Changes Business Dynamism and Productivity: Shocks vs. Responsiveness

Business Dynamism and Productivity
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By

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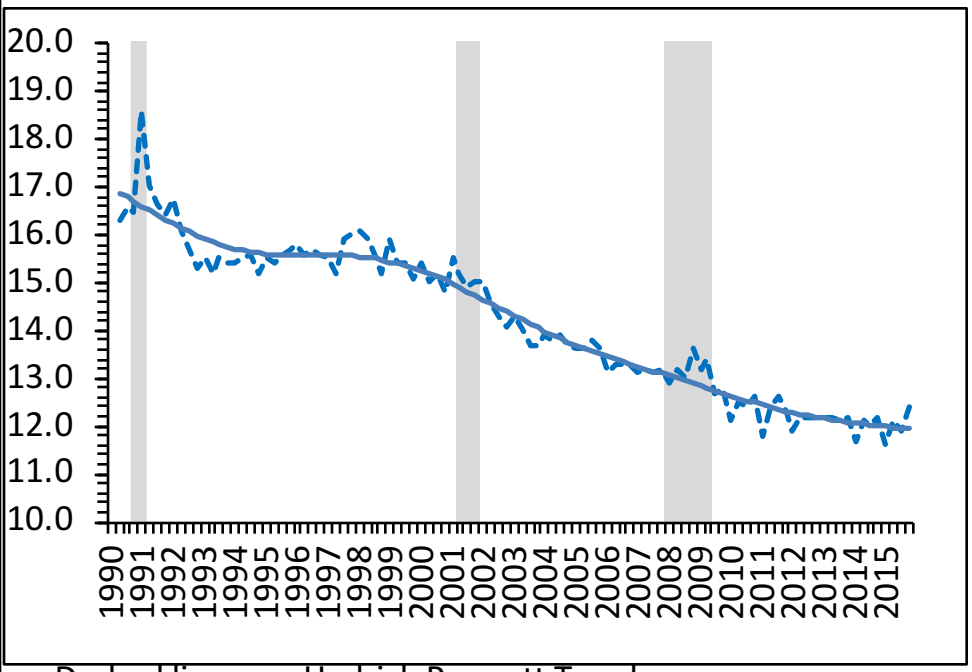
Declining Business Dynamism is Evident from Multiple Data Sources

Job Reallocation Rate, U.S. Private Non-Farm (Quarterly)

Source: BED

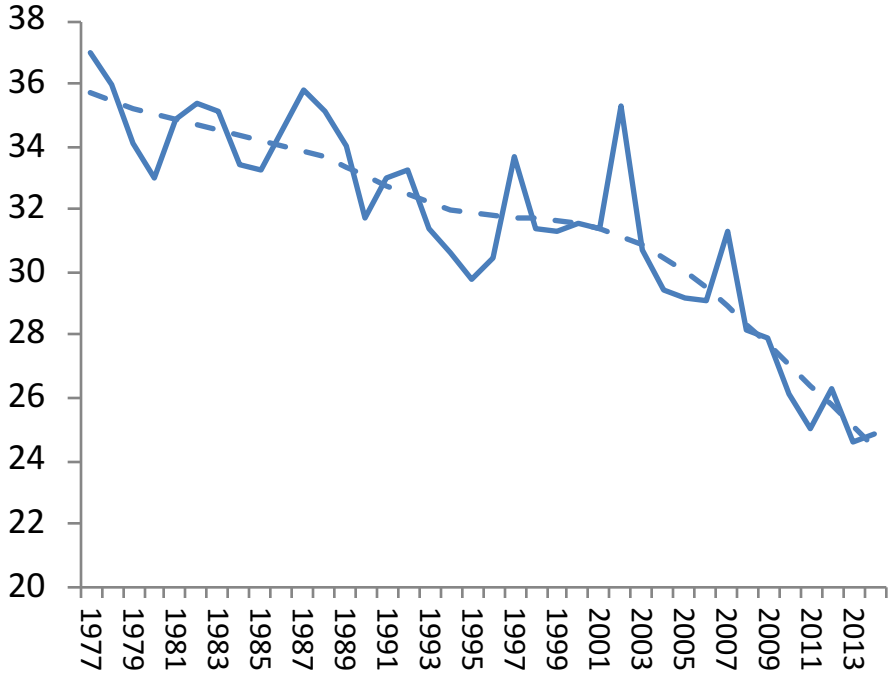


Dashed lines are Hodrick-Prescott Trends

- Declining Trend in Job Reallocation Accelerated in Post-2000 Period. Trend decline continues in post-Great Recession period.

Job Reallocation Rate, U.S. Private Non-Farm (Annual)

Source: BDS



- Reallocation closely connected to productivity growth.

