Make it in America?
Manufacturing Subsidies and Unemployment in the Great Recession

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Over time, advanced economies reallocate resources from manufacturing to services, cross-country data.

This reallocation process has cyclical features. In the US:

1. Job destruction in manufacturing mostly occurs in recessions, \( \sim 90\% \)
2. Job creation in services is concentrated in expansions
3. Recessions typically start with a contraction in manufacturing employment followed by an increase in service employment

Since the early 90’s, this cyclical pattern has changed. We find that:

1. Job destruction in manufacturing has accelerated in recessions (and in recoveries)
2. Job creation in services has slowed down in recoveries
3. Overall, manufacturing and service employment have become more synchronized (and more so in US states with higher household debt)
**Why has synchronization increased?**

Two premises:

1. Household debt has increased substantially since the 90’s (due to low borrowing real interest rates and/or increased world supply of savings). This has made households more prone to become financially constrained.

2. Services are mostly nontradable, so their aggregate demand is determined by local economic conditions.

- If households are financially constrained, current income matters for the aggregate demand of services. So *job destruction in manufacturing*, which reduces households’ income, leads to a fall in *demand* for services. This prevents *job creation in services* and *comovement* increases.

- This mechanism is mostly important in (severe) recessions and in recoveries, which is when households are more likely to become financially constrained.
Welfare implications

- We show that in recessions where households are financially constrained, there is a demand externality that justifies subsidizing production in manufacturing.

The logic is that

- manufacturing is a tradable good whose price is determined internationally,

- manufacturing level of activity affects the value of all non-tradable assets and services,

- higher households’ wealth relaxes households’ financial constraint, which helps in sustaining demand for services, and thereby overall aggregate demand, Obama

- since private agents take prices as given, they do not fully internalize the benefits of job creation in manufacturing (a pecuniary externality as in Lorenzoni, 2008).

manufacturing plays a key role during a deleveraging phase, Bernanke
Should we ‘Make it in America’?

Grand plan to subsidize manufacturing jobs by the US administration. Using a unique new data set we document:

- An increase in the incidence of business subsidies, time series
- A sharp increase in manufacturing subsidies, share, histogram
- Important variation across US states, map

Any justification? Yes, if households are financially constrained

What are the welfare effects? Try to provide a quantitative answer

We evaluate policies to promote manufacturing jobs by estimating a DSGE model with US state panel variation.

In our model interventions should be temporary and only when households are financially constrained.
Road map

Motivating evidence
- Increased comovement between manufacturing and services employment
- Comovement and household debt
- Further features of the US business cycle (another emerging economy?)

Relation to the literature

A static two sector neoclassical model with a demand channel

Stylized facts on business subsidies in the US

A fully fledged DSGE model which we estimate using US state level panel data (still in progress)
### US business cycle correlations (quarterly data)

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<thead>
<tr>
<th></th>
<th>Growth rates</th>
<th>Change</th>
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<tr>
<td><strong>Total services</strong></td>
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<td>$\rho(n_{mt-2}, n_{st})$</td>
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<td>$\rho(n_{mt-4}, n_{st})$</td>
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<td>$\rho(n_{mt}, n_{st-2})$</td>
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<td>$\rho(n_{mt}, n_{st-4})$</td>
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<td>$\rho(nx/gdp, n)$</td>
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**Note:** nx/gdp are changes. Similar results with HP detrending
Raw data

(a) Manufacturing employment

(b) Service employment

(c) Net export and current account

(d) Household debt and interest rates
Increased comovement and households’ leverage

- We test whether, in the last US recession, service employment has responded more to (exogenous) changes in manufacturing employment in US states where households were more indebted.
- We use annual data (2007-2011) at the US state level to estimate:

\[
\Delta n_{s,i,t} = \beta \Delta n_{m,i,t} \times HHlevg_{2007} + \gamma' X_{i,t} + \alpha_i + \varepsilon_{i,t}
\]

where \( i \) indexes states, \( t \) time.

- **Manufacturing employment:** We borrow from Autor, Dorn and Hanson (2012) the idea that the emergence of China is a shock to manufacturing employment with varying impact across US states. We use their index of China import penetration as IV.

- **Household leverage:** Household debt over income in logs in 2007. We also tried to instrument it using the Saiz (2011) index of housing supply elasticity, as in Mian and Sufi (2011).
**Increased comovement and households’ leverage II**

\[ \Delta n_{S,i,t} = \beta \Delta n_{M,i,t} \times \text{Leverage}_{i,2007} + \gamma' X_{i,t} + \alpha_i + \varepsilon_{i,t} \]

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<th>Total services</th>
<th>Services excluding FIRE</th>
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<td>(\Delta) Manufacturing employment</td>
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<td>(\Delta) M. empl \times Debt/income in 2007</td>
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<td>.19***</td>
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<td>(\Delta) House prices \times Debt/income in 2007</td>
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<td>Debt/income ratio in 2007</td>
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<td>Y</td>
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<td>IV</td>
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Notes: annual data (2007-2011) for 51 US States. Dependent variable is the change in logged private service employment. Debt/income is measured in logs. All regressions include year fixed effects, standard errors are clustered at the state level. In regressions without state fixed effects we also control for house prices level in 2007 and manufacturing employment share in 2007. ***, **, *: indicates significance at the 1, 5, and 10 percent level respectively. Bottom and top decile of sample log-change in total services employment are \{-2.5\%, .6\%\}; of log-change in total services employment minus FIRE are \{-2.8\%, .5\%\}; of log-change in manufacturing employment are \{-12.1\%, 1.4\%\}; of logged debt over income in 2007 are \{-.24, .38\}.

