BANK FOR INTERNATIONAL SETTLEMENTS

The International Dimensions of Macroprudential Policies

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Motivation .

- Macroprudential tools are gaining acceptance as important tool to tame excess volatility due to financial factors

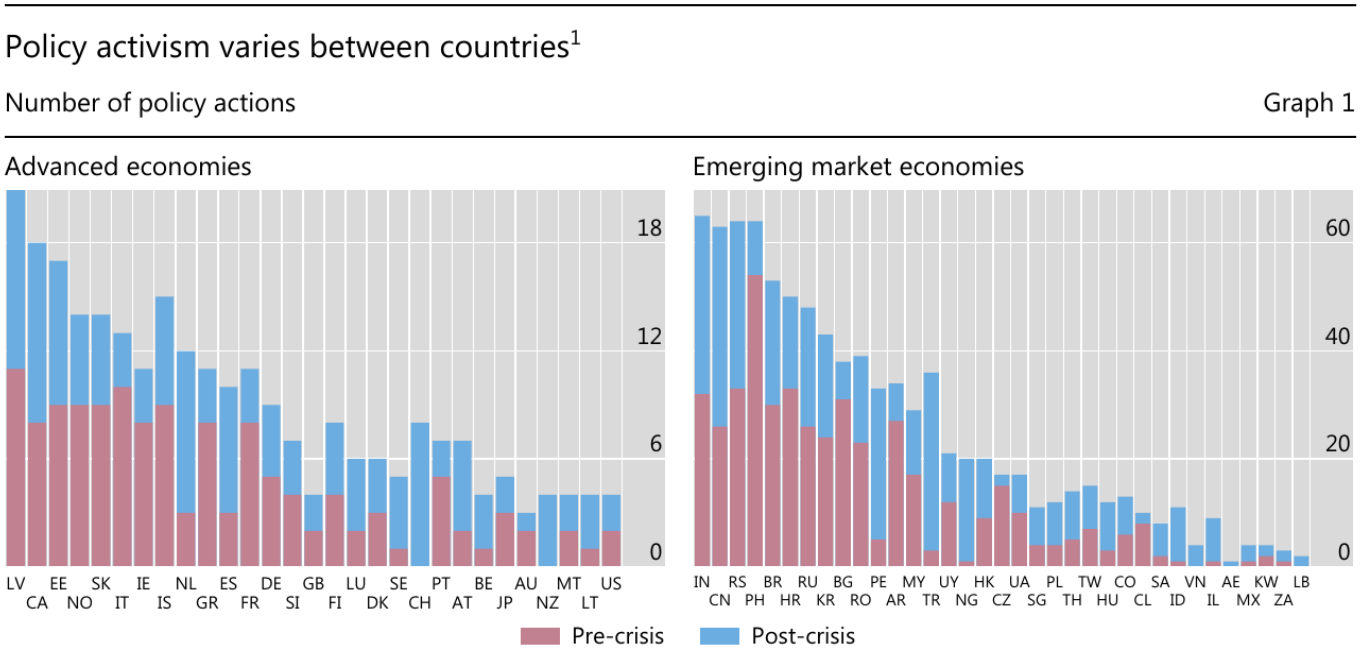


Figure: Boar et al. (BIS QR Sep. 17)

Mot. cont'd

Financial Factors

- Powerful channel of international transmission of shocks
- Large spillovers

Macroprudential policy

- Operates on financial dimension
- Large spillovers

Mot. cont'd

- Literature in its infancy (...but growing rapidly!)

This paper

What are the gains from international macroprudential cooperation?

[Focus on Core-Periphery model]

Overview of results

Empirical results

- MaP is effective in reducing GDP volatility

Theoretical results

- Gains from cooperation can be large ($> 0.5\%$ of steady-state consumption)
- Economy responds differently under coop and non-coop MaP interventions (short and long run)
  - Coop: limits markedly x-country spillovers
  - Nash: Stronger spillovers

Some empirical evidence on MaP

Summary of empirics

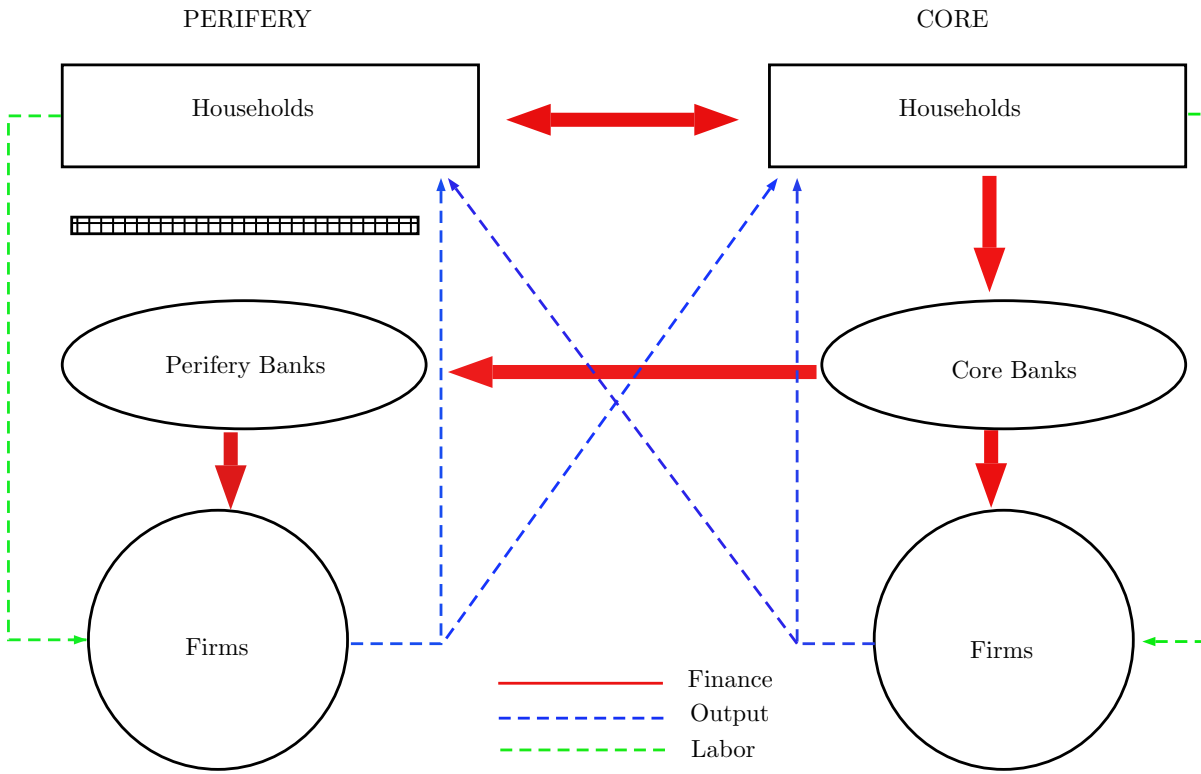
- MaP effective in reducing macroeconomic volatility
- Signs of x-country correlation of MaP for interlinked economies

▸ Regressions

Theory

Model

- IRBC + FF
- Flex Pric.
- Perf. C. Risk.S.
- Home Bias
- Asym Size
- Fin. Depend.
- Fin. Agency prob.



Model.

- Our baseline model is a flexible price version of BDL (2016)
- Two countries (small periphery and large core)
- Periphery is financially dependent on the core banking system
- Agency problem in financial intermediation à la GK.
- Rest is standard (core is IRBC model): production (capital&labor); investment; consumption
- Perfect consumption risk sharing
- National MaP authorities

Banks (Perif.).

- Agency problem: The franchising value (V) of the banks cannot be smaller than a fraction (κ) of the assets of the bank (A)
- If $V < \kappa A$ the bank will "default" and only $1 - \kappa$ is redistributed to creditors
- As a consequence banks must earn a "sufficiently large" interest margin: Lower deposit rate & higher return on assets

▸ Equations

Financial Friction

Inefficiency wedge

Credit Spread> Households' Risk Premium

Double for Periphery

MaP

- MaP is about creating (dis-)incentives for banks so to affect credit supply
- We abstract from the (important) details of MaP

As a first stab, MaP instrument:

tax/subsidy on the return on capital accruing to banks

- Reserve-requirements would work in a similar way
- Differential "cost of assets" for Core country: Some Regulatory leakage

Cost of MaP:

- Imposing that MaP is costly is key: Otherwise achieve first-best
- Often literature introduces ad-hoc costs of intervention
- As alternative we assume that need to raise resources to implement MaP through distortionary taxes

Public budget: mix of debt, labor tax, tax on banks and lump-sum tax

$$S_t^j + \tau_{l,t}^j W_t H_t^j + \tau_{k,t}^j r_{k,t}^j K_{t-1}^j + T_t^j = R_{t-1}^j S_{t-1}^j;\ j = \{e, c\} \quad (1)$$

where T_t^j is a lump-sum tax.

Cost of MaP

- We consider two alternatives
  1. Only labor tax used to balance budget period by period: very costly
  2. A mix of government debt, lump-sum taxes and labor taxes: mildly costly
- In the latter case we impose that debt must be gradually stabilized by

$$\widehat{\tau}_{l,t}^{j} = (1-\ell)\,\kappa_{SD}^{j}\left(\widehat{S}_{t}^{j}\right);\ j=\{e,c\} \tag{2}$$

and

$$\widehat{T}_{t}^{j} = \ell\kappa_{SD}^{j}\left(\widehat{S}_{t}^{j}\right);\ j=\{e,c\}. \tag{3}$$

where $\ell \in (0,1)$.

