Labor Contracts and Productivity Dynamics

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Overview

1. Motivation and Aim
2. Economic Intuition
3. Estimation Method
4. Dataset and Empirical Results
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Topic

An investigation of the effects of temporary (T) and permanent (P) labor contracts on productivity.

Output Y_t is increasing in TFP e^{ω_t}, labor L_t and capital K_t services

$$Y_t = e^{\omega_t} K_t^{\alpha} \left(P_t + sT_t\right)^{\beta}$$

- The effect on the labor-augmenting factor
- The effect on the TFP-augmenting factor

Why this Topic? Why Italy?

- Recent Macroeconomic Performance:
  - slowdown in productivity growth;
  - increase in the use of temporary contracts.

- Institutional Setting:
  - high job protection for permanent workers;
  - low restrictions on the use of temporary contracts.

Related Literature (I)

Aggregate Data (EU KLEMS and OECD).

- Bassanini et al. (2008). Stricter regulation for T has a positive or no impact on TFP.
- Lisi (2009). Labor productivity growth is negatively affected by T share.
- Damiani-Pompei (2010). TFP is negatively affected by the growth rate of T and positively affected by the product of EPL_T and T share.

Related Literature (II)

Firm-level Data.

- Boeri-Garibaldi (2007) explain the inverse relationship between output per worker and the share of T referring to the decreasing marginal productivity of labour.
- Aguirregabiria-Borrego (2008) estimate that permanent workers are more productive than temporary workers because of the gap in the labor-augmenting factor.

Possible explanations for the productivity gap

- Human capital
- Effort
- Flexibility in the use
- Adverse selection
- Fairness and attitude to work.

Production Function

- Output Y_t is increasing in TFP e^{ω_t}, labor L_t and capital K_t services

$$Y_t = e^{\omega_t} K_t^{\alpha} L_t^{\beta}$$

- Two kinds of labor contracts:

$$L_t = P_t + sT_t, \text{ with } s > 0$$

- TFP depends on $x_t = P_t / (P_t + T_t)$

$$\omega_t = g(\omega_{t-1}) + \gamma x_{t-1} + \varepsilon_t \text{ where } \varepsilon_t \sim N(0, \sigma_\varepsilon^2)$$

Labor Contract Choice

Firm prefers P to T until:
current labor-specific prod. gap + dynamic prod. effect $\geq$ expected firing costs$-$current f.c.$+$ wage gap

$$\begin{aligned} & \frac{\partial Y_t}{\partial L_t}(1-s) + \frac{1}{1+\zeta}\left(\frac{\partial x_t}{\partial P_t} - \frac{\partial x_t}{\partial T_t}\right) E\left[\frac{\partial Y_{t+1}}{\partial x_t}\right] \\ \geq \quad & \frac{1}{1+\zeta}\left(1-\delta^p\right) F * E\left[S_{t+1}\right] - FS_t + \left(W_P - W_T\right) \end{aligned}$$

- Generally, P are justified relying on labor-augmenting productivity advantage ($s < 1$).
- We consider both static labor-augmenting and dynamic TFP-augmenting effect on productivity.

Investment Choice

Physical Capital

$$E\left[\frac{\partial Y_{t+1}}{\partial K_{t+1}}\right] = \zeta + \delta$$

$$K_{t+1} = \left(\frac{\alpha}{\zeta+\delta} E\left[e^{\omega_{t+1}}\left(P_{t+1} + sT_{t+1}\right)^{\beta}\right]\right)^{\frac{1}{1-\alpha}}$$

Capital accumulation is:

- increasing in the expected TFP;
- increasing in the expected labor services.

References to the Production Function Estimation

- Production function estimation. Simultaneity and collinearity issues.
- Olley-Pakes approach. Scalar unobservable and strict monotonicity assumptions in the relationship between investment and productivity.
- Ackerberg-Caves-Frazer approach. Highlights the collinearity issue in the OP approach.
- Stochastic endogenous productivity. Doraszelski-Jaumandreu (2009) endogenize the productivity process.

Baseline Equations

$$y_{j,t} = \omega_{j,t} + \alpha k_{j,t} + \beta \ln\left(P_{j,t} + sT_{j,t}\right) + \eta_{j,t}$$

$\omega_{j,t}$ is observed by the firm but not by the econometrician
$\eta_{j,t}$ is not observed by the firm

The DGP of TFP depends on

$$\omega_{j,t} = g\left(\omega_{j,t-1}\right) + \gamma x_{j,t-1} + \varepsilon_{j,t}$$

Theoretical Assumptions

Assumption: investment to control for productivity

$$\begin{aligned} i_{j,t} &= f\left(E\left[\omega_{j,t+1}, L_{j,t+1} | \Psi_{j,t}\right], k_{j,t}\right) \\ i_{j,t} &= f\left(\omega_{j,t}, x_{j,t}, P_{j,t}, k_{j,t}\right) \end{aligned}$$

from the strict monotonicity condition

$$\omega_{j,t} = f^{-1}\left(i_{j,t}, x_{j,t}, P_{j,t}, k_{j,t}\right)$$

Substitute $\omega_{j,t}$ in the production function

$$\begin{aligned} y_{j,t} &= f^{-1}\left(i_{j,t}, x_{j,t}, P_{j,t}, k_{j,t}\right) + \alpha k_{j,t} + \beta l_{j,t} + \eta_{j,t} \\ y_{j,t} &= \phi_t\left(i_{j,t}, x_{j,t}, P_{j,t}, k_{j,t}\right) + \eta_{j,t} \end{aligned}$$