**Note:** similar results with MSA level regressions, or when instrumenting debt with Saiz index; and with service prices, see table states, table MSA.
Relation to the literature

The role of demand over the business cycle

- Debate on the modeling of aggregate demand in business cycles, see Lorenzoni (2009), Bai, Rios-Rull, Storesletten (2011), Monacelli (2009) and Sterk and Ravn (2012)

  Here demand plays a role in a neoclassical model with no nominal rigidities because one sector (services) is non-tradable

- There is debate about why unemployment remains high in the recent recovery: mismatch versus lack of demand, see Sahin, Song, Topa and Violante (2011) and Mian and Sufi (2011), see data

  Here, jobless recovery is due to lack of households’ demand as in Midrigan and Philippon (2011)
Jobless recoveries: other theories

- Debate on jobless recoveries, see Monacelli, Quadrini and Trigari (2011), Schaal (2012), Jaimovich and Siu (2010)
  Our story is much related to Jaimovich and Siu (2010) but with different policy implications

- Some recent papers analyze the macro consequences in the US of first leveraging and then deleveraging, see Justiniano, Primiceri and Tambalotti (2013a,b) and Kehoe, Ruhl and Steimberg (2012)
  Here we emphasize the special role of the tradable sector during a deleveraging phase where households are financially constrained
Sudden stops and emerging economies

Sudden Stops in emerging economies are characterized by large falls in Y and C, and reversal of CA and trade balance; see Aguiar an Gopinath (2006), Mendoza (2010), Bianchi (2012), and Mendoza and Yue (2012).

Our framework builds on Bianchi (2012) with three differences:

1. The supply of tradables (manufacturing) and nontradables (services) is endogenous
2. There is unemployment due to search frictions in labor market
3. Manufacturing contributes to the the demand for services (both directly and indirectly)

When households are financially constrained, this makes

- job creation in manufacturing inefficiently low
- the tradable sector special
A one-period economy

- A representative household with utility: \( \gamma \ln c_m + (1 - \gamma) \ln c_s - \omega b \)
- Manufactured goods are *tradable*, the numeraire, \( y_m = c_m + d \)
- Services are *nontradable*, \( y_s = c_s \)
- HH inherits debt \( b_0 \), which evolves as \( b = Rb_0 - d \)
  - Continuation cost of debt is \( \omega > 0 \) (small, debt is cheap)
- Borrowing capacity of HH depends on economic activity in *tradable* and *nontradable* sector (housing price, capital, equity):
  \[
  \xi y \geq b, \quad y = y_m + py_s, \quad \xi > 0
  \]

- Labor market with *directed* search: \( n_i = n_{i0} + f(\theta_i)u_i, \; i = s, m \)
- A vacancy costs \( z \) manufacturing units (say a machine)
- Predetermined sectoral labor forces, \( l_m + l_s = l \)
- Unemployed workers produce \( \phi \) units of services (cooking, cleaning)
- A manufacturing job requires \( \phi_m \) units of services (marketing, retailing, transportation).
  \[
  \bar{\phi} = \phi + \phi_m : \text{net demand for services by a manufacturing job}
  \]
- Manufacturing net output: \( y_m = A n_m - z \theta_m u_m - z \theta_s u_s \)
- Services output: \( y_s = (A - \phi)n_s + \phi l - \bar{\phi} n_m \)
Supply and demand of service jobs

- **Supply of service jobs:** free-entry in vacancy creation

\[
\frac{z}{q(\theta_m)} = (1 - \alpha)(A - \bar{\phi}p) \quad \theta_m = \theta_m(p), \quad \theta'_m < 0
\]

\[
\frac{z}{q(\theta_s)} = (1 - \alpha)p(A - \phi) \quad p = p(\theta_s), \quad p' > 0
\]

- **Demand for service jobs:** Households’ first order conditions

\[
\frac{1 - \gamma}{c_s} = p\lambda \quad \text{(FOC } c_s), \quad \lambda = \omega + \eta \quad \text{(FOC } d)
\]

By combining and using market clearing in services:

\[
p = \frac{1 - \gamma}{\omega + \min[\eta(p, \theta_s), 0]} \cdot \frac{1}{(A - \phi)n_s(\theta_s) + \phi l - \bar{\phi}n_m(\theta_m(p))}
\]

\[\eta(p, \theta_s) = \frac{\sigma}{(1 + \xi)y_m(p, \theta_s) - Rb_0} - \omega\]

Write \( p = p(\theta_s) \) so right hand side is a decreasing function of \( \theta_s \) only

See derivation of \( \eta \)-function
Market for service jobs, \[ \frac{d \ln \theta_s}{d \ln n_{m0}} \bigg|_{\eta>0} > \frac{d \ln \theta_s}{d \ln n_{m0}} \bigg|_{\eta=0} \]

\[
p = \frac{1 - \gamma}{\omega + \min[\eta(p, \theta_s), 0]} \cdot \frac{1}{(A - \phi)n_s(\theta_s) + \phi - \overline{\phi}n_m(\theta_m)}
\]
The social planner problem

