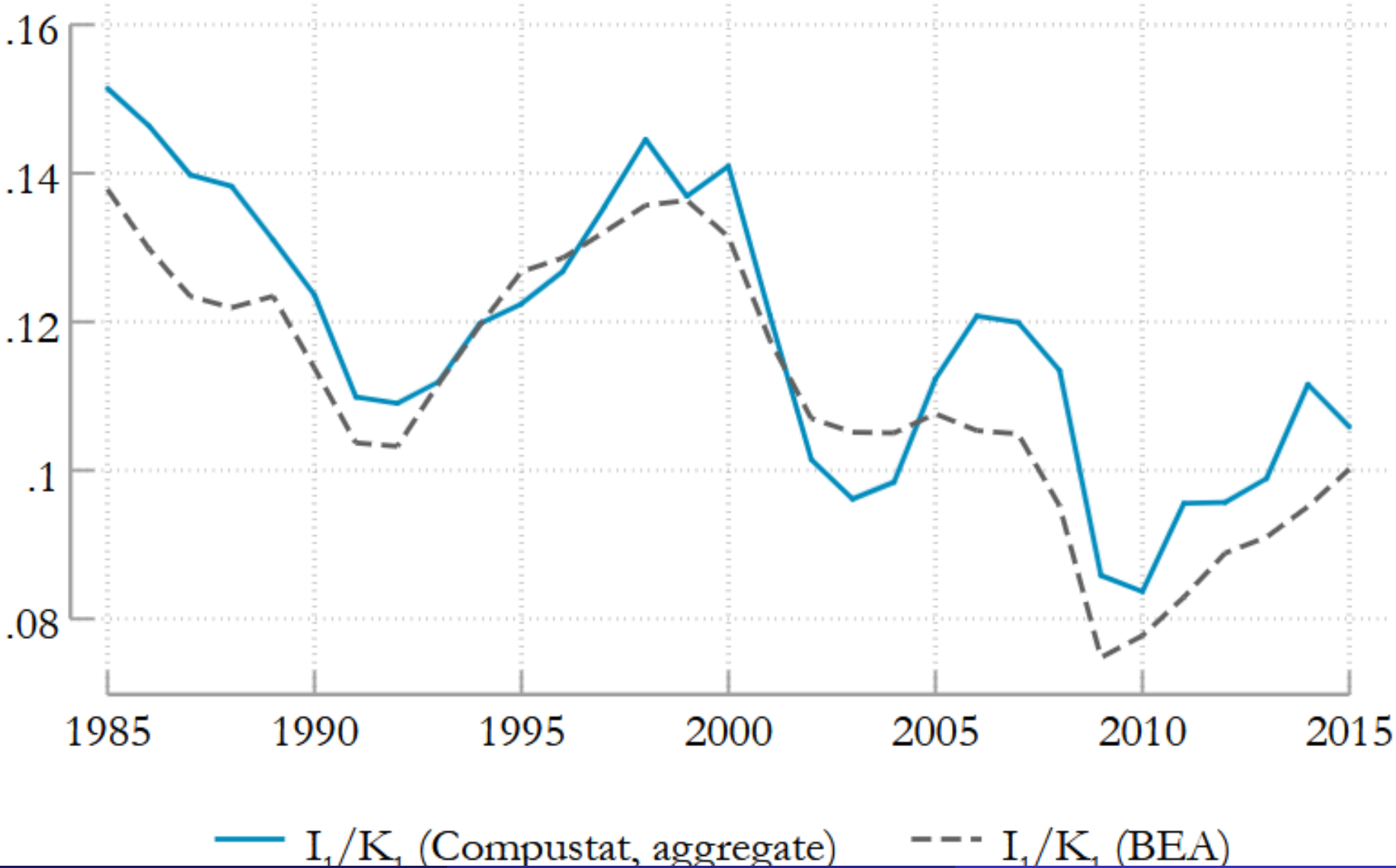
Rents and Intangible Capital: A Q+ Framework. (Crouzet and Eberly, 2023)

