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One EMU Fiscal Policy for the EURO

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Outline

Introduction - Motivation

In the past years, especially during the recent global crisis, **there has been a great discussion on the future of European economic integration and whether there is a need to increase fiscal policy coordination between Eurozone countries.**

Given a single monetary policy in the European Economic and Monetary Union (EMU), **country-specific shocks cannot be addressed through monetary policy, but must be balanced by country-specific fiscal policies.** Whether this calls for coordination or not is a much debated issue.

We analyze the gains from coordination, considering whether there is a scope for a fiscal capacity in the EMU to address asymmetric shocks to member countries.

Introduction - Strategy and Main Results

We build a Two-Country Open-Economy New-Keynesian DSGE model of a Currency Union to analyze the stabilization properties and the welfare implications of different scenarios for fiscal policy coordination in the EMU.

We find that:

- Coordinating fiscal policy, by targeting net exports rather than output, produces more stable dynamics.
- Consolidating government budget constraints across countries and moving tax rates jointly provides greater stabilization.
- Taxes on labour income are exponentially more distortionary than taxes on firm sales.

Introduction - Literature

Our analysis follows:

- **The Open Economy approach of Galí (2009)**, but in a two-country setting like in Silveira (2006).
- **The Currency Union setting of Ferrero (2009)**, where there are only distortionary taxes as sources of government revenue.
- **The Fiscal Policy setup of Hjortsø (2012)**, which uses targeting rules.

We add:

- **Home Bias in consumption** (or a degree of openness to international trade), to allow for deviations from Purchasing Power Parity.
- **Targeting Rules for fiscal policy**, which governments con use to coordinate.

Outline

Households

Each Household in country H, indexed by $i \in [0, h)$, seeks to **maximize the present-value utility**:

$$E_0 \sum_{t=0}^{\infty} \beta^t \xi_t \left[\frac{(C_t^i)^{1-\sigma} - 1}{1-\sigma} - \frac{(N_t^i)^{1+\varphi}}{1+\varphi} \right] \tag{2.1}$$

subject to the following sequence of budget constraints:

$$P_t C_t^i + D_t^i + B_t^i \leq \frac{D_{t-1}^i}{\mathcal{Q}_{t-1,t}} + B_{t-1}^i (1 + i_{t-1}) + (1 - \tau_t^w) W_t N_t^i + T_t^i + \Gamma_t^i \tag{2.2}$$

where $\beta \in [0, 1]$ is the common discount factor, ξ_t is a preference shock, N_t^i denotes hours of labour supplied and C_t^i is a **composite index for private consumption** defined by:

$$C_t^i \equiv \left[(1-\alpha)^{\frac{1}{\eta}} (C_{H,t}^i)^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}} (C_{F,t}^i)^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}} \tag{2.3}$$

If $1 - \alpha > h$ there is **home bias** in consumption in country H, because the **share of consumption** of domestic goods **is greater than the share of production** of domestic goods. More Details

International Assumptions and Risk-Sharing

The **terms of trade** are defined as the price of foreign goods in terms of home goods:

$$\mathcal{S}_t \equiv \frac{P_{F,t}}{P_{H,t}} \tag{2.4}$$

Although deviations from *Purchasing Power Parity (PPP)* may arise because of home bias in consumption, we assume that the **Law of One Price (LOP)** holds for every single good j:

$$P_{H,t}(j) = P^*_{F,t}(j) \qquad \text{and} \qquad P_{F,t}(j) = P^*_{H,t}(j) \tag{2.5}$$

The no-arbitrage condition in financial markets and the assumption of complete markets implies an **international risk-sharing** condition, which, by assuming symmetric initial conditions, reads:

$$C_t = \frac{h}{1-h}\left[\frac{\xi_t}{\xi^*_t}\mathcal{S}_t\left(\frac{1-\alpha^*+\alpha^*(\mathcal{S}_t)^{\eta-1}}{1-\alpha+\alpha(\mathcal{S}_t)^{1-\eta}}\right)^{\frac{1}{1-\eta}}\right]^{\frac{1}{\sigma}} C^*_t \tag{2.6}$$

More Details

Firms

In country H there is a continuum of Firms indexed by $j \in [0, h)$, each producing a differentiated good with the same technology represented by the following **production function**:

$$Y_t(j) = A_t N_t(j) \tag{2.7}$$

where A_t represents the country-specific **level of technology**.

Firm j's **period t profits net of taxes** in country H are given by:

$$\Gamma_t(j) = (1 - \tau_t^s) P_{H,t}(j) Y_t(j) - W_t N_t(j) \tag{2.8}$$

where τ_t^s is the marginal **tax rate on firm sales**.

- Following Calvo (1983), **each firm may reset its price with probability** $1-\theta$ **in any given period**.
- The **average duration of a price** is given by $(1-\theta)^{-1}$
- θ can be seen as a natural **index of price stickiness** for country H.
- The index of **price stickiness in the two countries can differ**: $\theta \neq \theta^*$

More Details

Central Bank and Monetary Policy

Monetary policy follows an **Inflation Targeting regime** of the kind:

$$\beta(1+i_t) = \left(\frac{\Pi_t^U}{\Pi^U}\right)^{\phi_\pi(1-\rho_i)} [\beta(1+i_{t-1})]^{\rho_i} \tag{2.9}$$

where **union-wide inflation** is defined as the population-weighted geometric average of the CPI inflations in the two countries:

$$\Pi_t^U \equiv (\Pi_t)^h (\Pi_t^*)^{1-h} \tag{2.10}$$

and where ϕ_π represents the **responsiveness of the interest rate to inflation** and ρ_i is a measure of the persistence of the interest rate over time (interest rate smoothing).

Government and Fiscal Policy

In country H **the government finances a stream of public consumption** G_t **and transfers** T_t **subject to the following sequence of budget constraints**:

$$P_{H,t}G_t + T_t + i_{t-1}B^G_{t-1} = \tau^s_t P_{H,t}Y_t + \tau^w_t W_t N_t + B^G_t - B^G_{t-1} \qquad (2.11)$$

- B^G_t is overall **nominal government debt** in country H
- **the left hand side represents current government expenditure and interest payments on outstanding debt**.
- **the right hand side represents government financing of that expenditure** through taxes and the possible variation of government debt.

Government consumption is characterized by complete home bias.

Fiscal Policy in a Pure Currency Union

Government consumption stabilizes the output gap countercyclically:

$$\frac{G_t}{G} = \left(\frac{Y_t}{Y}\right)^{-\psi_y(1-\rho_g)} \left(\frac{G_{t-1}}{G}\right)^{\rho_g} e^{\varepsilon_t} \tag{2.12}$$

while **keeping real transfers constant and balancing the budget**.