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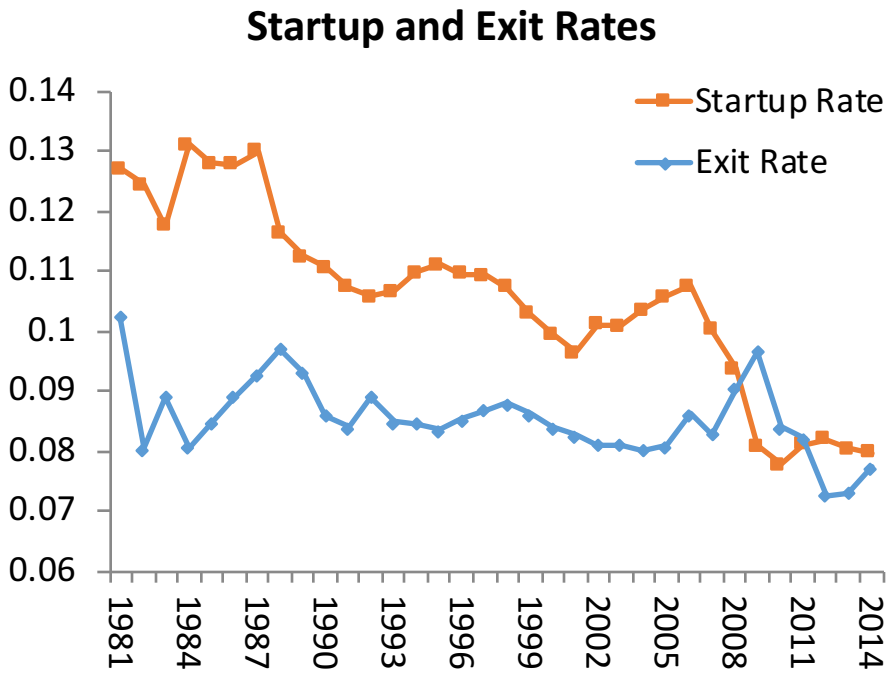
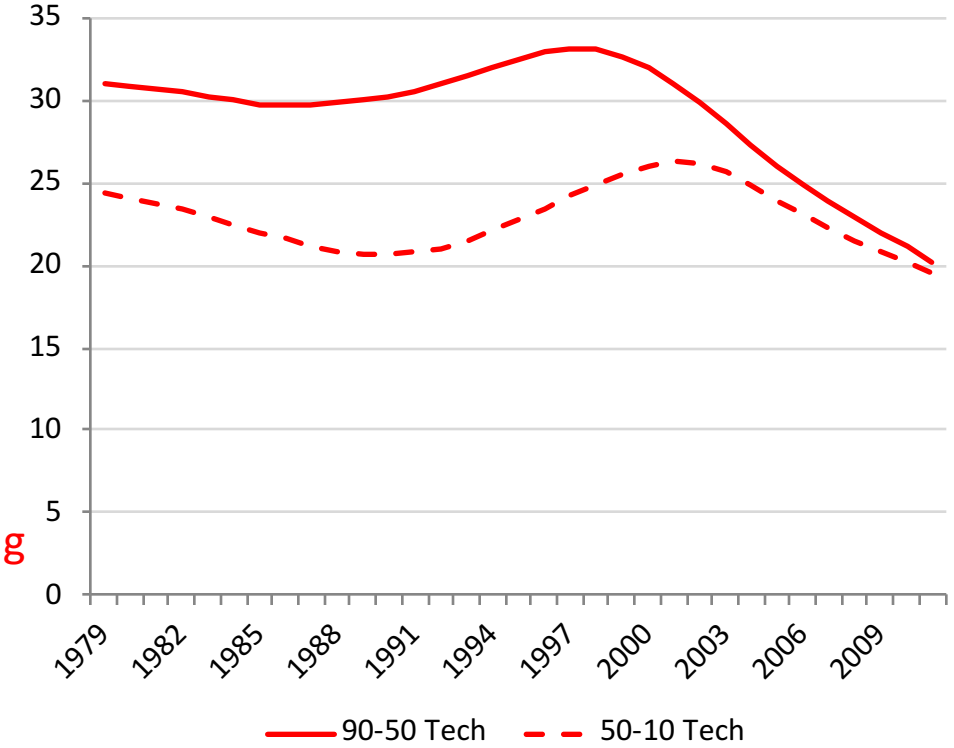
Startup and Exit Rates in Nonfarm Private Sector, 1981-2014



Young businesses are much more volatile than mature businesses. The changing age distribution of businesses accounts for about 25% of the secular decline in dynamism from the late 1980s to mid 2000s (Decker et al. 2014).

High Skewness in High Tech through 2000 – Sharp decline post 2000



There is also a decline in the skewness and high growth firm activity particularly amongst young firms in high tech (Decker et al. 2017).

