IRPET Istituto Regionale Programmazione Economica della Toscana

On firm exit during the double dip recession: A tale of two crises?

Tommaso Ferraresi & Marco Mariani

III Workshop

The Impact of the Great Recession on Manufacturing Firms

Parma, 19 January 2017

Introduction (1)

Prevailing arguments related to firm dymamics during recessions state that:

- ✓ Economic crisis speeds up the "natural" selection process based on productivity (Jovanovic, 1982) leading to the exit of the inefficient tail of industry, which might enhance the productivity of the economy (Caballero & Hammour, 1994). ***Cleansing effect***
- ✓ However, there are departures from this general rule. **Sullying effect**: crises may indiscriminately hit productive firms (Barleavy, 2002) and firms endowed with pricing power may be more resilient despite lack of efficiency (**Selection on profitability**, Foster et al, 2008)

Introduction (2)

Prevailing views regarding Italy look at the two dips of recent crisis as if they were two different stories (e.g. Locatelli et al, 2016) in macroeconomic terms.

As for industry dynamics in Italy during recent crisis there is evidence of:

- ✓ **Cleansing**: "bad" tails of the productivity distribution were hit (Mariani et al., 2013)
- ✓ **Sullying**: exporters experienced higher exit risks or other problems (Bugamelli et al, 2009; Mariani et al, 2013), as well as other "good" firms affected by credit constraints (Arrighetti et al, 2015)
- ✓ **S. on Profitability**: competitive rents operate as a resilience factor (Landini, 2016)

Contribution

- ✓ Inspired by the international literature on firm dynamics during recessions → **We look at the selection dynamics of complex firm profiles** (combinations of firm characteristics in terms of productivity, pricing power and openness to international trade)
- ✓ Accounting for the message coming from empirical literature on the crisis years in Italy/S. Europe → **We investigate to what extent risk of exit varies for such firm profiles in the different stages of the recession**

Data

The period under investigation is 2008-2014, data are collected from from different sources:

- ✓ Tuscan manufacturing public companies and their balance sheets from AIDA (Bureau van Djik)
- ✓ Exit dates (if any) from Business Register. Exits due to transfers or M&A are not regarded as exits
- ✓ NACE sectors, foundation dates and number of employees from the Statistical Archive of Active Firms – ASIA (Istat)
- ✓ Value of exports from COEWEB (Istat) microdata

Methodology / Definitions

We need to estimate the hazards of exit during the years of the crisis and calculate differential hazards between different firm profiles.

Let *T* denote the random variable for the firms' residual life duration during the crisis