Fiscal policy is financed by the variation of the tax rates on labour income and firm sales from their steady state levels respectively by a share $\gamma \in [0,1]$ **and** $1-\gamma$ through the following rule:

$$\gamma(\tau_t^s - \tau^s) = (1-\gamma)(\tau_t^w - \tau^w) \tag{2.13}$$

Fiscal Policy in a Coordinated Currency Union

Government consumption stabilizes its real net exports gap procyclically:

$$\frac{G_t}{G} = \left(\frac{\widetilde{NX}_t}{\widetilde{NX}}\right)^{\psi_{nx}(1-\rho_g)} \left(\frac{G_{t-1}}{G}\right)^{\rho_g} e^{\varepsilon_t} \tag{2.14}$$

while **keeping real transfers constant and balancing the budget**.

Fiscal policy is financed by the variation of the tax rates on labour income and firm sales from their steady state levels respectively by a share $\gamma \in [0,1]$ **and** $1-\gamma$ through the following rule:

$$\gamma(\tau_t^s - \tau^s) = (1-\gamma)(\tau_t^w - \tau^w) \tag{2.15}$$

Full Fiscal Union

A Full Fiscal Union **uses local government spending to manage fiscal policy at the union level with a consolidated budget constraint**:

$$P_{H,t}G_t + P^*_{H,t}G^*_t + T_t + T^*_t + \mathcal{B}^G_{t-1}(1+i_{t-1}) = \mathcal{B}^G_t + \tau^s_t P_{H,t}Y_t + \tau^{*s}_t P^*_{H,t}Y^*_t + \tau^w_t W_t N_t + \tau^{*w}_t W^*_t N^*_t \quad (2.16)$$

where $\mathcal{B}^G_t$ is **overall nominal government debt at time t, defined by the sum of the government debts** of countries H and F:

$$\mathcal{B}^G_t \equiv B^G_t + B^{*G}_t \quad (2.17)$$

Fiscal Policy in a Full Fiscal Union

Government consumption in each country stabilizes its real net exports gap procyclically:

$$\frac{G_t}{G} = \left(\frac{\widetilde{NX}_t}{\widetilde{NX}}\right)^{\psi_{nx}(1-\rho_g)} \left(\frac{G_{t-1}}{G}\right)^{\rho_g} e^{\varepsilon_t} \tag{2.18}$$

while **keeping real transfers constant in each country and balancing the overall budget**.

Fiscal policy is financed by the variation of the tax rates on labour income and firm sales from their steady state levels respectively by a share $\gamma \in [0,1]$ and $1-\gamma$ in each country:

$$\gamma(\tau_t^s - \tau^s) = (1-\gamma)(\tau_t^w - \tau^w) \tag{2.19}$$

while **distributing equally among the two countries the cost of fiscal policy by varying jointly the tax rates**:

$$\tau_t^{*s} - \tau^{*s} = \tau_t^s - \tau^s \qquad \tau_t^{*w} - \tau^{*w} = \tau_t^w - \tau^w \tag{2.20}$$

Outline

Calibration - Structure

Following Ferrero (2009), **we consider the top 5 Eurozone countries, which account for more than 80% of Eurozone GDP** and we divide them into:

1. **Country F**, the periphery (namely **France, Italy, Spain and The Netherlands**)
2. **Country H**, the core (namely **Germany**)

As in Ferrero (2009) **most of the parameters are set symmetrically**, except for:

- **The size of country H** is set to $h = 0.4$ (35% of Eurozone GDP).
- **The degree of price rigidity is different** and such that the average duration of a price is 4 quarters in country H and 5 quarters in country F.
- **The openness to international trade is different**, so that country H has a higher degree of openness compared to country F.

In the calibration we set $\eta > \frac{1}{\sigma}$, so that C_H **and** C_F **are substitutes** and hence the substitution effect of a price change dominates the income effect, but we also consider the case in which they are complements, as a sensitivity analysis for the effects of fiscal policy. More Details

Outline

Welfare Costs based on Consumption Equivalent Variations

To compare welfare attained under alternative fiscal policy scenarios **we rely on the expectation of lifetime utility conditional on the initial state** being the non-stochastic steady state.

We compute the welfare cost, λ, of a particular fiscal policy scenario **relative to the Pure Currency Union scenario with exogenous government consumption**, as the percentage decrease in the benchmark scenario's expected consumption that leaves the representative household as well off as in the alternative scenario.

Table: Optimal Fiscal Policy Parameters and Welfare Costs based on CEV

Policy Scenarios	Optimal Parameters*		Conditional Welfare Costs		
	ψ	ψ^*	Country H	Country F	Average
PCU (exogenous)	0	0	0%	0%	0%
PCU	0.067	0.061	0.32%	0.27%	0.29%
CCU	0.043	0.014	0.01%	0.28%	0.17%
FFU	0.043	0.014	-0.02%	0.32%	0.19%
FFU (exogenous)	0	0	0.48%	0.33%	0.39%

* The optimal parameters have been selected by maximizing the unconditional expectation of lifetime utility.

More Details

Welfare Gains based on an ad hoc Loss Function

Blanchard, Erceg and Lindé (2015) argues that **utility-based welfare measures probably underestimate the benefits of reducing the output gap in economies facing a high resource slack** (negative net exports), as in the Euro Area periphery.

Using a standard quadratic loss function, **the policymakers are assumed to care only about minimizing the square of the output gap and of the inflation gap in both regions**.

Table: Welfare Gains based on an ad hoc Loss Function

Policy Scenarios	Losses			Welfare Gains*		
	Country H	Country F	Average	Country H	Country F	Average
PCU (exogenous)	0.2207	0.1832	0.1982	0	0	0
PCU	8.6143	7.3293	7.8433	-3803%	-3900%	-3857%
CCU	0.0085	0.0046	0.0062	96.16%	97.46%	96.88%
FFU	0.0054	0.0028	0.0038	97.57%	98.47%	98.07%
FFU (exogenous)	0.0043	0.0026	0.0033	98.03%	98.56%	98.32%

