

# **What is the Risk of European Sovereign Debt Defaults?**

## **Fiscal Space, CDS Spreads and Market Mispricing of Risk**



Joshua Aizenman, UC Santa Cruz and the NBER

Michael Hutchison, UC Santa Cruz

Yothin Jinjarak, Univ. of London, SOAS

**THE FEDERAL RESERVE BANK OF ATLANTA  
SOVEREIGN DEBT AND DEFAULT AFTER THE  
FINANCIAL CRISIS OF 2007-2008**

**NOVEMBER 28-29, 2011**

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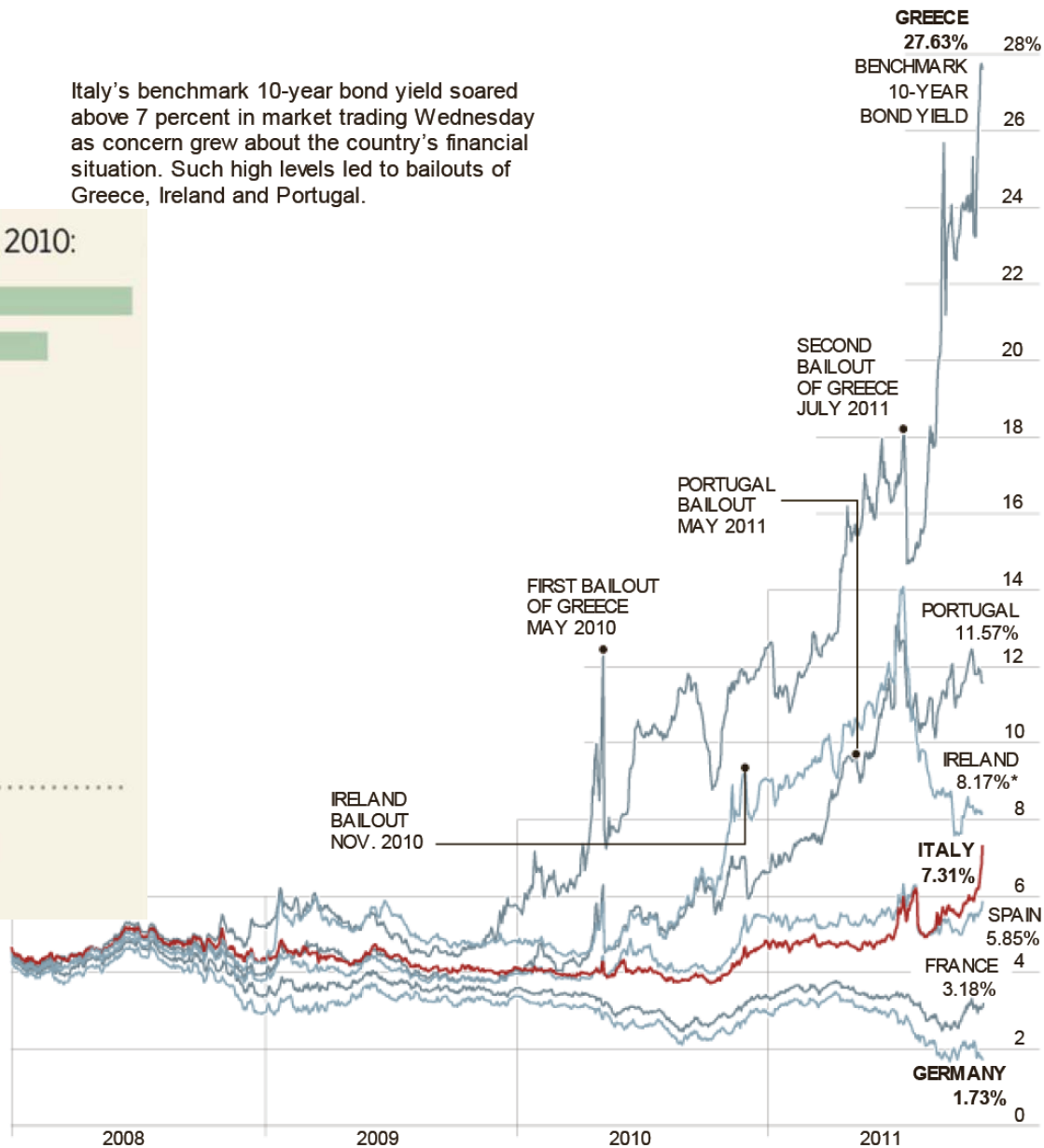
# Italian Bond Yields Soar

Italy's benchmark 10-year bond yield soared above 7 percent in market trading Wednesday as concern grew about the country's financial situation. Such high levels led to bailouts of Greece, Ireland and Portugal.

Debt as a percentage of GDP, selected countries, 2010:



Source: Eurostat



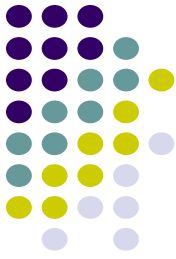
NYT, 11/10/11

\*Figures reflect Ireland's switch to a 9-year bond as a benchmark in October.

# Financial & fiscal Crises, 2008-



- World-wide recession
- Severe in industrial countries due to financial crisis
- Boom-bust cycle
- Expenditures up, revenues down plus one-off expenditures to stimulate economy and re-capitalize banks
- Europe hard-hit, especially SWEAP



# Questions

- Is market pricing of sovereign default risk systematically linked to fiscal solvency?
- What is sovereign default risk of SWEAP judging by CDS market data?
  - Greece, Ireland, Italy, Portugal, Spain
- Is SWEAP treated less favorably than others?
  - Are CDS “...betting on our bankruptcy and the breakup of euro“? (Papandreou)