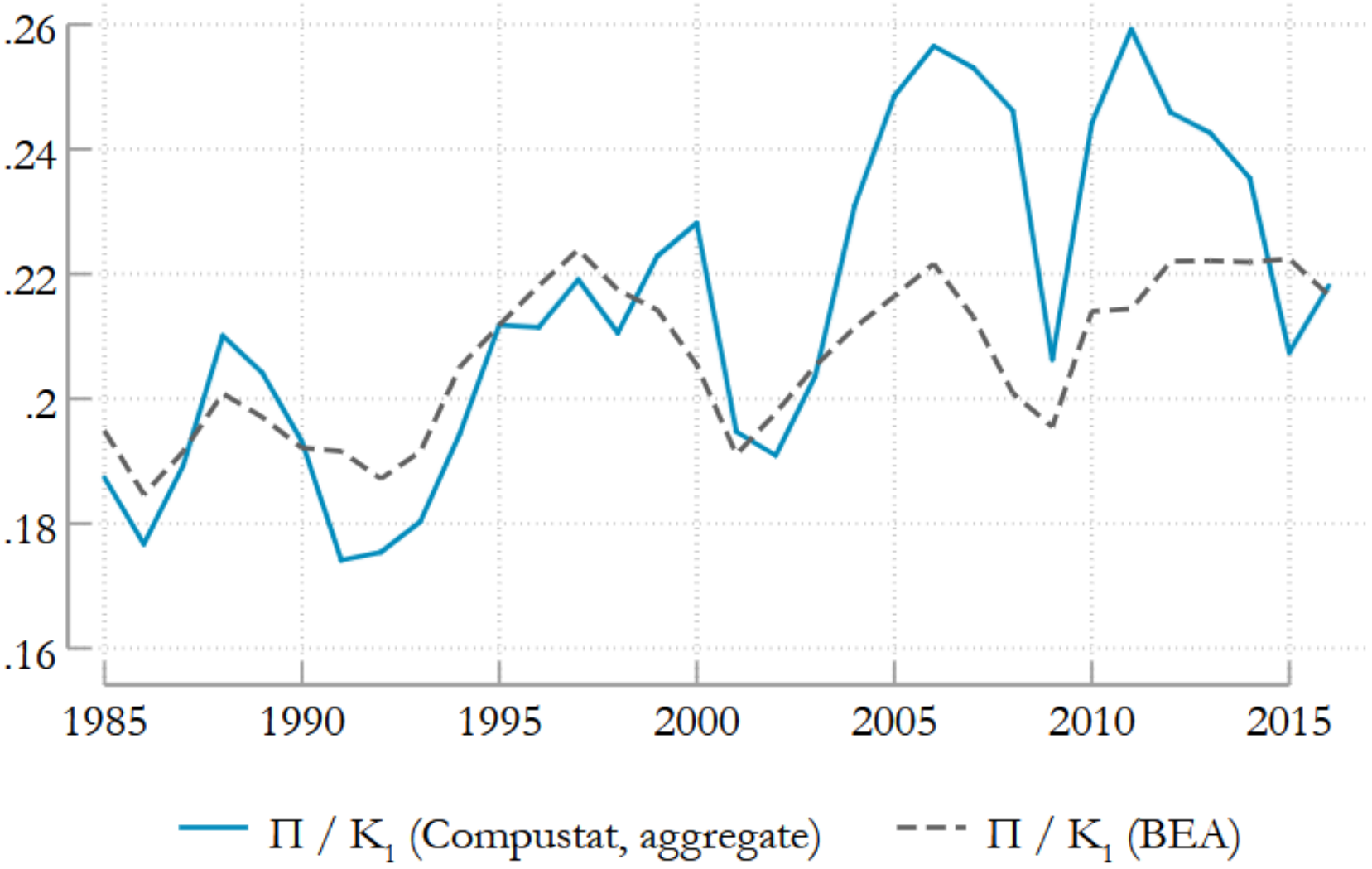
Zachary Orlando

February 22, 2025

Physical Investment Rate is Falling (Crouzet & Eberly,2023)



Return on Physical Assets is Rising (Crouzet & Eberly,2023)