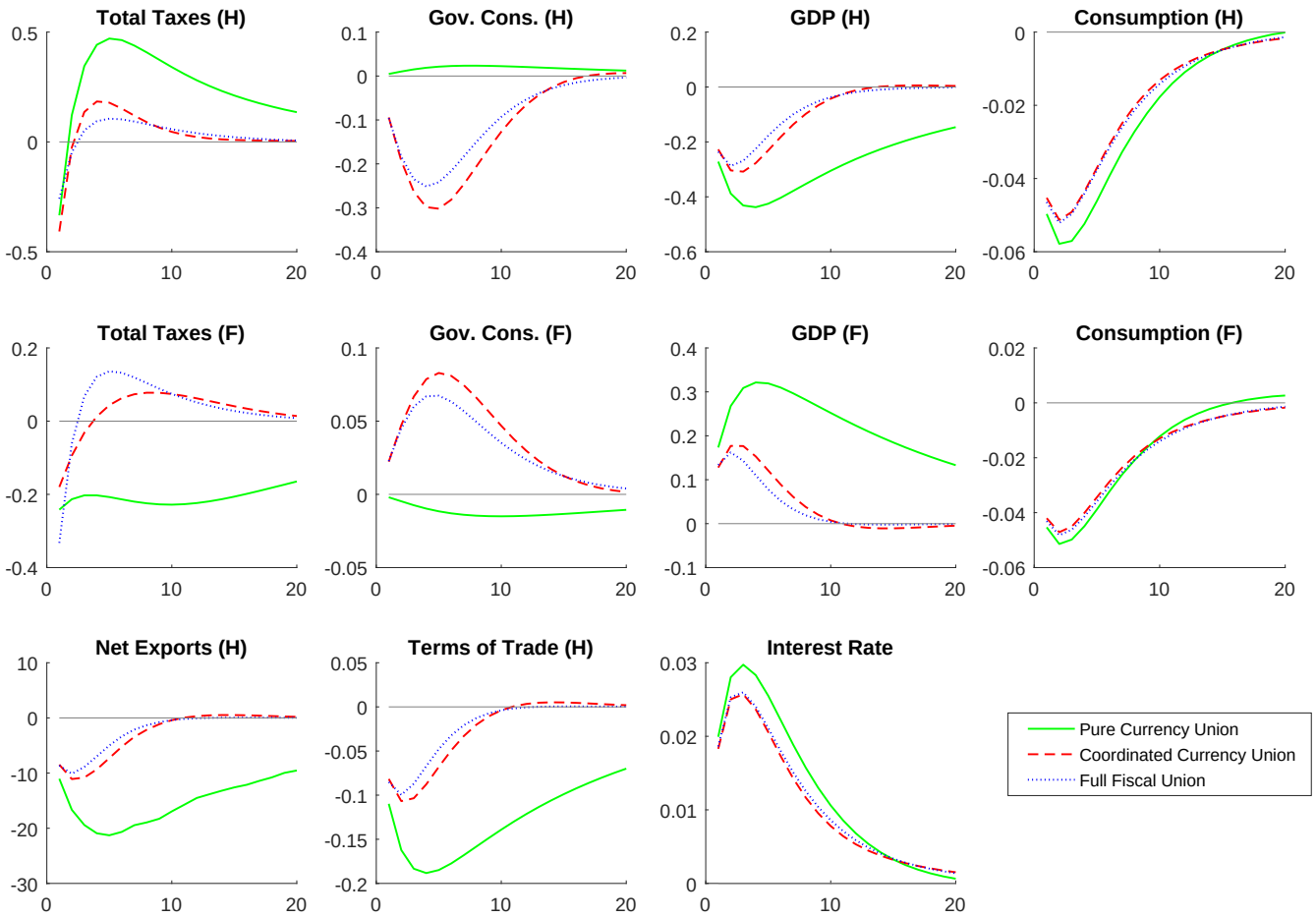
* Welfare Gains are computed as $\frac{Loss_b - Loss_a}{Loss_b}$, with $Loss_b$ the loss in the PCU with $\psi = \psi^* = 0$.

The gains from fiscal spillovers between the core and the periphery lie between the ones based on consumption equivalent variations and the ones based on an ad hoc loss function. More Details

Outline

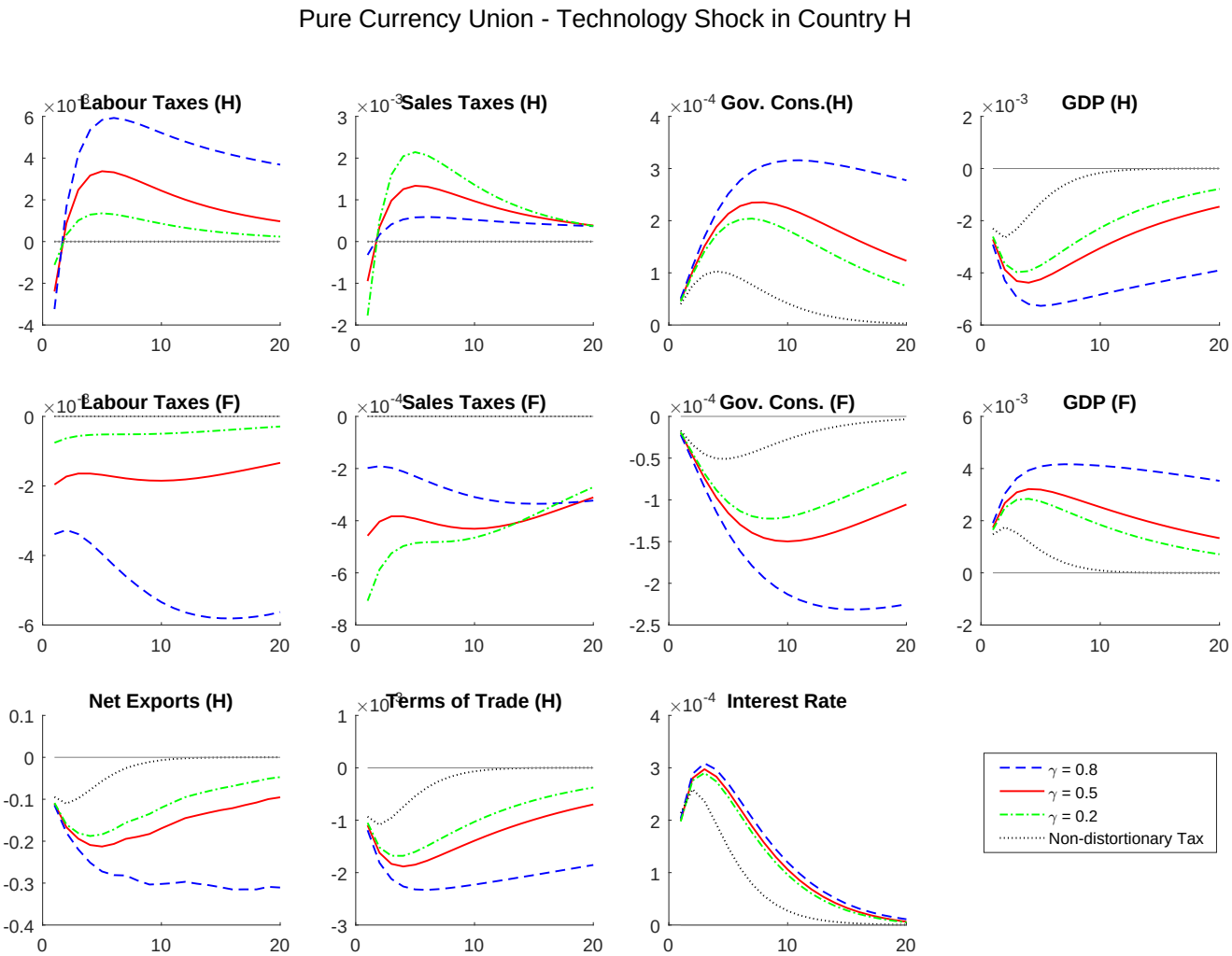
Fiscal Policy Coordination - Technology Shock Country H