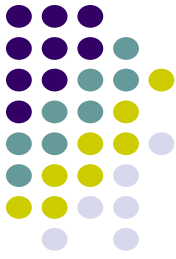
# Methodological Approach



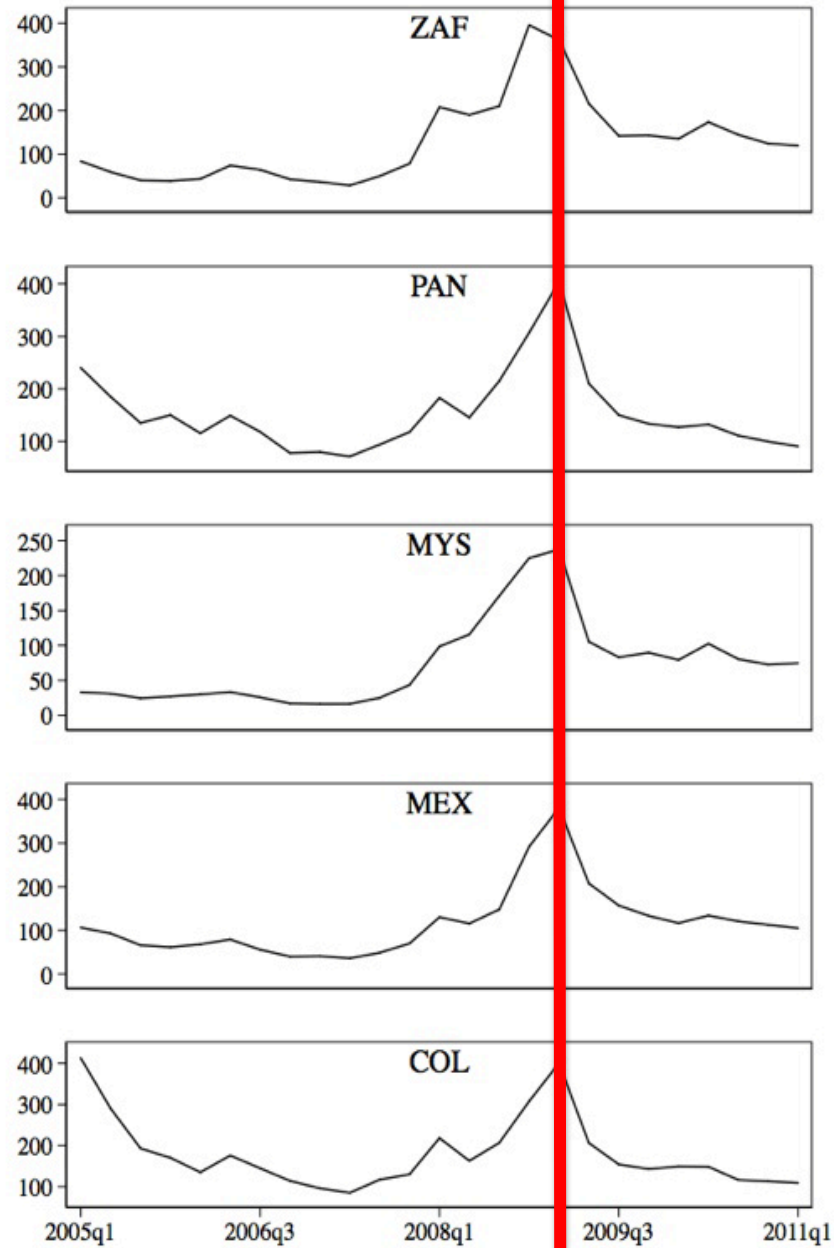
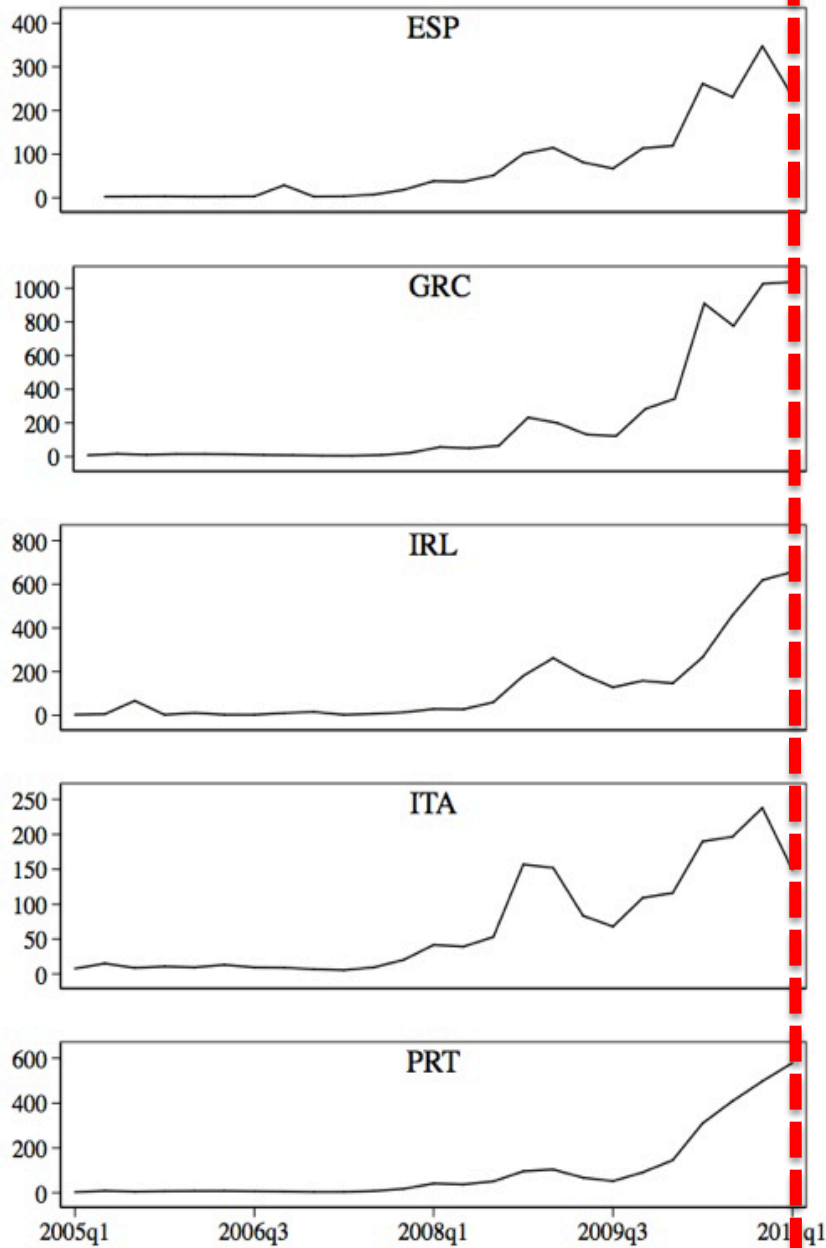
- Fiscal Space linkage with market risk of default
- Use CDS for market assessment of default risk
- Macro model of CDS pricing
  - Emphasis on fiscal space
  - Dynamic Panel– 60 countries, 2005-2010
- Model predictions of SWEAP CDS spreads
  - Out of sample forecast errors for SWEAP?
  - Comparison with “matched” economies