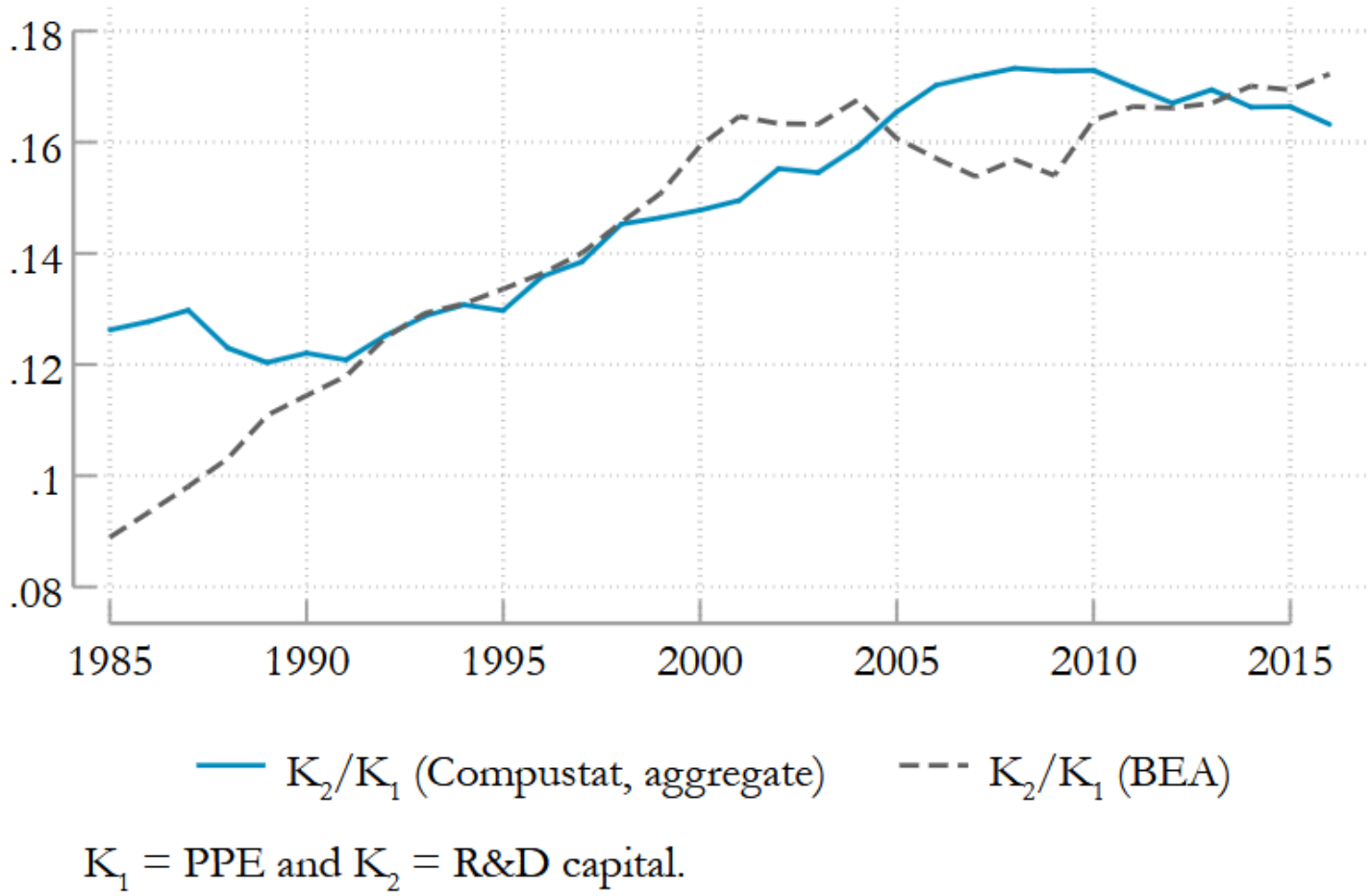
Question

- Why is physical investment falling while returns on physical assets are rising?
- Standard Q-theory would predict investment would rise with returns/valuations.

