The Transmission of Quasi-Sovereign Default Risk: Evidence from Puerto Rico

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Overview

- Empirical challenge for sovereign debt literature: Identify effects of default risk on the macroeconomy.
  - Difficult to isolate default risk from risks of banking/currency crisis, or of gov interference on private contracts (eg, Argentina, Greece).
  - Reverse Causality: Economic activity may drive default risk.
- This paper provides a novel setting to extract macro effects of default risk: Puerto Rican debt crisis.
- Document a government demand channel: increase default risk affects macroeconomy through reduced government spending.

Puerto Rico's Quasi-Sovereign Status

- U.S. territories cannot by law abandon the U.S. dollar (US Constitution, Article I, Sections 8 and 10).
- Banks are protected by the FDIC.
- P.R. government lacks legal authority to make banking system interventions $\rightarrow$ limit deposit withdrawals/capital controls (Puerto Rico Federal Relations Act (1950) & Contracts Clause (U.S. Constitution).
- Contracts Clause provides U.S. constitutional protection on government interference with private contracts (Commonwealth of Puerto Rico v. Franklin California Tax-Free Trust et al., October 2015)
- P.R. subsidiaries cannot access Chapter 9 (U.S. Bankruptcy Code)

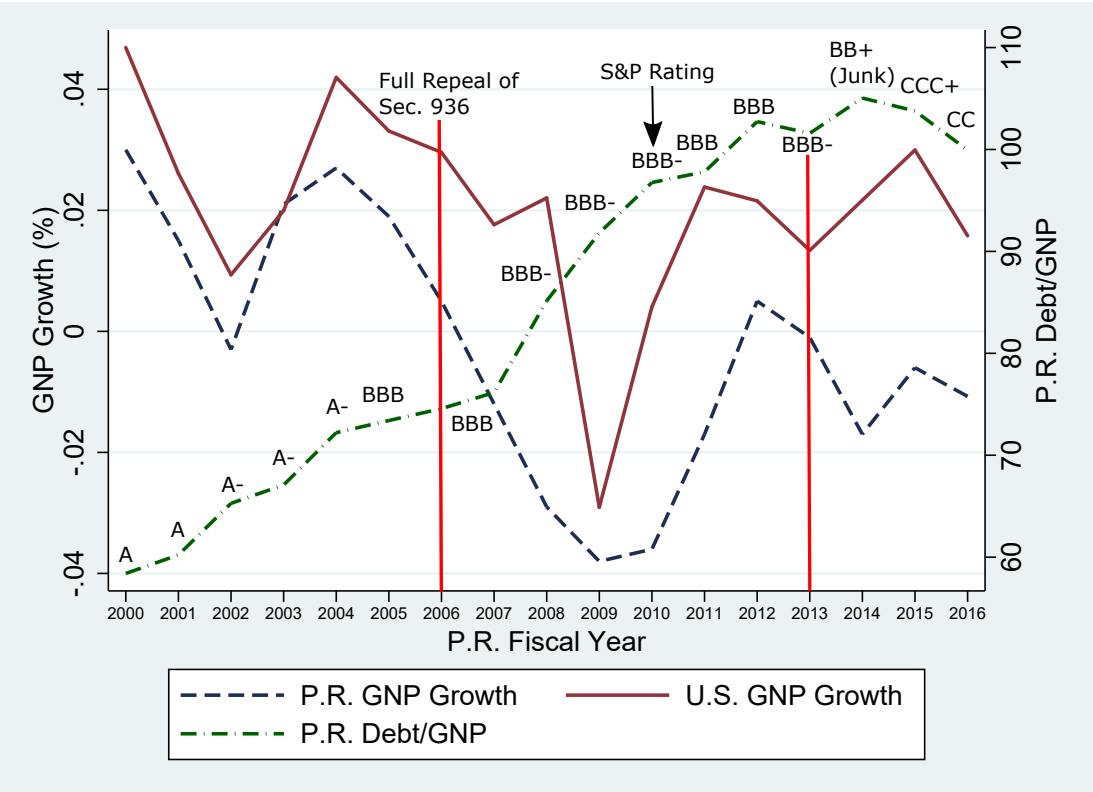
What does this paper do?

- Given P.R. backdrop, we provide evidence for a government-demand-driven channel for the transmission of sovereign default risk.
  - Develop a simple theoretical model that illustrates a mechanism connecting sovereign default risk with austerity risk.
- Provide evidence for this mechanism using monthly employment data for Puerto Rican industries
  - Exploit the cross-sectional variation in ex-ante government demand dependence across industries.

