

Gourio, François; Rudanko, Leena

**Working Paper**

## Can intangible capital explain cyclical movements in the labor wedge?

Working Paper, No. 2014-02

**Provided in Cooperation with:**

Federal Reserve Bank of Chicago

*Suggested Citation:* Gourio, François; Rudanko, Leena (2014) : Can intangible capital explain cyclical movements in the labor wedge?, Working Paper, No. 2014-02, Federal Reserve Bank of Chicago, Chicago, IL

This Version is available at:

<https://hdl.handle.net/10419/96661>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



Federal Reserve Bank of Chicago

**Can Intangible Capital Explain  
Cyclical Movements in the  
Labor Wedge?**

*François Gourio and Leena Rudanko*

January 2014

WP 2014-02

# Can Intangible Capital Explain Cyclical Movements in the Labor Wedge?

François Gourio and Leena Rudanko\*

January 15, 2014

## Abstract

Intangible capital is an important factor of production in modern economies that is generally neglected in business cycle analyses. We demonstrate that intangible capital can have a substantial impact on business cycle dynamics, especially if the intangible is complementary with production capacity. We focus on customer capital: the capital embodied in the relationships a firm has with its customers. Introducing customer capital into a standard real business cycle model generates a volatile and countercyclical labor wedge, due to a mismeasured marginal product of labor. We also provide new evidence on cyclical variation in selling effort to discipline the exercise.

---

\*Gourio: Federal Reserve Bank of Chicago and NBER. Address: 230 South LaSalle St, Chicago IL 60604, Email: francois.gourio@chi.frb.org. Rudanko: Boston University and NBER. Address: 270 Bay State Road, Boston MA 02215. Email: rudanko@bu.edu. We thank our discussant Lukasz Drozd. This research was supported by NSF grant SES-1024739. Rudanko thanks the Hoover Institution for its hospitality and financial support. The views expressed here are those of the authors, and do not necessarily represent those of the Federal Reserve Bank of Chicago or the Federal Reserve System.

Intangible capital is an important factor of production in modern economies. It is rarely introduced in business cycle models, however, perhaps because it is assumed to have little impact on the short-run dynamics of macroeconomic variables, or viewed as too difficult to measure. In this paper, we present preliminary results showing that intangible capital can have a substantial impact on business cycle dynamics, and offer some new empirical evidence relating to our theory.

Specifically, we provide quantitative simulations showing that the labor wedge – the ratio of the marginal rate of substitution of households and the marginal product of labor of firms – can appear counter-cyclical and volatile in an economy where intangible capital is an important factor of production – especially if this intangible capital is a complement to production capacity. The cyclical behavior of the labor wedge has been highlighted as an important feature of the data that remains so far largely unexplained (Hall 1997, Mulligan 2002, Chari, Kehoe, and McGrattan 2005).

The prime example of intangible capital motivating our analysis is customer capital – the capital embodied in the relationships a firm has with its customers – which has a natural complementarity with production capacity: in order to make sales, a firm must both produce the goods and services, as well as attract the customers to sell them to.<sup>1</sup> It would appear an important form of intangible capital based on the substantial resources firms spend on customer acquisition and retention each year: marketing expenses have been estimated to amount to as much as 8 percent of GDP, with 11 percent of the workforce employed in sales-related occupations. As many customer relationships take the form of long-term repeat relationships, this spending can be viewed as investment into customer capital.

We consider a simple extension of the real business cycle model incorporating investment by firms in a long-lived customer base. In this setting, an expansion in firm sales requires an increase in the customer base, through an increase in selling effort. Because selling effort represents investment into customer capital, it is volatile and contributes to a significant increase in aggregate labor. Sales and output rise only slowly, however, as customers accumulate over time. An economist faced with the evidence produced by the model would be

---

<sup>1</sup>Except perhaps at very high frequencies where inventories allow to disconnect sales from production for some goods.

