Firm Selection and Structural Transformation

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Firm selection in the context of structural transformation

Two influential theories of structural transformation:

- TFP growth is higher in manufacturing than in services: labor moves from M to S
- Nonhomothetic preferences: share of services in the consumption basket is increasing, labor moves from M to S

These two explanations might be more strongly related than previously thought:

- A drop in demand has an impact on industry composition: relatively unproductive firms exit.
- Thus, sectoral productivity and competition are endogenous.

Is firm selection important for structural transformation?

Research Questions:

- How important is firm selection in the context of structural transformation from manufacturing to services? (focus on US)
- What are the predictions? Is there any improvement over existing theories?

Related Literature

- Structural Transformation: Baumol (1967), Ngai and Pissarides (2007); Kongsamut, Rebelo and Xie (2001), Foellmi and Zweimueller (2008); Duarte and Restuccia (2010); Acemoglu and Guerrieri (2008); Caselli and Coleman (2001); Matsuyama (2009)
- Firm Selection: Jovanovic (1982), Hopenhayn (1992), Hopenhayn and Rogerson (1992), Ericson and Pakes (1995), Melitz (2003); Dunne, Roberts and Samuelson (1988), Asplund and Nocke (2006), Foster, Haltiwanger and Syverson (2008)

A simple static model of structural transformation

- Some firms are more productive than others; the relatively unproductive ones have to exit.
- How many firms have to exit depends on relative demand for the good.

Use a simple static model:

- 2 sectors: Manufacturing and Services
- No capital, just labor
- Take household expenditure on M and S as exogenous

Household Expenditure Shares are exogenous

- Household spends a share α of income X on manufacturing good C_m, and a share $1-\alpha$ of income on services C_s.

$$P_m C_m = \alpha X, \qquad P_s C_s = (1-\alpha)X$$

- The expenditure share of manufacturing α is assumed to decrease as income X grows (cf. nonhomothetic preferences). No assumption on functional form.
- Not necessarily demand by households, but demand in general
- The goods C_m and C_s are CES-aggregates of a continuum of intermediate manufacturing and services goods $c_m(\omega), c_s(\omega)$:

$$C_m = \left(\int_{\omega \in \Omega_m} c_m(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}, \quad C_s = \left(\int_{\omega \in \Omega_s} c_s(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}},$$

The final goods sectors are both perfectly competitive.

