

# Productivity and Potential Output Before, During, and After the Great Recession

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Discussion:

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# Findings

- Aggregate TFP growth slowed in the early 2000's after having sped up in the early 1990's
- Looks like a return to the slow productivity growth of the 1970's and 80's
- By a process of elimination (not housing, not the recession, ...) IT is left as a culprit
- Productivity growth by industry aligns with the IT story

# Is it All due to Semiconductors?

- Rare instance in which a macro phenomenon may hinge on one tiny industry
- Technological progress here is not just a residual (a la Solow), but something we can measure directly
- Lets see how far we get with this hypothesis: TFP in semiconductors drives aggregate TFP
- Of course, we are not the first to consider it ... Aizcorbe, Byrne, Jorgenson, Oliner, Sichel, Stiroh, Syverson, ...

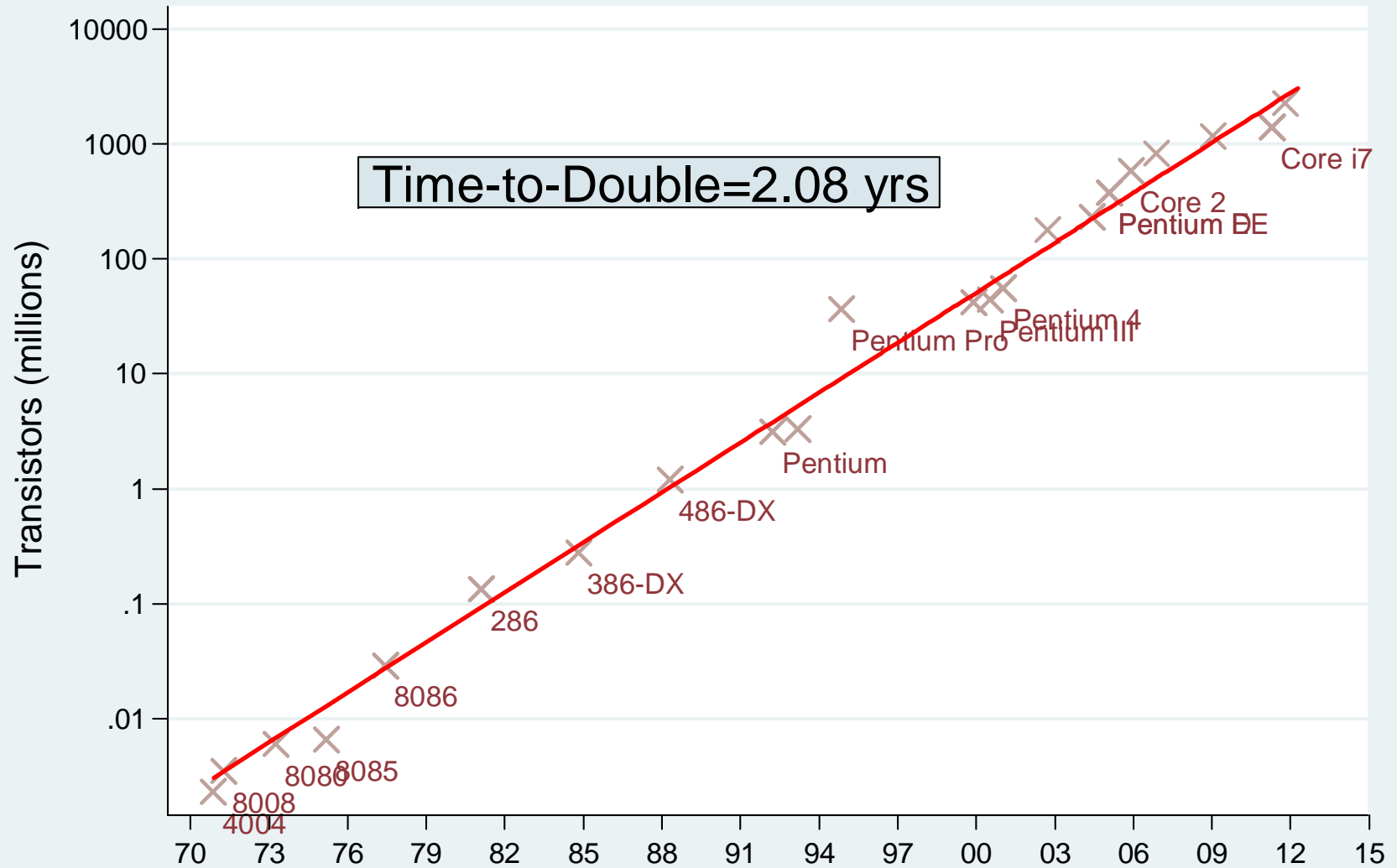
## Foundation: Hulten's Result

- Contribution of industry's TFP growth is its gross production as a share of aggregate value added
- The famous Domar weight
- Its irrelevant that:
  - Semiconductors are mostly used as intermediates, not as final goods
  - Intermediates are a small share in semiconductor production
- Domar weight for semiconductors peaked at about  $3/4$  of a percent

