

# Household Innovation and R&D: Bigger Than You Think

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# Non-Market Household Activity

- **Free Goods**



- **Services**

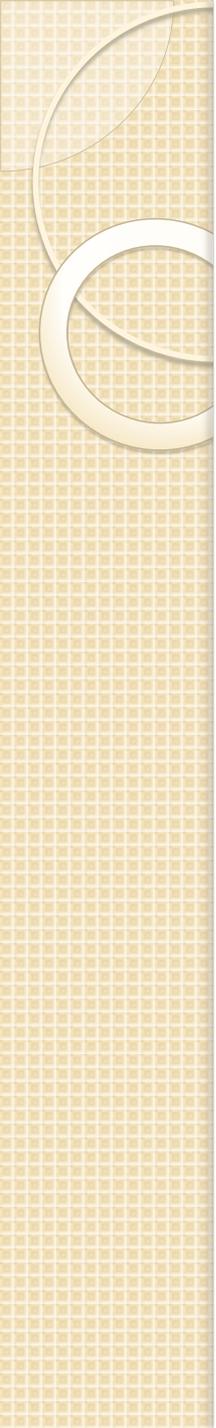
- Child/elder care, food prep
- Flow from HH durables



- **Human capital**

- Own & children





# Non-Market Household Activity

- These activities outside scope of GDP
- **Satellite Accounts** exist or other efforts at measurement

# This Paper

- **Main point of paper:** Existing accounting of household activity misses an important type of intangible capital produced by households
- Namely, **household R&D or innovation**
- It's big enough to matter!

# What is household R&D (innovation)?

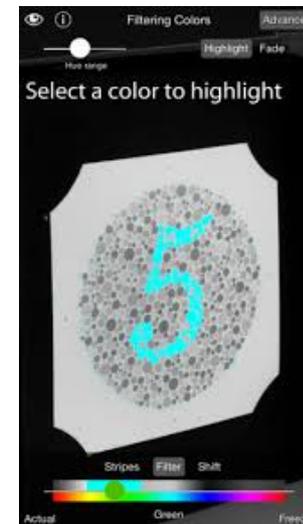
## **Definition:**

“Dedication of household resources to creating a product or process that will generate a service flow to the household (and often to other households) in the future.”

[Follows classic definition of investment]

# Examples of household R&D

- **DIY artificial pancreas** – for diabetics, monitors blood sugar and automatically adjusts insulin pump
- **iPhone app** that identifies colors for color-blind people



# Examples of household R&D

- **New sport or equipment;** e.g. whitewater kayaking



- **New craft and shop tools**





# How can we measure investment in household innovation?

- **Surveys** of households
- **Von Hippel** and co-authors have done surveys in ten countries
- **Note:** household innovation counts as leisure in American Time Use Survey

# Survey Design for U.S. in 2010

- **Definition of innovation:**
  - Developed new product or modification
  - For personal or family use
  - Provided useful functional improvements
- Questions designed to screen out non-innovations
- Nationally-representative online survey
- **1,992 responses**