Intermediate goods firms have increasing returns to scale

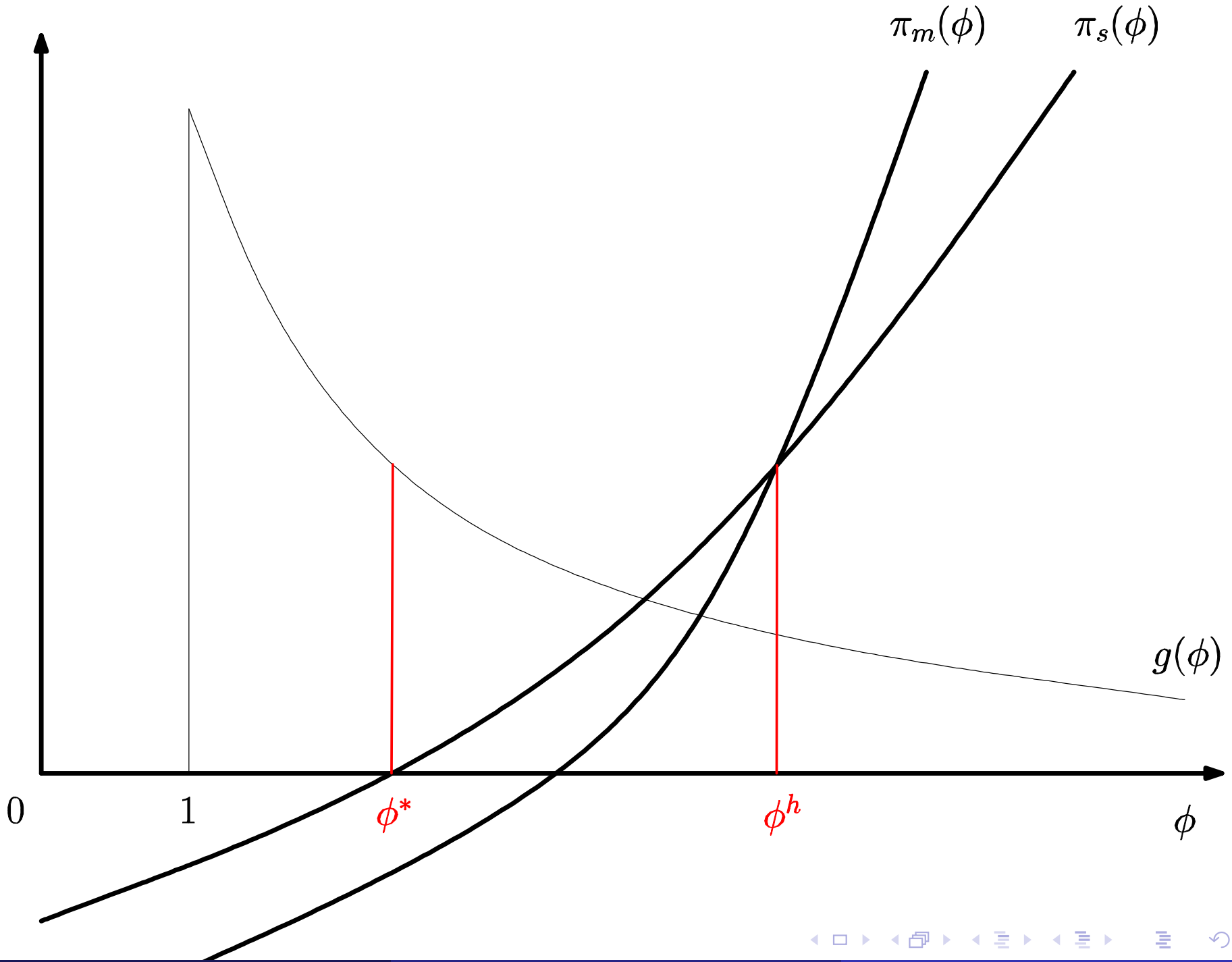
Intermediate Goods firms

- are monopolistically competitive
- face a fixed cost of production f_m or f_s, where $f_m > f_s$.
- have idiosyncratic labor productivity ϕ
- The amount of labor required to produce output q is

$$\ell(\phi) = f_i + \frac{q}{\phi}.$$

Firm entry:

- Firms pay entry cost of f_{entry} units of labor, then draw their productivity ϕ from a Pareto(γ) distribution.
- They then choose the sector where profit is higher. If they cannot make a positive profit, they exit.


$\pi_m(\phi)$
$\pi_s(\phi)$
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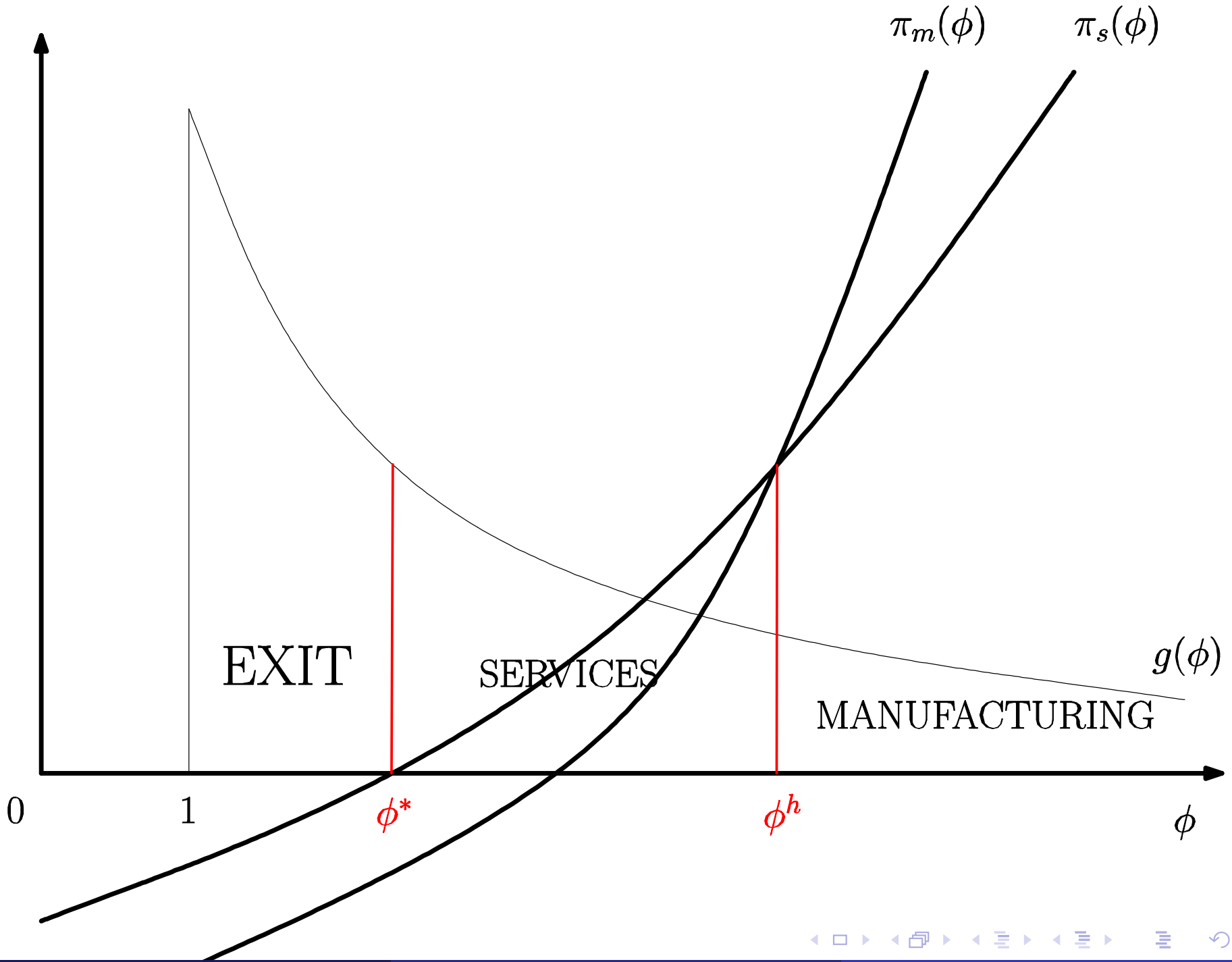
0
1
ϕ^*
ϕ^h
ϕ