# Credit Default Swap

## Market Assessment of Default Risk



- CDS price is quarterly payment paid for a contingent claim against ‘credit event.’
- Event: default, restructuring, haircut
- Banks are the main users (CVA desks).
- Mainly OTC derivative markets
- 5-year tenor the most liquid



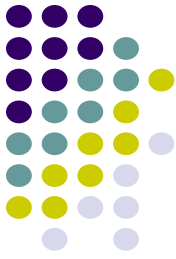




# Summary of CDS Studies

- Mainly finance, high frequency, corporate CDS
- Market incorporates news quickly
- Macro news matters for sovereign CDS
- Sovereign CDS prices co-move with bond yields
- No 'macro' studies linking fiscal solvency with sovereign CDS

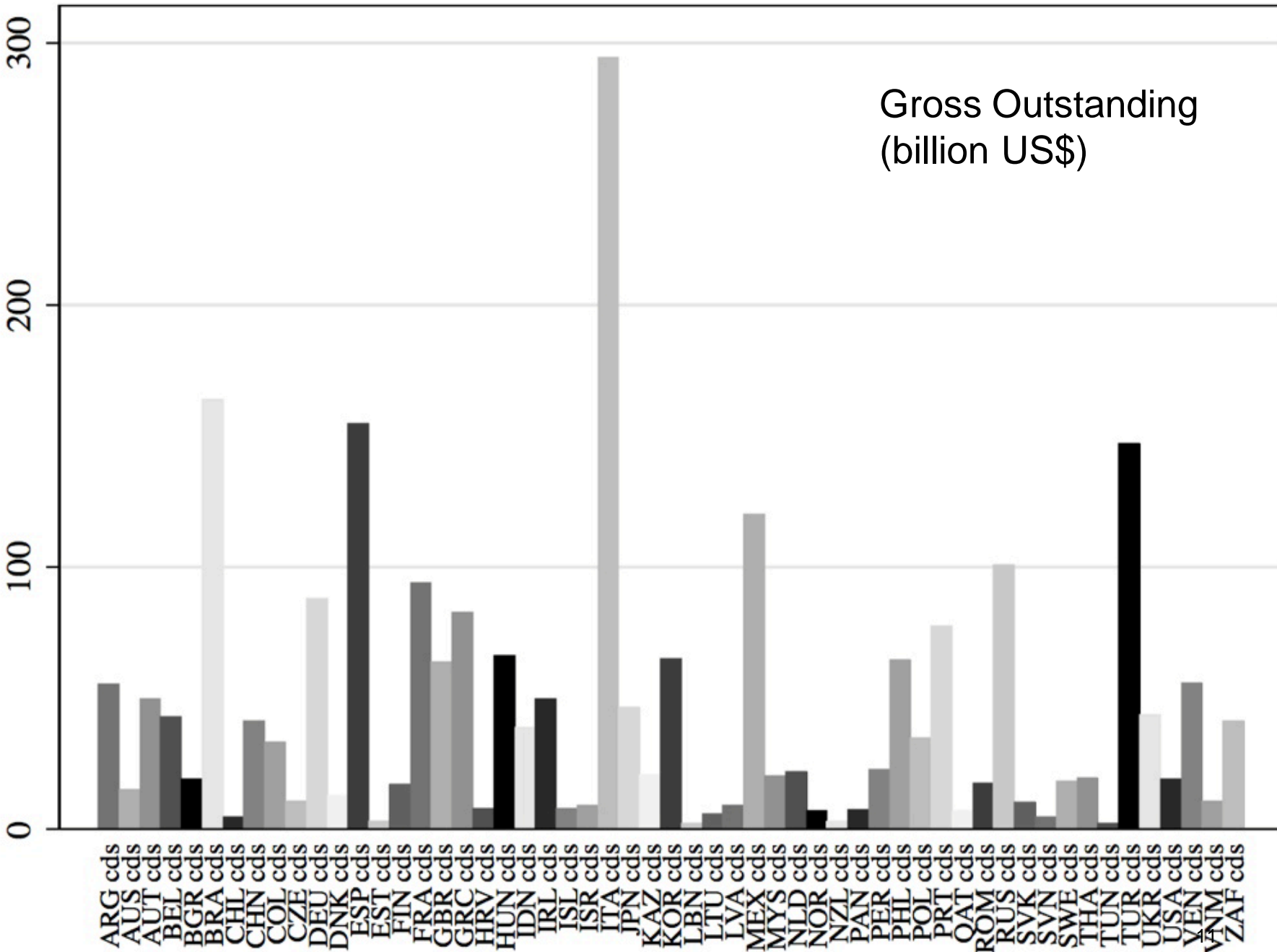
# Related Study



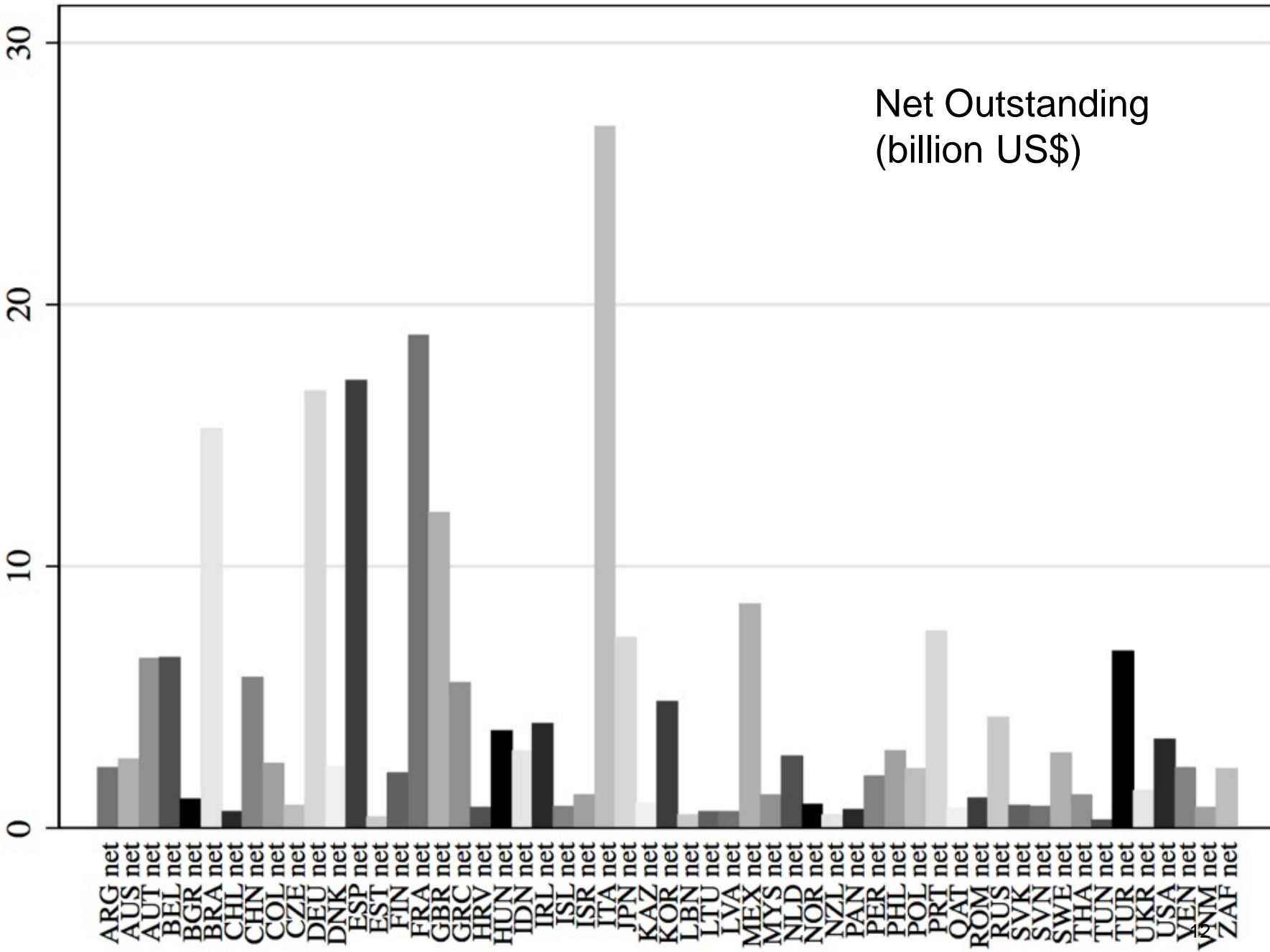
## Ang and Longstaff (NBER, 2011)

- Europe, US states
- Weekly data: May 08 - Jan 11
- Multi-factor affine framework with systemic and sovereign-specific credit shocks
- Systemic risk represents a smaller fraction of total risk for U.S. states than for the EMU's