Two Theories

1. Rising intangible capital (like patents) means that returns are accruing to other types of capital. (Returns to physical capital are lower than measured)
2. Rising rents reduces the incentive of firms to scale up production (as monopolies produce less than price-taking firms).

Intangibles Share is Rising (Crouzet & Eberly,2023)



K_1 = PPE and K_2 = R&D capital.

Structure of the Paper

- The idea of this paper:
  1. Generate a wedge between marginal Q (the shadow value of investment) and Average Q by adapting a neoclassical model of investment to have:
     - Multiple types of capital inputs.
     - Monopoly rents.
  2. This wedge contains three terms: the effect of intangibles, the effect of rents/markups and an interaction term that summarizes how these channels can amplify each other.
  3. Estimates the model on aggregate US data: at least one-third of the measured gap between marginal q of physical capital and Average Q is due to intangibles, probably more.
  4. Estimate the model on firms by sector: the investment gap is driven by fast-growing industries like Healthcare and Tech. Their gap is driven by growing intangibles.

Investment Gap

- Investment Gap $= Q - q =$
  1. Rents accruing to physical capital $+$
  2. Upward bias in Average Q due to returns really accruing to an omitted type of capital (intangibles) $+$
  3. Rents accruing to intangibles x upward bias due to omitted intangibles

The model

$$V_t^c(\mathbf{K}_t) = \max_{\mathbf{K}_{t+1}} \Pi_t(K_t) - \tilde{\Phi}_t(\mathbf{K}_t, \mathbf{K}_{t+1}) + \mathbb{E}_t \left[M_{t,t+1} V_{t+1}^c(\mathbf{K}_{t+1}) \right]$$

$$\text{s.t.} \quad K_t = F_t(\mathbf{K}_t).$$

- $\mathbf{K}_t$ is now a vector of N different types of input (e.g. labor, intangibles, physical cap.). $M_{t,t+1}$ is the one-period-ahead SDF.
- Time indexing allows the problem to depend on other exogenous processes.
- Assumptions: the production function is homogeneous, the profit function is concave and homogeneous of the order $\frac{1}{\mu}$ (where $\mu < 1$ captures economic rents). And adjustment costs are the sum of convex and strictly increasing adjustment costs for each input.

Investment Gap decomposition

$$Q_{n,t} - q_{n,t} = (\mu - 1) \sum_{k \geq 1} \mathbb{E}_t \left[M_{t,t+k} \Pi_{n,t+k} (1 + g_{n,t+1,t+k}) \right] \quad + \tag{1}$$

$$\sum_{\substack{m=1 \\ m \neq n}}^{N} S_{m,n,t+1} q_{m,t} \quad + \tag{2}$$

$$(\mu - 1) \sum_{\substack{m=1 \\ m \neq n}}^{N} S_{m,n,t+1} \sum_{k \geq 1} \mathbb{E}_t \left[M_{t,t+k} \Pi_{m,t+k} (1 + g_{m,t+1,t+k}) \right] \tag{3}$$

where $Q_{n,t} = \dfrac{V_t^e}{K_{n,t+1}}$ and $1 + g_{n,t+1,t+k} \equiv \dfrac{K_{n,t+k}}{K_{n,t+1}}$, and $S_{m,n,t+1} \equiv \dfrac{K_{m,t+1}}{K_{n,t+1}}$.