- Generally the social planner chooses quantities and not prices.
- The social planner problem faces the same borrowing constraint as the HHs, but recognizes that the relative price of services is set to clear markets:

\[
\max_{c^*_m, c^*_s, d^*, \theta^*_m, \theta^*_s} \left[ \gamma \ln c^*_m + (1 - \gamma) \ln c^*_s - \omega(Rb_0 - d^*) \right]
\]

subject to

\[
y_m = c^*_m + d^*
\]

\[
y_s = c^*_s
\]

\[
\xi \left[ y_m + \frac{(1 - \gamma) c^*_m}{\gamma c^*_s} y_s \right] \geq Rb_0 - d^*
\]
Decentralized equilibrium vs planner allocation

Decentralized eq.  Social planner

\[(\theta_m) \quad \frac{\bar{z}}{(1-\alpha)q(\theta_m)} = A - \phi p\]  \[(\theta^*_m) \quad \frac{\bar{z}}{(1-\alpha)q(\theta^*_m)} = A - \phi \psi(\eta^*) p\]

\[(\theta_s) \quad \frac{\bar{z}}{(1-\alpha)q(\theta_s)} = p(A - \phi)\]  \[(\theta^*_s) \quad \frac{\bar{z}}{(1-\alpha)q(\theta^*_s)} = \psi(\eta^*) p(A - \phi)\]

If \(\eta > 0\): \(\psi(\eta) \in (0, 1)\) and \(\psi'(\eta) < 0\).

Result

Hence, if the financial constraint is binding

- Too little creation in manufacturing \((\theta_m < \theta^*_m)\)
- Too much creation in services \((\theta_s > \theta^*_s)\)
- The equilibrium can be restored through a combination of subsidies to manufacturing jobs and taxes on service jobs, financed with non distortionary lump sum taxes

Note I: for given \(y_m\) and \(y_s\), consumption choices, \(c_m\) and \(c_s\) are optimal

Note II: \(\theta_m < \theta^*_m\) requires that \(\bar{\phi} > 0\)
Decentralized equilibrium versus planner allocation

Decentralized: solid blue lines. Constrained efficient allocation: red dashed lines
Marginal interventions in the Ramsey planner’s problem

We evaluate household’s utility in decentralized equilibrium:

\[ U(\theta_m, \theta_s) = \gamma \ln c_m + (1 - \gamma) \ln c_s - \omega b \]

where \( \theta_m \) and \( \theta_s \) solve free-entry conditions. We have that

\[ \frac{\partial U}{\partial \theta_m} = \eta \xi \bar{\phi} p (1 - \alpha) q (\theta_m) u_m > 0, \text{ if } \eta > 0 \]
\[ \frac{\partial U}{\partial \theta_s} = -\eta \frac{\xi}{\sigma} z u_s < 0, \text{ if } \eta > 0 \]

**Note:** Again notice special role of \( \bar{\phi} \)

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**Result**

Suppose that all taxes and subsidies are financed through non distortionary lump sum taxes and that the government budget is balanced. If the financial constraint is binding

- A marginal subsidy to manufacturing jobs increases welfare
- A marginal subsidy to service jobs reduces welfare
- A marginal subsidy to manufacturing consumption reduces welfare (because of a change in Ramsey problem)
**Data on business subsidies deals**

- Business subsidy data are collected by “Good Jobs First”
- No official data on business subsidies.
- Firm subsidies in the year: cash grants, tax abatements, cheap loans, infrastructure assistance, land-price write-downs.
- Subsidies are at the plant level, so a firm can receive several.
- Information come from official sources, government agencies, newspapers (local and national), direct inquiries. Source of information is well documented.
- In some cases we have detailed history of subsidy (reasons, length of process, conditionality clauses, job creation objectives).
- For each deal we have information on: type of deal, year when awarded, value of subsidy, name of the company, state where deal was granted, source of information. We imputed NAICS code of firms manually (outsourced through E-lance).
- The sample spans the period 2000-2012 and it consists of 224,978 subsidy deals of which 150,440 have non missing subsidy value.
Some stylized facts

1. Business subsidies have increased substantially, series, distribution, states
2. Business subsidies have been targeted to manufacturing, share, sectors
3. Manufacturing subsidies are concentrated in few new states, sectors, map
4. Manufacturing subsidies were somewhat larger in US states with a (relatively) important manufacturing industry hit harder by the crisis, scatter plots
5. In Michigan, manufacturing subsidies have been high and households have deleveraged by a substantial amount, scatter plots
6. Evidence from dif-in-dif

\[ x_{it} = \beta_t \tau_{it} + d_i + d_t + \theta X_{it} + \text{err}. \]

\( x \) : employment change (manufacturing, service, total). \( \tau \) : measure of subsidies (subsidy over VA or USD per worker) in manufacturing or services
DSGE model I

- A small open economy with \( n = 1, \ldots, N \) states (\( N \) large)
- A state \( n \) infinitely lived representative household with utility flow:
  \[
  \mu_n \ln u(c^m_n, c^s_n) - \tilde{\Upsilon}_n (m^{ms}_{nt}, m^{sm}_{nt})
  \]

  \( \mu_n \): mass of workers in state \( n \), \( \sum_{n=1}^{N} \mu_n = 1 \)
  \( u \): CES function; \( \tilde{\Upsilon}_n \): sectoral mobility costs

- Household income in state \( n \) is equal to
  \[
  \nu_{nt} = \kappa y_{nt} + (1 - \kappa) \mu_n \bar{y}_t, \quad \text{where} \quad \bar{y}_t \equiv \sum_{n=1}^{N} y_{nt}
  \]