Mix of Tax on Wage and on Sales ($\gamma = 0.5$) - Technology Shock in Country H



More Details | Preference Shock Country F | Targets for Coordination

Financing Fiscal Policy - Pure Currency Union



Full Fiscal Union | Laffer Curve

Outline

Conclusions and Possible Extensions

Conclusions:

- **Coordinating fiscal policy** by targeting the net exports gap **produces much more stabilization** than targeting the output gap.
- **Consolidating budget constraints yields the most stabilized dynamics** through the joint adjustment of the tax rates.
- **Taxes on labour income are exponentially more distortionary than taxes on firm sales**.
- **If the international goods are complements**, instead of substitutes, **most of the effects are reversed**, but the Full Fiscal Union scenario is still more stabilizing than the Coordinated Currency Union scenario. More Details

Possible Extensions:

- **Incomplete international financial markets** create richer dynamics.
- **The Zero Lower Bound**: by constraining monetary policy, fiscal policy is more effective.

The End

Thank you for your attention!

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Outline

Households

$C^i_{H,t}$ is an **index of consumption of domestic goods** given by:

$$C^i_{H,t} \equiv \left(\left(\frac{1}{h} \right)^{\frac{1}{\varepsilon}} \int_0^h C^i_{H,t}(j)^{\frac{\varepsilon-1}{\varepsilon}} \, dj \right)^{\frac{\varepsilon}{\varepsilon-1}} \tag{8.1}$$

$C^i_{F,t}$ is an **index of consumption of imported goods** given by:

$$C^i_{F,t} \equiv \left(\left(\frac{1}{1-h} \right)^{\frac{1}{\varepsilon}} \int_h^1 C^i_{F,t}(j)^{\frac{\varepsilon-1}{\varepsilon}} \, dj \right)^{\frac{\varepsilon}{\varepsilon-1}} \tag{8.2}$$

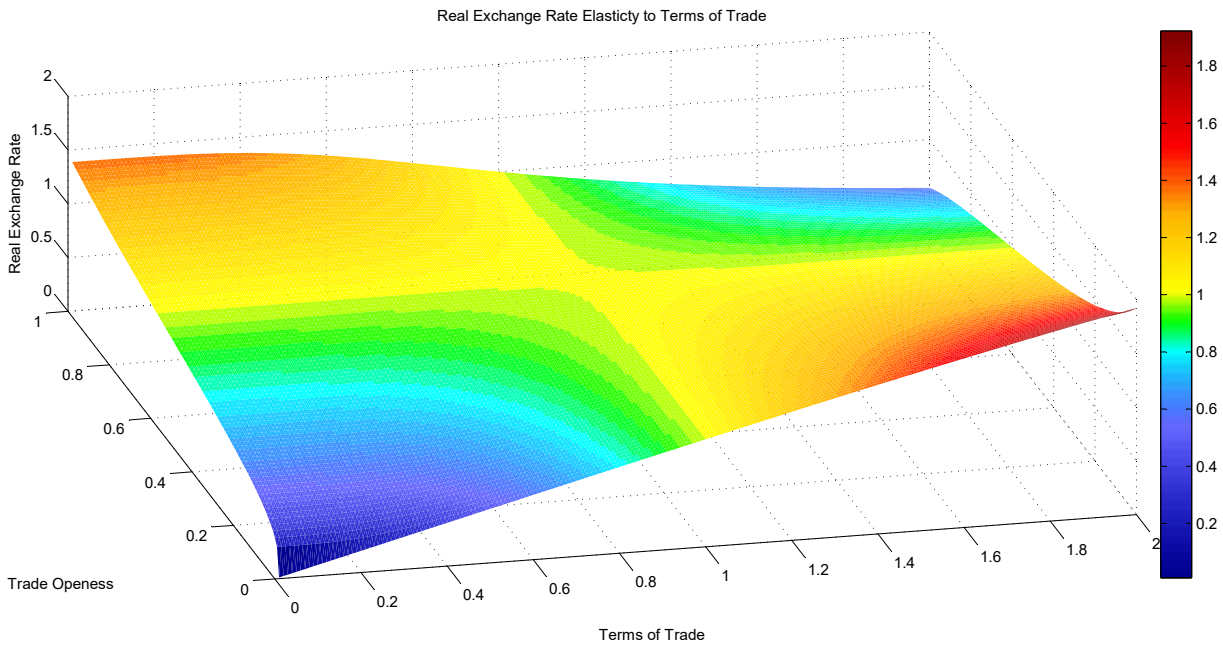
- $\varepsilon > 1$ measures the **elasticity of substitution between varieties** produced within a given country.
- $\eta > 0$ measures the **substitutability between domestic and foreign goods**.
- $\alpha \in [0, 1]$ is a measure of **openness of the economy to international trade**.
- $(1 - \alpha)$ is a measure of the degree of **home bias** in consumption.

Households

- P_t is the **CPI**, which depends on the PPIs and on home bias.
- D_t^i is the portfolio of **state-contingent claims**.
- B_t^i are risk-free **government bonds** (of either or both governments).
- $\mathcal{Q}_{t-1,t}$ is the **stochastic discount factor**.
- i_{t-1} is the **nominal interest rate** set by the central bank.
- W_t is the **nominal wage**.
- $\tau_t^w \in [0,1]$ is a marginal **tax rate on labour income** paid to the government.
- T_t^i denotes **lump-sum transfers** from the government.
- Γ_t^i denotes the share of **profits net of taxes** from ownership of firms.

Back to Households

Elasticity of Real Exchange Rate to Terms of Trade



Both home biases are larger than one. This implies that **the real exchange rate increases as the terms of trade increase if the degree of openness of country H is less than the size of country F** $(1 - h = 0.6)$, which is the case for our calibration $(\alpha = 0.52)$.

