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Financial conditions and labor productivity over the business cycle

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HIGHLIGHTS

- The pro-cyclicality of productivity has substantially declined since the mid 1980s.
- We provide evidence that financial shocks have impinged on productivity post 1984.
- A model with credit frictions and financial shocks is consistent with the evidence.
- Binding collateral constraints introduce a wedge in firms demand for labor.
- A negative financial shock increases the wedge causing firms to lower labor demand.

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ABSTRACT

The cyclical behavior of productivity has noticeably changed since the mid-80s. We provide VAR evidence that financial shocks have an important effect on productivity. We offer a novel explanation based on the effect of binding collateral constraints on labor demand.

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1. Introduction

The substantial decline in the cyclicality of output, labor, and labor productivity (output per hour) in the US since the mid-80s is a crucial area of inquiry in the study of business cycles. Recent studies confirm that labor and productivity have historically been mildly positively correlated, but since the mid-80s, these variables became counter-cyclical (Barnichon, 2010; Fernald and Wang, 2015; Gali and van Rens, 2015; McGrattan and Prescott, 2012; Lubik et al., 2015; Yépez, 2017). This observation is in stark contrast to the strong and positive linkage between labor and productivity predicted by theory.

We contribute to this literature by examining a source of fluctuations that has hitherto been overlooked as a plausible explanation to the productivity co-movement puzzle, namely financial shocks. Gilchrist and Zakrajšek (2012) posit that financial shocks in the form of an *excess bond premium* component of credit spread (henceforth *ebp*), play a prominent role in explaining fluctuations of real variables, and that the contribution of these shocks has increased since the mid-80s.

What has been the contribution of financial shocks to labor productivity fluctuations before and after the mid-80s? To answer this, we run a VAR with the following endogenous variables: (1) log-difference of real output per capita per hour; (2) log-difference of hours worked (non-farm business sector); (3) the *ebp* (in percentage points); and (4) the effective (nominal) federal funds rate. The full sample period is 1973q1–2010q3.[1]

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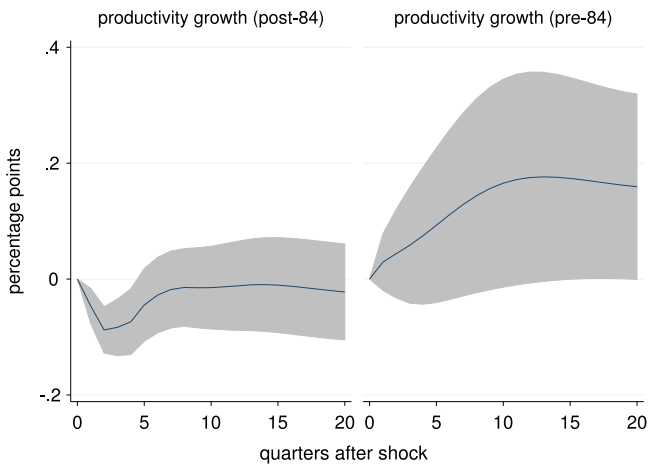

Fig. 1. Dynamic response of labor productivity to financial shock (pre-84 and post-84).

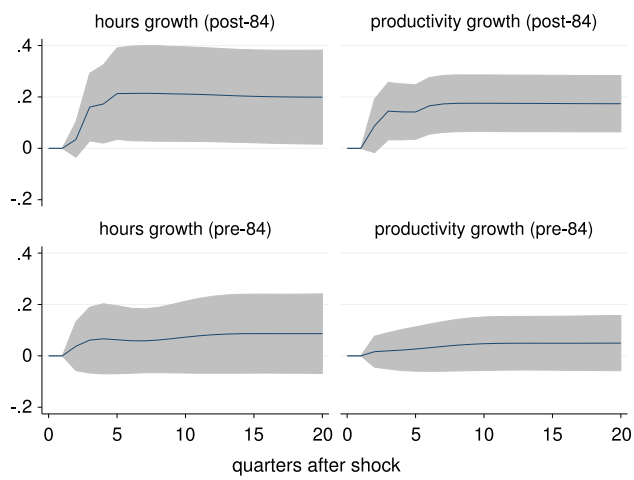

Fig. 2. Forecast error variance due to financial shock (pre-84 and post-84).