Ramsey cooperative equilibrium

Definition (Cooperative policy problem)

Both policymakers choose the vector of all endogenous variables Θ_t, and the policy instruments $\tau^e_{k,t}$ and $\tau^c_{k,t}$ in order to solve the following problem

$$\mathcal{W}_{CP,0} \equiv \max_{\Theta_t, \tau^e_{k,t}, \tau^c_{k,t}} \left[n\mathcal{W}^c_0 + (1-n)\,\mathcal{W}^e_0 \right] \tag{4}$$

subject to

$$E_t F\left(\Theta_{t+1}, \Theta_t, \Theta_{t-1}, \tau^e_{k,t+1}, \tau^c_{k,t+1}, \tau^e_{k,t}, \tau^c_{k,t}, \tau^e_{k,t-1}, \tau^c_{k,t-1}, \Phi_{t+1}, \Phi_t, \Phi_{t-1}; \varphi\right) = 0 \tag{5}$$

Φ_t, is the vector of all exogenous shocks, φ loads exogenous shocks $F(\cdot)$ is the "model"

Time consistency imposed through timeless-perspective constraint

Ramsey Nash equilibrium

Definition (Non-cooperative policy problem)

Under the non-cooperative policy (NP) problem , each policymaker chooses independently all endogenous variables and her own instrument in order to solve the following problem

$$\mathcal{W}^{j}_{NP,0} \equiv \max_{\Theta_t, \tau^{j}_{k,t}} \mathcal{W}^{j}_{0} : \ j = \{e, c\} \tag{6}$$

subject to

$$E_t F\left(\Theta_{t+1}, \Theta_t, \Theta_{t-1}, \tau^{e}_{k,t+1}, \tau^{c}_{k,t+1}, \tau^{e}_{k,t}, \tau^{c}_{k,t}, \tau^{e}_{k,t-1}, \tau^{c}_{k,t-1}, \Phi_{t+1}, \Phi_t, \Phi_{t-1}; \varphi\right) = 0 \tag{7}$$

Policy problem

1. Reduce inefficient fluctuations due to financial multiplier (credit channel)
2. Increase average stock of capital (depressed by FF)
3. Twist terms of trade (RER) to advantage of own country
4. Do all this with distortionary taxes

   If capital tax $\Uparrow$, then labor tax $\Downarrow$... to some extent
5. If possible, try to make other country do all of the job!

RESULTS

Calibration

- Key model statistics are within empirical ranges
- Bear in mind that welfare results are proportional to variances!

Calibration cont'd: Ratios

	Model	Data
Spread C (annual bp)	306	221–660†
Spread E (annual bp)	548	400–748††
Leverage C	5.83	6.14 – 12.02♩
Leverage E	5.56	4.46 – 7.94♩
$\frac{Investment}{GDP}$ C	24%	24%♩♩
$\frac{Investment}{GDP}$ E	25%	24%♩♩

Sources: † BofA Merrill Lynch US Corporate BBB Option-Adjusted Spread vs. High Yield (from FRED, Federal Reserve Bank of St. Louis), period: 1999.01 – 2016.10; †† Bank of America, Merrill Lynch Emerging Markets Corporate Plus Index Option-Adjusted Spread vs. High Yield (from FRED, Federal Reserve Bank of St. Louis), period: 1999.01 – 2016.10;♩ World Bank, one-stdev confidence interval of total bank-assets over bank-equity minus 1; ♩♩ World Bank, cross country averages; Period:1980 – 2014.

Calibration cont'd: moments

Variable	Model	Data:♩ average (stdev)
DGDP_e	0.87	1.17 (0.57)
DGDP_c	0.74	0.74 (0.35)
DI_e	3.7	7.48 (21.48) [med.=3.39]
DI_c	2.6	2.61 (1.20)
spread_e	510	202 – 391
spread_c	91	110 – 275
RER†	2.4	EME: 7.07 (4.84); AE: 3.72 (1.89)

♩ Sources: World Bank and BIS.

† The empirical counterpart is the real effective exchange rate.

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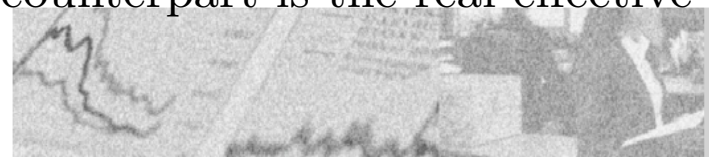


Ramsey cooperative and Nash equilibria

Parameters

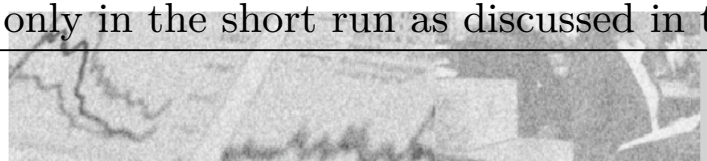
- Long-run dimension of policy
  - Good part of the LR gains come from ToT effect
  - Almost all asymmetry due to size

τ_k (MaP)†

	Cooperative		Nash	
	EME	AE	EME	AE
No public debt	-43%	-22%	-80%	-25%
With public debt††	-46%	-24%	-70%	-27%
Size-Symmetric IRBC				
No public debt	0	0	-9.5%	-9.5%
Size-asymmetric IRBC				
No public debt	0	0	-22.4%	-2.2%

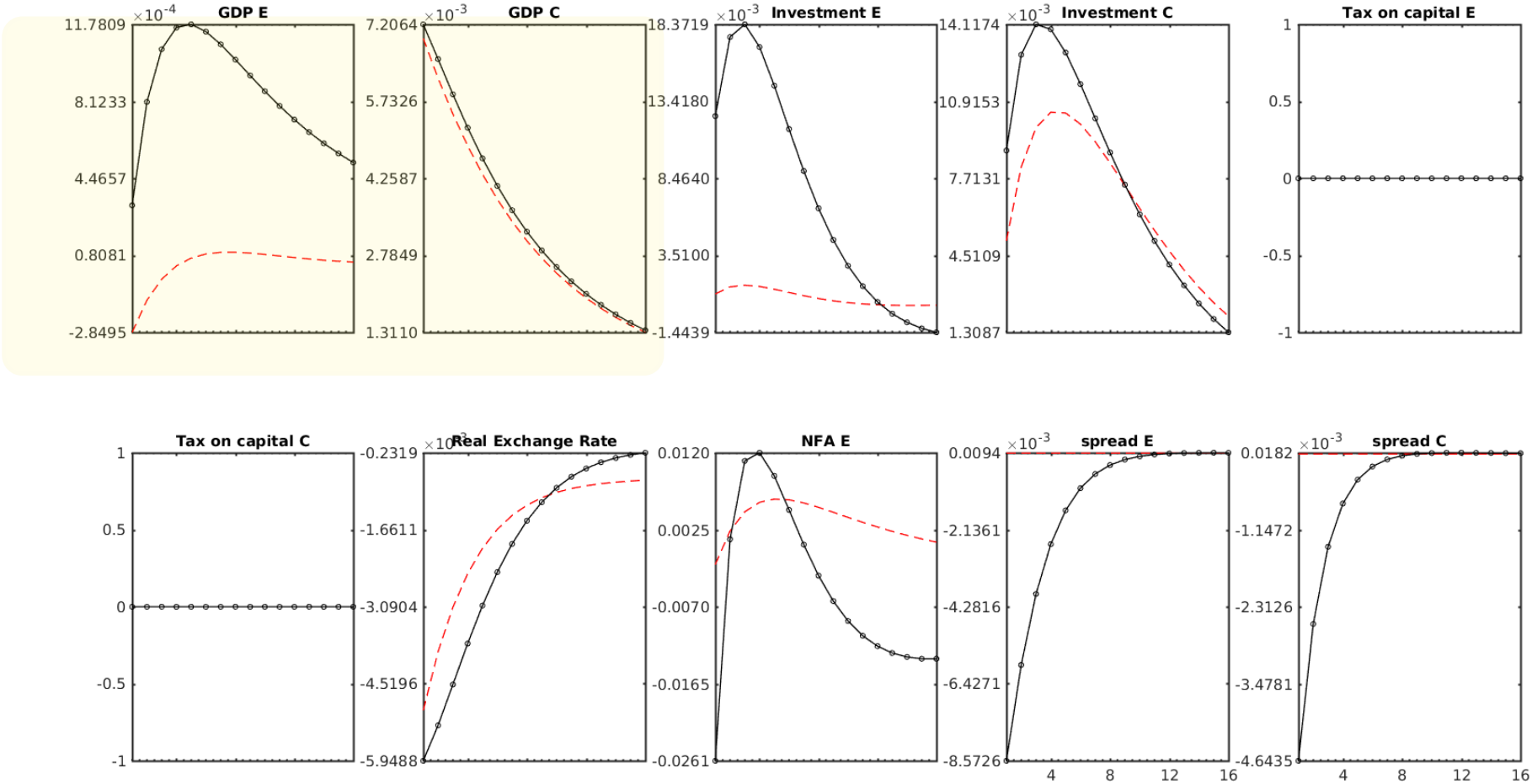
†These values are obtained solving the dynamic Ramsey model in the non-stochastic steady state.

†† Lump-sum taxes only in the short run as discussed in the text.