Net Exports and the Balance of Payments

Net Exports for country H are given by:

$$NX_t \equiv P_{H,t} Y_t - P_t C_t - P_{H,t} G_t \tag{8.3}$$

Net Foreign Assets for country H are given by:

$$NFA_t \equiv D_t + B_t - B_t^G \tag{8.4}$$

The **Balance of Payments** for country H is given by:

$$BP_t \equiv NX_t + i_{t-1} NFA_{t-1} \tag{8.5}$$

so that **Net Foreign Assets for country H evolve according to**:

$$NFA_t = (1 + i_{t-1}) NFA_{t-1} + NX_t = NFA_{t-1} + BP_t \tag{8.6}$$

Back to International Assumptions and Risk-Sharing

Firms

A firm in country H re-optimizing in period t will **choose the price $\bar{P}_{H,t}$ that maximizes the current market value of the profits generated while that price remains effective**, formally solving the problem:

$$\max_{\bar{P}_{H,t}} \sum_{k=0}^{\infty} \theta^k E_t \left\{ \mathcal{Q}_{t,t+k} Y_{t+k|t}(j) \left[(1 - \tau^s_{t+k}) \bar{P}_{H,t} - MC^n_{t+k} \right] \right\} \tag{8.7}$$

where $\mathcal{Q}_{t,t+k}$ is the **household's stochastic discount factor**.

One can then express the **optimal price chosen by firms** in country H as a function of only aggregate variables:

$$\bar{P}_{H,t} = \frac{\varepsilon}{\varepsilon - 1} \frac{\sum_{k=0}^{\infty} (\beta\theta)^k E_t \left\{ \frac{\xi_{t+k} (C_{t+k})^{-\sigma}}{P_{t+k}} \frac{Y_{t+k}}{(P_{H,t+k})^{-\varepsilon}} MC^n_{t+k} \right\}}{\sum_{k=0}^{\infty} (\beta\theta)^k E_t \left\{ \frac{\xi_{t+k} (C_{t+k})^{-\sigma}}{P_{t+k}} \frac{Y_{t+k}}{(P_{H,t+k})^{-\varepsilon}} (1 - \tau^s_{t+k}) \right\}} \tag{8.8}$$

Back to Firms

Calibration - Fiscal Policy

The calibration of the two countries mainly differs in the fiscal policy parameters.

- **The government consumption-to-GDP ratios** have been set respectively to 18.7% for country H and 21.9% for country F.
- **The marginal tax rates on labour income** have been set respectively to 40.61% for country H and to 27.94% for country F.
- **The marginal tax rate on firm sales** has been set to 19.5% for country F and to match then ratio of net exports to GDP of 1.73% for country H.
- **The transfers-to-GDP ratios** have been set, such that the government deficit is zero, to respectively 18.58% for country H and 16.81% for country F.

The parameters of openness have been set to match an export-to-GDP ratio of roughly 43% for country H, and by equating per-capita consumption across countries for country F:

$$\alpha^* = \frac{h}{1-h}\left[\alpha + \frac{\left(\frac{1-\frac{G}{Y}}{1-\frac{G^*}{Y^*}}\right)\left(\frac{(1-\tau^w)(1-\tau^s)}{(1-\tau^{*w})(1-\tau^{*s})}\right)^{\frac{1}{\varphi}} - 1}{1 + \frac{h}{1-h}\left(\frac{1-\frac{G}{Y}}{1-\frac{G^*}{Y^*}}\right)\left(\frac{(1-\tau^w)(1-\tau^s)}{(1-\tau^{*w})(1-\tau^{*s})}\right)^{\frac{1}{\varphi}}}\right] \tag{8.9}$$

Back to Calibration

Welfare Analysis and Optimal Policy Parameters

The optimal fiscal parameters have been selected to maximize the unconditional expectation of lifetime utility of the total population of households.

As a measure of welfare **we consider the weighted average of the second order approximation of the utility of households** in each country given by:

$$\widetilde{W}_t = hW_t + (1-h)W_t^* \tag{8.10}$$

where:

$$W_t = \xi_t \left(\frac{\left(\frac{C_t}{h}\right)^{1-\sigma} - 1}{1-\sigma} - \frac{\left(\frac{Y_t d_t}{A_t h}\right)^{1+\varphi}}{1+\varphi} \right) + \beta W_{t+1} \tag{8.11}$$

Therefore λ **can be recovered from** the following identity:

$$E\{W_a\} = \frac{\xi_b}{(1-\beta)} \left(\frac{\left(\frac{(1-\lambda)C_b}{h}\right)^{1-\sigma} - 1}{1-\sigma} - \frac{\left(\frac{Y_b d_b}{A_b h}\right)^{1+\varphi}}{1+\varphi} \right) \tag{8.12}$$

Back to Welfare Analysis

Welfare Gains based on an ad hoc Loss Function

The utility-based welfare measure shows less benefits from fiscal expansions than a simple ad hoc welfare measure because net exports play a substantial role in reducing the periphery's output gap and the increase in consumption in the periphery is delayed so that it has very small welfare effects.

Since **fiscal policy has a stabilizing function**, it mimics the behavior of monetary policy, and together they reduce both the inflation gap and the output gap.

The overall loss function is the weighted average of each region's loss function:

$$Loss = \sum_{j=0}^{\infty} \beta^j \left\{ h \left[(\hat{\pi}_{t+j})^2 + \frac{1}{3}(\hat{Y}_{t+j})^2 \right] + (1-h) \left[(\hat{\pi}^*_{t+j})^2 + \frac{1}{3}(\hat{Y}^*_{t+j})^2 \right] \right\} \quad (8.13)$$