- Systemic risk has roots in financial markets, not macro fundamentals

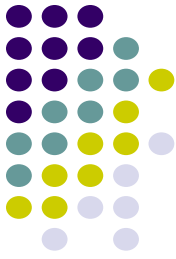
Gross Outstanding  
(billion US\$)



Net Outstanding  
(billion US\$)



# Fiscal Space and other variables



- Fiscal “space” (Aizenman and Jinjarak, 2010)
  - Essentially measures of fiscal capacity or burden
  - Stock variable: tax years to repay public debt
    - We use debt/tax revenue (high values, less fiscal space)
    - Tax revenue is 5-year average to control for business cycle effects
  - Flow variable: deficit/tax revenue (high values, less fiscal space)

# Debt, Deficit, Tax Base 'Fiscal Space'



2005	Public Debt	<b>Tax</b>	Public Debt	Fiscal Balance	<b>Fiscal Balance</b>
	GDP	<b>GDP</b>	Tax	GDP	<b>Tax</b>
Panama	63%	<b>10%</b>	6.3		
Austria	64%	<b>44%</b>	1.5		
Poland		<b>33%</b>		-2.9	<b>-0.09</b>
Philippines		<b>13%</b>		-2.7	<b>-0.21</b>



# Data

50 countries, 2005-10, balanced panels

CDS prices from CMA Datavision

Macro controls

‘Fiscal Space’

