How Firms Respond to Business Cycles: The Role of the Firm Age and Firm Size

Teresa Fort
Tuck School of Business at Dartmouth

John Haltiwanger
University of Maryland

Ron S. Jarmin
U.S. Census Bureau

Javier Miranda
U.S. Census Bureau

Paper presented at the 13th Jacques Polak Annual Research Conference
Hosted by the International Monetary Fund
Washington, DC—November 8–9, 2012

The views expressed in this paper are those of the author(s) only, and the presence of them, or of links to them, on the IMF website does not imply that the IMF, its Executive Board, or its management endorses or shares the views expressed in the paper.
How Firms Respond to Business Cycles: 
The Role of Firm Age and Firm Size

November 2012

by

Teresa Fort, Tuck School of Business
John Haltiwanger, University of Maryland
Ron Jarmin, U.S. Census Bureau
Javier Miranda, U.S. Census Bureau

We thank the Kauffman Foundation for financial support. Any opinions and conclusions expressed herein are those of the authors and do not necessarily represent the views of the U.S. Census Bureau. All results have been reviewed to ensure that no confidential information is disclosed.
Overview

• Main Theme: Important to Distinguish Between Firm Age and Firm Size for Cyclical Dynamics
  – Most of focus in literature has been on firm size.
    • Debate about sensitivity to different types of shocks
  – Firm age and firm size related but not the same
    • Young firms are small but many mature, small firms.
    • They have very different dynamics.

• Young firms (which are small and medium size) hit especially hard in Great Recession.
  – Why?
  – Our answer: Collapse of Housing Prices an Important Contributor
    • Young firms hit especially hard in states with especially large declines in housing prices.
    • Estimate a panel VAR at state*year level to isolate local housing price effects from local cyclical shocks.
    • Consistent with home equity/financing channel for young businesses but other mechanisms may be at work as well.
Net Growth Rates by Firm Age and Firm Size

- Young, Small
- Young, Med
- Older, Small
- Older, Med
- Older, Large
Differences in Net Growth Rates

- Young, Small-Large, Older
- Young, Med-Large, Older
- Older, Small-Older, Large
- Older, Med - Older, Large
- Economy_Net
### Table 2 Correlations Between Cyclical Indicators and Net Differential Employment Growth Rates

<table>
<thead>
<tr>
<th></th>
<th>Change in Unemp Rate</th>
<th>Net Emp. Growth Rate</th>
<th>Real GDP Growth</th>
<th>HP Filtered Unemp Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young/Small-Older/Large</td>
<td>-0.452 -0.292</td>
<td>0.551 0.279</td>
<td>0.527 0.305</td>
<td>0.239 0.215</td>
</tr>
<tr>
<td></td>
<td>(0.012) (0.148)</td>
<td>(0.002) (0.168)</td>
<td>(0.003) (0.130)</td>
<td>(0.203) (0.292)</td>
</tr>
<tr>
<td>Young/Medium-Older/Large</td>
<td>-0.342 -0.263</td>
<td>0.507 0.329</td>
<td>0.475 0.344</td>
<td>0.125 -0.057</td>
</tr>
<tr>
<td></td>
<td>(0.064) (0.194)</td>
<td>(0.004) (0.101)</td>
<td>(0.008) (0.085)</td>
<td>(0.512) (0.782)</td>
</tr>
<tr>
<td>Older/Small-Older/Large</td>
<td>0.283 0.342</td>
<td>0.146 -0.258</td>
<td>-0.171 -0.242</td>
<td>0.608 0.620</td>
</tr>
<tr>
<td></td>
<td>(0.130) (0.087)</td>
<td>(0.441) (0.204)</td>
<td>(0.367) (0.233)</td>
<td>(0.000) (0.001)</td>
</tr>
<tr>
<td>Older/Medium-Older/Large</td>
<td>-0.218 -0.075</td>
<td>0.403 0.267</td>
<td>0.313 0.162</td>
<td>0.391 0.551</td>
</tr>
<tr>
<td></td>
<td>(0.247) (0.715)</td>
<td>(0.027) (0.188)</td>
<td>(0.092) (0.429)</td>
<td>(0.033) (0.004)</td>
</tr>
</tbody>
</table>

Note: P-values in parentheses.

