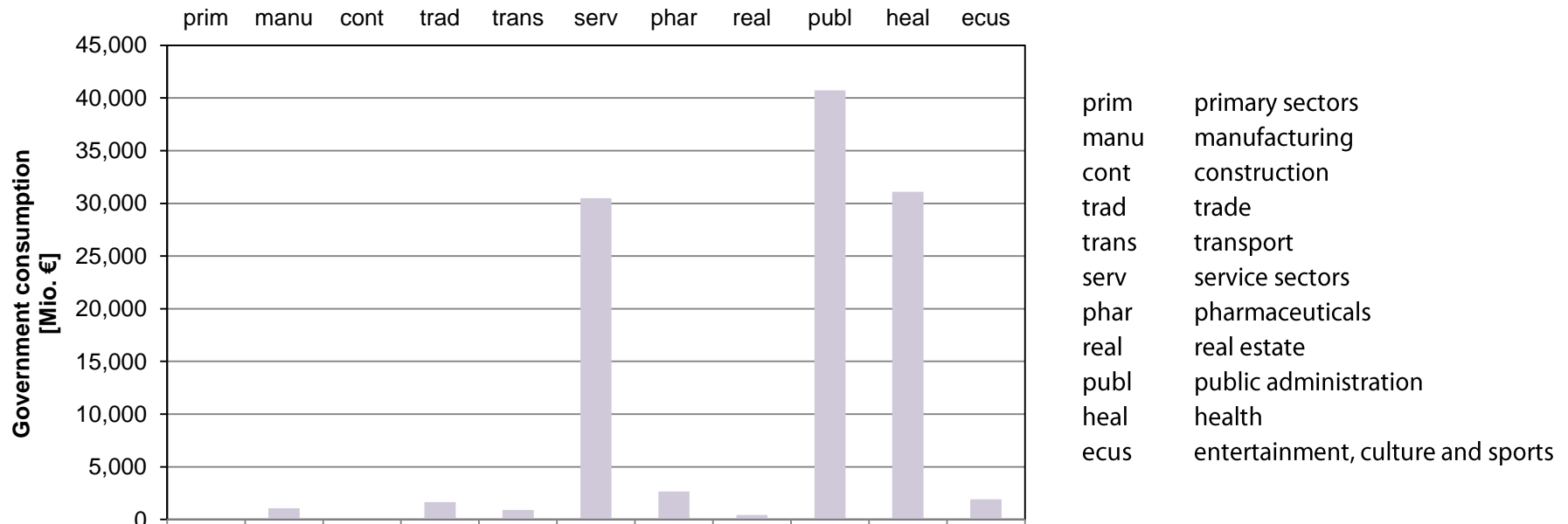
# Results



2050 (In Mio. € <sub>2008</sub> )	BL
<b>Government Revenues</b>	Baseline
Production tax	25,670
Labour tax	119,797
Capital tax	26,863
Value added tax	39,516
other taxes	14,140
CC induced foreign debt	0
<b>Total Government Revenue</b>	<b>225,986</b>
<b>Government Expenditures</b>	
Government consumption	123,054
Climate induced relief payments	297
Transfers to households	96,776
Unemployment benefits	5,859
<b>Total Government Expenditure</b>	<b>225,986</b>

Provision of public services

# Government consumption (Baseline 2050)



- Sectors *serv*, *publ* and *heal* are main expenditure items of government (i.e. provision of public services)
- Labor intensive
- Sum up to €123 bn. p.a.




2050 (In Mio. €<sub>2008</sub>) BL


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**Government Revenues** Baseline


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**Government Expenditures**


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Government consumption	123,054
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Allow increase of climate induced relief payments,  
but counterbalance consumption  
→ items should sum up to zero