Table 1: Cyclicity of Sales Employment

	CPS 1994q1-2010q4 Time-series	CPS March 1968-2013 Time-series	ACS 2005-2011 Cross-state
Sales-Related Occupations (SRO)	1.09	1.10	0.53
SRO - cashiers and clerks	1.31	1.36	1.32
SRO - cashiers and clerks + marketing	1.21	1.04	1.28
SRO - broad cashiers and clerks + marketing	1.40	1.05	1.90

Notes: Regression coefficient of sales employment growth on aggregate employment growth.

puzzled by the small increase in output relative to labor, which implies a significant drop in the measured labor wedge. The wedge is not related to an inefficiency here, but rather reflects the measurement problems associated with intangible capital.

Our theory has implications for the cyclical properties of selling effort, and hence, we start by providing some new evidence on this. We then formalize and quantify these ideas in the context of a model.<sup>2</sup>

## 1 Cyclicity of Selling Effort

Is selling effort procyclical or countercyclical? Two alternative intuitions come to mind. On the one hand, if building a customer base is a form of investment, we might expect it to be procyclical, as investment tends to be. But on the other hand, if the business cycle is driven by fluctuations in demand, and if recessions are times when finding customers is harder, selling effort might be countercyclical.

One important piece of evidence on this issue is the cyclical behavior of advertising, known to be significantly procyclical.<sup>3</sup> Advertising represents only a subset of selling effort, how-

<sup>2</sup>This work is related to Gourio and Rudanko (forthcoming) providing a more detailed model and evidence on customer capital, as well as a discussion of the literature. The most closely related works to the present paper include McGrattan and Prescott (2010) and McGrattan and Prescott (2014), who study the role of intangible capital in accounting for the behavior of productivity and hours in the 1990s, and the recent recession, respectively.

<sup>3</sup>There is no single perfect time series of advertising, but all the available series we are aware of are procyclical and volatile: (i) the McCann advertising series (see Hall 2013), (ii) aggregated advertising spending from Compustat, (iii) the Newspaper Association of America-produced estimates of newspaper advertising revenue, (iv) the Duke CFO survey of advertising and marketing spending plans, and (v) the advertising

ever. With the aim of measuring a broader notion of selling effort, we turn to labor force surveys, which include information on occupations. Specifically, we use the basic monthly CPS over the period 1994-2010, the March CPS over the period 1968-2013, and the American Community Survey over the period 2005-2011, all obtained through IPUMS.

Our primary interest is measuring the number of employees engaged in building new customer relationships (corresponding to investment into customer capital), which brings about the challenge of figuring out which occupations correspond to this activity. The BLS defines a group of “sales-related occupations” (SRO), but some of these jobs are likely to have more to do with serving existing customers than attracting new ones. Further, the BLS does not include in this category several occupations that clearly represent new customer acquisition, such as marketing managers and market researchers.<sup>4</sup>

For these reasons, we construct several categories of selling employment. The first one is the sales-related occupations category as defined by the BLS, which amounts to 10.7 percent of total employment. These workers are roughly average in terms of their wage, education (28 percent have a college education), and demographics. If we take out cashiers and clerks, who are likely to be less involved in customer acquisition, the share of employment for this category falls to 4.7 percent, but the average wage increases by 30 percent (37 percent of the remaining workers have a college education). This new category is mostly made up of different types of sales representatives, including those in financial services and real estate, and retail sales supervisors. The third category adds marketing managers and market researchers to the second category. Finally, the fourth category takes out retail sales supervisors from the third category.<sup>5</sup>

Having constructed these four groups, we measure their cyclical sensitivity by running simple regressions of the employment growth of each group  $\Delta \log N_{it}$  on aggregate employment index and the magazine advertising data of the NBER macro history database.

---

<sup>4</sup>Clearly, many workers are engaged to some extent in customer acquisition. We focus on specific categories here in order to measure the cyclicity of this activity, but the overall scope of the activity likely exceeds the bounds of these specific categories.

<sup>5</sup>This category would appear a substitute for the cashiers and clerks category, based on our analysis of the patterns of switching job categories over time.

growth  $\Delta \log N_t$ :

$$\Delta \log N_{it} = \alpha_i + \beta_i \Delta \log N_t + \varepsilon_{it}.$$

Table 1 reports the results for the three data sets discussed. For the first column, we use annual growth rates calculated from quarterly data obtained by aggregating the basic monthly CPS files over the period 1994-2010, while for the second, we use annual growth rates from the March CPS files over the period 1968-2013. For the third column, we use cross-sectional data, running a cross-state regression during the Great Recession period. In this case, we construct the growth rate of employment in each state as the average employment level in 2009-2011 relative to the average employment level in 2005-2007.

