



# Allocation of FX losses in Emerging Europe (1)

- FX mismatch makes borrowers vulnerable to unexpected currency depreciation.
- Often borrowers face FX mismatch because lenders prefer to avoid exchange rate risk (Basso et al., 2011; Brown et al., 2010).
- The Hungarian government shifted FX losses to banks with a foreign currency mortgage repayment scheme in 2011.
- Similar schemes were implemented in Croatia and suggested in Romania and Poland.
- **The trade-off:** relieving borrowers from FX losses or posing a threat to financial stability (ECB, 2011)?

## Allocation of FX losses in Emerging Europe (2)

- Corporate borrowers were highly indebted in foreign currency too (e.g. 64% of accumulated debt of Hungarian firms).
- Why none of the countries in the region considered a shift of FX losses from corporates to banks?
- **This paper:**
  - Is shifting household currency mismatch losses is beneficial from a macroeconomic perspective?
  - Is shifting household currency mismatch losses to banks indeed could have led to a smaller output contraction than shifting corporate currency mismatch losses?

# Main findings

- The estimation shows that
  - the debt overhang friction improves model fit considerably and performs better than a costly state verification friction (as in Bernanke et al. (1999));
  - risky household debt is important in explaining aggregate fluctuations as well.
- Model simulation confirms that shifting currency mismatch losses to banks has different implications dependent on whether households or production firms borrow in foreign currency:
  - we find potential gains from shifting currency mismatch losses from firms to banks;
  - household currency mismatch losses, however, appear to have a relatively small effect on output.

## Related literature

- Corporate finance has used the debt overhang framework since Myers (1977). The interactions of debt overhang in different sectors of the economy: Lamont (1995), Philippon (2010).
- Household default literature and especially papers that analyzed household default from the business cycles perspective, e.g. Clerc et al. (2011).
- Literature on the effects of liability dollarization used a CSV framework (Céspedes, Chang, and Velasco, 2004; Devereux, Lane, and Xu, 2006; Gertler, Gilchrist, and Natalucci, 2003; Cook, 2004).

# Model

- We develop a medium-scale DSGE model with
  - households with net worth constraints (Bernanke et al., 1999);
  - production firms facing debt overhang frictions (Occhino and Pescatori, 2015);
  - leveraged banks (Gertler and Karadi, 2011).
  - foreign trade sector;
  - nominal price and wage rigidities.
- Households, firms and banks have open FX positions calibrated to the Hungarian economy.

# Motivation for frictions

- The Hungarian recession serves as a motivation for different financial inefficiencies in the model:
  - Household debt overhang was unlikely (Brown and Lane, 2011), hence, reduced household net worth might have weighed on consumption and raised borrowing costs but did not distort labor supply.
  - Production firms could have faced debt overhang frictions: they rarely had access to natural hedges and exhibited slow investment recovery.
  - Bank losses have implications for the real economy, if they are subject to leverage constraints.
- We estimate the model on Hungarian data 2000:Q1-2016:Q3 using Bayesian estimation techniques to assess the chosen financial frictions for firms.

# The estimation

- We estimate parameters using Hungarian macro and financial data from 2000:Q1-2016:Q3:
  - Macro: real GDP growth, consumption growth, investment growth, CPI inflation, nominal gross interest rate, real exchange rate, trade balance to GDP, foreign interest rate, foreign inflation, foreign real GDP growth.
  - Financial: the corporate loan spread, the household spread and the bank spread.
- The model allows for one real trend growth rate.
- Measurement errors are calibrated to 10 percent of observed variance of particular time series (compare to Christiano et al., 2011).
- The estimated log-likelihood values are based on a double chain Metropolis-Hastings algorithm with 400,000 draws after a burn-in period of 200,000 draws and with acceptance rate set to 0.21.



# Marginal likelihood of different models

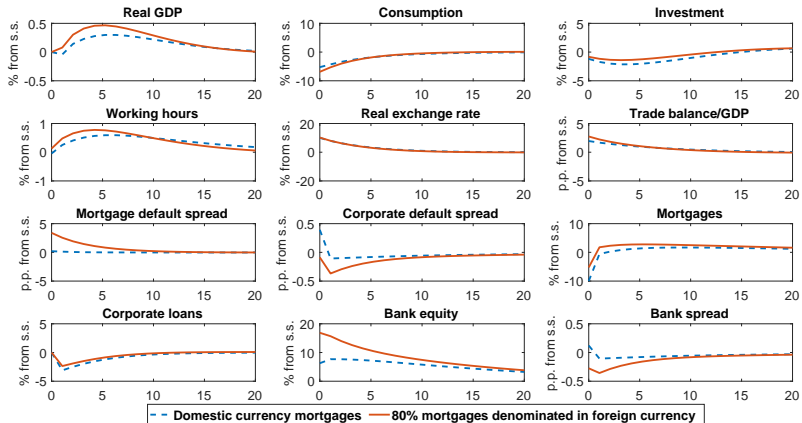
HH types	Fin. frictions firms	banks	Fin. shocks	Spread data	LogL
S	DO	-	$\sigma_{F,t}$	firm	-2326.9
S&B	DO	-	$\sigma_{F,t}$	firm	-2304.6
S&B	DO	-	$\sigma_{F,t}, \sigma_{M,t}$	firm and HH	-2531.7
S&B	BGG	-	$\sigma_{F,t}, \sigma_{M,t}$	firm and HH	-2839.3
S&B	DO	GK	$\sigma_{F,t}, \sigma_{M,t}, \lambda_t^B$	firm, HH and bank	-2397.5
S&B	BGG	GK	$\sigma_{F,t}, \sigma_{M,t}, \lambda_t^B$	firm, HH and bank	-2900.1