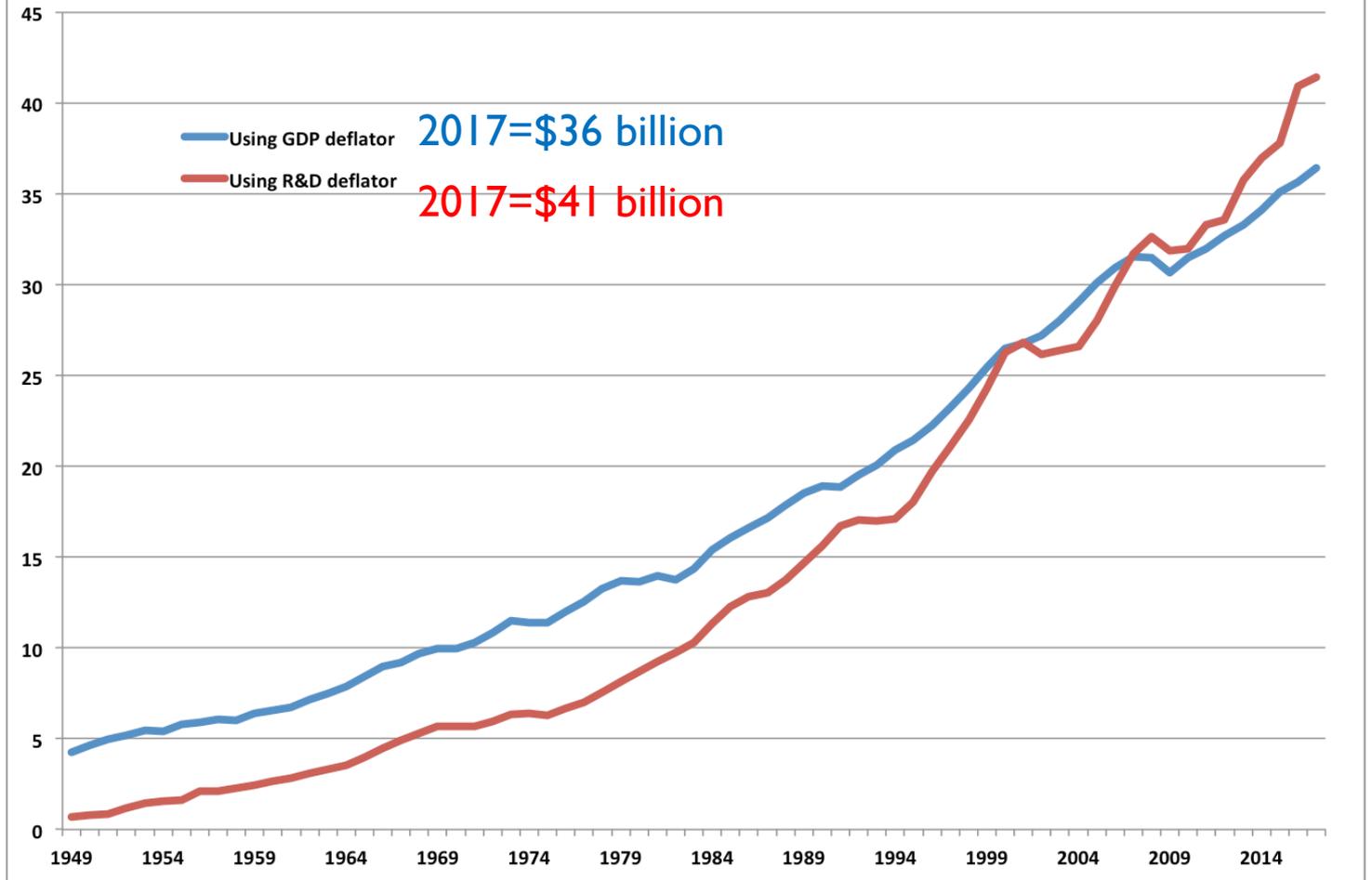
# What is the value of this investment?

- **Cost-based estimates** (same method as used in literature on intangible business capital)
- For US for 2010
  - 14.7 days per innovation
  - \$1,065 out-of-pocket per innovation
  - 1.9 projects/yr
  - Average hourly wage
  - 16 million innovators
- **\$20.2 billion**

# Extensions

- Adjust for narrowness of U.S. survey relative to surveys in other countries.
- Only have survey data for one year
- **Extrapolate to other years** using nominal GDP or R&D expenditures
- **Convert to constant \$** using deflators for GDP or R&D expenditures