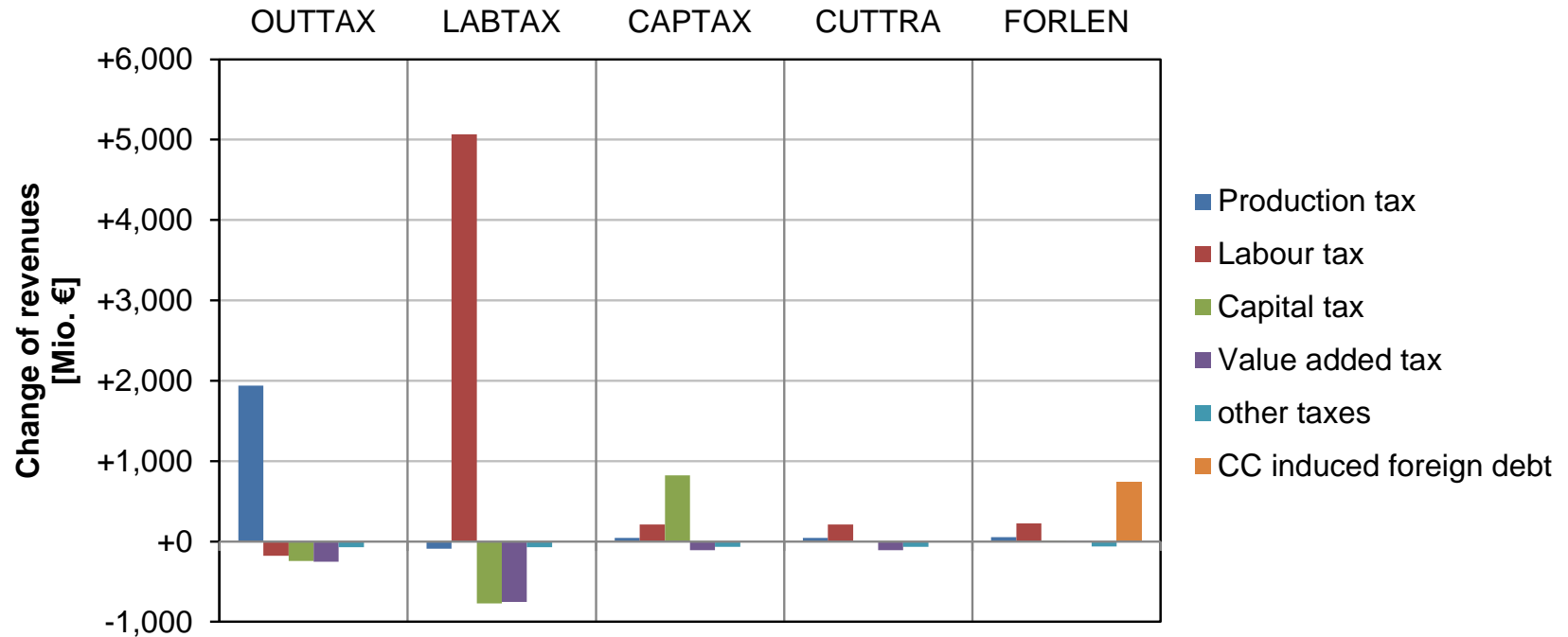
2050 (In Mio. € <sub>2008</sub> )	BL	ΔCC
<b>Government Revenues</b>	Baseline	NOCNTB
Production tax	25,670	-202
Labour tax	119,797	-468
Capital tax	26,863	-11
Value added tax	39,516	+54
other taxes	14,140	+43
CC induced foreign debt	0	+0
<b>Total Government Revenue</b>	<b>225,986</b>	<b>-584</b>
<b>Government Expenditures</b>		
Government consumption	123,054	-1750
Climate induced relief payments	297	+547
Transfers to households	96,776	+1
Unemployment benefits	5,859	+618
<b>Total Government Expenditure</b>	<b>225,986</b>	<b>-584</b>



2050 (In Mio. € <sub>2008</sub> )	BL	ΔCC	ΔCC	ΔCC	ΔCC	ΔCC	ΔCC
<b>Government Revenues</b>	Baseline	NOCNTB	OUTTAX	LABTAX	CAPTAX	CUTTRA	FORLEN
Production tax	25,670	-202	+1739	-294	-158	-157	-150
Labour tax	119,797	-468	-645	+4599	-255	-256	-244
Capital tax	26,863	-11	-252	-781	+813	-8	+1
Value added tax	39,516	+54	-196	-697	-54	-54	+59
other taxes	14,140	+43	-29	-27	-23	-23	-18
CC induced foreign debt	0	+0	+0	+0	+0	+0	+735
<b>Total Government Revenue</b>	<b>225,986</b>	<b>-584</b>	<b>+617</b>	<b>+2799</b>	<b>+324</b>	<b>-497</b>	<b>+383</b>
<b>Government Expenditures</b>							
Government consumption	123,054	-1750	-547	-547	-547	-547	-547
Climate induced relief payments	297	+547	+547	+547	+547	+547	+547
Transfers to households	96,776	+1	-34	+1	+1	-821	+3
Unemployment benefits	5,859	+618	+651	+2799	+323	+324	+380
<b>Total Government Expenditure</b>	<b>225,986</b>	<b>-584</b>	<b>+617</b>	<b>+2799</b>	<b>+324</b>	<b>-497</b>	<b>+383</b>

→ Compare balancing scenarios with no-counterbalancing (*NOCNTB*) to see effect of balancing instruments