$\pi_m(\phi)$
$\pi_s(\phi)$
EXIT
SERVICES
MANUFACTURING
$g(\phi)$
0
1
ϕ^*
ϕ^h
ϕ

Profits and Equilibrium cutoffs depend on relative demand

- The productivity cutoff for successful entry ϕ^* is given by

$$\pi_s(\phi^*) = 0$$

and the cutoff above which firms go into manufacturing, ϕ^h, is defined by

$$\pi_s(\phi^h) = \pi_m(\phi^h)$$

- The profit functions are

$$\begin{aligned}
\pi_s(\phi) &= \left(\frac{\phi}{\phi^*}\right)^{\sigma-1} wf_s - wf_s \\
\pi_m(\phi) &= \left(\frac{\phi}{\phi^*}\right)^{\sigma-1} \frac{X_m}{X_s}\frac{M_s}{M_m}\left(\left(\frac{\phi^h}{\phi^*}\right)^{1-\sigma+\gamma} - 1\right) wf_s - wf_m
\end{aligned}$$

- Because of Pareto dist, ϕ^h/ϕ^* depends on relative demand X_m/X_s only.

Free entry determines entry cutoff

- Free entry: expected profit from entry equals entry cost:

$$P(\phi > \phi^*)E(\pi(\phi)|\phi > \phi^*) = f_e w$$

- Payments to labor in entry must equal aggregate profits:

$$wL_e = \overline{\pi} M = \Pi$$

  Total production payments to labor are

$$wL_p = R - \Pi$$

- Total labor payments are

$$X = wL = wL_e + wL_p = R - \Pi + \Pi = R$$

- The mass of firms is then given by

$$M = \frac{R}{\overline{r}} = \frac{wL}{\overline{r}}$$

  where $\overline{r}$ is the average post-entry revenue.

Very preliminary calibration

- Pareto shape parameter: Ghironi and Melitz (2003) use $\gamma = 3.4$ to match SD of log US plant sales.
- Elasticity of substitution $\sigma = 3.8$ from BEJK (2003)
- Fixed cost of entry: exit rate among firms in their first year is roughly 0.22, pick f_e to match $P(\phi < \phi^*) = 0.22$.
- Fixed cost of production: pick f_m, f_s to have the model match the measure of manufacturing and services establishments in the US in 1977.

