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# ESCoE Research Seminar

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# Do-It-Yourself Home Improvement and Other Home-Produced Goods: Changes for Measured GDP and Housing Values



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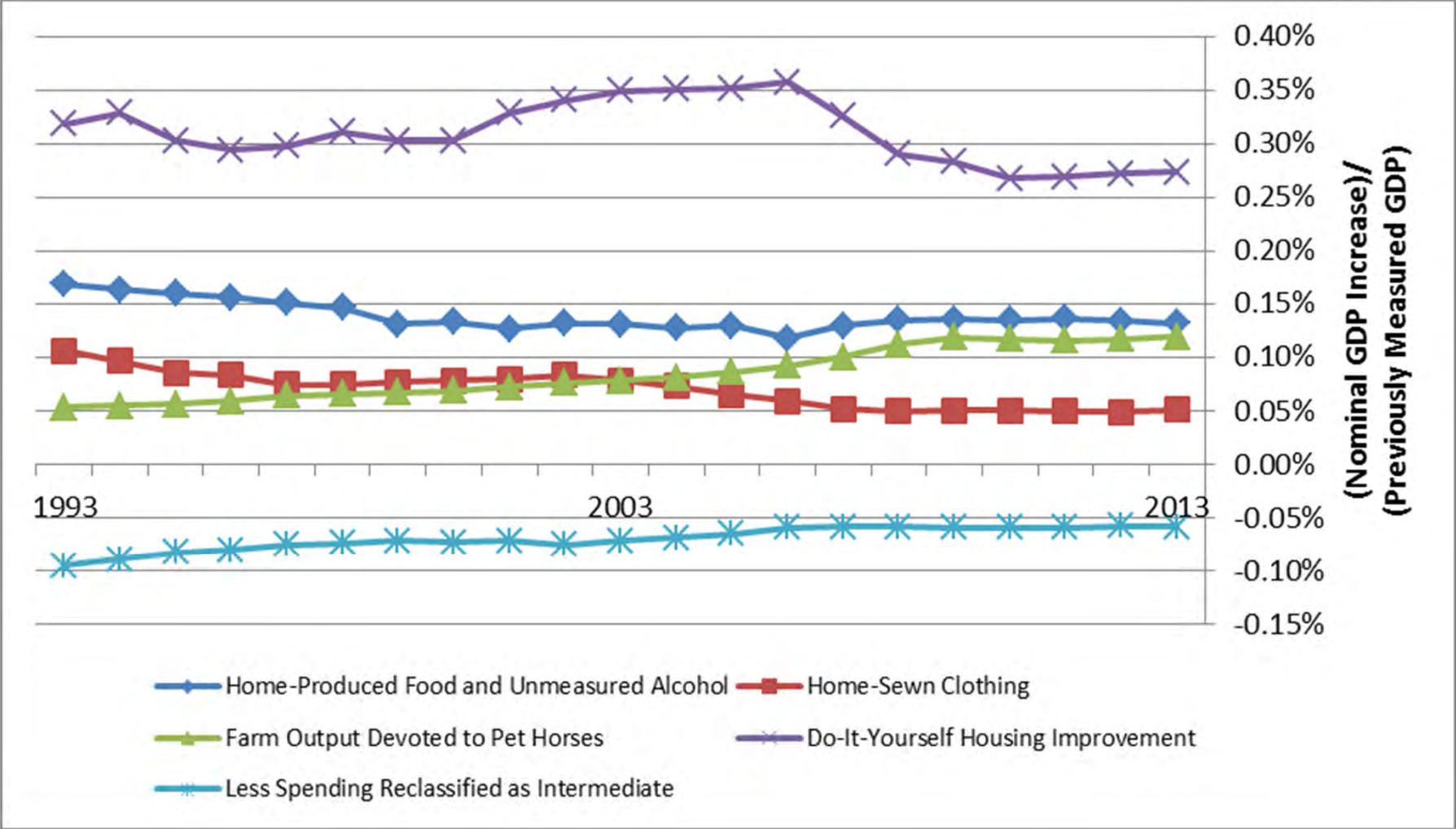
# Outline of Talk

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- Disclaimers
  - This paper is my own personal research.
  - The numbers in this paper are speculative.
- Measuring Do-It-Yourself Home Improvement
  - Nominal value of unpaid homeowner labor.
  - Price indexes for do-it-yourself projects.
- Other Do-It-Yourself Activity in GDP
  - Homegrown and hunted food.
  - Unmeasured alcohol during Prohibition, home-sewn clothing, etc.
  - Farm Output for Pet Horses.
- Small Secondary businesses run from home
  - Conceptually, this income is part of GDP but measurement is difficult.

# Recent Revisions to Nominal GDP



- Home-produced food and do-it-yourself housing improvement are based on pre-existing government surveys. The other adjustments are more speculative.

# Do-It-Yourself Home Improvement

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- The System of National Accounts (SNA 2008) provides detailed guidelines for measuring GDP
- Section 6.37 discusses home-improvement
  - “Substantial repairs, such as replastering walls or repairing roofs, carried out by owners are essentially intermediate inputs into the production of housing services ... Major renovations or extensions to dwellings are fixed capital formation and recorded separately.”
  - Minor repairs or renovations like changing lightbulbs or cleaning gutters are excluded from GDP.
- At the current time, BEA only counts purchased materials or services in home improvement
  - I explore imputing a value for unpaid homeowner labor and then adding that value to measured investment.
  - BEA includes unpaid homeowner labor for new construction.