Back to Welfare Analysis

Numerical Simulations

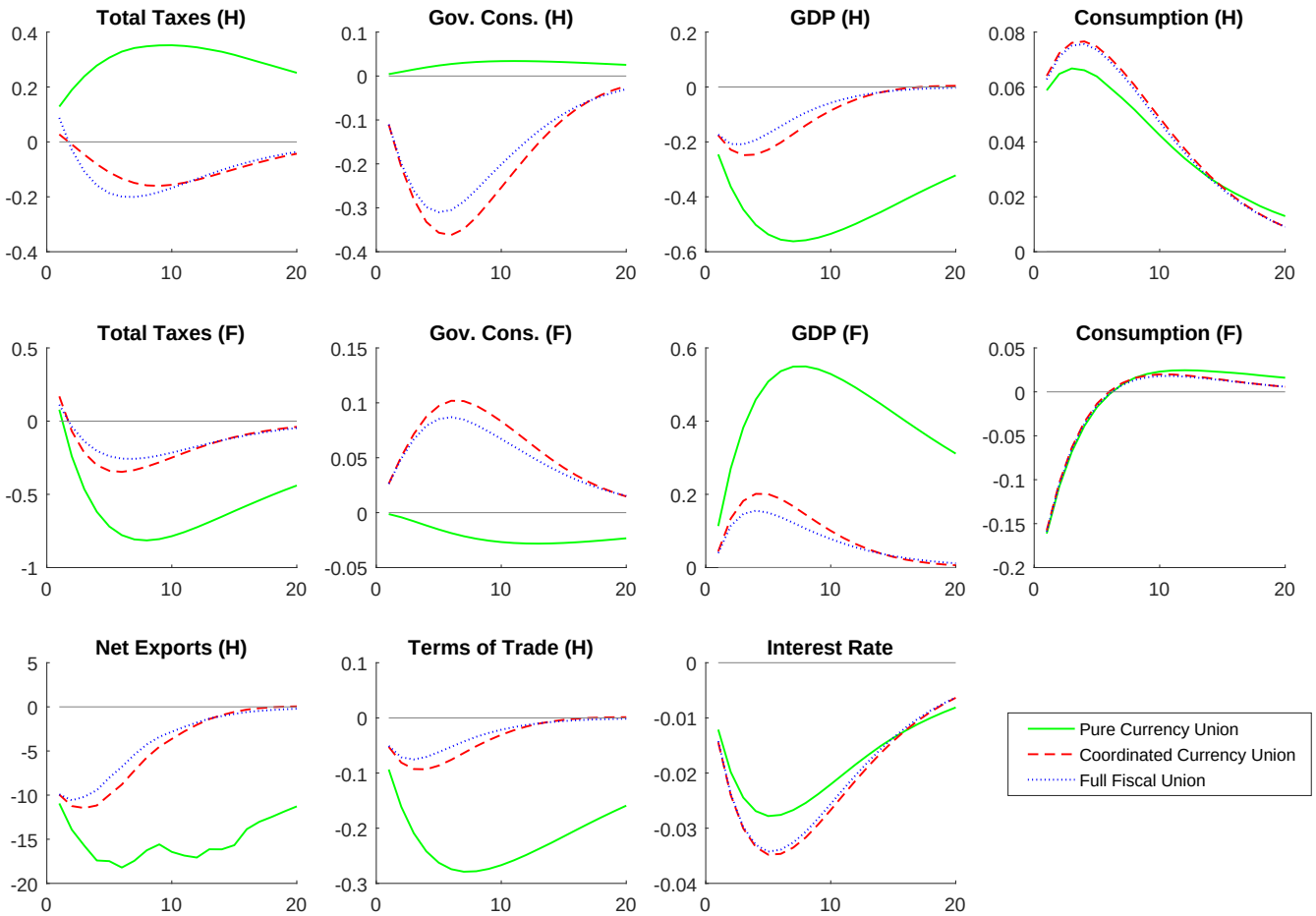
We simulate the model numerically using Dynare, which takes a second-order approximation of the model **around its symmetric non-stochastic steady-state with zero inflation and constant government debt**.

- **We study the stabilization properties of different financing schemes and coordination strategies**.
- **We study the international transmission of shocks**.
- We compare impulse responses to a **negative technology shock in country H**.
- And impulse responses to a **negative preference shock in country F**.
- A supply shock is more relevant in a country like **Germany** (country H), which **is a main producer and exporter of goods and services** in the EMU.
- A demand shock is more relevant for **periphery countries** (country F), which **are mainly consumers and importers** in the EMU.

Back to Numerical Simulations

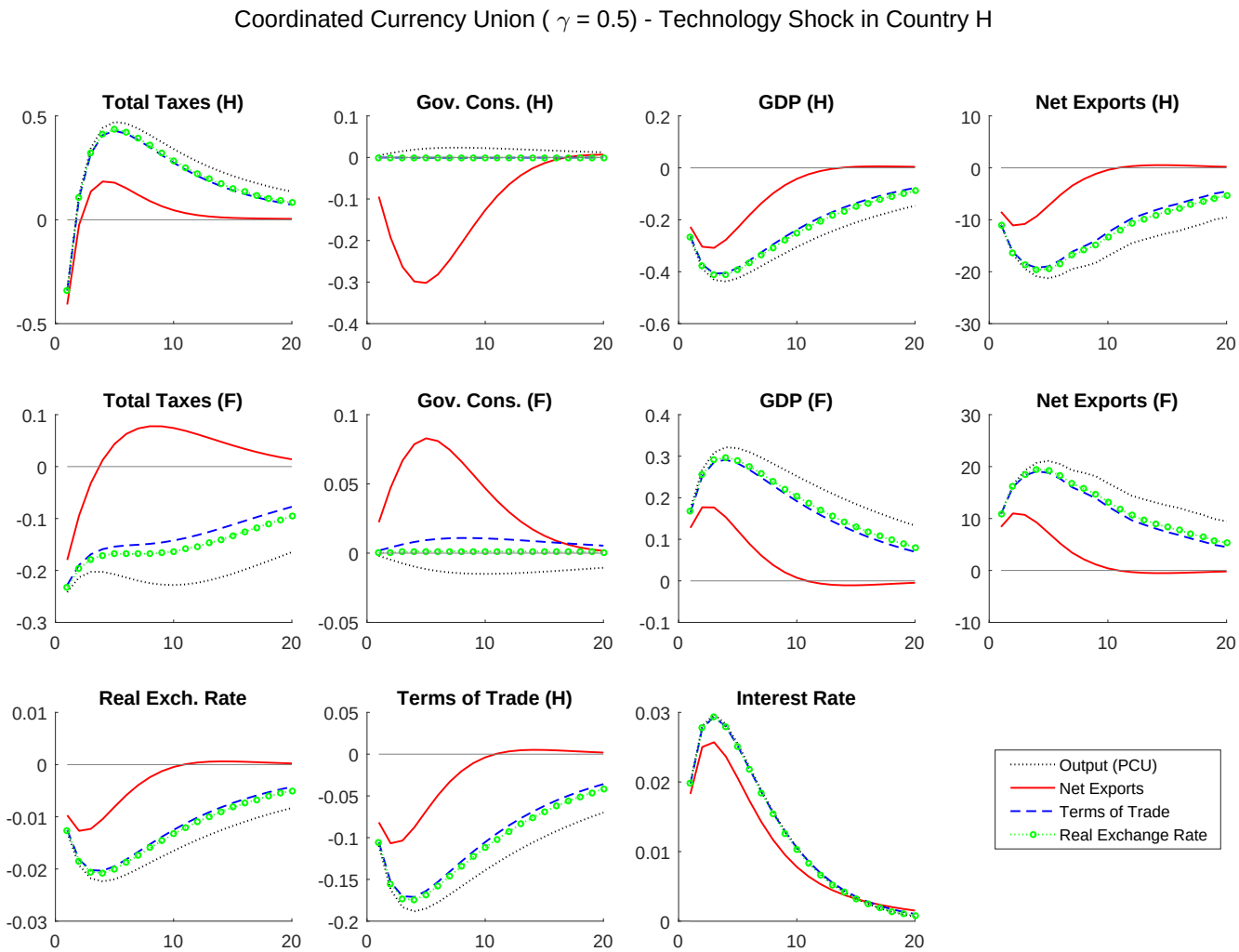
Fiscal Policy Coordination - Preference Shock Country F