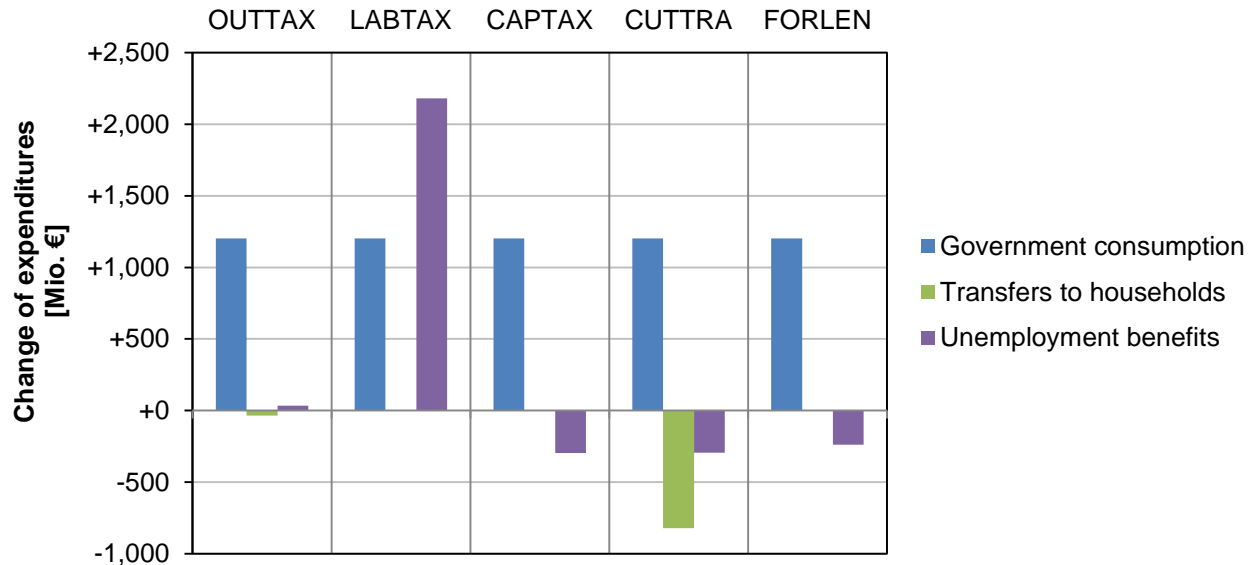
# Results: change in revenues relative to NOCNTB



What is necessary for counterbalancing?

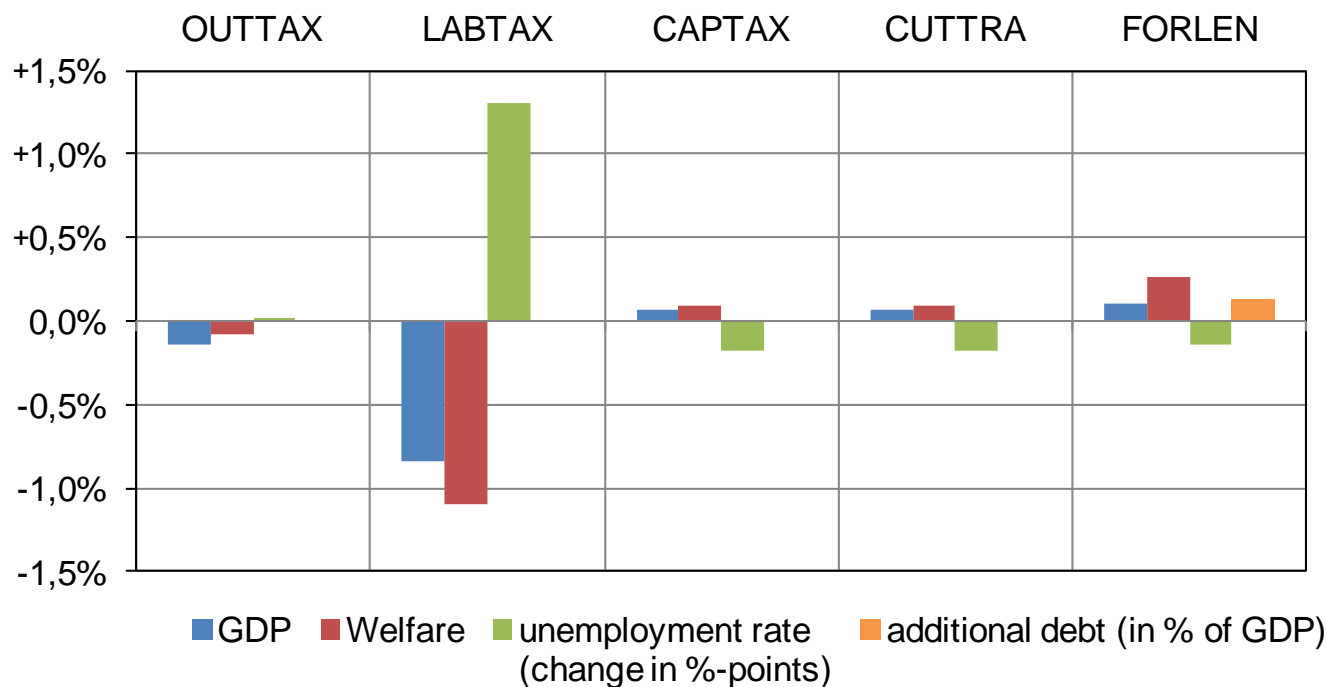
- OUTTAX: +0.2% on output tax rate
- LABTAX: +4.7% on labor tax rate
- CAPTAX: +0.5% on capital tax rate
- CUTTRA: cut in transfers by -0.8%
- FORLEN: annual additional debt by € 0.8 bn. (0.1% of GDP in 2050)