Results: a decline in relative demand for M increases average manufacturing productivity through selection

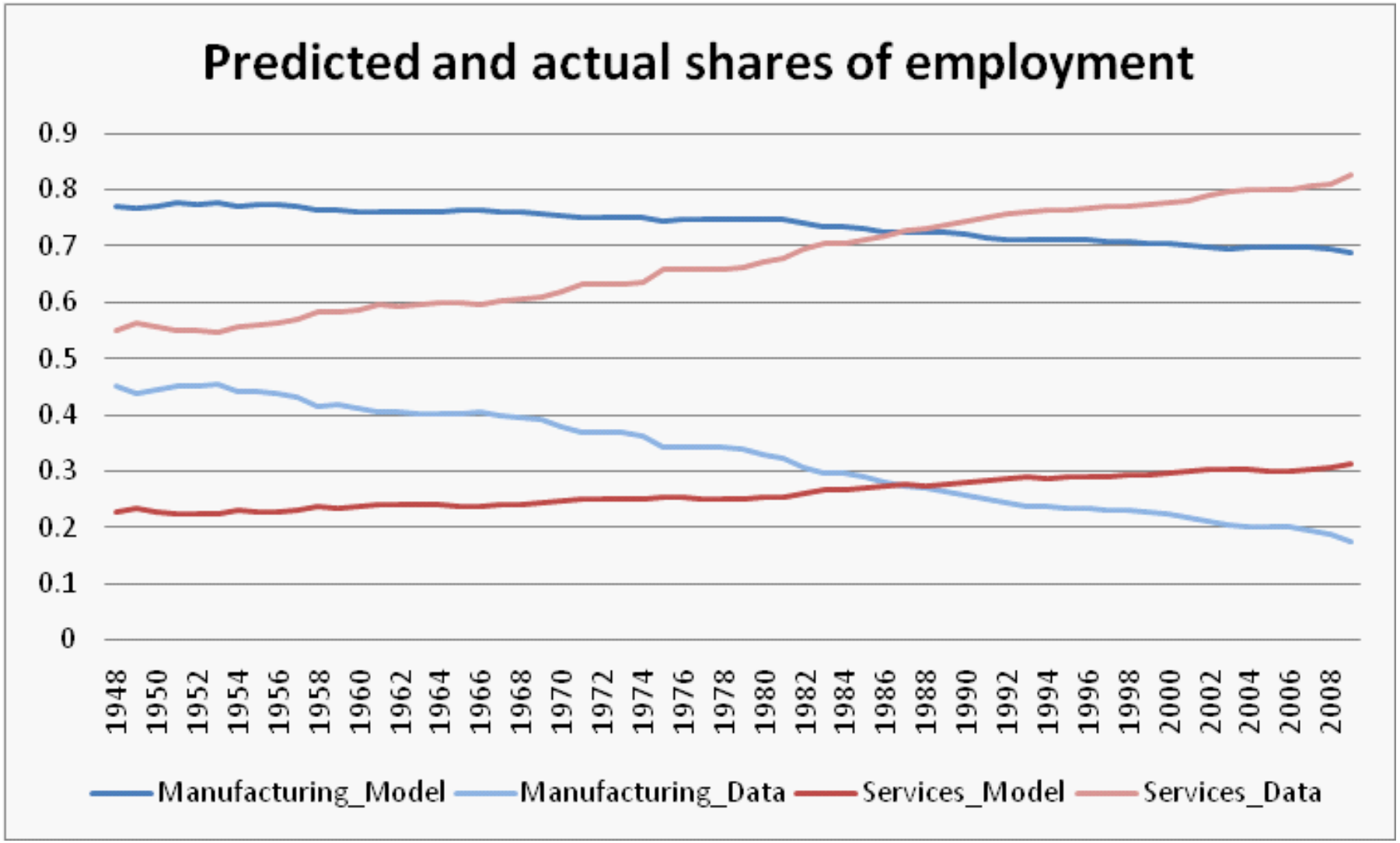
Consider a drop in X_m/X_s:

- The $\pi_m(\phi)$ curve shifts down, the $\pi_s(\phi)$ curve shifts up, resulting in a higher cutoff ϕ^h.
- The (weighted) average productivity of manufacturing firms increases linearly with ϕ^h (due to Pareto).
- The average productivity of services firms also increases, but less than the one of manufacturing firms.