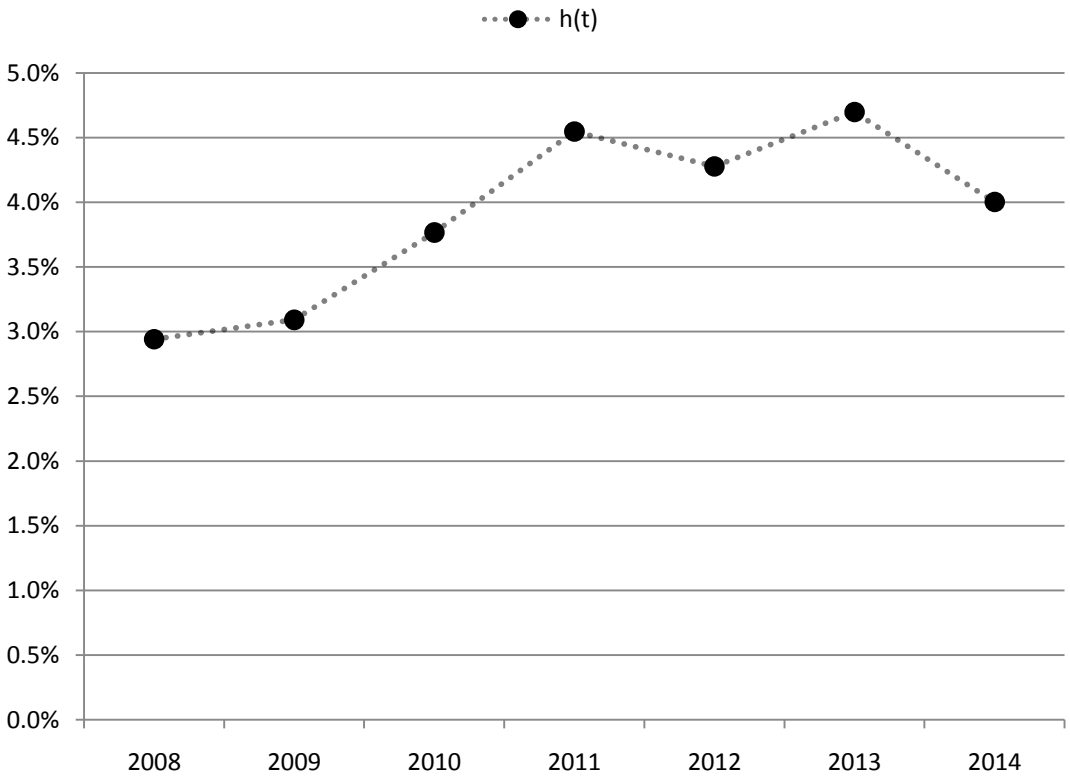
- ✓ The hazard of exit at time *t* is defined as $h(t) = \lim_{dt->0} \frac{\Pr(t \leq T < t + dt)}{dt}$
- ✓ In a discrete-time setting, $h(t) = \Pr(t \leq T < t + 1)$

The quantities we are mostly interested in in are differences beween the hazard levels associated with different (combinations of) firm characteristics (eg., productivity#pricing power#export propensity)

$$\Delta h(t, X) = h(t, X = x) - h(t, X \neq x)$$

IRPET

Aggregate yearly hazard of exit



Hazard of exit is roughly increasing in time, and is higher during the second phase of the crisis (from 2011)

Cumulative Hazard reaches 22.9% in 2014

Methodology / How to estimate *h(t, X)*

To estimate these hazards we need a duration model, as firms' life duration during may be (right-)censored at the end of observation period. This model:

A. Should produce hazards on a yearly basis (more fine-grained estimates are unnecessary)

B. Should be flexible enough to deal with possible non-proportional hazards between the levels of X

The most flexible way to achieve goals A. and B. is to specify a discrete-time duration model, where t corresponds to calendar years (2008, …, 2014), that enables the estimation of h(t, X) through a logit or other GL models for the probability of a binary event

Methodology / Detecting NP hazards

After some preliminary non-parametric analysis, we assess coefficients on

A. Each variable interacted with time, in separate models

B. Multiple variables interacted with time in a same model

Labor productivity classes never have parallel risk trajectories over time → Productivity has to be always interacted with time in the final model

Not the case for pricing power, exports, and so on

We also assess interactions between productivity, pricing power, exports and include them in the final model when appropriate. Whenever pricing power and exports are interacted with productivity, we find that interaction with time must be added

Ingredients of our discrete-time model

Using a logit link, $h(t) = \frac{\exp(\beta^T X)}{1+\exp(\beta^T X)}$, where the vector X includes:

A. Year dummies for the "latent" baseline hazard

B. Time-varying covariates for which, after careful data inspection, PH assumption holds (proportional odds) → these variables must not be interacted with time: age (0-5; 6+), size class$_{-1}$ (0-10; 11-49; 50+ empl.), export/sales$_{-1}$ (0%; 1-20%; 20%+), pricing power class$_{-1}$ (1/0; EBIT)

C. Time-varying covariate for which PH assumption does not hold → this variable must be interacted with time: productivity class$_{-1}$ (1 above sectoral mean; V.A. per empl.)