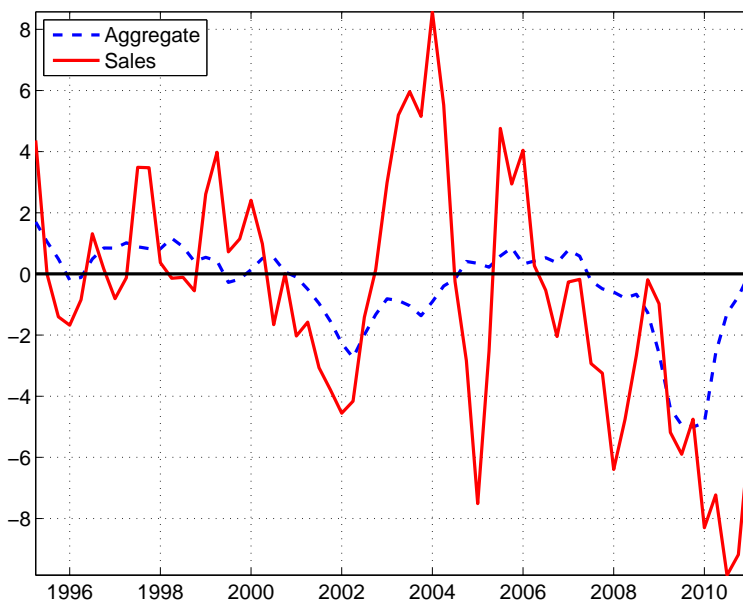


Figure 1: Annual Percentage Growth Rate of Aggregate and Sales Employment

The results show that employment in sales-related occupations is procyclical, and somewhat more variable than aggregate employment overall. When we focus on those categories thought to be more involved in customer acquisition (our second, third, and fourth categories), we find that in many cases there are larger sensitivities still. This is perhaps even more surprising given that these workers are more educated and earn higher incomes – qualities we would expect to be associated with less cyclical variation *ceteris paribus*. Figure 1 illustrates this pattern for the CPS 1994-2010 data, showing that the declines in sales employment during the 2001 and 2008 recessions were steeper than the declines of aggregate

employment.

Overall, we conclude that selling effort appears to be procyclical and relatively volatile.

## 2 Theory

Consider the following simple extension of the neoclassical business cycle model. Firms produce output  $y_t$  using a standard Cobb-Douglas production technology:  $y_t = k_t^\alpha (z_t n_{p,t})^{1-\alpha}$ , where  $k_t$  is capital,  $n_{p,t}$  production labor, and  $z_t$  productivity. Capital accumulates according to the law of motion  $k_{t+1} = (1 - \delta)k_t + x_t$ , and the wage rate is  $w_t$ . To deliver this production output to the goods market, the firm must build a base of customers, which accumulates according to the law of motion

$$m_{t+1} = (1 - \delta_m)(m_t + \xi n_{s,t}). \quad (1)$$

The customer base depreciates at the rate  $\delta_m$  and grows as the firm employs sales labor to market and sell its production. (We use a broad interpretation of this sales labor, such that all labor engaged in customer acquisition activities is included.) For the sake of simplicity we assume a linear, labor-only technology for customer acquisition, with  $\xi$  representing the productivity of sales activity.<sup>6</sup> Given this, the firm problem reads as follows:

$$\begin{aligned} \max E_0 \sum_{t=0}^{\infty} M_{0,t} [y_t - w_t(n_{p,t} + n_{s,t}) - x_t], \\ \text{s.t. } k_{t+1} &= (1 - \delta_k)k_t + x_t, \\ m_{t+1} &= (1 - \delta_m)(m_t + \xi n_{s,t}), \\ y_t &= k_t^\alpha (z_t n_{p,t})^{1-\alpha}, \\ y_t &= m_t + \xi n_{s,t}, \end{aligned}$$

---

<sup>6</sup>See Gourio and Rudanko (forthcoming) for a more detailed model of customer capital that this stylized model is a special case of.



where  $M_{0,t}$  is the stochastic discount factor, in equilibrium equal to the marginal rate of substitution of households. This firm problem differs from the standard one simply by adding the law of motion for the customer base together with the demand constraint that sales equal the size of the customer base  $y_t = m_t + \xi n_{s,t}$ , as well as the related choice of how much sales labor to hire.