*Note:* Marginal likelihood was computed using the Laplace approximation at the posterior mode. All estimations use macro data.

*Abbreviations:* HH stands for household. S as in the 'HH type' column stands for savers. S&B means savers and borrowers. DO means debt overhang, BGG means monitoring frictions as implemented in Bernanke et al. (1999). GK means the endogenous bank leverage constraint as implemented in Gertler and Karadi (2011).

## IRFs

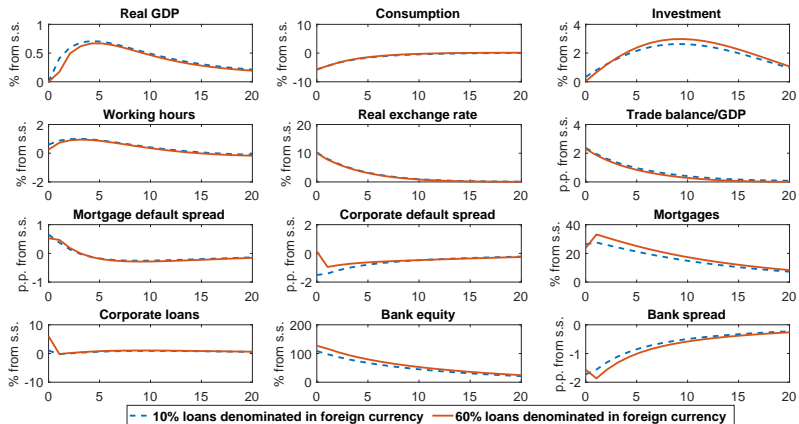
Figure 1: Country's premium shock and currency mismatch for households with leverage-constrained banks.



Note: The figure plots IRFs to an unexpected increase in the country's premium by three p.p. Corporate loans in both cases are issued in domestic currency only.

## IRFs

Figure 2: Country's premium shock and currency mismatch for firms with leverage-constrained banks.



Note: The figure plots IRFs to an unexpected increase in the country's premium by three p.p. Mortgages in both cases are extended in domestic currency only.

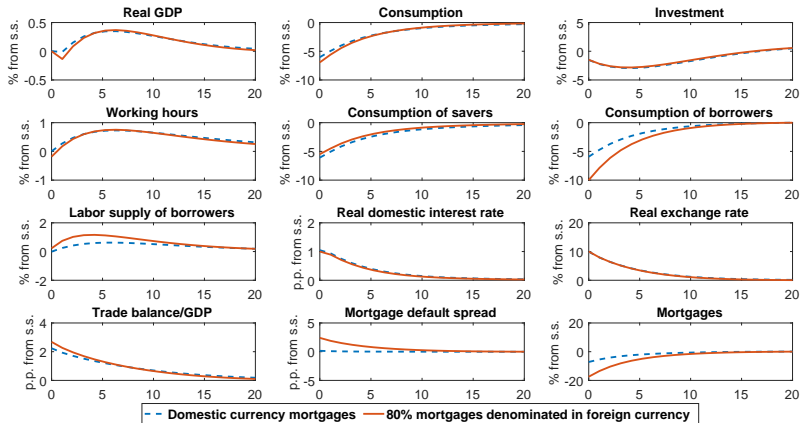
## Conclusions and discussion

- We find that shifting corporate losses rather than household losses back to banks creates macroeconomic gains.
- Macroeconomic losses from currency mismatch in the firm sector are larger for several potential reasons:
  - debt overhang generates larger amplifications of aggregate shocks than a CSV framework (Occhino and Pescatori, 2015);
  - housing is not a productive asset but capital is;
  - firms use more domestic inputs than consumers.