Financial Frictions: Core TFP shock – No MaP

o=FF; dashed=IRBC



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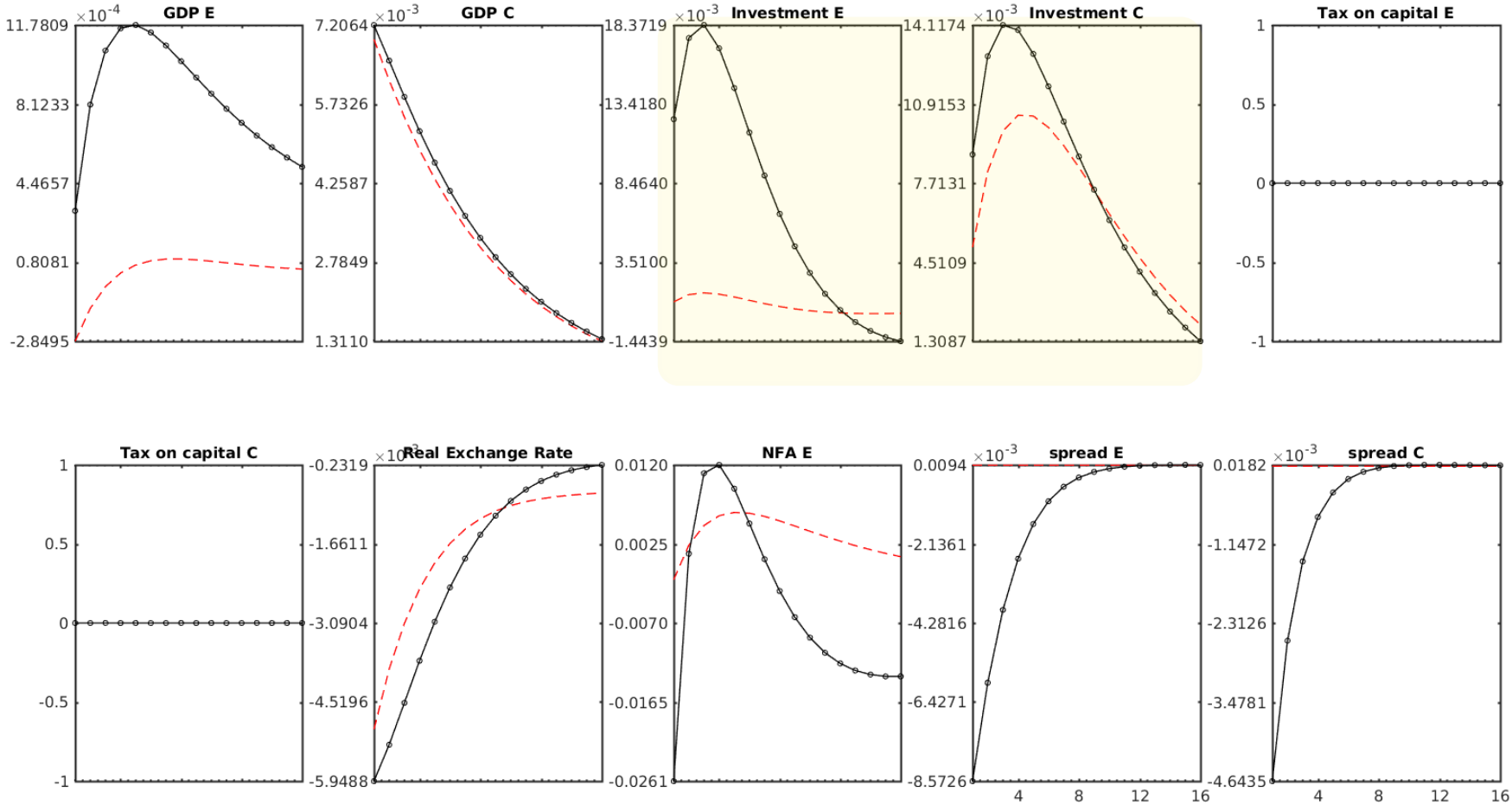

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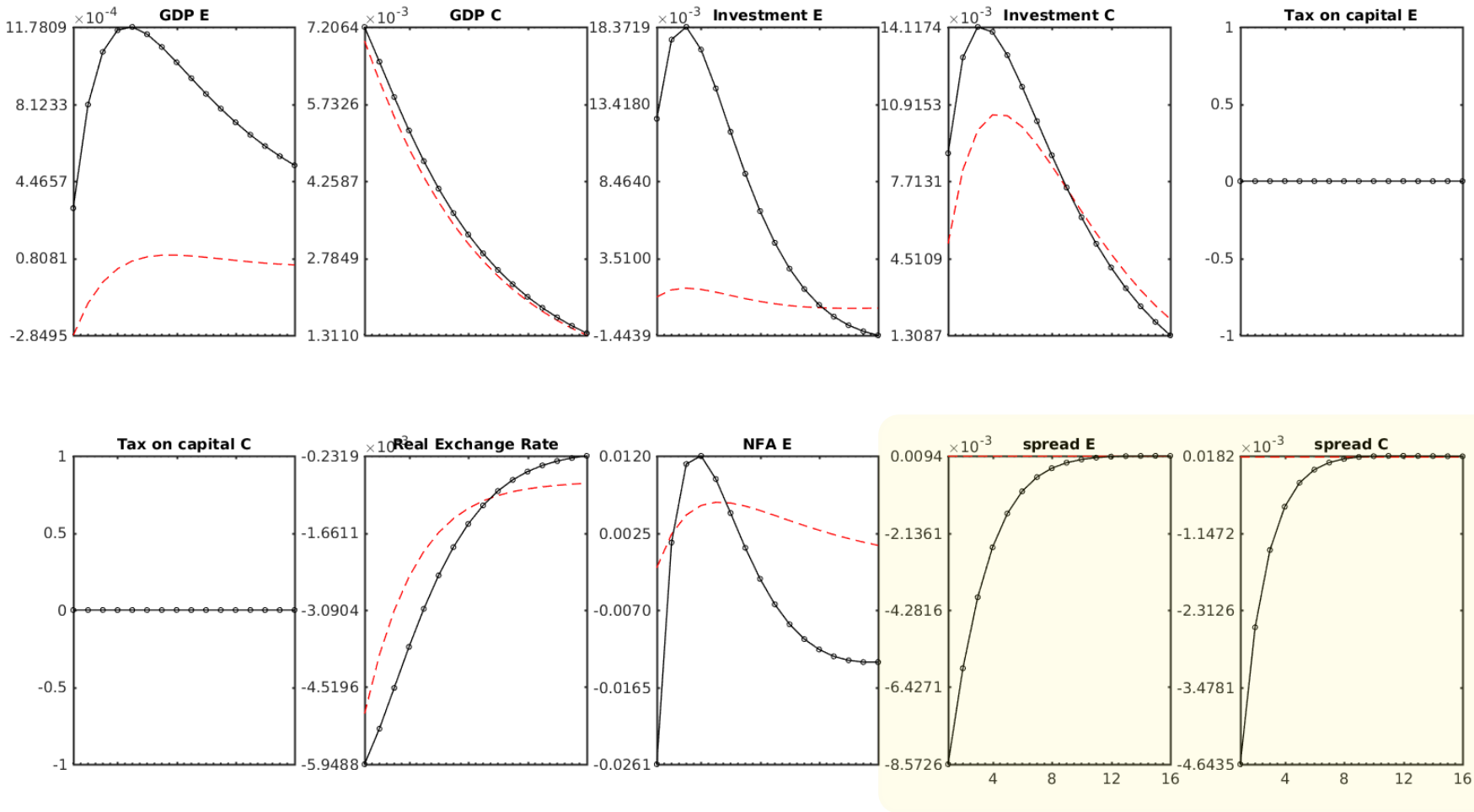
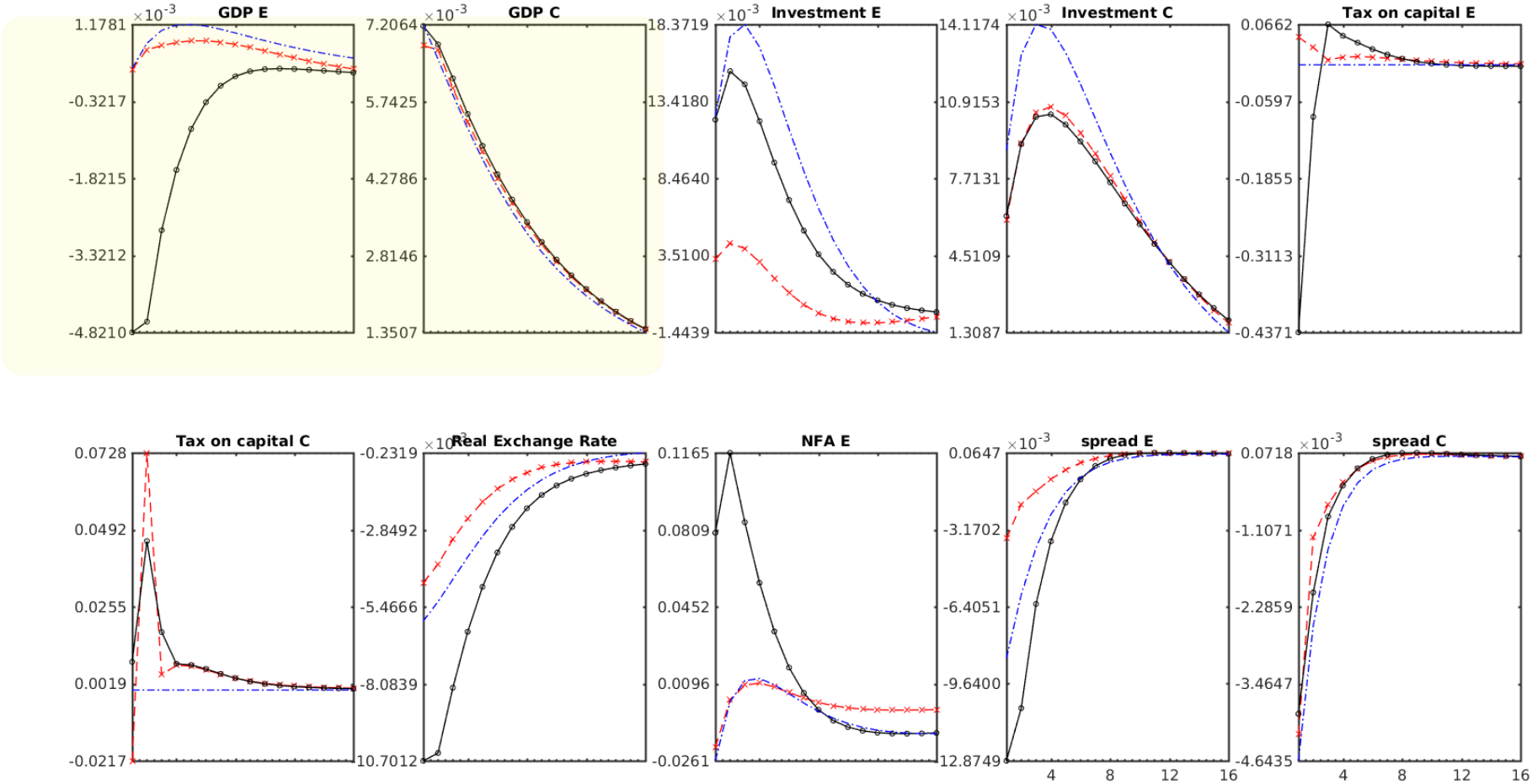