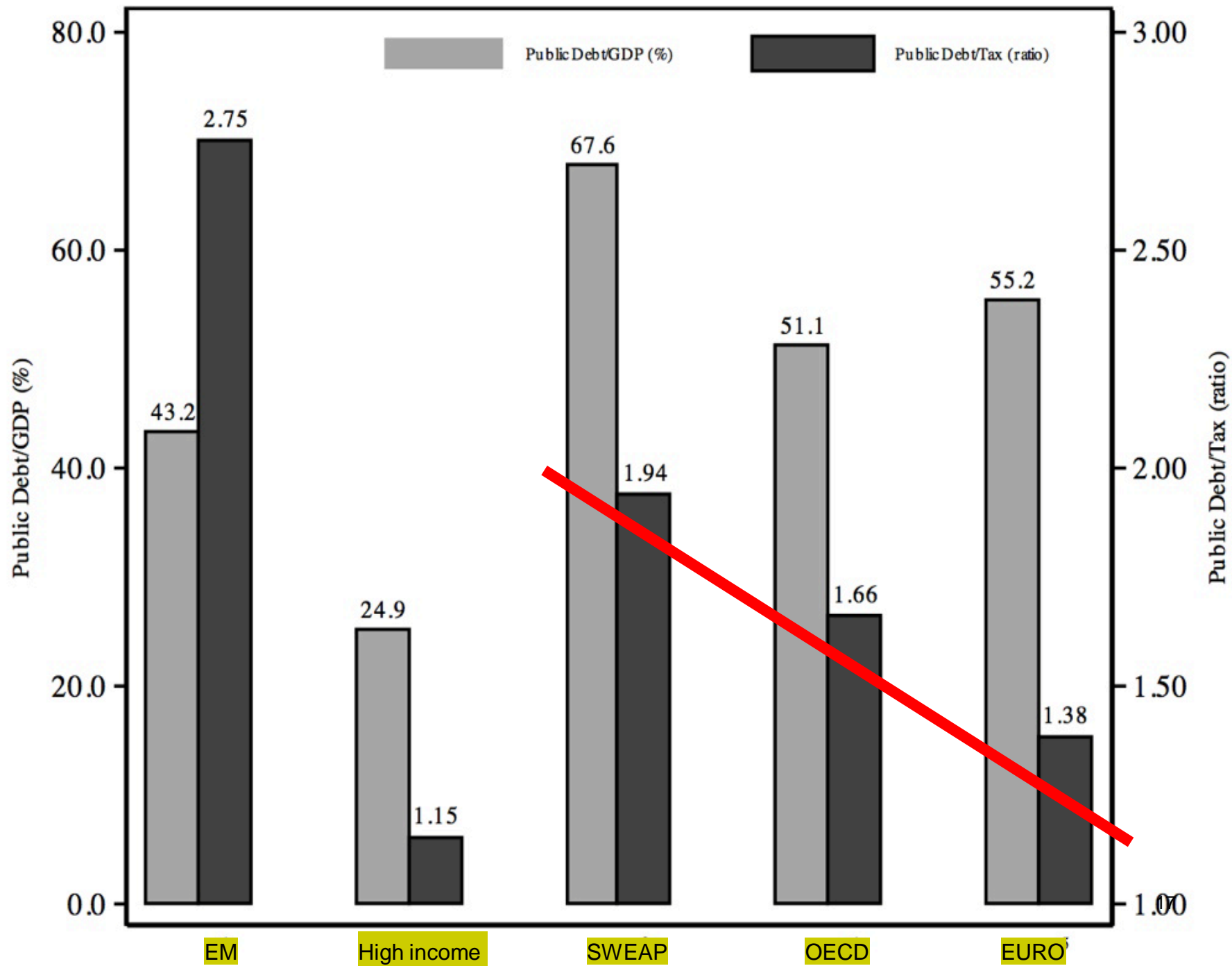


# Macro controls:

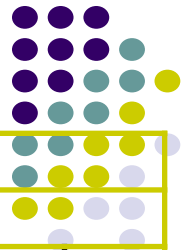
## Fiscal Space and other macro factors

- Fiscal capacity or burden
  - Stock measure: Public Debt/Tax Base:
  - How many tax years to repay the debt?
  - Flow measure: Fiscal Balance/Tax Base
  - Tax Base = average Tax/GDP of  $t-1, \dots, t-5$
- TED spread,
- External debt (total foreign liabilities/GDP)
- Trade openness (trade/GDP)
- Inflation.





# Dynamic of CDS Spreads



Y = CDS Spread (5-year tenor in basis points)	2005-10			2005-10		
	coefficient	[std. err.]		coefficient	[std. err.]	
t2008	328.0	[78.0]	***	295.6	[78.3]	***
t2009	-36.8	[33.7]		35.4	[27.7]	
t2010	2.5	[32.6]		92.9	[27.1]	***
t2008 x Euro dummy	-225.3	[82.3]	***	-209.5	[80.7]	***
t2009 x Euro dummy	14.6	[30.1]		-15.0	[30.8]	
t2010 x Euro dummy	5.2	[26.6]		-29.1	[28.0]	
t2008 x SWEAP	-249.5	[98.2]	**	-159.3	[82.7]	*
t2009 x SWEAP	18.7	[58.6]		73.4	[36.1]	**
t2010 x SWEAP	174.4	[107.9]		261.9	[63.7]	***
TED Spread	3.2	[27.3]		7.3	[27.8]	
Lagged CDS Spread	0.2	[0.1]	***	0.3	[0.1]	***
Trade/GDP	-86.1	[150.7]		-118.0	[128.8]	
Inflation	24.5	[11.9]	**	19.8	[10.3]	*
External Debt/GDP	-36.6	[30.1]		-1.9	[17.9]	
<b>Fiscal Balance/Tax Base</b>	<b>-829.4</b>	<b>[302.0]</b>	<b>***</b>			
<b>Public Debt/Tax Base</b>				<b>81.0</b>	<b>[29.9]</b>	<b>***</b>
R-sq.	.52			.40		
Observations	300 , balanced w/			300 , balanced w/		
Countries	50	fixed Effects		50	fixed Effects	<sup>18</sup>



# Main results

- Higher levels of sovereign debt and fiscal positions (deficit or debt) relative to the tax base significantly increase market pricing of sovereign default risk.
- Higher inflation leads to higher spreads.

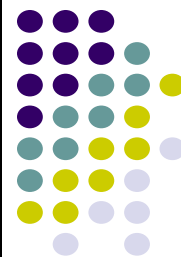
## Robustness

3-year, 5-year, 10-year tenors

Debt/Tax v. Debt/GDP horserace

Arellano-Bond type estimation

# Patterns during 2008, 9, 2010



- For Euro countries, including the SWEAP, sovereign spreads were substantially less than the international average in 2008.
- SWEAP spreads were somewhat above the average in 2009 and then rose sharply in 2010.
- Sovereign default risk in the SWEAP was priced much higher than the average of other countries, and moved in the opposite direction of the international trend in 2010. Risk assessments were falling around most of the world in 2010 but rising sharply in the SWEAP group.

# 2005-7 versus 2008-2010



- **Fiscal space** estimates are highly important in the pre-crisis “tranquil” 2005-07 sample. Debt and deficits relative to the tax base clearly lead to much higher risk assessments and CDS spreads.
- During the crisis, pricing of risk is largely decoupled from our two fiscal space measures.
- The ability of the model to explain CDS spreads drops from around 70-80% in the tranquil period to 45-60% during the crisis.
- **The TED spread**, trade openness, external debt and inflation play a larger role in 2008-2010.

# Interpretation



- The emergence of the TED spread as a key pricing factor in the crisis suggests that expectations of market volatility jumped during the crisis and that this pushed up CDS spreads.
- Possible default implies that the payoff to creditors is weakly concave (fixed payoff in good times, declining with an adverse shock above a threshold in bad times), suggesting that higher volatility will reduce the expected payoff in countries exposed to higher volatility during a crisis for a given debt/tax or debt/gdp and thereby increasing CDS spreads.
- This also explains the impact of the end of the Great Moderation—countries with greater exposure to volatility, other things equal, are facing higher spreads.