We denote by  $\mu_t$  the Lagrange multiplier on the demand constraint, so that the optimality condition for sales labor becomes

$$w_t = \xi E_t \sum_{j=0}^{\infty} (1 - \delta_m)^j M_{t,t+j} \mu_{t+j}, \quad (2)$$

indicating that the firm hires sales labor up to a point where the marginal cost equals the present discounted value of the resulting customer capital.

The optimality condition for production labor becomes

$$w_t = (1 - \alpha) \frac{y_t}{n_{p,t}} (1 - \mu_t), \quad (3)$$

indicating that the firm hires production labor to a point where the marginal cost equals the marginal product, while taking into account the costs of customer capital required to sell the additional output. Rearranging equation (3) shows that  $\mu_t$  turns out to equal the markup the firm makes over the marginal costs of production.

And finally, the optimality condition for investment becomes

$$1 = E_{t-1} \left[ M_{t-1,t} \left( 1 - \delta_k + \alpha \frac{y_t}{k_t} (1 - \mu_t) \right) \right], \quad (4)$$

which similarly takes into account the costs of customer capital required to sell the additional output.

The household side of the model is standard: The household chooses how much labor to supply and how much to consume to maximize the expected present discounted value of flow utility,  $U(c, n) = \log c - \frac{\gamma}{1+1/\varepsilon} n^{1+1/\varepsilon}$ . The first order conditions imply that  $w_t = \gamma c_t n_t^{1/\varepsilon}$  and  $M_{t,t+j} = \beta^j c_t / c_{t+j}$ .

In equilibrium, markets for goods and labor clear:  $c_t + x_t = y_t$  and  $n_t = n_{p,t} + n_{s,t}$ .

### 3 Shock Propagation

We now turn to study the impact of intangible capital on shock propagation in the model. For the sake of brevity, we focus on shocks to productivity  $z_t$ .

To parameterize the model, we first adopt values for the standard parameters from the business cycle literature, setting  $\alpha = 0.3$ ,  $\delta_k = 0.025$ ,  $\beta = 0.995$ ,  $\varepsilon = 4$ , on a quarterly basis, and set  $\gamma = 4.19$  to target a steady-state wedge of 0.4. We then follow the approach of Gourio and Rudanko (forthcoming) in parameterizing  $\delta_m$  and  $\xi$ . We set  $\delta_m = 0.05$  based on available evidence on customer turnover rates, and  $\xi = 0.72$  to target a steady-state share of labor in sales of 15 percent. As discussed above, according to the BLS classification, sales-related occupations account for 11 percent of employment, but also employees outside this category are likely to be involved in customer acquisition to a degree.

Turning to the results, Figure 2 displays the responses of output, labor, sales labor, and the labor wedge in the model to a persistent one percent increase in productivity  $z$ . We measure the labor wedge as

$$\tau = 1 + \frac{U_n(c,n)}{U_c(c,n)} \frac{y}{n}, \quad (5)$$

following Shimer (2009).

The figure compares the customer capital model to the standard real business cycle (RBC) model, the limit of the customer capital model when  $\xi \rightarrow \infty$ . As the first panel illustrates, customer capital generates a hump-shaped output response. When productivity increases, firms seek to take advantage of this by expanding production, but the expansion is constrained by the customer base. To build up the customer base, firms increase sales labor in response to the shock, and as a result aggregate labor increases more than in the RBC model. As a consequence, the response of measured productivity in our model is also hump-shaped, and markedly different from  $z$ . The final panel depicts the labor wedge, which is constant

in the RBC model but counter-cyclical and volatile in the customer capital model.