Only 30 observations from 1981-2010 and 26 observations from 1981-2006
Bivariate Regressions of Net Differentials on Cyclical Indicators at State-Year Level (Controlling for State and Year Fixed Effects)

<table>
<thead>
<tr>
<th></th>
<th>Young/Small-Large/Old</th>
<th>Young/Medium-Large/Old</th>
<th>Old/Small-Large/Old</th>
<th>Old/Medium-Large/Old</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chg in Unemp. Rt</td>
<td>-2.207***</td>
<td>-1.432***</td>
<td>-0.570***</td>
<td>-0.479***</td>
</tr>
<tr>
<td></td>
<td>(0.212)</td>
<td>(0.248)</td>
<td>(0.142)</td>
<td>(0.140)</td>
</tr>
<tr>
<td>HP Filtered Unemp.</td>
<td>-2.406***</td>
<td>-0.914*</td>
<td>-0.885***</td>
<td>-0.456*</td>
</tr>
<tr>
<td></td>
<td>(0.347)</td>
<td>(0.401)</td>
<td>(0.227)</td>
<td>(0.225)</td>
</tr>
<tr>
<td>Net Emp Gr. Rt</td>
<td>0.559***</td>
<td>0.224***</td>
<td>-0.241***</td>
<td>-0.209***</td>
</tr>
<tr>
<td></td>
<td>(0.058)</td>
<td>(0.068)</td>
<td>(0.038)</td>
<td>(0.038)</td>
</tr>
<tr>
<td>Real GDP Gr. Rt.</td>
<td>0.338***</td>
<td>0.158***</td>
<td>0.029</td>
<td>0.036</td>
</tr>
<tr>
<td></td>
<td>(0.040)</td>
<td>(0.047)</td>
<td>(0.027)</td>
<td>(0.026)</td>
</tr>
<tr>
<td>Real Pers. Inc. Gr Rt</td>
<td>0.658***</td>
<td>0.391***</td>
<td>0.114*</td>
<td>0.068</td>
</tr>
<tr>
<td></td>
<td>(0.066)</td>
<td>(0.078)</td>
<td>(0.044)</td>
<td>(0.044)</td>
</tr>
</tbody>
</table>

Note: 1530 observations
Panel VAR

\[ Y_{s,t} = A(L)Y_{st} + State_s + Year_t + \varepsilon_{st} \]

- \( Y \) is a vector of covariates
- \( L \) is a lag operator of length \( L \) (in practice two years)
- \( A(L) \) is a matrix of lagged coefficients
- \( State \) and \( Year \) represent state fixed and year fixed effects.
- \( \varepsilon \) is the residual innovation vector of shocks to each of the covariates.
- Convert to orthogonalized MA representation using Cholesky decomposition with ordering:
  - Change in State-Level Unemployment Rate
  - State-level Housing Price Growth
  - Net Growth Differential Young/Small-Older/Large
  - Net Growth Differential Young/Medium-Older/Large
  - Net Growth Differential Older/Small-Older/Large
  - Net Growth Differential Older/Medium-Older/Large
- Focus on the responses to the first two innovations:
  - First: state-specific cyclical shock;
  - Second: housing price shock orthogonal to first innovation (purged of endogenous response of housing prices).
  - Ordering of remaining variables is not relevant for impact of first two variables.
State-Specific Housing Price Dynamics

Response of Housing Prices at State Level
Annual Levels VAR(2) Model, Year Effects

St_Chg UR shock

GR_HPrice_St shock
Impact on Net Growth Young/Small relative to Large/Old for State-Specific Shocks

Response of Difference of Young/Small with Large/Old Net
Annual Levels VAR(2) Model, Year Effects