- Household budget constraint is: \( \nu_{nt} = c^m_{nt} + d_{nt} + p_{nt} c^s_{nt} \)
- Household debt should satisfy
  \[
  \xi_{nt} \nu_{nt} \geq b_{nt} + \zeta S_{nt}, \quad \forall n
  \]

  \( S_{nt} \): firm investment in job creation and job destruction;
  \( b_{nt} = Rb_{nt-1} - d_{nt}, \beta R < 1 \)

  (see Bernanke and Gertler (89) and Cooley, Marimon and Quadrini (2004))
DSGE model II

- A vacancy costs \( z \) per period and search is directed
- Endogenous job destruction, so \( \Delta_{nt}^i = \Delta_n \left( \frac{J_{nt}^i}{\lambda_{nt} + \varsigma \eta_{nt}} \right) \), \( \Delta_n' < 0 \)
- In \( i = s, m \) employment evolves as
  \[
e_{nt}^i = \left(1 - \Delta_{nt}^i \right) e_{nt-1}^i + f\left( \theta_{nt}^i \right) u_{nt}^i,
  \]
- Unemployed workers produce \( \phi \) units of services
- A manufacturing job requires \( \phi_m \) units of services
- A manufacturing job yields \( Z_{nt} A_{nt} \) units of goods
- A service job yields \( A_{nt} \) unit of services
- There are job subsidies \( \tau_{nt}^i, i = m, s \)
- The Federal government budget is balanced: \( \sum_{n,i} \tau_{nt}^i e_{nt}^i = \bar{\tau}_t \)
- State \( n \) net output in manufacturing: \( y_{nt}^m = Z_{nt} A_{nt} e_{nt}^m - S_{nt} - \chi_{nt} \)
- State \( n \) net output in services: \( y_{nt}^s = (A_{nt} - \phi) e_{nt}^s + \phi \mu_n - \bar{\phi} \)
- Value of output in state \( n \):
  \[
y_{nt} = y_{nt}^m + p_{nt} y_{nt}^s + \Omega_{nt}
  \]
  \( \Omega_{nt} \): net transfers, \( \Omega_{nt} = \tau_{nt}^m e_{nt}^m + \tau_{nt}^s e_{nt}^s - \mu_n \bar{\tau}_t \)
Shocks

1. Shocks have **aggregate** and (idiosyncratic) **state specific** component
2. Shocks to market activity: $A_{nt}$
3. Shocks to manufacturing productivity: $Z_{nt}$
4. Financial shocks: $\xi_{nt}\nu_{nt} \geq b_{nt} + \varsigma S_{nt}$
5. Separation rates shock: $\Delta^m_{nt}$ and $\Delta^s_{nt}$
6. Shocks to job subsidies in manufacturing $\tau^m_{nt}$ and in services $\tau^s_{nt}$
7. Job subsidies partly respond to other structural shocks:
   
   $\tau^i_{nt} = \rho \tau^i_{nt} + \sum_{j=\{a, z, \delta, \xi\}} \pi^j \epsilon^j_{nt} + \epsilon^i_{nt}$

Timing
Equilibrium conditions
States interaction and heterogeneity

- **States interact** through
  - Federal government budget constraint
  - Redistribution of income across US states: Production in one state affects income in all other states. This is modeled in reduced form but it captures explicit federal government redistribution, migration, cross-states financial linkages or cross-states asset holdings

- **States differ** in
  - Steady state manufacturing productivity $Z_n$
  - Steady state financial capacity $\xi_n$
  - Steady state job maintenance cost function
  - Sequence of state specific shocks
Equilibrium conditions

1. The job net surplus:

\[ V_{nt} = \lambda_{nt} \left( \hat{P}_{nt}^i + \tau_{nt}^i - p_{nt}^i \phi_{nt}^i \right) + \beta E_t \left[ (1 - \Delta_{nt+1}^i) J_{nt+1}^i - (\lambda_{nt+1} + \varsigma \eta_{nt+1}) O_{nt+1}^i (\Delta_{nt+1}^i) \right] \]

2. Directed search: Hosios condition is satisfied

3. Free entry condition:

\[ z \left( 1 + \varsigma \frac{\eta_{nt}}{\lambda_{nt}} \right) = q \left( \theta_{nt}^i \right) (1 - \alpha) \frac{V_{nt}^i}{\lambda_{nt}} \]

4. Value of searching for a job:

\[ H_{nt}^i = U_{nt}^i + f_{nt}^i \alpha V_{nt}^i \]

5. Sectoral mobility:

\[ \tilde{\Upsilon}_{n1} = \beta E_t \left( H_{nt+1}^s - H_{nt+1}^m \right) \]

6. Financial constraint

\[ \xi_{nt} \left[ \kappa y_{nt} + (1 - \kappa) \mu_n \sum_{k=1}^{N} y_{kt} \right] = b_{nt} + \varsigma S_{nt} \]

7. Consumption choices:

\[ u_1(c_{nt}^m, c_{nt}^s) = \psi_{nt}, \quad p_{nt} = \frac{1 - \gamma}{\gamma} \cdot \left( \frac{c_{nt}^m}{c_{nt}^s} \right)^{1+\epsilon} \]

8. Household n LM of budget constraint:

\[ \psi_{nt} = \eta_{nt} + \beta R E_t (\psi_{nt+1}) \]