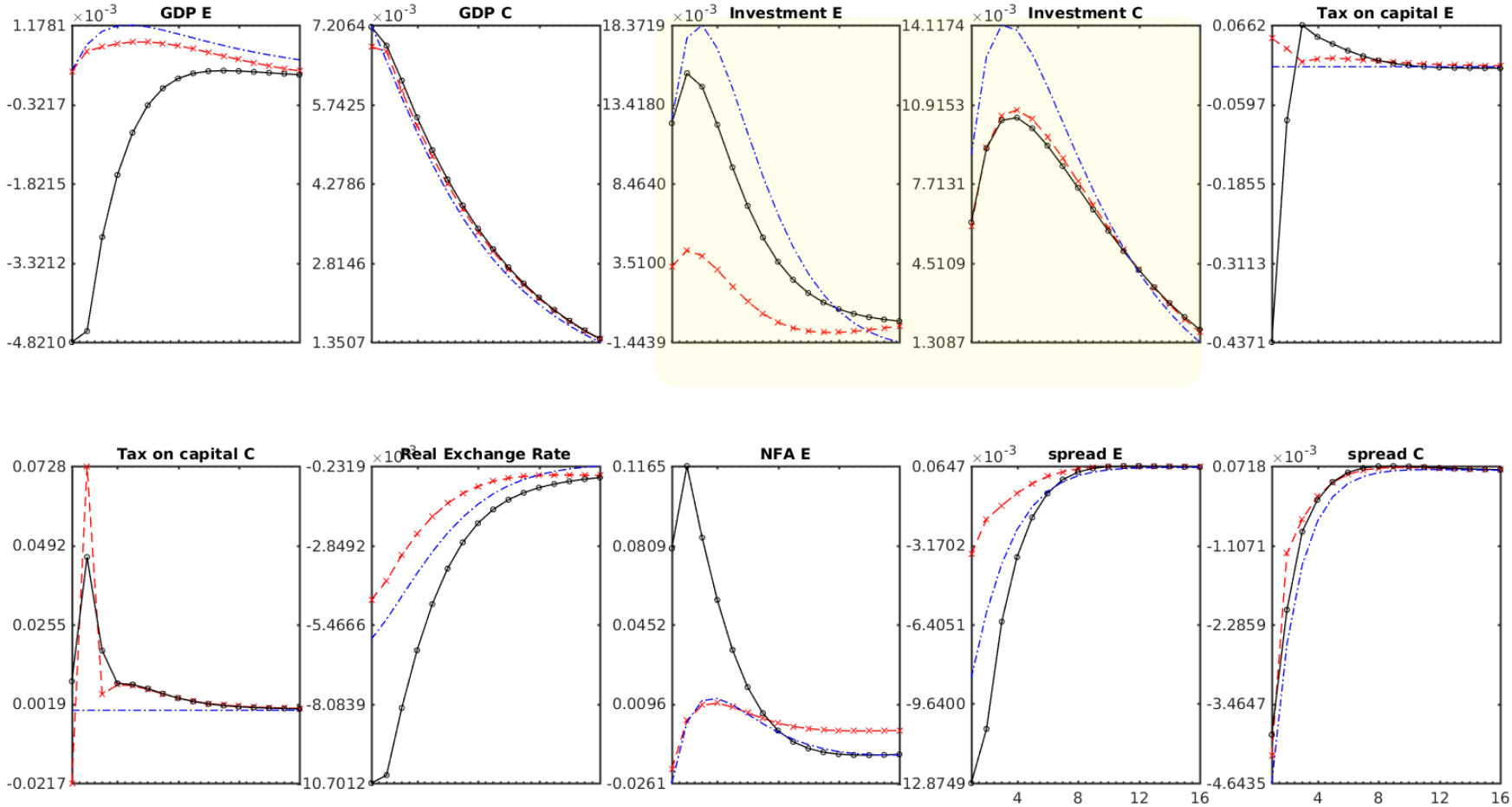
Financial Frictions: Core TFP shock – Gov. Debt.

o=NASH; dashed x =Coop; dot-dashed=No MaP



Financial Frictions: Core TFP shock – Gov. Debt.

o=NASH; dashed x =Coop; dot-dashed=No MaP



Financial Frictions: Core TFP shock – Gov. Debt.

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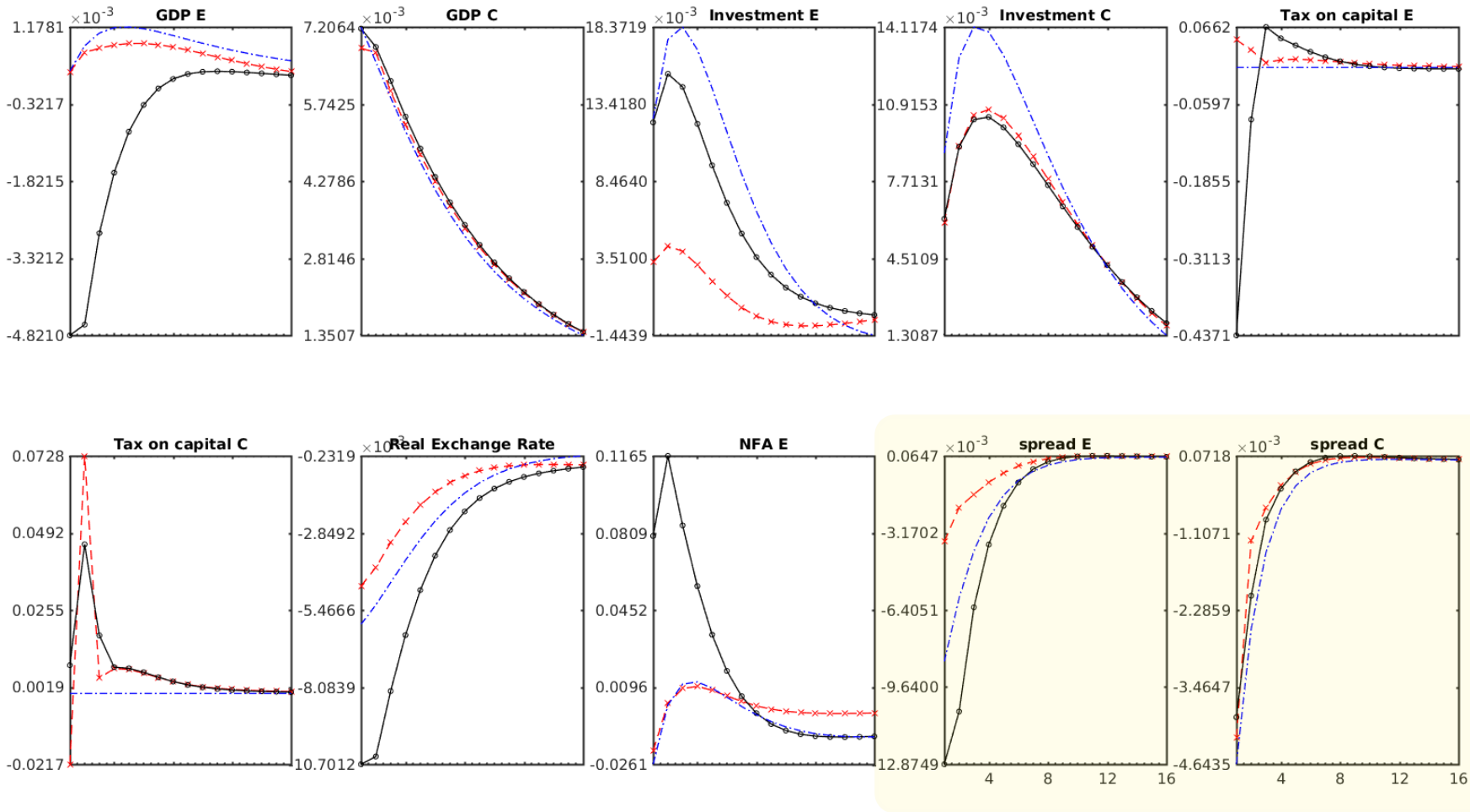
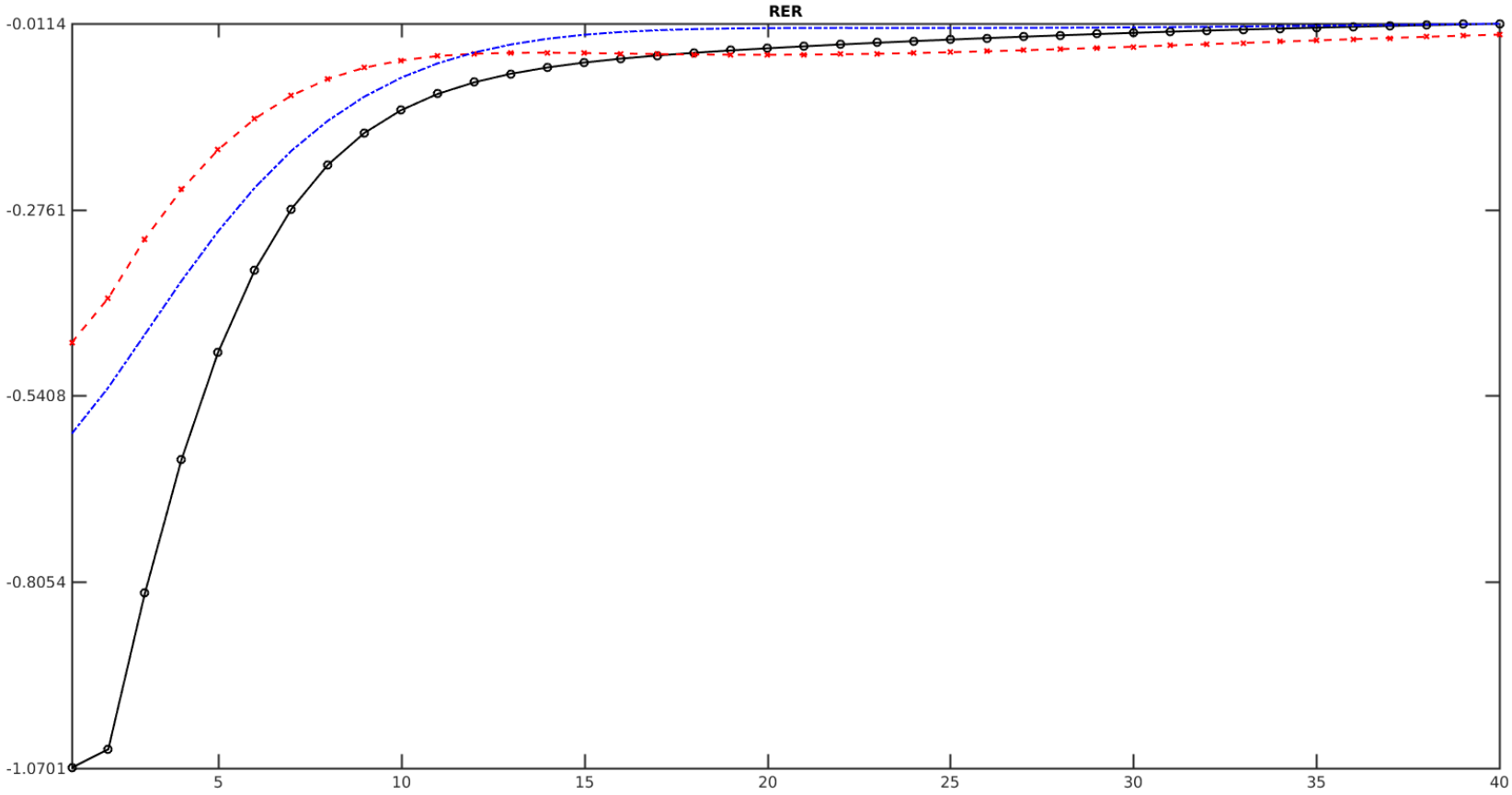