Mix of Tax on Wage and on Sales ($\gamma = 0.5$) - Preference Shock in Country F



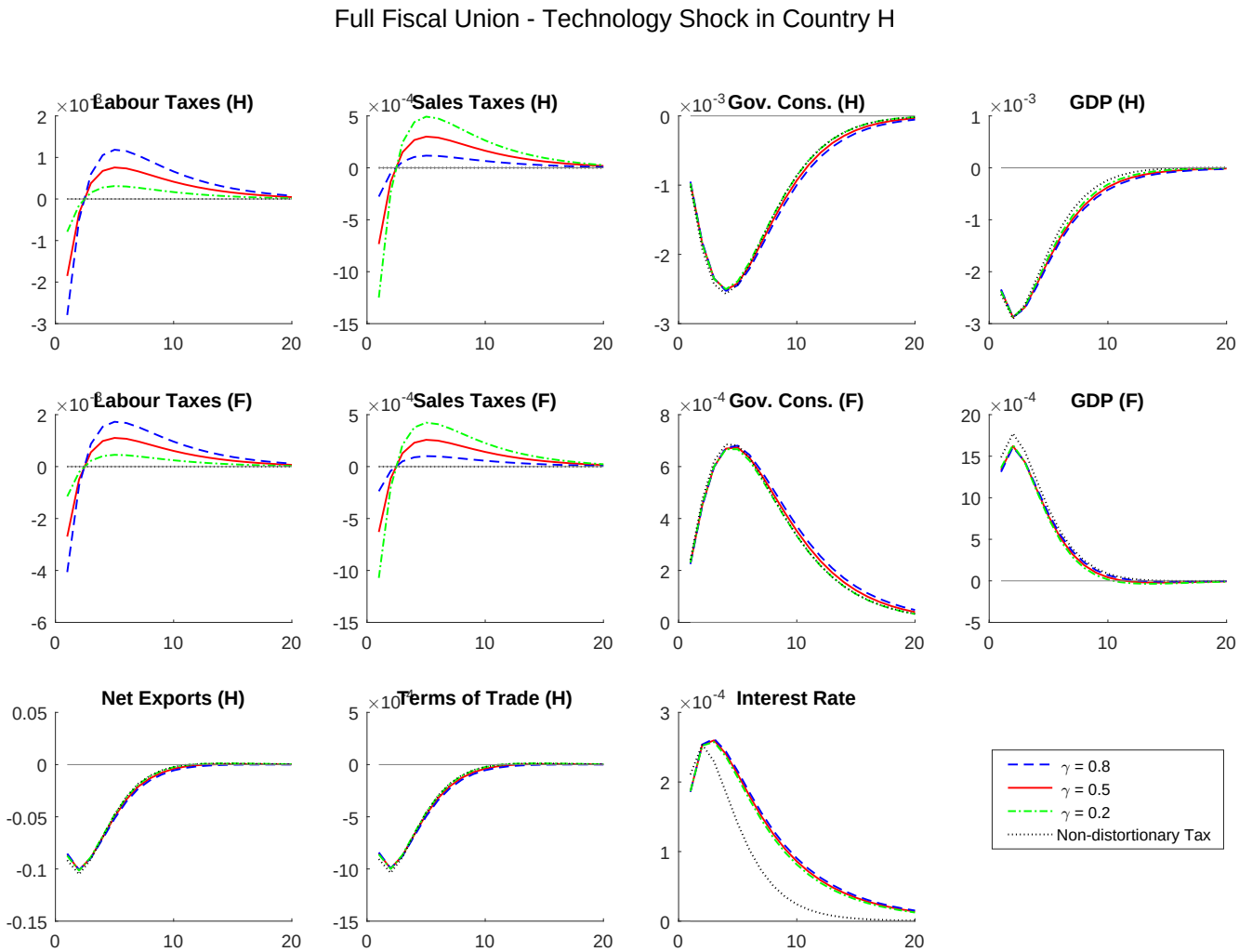
Back to Technology Shock Country H

Targets for Coordination - Technology Shock in Country H



Back to Technology Shock Country H

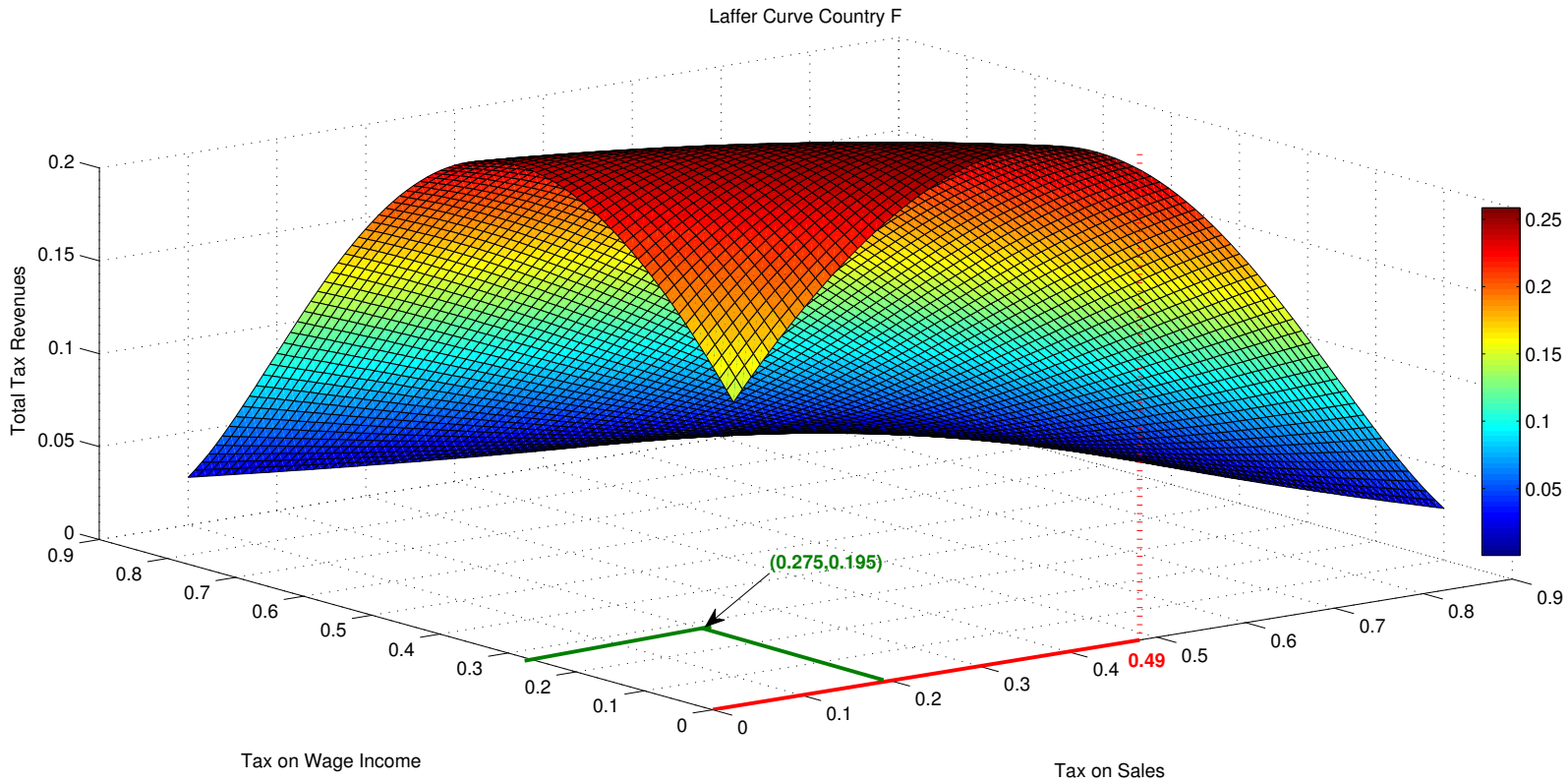
Financing Fiscal Policy - Full Fiscal Union