9. Household n marginal value of state n output:

\[ \lambda_{nt} = \kappa (\psi_{nt} + \eta_{nt} \xi_{nt}) \]
DSGE relative to Difference-in-Differences analysis

- We use a DSGE model to evaluate ‘Make it in America’ policies introduced by the Obama’s administration during the 2008-2011 period (subsidies to manufacturing jobs).
- We compare results with Diff-in-Diff estimation results. Three possible source of differences:
  1. **State specific shocks** States which were mostly affected by “Make it in America” policies were also states that were hit harder by the crisis. If this effect is not properly taken into account, Dif-in-Dif tends to under-estimate the effects.
  2. **Government financing spill-overs** Subsidies to one state are financed through taxes in other states. This negatively affects the control group. Dif-in-Dif tends to over-estimate the effects.
  3. **Cross-states income redistribution** The value of economic activity in one state affects the financial capacity of other states because of redistribution of income across states. This positively affects the control group. Dif-in-Dif tends to under-estimate the effects.
A financial-shock with manufacturing subsidies, $\xi = 1.5$

1% shock, 0.2% subsidy expenditures increase of steady state output, $\kappa = 1$, $\mu_n = 1$

Note: Blue solid line corresponds to baseline, red dashed to $\tau_{1t}^m > 0$

See A-shock, Z-shock, see parameters
A financial-shock with service subsidies, $\xi = 1.5$

1% shock, 0.2% subsidy expenditures increase of steady state output, $\kappa = 1$, $\mu_n = 1$

Note: Blue line corresponds to baseline, red to $\tau^m_{1t} > 0$, black to $\tau^s_{1t} > 0$

See A-shock, Z-shock, see parameters
Sensitivity of demand to income: the effect of $\xi$

$0.2\%$ subsidy expenditures increase of steady state output, $\kappa = 1$ and $\mu_1 = 1$

Note: Blue solid corresponds to $\xi = 1.5$, red dashed to $\xi = 0.8$, black dotted line to $\xi = 2$, see parameters
Cross states spill-overs: a subsidy in state 1 on state 2, $\xi = 2$

0.2% subsidy expenditures in state 1 for different values of $\kappa$ and $\mu_1 = .5$

(a) Effects in state 1

(b) Effects in state 2

Note: Blue corresponds to $\kappa = .8$, red to $\kappa = .6$, black to $\mu_1 = .5$, see parameters
Conclusions

- We document that structural transformation in the US has cyclical features that have changed over time.

- We develop a theory where households' demand plays a role in explaining these changes.

- According to this theory, "Make it in America" temporary policy interventions could be welfare improving when households are financially constrained.

- This is because manufacturing is a tradable good whose price is determined internationally and whose level of activity affects the value of all non-tradable assets and services. This helps in relaxing households' financial constraints.

- We document some new facts about business subsidies in the US over the Great Recession.

- We estimate (in progress) a DSGE model with US states panel data to evaluate the effects of "Make it in America" policies and compare with Dif-in-Dif estimation results.
Thanks for your attention!
Structural transformation

Source: Herrendorf, Rogerson and Valentinyi (2011)
Employment changes and HH indebtedness

Correlation: −.73

Correlation: .22
Relative price of services
Manufacturing jobs sustain aggregate demand

“If a steel worker or a construction worker, they’ve got a job and they’ve got a little more money in their pockets, maybe they buy that new car. And that means that now that business has more profits, maybe they hire more workers. If a teacher or a receptionist has a little bit more money in their pockets, maybe they go over to another restaurant. Maybe they go to Romero’s and they eat out. And now the restaurant hires a couple more workers – everybody does better. That’s how the economy grows best – from the middle out, from the bottom up, not from the top down”

“I said I believe in American workers, I believe in this American industry, and now the American auto industry has come roaring back and GM is number one again. So now I want to do the same thing with manufacturing jobs not just in the auto industry, but in every industry.”

US President Barack Obama,
“Remarks by the President at a Campaign Event.”
Colorado State Fairgrounds, Pueblo, Colorado, August 9, 2012.
A view for supporting the US manufacturing sector

“To repay foreign creditors, as it must someday, the United States will need large and healthy export industries. The relative shrinkage in those industries in the presence of current account deficits — a shrinkage that may well have to be reversed in the future — imposes real costs of adjustment on firms and workers in those industries.”

Ben S. Bernanke,

A view for accommodative monetary policies

“Is the current high level of long-term unemployment primarily the result of cyclical factors, such as insufficient aggregate demand, or of structural changes, such as worsening mismatch between workers’ skills and employers’ requirements? If cyclical factors predominate, then policies that support a broader economic recovery should be effective in addressing long-term unemployment as well; if the causes are structural, then other policy tools will be needed. I will argue today that, while both cyclical and structural forces have doubtless contributed to the increase in long-term unemployed, the continued weakness in aggregate demand is likely the predominant factor. Consequently, the Federal Reserve’s accommodative monetary policies, by providing support for demand and for the recovery, should help, over time, to reduce long-term unemployment as well.”