Related Literature

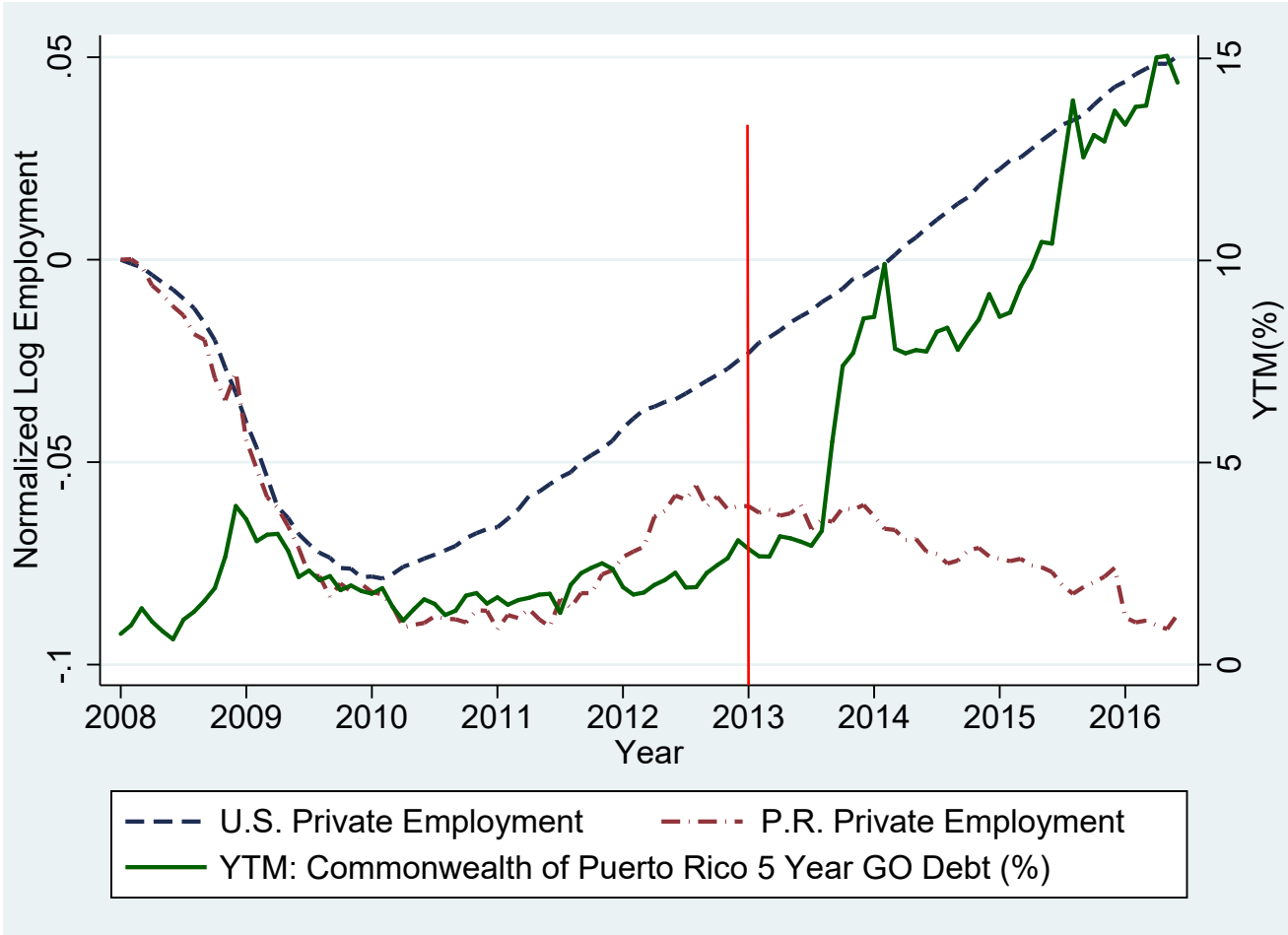
- Empirical literature on the costs of sovereign default: Hébert & Schreger (2017) $\rightarrow$ Argentina; Zettelmeyer et. al. (2013) $\rightarrow$ Greece.
- Yeyati & Panizza (2011) $\rightarrow$ output contractions precede defaults $\rightarrow$ default anticipation drives the costs of default.
- Austerity & Growth: Auerbach & Gorodnichenko (2012); Jordá & Taylor (2016); Blanchard & Leigh (2014); Chari & Henry (2015); House & Tesar (2015)
- Theoretical literature on sovereign debt: Survey by Aguiar et. al. (2014).
- Effect of sovereign risk on bank loan supply (Popov & Van Horen (2015); De Marco (2016); Becker & Ivashina (2018); Bofondi et al. (2017)), & transmission of sovereign risk via reduced bank loan supply to the employment of affected firms (Balduzzi et al. (2015); Acharya et al. (2018).
- Add to this literature by using the unique natural experiment of Puerto Rico & higher frequency monthly employment data.