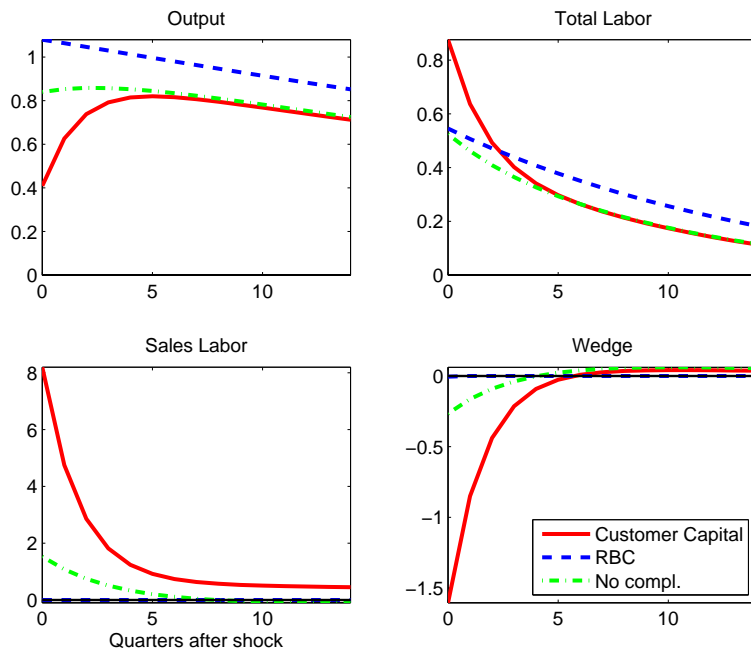


Figure 2: Impulse Responses to Positive Productivity Shock, in Percentage Terms

To understand the behavior of the labor wedge in the customer capital model, note that the labor wedge calculation assumes a standard Cobb-Douglas aggregate production function, where the marginal product of labor can be measured using the average product  $y/n$  (see equation (5)). This expression is misspecified in our model. Our model can be thought of as a two-sector model (production and sales) with perfect complementarity between sectors, where the output of the sales sector (the new customer relationships) is not counted in GDP. As a result, the average product of labor – calculated as  $y/n$  – does not correspond to the marginal.<sup>7</sup>

To illustrate the role of the complementarity, Figure 2 compares these responses to a variant of the customer capital model relaxing the complementarity. In this model  $m$  represents an intangible capital which enters into production as:  $y = (k^\alpha(zn_p)^{1-\alpha})^\omega(m + \xi n_s)^{1-\omega}$ .<sup>8</sup> The

<sup>7</sup>Our model generates a wedge on the labor demand side. Karabarounis (forthcoming) has recently argued in favor of a wedge on the labor supply side instead, but his approach requires treating average per-period wages as allocative.

<sup>8</sup>This technology is closer to what McGrattan and Prescott (2014) use for the production of tangibles, but they emphasize shocks to intangible rather than tangible production, with intangible capital a non-rival input in the production of tangibles and intangibles.

Table 2: Business Cycle Statistics

	Volatilities				Correlations			
	$y$	$n$	$n_s$	$lw$	$(n, y)$	$(n_s, y)$	$(n_s, n)$	$(lw, n)$
Data	1.12	0.92	2.31	1.62	0.94	0.27	0.37	-0.89
Models:								
RBC	0.90	0.46	–	–	0.98	–	–	–
Customer Capital	0.74	0.77	6.81	1.36	0.60	0.34	0.95	-0.92
No complementarity	0.94	0.54	1.49	0.27	0.94	0.72	0.90	-0.79

Notes: Both empirical (1994-2010) and model-simulated time series are HP(1600)-filtered.

expression for the marginal product continues to be misspecified in this setting as well, but as the figure shows, the quantitative impact on model dynamics is clearly weaker.

A potential resolution to the measurement problem is to use consistent measures of labor and output in the expression for the marginal product: if we only include production output in the numerator, then we should only include production labor in the denominator. Returns to labor are equated across production and sales activities in this economy, and in the model without complementarity one can indeed use  $y/n_p$  as an exact measure of the marginal product of labor. In the customer capital model (with complementarity) this is not the case, however, as seen in equation (3).

Finally, note that simply making it costly for firms to attract customers is not enough to get the effects of customer capital highlighted here. In a model where the customer base depreciates fully from one period to the next ( $\delta_m = 1$ ), sales labor is always proportional to output and the model dynamics are very similar to the standard RBC model.