Not much progress in understanding underlying causes or implications for productivity

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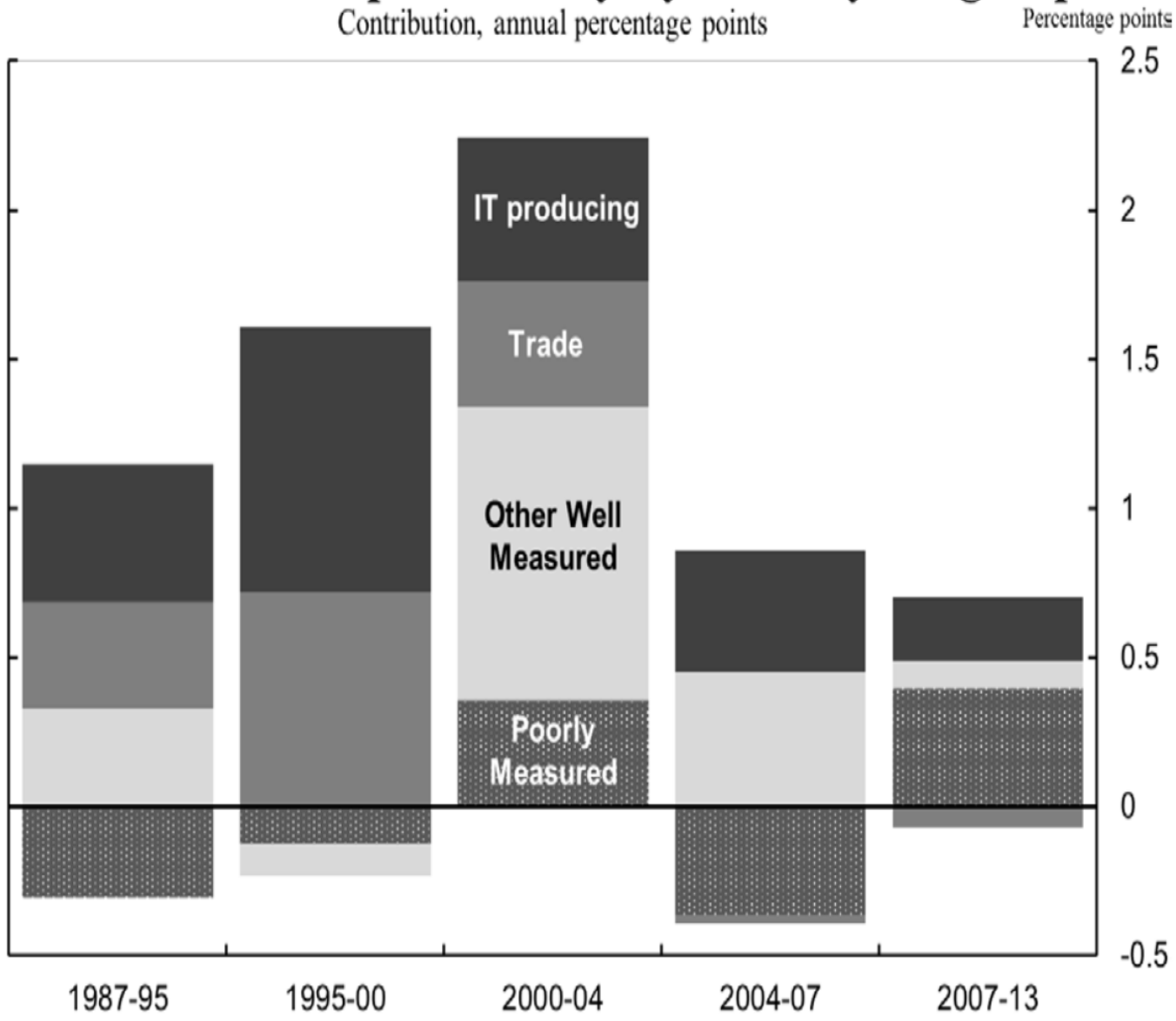
Possible causes for the decline in job reallocation?

Canonical models of firm dynamics with adjustment costs (Hopenhayn and Rogerson (1993)).