Figure: P.R. vs U.S. GNP



- P.R.'s final default (June 30, 2016) preceded by several years of economic malaise.
- Output and employment costs precede default $\rightarrow$ default anticipation may explain it (Yeyati & Panizza, 2011).

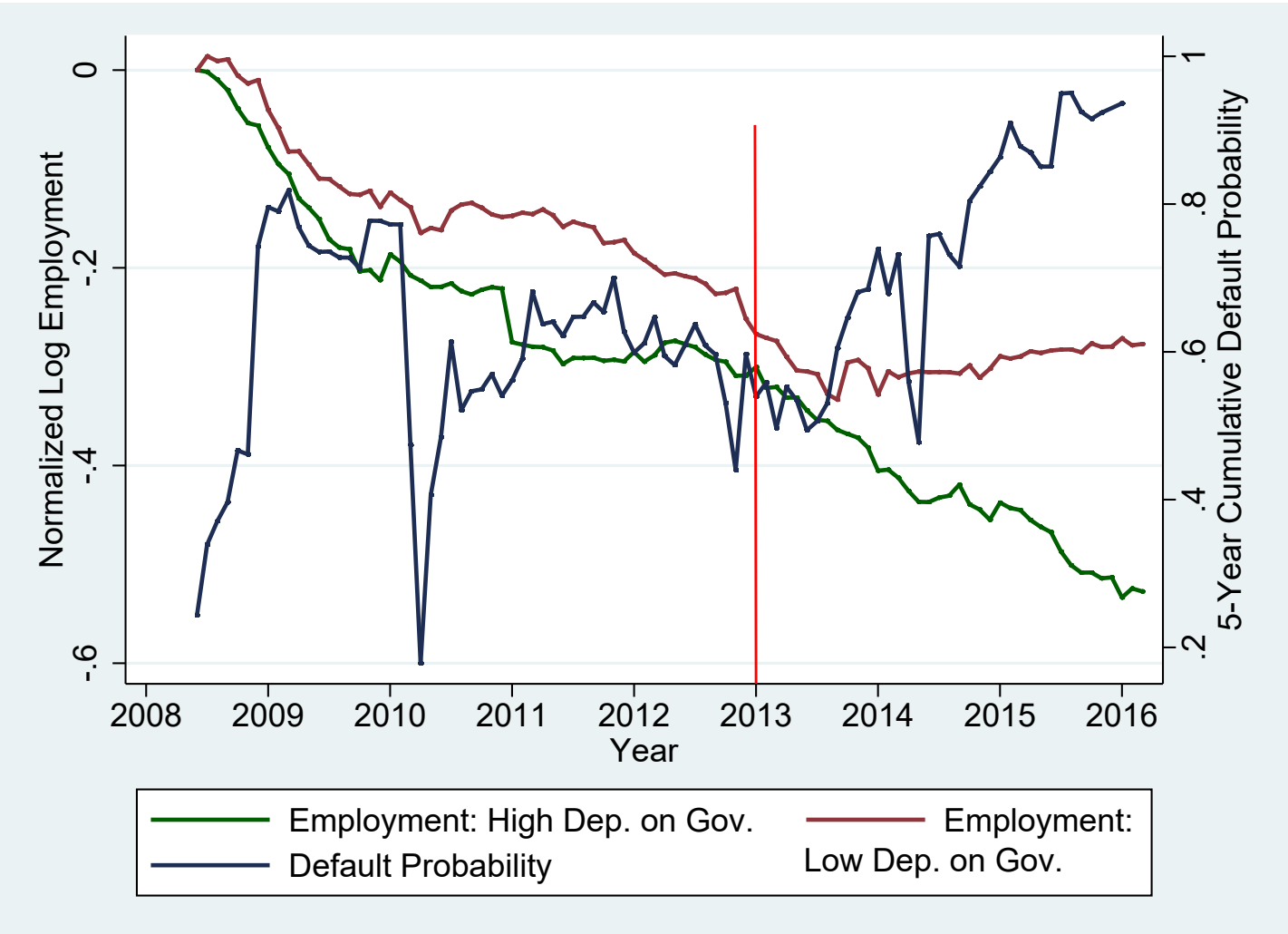
Figure: Employment and Yields



- Post-2012, close relationship of real activity in Puerto Rico with the U.S. mainland breaks down: P.R. activity lags behind.