To quantify the magnitude of these effects, we produce business cycle moments and compare them to US data in Table 2. For each model, we set the volatility of  $z$  so that the Solow residual in the model has the same volatility as in the data. The first row recapitulates well-known stylized moments of US business cycles. Relative to this evidence, the RBC model underestimates the volatility of employment and the labor wedge, while the customer capital model generates significantly more volatility in both. The volatility of sales labor in the model appears high relative to the data, however.

## 4 Concluding Remarks

Intangible capital is typically omitted in business cycle analysis, and our preliminary results suggest that this may be an important omission. Clearly, more work remains to be done on developing the evidence, and the theory will likely need to be adjusted accordingly. Our simple model for example predicts a volatility for selling effort that is high relative to our data. How would this – and other results – change if the model was extended to allow firms to use prices as an alternative means of attracting customers? How would imperfect competition, an intensive margin of demand, or endogenous separations of customers affect these results? These questions remain for future research.

## References

- CHARI, V. V., P. KEHOE, AND E. MCGRATTAN (2005): “Business Cycle Accounting,” *Econometrica*, 75, 781–836.
- GOURIO, F., AND L. RUDANKO (forthcoming): “Customer Capital,” *Review of Economic Studies*.
- HALL, R. (1997): “Macroeconomic Fluctuations and the Allocation of Time,” *Journal of Labor Economics*, 15, S223–S250.
- (2013): “What the Cyclical Response of Advertising Reveals about Markups and Other Macroeconomic Wedges,” Unpublished manuscript, Stanford University.
- KARABARBOUNIS, L. (forthcoming): “The labor wedge: MRS vs. MPN,” *Review of Economic Dynamics*.
- MCGRATTAN, E., AND E. PRESCOTT (2010): “Unmeasured Investment and the Puzzling U.S. Boom in the 1990s,” *American Economic Journal: Macroeconomics*, 2, 88–123.
- (2014): “A Reassessment of Real Business Cycle Theory,” unpublished manuscript, FRB Minneapolis.

MULLIGAN, C. (2002): “A Century of Labor-Leisure Distortions,” Working Paper 8774, National Bureau of Economic Research.

SHIMER, R. (2009): “Convergence in Macroeconomics: The Labor Wedge,” *American Economic Journal: Macroeconomics*, 1, 280–97.

## Working Paper Series

A series of research studies on regional economic issues relating to the Seventh Federal Reserve District, and on financial and economic topics.

Corporate Average Fuel Economy Standards and the Market for New Vehicles <i>Thomas Klier and Joshua Linn</i>	WP-11-01
The Role of Securitization in Mortgage Renegotiation <i>Sumit Agarwal, Gene Amromin, Itzhak Ben-David, Souphala Chomsisengphet, and Douglas D. Evanoff</i>	WP-11-02
Market-Based Loss Mitigation Practices for Troubled Mortgages Following the Financial Crisis <i>Sumit Agarwal, Gene Amromin, Itzhak Ben-David, Souphala Chomsisengphet, and Douglas D. Evanoff</i>	WP-11-03
Federal Reserve Policies and Financial Market Conditions During the Crisis <i>Scott A. Brave and Hesna Genay</i>	WP-11-04
The Financial Labor Supply Accelerator <i>Jeffrey R. Campbell and Zvi Hercowitz</i>	WP-11-05
Survival and long-run dynamics with heterogeneous beliefs under recursive preferences <i>Jaroslav Borovička</i>	WP-11-06
A Leverage-based Model of Speculative Bubbles (Revised) <i>Gadi Barlevy</i>	WP-11-07
Estimation of Panel Data Regression Models with Two-Sided Censoring or Truncation <i>Sule Alan, Bo E. Honoré, Luojia Hu, and Søren Leth-Petersen</i>	WP-11-08
Fertility Transitions Along the Extensive and Intensive Margins <i>Daniel Aaronson, Fabian Lange, and Bhashkar Mazumder</i>	WP-11-09
Black-White Differences in Intergenerational Economic Mobility in the US <i>Bhashkar Mazumder</i>	WP-11-10
Can Standard Preferences Explain the Prices of Out-of-the-Money S&P 500 Put Options? <i>Luca Benzoni, Pierre Collin-Dufresne, and Robert S. Goldstein</i>	WP-11-11
Business Networks, Production Chains, and Productivity: A Theory of Input-Output Architecture <i>Ezra Oberfield</i>	WP-11-12
Equilibrium Bank Runs Revisited <i>Ed Nosal</i>	WP-11-13
Are Covered Bonds a Substitute for Mortgage-Backed Securities? <i>Santiago Carbó-Valverde, Richard J. Rosen, and Francisco Rodríguez-Fernández</i>	WP-11-14
The Cost of Banking Panics in an Age before “Too Big to Fail” <i>Benjamin Chabot</i>	WP-11-15