D. A time-invariant covariate: NACE sector 2 dgt for which PH assumption holds

E. The interactions between
   - ✓ productivity$_{-1}$, pricing power$_{-1}$ and time
   - ✓ productivity$_{-1}$, export/sales$_{-1}$ and time

Selected descriptive statistics (1)

	All years	2008	2009	2010	2011	2012	2013	2014
Product$_{-1}$ above sectoral median(1/0)	0.485	0.474	0.480	0.479	0.482	0.485	0.486	0.510
Pricing power$_{-1}$ above sectoral median (1/0)	0.484	0.474	0.478	0.478	0.480	0.484	0.490	0.509
Domestic firm$_{-1}$ (1/0)	0.591	0.588	0.593	0.607	0.591	0.590	0.590	0.575
Exports$_{-1}$ 1-20% (1/0)	0.186	0.188	0.191	0.189	0.184	0.183	0.180	0.187
Exports$_{-1}$ 20%+ (1/0)	0.223	0.224	0.216	0.204	0.225	0.227	0.230	0.238
N. obs.	74,509	10,332	10,608	10,804	10,907	10,867	10,748	10,243
N. unique firms	12,748	10,332	10,608	10,804	10,907	10,867	10,748	10,243

Selected descriptive statistics (2)

	All years	2008	2009	2010	2011	2012	2013	2014
N. unique firms	12,748	10,332	10,608	10,804	10,907	10,867	10,748	10,243
Delayed entries	2,950	534	580	524	510	456	346	0
Early entries	9,798	9,798	10,028	10,280	10,397	10,411	10,402	10,243
N. of exits	2,915	304	328	407	496	465	505	410
h(t)= Pr(t<=T<t+1)	0.229	0.029	0.031	0.038	0.045	0.043	0.047	0.040
H(t)=Pr(T<=t)	0.229	0.029	0.058	0.091	0.128	0.161	0.197	0.229

Results/ Model coefficients

	Coefficient	S.E.
Constant	-2.878***	0.126
Year		
=2008	0	.
=2009	0.074	0.120
=2010	0.0904	0.116
=2011	0.374***	0.113
=2012	0.206*	0.117
=2013	0.311***	0.112
=2014	0.123	0.116
Productivity class (-1)		
Below the sectoral median	0	.
Above the sectoral median	-1.500***	0.298
Profitability class (-1)		
Below the sectoral median	0	.
Above the sectoral median	-0.929***	0.157
Export/Sales (-1)		
0: Domestic firm	0	.
1-20%	0.131	0.172
20%+	-0.032	0.181
Interactions		
Year=2009 X Prod. above median	-0.178	0.408
Year=2010 X Prod. above median	0.729**	0.360
Year=2011 X Prod. above median	0.767**	0.350
Year=2012 X Prod. above median	0.931***	0.343
Year=2013 X Prod. above median	0.800**	0.345
Year=2014 X Prod. above median	0.618*	0.365
Prod. above median X Prof. above median	0.159	0.343
Year=2009 X Prod. below median X Prof. above median	-0.173	0.232
Year=2009 X Prod. above median X Prof. above median	1.108***	0.416
Year=2010 X Prod. below median X Prof. above median	-0.446*	0.235
Year=2010 X Prod. above median X Prof. above median	0.516	0.372
Year=2011 X Prod. below median X Prof. above median	-0.393*	0.221
Year=2011 X Prod. above median X Prof. above median	0.27	0.355
Year=2012 X Prod. below median X Prof. above median	-0.245	0.222
Year=2012 X Prod. above median X Prof. above median	0.492	0.347