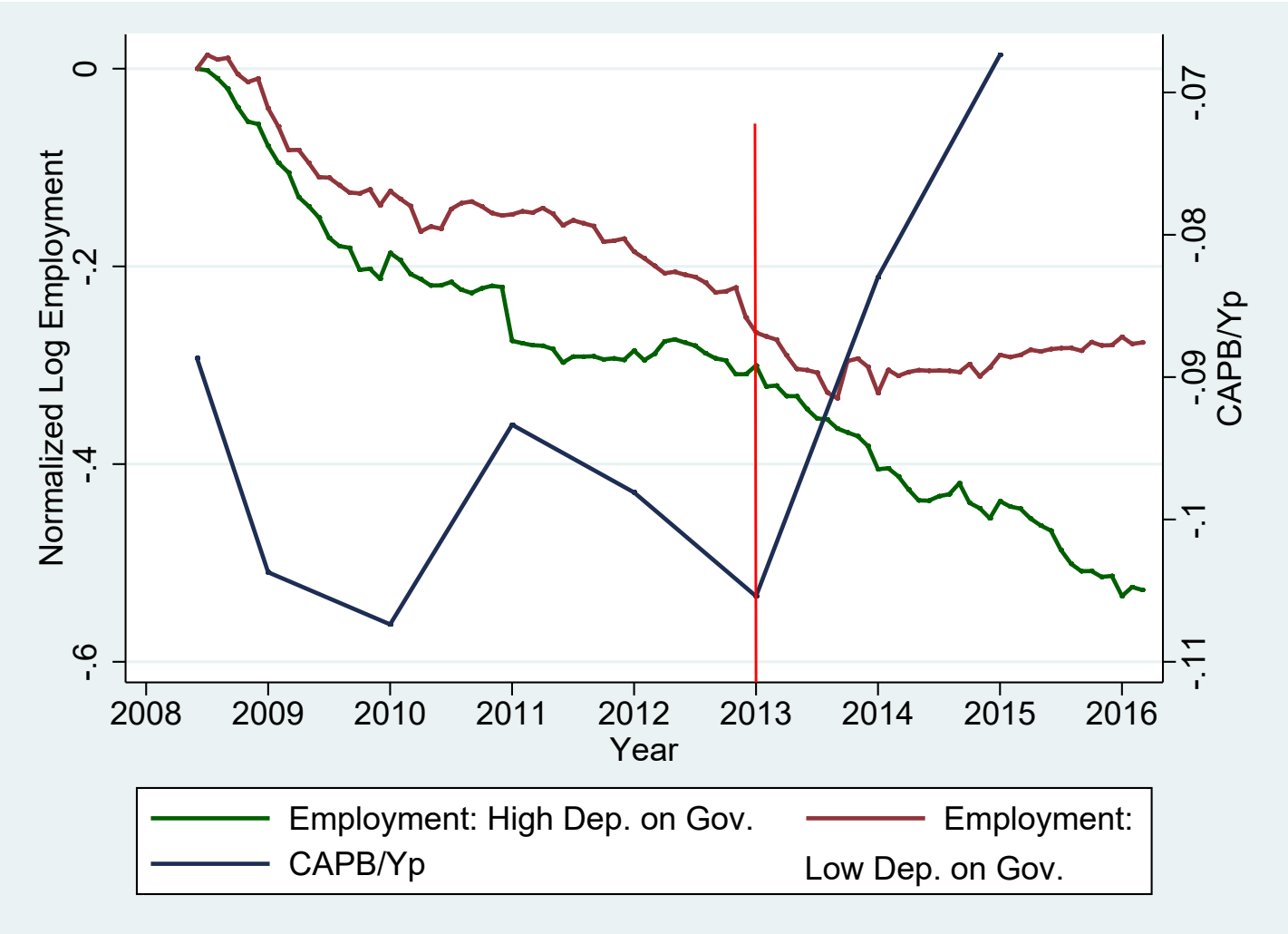
Default Risk and Government Demand

Figure: Employment by Dependence on Government Demand & Default Probability



Austerity and Government Demand

Figure: Employment by Dependence on Government Demand and CAPB



What do we find?

1. Increased default risk associated with slower employment growth in government demand-dependent industries
   - Effects amplified when default risk is interacted with austerity measures.
2. Austerity associated with reduced output growth through a local fiscal multiplier effect.
3. Increased default risk associated with:
   - Slower employment growth in external finance-dependent industries.
   - Impact on government demand-dependent industries quantitatively strengthens when we control for external finance dependence.

Simple Model

- Two-period NK SOE (Galí Monacelli 2005 + Benigno 2015)
- Add sovereign borrowing
- Add multiple sectors w. heterogeneous exposure to gov demand.