St_Chg_UR shock

GR_HPrice_St shock
Impact on Net Growth Old/Small relative to Large/Old for State-Specific Shocks

Response of Difference of Old/Small with Large/Old Net
Annual Levels VAR(2) Model, Year Effects

- St_Chg UR shock
- GR_HPrice St shock
Results Robust to Alternative Indicators

Response of Difference of Young/Small with Large/Old Net Annual Levels VAR(2) Model, Year Effects

- GR_RPI_St shock
- GR_HPrice_St shock
Results Robust to Alternative Indicators (even to using HP filtered Unemployment Rate)
States with Large Housing Price Declines Have Large Changes in Net Differential for Young/Small
Mechanisms?

• Possible channel: home equity financing of young businesses.
• Alternative possible mechanisms:
  • Do results reflect sectoral composition effects?
    • Mian and Sufi (2012) emphasize impact of housing price shocks on local non-tradables.
  • Results on local cyclical shocks hold within all sectors
  • Results on housing price shocks hold within Retail, FIRE, Construction and Services.
  • If alternative channel, must explain why differential response of young/small vs. large/mature within sectors.
Summary and Next Steps

• Robust findings that young firms are more sensitive to cyclical and housing price shocks.
  • Exploited geographic variation over time to identify effects.

• Given large national adverse impact on young in Great Recession and slow recovery, these findings important for understanding this period.

• More to do to discern actual mechanism(s) at play
  • Likely will need more data:
    • E.g., direct evidence on home equity, startup/young business financing by sector.
Extra Slides
Literature

- **Large literature focusing on role of firm size in cyclical sensitivity:**
  - Gertler and Gilchrist (1994) highlight greater responsiveness of small firms to monetary policy and credit shocks.
  - Moscarini and Postel-Vinay (2012) find that net differential between small and large firms widens when unemployment is above trend – motivated by poaching model.

- **Business finance**
    - Many papers use size as proxy for access but suggest age is important.
    - Robb and Wolken and Robb and Robinson highlight the role of home equity for young businesses

- **Housing prices and impact on local economy**
  - Mian and Sufi (2010, 2011a, 2011b)
Key Correlations

- Correlation of Net Employment Growth with:
  - Change in Unemployment Rate = -0.84
  - Real GDP Growth Rate = 0.90
  - HP-Filtered Unemployment Rate = -0.23

- Correlation of Real Housing Price Growth with:
  - Change in Unemployment Rate = -0.56
  - Real GDP Growth Rate = 0.56
  - HP-Filtered Unemployment Rate = -0.10
Table 3 Descriptive Regressions at State Level (Controlling for State and Year Fixed Effects) – Using State-Level Change in Unemployment Rate as Cyclical Indicator

Bivariate

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>diff_net_rate_11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diff_net_rate_21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diff_net_rate_12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diff_net_rate_22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chg_UR_st</td>
<td>-2.207***</td>
<td>-1.432***</td>
<td>-0.570***</td>
<td>-0.479***</td>
</tr>
<tr>
<td></td>
<td>(0.212)</td>
<td>(0.248)</td>
<td>(0.142)</td>
<td>(0.140)</td>
</tr>
</tbody>
</table>

Multivariate

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>diff_net_rate_11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diff_net_rate_21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diff_net_rate_12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diff_net_rate_22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chg_UR_st</td>
<td>-1.916***</td>
<td>-1.347***</td>
<td>-0.484***</td>
<td>-0.437**</td>
</tr>
<tr>
<td></td>
<td>(0.213)</td>
<td>(0.253)</td>
<td>(0.144)</td>
<td>(0.143)</td>
</tr>
<tr>
<td>GR_HPrice_st</td>
<td>0.183***</td>
<td>0.054</td>
<td>0.054**</td>
<td>0.026</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
<td>(0.032)</td>
<td>(0.018)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>N</td>
<td>1530</td>
<td>1530</td>
<td>1530</td>
<td>1530</td>
</tr>
</tbody>
</table>