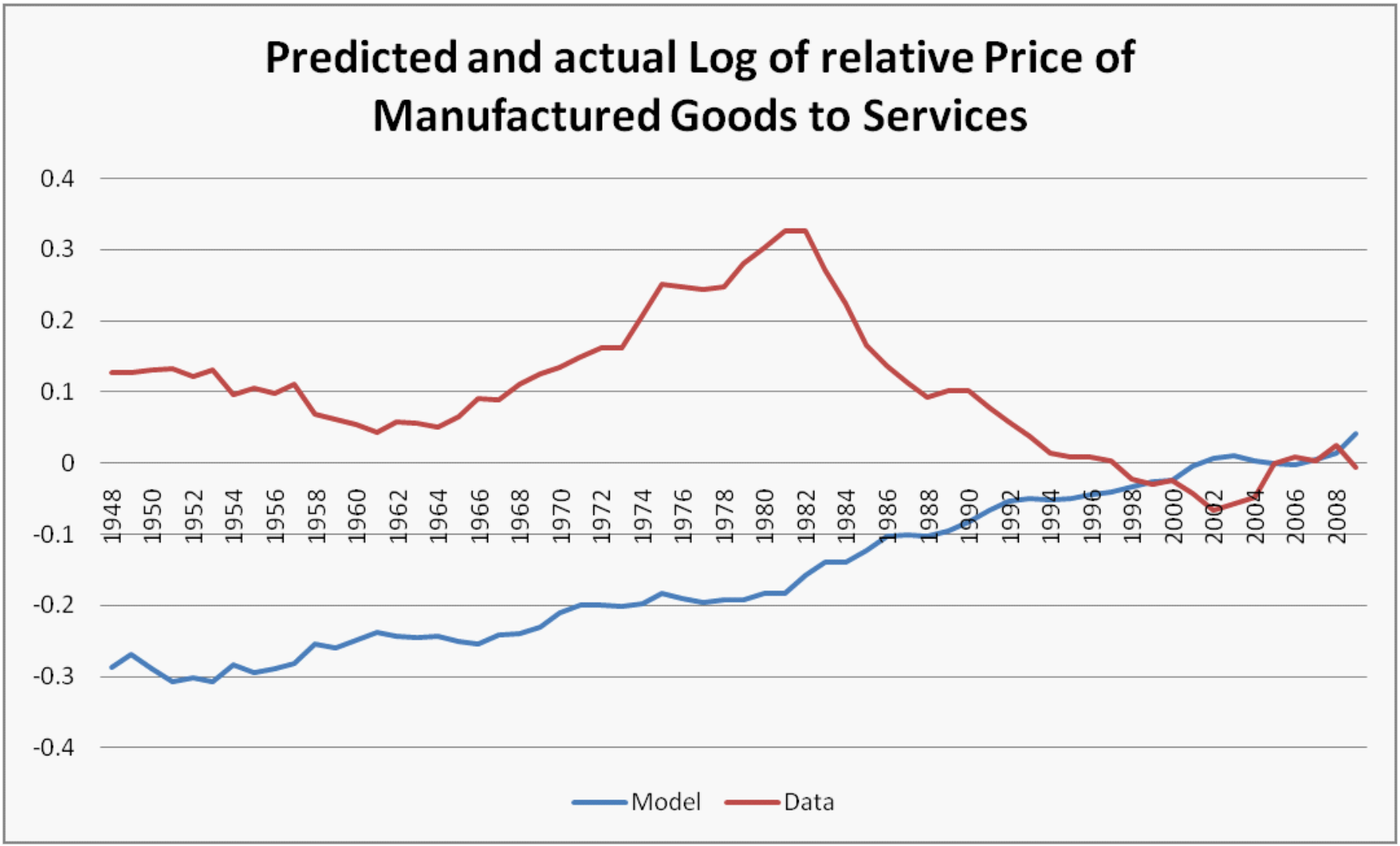
Three effects drive the reallocation of labor:

- Direct effect: relative quantity of goods demanded changes $\Rightarrow$ labor reallocated to services
- Increase in M-productivity lowers P_m, increasing the quantity of goods demanded $\Rightarrow$ labor input increases
- Fewer firms in manufacturing $\Rightarrow$ lower fixed costs $\Rightarrow$ manufacturing labor demand decreases