	Coefficient	S.E.
Interactions		
Year=2013 X Prod. below median X Prof. above median	-0.239	0.212
Year=2013 X Prod. above median X Prof. above median	0.342	0.355
Year=2014 X Prod. below median X Prof. above median	-0.555**	0.244
Year=2014 X Prod. above median X Prof. above median	0.970***	0.370
Prod. above median X Exp 1-20%	-0.332	0.445
Prod. above median X Exp 20%+	0.044	0.385
Year=2009 X Prod. below median X Exp 1-20%	-0.235	0.250
Year=2009 X Prod. below median X Exp 20%+	-0.033	0.254
Year=2009 X Prod. above median X Exp 1-20%	-0.493	0.542
Year=2009 X Prod. above median X Exp 20%+	-0.379	0.445
Year=2010 X Prod. below median X Exp 1-20%	0.176	0.231
Year=2010 X Prod. below median X Exp 20%+	0.492**	0.236
Year=2010 X Prod. above median X Exp 1-20%	-0.694	0.507
Year=2010 X Prod. above median X Exp 20%+	-0.957**	0.435
Year=2011 X Prod. below median X Exp 1-20%	0.078	0.226
Year=2011 X Prod. below median X Exp 20%+	-0.137	0.240
Year=2011 X Prod. above median X Exp 1-20%	-0.35	0.475
Year=2011 X Prod. above median X Exp 20%+	-0.495	0.400
Year=2012 X Prod. below median X Exp 1-20%	-0.114	0.243
Year=2012 X Prod. below median X Exp 20%+	-0.023	0.239
Year=2012 X Prod. above median X Exp 1-20%	-0.004	0.456
Year=2012 X Prod. above median X Exp 20%+	-0.716*	0.399
Year=2013 X Prod. below median X Exp 1-20%	0.127	0.226
Year=2013 X Prod. below median X Exp 20%+	0.317	0.226
Year=2013 X Prod. above median X Exp 1-20%	-0.108	0.467
Year=2013 X Prod. above median X Exp 20%+	-1.096***	0.423
Year=2014 X Prod. below median X Exp 1-20%	-0.069	0.244
Year=2014 X Prod. below median X Exp 20%+	0.176	0.240
Year=2014 X Prod. above median X Exp 1-20%	-0.576	0.487
Year=2014 X Prod. above median X Exp 20%+	-1.022**	0.419
Observations	74,509	
Pseudo R2	0.079	
Log likelihood	-11,331.3	

Coefficients on firm age, firm size and sector not reported due to lack of space!
S.E. are cluster-robust at the firm level (Cameron & Miller, 2015)