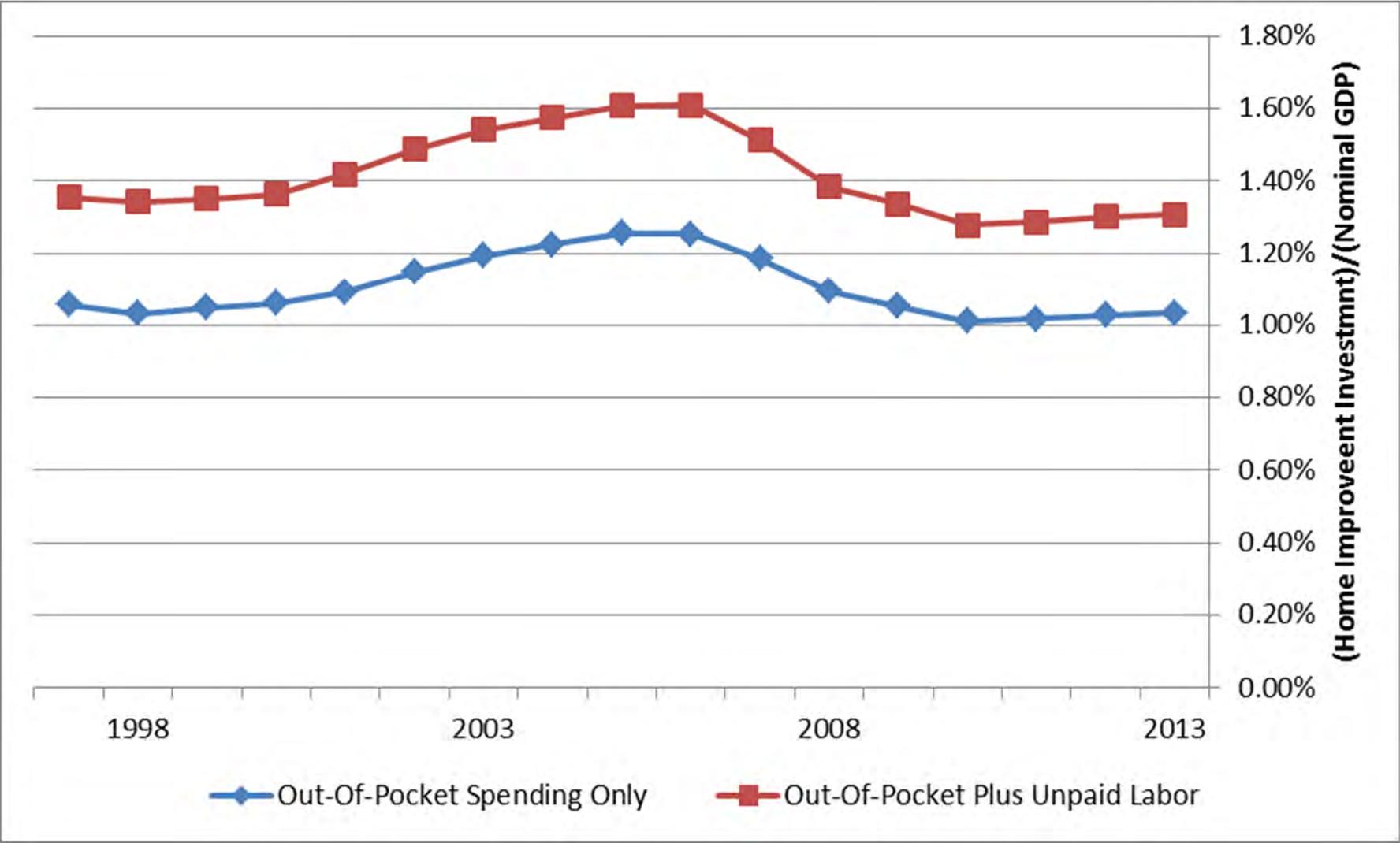
# Measuring Unpaid Homeowner Labor

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- The American Housing Survey (AHS) tracks housing
- AHS data on home improvement from 1997-2009
  - The precise projects done in the past two years.
  - How much the homeowner spent out-of-pocket by project.
  - Whether the homeowner hired contractors for the project.
- Homeowners who do work themselves spend 62% less
- 41% of projects use unpaid homeowner labor
  - The do-it-yourself rate is steady from 1997-2009.
  - Unpaid homeowner labor adds 34.5% of extra value on top of out-of-pocket spending.
  - In 2007, BEA reports \$139 billion of out-of-pocket investment on home improvements for owner occupied housing. Unpaid homeowner labor adds another \$48 billion of investment.

# Nominal Home Improvement Relative to GDP



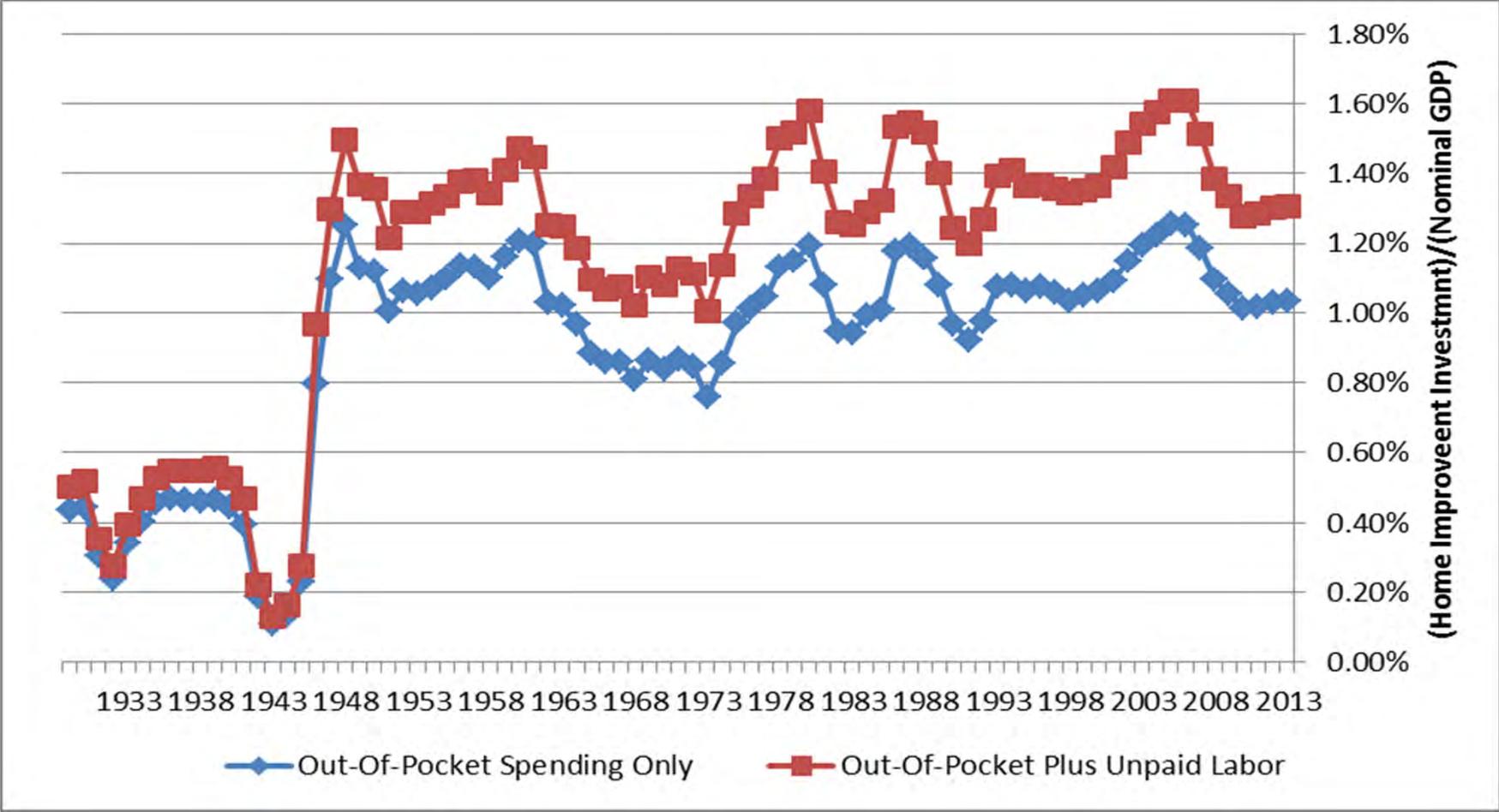
# Imputing Unpaid Homeowner Labor pre-1997

