# Do temporary contracts affect TFP ?. Evidence from Spanish manufacturing firms

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# **I-Motivation**

## > Two stylized facts about the Spanish economy

- Widespread use of temporary (fixed-term) contracts
  - High Temp rate (>30% of salaried workers...26% nowadays) since late 1980s. > twice the EU average.
  - Big gap between EPL for perm and temp workers  $\rightarrow$  Low (tempperm) conversion rates (<10%)



#### • TFP growth slowdown puzzle.

Private sector TFP growth rate (EUKLEMS): 1.05 (1985-94) to -0.52 (1995-05)



Our research question:

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- Explore link between temp contracts & TFP
- Mechanisms: (I) Low conversion rates → ↓ effort → ↓ TFP
  (II) High temp rate → ↓ training → ↓ TFP
- Data: Large panel of Spanish manufacturing firms.
- Encuesta de Estrategias Empresariales (1991-2005).
  About 3,800 firms > 10 employees & 23,000 observations.





### **Related literature**

#### Spain

Jimeno & Toharia (1996), Sánchez & Toharia (2000)

#### • Other economies

Engellandt & Riphan (2005), Ichino & Riphan (2005), Boeri & Garibaldi (2007), Autor et al (2007), Bassanini & Venn (2008), Bassanini et al. (2008) Dew-Becker & Gordon (2008), Damiani & Pompei (2009).

# II- Toy model of temp workers ' effort

- Firms are characterized by parameter  $\theta$  (historical conversion rates) which depends on EPL regulation, sector, age, size, etc.
- Workers' first job is always under a temp. contract (lasts 1 period) with (exogenous) wage  $w_T$ . Perm jobs cannot be distroyed.
  - Temp workers learn about  $\theta$  when joining firms and exert effort (e) with cost c(e) s.t.  $c_e > 0$ ,  $c_{ee} > 0$ .
  - Later: either (i) promoted to perm contract with prob. p& (exogenous) asset value  $V_P$  or (ii) dismissed with prob.  $(1-p) \rightarrow$  unemployment with asset value U.
  - $p(e, \theta)$ : workers' subjective probability of conversion:  $p_e > 0, p_{ee} < 0 \& p_{\theta} > 0, p_{\theta\theta} < 0 \& p_{e\theta} > 0$

## Model (cont.)

Asset value of a temp job  $(V_T)$ 

$$V_{T} = w_{T} - c(e) + \frac{1}{1+r} \{ p(e,\theta)V_{P} + (1-p(e,\theta)U \}$$

Asset value of unemployment (U)

$$U = \frac{1}{1+r} \{ hV_T + (1-h)U \}$$

Let  $w_T = 0$  & r = 0 (qualitative results remain otherwise)  $\max_e \quad [V_P - \frac{c(e)}{p(e,\theta)}]$ 

**<u>Proposition</u>**: Let  $e^*(\theta)$  be the solution of the previous problem under the above-mentioned set of assumptions. Then  $\partial e^*/\partial \theta > 0$  only if

$$p_{e\theta}(e^*,\theta) > \bar{p}_{e\theta}(e^*,\theta).$$

#### Benchmark reduced-form model of firms' productivity

• Let  $Y=B(EL)^{\alpha}X^{l-\alpha}$ , then Solow residual (TFP), *a*, is

 $a = b + \alpha e$ .

 $\rightarrow \quad \partial a/\partial \theta = \alpha \left[ \partial a/\partial e \right] \cdot \left[ \partial e/\partial \theta \right] > 0.$ 

- Besides effort, evidence about temporary workers receiving less firm-specific training due to their high job-turnover rate → b = b (tw, Z) with ∂b / ∂tw < 0.</li>
  [% of training in Spain (ECHP): Perm: 23.8%, Tem: 4.5%]
- Therefore, the benchmark model is

 $a = a (e(\theta), tw, \mathbf{Z})$ 

with  $\partial a/\partial \theta > 0$ ,  $\partial^2 a/\partial \theta^2 < 0$  (if P-jobs highly protected) &  $\partial a/\partial tw < 0$ .

# III- Data

- ESEE (unbalanced panel of firms, 1991-2005)
- Representative sample of Spanish manufacturing sector
- >200 (census with 70% participation) & Random sampling of 5% 10-200; unbalanced panel with 13.200 obs. (after filtering)
- Entry & exits
- Firms' and labour force characteristics:
  - TFP (cost shares á la Hall)

$$a_{it} = y_{it} - \alpha_l I_{it} - \alpha_m m_{it} - \alpha_k (k_{it} + \kappa_{it})$$

• Other covariates (HC, R&D, FC, PC, age size, status, etc.)