Ben S. Bernanke,
in Recent Developments in the Labor Market, NABE Meeting March 26, 2012.
## US business cycle correlations (quarterly data)

<table>
<thead>
<tr>
<th>HP $\lambda = 1600$</th>
<th>52:I-89:IV</th>
<th>90:I-12:IV</th>
<th>Change</th>
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<td><strong>Total services</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>$\rho(n_{mt-2}, n_{st})$</td>
<td>.69</td>
<td>.83</td>
<td>.14*</td>
</tr>
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<td>$\rho(n_{mt-4}, n_{st})$</td>
<td>.30</td>
<td>.50</td>
<td>.20*</td>
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<td>$\rho(n_{mt}, n_{st-2})$</td>
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<td>.17*</td>
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<td>$\rho(n_{mt}, n_{st-4})$</td>
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<td>.30</td>
<td>.24*</td>
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<td><strong>Retail services</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>$\rho(n_{mt-2}, n_{rt})$</td>
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<td>.25*</td>
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<td>.30</td>
<td>.34*</td>
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<td>$\rho(n_{mt}, n_{rt-2})$</td>
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<td>.81</td>
<td>.10</td>
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<td>$\rho(n_{mt}, n_{rt-4})$</td>
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<td>.46</td>
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<td><strong>Services without FIRE</strong></td>
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<td></td>
</tr>
<tr>
<td>$\rho(n_{mt-2}, n_{nft})$</td>
<td>.69</td>
<td>.83</td>
<td>.14*</td>
</tr>
<tr>
<td>$\rho(n_{mt-4}, n_{nft})$</td>
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<td>.50</td>
<td>.20*</td>
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<td>$\rho(n_{mt}, n_{nft-2})$</td>
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<td>$\rho(n_{mt}, n_{nft-4})$</td>
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<td>.23</td>
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<tr>
<td>$\rho(nx/gdp, gdp)$</td>
<td>-.33</td>
<td>-.70</td>
<td>-.37*</td>
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<tr>
<td>$\rho(nx/gdp, n)$</td>
<td>-.20</td>
<td>-.54</td>
<td>-.34*</td>
</tr>
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</table>
Increased comovement and households’ leverage III: prices

\[ \Delta p_{S,i,t} = \beta \Delta \eta_{M,i,t} \times \text{Leverage}_{i,2007} + \gamma' X_{i,t} + \alpha_i + \varepsilon_{i,t} \]

<table>
<thead>
<tr>
<th></th>
<th>Total services</th>
<th>Services excluding FIRE</th>
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<tr>
<td>( \Delta ) Manufacturing employment</td>
<td>.00</td>
<td>.01</td>
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<tr>
<td>( \Delta ) M. empl \times Debt/income in 2007</td>
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<td>.08***</td>
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<tr>
<td>( \Delta ) House prices</td>
<td>.01</td>
<td>.04</td>
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<tr>
<td>( \Delta ) House prices \times Debt/income in 2007</td>
<td>-.03</td>
<td>-.10*</td>
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<tr>
<td>Debt/income ratio in 2007</td>
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<td>.00</td>
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<td></td>
<td>[.002]</td>
<td>[.00]</td>
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<tr>
<td>Observations</td>
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<td>204</td>
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<tr>
<td>R-squared</td>
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<td>.91</td>
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<td>J-test</td>
<td>15.12</td>
<td>10.63</td>
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<tr>
<td>State fixed effects</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>IV</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

Notes: annual data (2007-2011) for 51 US States. All variables are in logs. Price of services is relative to the manufacturing price (nationwide). Dependent variable in columns (1)-(4) is the change in log relative price of private services excluding real estate sector, in columns (5)-(8) is the change in log relative price of private services excluding financial and real estate activities (FIRE). Debt/income is calculated in 2007 at the start of the recession and it measured in logs. All regressions include year fixed effects, standard errors are clustered at the state level. Coefficients of the constant and year dummies are not reported. ***, **, *: indicate significance at the 1, 5, and 10 percent level respectively. Bottom and top decile of sample of log-change in relative price of total private services are \{-2.1\%, 2.4\\}; of log-change in relative price of total private services minus FIRE are \{-1.8\%, 1.4\\}; of log-change in manufacturing employment are \{-12.1\%, 1.4\\}; of logged debt over income in 2007 are \{-.24, .38\}. 

Comovement and households’ leverage IV: MSA employment

\[ \Delta n_{S,i,t} = \beta \Delta n_{M,i,t} \times \text{Leverage}_{i,2007} + \gamma' X_{i,t} + \alpha_i + \varepsilon_{i,t} \]

<table>
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<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
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<tr>
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<td>.14</td>
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<td>.01</td>
<td>.17</td>
<td>.09</td>
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<tr>
<td>( \Delta M. \text{ empl} \times ) Debt/income ratio in 2007</td>
<td>.03*</td>
<td>.03*</td>
<td>.06***</td>
<td>.06***</td>
<td>.04*</td>
<td>.04*</td>
<td>.07***</td>
<td>.07***</td>
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<td>( \Delta ) House prices</td>
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<td>.05**</td>
<td>.07</td>
<td>.05***</td>
<td>.06</td>
<td>.0</td>
<td>.06</td>
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<td>-.06</td>
<td>-.02</td>
<td>-.07</td>
<td>-.02</td>
<td>-.06</td>
<td>-.02</td>
<td>-.07</td>
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<tr>
<td>Debt/income ratio in 2007</td>
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<td>.003*</td>
<td>.00</td>
<td>.004**</td>
<td>.00</td>
<td>.00</td>
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<td>[.002]</td>
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<td>[.00]</td>
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<tr>
<td>Manufacturing empl. Share in 2007</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
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<td>[.00]</td>
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<tr>
<td>House prices in 2007</td>
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<td>-.01</td>
<td>-.01</td>
<td>-.01</td>
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<td>-.01</td>
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<td>Observations</td>
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<td>416</td>
<td>445</td>
<td>446</td>
<td>445</td>
<td>416</td>
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<tr>
<td>R-squared</td>
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<td>.52</td>
<td>.28</td>
<td>.46</td>
<td>.48</td>
<td>.58</td>
<td>.29</td>
<td>.54</td>
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<tr>
<td>p-value</td>
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<td>.17</td>
<td>.37</td>
<td>.13</td>
<td>.37</td>
<td>.13</td>
<td>.37</td>
<td>.13</td>
</tr>
<tr>
<td>Commuting zone fixed effects</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>IV</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
</tbody>
</table>