Financial Frictions: Core TFP shock (x100)

o=NASH; dashed x =Coop; dot-dashed=No MaP



Welfare Gains

Table: Gains from cooperation in percentage of permanent consumption †

MaP funding	Global Welfare	EME Welfare	AE Welfare
Baseline country size ($n = 0.15$)			
With public debt	0.69	3.98	0.11
Without public debt	0.61	6.51	-0.43
Larger EME ($n = 0.45$)			
With public debt	0.29	1.09	-0.35
Without public debt	0.45	1.96	-0.78

Table: Gains from cooperation in percentage of permanent consumption †

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Without public debt	0.45	1.96	-0.78

Financial Asymmetry

Table: Gains from cooperation in percentage of permanent consumption for different relative EME spread

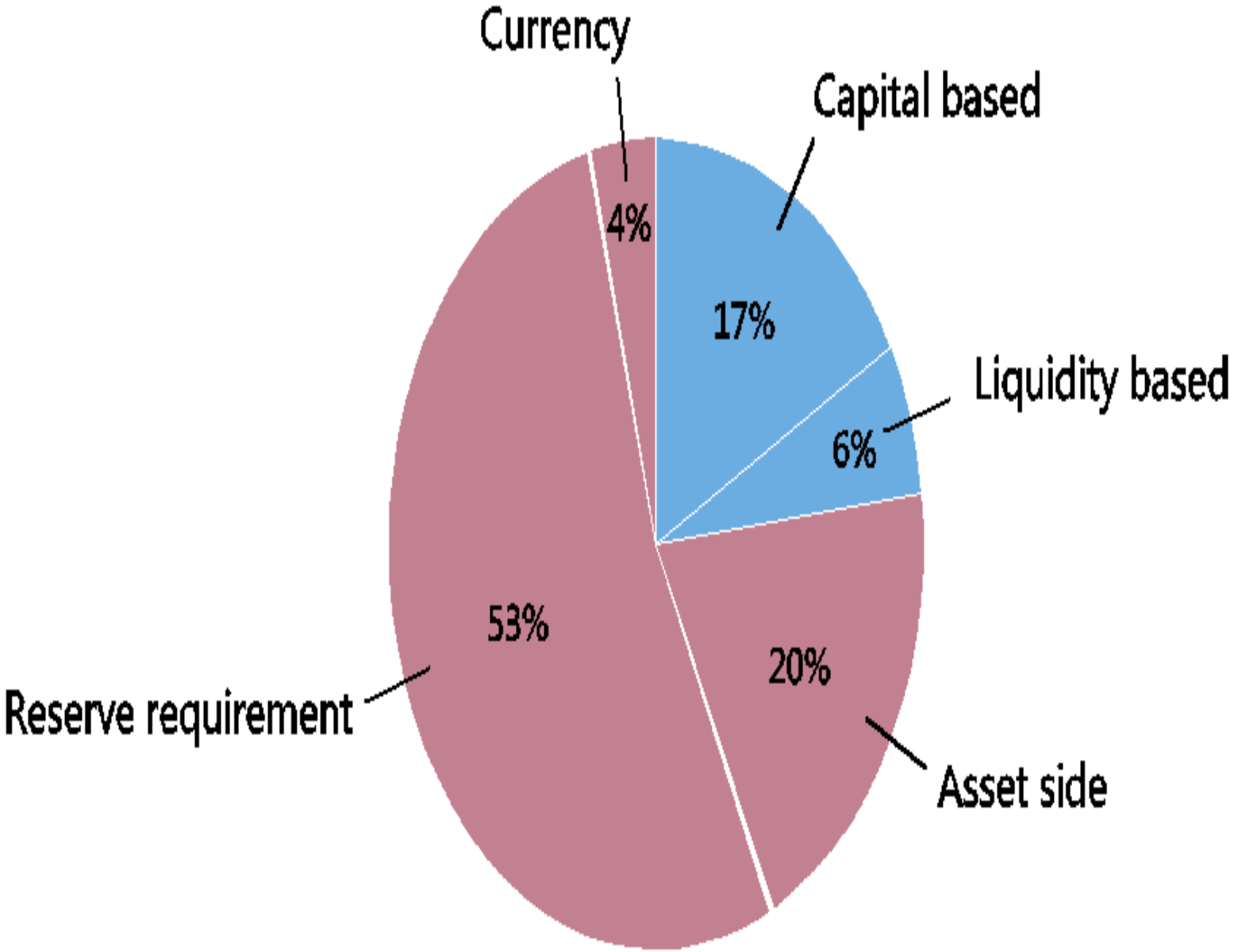
	With public debt			Without public debt		
EME relative spread†	Global	EME	AE	Global	EME	AE
0.83	0.5379	5.262	-0.2944	0.7435	7.946	-0.5273
0.8	0.5334	5.216	-0.2916	0.7449	7.973	-0.5307
0.78	0.5296	5.169	-0.2878	0.7466	7.999	-0.5336
0.75	0.5266	5.121	-0.2828	0.7487	8.024	-0.536
0.72	0.5248	5.072	-0.2762	0.7514	8.049	-0.5376
0.7	0.5247	5.022	-0.2675	0.7548	8.073	-0.5383
0.67	0.527	4.972	-0.256	0.7591	8.097	-0.5378
0.64	0.5327	4.922	-0.2405	0.7649	8.121	-0.5357
0.62	0.5437	4.875	-0.2192	0.7725	8.144	-0.5315
0.59	0.563	4.832	-0.1888	0.7827	8.168	-0.5243
0.56	0.5962	4.797	-0.1437	0.7968	8.193	-0.5129

†The relative spread is modified by changing κ^e from $\kappa^e = \kappa^c = 0.4$ to $\kappa^e = 0.30$, in equal steps. Note that the baseline calibration has $\kappa^e = \kappa^c = 0.30$.

Conclusions

- Our model suggests that self-oriented MaP would generate markedly different outcomes relative to cooperative policy.
- Cooperative policy results in attenuated spillovers
- Gains appear to be strongly asymmetric: Implementation could be difficult.
- Gains from cooperation are large!

Types of MaP


Currency
Capital based
4%
17%
Liquidity based
6%
53%
20%
Reserve requirement
Asset side

MaP Effectiveness

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Total	Resilience	Cyclical	Capital based	Liquidity based	Asset sid
Lagged dependent variable	0.8448***	0.8344***	0.8426***	0.8442***	0.8370***	0.8425**
	(0.0233)	(0.0296)	(0.0240)	(0.0236)	(0.0262)	(0.0229)
Log initial income per cap.	0.0014**	0.0014***	0.0014**	0.0014**	0.0012**	0.0013**
	(0.0006)	(0.0005)	(0.0006)	(0.0005)	(0.0005)	(0.0005)
FD	-0.0140***	-0.0109***	-0.0144***	-0.0091***	-0.0106***	-0.0108**
	(0.0039)	(0.0034)	(0.0037)	(0.0030)	(0.0029)	(0.0036)
MaP (index)	-0.0022**	-0.0031	-0.0024**	-0.0013	-0.0097**	-0.0048
	(0.0011)	(0.0030)	(0.0011)	(0.0034)	(0.0043)	(0.0034)
OPEN	-0.0023*	-0.0019*	-0.0021*	-0.0019**	-0.0015*	-0.0016*
	(0.0013)	(0.0010)	(0.0012)	(0.0010)	(0.0009)	(0.0010)
FD×MaP	0.0050**	0.0061	0.0057***	0.0028	0.0195**	0.0087
	(0.0021)	(0.0063)	(0.0021)	(0.0066)	(0.0097)	(0.0063)
FD×MaP×OPEN	-0.0022*	-0.0039	-0.0021*	-0.0035	-0.0087*	-0.0044
	(0.0012)	(0.0029)	(0.0012)	(0.0033)	(0.0045)	(0.0029)
MaP×OPEN	0.0012*	0.0024	0.0011	0.0024	0.0046**	0.0029*
	(0.0007)	(0.0016)	(0.0007)	(0.0018)	(0.0020)	(0.0016)
FD×OPEN	0.0035*	0.0026	0.0034*	0.0025	0.0020	0.0023
	(0.0021)	(0.0017)	(0.0020)	(0.0017)	(0.0015)	(0.0018)
Av. schooling (in logs)	-0.0004	-0.0006	-0.0002	-0.0007	-0.0003	-0.0008
	(0.0028)	(0.0027)	(0.0027)	(0.0027)	(0.0026)	(0.0026)
Gov. cons. (in logs)	-0.0014	-0.0017	-0.0014	-0.0015	-0.0017	-0.0014
	(0.0012)	(0.0014)	(0.0012)	(0.0013)	(0.0013)	(0.0012)
Inflation	0.0002	0.0003*	0.0002*	0.0003*	0.0003**	0.0003*
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Year dummies	yes	yes	yes	yes	yes	yes
Observations	1,471	1,471	1,471	1,471	1,471	1,471
Number of countries	63	63	63	63	63	63