## **Descriptive Statistics**

	Mean	S.D
Average TFP growth in the period 1992-1995 (in percentage)	2.58	-
Average TFP growth in the period 1996-2005 (in percentage)	1.21	-
Average TFP growth in the period 2001-2005 (in percentage)	-0.74	-
TFP (in logs)	3.63	0.55
Percentage of temporary workers	22.99	22.85
Percentage of Foreign Capital	16.87	35.73
Percentage of Public Capital	1.15	9.59
Percentage of workers with a college degree	9.05	6.78
R&D Expenditures / Sales (in percentage)	0.69	2.20
Age (in years)	24.11	20.48
Percentage of Incorporated Companies	64.94	47.72
Percentage of Entrants	7.03	25.57
Percentage of Exiting firms	1.32	11.40
Percentage of firms with scission	0.66	8.09
Percentage of firms involved in a merger process	1.42	11.85
Percentage of firms reporting expansive market	29.03	45.39
Percentage of firms reporting recessive market	20.56	40.42

#### **Proportion of Temp Workers by firm's age & size**

#### Small and Medium-sized firms (less than 200 employees)

	Mean	SD	Obs.
Less than 5 years in the market	41.5	31.0	1937
More than 5 years in the market	20.4	22.1	12028

#### Large firms (more than 200 employees)

	Mean	SD	Obs.
Less than 5 years in the market	18.5	22.7	176
More than 5 years in the market	15.4	16.5	5738

# **Conversion rates (not available)**

Retrieve c's (= $\theta$ ) from stocks of perm and temp workers

$$L_{P,it} = (1-b_i)L_{P,i,t-1} + c_i L_{T,i,t-1} + d_i U_t + \alpha' X_{it} + \varepsilon_{it}$$

$$L_{P,it} = (1 - b_{it})L_{P,i,t-1} + c_{it}L_{T,i,t-1} + d_{it}U_t + \alpha'X_{it} + \varepsilon_{it}$$

Two estimation approaches:

1.- **Pooled estimation** (sample averages by industry-age-size)  $\rightarrow c_i$  (reasonable sample avg. 12.7%).

2.- **Recursive estimation** 
$$\rightarrow$$
 c<sub>it</sub>

## **Conversion rates**





# **IV-Empirical Approach:** (1) Non-parametric

(FO)Stochastic Dominance Test of conditional TFP distributions (Delgado et al., 2002):

 $\tilde{a}_{it}$  = TFP index of firm *i* in period *t* 

Adapted K-S tests for F(.) being FOSD by G(.):

$$H_0^a: F_t\left(\cdot \middle| \tau = \tau_0\right) = G_t\left(\cdot \middle| \tau = \tau_0\right) \quad vs \quad H_1^b: F_t\left(\cdot \middle| \tau = \tau_0\right) > G_t\left(\cdot \middle| \tau = \tau_0\right) \\ \text{central don't reject} \\ \text{where } \tau = \{\text{size, age, } \dots\}, \text{ threshold of temp (10\%), & conv (10\%)} \}$$

Statistics:

$$\delta_{N} = \sqrt{\frac{n.m}{N}} \max_{1 \le i \le N} \left| T_{N}(\tilde{a}_{i}) \right| \qquad \& \qquad \eta_{N} = \sqrt{\frac{n.m}{N}} \max_{1 \le i \le N} \left\{ T_{N}(\tilde{a}_{i}) \right\}$$

Robust to threshold & dating of temp & conv rates : t, t-1,...

### **Empirical Results: (a) F(TFP / tw) vs. G(TFP / tw)**



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## (b) F(TFP / c) vs. G(TFP / c)



## (2) Regression model

$$a_{it} = \beta_0 + \beta_1 c_i + \beta_2 c_i^2 + \beta_3 t w_{it} + \gamma' \mathbf{z}_{it} + \rho(L) a_{i,t-1} + v_{it}$$

 $a_{it} = \eta_i + \beta_1 c_{it} + \beta_2 c_{it}^2 + \beta_3 t w_{it} + \beta_4 (c_{it} * t w_{it}) + \gamma' \mathbf{z}_{it} + \rho(L) a_{i,t-1} + v_{it}$ 

Potential concave effect of conversion rates ( $\beta_2 < 0$ )

#### **Pooled Regression** (OLS and IV)

- IVs: % temps in t-1, t-2, % public capital in t-1, t-2.
- Block boostrap for s.e.'s because c's are generated regressors.