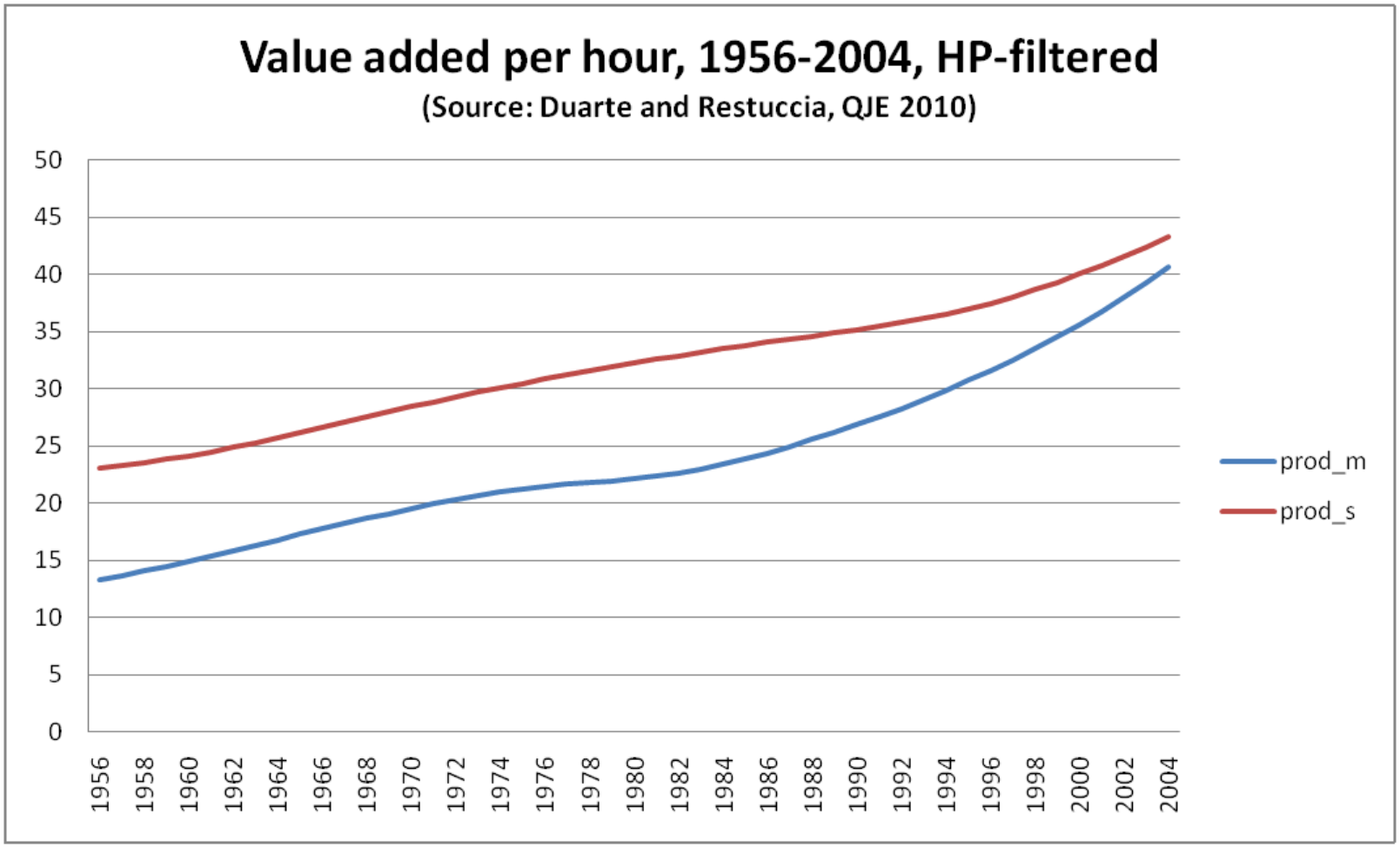
Model can match trend in employment, but not hours