Setup

- SOE, representative hh, benevolent government
- $t = 0$ (short run) and $t = 1$ (long run)
  - Nominal wage flexible in $t = 1$
  - but fixed at $\overline{W}$ in $t = 0$
- Domestic economy has two sectors
  - m: more exposed to government demand
  - l: less exposed to government demand
  - hh also consume imported foreign good f

$$u(C) + v(G) + \beta E\left[u(C') + v(G')\right]$$

$$\begin{aligned} C &= \left[(C_m)^{1-\lambda}(C_l)^{\lambda}\right]^{1-\chi}(C_f)^{\chi} \\ C' &= \ldots \end{aligned}$$

Labor market

- hh supply labor inelasticaly up to $\bar{h}$
  - Short run $h \leq \bar{h}$ (sticky wage); Long run $h' = \bar{h}$ (flexible wage)

$$\begin{aligned} P_m C_m + P_l C_l + P_f C_f &= \overline{W} h + \Pi - T \\ P'_m C'_m + P'_l C'_l + P'_f C'_f &= W' \bar{h} + \Pi' - T' \end{aligned}$$

- Firms in sector $j \in \{m, l\}$:

$$\begin{aligned} \Pi_j &= \max_{h_j} P_j A h_j^{\alpha} - \overline{W} h_j \\ \Pi'_j &= \max_{h'_j} P'_j A' h_j^{'\alpha} - W' h'_j \end{aligned}$$

- Aggregate labor demand:

$$\begin{aligned} h &= h_m + h_l \\ h' &= h'_m + h'_l. \end{aligned}$$

Closing the model: Import/Export

- Imported good price:

$$P_f = P_f' = 1$$

  - Law of one price: $P_f = eP_f^*$
  - Fixed exchange rate $e = 1$
  - Normalize $P_f^* = 1$
- Export: exogenous foreign demand X_j for domestic goods $j \in \{m, l\}$

$$\begin{aligned} X_j &\equiv \zeta P_j^{-\rho} \\ X_j' &\equiv \zeta' P_j^{'\rho}. \end{aligned}$$

Asymmetric exposure to government demand

- Government provides public good G, with input *only* from domestic sector m:

$$G = f(G_m), \;\; G' = f(G'_m)$$

- Finances spending by lump-sum tax + borrowing from abroad
- Faces fiscal constraint: can tax at most $\bar{T}$ and $\bar{T}'$

$$\begin{aligned} P_m G_m &\leq \bar{T} + qB \\ P'_m G'_m &\leq \bar{T}' - (1 - def)B. \end{aligned}$$

- $t = 1$: If default, gov receives cont. payoff $\underline{V}$
-

$$q = \frac{1 - Pr(def)}{1 + r^*}$$

Asymmetric effects of government spending

- Short-run goods market clearing:

$$\begin{aligned} C_m + \zeta P_m^{-\rho} \quad + G \quad &= A h_m^{\alpha} \\ C_l + \zeta P_l^{-\rho} \quad\quad\; &= A h_l^{\alpha} \end{aligned}$$

- Combined with short-run labor market clearing
  $\Rightarrow h_m$ more sensitive to gov demand

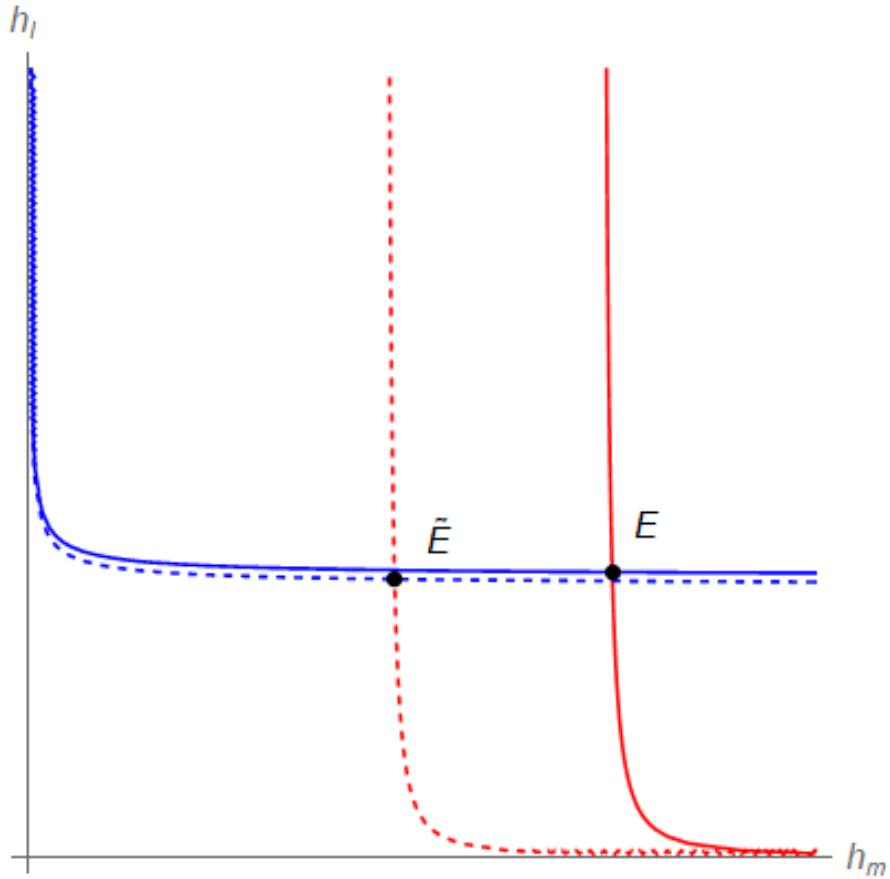
$$\begin{aligned} &\overbrace{(1-\lambda)\frac{1-\chi}{\chi}\left(qB + \bar{\omega} h_m^{(1-\alpha)(1-\rho)} + \bar{\omega} h_l^{(1-\alpha)(1-\rho)}\right)}^{\text{domestic demand}} + \overbrace{\bar{\omega} h_m^{(1-\alpha)(1-\rho)}}^{\text{foreign demand}} + \overbrace{(\bar{T} + qB)}^{\text{gov demand}} = \overbrace{\frac{1}{\alpha}\bar{W} h_m}^{\text{supply}} \\ &\lambda\frac{1-\chi}{\chi}\left(qB + \bar{\omega} h_m^{(1-\alpha)(1-\rho)} + \bar{\omega} h_l^{(1-\alpha)(1-\rho)}\right) + \bar{\omega} h_l^{(1-\alpha)(1-\rho)} = \frac{1}{\alpha}\bar{W} h_l \end{aligned}$$