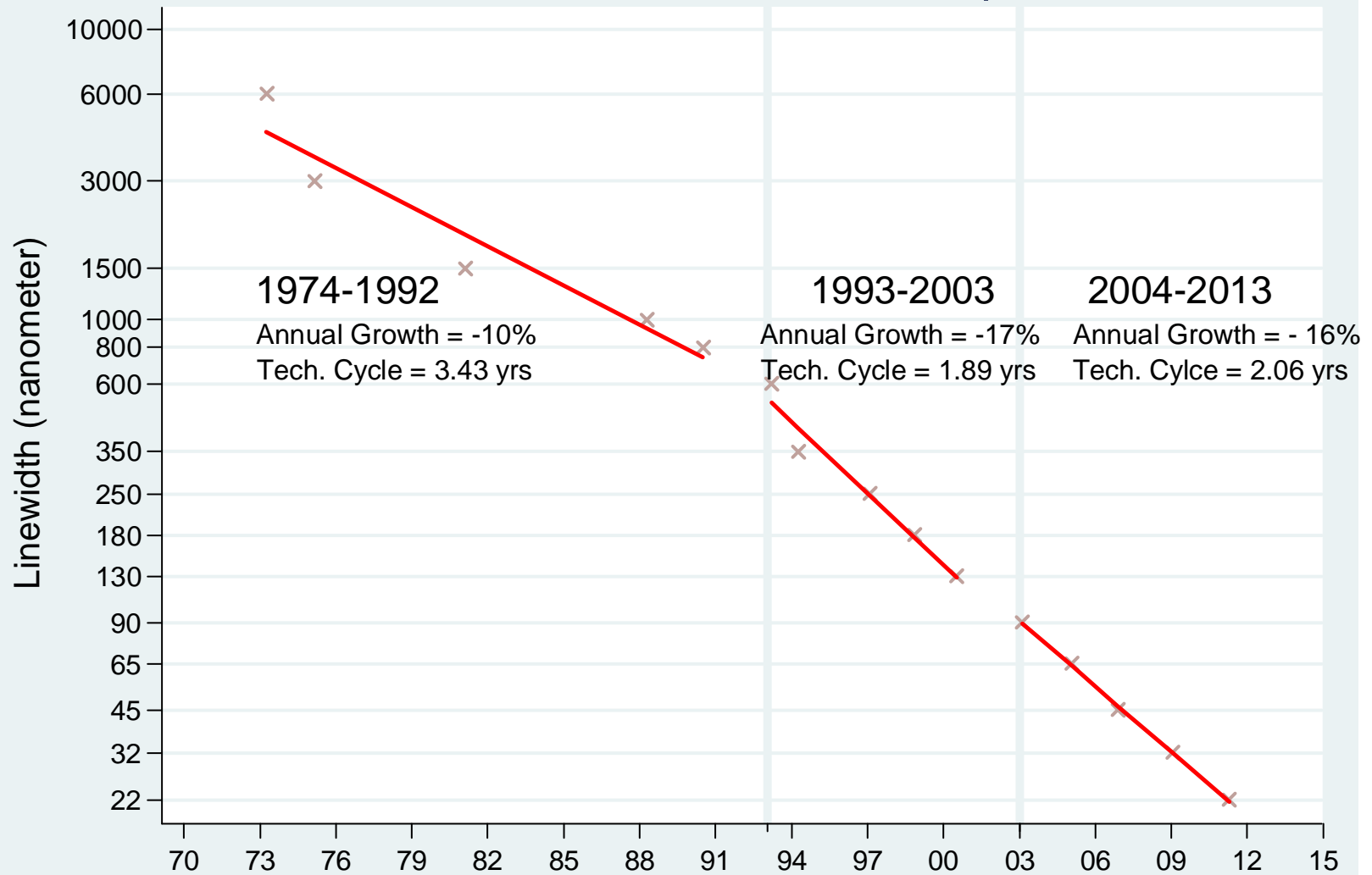
# Focus on Microprocessors

- Moore's Law
- Advances in manufacturing technology
- Increases in performance
- ... set of updated figures from Pillai (2013)