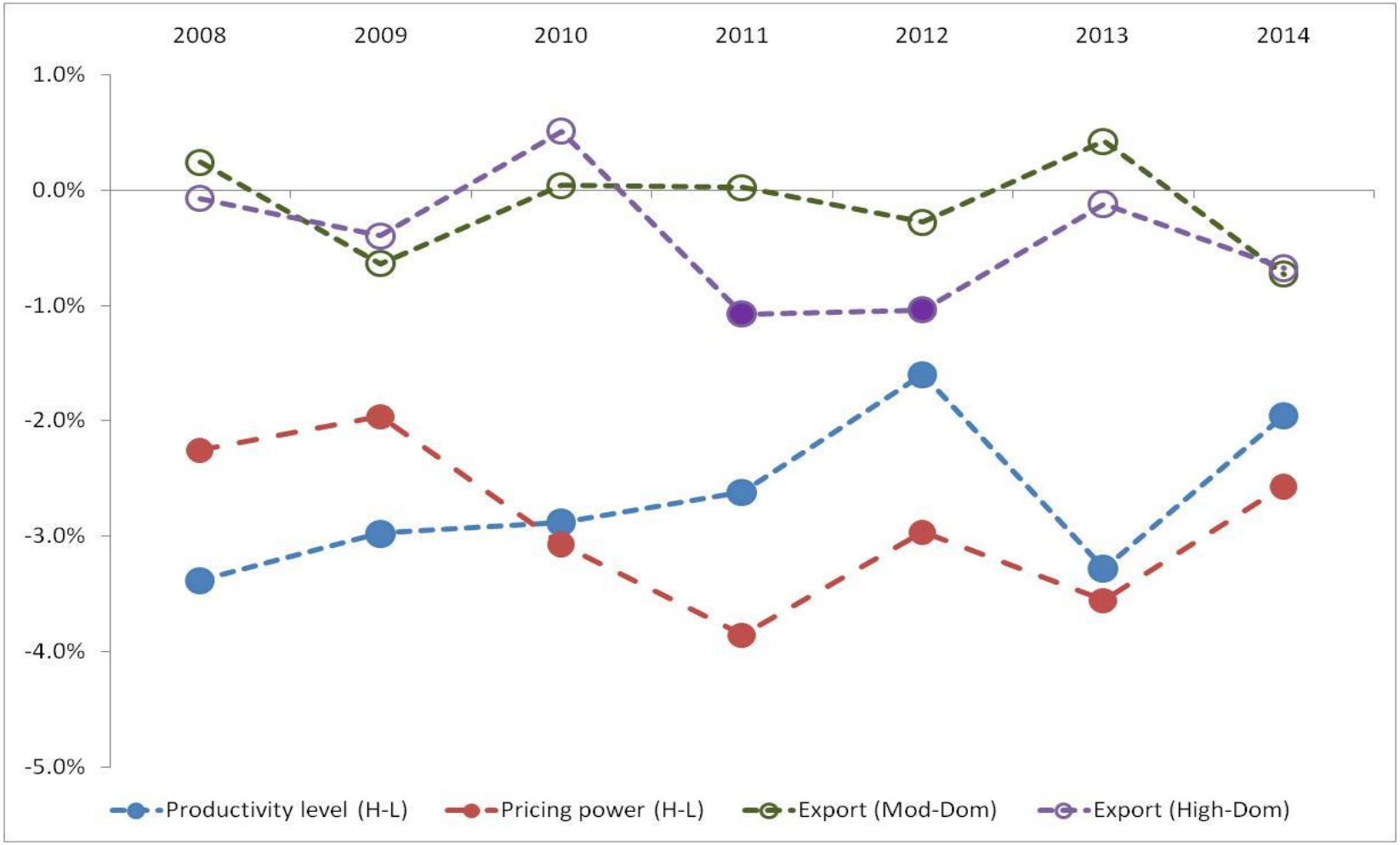
IRPET

Differential risk of exit per year (R-C)

	2008	2009	2010	2011	2012	2013
2009	**0.002**					
2010	0.008***	**0.006****				
2011	0.016***	0.014***	**0.008*****			
2012	0.013***	0.012***	0.005**	**-0.003**		
2013	0.017***	0.015***	0.009***	0.001	**0.003**	
2014	0.008***	0.006**	0.000	-0.008	-0.005**	**- 0.009*****