where $\bar{\omega} \equiv (\frac{\overline{W}}{A\alpha})^{1-\rho}\ \zeta$

Proposition 1 An increase in the default risk reduces the competitive equilibrium employment in the short run, with the effect stronger on sector m, which is more exposed to government demand. Specifically, a negative shock to the default value $\underline{V}$ raises $\Pr(def)$ and reduces h_l and especially h_m:

$$\frac{\partial h_m}{\partial \underline{V}} < \frac{\partial h_l}{\partial \underline{V}} < 0.$$

Asymmetric effects of default risk



Shock to default risk:

- $\underline{V} \uparrow$ (or $A' \downarrow$) $\Longrightarrow$ $q \downarrow \Longrightarrow$ $q\ B(q) \downarrow \Rightarrow$ austerity
- Austerity $\Rightarrow$ employment $\downarrow$ esp. in more exposed sector m

Empirical analysis

Key Datasets

- **Macro Data**
  - P.R. fiscal balance: P.R. financial statements: 2000-2016
  - P.R. GNP: GDB: 2000-2016
  - FRED for U.S. GDP
- **Micro Data**
  - Employment 3-digit NAICS: BLS: 2000Jan-2016June (73 industries)
  - Output 3-digit NAICS: PR Planning Board: 2002-2015 (19 industries)
  - Share of sales to P.R. Government: 2012: Economic Census of Island Areas
  - Banking balance sheet data for P.R. banks: FDIC Call Reports
  - External finance-dependence: Compustat/CRSP: 2000-2015
- **Financial Market Data**
  - CDS spreads: JP Morgan Markit: 2008-2015 Daily

Main Specification

$$\Delta E_{it} = \alpha_i + \mu_t + \nu SH_{it-1} + \sum_{j=1}^{12} \delta_{t-j} * GOV_i * \Delta DEF_{t-j} + \beta * GOV_i$$
$$* \Delta capb_{prioryear} + \sum_{j=1}^{12} \gamma_{t-j} * GOV_i * \Delta DEF_{t-j} * \Delta capb_{prioryear} + \epsilon_{it} \quad (1)$$