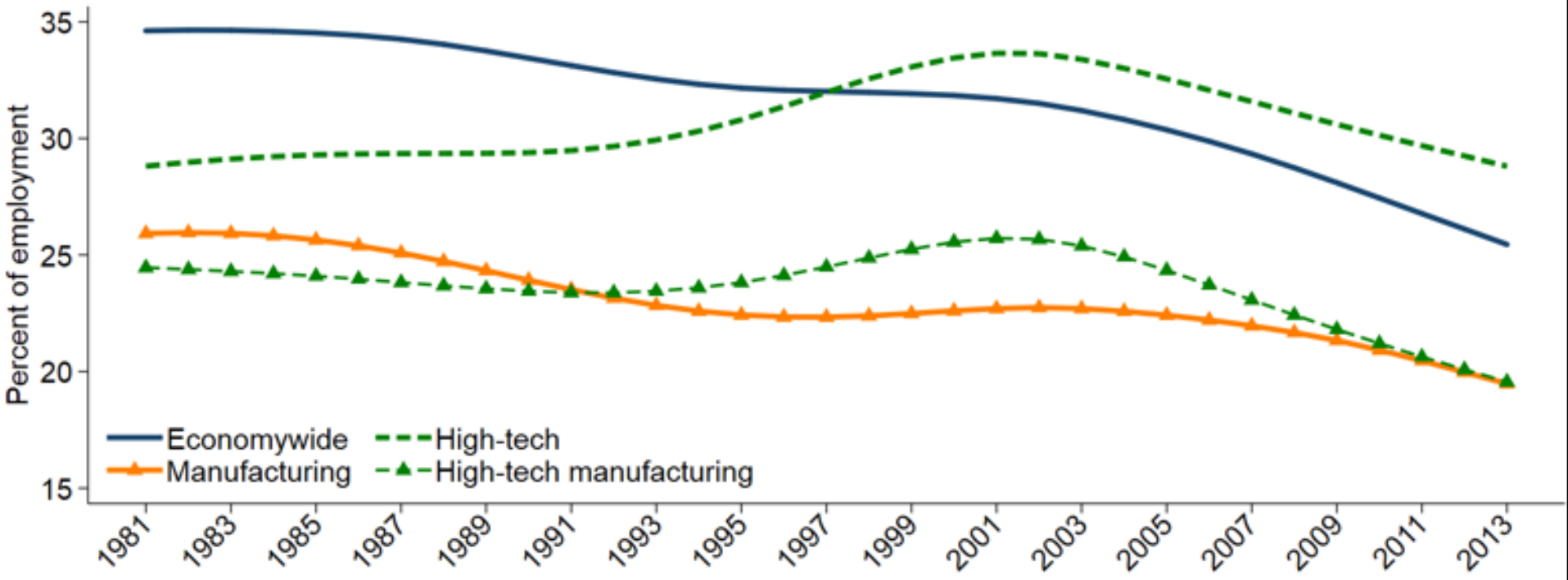
- Reallocation is the result of businesses response to changing environment. Businesses facing positive productivity/profitability conditions enter/expand. If weak conditions then exit/contract => allocative efficiency
- Decline in reallocation:
  - **Shock Hypothesis:** the dispersion of idiosyncratic productivity or profitability realizations (shocks) has declined **=>** no incentive to change.
  - **Responsiveness Hypothesis:** businesses become more sluggish in responding to realized shocks (adjustment costs) **=>** weakened productivity selection and possibly large impacts on aggregate productivity.

U.S. total factor productivity by industry subgroup



Source: Byrne et. al. (2016)

Figure 1: Job reallocation patterns differ by sector



Note: Y axis does not start at zero. HP trends using parameter set to 100. Industries defined on a consistent NAIC
high-tech is defined as in Hecker (2005). Data include all firms (new entrants, continuers, and exiters). Source: LB

Empirical Strategy

From canonical models estimate:

- $g_{et} = f_t(a_{et}, n_{et-1})$

  g_{et} : establishment-level growth
  a_{et} : realization of establishment-level productivity
  n_{et-1} : initial employment.

- Can attribute empirical changes in dispersion/skewness of g_{et} to:
  - 1. Changes in the distribution of a_{et} (persistence or dispersion)
  - 2. Changes in the marginal responsiveness of g_{et} to a_{et}.
  - I'll show you increase in 1 and decline in 2 (overall and in high tech post 2000).

<u>Our innovation:</u> We then use estimates from the policy function to estimate impact on aggregate productivity from the decline:

- Estimate counterfactual from the base level response
- $\sum_j \hat{\theta}^H_{jt+1} a_{jt} - \sum_j \theta_{jt}\, a_{jt}$ Where $\hat{\theta}^H_{jt+1} = \hat{g}_{et}$

- 1st step: Estimate productivity shocks → RF (manufacturing), RLP (economy-wide)
  - High-tech, non high-tech and interactions by age
- **We find large impacts on productivity growth from declines in responsiveness**