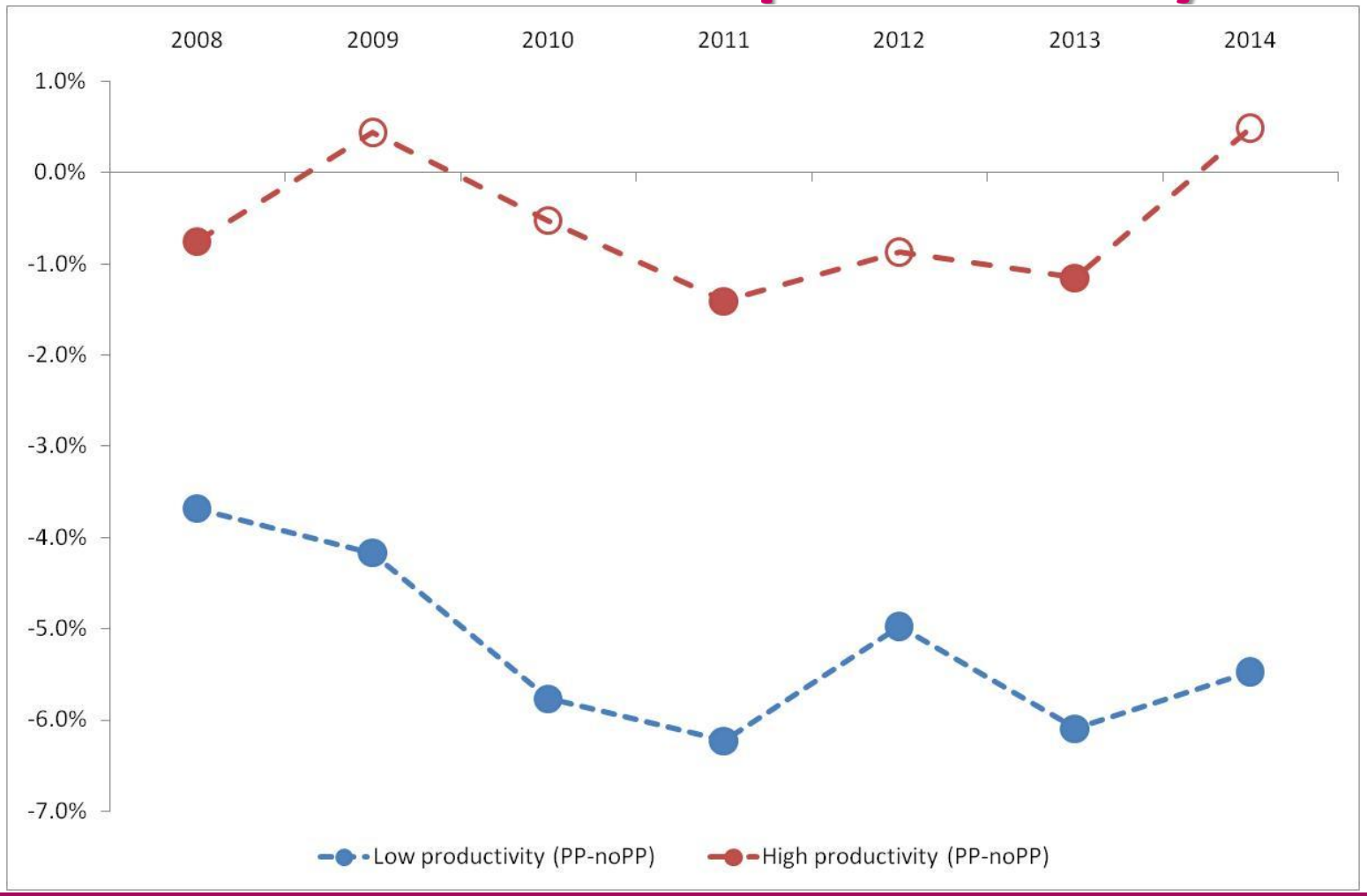
The model supports the idea that risk of exit grows especially from 2009 to 2011, then it decreases in 2014