## Working Paper Series *(continued)*

Import Protection, Business Cycles, and Exchange Rates: Evidence from the Great Recession <i>Chad P. Bown and Meredith A. Crowley</i>	WP-11-16
Examining Macroeconomic Models through the Lens of Asset Pricing <i>Jaroslav Borovička and Lars Peter Hansen</i>	WP-12-01
The Chicago Fed DSGE Model <i>Scott A. Brave, Jeffrey R. Campbell, Jonas D.M. Fisher, and Alejandro Justiniano</i>	WP-12-02
Macroeconomic Effects of Federal Reserve Forward Guidance <i>Jeffrey R. Campbell, Charles L. Evans, Jonas D.M. Fisher, and Alejandro Justiniano</i>	WP-12-03
Modeling Credit Contagion via the Updating of Fragile Beliefs <i>Luca Benzoni, Pierre Collin-Dufresne, Robert S. Goldstein, and Jean Helwege</i>	WP-12-04
Signaling Effects of Monetary Policy <i>Leonardo Melosi</i>	WP-12-05
Empirical Research on Sovereign Debt and Default <i>Michael Tomz and Mark L. J. Wright</i>	WP-12-06
Credit Risk and Disaster Risk <i>François Gourio</i>	WP-12-07
From the Horse's Mouth: How do Investor Expectations of Risk and Return Vary with Economic Conditions? <i>Gene Amromin and Steven A. Sharpe</i>	WP-12-08
Using Vehicle Taxes To Reduce Carbon Dioxide Emissions Rates of New Passenger Vehicles: Evidence from France, Germany, and Sweden <i>Thomas Klier and Joshua Linn</i>	WP-12-09
Spending Responses to State Sales Tax Holidays <i>Sumit Agarwal and Leslie McGranahan</i>	WP-12-10
Micro Data and Macro Technology <i>Ezra Oberfield and Devesh Raval</i>	WP-12-11
The Effect of Disability Insurance Receipt on Labor Supply: A Dynamic Analysis <i>Eric French and Jae Song</i>	WP-12-12
Medicaid Insurance in Old Age <i>Mariacristina De Nardi, Eric French, and John Bailey Jones</i>	WP-12-13
Fetal Origins and Parental Responses <i>Douglas Almond and Bhashkar Mazumder</i>	WP-12-14



## **Working Paper Series** *(continued)*

Repos, Fire Sales, and Bankruptcy Policy <i>Gaetano Antinolfi, Francesca Carapella, Charles Kahn, Antoine Martin, David Mills, and Ed Nosal</i>	<b>WP-12-15</b>
Speculative Runs on Interest Rate Pegs The Frictionless Case <i>Marco Bassetto and Christopher Phelan</i>	<b>WP-12-16</b>
Institutions, the Cost of Capital, and Long-Run Economic Growth: Evidence from the 19th Century Capital Market <i>Ron Alquist and Ben Chabot</i>	<b>WP-12-17</b>
Emerging Economies, Trade Policy, and Macroeconomic Shocks <i>Chad P. Bown and Meredith A. Crowley</i>	<b>WP-12-18</b>
The Urban Density Premium across Establishments <i>R. Jason Faberman and Matthew Freedman</i>	<b>WP-13-01</b>
Why Do Borrowers Make Mortgage Refinancing Mistakes? <i>Sumit Agarwal, Richard J. Rosen, and Vincent Yao</i>	<b>WP-13-02</b>
Bank Panics, Government Guarantees, and the Long-Run Size of the Financial Sector: Evidence from Free-Banking America <i>Benjamin Chabot and Charles C. Moul</i>	<b>WP-13-03</b>
Fiscal Consequences of Paying Interest on Reserves <i>Marco Bassetto and Todd Messer</i>	<b>WP-13-04</b>
Properties of the Vacancy Statistic in the Discrete Circle Covering Problem <i>Gadi Barlevy and H. N. Nagaraja</i>	<b>WP-13-05</b>
Credit Crunches and Credit Allocation in a Model of Entrepreneurship <i>Marco Bassetto, Marco Cagetti, and Mariacristina De Nardi</i>	<b>WP-13-06</b>
Financial Incentives and Educational Investment: The Impact of Performance-Based Scholarships on Student Time Use <i>Lisa Barrow and Cecilia Elena Rouse</i>	<b>WP-13-07</b>
The Global Welfare Impact of China: Trade Integration and Technological Change <i>Julian di Giovanni, Andrei A. Levchenko, and Jing Zhang</i>	<b>WP-13-08</b>
Structural Change in an Open Economy <i>Timothy Uy, Kei-Mu Yi, and Jing Zhang</i>	<b>WP-13-09</b>
The Global Labor Market Impact of Emerging Giants: a Quantitative Assessment <i>Andrei A. Levchenko and Jing Zhang</i>	<b>WP-13-10</b>