MaP Effectiveness

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Total	Resilience	Cyclical	Capital based	Liquidity based	Asset sid
Lagged dependent variable	0.8448***	0.8344***	0.8426***	0.8442***	0.8370***	0.8425**
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MaP (index)	-0.0022**	-0.0031	-0.0024**	-0.0013	-0.0097**	-0.0048
	(0.0011)	(0.0030)	(0.0011)	(0.0034)	(0.0043)	(0.0034)
OPEN	-0.0023*	-0.0019*	-0.0021*	-0.0019**	-0.0015*	-0.0016*
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FD×MaP	0.0050**	0.0061	0.0057***	0.0028	0.0195**	0.0087
	(0.0021)	(0.0063)	(0.0021)	(0.0066)	(0.0097)	(0.0063)
FD×MaP×OPEN	-0.0022*	-0.0039	-0.0021*	-0.0035	-0.0087*	-0.0044
	(0.0012)	(0.0029)	(0.0012)	(0.0033)	(0.0045)	(0.0029)
MaP×OPEN	0.0012*	0.0024	0.0011	0.0024	0.0046**	0.0029*
	(0.0007)	(0.0016)	(0.0007)	(0.0018)	(0.0020)	(0.0016)
FD×OPEN	0.0035*	0.0026	0.0034*	0.0025	0.0020	0.0023
	(0.0021)	(0.0017)	(0.0020)	(0.0017)	(0.0015)	(0.0018)
Av. schooling (in logs)	-0.0004	-0.0006	-0.0002	-0.0007	-0.0003	-0.0008
	(0.0028)	(0.0027)	(0.0027)	(0.0027)	(0.0026)	(0.0026)
Gov. cons. (in logs)	-0.0014	-0.0017	-0.0014	-0.0015	-0.0017	-0.0014
	(0.0012)	(0.0014)	(0.0012)	(0.0013)	(0.0013)	(0.0012)
Inflation	0.0002	0.0003*	0.0002*	0.0003*	0.0003**	0.0003*
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Year dummies	yes	yes	yes	yes	yes	yes
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Log initial income per cap.	0.0014**	0.0014***	0.0014**	0.0014**	0.0012**	0.0013**
	(0.0006)	(0.0005)	(0.0006)	(0.0005)	(0.0005)	(0.0005)
FD	-0.0140***	-0.0109***	-0.0144***	-0.0091***	-0.0106***	-0.0108**
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MaP (index)	-0.0022**	-0.0031	-0.0024**	-0.0013	-0.0097**	-0.0048
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OPEN	-0.0023*	-0.0019*	-0.0021*	-0.0019**	-0.0015*	-0.0016*
	(0.0013)	(0.0010)	(0.0012)	(0.0010)	(0.0009)	(0.0010)
FD×MaP	0.0050**	0.0061	0.0057***	0.0028	0.0195**	0.0087
	(0.0021)	(0.0063)	(0.0021)	(0.0066)	(0.0097)	(0.0063)
FD×MaP×OPEN	-0.0022*	-0.0039	-0.0021*	-0.0035	-0.0087*	-0.0044
	(0.0012)	(0.0029)	(0.0012)	(0.0033)	(0.0045)	(0.0029)
MaP×OPEN	0.0012*	0.0024	0.0011	0.0024	0.0046**	0.0029*
	(0.0007)	(0.0016)	(0.0007)	(0.0018)	(0.0020)	(0.0016)
FD×OPEN	0.0035*	0.0026	0.0034*	0.0025	0.0020	0.0023
	(0.0021)	(0.0017)	(0.0020)	(0.0017)	(0.0015)	(0.0018)
Av. schooling (in logs)	-0.0004	-0.0006	-0.0002	-0.0007	-0.0003	-0.0008
	(0.0028)	(0.0027)	(0.0027)	(0.0027)	(0.0026)	(0.0026)
Gov. cons. (in logs)	-0.0014	-0.0017	-0.0014	-0.0015	-0.0017	-0.0014
	(0.0012)	(0.0014)	(0.0012)	(0.0013)	(0.0013)	(0.0012)
Inflation	0.0002	0.0003*	0.0002*	0.0003*	0.0003**	0.0003*
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Year dummies	yes	yes	yes	yes	yes	yes
Observations	1,471	1,471	1,471	1,471	1,471	1,471
Number of countries	63	63	63	63	63	63

MaP Effectiveness

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Total	Resilience	Cyclical	Capital based	Liquidity based	Asset sid
Lagged dependent variable	0.8448***	0.8344***	0.8426***	0.8442***	0.8370***	0.8425**
	(0.0233)	(0.0296)	(0.0240)	(0.0236)	(0.0262)	(0.0229)
Log initial income per cap.	0.0014**	0.0014***	0.0014**	0.0014**	0.0012**	0.0013**
	(0.0006)	(0.0005)	(0.0006)	(0.0005)	(0.0005)	(0.0005)
FD	-0.0140***	-0.0109***	-0.0144***	-0.0091***	-0.0106***	-0.0108**
	(0.0039)	(0.0034)	(0.0037)	(0.0030)	(0.0029)	(0.0036)
MaP (index)	-0.0022**	-0.0031	-0.0024**	-0.0013	-0.0097**	-0.0048
	(0.0011)	(0.0030)	(0.0011)	(0.0034)	(0.0043)	(0.0034)
OPEN	-0.0023*	-0.0019*	-0.0021*	-0.0019**	-0.0015*	-0.0016*
	(0.0013)	(0.0010)	(0.0012)	(0.0010)	(0.0009)	(0.0010)
FD×MaP	0.0050**	0.0061	0.0057***	0.0028	0.0195**	0.0087
	(0.0021)	(0.0063)	(0.0021)	(0.0066)	(0.0097)	(0.0063)
FD×MaP×OPEN	-0.0022*	-0.0039	-0.0021*	-0.0035	-0.0087*	-0.0044
	(0.0012)	(0.0029)	(0.0012)	(0.0033)	(0.0045)	(0.0029)
MaP×OPEN	0.0012*	0.0024	0.0011	0.0024	0.0046**	0.0029*
	(0.0007)	(0.0016)	(0.0007)	(0.0018)	(0.0020)	(0.0016)
FD×OPEN	0.0035*	0.0026	0.0034*	0.0025	0.0020	0.0023
	(0.0021)	(0.0017)	(0.0020)	(0.0017)	(0.0015)	(0.0018)
Av. schooling (in logs)	-0.0004	-0.0006	-0.0002	-0.0007	-0.0003	-0.0008
	(0.0028)	(0.0027)	(0.0027)	(0.0027)	(0.0026)	(0.0026)
Gov. cons. (in logs)	-0.0014	-0.0017	-0.0014	-0.0015	-0.0017	-0.0014
	(0.0012)	(0.0014)	(0.0012)	(0.0013)	(0.0013)	(0.0012)
Inflation	0.0002	0.0003*	0.0002*	0.0003*	0.0003**	0.0003*
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Year dummies	yes	yes	yes	yes	yes	yes
Observations	1,471	1,471	1,471	1,471	1,471	1,471
Number of countries	63	63	63	63	63	63

MaP Spillovers

Explanatory variables	Dependent variable: change in macroprudential tool index in country i at time t ($\Delta MaP_{i,t}$)				
	MaP aggregate index	**MaP aggregate index**	**MaP aggregate index**	**Resilience index**	**Cyclical index**
	(1)	(2)	(3)	(4)	(5)
Change in macroprudential tool index in country j at time t ($\Delta MaP_{j,t}$)	-0.0055	-0.0026	-0.0123	-0.0138	-0.0157
	(0.0239)	(0.0201)	(0.0196)	(0.0117)	(0.0198)
$\Delta MaP_{j,t}\times$ LINKAGES (1)	0.0105**	0.0101***	0.0104***	0.0127***	0.0087**
	(0.0041)	(0.0036)	(0.0036)	(0.0023)	(0.0037)
Country pair fixed effects	no	yes	yes	yes	yes
Macro controls (2)	no	no	yes	yes	yes
Observations	105,220	105,220	105,220	105,220	105,220
Number of countries	63	63	63	63	63
R^2	0.0050	0.0499	0.0588	0.0350	0.0615

Note: The dependent variable is the change in macroprudential index in country i at time t ($\Delta MaP_{j,t}$). Robust standard errors in parentheses. *, **, *** indicate significance at 10%, 5% and 1% level respectively. (1) The indicator of real and financial linkages is given by the sum of the following bilateral measures: exports and imports (IMF-Direction of Trade Statistics), balance sheet claims and liabilities (BIS International banking and financial statistics) and assets and liabilities (IMF-Coordinated Portfolio Investment Survey) between country i and the counterparty country j. (2) Macro controls include the growth rates of real GDP in the two countries.

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Results

Label	Value	Label	Value
n	0.15	κ_c	0.3
β	0.9926	κ_{Vc}	0.3
σ_p	6	κ_e	0.3
ς	0	$\tau k^{e,*}$	-0.4535
θ_e	0.9	$\tau k^{c,*}$	-0.2459
θ_c	0.9	κ^e_{Htx}	0.2
α	0.3	κ^c_{Htx}	0.2
$\nu_{p,e}$	0.83	ℓ	0.5
$\nu_{p,c}$	0.97	$\rho_{A,e}$	0.85
δ	0.025	$\rho_{A,c}$	0.85
$\delta_{T,e}$	0.01	ρ_ξ	0.85
$\delta_{T,c}$	0.01	σ_{Ae}	0.007
χ	1	σ_{Ac}	0.007
η	3	σ_{ξ_c}	0.005
η_p	1.5	σ_{ξ_e}	0.005
ψ	2	σ	1

Banks – Perif.

$$V_{it}^e = Q_t^e K_{it}^e - N_{it}^e \qquad \text{(Balance Sheet)}$$

$$N_{i,t}^e = R_{k,t}^e Q_{t-1}^e K_{i,t-1}^e - R_{b,t-1} V_{i,t-1}^e \qquad \text{(Net Worth)}$$

$$J^e\left(N_t^{e,s}\right) = E_t \max_{N_t, K_t^e, V_{st}^e} (1-\theta) \sum_{i=0}^{\infty} \Lambda_{t+1+i}^e \left[\theta^i N_{s,t+1+i}^e\right] \qquad \text{(Value F.)}$$

$$J_{s,t}^e \geq \kappa^e Q_t^e K_{s,t}^e \qquad \text{(ICC)}$$

where $J_{s,t}^e$ is the value of bank s, and Λ_t^e is the household discount factor. Back

Center Country Bank

Balance sheet

$$V^e_{jt} RER_t^{-1} + Q^c_t Z^c_{j,t} = N^c_{jt} + B^c_t$$

ICC

$$J_{jt} \geq \kappa^c_V RER_t^{-1} V^e_{jt} + \kappa^c Q_{c,t} Z^c_{j,t};\ \kappa^c_V, \kappa^c > 0$$