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- We assume that unpaid homeowner labor reduced construction costs less historically than it does now.
  - In 1936, a USDA study estimated that farmers only saved 15% by doing their own home improvement projects.
  - We model this shift as a Leontief production function and minimal labor productivity growth for minor construction jobs.
- I use demographics to impute % done by contractors
  - In the AHS, homeowners are more likely to use contractors if they are highly educated, older, female or living in cities.
  - The Census provides demographics data on homeowners from 1900-2000 and the ACS provides data for 2000-2011.
- I impute a long-run decrease in the DIY share since 1900.
  - In the 1950's, young couples bought homes in the suburbs and imputed do-it-yourself rates spiked.

# Nominal Home Improvement Relative to GDP



- Home improvement tends to fall during recessions, so unpaid homeowner labor is cyclical. It was also low during World War 2 because of rationing.

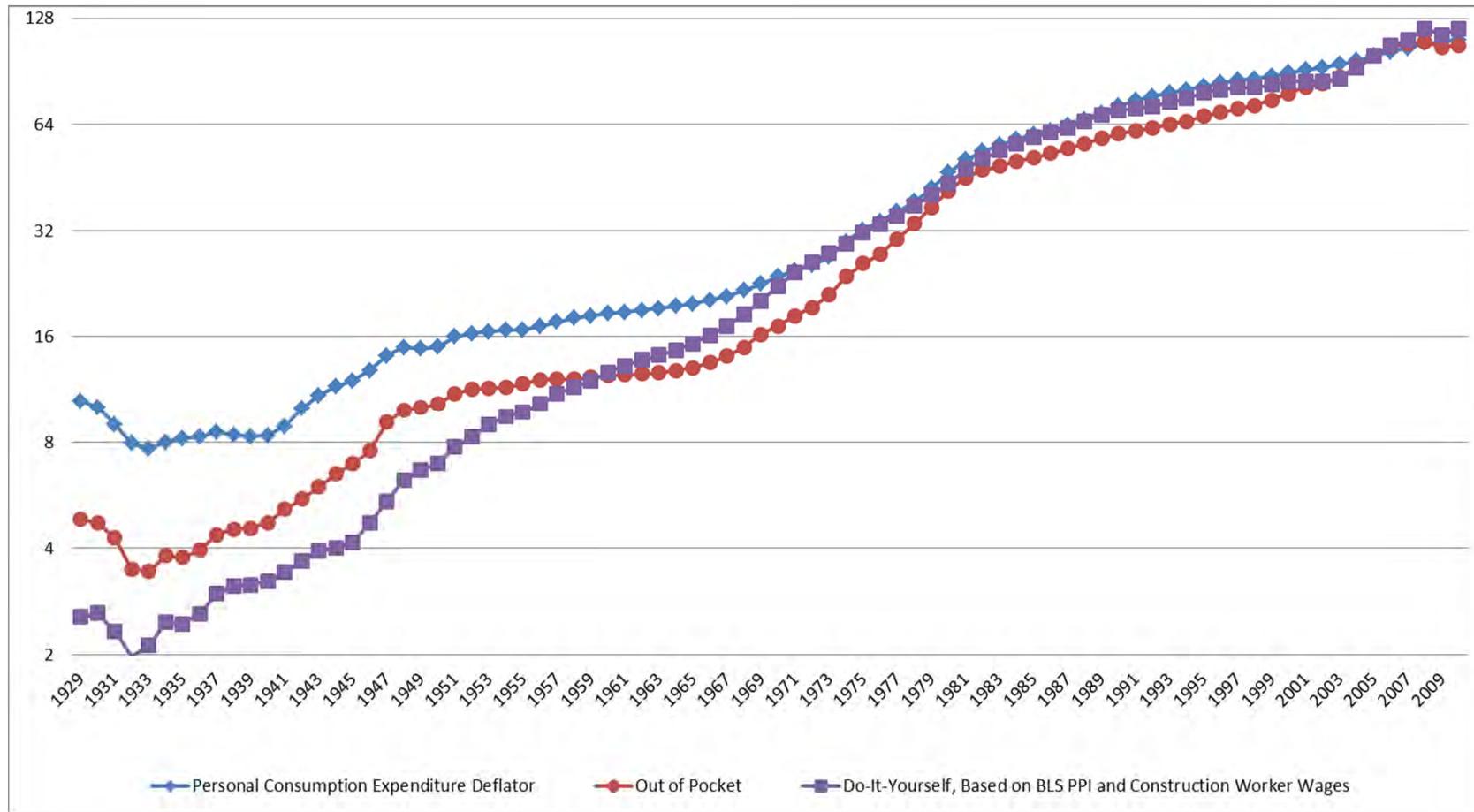
# Prices for Unpaid Homeowner Labor

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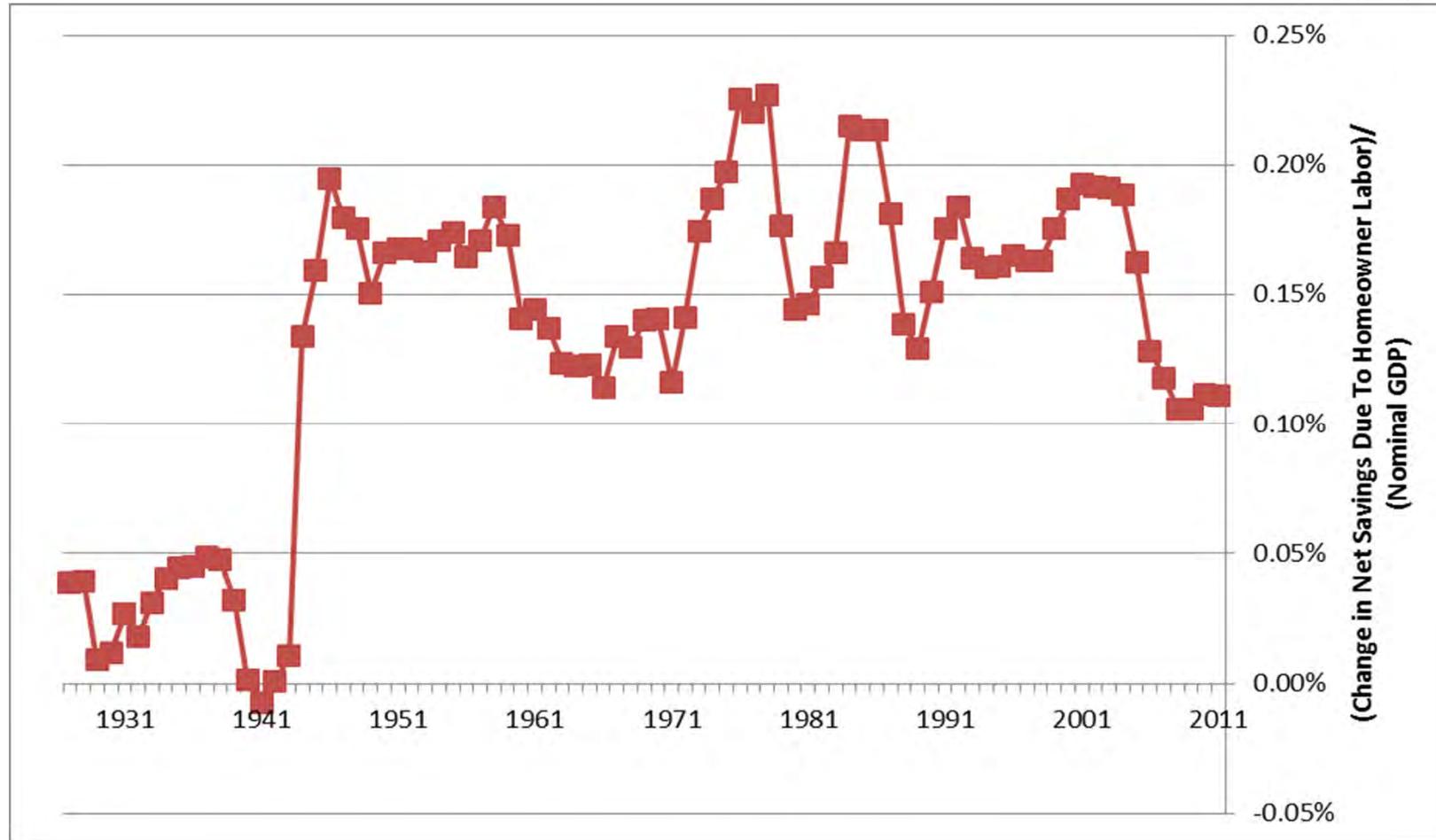
- Home-owner time is a substitute for handyman/contractor time
  - I have not been able to find an exact wage index for handyman/contractors over time.
  - This industry uses little capital and has not experienced much productivity growth over time. As a result, prices track wages closely.
- I use a producer price index (PPI) for residential repair and maintenance (PCUBMRS—BMRS)
  - Handyman/contractors rarely own or purchase materials on their own behalf – so material costs aren't included in their PPI.
- Before 1987, I use wages for construction workers as an index
  - I also tried using weekly earnings for self-employed construction workers.
  - This price index shows the same general pattern, but it is much more volatile.

# Prices for Home Improvement



- This chart shows that real wages for blue collar men have been stagnant since the 1970's. This stagnation has been noted elsewhere.