Notes: annual data (2007-2010) for 183 Metropolitan Statistical Areas (MSAs). All variables are in logs. Dependent variable in columns (1)-(4) is the change in log total private services employment, in columns (5)-(8) is the change in log total private services employment without financial and real estate activities (FIRE). Debt/income is calculated in 2007 at the start of the recession. All regressions include Year fixed effects, standard errors are clustered at the Commuting Zone level. Coefficients of the constant and year dummies are not reported. ***,**: indicates significance at the 1, 5, and 10 percent level respectively. Bottom and top decile of sample log-change in total services employment are \{-3.9%, .5%\}; of log-change in total services employment minus FIRE are \{-4.4%, .3%\}; of log-change in manufacturing employment are \{-14.2%, -.0%\}; of logged debt over income in 2007 are \{-.24, 1.68\}. 
Comovement and households’ leverage V: MSA prices

\[ \Delta p_{S,i,t} = \beta \Delta n_{M,i,t} \times \text{Leverage}_{i,2007} + \gamma' X_{i,t} + \alpha_i + \varepsilon_{i,t} \]

<table>
<thead>
<tr>
<th></th>
<th>Total services</th>
<th>Total services excl. FIRE</th>
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<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
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<tr>
<td>(\Delta) Manufacturing employment</td>
<td>-.008*</td>
<td>-.013**</td>
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<tr>
<td>(\Delta) M. empl \times Debt/income ratio in 2007</td>
<td>.010**</td>
<td>.013**</td>
</tr>
<tr>
<td>(\Delta) House prices</td>
<td>.004</td>
<td>.010</td>
</tr>
<tr>
<td>(\Delta) House prices \times Debt/income ratio in 2007</td>
<td>-.009**</td>
<td>-.021*</td>
</tr>
<tr>
<td>Debt/income ratio in 2007</td>
<td>.000</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>[.000]</td>
<td>[.001]</td>
</tr>
<tr>
<td>Manufacturing empl. Share in 2007</td>
<td>.000</td>
<td>.000*</td>
</tr>
<tr>
<td></td>
<td>[.000]</td>
<td>[.000]</td>
</tr>
<tr>
<td>House prices in 2007</td>
<td>-.003***</td>
<td>-.003*</td>
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<td>[.001]</td>
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<td>R-squared</td>
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<td>J-test</td>
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<td>Commuting zone fixed effects</td>
<td>N</td>
<td>Y</td>
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<tr>
<td>IV</td>
<td>N</td>
<td>N</td>
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</tbody>
</table>

Notes: annual data (2007-2010) for 359 Metropolitan Statistical Areas (MSAs). All variables are in logs. Price of services is relative to the manufacturing price (nationwide). Dependent variable in columns (1)-(4) is the change in log relative price of total private services excluding real estate, in columns (5)-(8) is the change in log relative price of total private services without financial and real estate activities (FIRE). Debt/income is calculated in 2007 at the start of the recession. All regressions include Year fixed effects, standard errors are clustered at the Commuting Zone level. Coefficients of the constant and year dummies are not reported. ***,**,*: indicates significance at the 1, 5, and 10 percent level respectively. Bottom and top decile of sample of log-change in relative price of total private services are {-.6%, 1.9%}; of log-change in relative price of total private services minus FIRE are {-.3%, 2.3%}; of log-change in manufacturing employment are {-15.0%, .0%}; of logged debt over income in 2007 are {-18, 1.61}. 

\[ \Delta p_{S,i,t} = \beta \Delta n_{M,i,t} \times \text{Leverage}_{i,2007} + \gamma' X_{i,t} + \alpha_i + \varepsilon_{i,t} \]
Derivation of $\eta$-function

- Suppose financial constraint is tight. Then $pc_s = \frac{1-\gamma}{\gamma} c_m$ implies:

$$d \equiv y_m - c_m = Rb_0 - \xi \left( y_m + \frac{1-\gamma}{\gamma} c_m \right)$$

- After solving for $c_m$:

$$c_m = \frac{\gamma}{\sigma} \left[ (1 + \xi) y_m - Rb_0 \right]$$

- This can be substituted into FOC for $c_m$:

$$\frac{\gamma}{c_m} = \lambda = \eta + \omega$$

to obtain

$$\eta = \frac{\sigma}{(1 + \xi) y_m - Rb_0} - \omega$$

- Net output in manufacturing $y_m$ is

$$y_m(p, \theta_s) \equiv An_m0 + Af(\theta_m(p)) u_m - \theta_m(p) z u_m - z \theta_s u_s \quad y_{m1}, y_{m2} < 0$$