Standard errors in parentheses

* p < 0.05, ** p < 0.01, *** p < 0.00. Note 11=Young/Small, 21=Young/Medium, 12=Old/Small, 22=Old/Medium. All net differentials are with respect to Old/Large.
Table 4 Descriptive Regressions at State Level (Controlling for State and Year Fixed Effects) – Using HP Filtered State-Level Unemployment Rate as Cyclical Indicator

<table>
<thead>
<tr>
<th>Bivariate</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>diff_net_rate_11</td>
<td>HP_UR_st</td>
<td>2.406***</td>
<td>-0.914*</td>
<td>-0.885***</td>
</tr>
<tr>
<td>diff_net_rate_21</td>
<td>(0.347)</td>
<td>(0.401)</td>
<td>(0.227)</td>
<td>(0.225)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Multivariate</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>diff_net_rate_11</td>
<td>HP_UR_st</td>
<td>1.731***</td>
<td>-0.657</td>
<td>-0.708**</td>
</tr>
<tr>
<td>diff_net_rate_21</td>
<td>(0.355)</td>
<td>(0.417)</td>
<td>(0.236)</td>
<td>(0.234)</td>
</tr>
<tr>
<td>GR_HPrice_st</td>
<td>0.195***</td>
<td>0.074*</td>
<td>0.051**</td>
<td>0.030</td>
</tr>
<tr>
<td>(0.028)</td>
<td>(0.033)</td>
<td>(0.019)</td>
<td>(0.019)</td>
<td></td>
</tr>
</tbody>
</table>

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ Note 11=Young/Small, 21=Young/Medium, 12=Old/Small, 22=Old/Medium. All net differentials are with respect to Old/Large.
Impact on Net Growth Young/Medium relative to Large/Old for State-Specific Shocks

Reponse of Difference of Young/Medium with Large/Old Net
Annual Levels VAR(2) Model, Year Effects

St_Chg UR shock

GR_HPrice St shock
Impact on Net Growth Old/Medium relative to Large/Old for State-Specific Shocks
Impact on Job Creation Young/Small relative to Large/Old

Response of Difference of Young/Small with Large/Old Net
Annual Levels VAR(2) Model, Year Effects

St_Chg UR shock

GR_HPrice St shock
Impact on Job Destruction Young/Small relative to Large/Old

Response of Difference of Young/Small with Large/Old Net
Annual Levels VAR(2) Model, Year Effects

St_Chg_UR shock

GR_HPrice_St shock
Response of Difference of Young with Old Net
Annual Levels VAR(2) Model, Year Effects

St_Chg_UR shock

GR_HPrice_St shock
Response of Difference of Small/Medium with LargeNet
Annual Levels VAR(2) Model, Year Effects

St_Chg_UR shock

GR_HPrice_St shock
Contribution of Local Shocks to Two-Year Change in Net Differential for Young/Small-Old/Large (Pooling over all states and years)

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Net Differential for Young/Small-Old/Large</td>
<td></td>
</tr>
<tr>
<td>Predicted Change from Local Housing Prices</td>
<td>1.099***</td>
</tr>
<tr>
<td>Predicted Change from Local Cyclical Shock</td>
<td>0.900***</td>
</tr>
</tbody>
</table>

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Differential Responses of Young/Small by Sector

Construction                         Manufacturing                       Retail Trade

Wholesale Trade                         FIRE                                    Services
The Role of Housing Prices for Young Firms?

  - They find that the impact of state-specific housing prices greater for non-tradeables.
  - Pooled sector results could have been driven by this if young/small disproportionately in tradeables.
  - But our results hold within sectors so not just a between effect.
    - Not for all sectors. Our greater sensitivity for non-tradeables but also Construction, Services, and FIRE.
- Must be a reason that young are more sensitive even within non-tradeables.
  - Is it credit channel? Maybe but need direct evidence that home equity more relevant in some sectors.
  - Is sectoral variation in results due to variation in entry costs?