**Figure 3**  
**Real Investment, Household R&D, 1949-2017**  
**(billions of 2012 \$)**



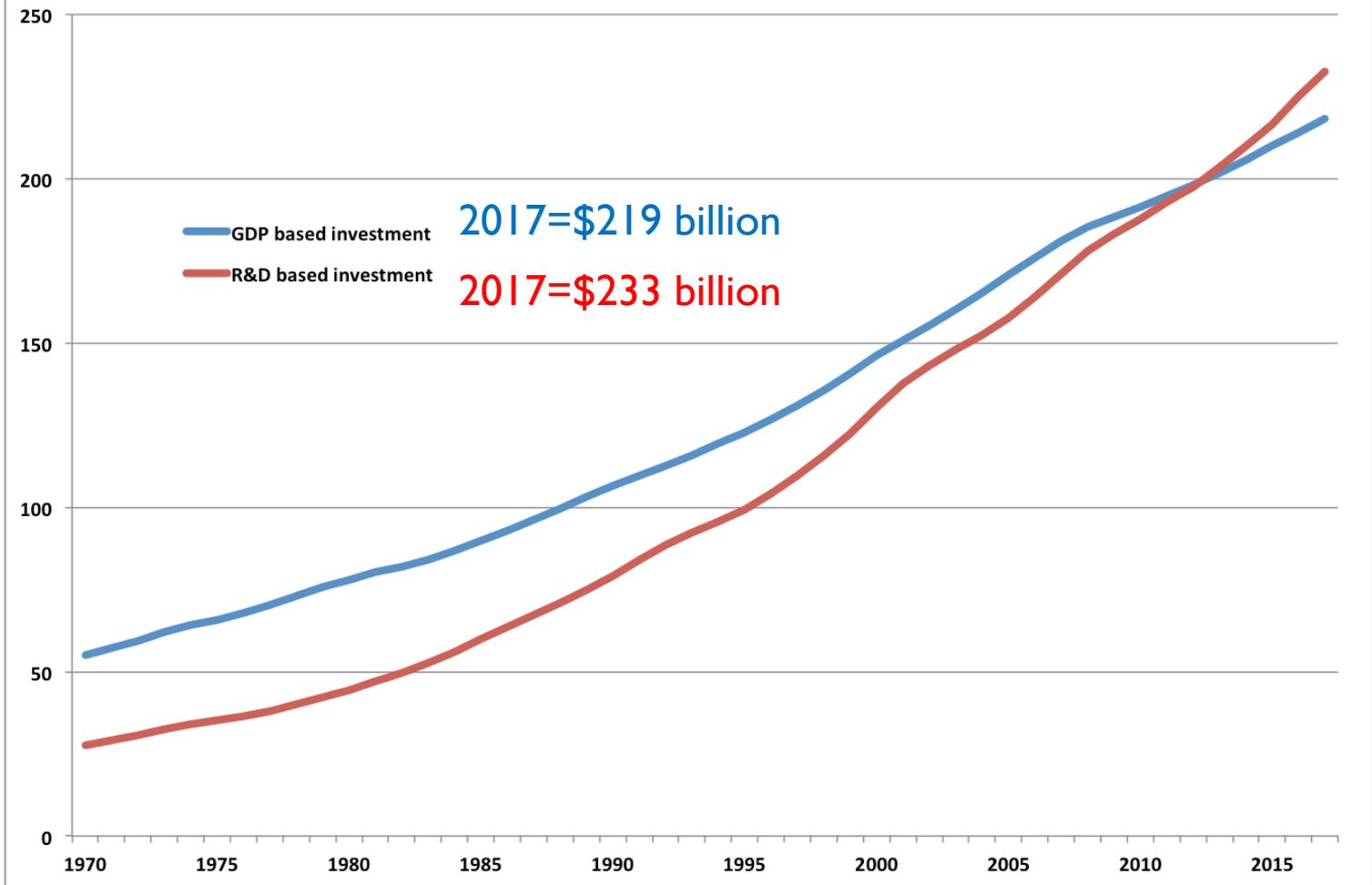
# Capital stocks of household R&D

- **Perpetual inventory method**

$$K_t = (1 - \delta)K_{t-1} + I_t$$

- Depreciation rate = 15 %
- Start recursions in 1949 with  $K_{1949} = I_{1949}$
- Report 1970 → to lessen start-up bias

**Figure 4**  
**Real Capital Stock, Household R&D, 1970-2017**  
**(billions of 2012 \$)**



# Is household product R&D big enough to matter?

- Investment in 2017 was **9%** of total private and govt funded nondefense R&D (=\$44 billion / \$484 billion)
- Investment in 2010 was **52%** of business R&D for consumer products (=\$32 billion / \$62 billion)
- Nominal K about **half** the stock of household autos
- Nominal K about **equal** to stock of household appliances

# GDP Effects

- Suppose household R&D in scope for GDP
- How much of an adjustment?
- For 2017:
  - **Time cost** (not out-of-pocket costs because those expenditures already in GDP): **\$39 billion**
  - **Service flow** (just as we include service flow from stock of owner-occupied housing): **\$50 billion**
- Total = **0.5 percent** of GDP

# Conclusion

- **Household R&D:**
  - **Important** category of intangible investment by households.
  - **Substantial and consequential**
  - **Warrants more attention**



# Haiku (paper in 17 syllables!)

Off market, households  
Invest in R and D too,  
It's a big deal!