# Change to Net Savings Over Time



- New investment due to unpaid homeowner labor is almost always larger than depreciation on past investment. As a result, measured savings rates rise.
- Since 1960, the US savings rate has dropped dramatically. Including unpaid homeowner labor slightly ameliorates the decline – but doesn't reverse it.

# Home-Produced Food in GDP

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- SNA 2008 (Section 6.32) recommends that home-produced goods be counted in GDP
- The US Department of Agriculture (USDA) publishes numbers for home-produced food back to 1860
  - Food items are valued at typical retail prices.
- In 2007, consumers produced \$19.1 billion of food
  - BEA already counts \$0.4 billion of food produced by farm families.
  - The remainder of production is done by non-farm households with backyard gardens. This production is not included in GDP, and the housing services from this land is included in personal consumption.
  - ERS's farm income accounts suggest that land accounts for approximately 25% of the final value of farm output. Based on that, I shift \$4.8 billion of housing services to intermediate expenses.
  - For simplicity, I ignore minor intermediate inputs like seeds.
  - Non-farm home-produced food adds \$14.1 billion to GDP.
- Relative to GDP, home-produced food has decreases over time.

# Unmeasured Alcohol and Clothing

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- Unmeasured alcohol 1929-1935
  - I only track the increase that occurred during Prohibition.
  - Under Prohibition, the commercial sale was generally illegal. But households were allowed to produce their own alcohol.
    - If alcohol was legally produced, it is part of GDP under section 6.32.
    - If alcohol was illegally produced, it is part of GDP under Section 6.44.
  - Alcohol consumption decreased very little during Prohibition
    - Diverted industrial alcohol and imports supplied only 15% of demand.
    - Unmeasured alcohol production must have been large.
- Home-sewn clothing tracks consumer spending on clothing material and sewing supplies
  - BEA already estimates both items in Table 2.4.5U (lines 108 and 133) from 1959 to 2011.
  - In 2007, consumers created \$10.1 billion of clothes from \$4.06 billion of raw materials.