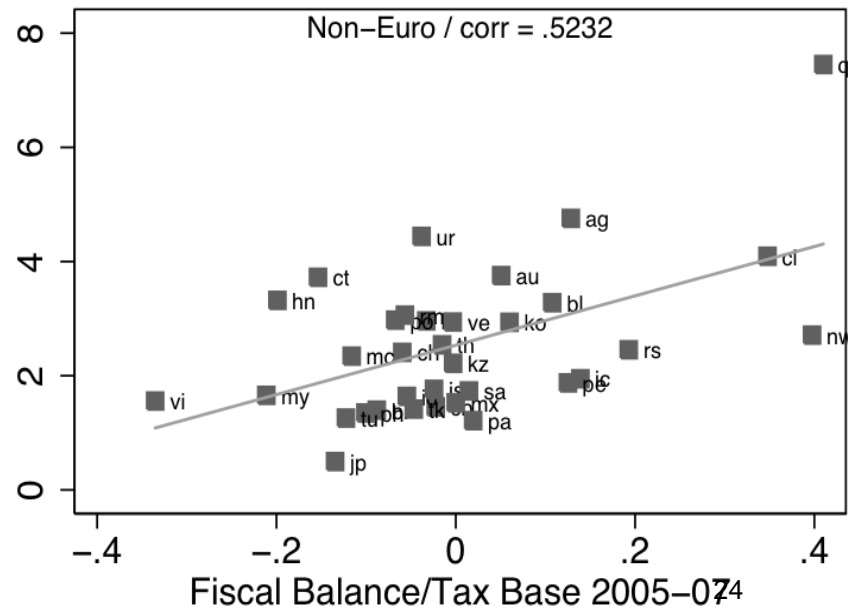
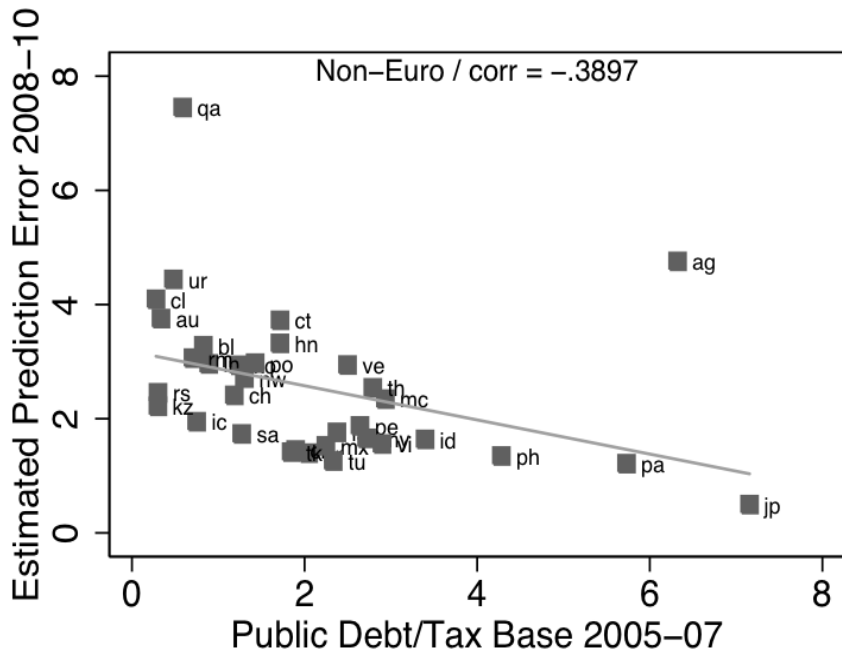
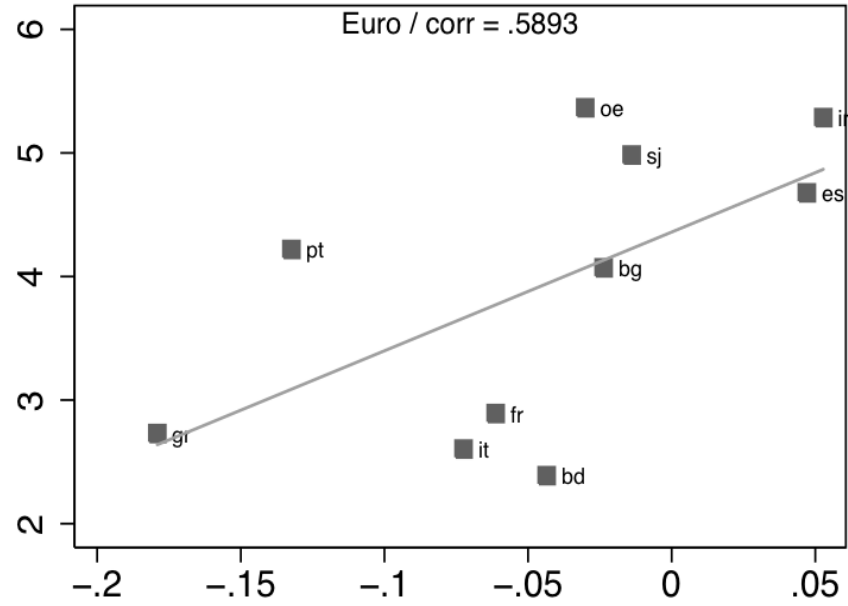
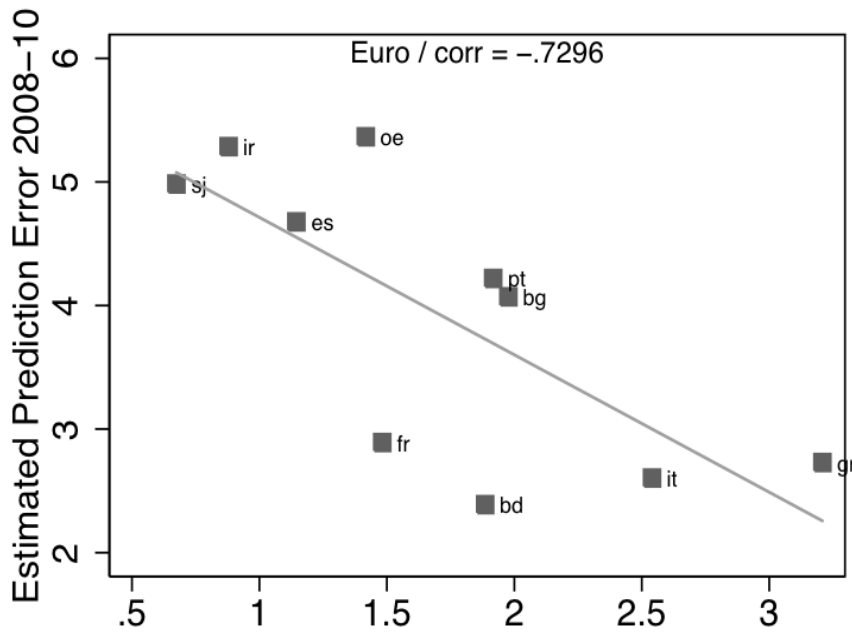
# SWEAP and other countries CDS Pricing Before and During the Crisis



$$\text{Prediction error} = \frac{\text{Actual 5 - yr. CDS}}{\text{Predicted 5 - yr. CDS}}$$

$> 1 \equiv$  under prediction; CDS is over - priced

Euro area countries with high debt and deficits during the pre-crisis period experienced *lower* CDS spreads relative to predicted values than did the non-Euro area countries.