FOC

$$Z_{j,t}:\ E_t \Omega^c_{t+1|t} \left(R^c_{kt+1} - R^c_t\right) = \kappa^c \gamma^c_t \tag{8}$$

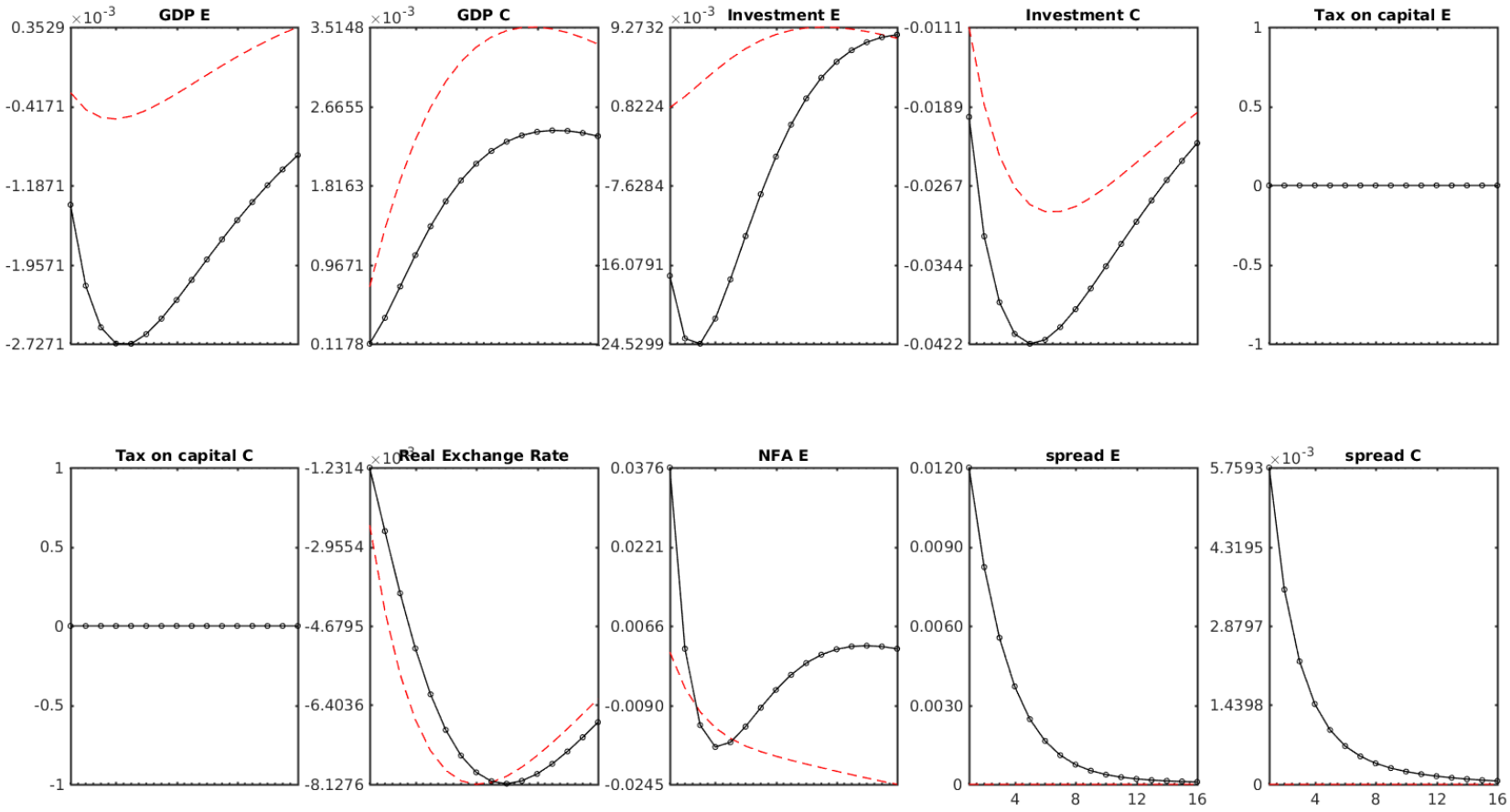
$$V^e_{j,t}:\ E_t \Omega^c_{t+1|t} \left(R_{b,t} \frac{RER_t}{RER_{t+1}} - R^c_t \right) = \kappa^c_V \gamma^c_t \tag{9}$$

So far

$$\kappa^c_V = 0$$

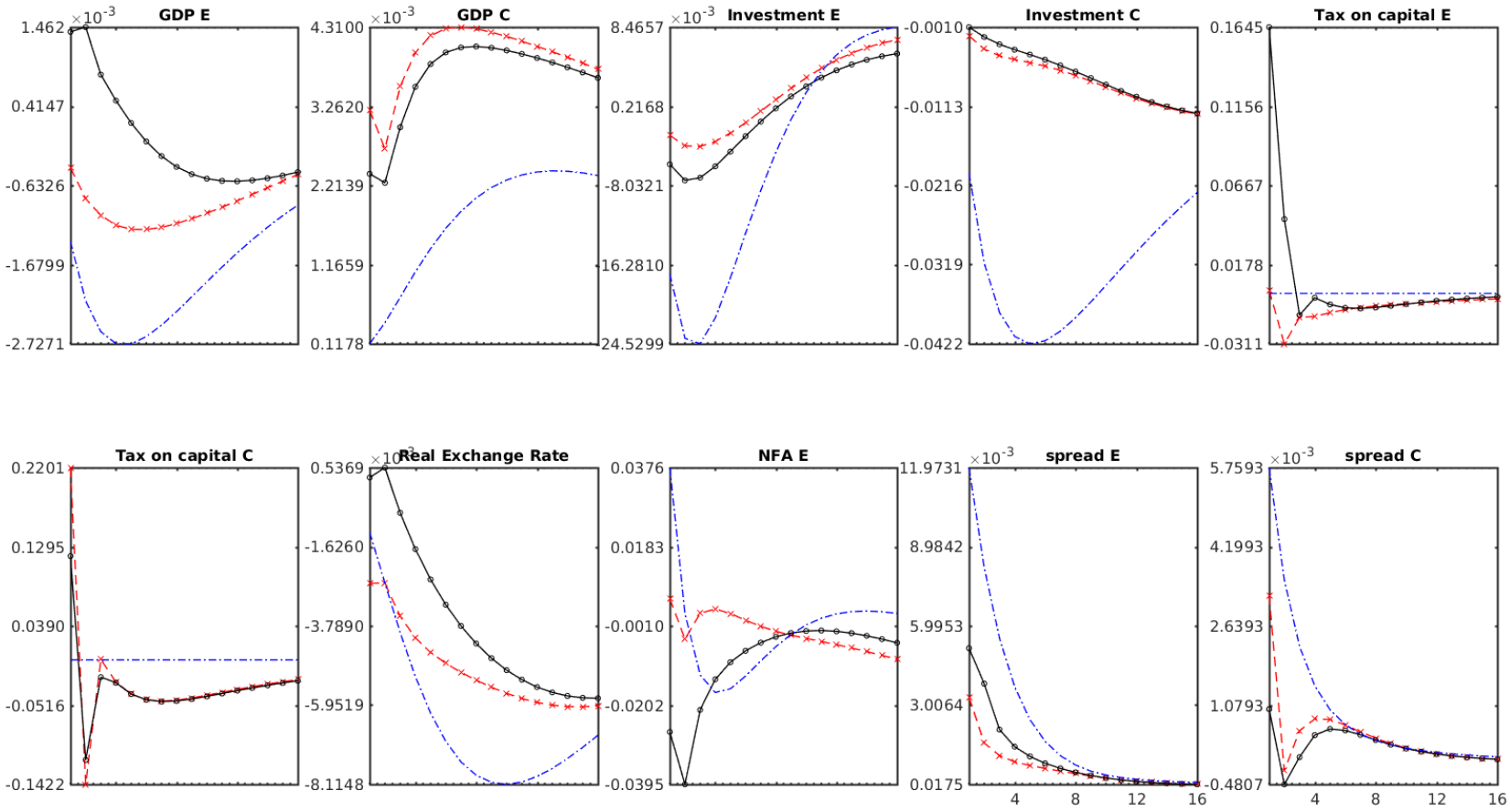
Financial Frictions: Core K Quality shock – No MaP