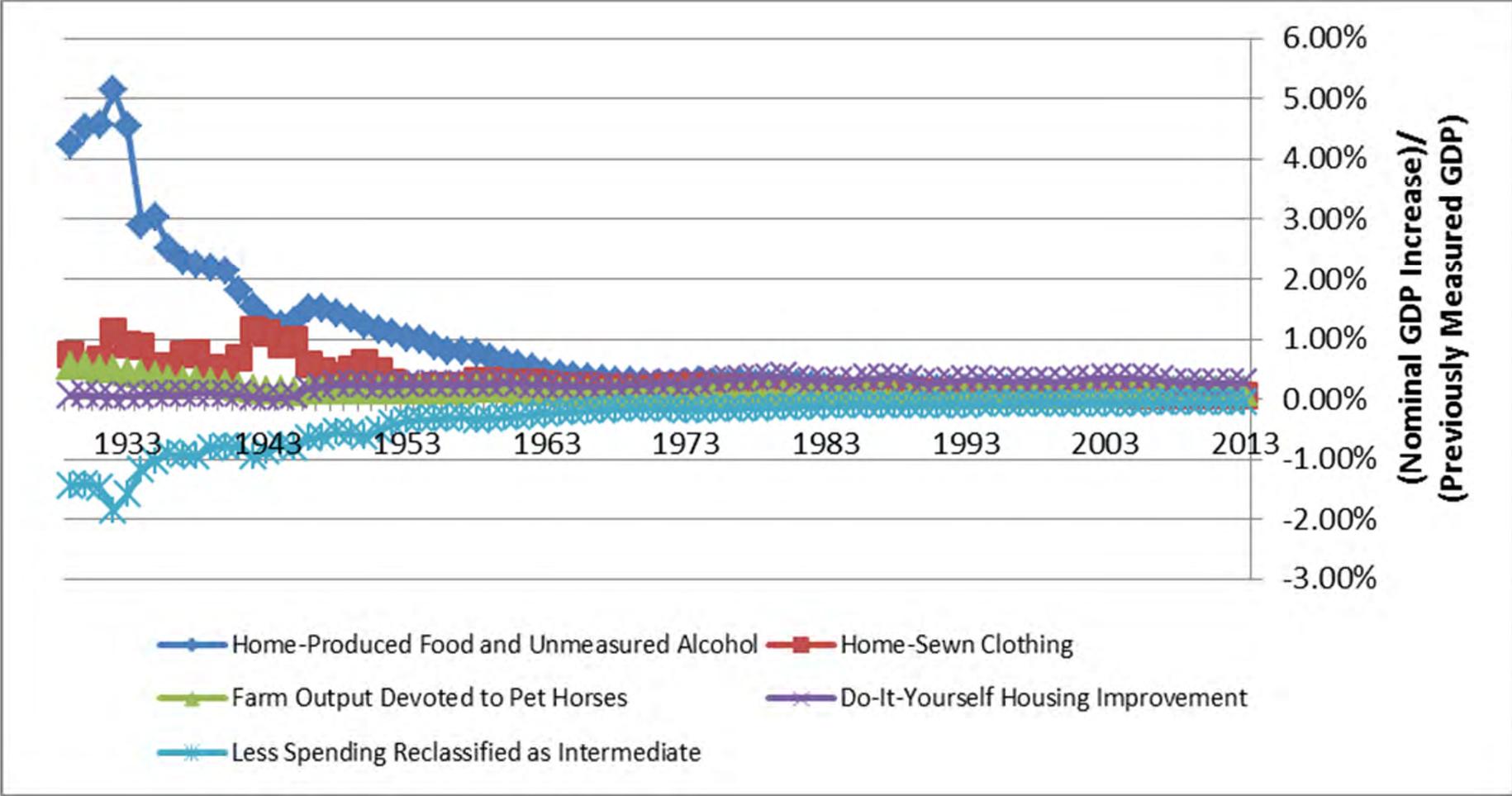
# Farm Output Devoted to Pet Horses

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- In 2012, U.S. farmers owned nearly 4 million horses
  - Since 1950, tractors and trucks have largely replaced horses for market work like plowing and harvesting. Only a few horses are still used by the Amish (for religious reasons) or for specialized work.
  - But the vast majority of modern farm horses are used for leisure riding or other non-market tasks.
  - I believe that these horses should be treated just like dogs, cats and other urban pets.
  - As a result, their food and other maintenance costs should be allocated almost entirely to final output.
- Historically, some farm horses were used for non-market work.
  - Farm households typically used horses for personal travel and other household production.
  - Conceptually, this is similar to modern small businesses which use the same vehicle for work and personal travel.
  - I allocate 25% of farm horse costs to final output.

# Historical Revisions to Nominal GDP



- Prohibition was repealed in 1934, so unmeasured alcohol dropped dramatically between 1933 and 1934.