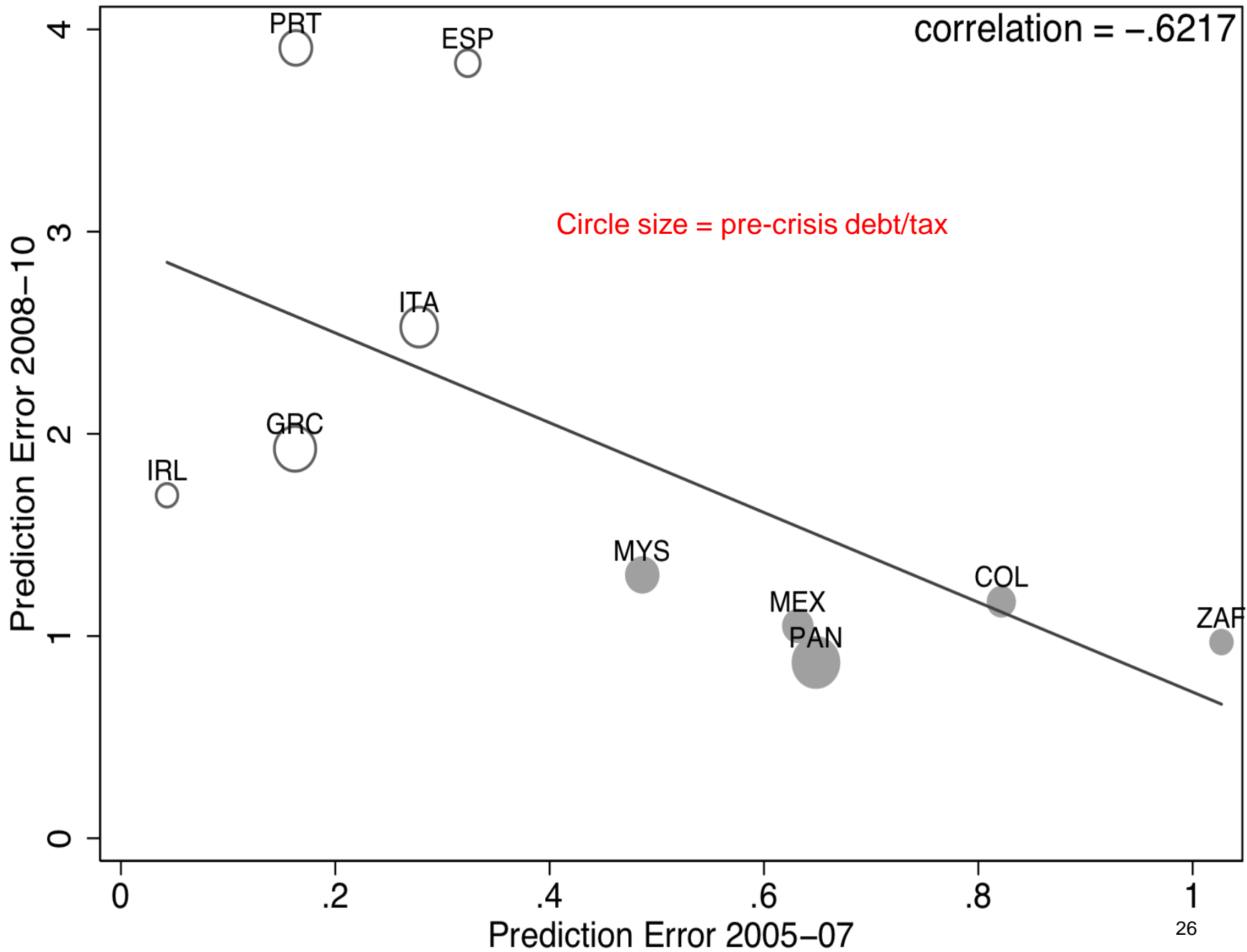




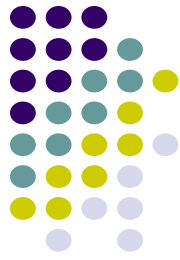


# Matching (in fiscal space)

- To gain further insight, we “match” the SWEAP with 5 middle-income countries (MI) that, during the crisis (2010), were closest in terms of fiscal space (debt/tax).
- See if the pricing of risk in SWEAP was different than corresponding MI matches
- SWEAP
  - ESP | GRC | IRL | ITA | PRT
- Emerging
  - ZAF | PAN | MYS | MEX | COL



# Inference from the matching



- Sovereign risk in SWEAP countries is ‘overpriced’ in comparison with corresponding MI countries.
- The relatively small prediction errors of the SWEAP countries in the pre-crisis period are followed by quite large prediction errors in the crisis period.
- For the MI countries—
  - a wide variation among the prediction errors in the pre-crisis period.
  - in the crisis period, all of the matched MI country predictions were quite close to realized CDS spreads.

# Taking Stock



- A large component of market risk assessment cannot be accounted for by fundamentals
- Actual CDS spreads in SWEAP are more than twice what (deteriorating) fundamentals predict
  1. Excessive optimism before crisis?
  2. Excessive pessimism after crisis?
  3. Expectations of further deterioration of fundamentals?

**Keynote, 30 May 2008, “The Eurosystem and its Prospects - History in the Making” Professor Axel Weber, President of the Deutsche Bundesbank, noted**



- “Now, what are the determinants of the Eurosystem’s success? Why did a currency area with no track record of its own attain such a high degree of credibility in so short a time? ...Key elements of (ECB’s) institutional framework have been transferred to the Eurosystem from the national central banks (NCBs), including the Deutsche Bundesbank. **Consequently, with the transfer of parts of the NCBs’ structure and ethos, the reputation of the currencies that were stable prior to EMU has lived on in the euro.”**

# Multiple Equilibria ?

## Buyer of last resort for government bonds\*



Solvency problems arise in one country (Greece)

→ bondholders fear the worst, sell other nations' bonds.

→ This loss of confidence can trigger a liquidity crisis in these other markets because there is no buyer of last resort.

→ Fears can grow until the liquidity problem degenerates into a solvency problem. The cycle starts as the loss of confidence, increases the interest rates needed to rollover bonds. Higher interest harms governments' solvency.

→ The cycle of fear and rising interest rates may lead to a self-fulfilling default.

\* De Grauwe, P (2011), "The Governance of a Fragile Eurozone", CEPS.