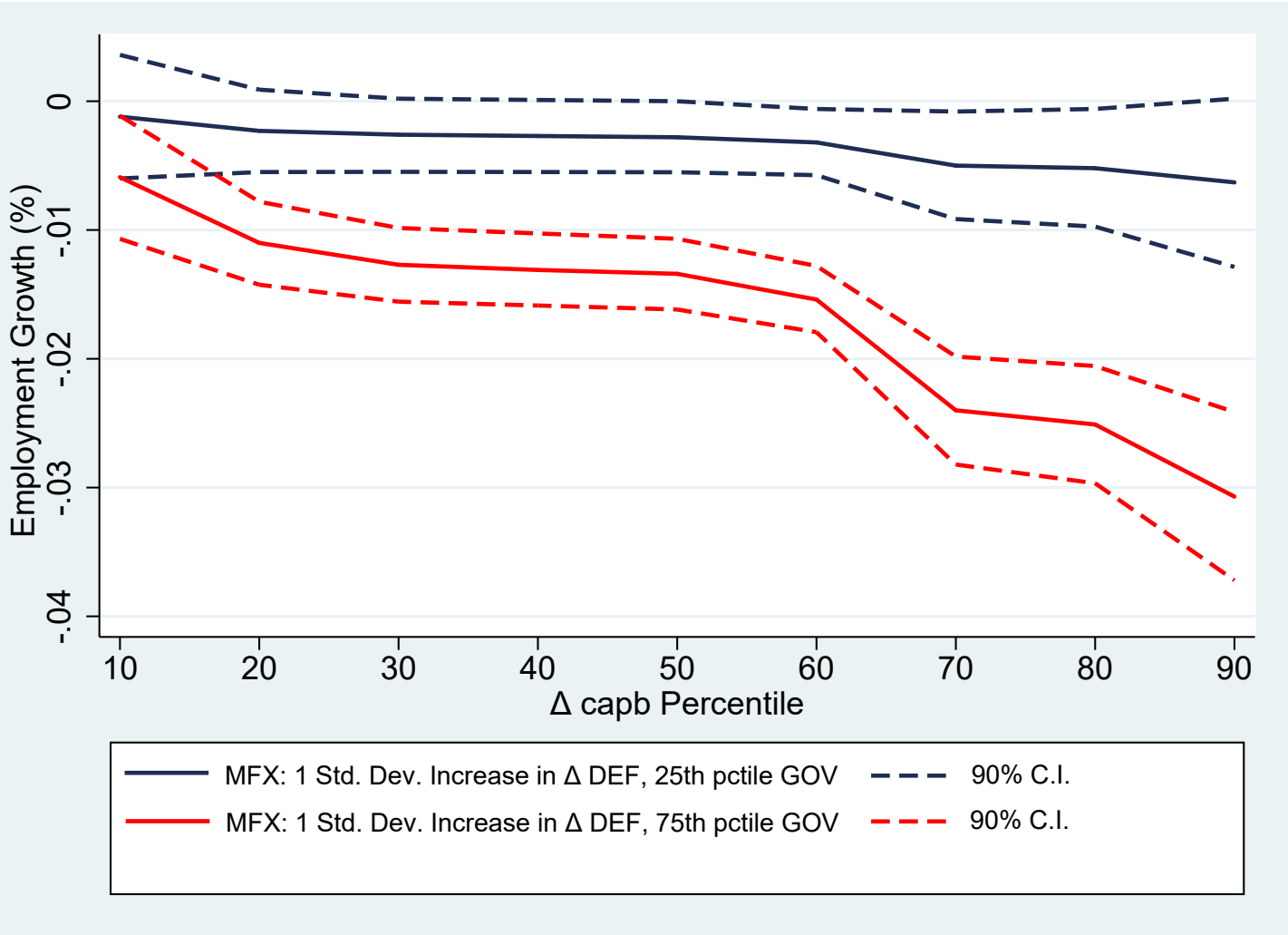
- ΔE_{it}: employment growth for industry i in month t.
- SH_{it-1}: total private employment share for industry i in month $t-1$.
- ΔDEF_t: change in the monthly average of default probability in month t.
- GOV_i: share of sales to the government for industry i.
- $\Delta capb$: annual first difference in cyclically-adjusted primary balance ($\%\, Y_P$).
- α_i: industry fixed effects. μ_t: month fixed effects.

Results

	(1)	(2)	(3)
Constant	0.0116	0.0024	0.0154*
	(0.0076)	(0.0035)	(0.0086)
SH_{t-1}	-2.2381***	-.3827	-2.2426***
	(0.6420)	(0.4113)	(0.6215)
$GOV * \Delta CAPB_{prioryear}$		-3.6859**	2.182507
		(1.3132)	(1.9278)
$\sum_{j=1}^{12} GOV * \Delta DEF_{t-j}$	-3.3875***		-5.9455***
$\sum_{j=1}^{12} GOV * \Delta DEF_{t-j} * \Delta CAPB_{prioryear}$			-271.5450***
Observations	1,343	2,907	1,343
Industry Fixed Effects	Y	Y	Y
Time Fixed Effects	Y	Y	Y
F test $GOV * \Delta DEF$ jointly significant	5.67***		6.66***
Prob$>F$	0.0009		0.0003
F test $GOV * \Delta DEF * \Delta CAPB_{prioryear}$ jointly significant			151.55***
Prob$>F$			0.0000

Marginal Effects

Figure: Marginal Effects of Default Risk Across Austerity



Economic Significance

	ΔDEF 25th pctile	ΔDEF 75th pctile	ΔDEF 90th pctile
GOV 25th pctile	-0.0012	-0.0023	-0.0034
GOV 75th pctile	0.0002	-0.0049	-0.0101
Difference	0.0015	-0.0026	-0.0068
Percent of average monthly employment growth	40.3%	71.6%	188.2%
	$\Delta capb$ 25th pctile	$\Delta capb$ 75th pctile	$\Delta capb$ 90th pctile
GOV 25th pctile	0.0003	-0.0001	-0.0003
GOV 75th pctile	0.0007	-0.0014	-0.0022
Difference	0.0003	-0.0013	-0.0019
Percent of average monthly employment growth	9.7%	35.7%	53.4%

Summary: Government Demand Channel

- Increased default risk$\rightarrow$
  - Significantly reduced employment growth in government demand-dependent industries.
  - austerity measures amplify the impact of default risk.
- Findings consistent with the government demand channel.
  - Increased default risk $\rightarrow$ anticipation of future austerity measures $\rightarrow$ employment more sensitive in industries dependent on government demand.