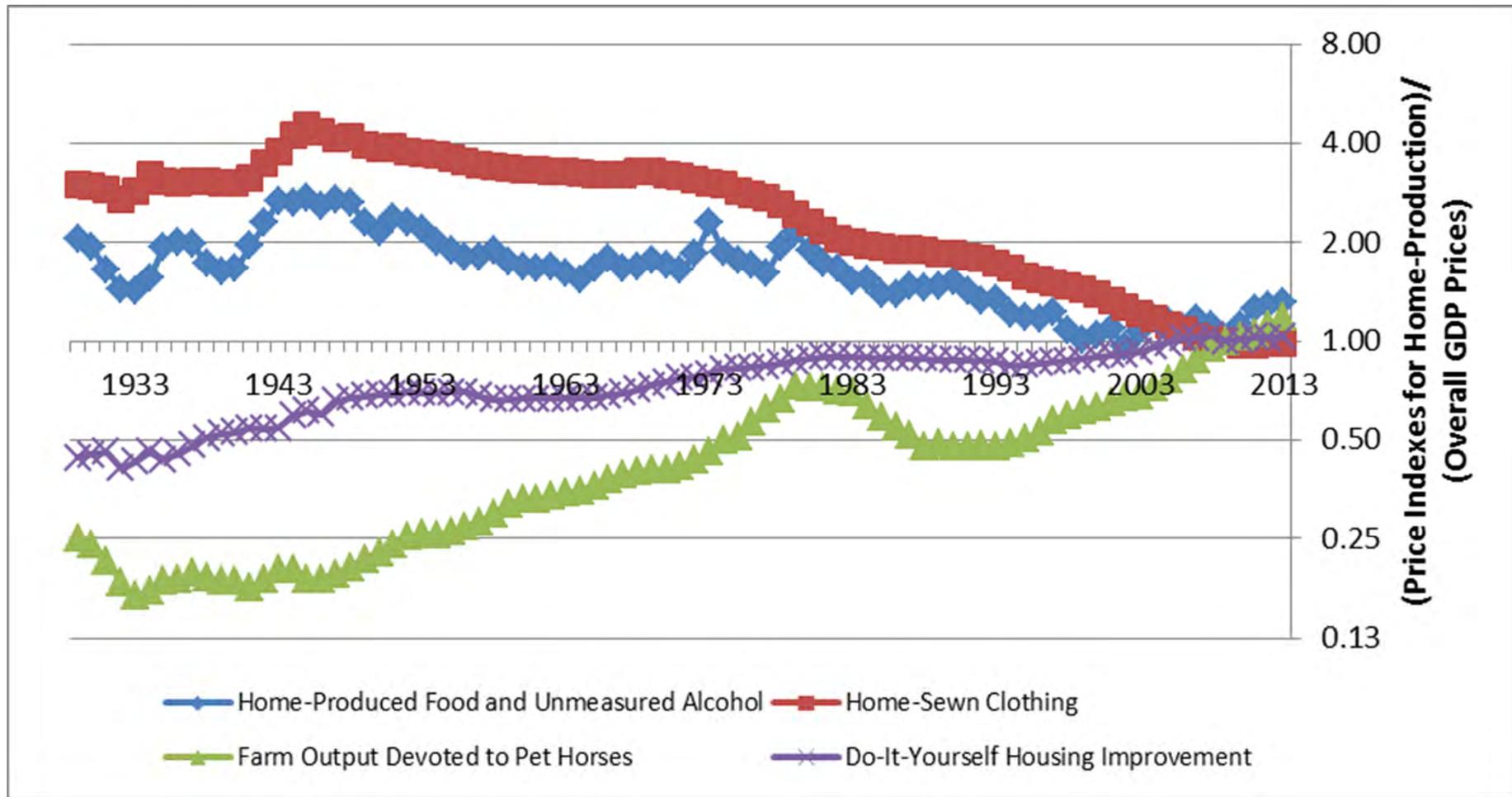
# Prices for Home-Produced Goods

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- Home-Produced Food
  - I use BEA’s existing price index for food produced and consumed on farms (Table 2.4.4, line 29).
  - Most of the food produced and consumed by farm households comes from small scale gardens similar to suburban gardens – so it is reasonable to use the same price index for both.
- Unmeasured Alcohol
  - It is very difficult to observe either prices or quality of alcohol during Prohibition.
  - For now, I use the same price index as home-produced food.
- Home-Sewn Clothing
  - I use BEA’s pre-existing price index for garments (Table 2.4.4, line 31).
- Farm Output for Pet Horses
  - In previous work on cultivated assets, I developed a price index for long-lived farm pastures. I use that same price index here.
  - Results are similar if I use hay prices or capital costs for farm buildings.

# Prices for Home Production



- Even though each category has its own price trends, the combined price index mostly tracks overall GDP prices.

# Small Secondary Businesses Run from Home

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- SNA 2008 includes all business revenue, even if the business owner does not report being self-employed.
  - Some full-time employees earn extra money from side businesses.
  - Retirees and students may also run businesses part time.
- Business categories studied here:
  - Resale of used goods by individuals
  - Rooming and boarding services by individuals
  - Home offices for workers.
  - Participating in paid surveys or experiments.
- In the United States, these income sources are typically not considered taxable income – and so they might be omitted from the current GDP statistics.