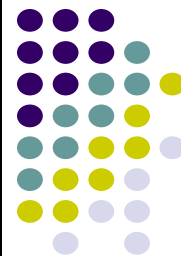
\* Calvo, Guillermo (1988), "Servicing the Public Debt: The Role of Expectations", *American Economic Review*, 78(4):647-661.



# What've we learned

- 'Fiscal space' (debt/tax; deficit/tax) is a robust predictor of CDS spreads.
- Systematically large prediction errors for CDS during the crisis.
- Volatility key for crisis pricing.
- SWEAP is priced much higher given fundamentals than matched MI emerging countries.

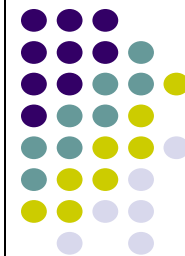
# Interpretation



1. High 2010 CDS spreads in SWEAP attributable to excessive pessimism?
2. ...or market may be expecting the SWEAP fiscal space to deteriorate in the near future.
3. Financial bailouts don't lower PDV of debt. Official loans that provide liquidity but don't lower PDV of the debt only lower the seniority of private debt, and may worsen the situation.



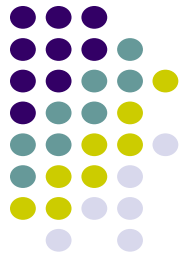
# Explaining SWEAP “exceptionalism”



- The adjustment challenges for SWEAP may be due to exchange rate inflexibility and exogenous monetary policy associated with Euro area; not a constraint in the matched MI countries.
- SWEAP Can't lower real value of debt through inflation or ER depreciation; can't adjust real economy via exchange rate depreciation

# Thanks!

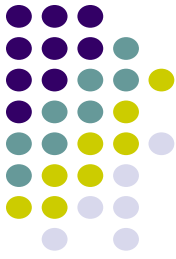




# More on CDS Markets

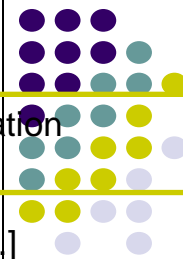
- Risk pooling, asynchronicities, counter-party risk
- Decentralised trading, multilateral netting
- Naked trading of CDS: not owning the underlying bond
- No credit event: worth buying sovereign CDS?
  - i.e. a rollover of Greek debt
  - 10 banks and 5 investment funds = ISDA committee deciding on 'credit event'

# Interesting Patterns, Many Possible Interpretations



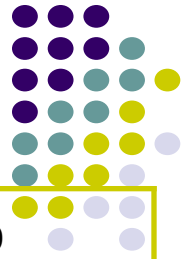
- Eurozone (SWEAP) uniqueness: €
- (Un)Warranted pessimism to fiscal deterioration
- Multiple equilibria
- Potential contagion

# Horserace and Serial Correlation



Y = CDS Spread (5-year tenor in basis points)	Debt/GDP ?			Arellano-Bond Estimation		
	coefficient	[std. err.]		coefficient	[std. err.]	
t2008	378.0	[100.9]	***			
t2009	10.5	[22.4]				
t2010	63.4	[14.4]	***			
t2008 x Euro dummy	-260.1	[86.1]	***			
t2009 x Euro dummy	53.1	[34.4]				
t2010 x Euro dummy	27.4	[26.9]				
t2008 x SWEAP	-250.4	[94.9]	***			
t2009 x SWEAP	100.0	[43.6]	**			
t2010 x SWEAP	260.0	[62.2]	***			
TED Spread	-10.1	[15.5]		70.7	[13.3]	***
Lagged CDS Spread (t-1)	0.3	[0.0]	***	-0.7	[0.0]	***
Trade/GDP	-23.0	[31.2]		-186.8	[34.5]	***
Inflation	30.3	[6.5]	***	3.7	[1.9]	**
External Debt/GDP	6.2	[5.3]		38.3	[8.9]	***
<b>Public Debt/GDP</b>	<b>1.5</b>	<b>[0.4]</b>	<b>***</b>			
<b>Public Debt/Tax</b>				<b>240.3</b>	<b>[14.8]</b>	<b>***</b>
R sq.	.18			.11		
Observations	300	, balanced w/		100	, 3 y-lags w/ <sup>37</sup>	
Countries	50	clustered s.e.		50	fixed effects	

# Structural Change



Y = CDS Spread (5-year tenor in basis points)	Tranquil Sample: 2005-07			Crisis Sample: 2008-10		
	coefficient	[std. err.]		coefficient	[std. err.]	
TED Spread	21.7	[7.7]	***	186.7	[45.1]	***
Lagged CDS Spread	0.2	[0.1]	***	-0.1	[0.1]	
Trade/GDP	-58.9	[37.5]		-191.4	[199.6]	
Inflation	6.5	[1.7]	***	27.2	[9.0]	***
External Debt/GDP	-5.2	[9.6]		33.0	[102.2]	
<b>Fiscal Balance/Tax Base</b>	<b>-291.7</b>	<b>[86.5]</b>	<b>***</b>	<b>-567.4</b>	<b>[606.0]</b>	
R-sq.	.89			.61		
Observations	150	, balanced w/		150	, balanced w/	
Countries	50	fixed effects		50	fixed effects	



# CDS Positions in 02/2011

[Source: \$billions; Calculated from Depository Trust & Clearing Corporation (DTCC) data]

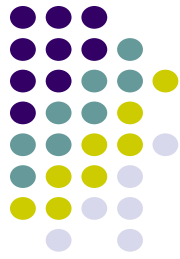
Eurozone	Gross	Net	Gross	Emerging	Gross	Net	Gross
			Net				Net
Italy	294	27	11	Mexico	120	9	13
Greece	83	6	14	Panama	7	0.7	10
Ireland	50	4	13	Malaysia	20	1.2	16
Spain	155	17	9	S. Africa	41	2.3	18
Portugal	77	8	10	Colombia	33	2.5	13

Net = Amount the market will have to pay<sub>39</sub> out in a credit event in CDS.

# Prediction Errors

Actual CDS Values

Predicted CDS Values



Country	Year	2008	2009	2010
	Sample	min	min	min
Greece	<b>05-07</b>	<b>2.7</b>	<b>2.2</b>	<b>3.3</b>
	05-10	2.3	1.8	1.7
Portugal	05-07	2.8	2.9	6.9
	05-10	3.2	4.0	4.5
Emerging	05-07	3.9	1.0	1.8
	05-10	2.7	1.2	1.2
Euro-SWEAP	05-07	5.0	5.8	13.7
	05-10	2.1	4.2	3.2