Table 1: Estimated parameters

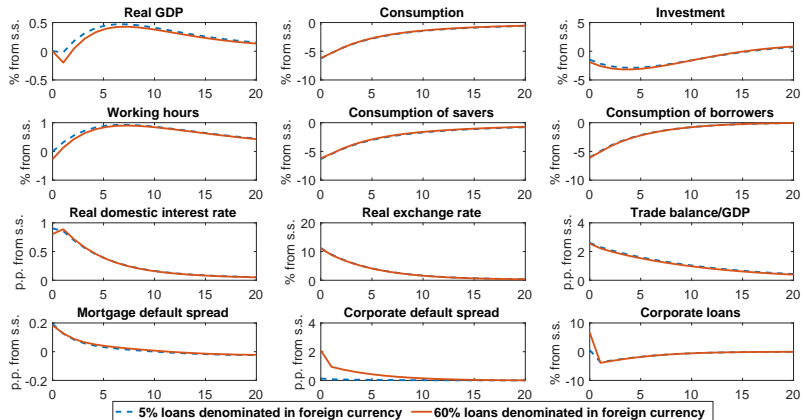
Par.	Description	Prior mean	Prior s.d.	Post.				mean	
				DO S	DO S&B	DO S&B	BGG S&B	DO-GK S&B	BGG-GK S&B
Autoregr.									
$\rho_a$	Nonstat. prod.	0.5	0.2	0.077	0.235	0.430	0.915	0.129	0.086
$\rho_z$	Stat. prod.	0.5	0.2	0.205	0.259	0.455	0.965	0.648	0.922
$\rho_u$	Capital util.	0.5	0.2	0.974	0.979	0.958	0.994	0.943	0.993
$\rho_\zeta$	Risk prem.	0.5	0.2	0.998	0.992	0.674	0.967	0.997	0.985
$\rho_{\sigma_M}$	HH vol.	0.5	0.2				0.956	0.666	0.619
$\rho_{\sigma_F}$	Revenue vol.	0.5	0.2	0.944	0.948	0.962	0.994	0.553	0.896
$\rho_{\lambda B}$	Asset div.	0.5	0.2					0.978	0.959
Standard dev.									
$\sigma_\mu$	Nonstat. prod.	0.01	$\infty$	0.029	0.023	0.021	0.007	0.025	0.035
$\sigma_z$	Stat. prod.	0.01	$\infty$	0.010	0.010	0.015	0.022	0.010	0.030
$\sigma_u$	Capital util.	0.01	$\infty$	0.100	0.091	0.111	0.463	0.113	0.048
$\sigma_R$	Mon. policy	0.01	$\infty$	0.003	0.003	0.003	0.004	0.003	0.003
$\sigma_\zeta$	Risk prem.	0.01	$\infty$	0.003	0.003	0.002	0.002	0.003	0.003
$\sigma_{\sigma_M}$	HH vol.	0.01	$\infty$				0.085	0.010	0.219
$\sigma_{\sigma_F}$	Revenue vol.	0.01	$\infty$	0.183	0.163	0.080	0.139	0.009	0.428
$\sigma_{\lambda B}$	Asset div.	0.01	$\infty$					0.253	0.045

Figure 3: Country's premium shock and currency mismatch for households.



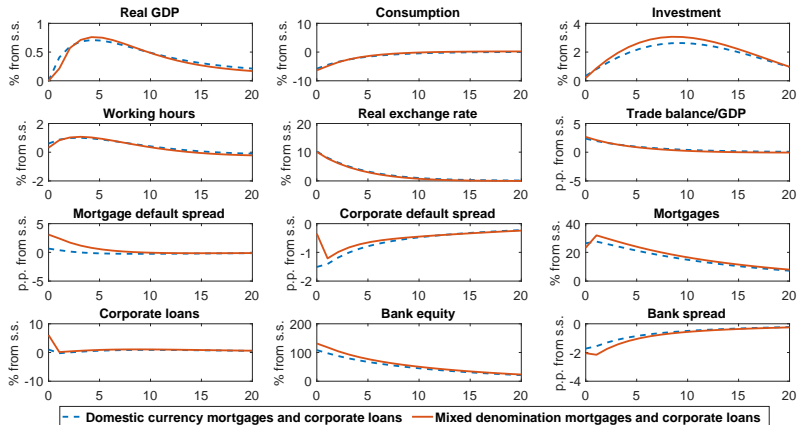
Note: The figure plots IRFs to an unexpected increase in the country's premium by three p.p. Corporate loans in both cases are issued in domestic currency only.

Figure 4: Country's premium shock and currency mismatch for firms.



Note: The figure plots IRFs to an unexpected increase in the country's premium by three p.p. Mortgages in both cases are extended in domestic currency only.

Figure 5: Country's premium shock and currency mismatch for all borrowers with leverage-constrained banks.



Note: The figure plots IRFs to an unexpected increase in the country's premium by three p.p. Mixed denomination mortgages and loans mean that 80% of mortgages and 60% of loans is dominated in foreign currency. In the domestic currency case, 10% corporate loans and zero of mortgages are denominated in foreign currency.