The Local Fiscal Multiplier

$$\Delta Y_{it} = \alpha + \beta \Delta Y_{it-1} + \gamma \Delta capb_t + \epsilon_{it} \quad (2)$$

Table: Austerity and Default Risk Have Real Effects on the Output Growth of Puerto Rican Manufacturers

	(1)	(2)	(3)
Constant	-0.0088	-0.0095***	-0.0053
	(0.0066)	(0.0010)	(0.0274)
ΔY_{it-1}	0.2349**	0.1464	0.1750*
	(0.1113)	(0.1118)	(0.0972)
$\Delta capb_t$	-0.9470***	-1.0703***	
	(0.2890)	(0.3101)	
$GOV * \Delta DEF_t$			-6.2783*
			(3.0879)
Observations	266	266	136
Sector Fixed Effects	N	Y	Y
Time Fixed Effects	N	N	Y

Alternative Explanation: External Finance Dependence

Default Risk & External Finance: Specification

Difference-in-difference approach (Rajan and Zingales 1998, Dell'Ariccia et al. 2008):

$$\Delta E_{it} = \alpha_i + \mu_t + \nu SH_{it-1} + \sum_{j=1}^{12} \delta_{t-j} * GOV_i * \Delta DEF_{t-j} + \sum_{j=1}^{12} \gamma_{t-j} * EXTFIN_i^{US} * \Delta DEF_{t-j} + \sum_{j=1}^{12} \beta_{t-j} * LD_i * \Delta DEF_{t-j} + \epsilon_{it} \quad (3)$$

- $EXTFIN_i^{US}$: the Rajan and Zingales (1998) measure of dependence on external finance for industry i.
- LD_i: Industry-level measure of local demand dependence.

Default Risk & External Finance: Results

	(1)	(2)	(3)
Constant	0.0189**	0.0170**	0.0155*
	(0.0078)	(0.0072)	(0.0077)
SH_{t-1}	-2.7585***	-2.6101***	-2.5770***
	(0.7085)	(0.5855)	(0.5877)
$\sum_{j=1}^{12} EXTFIN^{US} * \Delta DEF_{t-j}$	-0.0313	-0.0931	-0.0814
$\sum_{j=1}^{12} LD * \Delta DEF_{t-j}$		-0.0628	0.2438
$\sum_{j=1}^{12} GOV * \Delta DEF_{t-j}$			-6.5147
Observations	1,501	1,422	1,343
Industry Fixed Effects	Y	Y	Y
Time Fixed Effects	Y	Y	Y
F test $EXTFIN^{US} * \Delta DEF$ jointly significant	25.90***	36.35***	31.41***
Prob¿F	0.0000	0.0000	0.0000
F test $LD * \Delta DEF$ jointly significant		12.33***	108.13***
Prob> F		0.0000	0.0000
F test $GOV * \Delta DEF$ jointly significant			171.63***
Prob> F			0.0000

Default Risk & External Finance: Summary

- Increased default risk $\rightarrow$ significantly reduced employment in *external finance dependent industries.*
- Government demand channel quantitatively stronger when controlling for the external finance channel.
  - Credit Supply: Commercial and industrial loan activity declines by 35.6% between 2008-2015.
  - Non-Puerto Rican banks do not act as substitutes$\rightarrow$ lending declined from 19% in 2008 to 4% in 2016.
  - Puerto Rican banks significantly exposed to P.R. debt $\rightarrow$ 40% of capital loans to P.R. municipalities.
  - A Quasi-Sovereign ceiling operates $\rightarrow$ bond financing does not substitute for the bank credit crunch.
  - Findings consistent with the external finance channel: Puerto Rican banks holding government debt take losses $\rightarrow$ constrained ability to raise capital and lend $\rightarrow$ cost passed on to private employers.

Robustness Tests

- Population shocks
- Recession risk
- Housing price shocks
- Industry-specific shocks
- Puerto Rican industry-specific shocks
- Alternative measure of default probability
- Restricting the sample to the period after the global financial crisis
- Alternative calculation periods for EXTFINUS and GOV

Conclusion

- Provide theoretical framework and empirical evidence for the (relatively unexplored) government demand channel.
  - Default anticipation can have significant real economic effects $\rightarrow$ in this paper via fiscal austerity and government demand dependence.
  - Importantly, our results suggest that firms can anticipate government spending cuts and reduce hiring when default risk increases.