Fig. 1 shows the dynamic response of labor productivity to a 1-standard deviation increase in the *ebp* both for the post-84 period (left panel) and the pre-84 period (right panel). Notably, and in contrast to the pre-84 subsample, the graph for the post-84 period indicates that labor productivity experiences a significant and persistent short-run drop (about 1-standard deviation) when the *ebp* rises.

Next, Fig. 2 shows the contribution of *ebp* shocks to the forecast error variance of productivity and hours. Notably, the upper two panels provide evidence that the *ebp* shock has been an important determinant of the variability of labor productivity and hours worked since 1984, while this shock had no significant impact in the pre-84 subsample.

In summary, the VAR evidence indicates that financial shocks have had a significant impact on labor productivity since the mid-80s. Furthermore, the relative contribution of financial shocks to the variability of these key labor market variables has become more important since the mid-80s.

This study is closely related to Jermann and Quadrini (2012) who hint toward an important link between financial frictions and productivity. I add to this literature by examining the implications of (occasionally binding) credit constraints *and* financial shocks (henceforth, financial conditions) on the co-movement properties of productivity, TFP, labor, and output.

This paper proceeds as follows. Section 2 describes the model and its calibration. Section 3 analyzes the model and its dynamic behavior. Section 4 concludes.

2. Model

The environment is a real business cycle (RBC) model with credit constraints in which there are two types of agents, unconstrained households and constrained entrepreneurs.

2.1. Households

Households enjoy consumption and leisure, they derive income from work and accumulate wealth by saving. Their objective function is given by:

$$\max_{c_t^s, n_t} E_t \sum_{t=0}^{\infty} (\beta^s)^t U(c_t^s, n_t)$$

s.t.

$$c_t^s + \frac{b_{t+1}}{R_t} = w_t n_t + b_t, \tag{1}$$

with $b_{t+1} \geq -\bar{B}$ for some number $\bar{B}$.

Given w_t the real wage and R_t the gross real interest rate, each period the household chooses how much to consume c_t^s and how many hours to work n_t, where β^s denotes the household's discount factor.

Preferences are $U(\cdot) = \left[\frac{(c_t^s - h\, c_{t-1}^s)^{1-\sigma}}{1-\sigma} - \iota \frac{n_t^{1+\phi}}{1+\phi}\right]$, where h is the habit parameter, ι is the (dis)utility weight of labor, and ϕ is the inverse Frisch elasticity of labor supply. The corresponding efficiency conditions are:

$$w_t = -\frac{U_{n_t}}{U_{c_t^s}} \tag{2}$$

$$\frac{1}{E_t\,[m_{t+1}]} = R_t. \tag{3}$$

Eq. (2) is the standard intra-temporal condition that equates the real wage to the marginal rate of substitution, while Eq. (3) is the standard Euler equation, where the term $E_t[m_{t+1}] = \beta^s E_t \left[\frac{U_{c_{t+1}^s}}{U_{c_t^s}}\right]$ denotes the household's stochastic discount factor.

2.2. Entrepreneurs

Entrepreneurs run firms in the economy and derive utility from consumption c_t^e. They invest i_t in new capital projects and hire labor n_t. Furthermore, entrepreneurs are more impatient than households, $\beta^e < \beta^s$. Hence, the former are borrowing constrained while the latter are not. The entrepreneur's problem is given by:

$$\max_{c_t^e} E_t \sum_{t=0}^{\infty} (\beta^e)^t U(c_t^e)$$

s.t.

$$y_t - n_t\, w_t - b_t + \frac{b_{t+1}}{R_t} = c_t^e + i_t. \tag{4}$$

Entrepreneurial production is given by $y_t = z_t\,(u_t\, k_t)^{\alpha}\, n_t^{1-\alpha}$, where k_t and n_t are capital and labor inputs respectively, z_t is technology, u_t is capacity utilization, and α is the capital share of income.

Entrepreneurs require an intra-period loan in order to finance their working capital bills at the beginning of each period and before the realization of revenues. Entrepreneurial liquidity each period is set to $l_t = y_t$, and is subject to a financial friction in the form of a limited enforcement constraint (LEC) given by:

$$\xi_t k_{t+1} \geq \frac{b_{t+1}}{R_t} + l_t. \tag{5}$$

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