Measuring Productivity

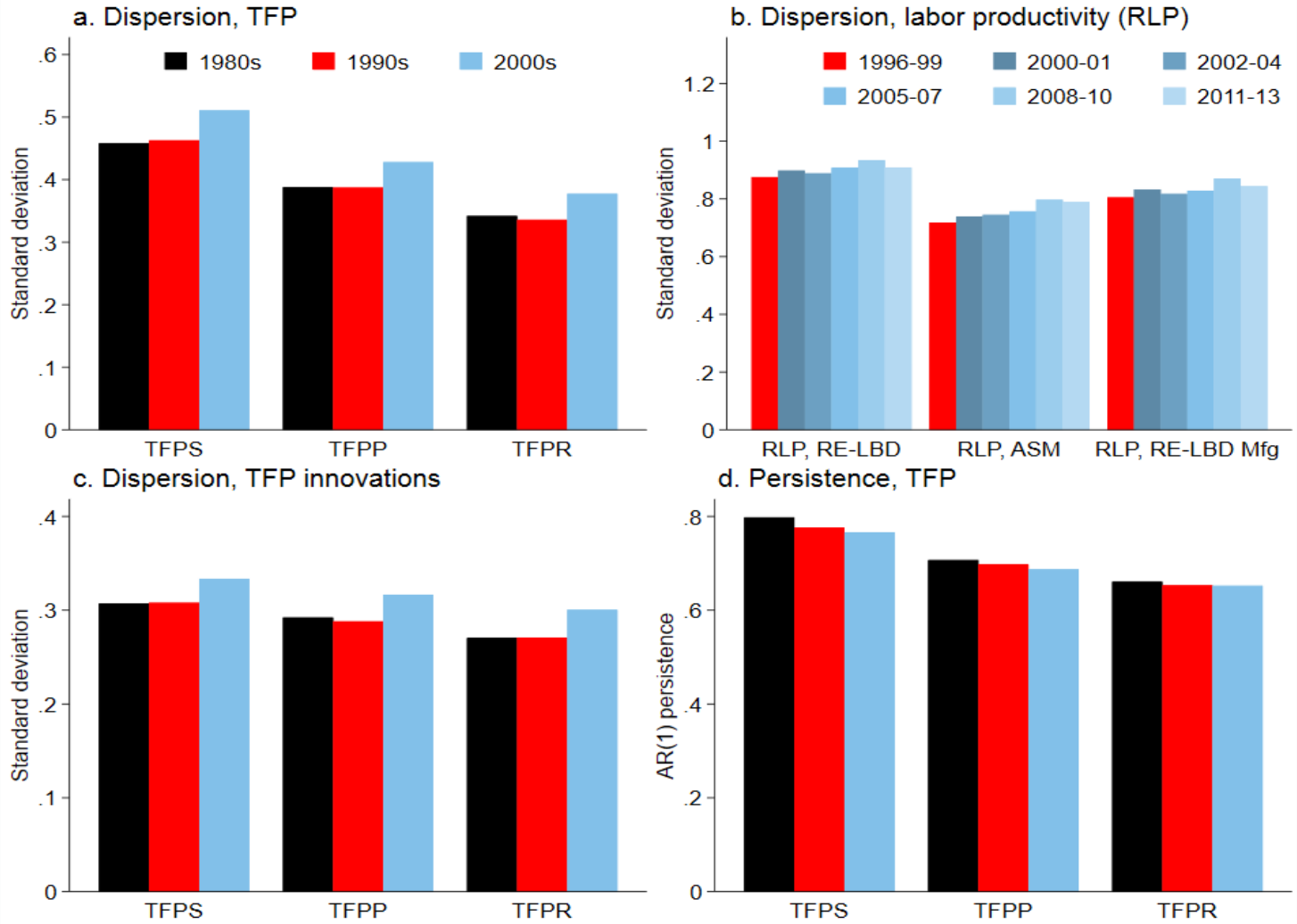
- RFRS is measured as:

$$lnRFRS_{et} = lnQ_{et}^{R} - \alpha_K lnK_{et} - \alpha_L lnL_{et} - \alpha_M lnM_{et} - \alpha_E lnE_{et}$$

Where factor revenue elasticities are the share of the factor's costs in total revenue.

- Revenue productivity residual
  - Manufacturing
  - Deviated from industry year averages to focus on idiosyncratic shocks
  - Reflects technical efficiency as well as demand/product appeal shocks
  - Interpret as a composite shock. Results robust to:
    - RFR estimates using proxy methods using Woolridge (2009) GMM
    - TFPR estimates (using output elasticities as factor cost shares)
    - RLP (economy-wide)
- We estimate RLP for the economy as a whole

Figure 3: Within-industry productivity dispersion has risen



Note: Dispersion measures refer to standard deviation of within-industry (log) productivity. Panels a, c, and d sha
Persistence measures refer to AR(1) parameter.Source: ASM-CM (panels a, c, and d); RE-LBD (panel b).

- **RFRS: Increase from 0.46 to 0.51. For shocks alone to account for decline in reallocation we should observe decline or hump shaped pattern of dispersion.**