# Results: change in expenditure relative to NOCNTB



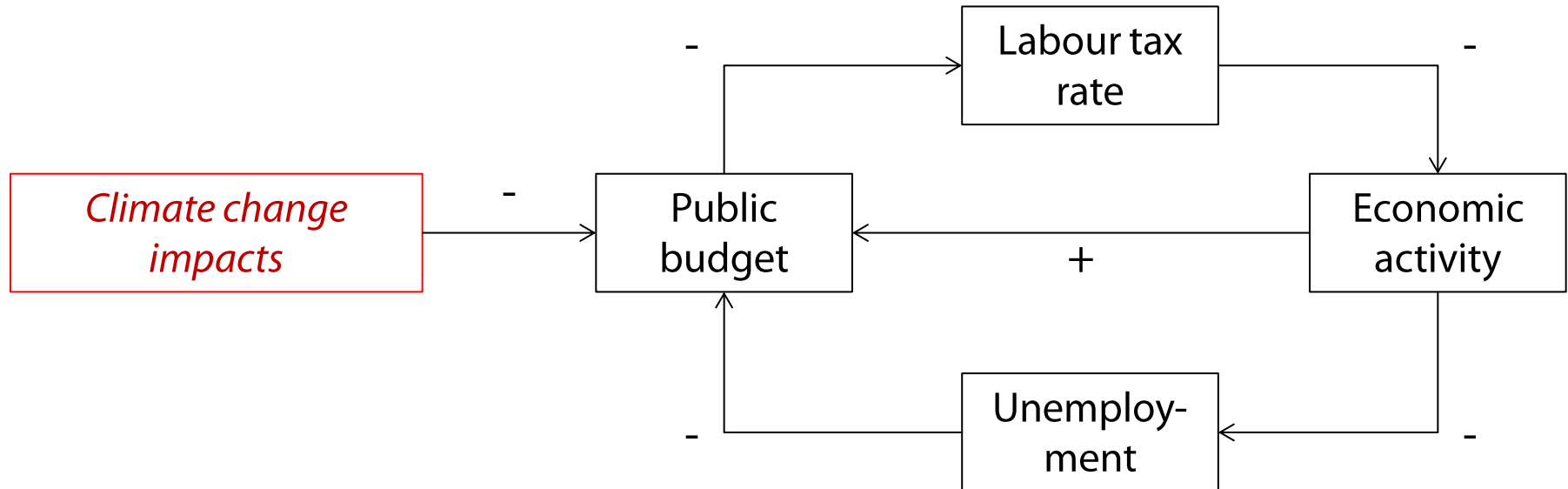
- Government consumption always increases by the same amount (this is exactly what we want to counterbalance)
- *OUTTAX*: opposing effects: positive employment effect (due to more demand for labor intensive public services) but at the same time economic activity goes down
- *LABTAX*: higher payments for unemployment benefits
- *CAPTAX*: higher taxes on capital → shift to more labor input in production → exp. for unemployment benefits decline
- *CUTTRA*: less transfer payments; since government now spends more for public services (which is more labor intensive than private consumption goods and services) we see positive effects on employment

# Results: macro indicators



	BL	ΔCC	ΔCC	ΔCC	ΔCC	ΔCC	ΔCC
	Baseline	NOCNTB	OUTTAX	LABTAX	CAPTAX	CUTTRA	FORLEN
GDP	554.771	-0,2%	-0,4%	-1,1%	-0,2%	-0,2%	-0,1%
welfare	412.291	-0,6%	-0,6%	-1,7%	-0,5%	-0,5%	-0,3%
unemployment rate (change in % points)	3,50%	+0,4%	+0,4%	+1,7%	+0,2%	+0,2%	+0,2%

# Results: macro indicators





# CONCLUSIONS



# Conclusions



- Counterbalancing budgetary effects may have positive or negative effects on macroeconomy
- Feedback loops may arise, amplifying mechanisms
- Change in government balance, does not indicate, whether the macro-effect is positive or negative
- Caveat: Distributional effects not captured



# Thank you!

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