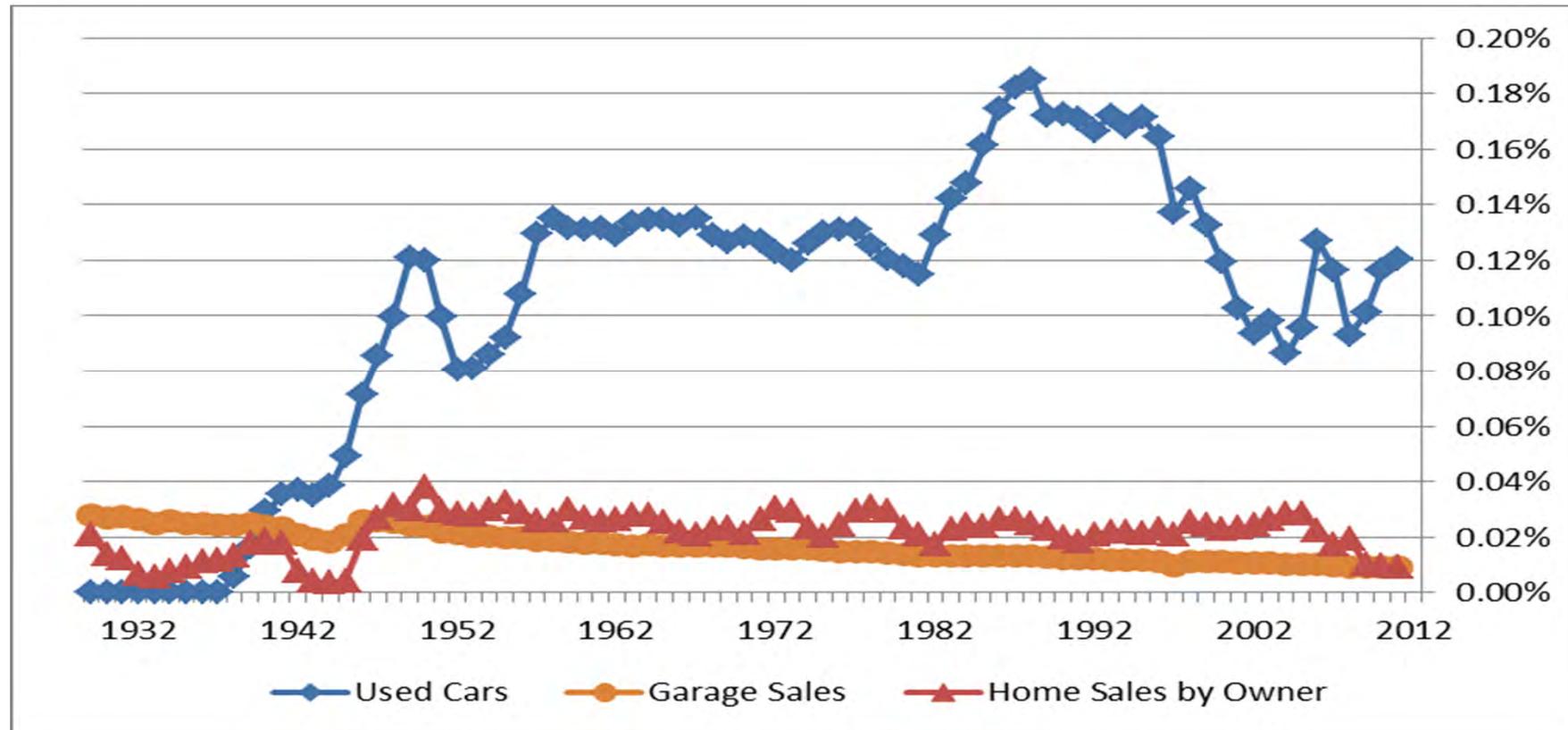
# Resale of Used Goods by Individuals

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- Selling goods is clearly a market activity, so it should be included in GDP even if the seller another job.
  - Like other retailers, only the margin is output.
- Most people resell items they already own
  - Used items are generally much less valuable than new items, so Sales Price < Original Purchase Cost
  - Value-Added = Sales Price – Wholesale Cost for Used Items
- Resale of used cars is especially easy to value
  - Value-Added = Sales Price – Dealer Price
- Clothing, toys and household items are harder
  - Value-Added is probably 75% or more of Sales Price
- Home Sales by Owners is also included.

# Nominal Retail Margin, relative to GDP



- Used Cars has good data, so the annual fluctuation is reliable after 1987
  - For the others, I use proxy variables.

- Short-term room rentals have always existed, but Airbnb and other websites have probably made them more common.
  - In the United States, income from renting less than 14 days per year is not taxable and so not tracked by the IRS at all.
  - Even individuals who rent for more than 14 days per year frequently fail to report their income to the IRS.
  - Unfortunately, I was not able to find any data on short-term rentals.
- In contrast, long-term room rentals are easy to identify from the Census's question on 'relationship to head of household'
  - Roomers only rented a room without meals
  - Boarders also received cooked meals
- Roomers/Boarders are different from roommates
  - Roommates tend to be equal partners renting jointly
  - Roomers/Boarders rent a single room from home-owners.
- Employees may also receive room & board