Solid=FF; dashed=IRBC



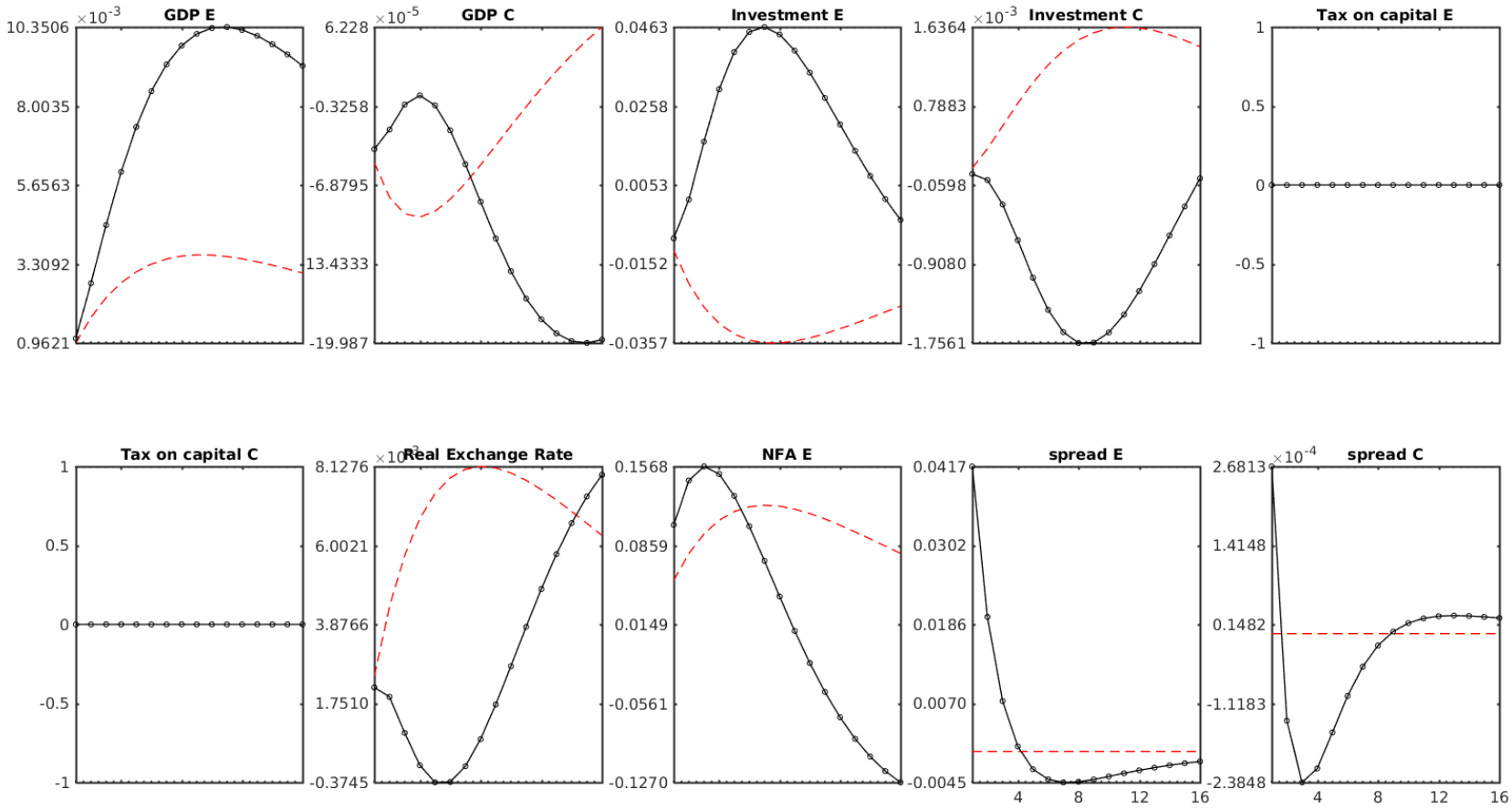
Financial Frictions: Core K Quality shock

Solid=NASH; dashed=Coop; dot-dashed=No MaP



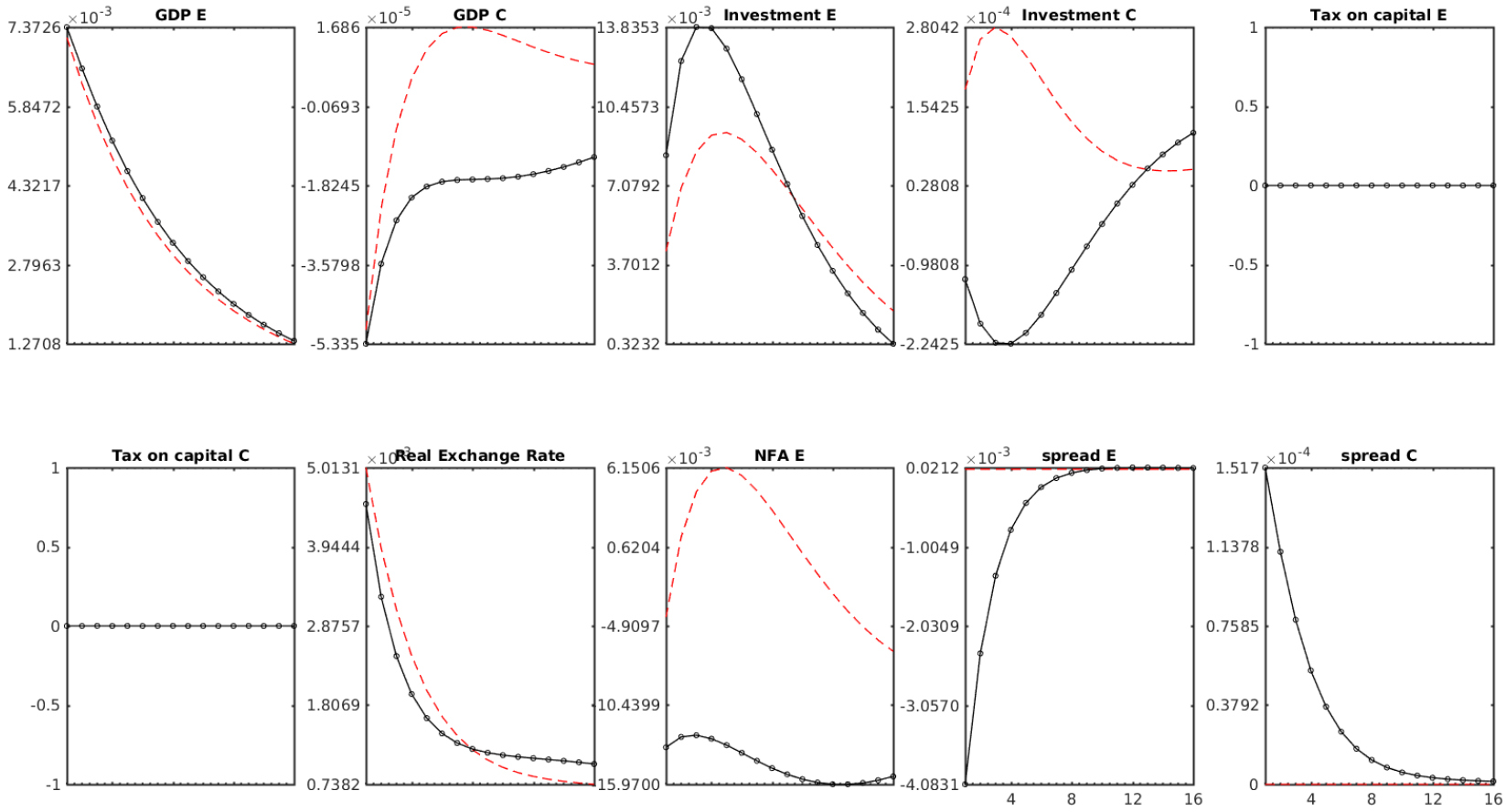
Financial Frictions: Perif. K Quality shock – No MaP

Solid=FF; dashed=IRBC



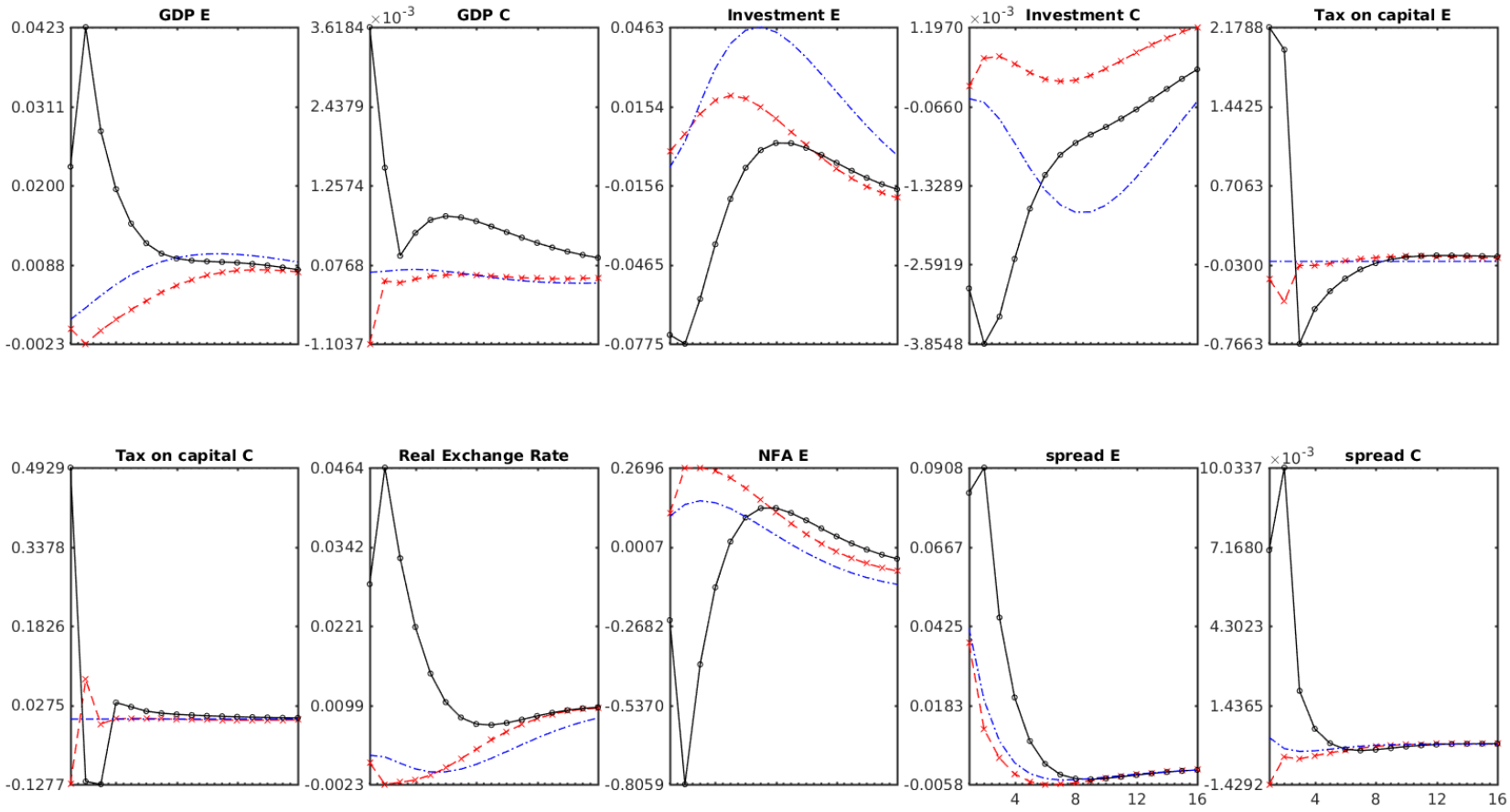
Financial Frictions: Perif. TFP shock – No MaP

Solid=FF; dashed=IRBC



Financial Frictions: Perif. K Quality shock

Solid=NASH; dashed=Coop; dot-dashed=No MaP



Financial Frictions: Perif. TFP shock

Solid=NASH; dashed=Coop; dot-dashed=No MaP