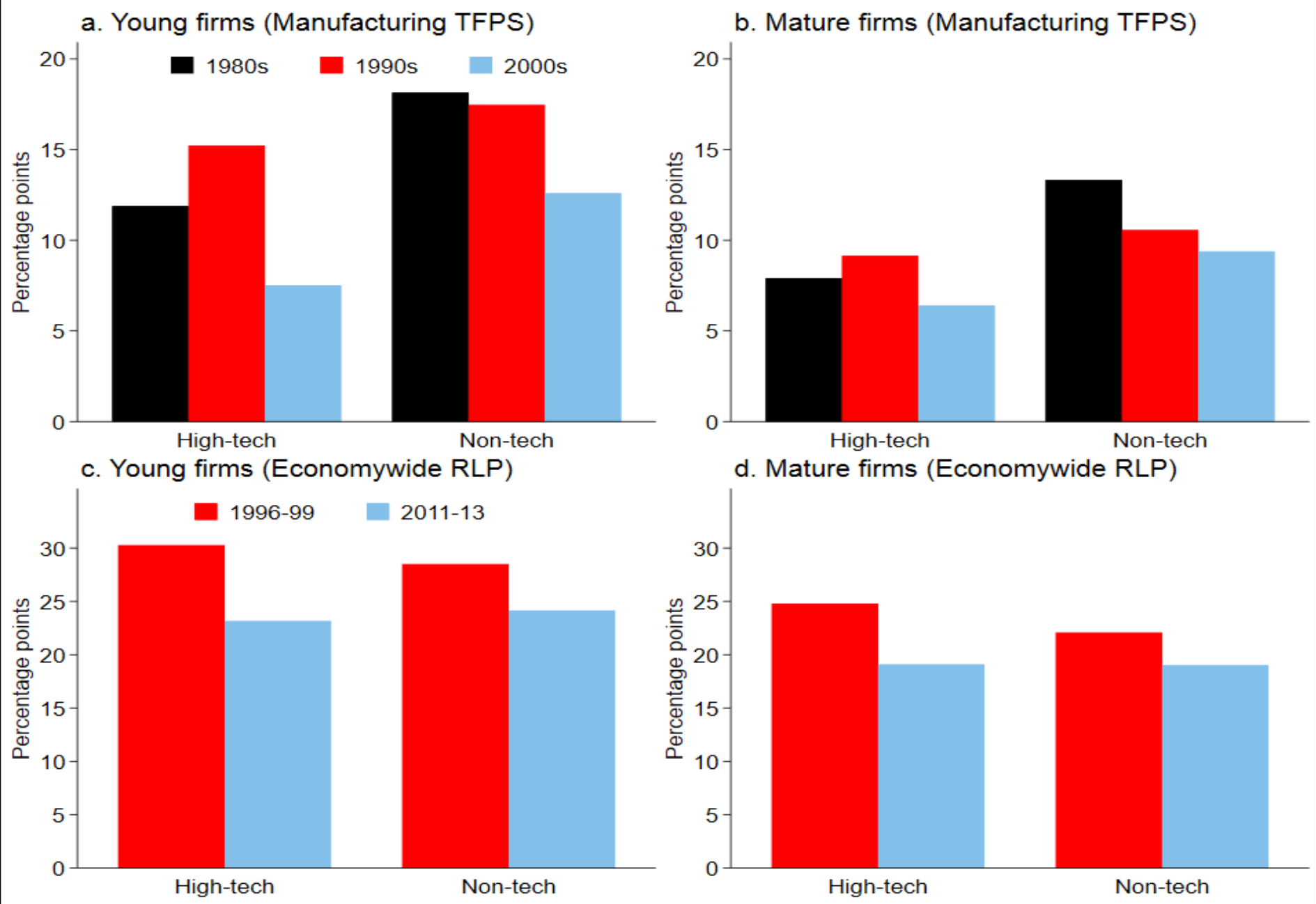
Has there been a change in the responsiveness of shocks?

- Estimatethe following policy function:

$$g_{e,t+1} = \lambda_{t+1} + \beta_y * TFPR_{et} * Young_t + \delta_{1y} * TFPR_{et} * Young_t * Trend_t$$
$$+\delta_{2y} * TFPR_{et} * Young_t * Trend_t^2 + \beta_o * TFPR_{et} * Mature_t$$
$$+\delta_{1o} * TFPR_{et} * Mature_t * Trend_t + \delta_{2o} * TFPR_{et} * Mature_t * Trend_t^2 + X'_{et}\Theta + \varepsilon_{e,t+1}$$

- $TFPR$ = log RFRS (deviated from industry*year mean)
- Within age effects to abstract from composition effects and accommodate differential effects (learning by doing)
- X_{et} includes year effects, initial firm size, and local business cycle indicators both as main effects and interacted with RFRE. All are interacted with firm age effects.
- Estimate separately for High Tech and Non High Tech manufacturing
- Results robust to productivity measure, innovation component, and trend functional form (results with decade dummies)

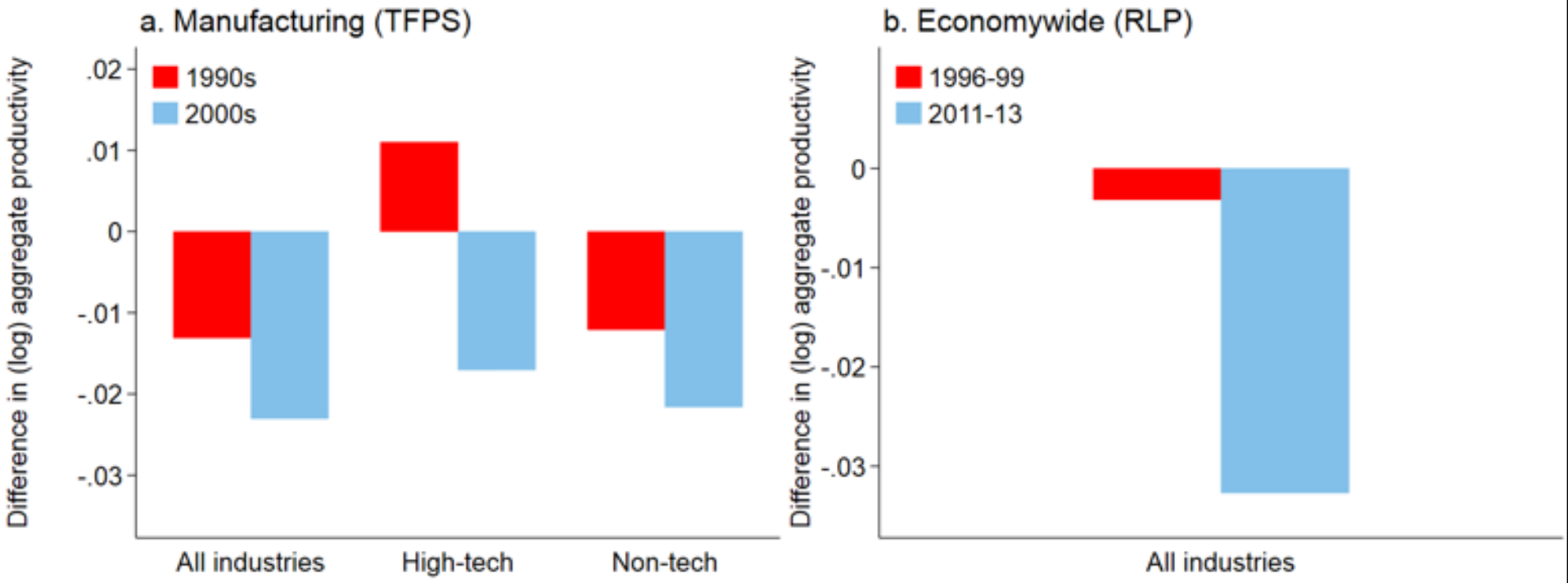
Figure 5: Employment growth responsiveness: Young vs. mature firms, high-tech vs. non-tech