Model can capture rising P_M/P_S from 1960 to 1980

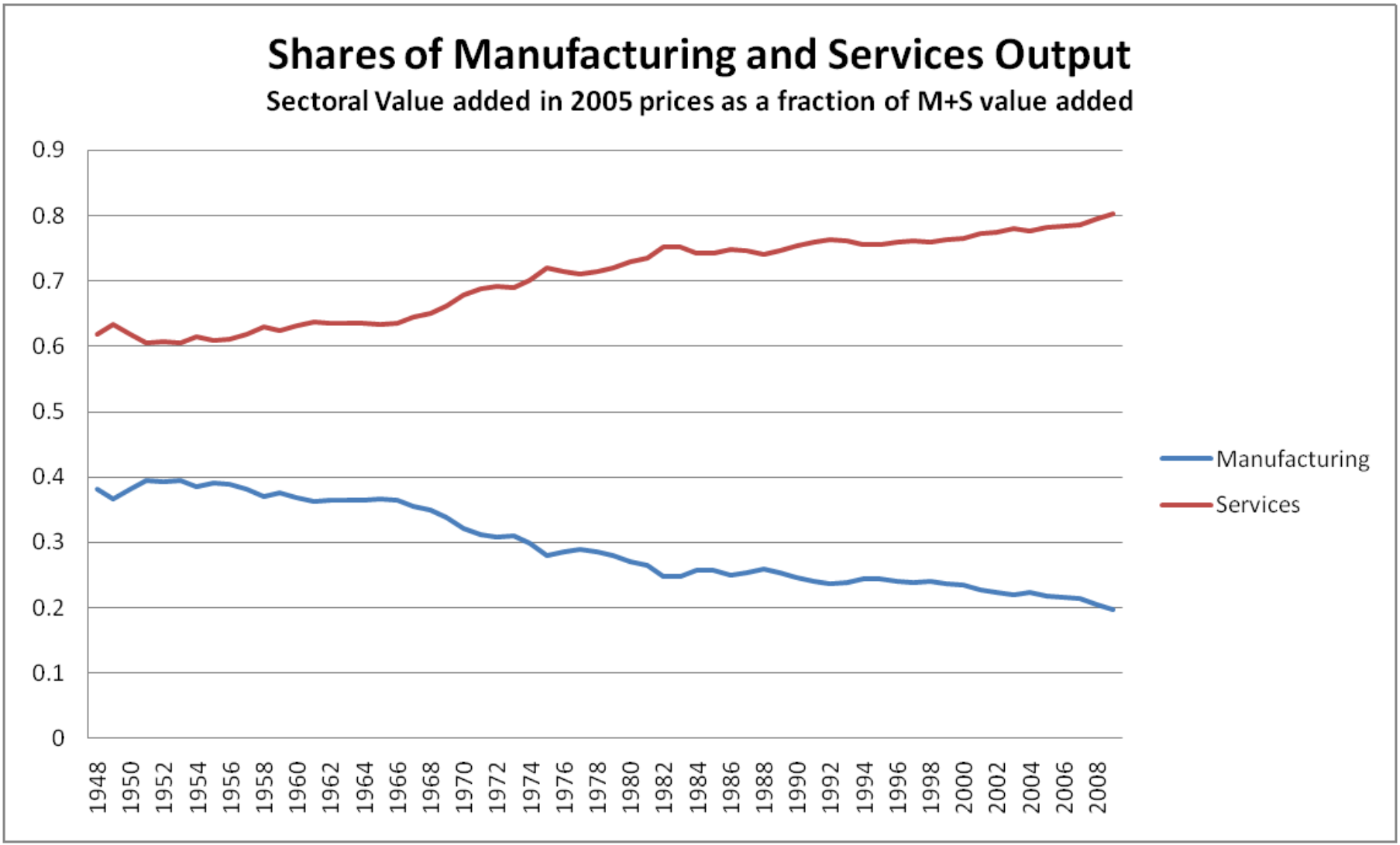


1960-1980: No sign of labor productivity growing slower in manufacturing than in services



▸ Employment

It's not a positive demand shock either



Decline in mass of manufacturing firms puts upward pressure on relative price

Why does the relative price of manufactured goods increase, even though manufacturing productivity increases faster than services productivity?

- Price level in manufacturing is

$$P_m = \left[\int_0^1 p(\omega)^{1-\sigma} d\omega\right]^{1/(1-\sigma)} = \left[M_m \int_{\phi^h}^{\infty} p(\phi)^{1-\sigma} dG(\phi)\right]^{1/(1-\sigma)}$$

- Decrease in mass of firms M_m means a decrease in competition, increase in P_m.
- Even though both P_s and P_m both fall because of the increase in average productivity, P_m falls by less as a result of firm selection.
- This might explain the period from 1960 to 1980.