Balanced Growth

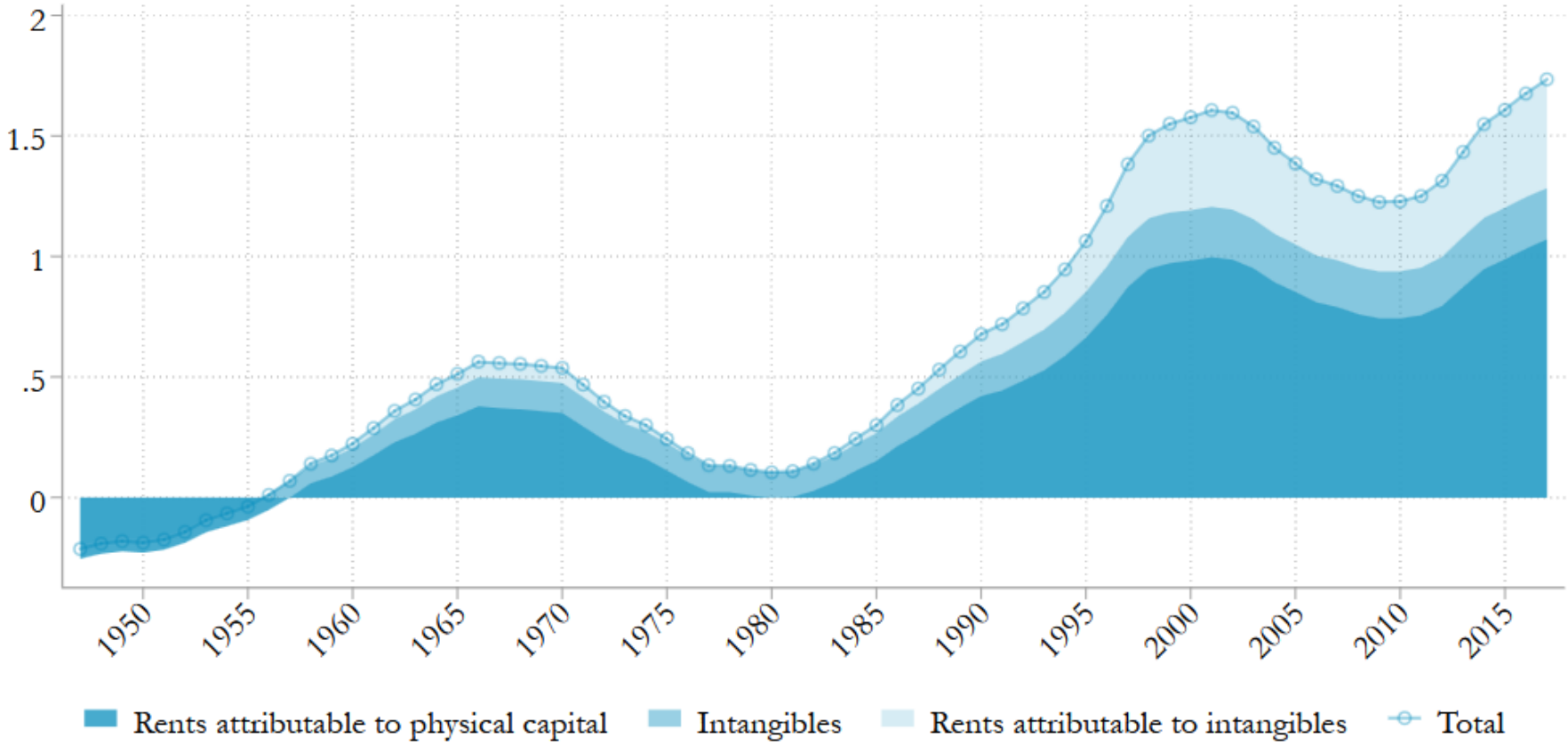
- $M_{t,t+1}$ is the one-period SDF.
- Note: the gap between Average Q and Marginal Q for an input is a monotonic function of the gap between investment and Hayashi(1982) investment.
- For the $n = 2$ case, and assuming investment in each input follows a balanced growth path (g = growth rate, $(1 + r)^{-1}$ = SDF, this simplifies to:

$$Q_1 - q_1 = \frac{\mu - 1}{r - g} R_1 + S q_2 + \frac{\mu - 1}{r - g} R_2 S \tag{4}$$