Differential risk of exit for productivity, pricing power and export



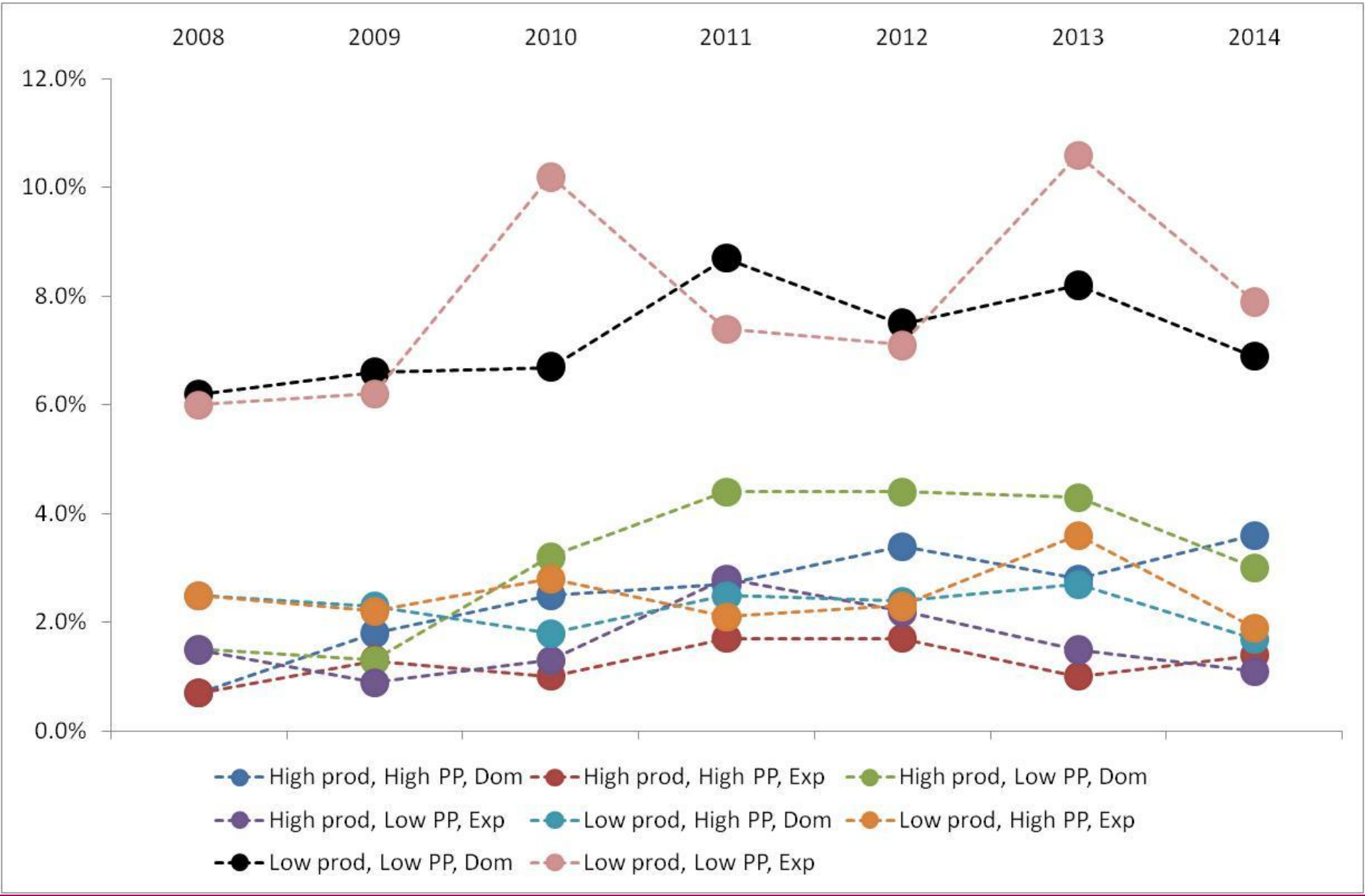
IRPET

Differential risk of exit for pricing power conditional on productivity

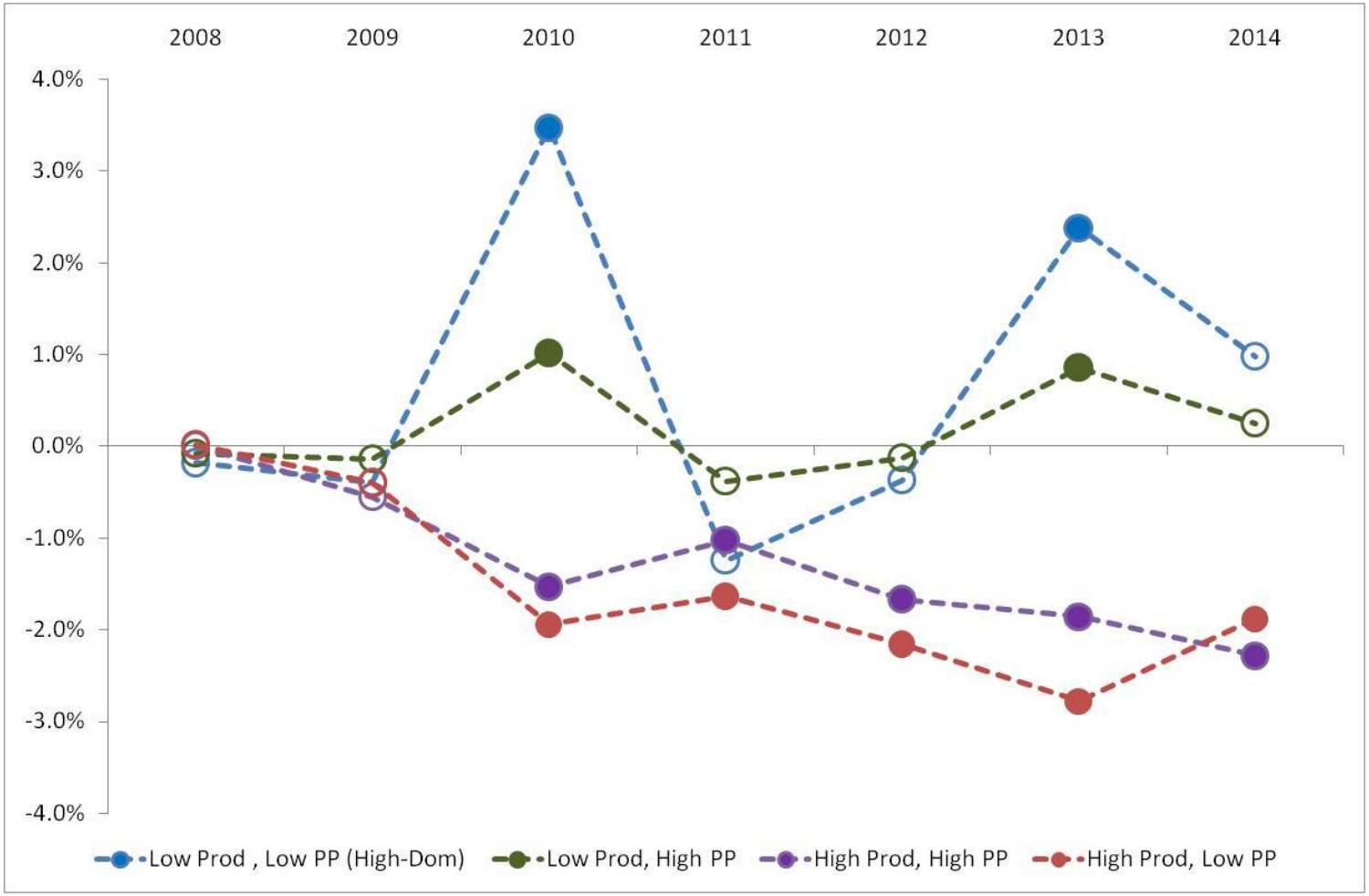


IRPET

Risk of exit for complex firm profiles



Differential risk of exit for high openess to trade conditional on productivity and PP



IRPET

Summary of results

- ✓ **Cleansing** is confirmed throughout the crisis
- ✓ **Sullying**:
  - **Increasing risk in the productive tail**: protection against exit due to productivity roughly decreases in the second part of the crisis
  - **Selection on profitability**: benefit of pricing power is confirmed throughout the crisis for less productive firms, perhaps stronger in the second phase
  - **Trade openness**: on average, exporters often seem to face the same risk of exit of domestic firms (except 2011-2012). At a closer look, we can argue that it does not help at the beginning. From 2010, it protects productive firms in the face of the collapse of internal demand. Instead, it may endanger all less productive ones, especially those lacking pricing power

Thank you!

Your comments are welcome

tommaso.ferraresi@irpet.it

marco.mariani@irpet.it