Opening the manufacturing sector to trade causes a one-time labor reallocation from manufacturing to services

Extension: International trade in manufactured goods

- Assume manufacturing firms can pay a fixed cost f_x to export to an identical country. Furthermore, assume iceberg trade costs τ.
- This causes an increase in the manufacturing cutoff ϕ^h and the establishment of an additional exporter cutoff ϕ_x^*.
- Additional reallocation of labor to services, increase in manufacturing productivity (Melitz-effect).
- Ricardian effects not present (cf. Matsuyama, 2009)

Conclusion

- In my theory, changes in relative demand cause different productivity growth rates across sectors through firm selection
- This can reconcile output and productivity patterns with the observed change in relative prices (1960–1980, 2002–)
- The theory can explain how trade affects structural transformation through Melitz-type firm selection (might be particularly relevant for 2002–)

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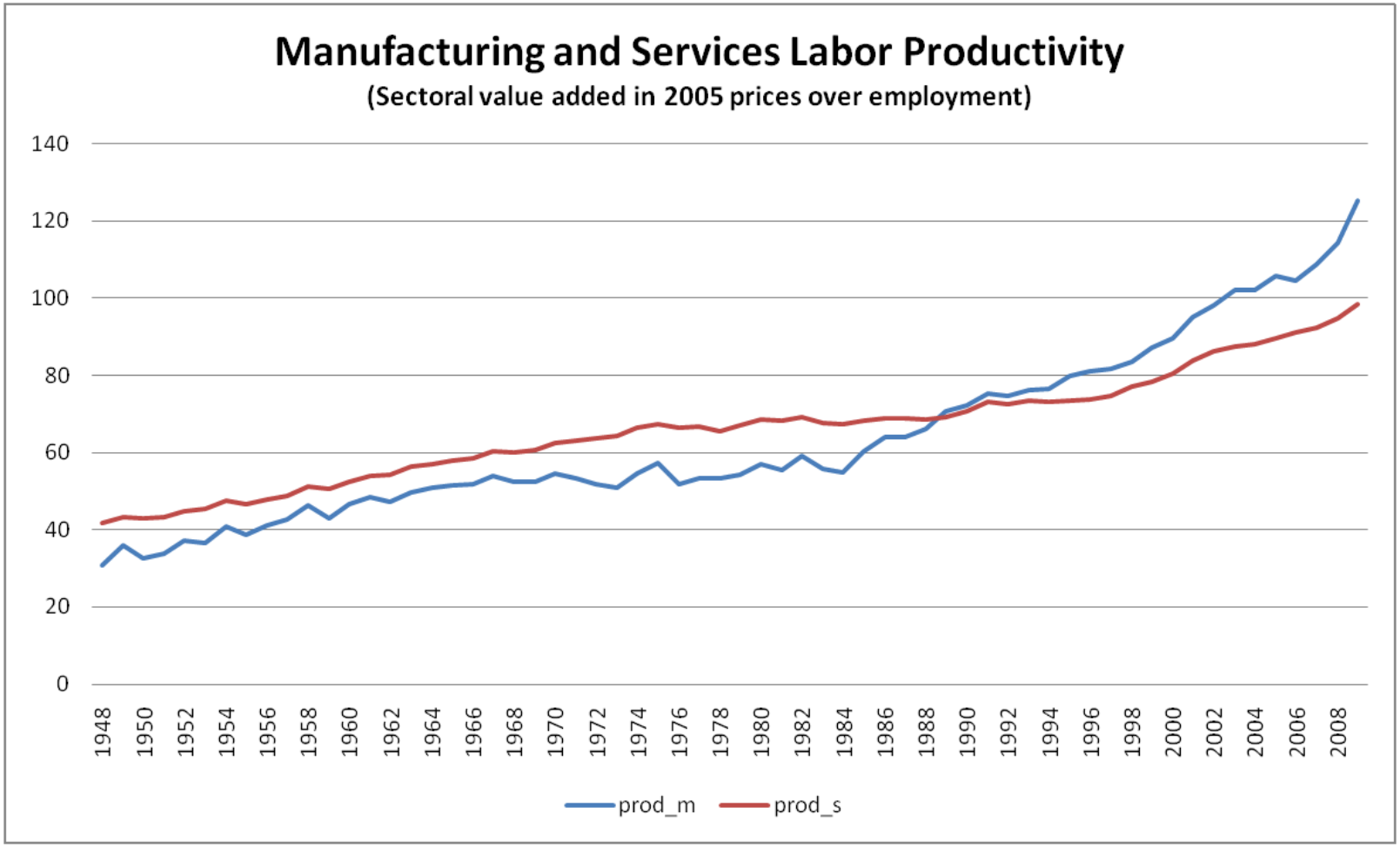
1960-1980: No sign of labor productivity growing slower in manufacturing than in services



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