$$R_n \equiv (r - g)\Phi'_n(1 + g) + \Phi_n(1 + g) \quad n = 1, 2 \tag{5}$$

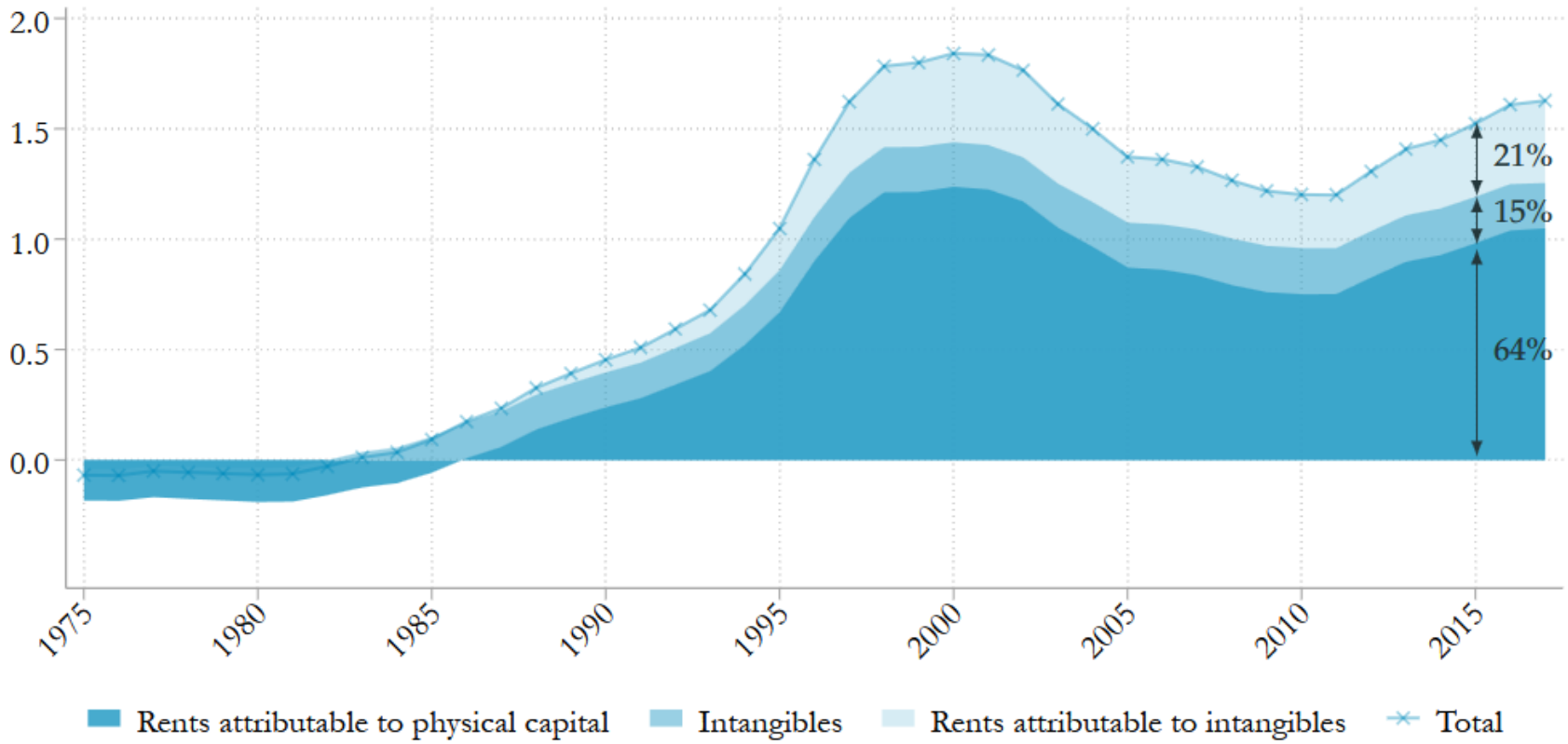
Estimated Aggregate Gap

- Using the BGP assumption, quadratic adjustment costs and calibrating each parameter in the wedge / adjustment cost parameters γ_1, γ_2 using aggregate US data:

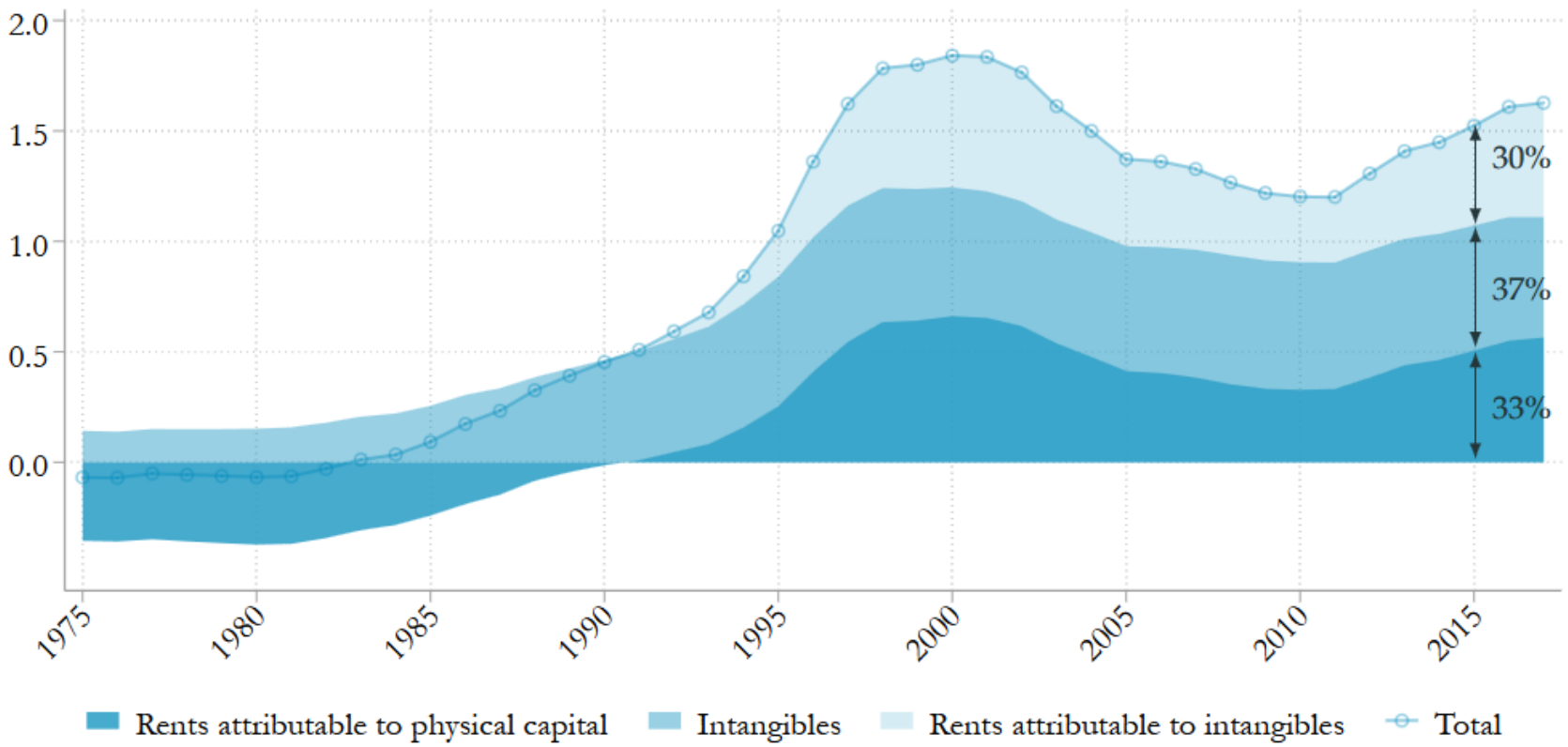


$$\gamma_1 = 3, \quad \gamma_2 = 12 \quad \text{(Belo et al., 2019)}$$

Firm-level Gap: Intangibles = R&D



Firm-level Gap: Intangibles = R&D + Organizational Capital



- Organizational Capital is the intangible value of a firm's knowledge and processes.

Comments

- Fixed Costs would break the decomposition. At least at the firm level, these seem to be pretty relevant, especially when thinking about monopolies.
- Is there a relationship between growing intangibles and growing rents?
- Perhaps returns have just become riskier?