Two-Steps Estimation

Step 1. Regress $y_{j,t}$ on $\phi_{j,t}\left(i_{j,t}, x_{j,t}, P_{j,t}, k_{j,t}\right)$ and estimate

$$\widehat{\phi}_{j,t}\left(i_{j,t}, x_{j,t}, P_{j,t}, k_{j,t}\right) = y_t - \widehat{\eta}_t$$

Step 2. Since $\omega_{j,t} = \phi_t - \alpha k_{j,t} - \beta \ln\left(P_{j,t} + sT_{j,t}\right)$ and $\omega_{j,t} = E\left[\omega_{j,t} | \omega_{j,t-1}, x_{j,t-1}\right] + \varepsilon_{j,t}$, regress:

$$\begin{aligned}\widehat{\phi}_{j,t} &= z + \alpha k_{j,t} + \beta \ln\left(P_{j,t} + sT_{j,t}\right) + \gamma x_{j,t-1} \\ &\quad + \rho\left(\widehat{\phi}_{j,t-1} - \alpha k_{j,t-1} - \beta \ln\left(P_{j,t-1} + sT_{j,t-1}\right)\right) + \varepsilon_{j,t}\end{aligned}$$

Benchmark Estimations

To overcome the simultaneity issue, labor services must be instrumented:

- Bench1, P and T are instrumented with their own past values because they are correlated with the residual ε;
- Bench2, also x is instrumented with its own past value just to preserve the time consistency with P and T.

Two ways of estimating $g\left(\omega_{t-1}\right)$:

- TFP follows an AR(1) process;
- Semi-parametric estimation (polynomial of degree 4)

Descriptive Statistics

	sample	references
n. of firms	1,914	
% firms no T	60	67***
L	150	198*-142**
x	0.96	0.96***
K/L	0.062	0.07*
Y/L	0.049	0.041*
corr (Y/L,P)	0.08*°	
corr (Y/L,T)	-0.04	
corr (P,T)	0.32*°	
corr (Y/L,x(-1))	0.09*°	
corr (P,x(-1))	0.05	
corr (T,x(-1))	-0.59*°	

* Source Iranzo et al. (2006). ** Source Hall et al. (2006). *** Source Caggese and Cuñat (2008). *° The correlation is significant at 1 per cent.

Empirical Results - No control variables

	α	β	s	ρ	γ
guess	.34	.66	1	.9	0
OLS	.26 .01	.764 .014			
NLS	.258 .006	.767 .008	.649 .034		
Bench1 AR(1)	.277 .004	.73 .006	1.932 .21	.36 .019	.549 .07
Bench2 AR(1)	.277 .004	.729 .006	.746 .07	.382 .019	.073* .041
Bench1 S-par	.284 .005	.723 .007	.969 .104		.108 .041
Bench2 S-par	.284 .005	.722 .007	.892 .066		.081 .028

Comments on the empirical results

- Compared with the OLS and NLS estimations, the structural estimations reduce the distance between labor and capital coefficients.
- Compared with the NLS estimation, the structural approach estimates higher values of the labor-specific factor of T.
- The incidence of P has always a positive and significant effect on TFP dynamics.
- The autoregressive coefficient under the AR(1) hp is very low.
- The Bench1-AR(1) procedure estimates a very high value of the labor-specific factor of T.

Empirical Results with Control Variables

	α	β	s	ρ	γ
guess	.34	.66	1	.9	0
OLS	.251 .01	.753 .014			
NLS	.251 .006	.753 .009	.732 .04		
Bench1 AR(1)	.283 .005	.724 .007	1.099 .248	.358 .022	.259 .114
Bench2 AR(1)	.283 .005	.724 .007	.771 .071	.358 .022	.097 .043
Bench1 S-par	.288 .005	.717 .008	1.005 .149		.148 .061
Bench2 S-par	.28 .005	.716 .008	.859 .073		.092 .034

Comments in presence of control variables

Including control variables:

- the comparison between the structural estimates and the other estimates does not change qualitatively;
- the incidence of P has always a positive and significant effect on TFP dynamics and γ becomes significant at 5% also under Bench2-AR(1) procedure;
- the Benchs-AR(1) procedure estimate reasonable values of the labor-specific factor of T, but the autoregressive coefficient under the AR(1) hp is still very low.

Comments on the role of the control variables

- Variables having positive and significant effect on TFP dynamics: doing innovation, firm size, workers attending external formation courses.
- Variables having negative and significant effect on TFP dynamics: being credit constrained, have never used temporary workers, (firm age).
- Variables not having significant effect on TFP dynamics: Pavitt classification, workers' level of education, doing R&D, employing temporary agency workers, workers doing R&D or with training contract, (firm age).

Conclusions

- Firm-level analysis lends support to the view that the use of temporary contracts dampens TFP growth.
- No conclusive results concerning the difference in the labor-augmenting factor between temporary and permanent contracts.
- The effects of a two-tier labor-market reform on productivity dynamics may be not only transitory but permanent.

Thanks for your attention ... any comments are welcome