Back to Pure Currency Union

Laffer Curve for Country F

The following figure shows the tax rates on labour income and firm sales that maximize overall tax revenues in country F in red, while the calibrated tax rates on labour income and firm sales are shown in green.



Back to Financing Fiscal Policy

The Case for International Goods as Complements

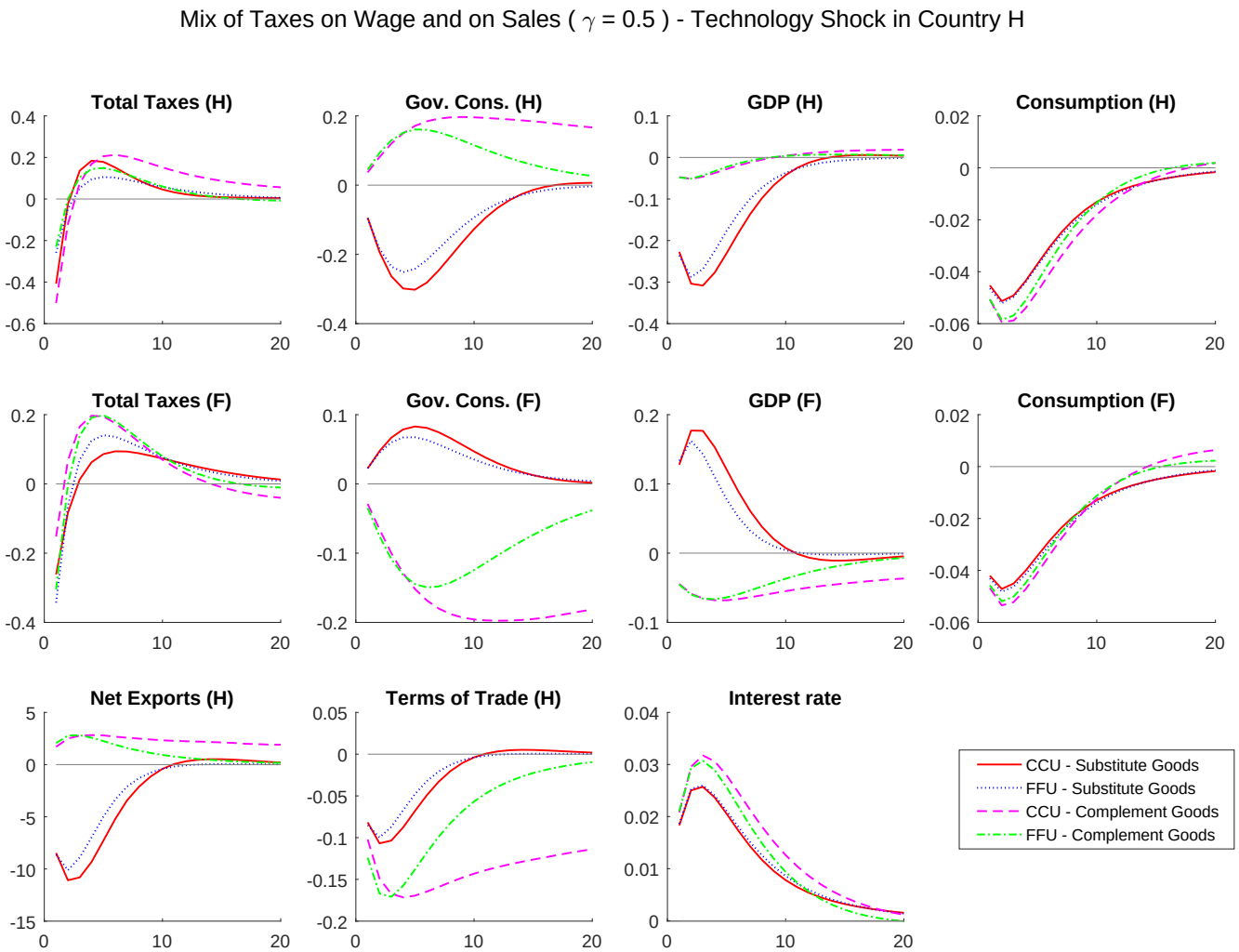
Consolidating budget constraints partially offsets the amplification effect due to the stabilization of net exports, which is why **the Full Fiscal Union scenario**, despite being less stabilizing than the Pure Currency Union scenario, **has a lower cost in terms of the ad hoc loss function than the Coordinated Currency Union scenario**:

Table: Welfare Gains based on an ad hoc Loss Function - Complements

Policy Scenarios	Losses			Welfare Gains*		
	Country H	Country F	Average	Country H	Country F	Average
PCU (exogenous)	0.0727	0.0634	0.0671	0%	0%	0%
PCU	0.0727	0.0630	0.0669	0%	0.63%	0.36%
CCU	0.1249	0.2479	0.1987	-71.80%	-291.01%	-196.04%
FFU	0.0812	0.1034	0.0945	-11.69%	-63.09%	-40.82%
FFU (exogenous)	0.0858	0.0723	0.0777	-18.02%	-14.04%	-15.76%

* Welfare Gains are computed as $\frac{Loss_b - Loss_a}{Loss_b}$, with $Loss_b$ the loss in the PCU with $\psi = \psi^* = 0$.

Substitutes vs Complements - Tech. Shock Country H



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