Q.E.D
Number of subsidy deals and subsidy expenditures over US GDP

(a) Number of subsidy deals

(b) Firm subsidy value over US GDP
Distribution of subsidies

*Log value of subsidy deals at 2009 prices*

(a) Manufacturing subsidies

(b) Total subsidies
Total subsidy value over GSP

- Louisiana
- Michigan
- Oregon
- Missouri
- Tennessee
- New Jersey
- Ohio
- Iowa
- Connecticut
- Rhode Island
- Maine
- Idaho
- New York
- Utah
- Vermont
- Arkansas
- Pennsylvania
- Wisconsin
- West Virginia
- New Mexico
- Nebraska
- Delaware
- Alabama
- Kansas
- South Dakota
- Illinois
- Texas
- Florida
- Nevada
- Massachusetts
- Virginia
- Alaska
- North Dakota
- Maryland
- Arizona
- Colorado
- Minnesota
- Indiana
- California
- New Hampshire
- Wyoming
- Hawaii

2000–2007

2008–2012
Share of subsidies in manufacturing

Sectoral subsidies over sectoral GSP, 2008−2012
US states distribution of manufacturing subsidies

Value of manufacturing subsidies over manufacturing GSP (percentage)

(a) Subsidies in 2000-2007

(b) Subsidies in 2008-2012
Manufacturing subsidies and the manufacturing industry

Value of manufacturing subsidies over manufacturing GSP (percentage)

(a) Subsidy 08-09 and VA share

(b) Subsidy 10-12 and VA share

(c) Subsidy 08-09 and $\Delta$emp.

(d) Subsidy 10-12 and $\Delta$emp.

See results with manufacturing subsidies per worker in manufacturing
Manufacturing subsidies and household debt

Value of manufacturing subsidies over manufacturing GSP (percentage)

See results with manufacturing subsidies per worker in manufacturing
Manufacturing subsidies and the manufacturing industry

Value of manufacturing subsidies per manufacturing worker, USD

(a) Subsidy 08-09 and VA share
(b) Subsidy 10-12 and VA share
(c) Subsidy 08-09 and ∆emp.
(d) Subsidy 10-12 and ∆emp.
Manufacturing subsidies and household debt

Value of manufacturing subsidies per manufacturing worker, USD

(a) Subsidy 08-09 and HH debt
(b) Subsidy 10-12 and HH debt
(c) Subsidy 08-09 and HH debt change
(d) Subsidy 10-12 and HH debt change
Timing

**Timing** convention:

i. Aggregate shocks are realized  
ii. Investment in job maintenance  
iii. Old jobs are destroyed (probability $\Delta_i^{n_t}$) and workers can search for a new job in the same period  
iv. Decisions about job creation  
v. Old jobs and new jobs (resulting from matches at time $t$) produce output.  
vi. Unemployed workers choose whether to change sector  
 vii. Income is transferred across states, pooled within state and consumed. Next period begins
## Parameters value

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Target</th>
<th>Value</th>
</tr>
</thead>
<tbody>
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<td>$R$</td>
<td>Borrowing rate</td>
<td>.5 % annual rate</td>
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<td>$\beta$</td>
<td>Discount factor</td>
<td>5 % annual rate</td>
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<td>$\phi$</td>
<td>Home productivity</td>
<td>1.5 % hiring cost of GDP</td>
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<td>$z$</td>
<td>Posting cost</td>
<td>60 % finding rate</td>
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<td>Separation rate</td>
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<td>$\mu$</td>
<td>Job separation elasticity</td>
<td>Literature &amp; Preliminary estimates</td>
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<tr>
<td>$Z$</td>
<td>Manufacturing productivity</td>
<td>15 % share in manufacturing</td>
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<td>Consumption share</td>
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<td>$\varsigma$</td>
<td>Firm demand for liquidity</td>
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<td>$\psi$</td>
<td>Liquidity job maintenance</td>
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<tr>
<td>$\upsilon$</td>
<td>Reallocation cost elasticity</td>
<td>Preliminary estimates</td>
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</tbody>
</table>
An A-shock with manufacturing subsidies, $\xi = 1.5$

1% shock, 0.2% subsidy expenditures increase of steady state output, $\kappa = 1$ and $\mu_1 = 1$

Note: Blue solid line corresponds to baseline, red dashed line to $\tau_{1t}^m > 0$

See $Z$-shock, $\xi$-shock, see parameters
An A-shock with service subsidies, $\xi = 1.5$

1% shock, 0.2% subsidy expenditures increase of steady state output, $\kappa = 1$ and $\mu_1 = 1$

Note: Blue line corresponds to baseline, red to $\tau_m > 0$, black to $\tau_s > 0$

See Z-shock, $\xi$-shock, see parameters
A Z-shock with manufacturing subsidies, $\xi = 1.5$

$1\%$ shock, $0.2\%$ subsidy expenditures increase of steady state output, $\kappa = 1$ and $\mu_n = 1$

Note: Blue solid line corresponds to baseline, red dashed line to $\tau^m_{1t} > 0$

See $A$-shock, $\xi$-shock, see parameters
A Z-shock with service subsidies, $\xi = 1.5$

1% shock, 0.2% subsidy expenditures increase of steady state output, $\kappa = 1$ and $\mu_n = 1$

Note: Blue line corresponds to baseline, red to $\tau_{1t}^m > 0$, black to $\tau_{1t}^s > 0$

See $A$-shock, $\xi$-shock, see parameters