Note: Compares employment growth of establishment (panels a, b) or firm (panels c, d) that is one standard devi above its industry-year mean productivity, versus the mean. Source: ASM-CM (panels a, b); RE-LBD (panels c, d

$$\sum_j \hat{\theta}_{jt+1}^{80s} a_{jt} - \sum_j \hat{\theta}_{jt+1}^{90s} a_{jt}$$

Figure 6: Declining responsiveness reduces aggregate productivity growth



Note: Diff-in-diff counterfactual comparing model-predicted productivity growth under constant responsiveness vs. actual responsiveness (see text). High-tech defined as in Hecker (2005). Source: ASM-CM (panel a); RE-LBD (panel b).

Summary

- Resource reallocation plays a critical role in productivity growth
- Post 2000 Slowdown in Productivity
  - Slowdown in U.S. and OECD
  - In US burst in 1990s and slowdown led by ICT sector
- Slower pace of job reallocation and entrepreneurship for the last few decades
  - High Tech and Information exhibiting burst of reallocation in 90's and steep Post-2000 declines.
- We study changing patterns of reallocation by drawing insight from canonical models of firm dynamics. We find:
  - Widening dispersion of productivity across firms
    - No evidence for a slowdown in innovations (defined broadly)
  - Declining Responsiveness of Growth and Survival to Productivity post 2000
    - Robust to productivity measures, time trend specification and firm age composition as well as to only considering innovation to shocks.
    - This is potentially a sign of increased frictions/wedges
- Diff-in-diff counterfactuals show substantial Decline in Contribution of Reallocation (especially in Information/High Tech) to Productivity Growth as a result of the declining response

Mechanisms for Changing Responsiveness (of Employment Growth)

- **Globalization**
  - Plants of young firms with high productivity draws used to grow in U.S. Now they produce abroad (at least for part of their production process).
    - Bernard, Jensen and Schott (2006) highlight that manufacturing changes in employment linked to globalization (import penetration from low wage countries).
  - It can explain 16% of the decline in the responsiveness to lagged TFP in 2000s. Outsourcing also tied to some TFP measurement issues
- **Substitution to capital**
  - Plants of young firms with high productivity draws used to create jobs rapidly. Now they add machines.
  - No K/L substitution. Response of equipment investment similar: ↑ in the 90's ↓ after 2000 (HT). Note substitution away from investment in ICT assets and towards ICT services in 2000s
  - Increased focus on intangible assets. Weakening response of employment may be compensated by increases in intangible capital investment? No data to answer this yet.
- **Compositional changes in High Tech**
  - Byrne (2015) shows that in post-2000 period there is a decline in the general purpose part of High Tech (e.g., computers) toward more specialized equipment (military and medical applications).
  - Less product substitutability dampens competitive pressures and reduces responsiveness of firm dynamics to productivity differences (Syverson 2004).
  - No Increase in responsiveness in the 90s nor a decline in 2000s due to shifting composition

Frictions/Wedges

- Labor market frictions
  - More difficult to hire and fire? Licensing/employment protections/aging population
  - Next wave of technologies are costlier to introduce --Role of intangible? software customization, new skills, organization, management
- Frictions in financial markets
  - Sarbanes-Oxley post 2000? US based.
  - Harder to finance investment in risky new technologies? dot-com bubble/collapse.
  - Education debt/Housing as collateral? US/more recent.
- Product market frictions
  - Are markets less competitive? Increasing market power. Network effects. Rising markups.
  - Patent thickets.

Differences for Information sector striking. But High Tech is spread across numerous broad sectors including Information, Services, and Manufacturing. Using Hecker (2005) methodology for High Tech.