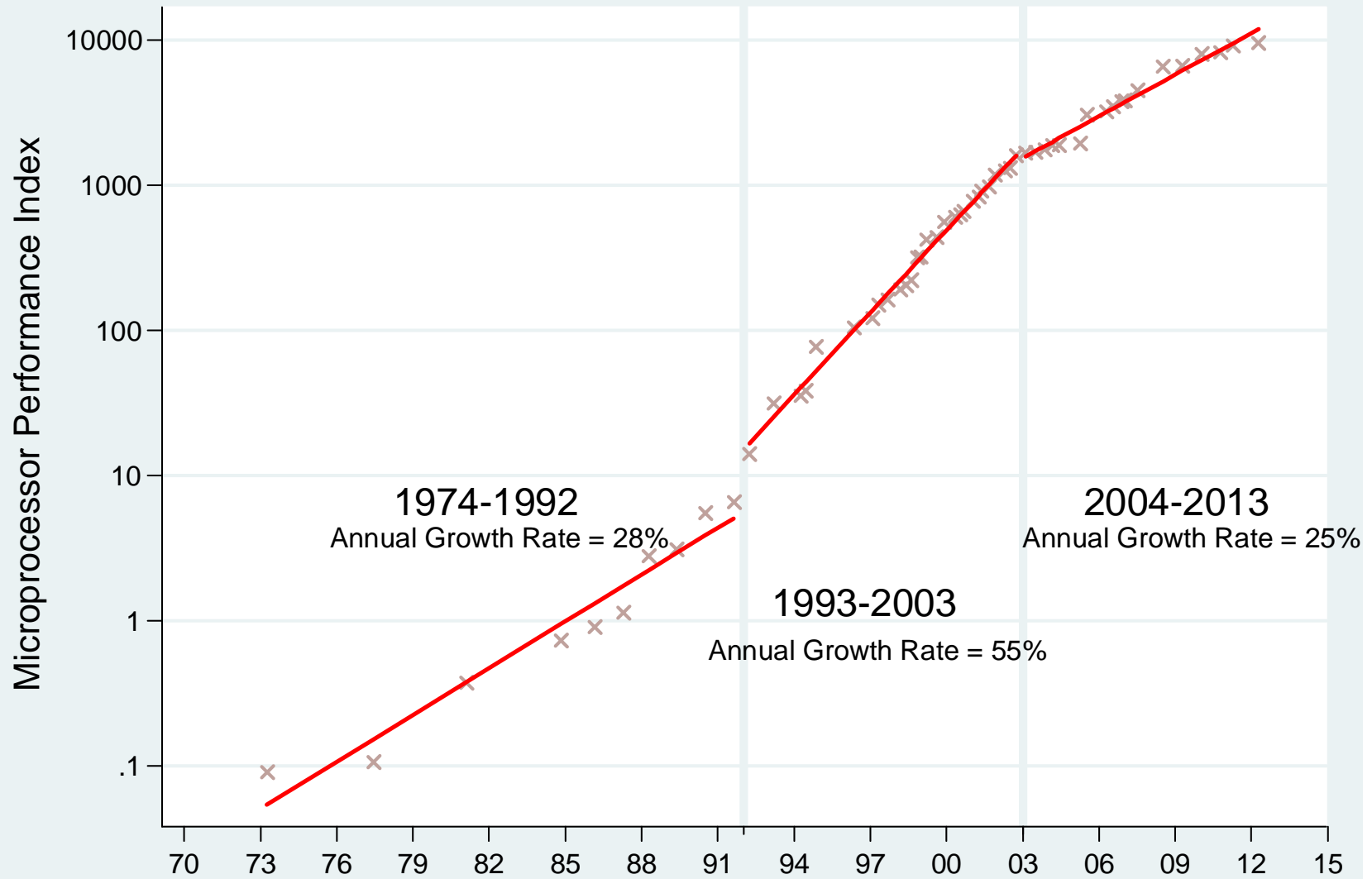
# Moore's Law: Intel Microprocessors



# INTEL: New Linewidth Adoption



# INTEL: Acceleration in 1990s





# From MPU Performance to Semiconductor TFP

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	<b>MPU Perf. Growth rate (%)</b>	<b>Semi TFP Growth (%)</b>
<b>1974-1995</b>	38.77	26.31
<b>1996-2004</b>	57.50	43.47
<b>2005-2013</b>	24.62	26.35

## Direct Contribution of Semiconductor TFP

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	<b>Fernald TFP (%)</b>	<b>MPU Perf. Growth rate (%)</b>	<b>Semicon share (%)</b>	<b>Semi contrib to TFP change (%)</b>
<b>1971-1992</b>	0.64	28.06	0.39	0.11
<b>1993-2003</b>	1.29	54.50	0.80	0.44
<b>2004-2013</b>	0.70	24.62	0.52	0.13

# Concerns about the Methodology

- What should we make of the falling Domar weight?
- Does it matter if production takes place abroad?
- Should fabless firms count?
- Need to rethink the Domar weight in a world of offshoring

## Conclusions: What about the Future?

- How much longer will Moore's Law continue?
- Will it translate to performance gains?
- How will applications take advantage of better performance?