## Working Paper Series *(continued)*

Size-Dependent Regulations, Firm Size Distribution, and Reallocation <i>François Gourio and Nicolas Roys</i>	WP-13-11
Modeling the Evolution of Expectations and Uncertainty in General Equilibrium <i>Francesco Bianchi and Leonardo Melosi</i>	WP-13-12
Rushing into American Dream? House Prices, Timing of Homeownership, and Adjustment of Consumer Credit <i>Sumit Agarwal, LuoJia Hu, and Xing Huang</i>	WP-13-13
The Earned Income Tax Credit and Food Consumption Patterns <i>Leslie McGranahan and Diane W. Schanzenbach</i>	WP-13-14
Agglomeration in the European automobile supplier industry <i>Thomas Klier and Dan McMillen</i>	WP-13-15
Human Capital and Long-Run Labor Income Risk <i>Luca Benzoni and Olena Chyruk</i>	WP-13-16
The Effects of the Saving and Banking Glut on the U.S. Economy <i>Alejandro Justiniano, Giorgio E. Primiceri, and Andrea Tambalotti</i>	WP-13-17
A Portfolio-Balance Approach to the Nominal Term Structure <i>Thomas B. King</i>	WP-13-18
Gross Migration, Housing and Urban Population Dynamics <i>Morris A. Davis, Jonas D.M. Fisher, and Marcelo Veracierto</i>	WP-13-19
Very Simple Markov-Perfect Industry Dynamics <i>Jaap H. Abbring, Jeffrey R. Campbell, Jan Tilly, and Nan Yang</i>	WP-13-20
Bubbles and Leverage: A Simple and Unified Approach <i>Robert Barsky and Theodore Bogusz</i>	WP-13-21
The scarcity value of Treasury collateral: Repo market effects of security-specific supply and demand factors <i>Stefania D'Amico, Roger Fan, and Yuriy Kitsul</i>	WP-13-22
Gambling for Dollars: Strategic Hedge Fund Manager Investment <i>Dan Bernhardt and Ed Nosal</i>	WP-13-23
Cash-in-the-Market Pricing in a Model with Money and Over-the-Counter Financial Markets <i>Fabrizio Mattesini and Ed Nosal</i>	WP-13-24
An Interview with Neil Wallace <i>David Altig and Ed Nosal</i>	WP-13-25

## **Working Paper Series** *(continued)*

Firm Dynamics and the Minimum Wage: A Putty-Clay Approach **WP-13-26**  
*Daniel Aaronson, Eric French, and Isaac Sorkin*

Policy Intervention in Debt Renegotiation:  
Evidence from the Home Affordable Modification Program **WP-13-27**  
*Sumit Agarwal, Gene Amromin, Itzhak Ben-David, Souphala Chomsisengphet,  
Tomasz Piskorski, and Amit Seru*

The Effects of the Massachusetts Health Reform on Financial Distress **WP-14-01**  
*Bhashkar Mazumder and Sarah Miller*

Can Intangible Capital Explain Cyclical Movements in the Labor Wedge? **WP-14-02**  
*François Gourio and Leena Rudanko*