NAICS Code	Industry
Information and Communications Technology (ICT) High-Tech	
3341	Computer and peripheral equipment manufacturing
3342	Communications equipment manufacturing
3344	Semiconductor and other electronic component manufacturing
3345	Navigational, measuring, electromedical, and control instruments manufacturing
5112	Software publishers
5161	Internet publishing and broadcasting
5179	Other telecommunications
5181	Internet service providers and Web search portals
5182	Data processing, hosting, and related services
5415	Computer systems design and related services
Miscellaneous High-Tech	
5417	Scientific research-and-development services
5413	Architectural, engineering, and related services
3364	Aerospace product and parts manufacturing
3254	Pharmaceutical and medicine manufacturing

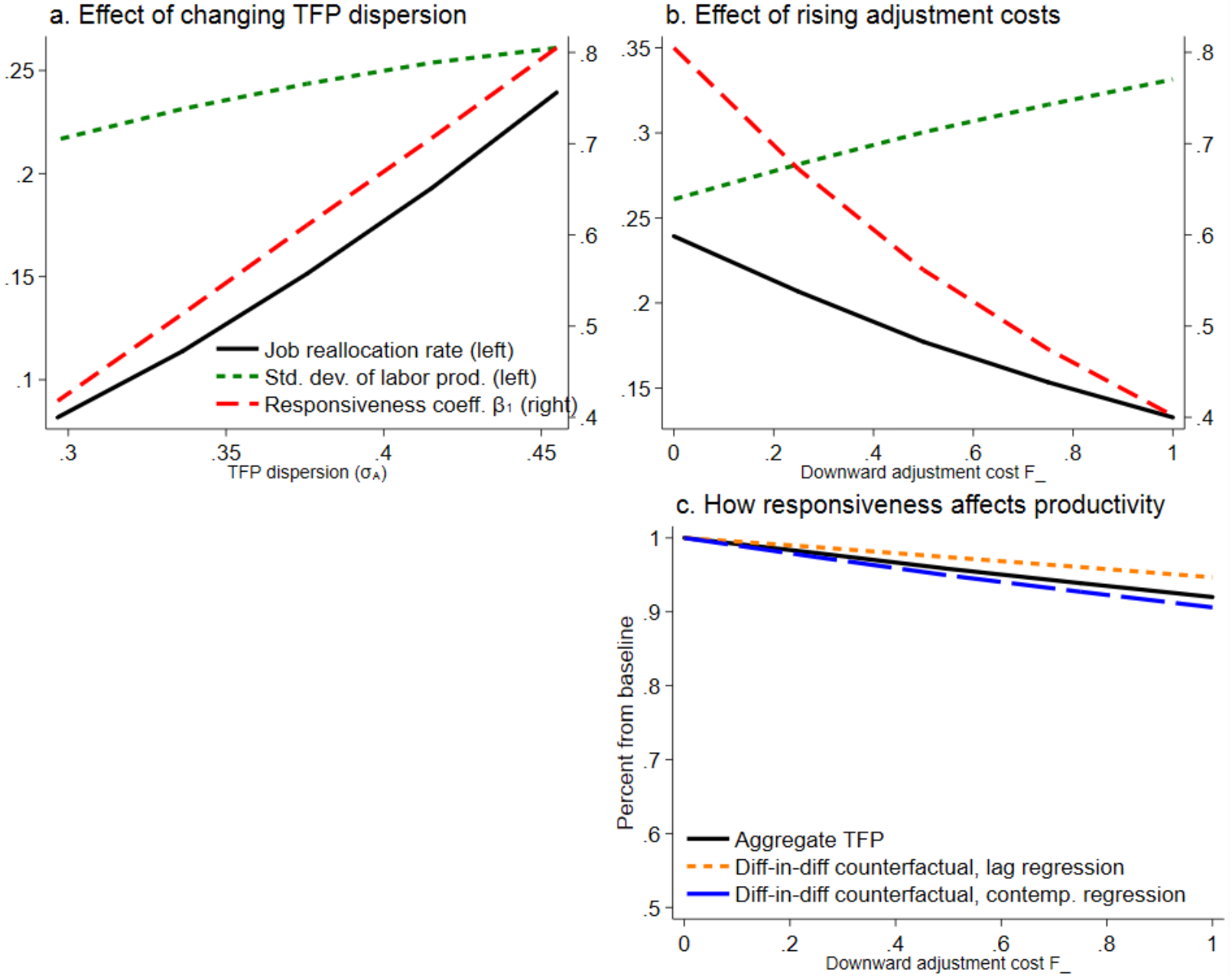
Manufacturing

Information

Services

We focus on High Tech sector since critical for innovation, productivity, and growth. Rapidly growing young firms part of "folklore" of High Tech.

Figure 2: The shocks and responsiveness hypotheses, model results



Note: Panels a and b share same legend. Results relative to model baseline calibration with downward adjustme cost F_=0 (leftmost on panels a and c) and TFP dispersion σ_A=0.46 (rightmost on panel b).