#### Firm-level Fixed-effects (System GMM)

- IVs: t-2,..,t-5.
- Block bootstrap for s.e.'s since conversion rates are generated regressors.

## **Empirical Results I**

	Model 1 (OLS)	Model 2 (OLS)	Model 3 (IV)
Conversion Rate	0.059	0.060	0.069
	[0.029]**	[0.029]**	[0.029]**
	(0.037)*	(0.037)*	(0.037)*
Conversion Rate Squared	-0.092	-0.095	-0.092
	[0.050]*	[0.050]*	[0.050]*
	(0.059)	(0.058)	(0.058)
Proportion of Temporary Workers in t	-0.032	-	-0.028
	[0.008]***		[0.009]***
	(0.007)***		(0.009)***
Proportion of Temporary Workers in t-1	-	-0.024	-
		[0.008] ***	
		(0.008)***	
TFP t-1 (in logs)	0.535	0.535	0.535
	[0.018] ***	[0.018] ***	[0.018] ***
	(0.018)***	(0.018)***	(0.018)***
TFP t-2 (in logs)	0.225	0.225	0.225
	[0.013]***	[0.013]***	[0.013]***
	(0.013)***	(0.013)***	(0.013)***
Human Capital in t-1	ves	ves	ves
Incorporated Company in t-1	ves	ves	ves
Human Capital in t-1	yes	yes	yes
Age and Age Squared	yes	yes	yes
Industry, Size, Year, Entry, Exit, Merger, and Scission dummies	yes	yes	yes
Downturn and Expansion dummies	yes	yes	yes
N. Obs.	13154	13154	13154
R-squared	0.94	0.94	0.94
Hansen J (p-value)	-	-	1.502 (0.58)
First Stage Regression:			
Partial R2	-	-	0.70
F (p-value)	-	-	3941.8 (0.000)

## **Empirical Results II**

	System GMM	Pooled IV
Conversion rate	0.139 <sup>***</sup> (0.058)	0.069 <sup>**</sup> (0.037)
Conversion rate sq.	-0.098 <sup>*</sup> (0.061)	-0.092 <sup>*</sup> (0.058)
[Conversion rate Threshold]	61%	37%
Proportion of Temp. Workers	-0.054 <sup>***</sup> (0.024)	-0.028***
Interaction (temp*conv)	007 <sup>**</sup> (0.003)	-0.010 <sup>*</sup> (0.004)
TFP (t-1)	0.468 <sup>***</sup> (0.043)	0.535 <sup>***</sup> (0.018)
TFP (t-2)	0.159 <sup>***</sup> (0.021)	0.225 <sup>***</sup> (0.013)
Other covariates	Yes	Yes
No. obs. Sargan test / J-test Arellano-Bond test for AR(1) in first diffs. Arellano-Bond test for AR(2) in first diffs.	12182 p=0.372 p=0.000 p=0-493	13154 p= 0.647

## Short-run & Long-run effects

➤ Temp rate

- SR : ↑ tw (1 p.p.) → ↑ TFP 0.07 (pool) --- 0.14 (FE) p.p.
- LR :  $\uparrow$  tw (1 p.p.)  $\rightarrow$   $\uparrow$  TFP 0.27 (pool) --- 0.40 (FE) p.p.

Conv Rate

- SR:  $\uparrow$  c (1 p.p.)  $\rightarrow$   $\uparrow$  TFP 0.05 (pool) --- 0.11 (FE) p.p.
- LR:  $\uparrow$  c (1 p.p.)  $\rightarrow$   $\uparrow$  TFP 0.20 (pool) ---0.32 (FE) p.p.

Simulation (2001-2005):

 $\downarrow$  TFP growth = -0.74 Combined effect of c & tw: -0.46 (60%)

# **V-Conclusions**

- Illustration of how work practices affects firms' productivity: EPL segmentation → ↓ lower prospects of conversion→ ↓ effort (& ↓ training).
- Effects are sizeable: 60% of ↓ TFP in 2000-05 (likely to be downward biased since small firms are underrepresented in ESEE).
- Future research agenda: effects of precarious contracts, over-education & immigration on technology adoption (*bricks vs. brains* models).

(Bentolila, Dolado & Jimeno, in process)

# THANKS FOR YOUR ATTENTION !!