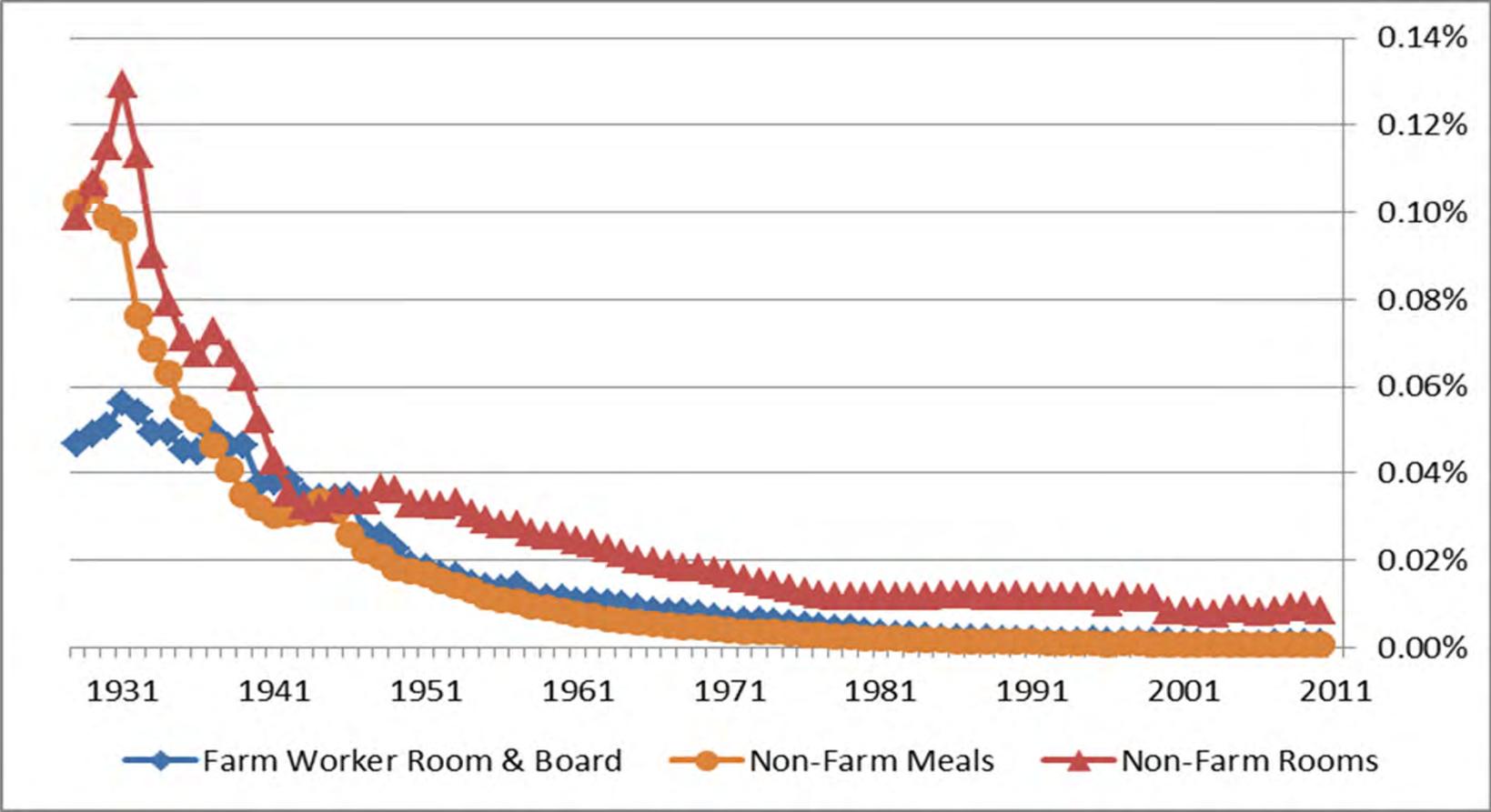
# Value-Added from Rooming/Boarding

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- For meals, Value-Added = 50% Revenue
  - I don't observe actual prices paid, but the USDA has good data on typical prices for farm meals.
  - ~40% is spent on food inputs, ~5% for utilities to cook the food & ~5% for space to eat the meal.
- For rooms, Value-added = 25% Revenue
  - I can't observe actual space rented by roomers.
  - I assume space is split evenly between home-owners and roomers. Roomers then pay a 25% mark-up.
- Employee treatment depends on industry
  - On farms, I assume that included housing is an in-kind benefit that should be included in GDP.
  - Domestic servants who live with their employers are generally given the housing for the convenience of the employer and this housing shouldn't be included in GDP (6.222c)

# Nominal Rooming/Boarding Services vs. GDP



- This graph doesn't include short-term room rentals, so it almost certainly underestimates total output.

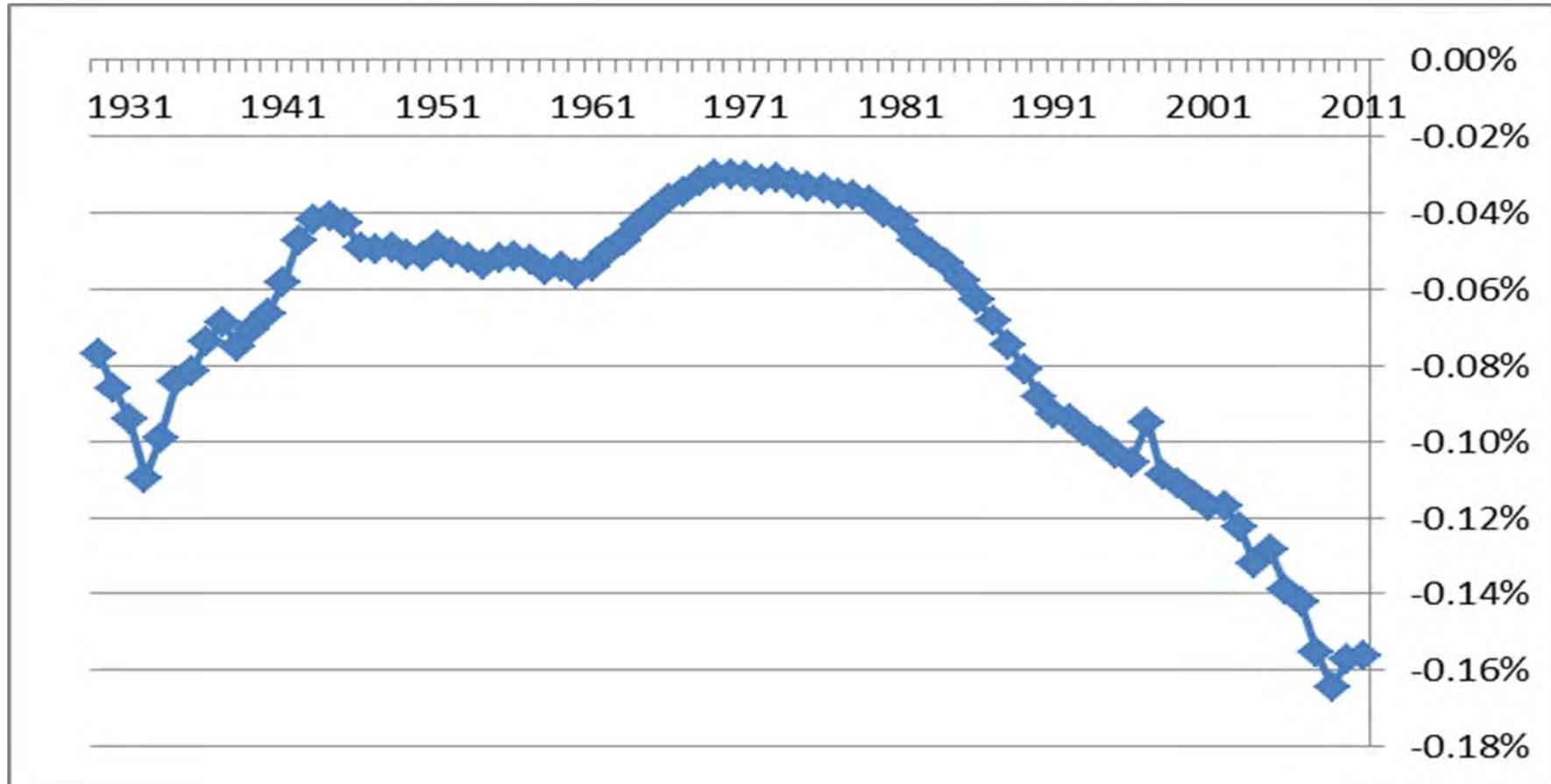
# Home Offices for Workers

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- Home-owners and renters often use a portion of their homes for businesses
  - When calculating self-employment income, the IRS (and BEA) subtract an implicit rent for the space.
  - BEA currently places 100% of residential housing in PCE. Home offices are an intermediate expense.
- I use the Census instead of IRS data
  - IRS calculates values based on purchase price rather than imputed rental rates
  - Some home-owners might report incorrect values or fail to claim deductions they're entitled to.
  - The IRS's data isn't available back to 1929.

# Nominal Home Office vs. GDP



- Unlike the other informal market activities, this adjustment is subtracted from GDP.
- In the past few decades, more people have been working at home

# Paid Surveys or Experiments

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- Companies often pay survey participants
  - Companies often use surveys to identify consumers and figure out how to appeal to them.
  - Some companies use competitions to generate new product ideas or marketing campaigns. These competitions frequently pay a few winners large amounts and the rest nothing.
- Medical experiments pay participants for time spent.
- Payments generally aren't reported as income.
  - Payments for individual surveys are generally below the IRS's reporting threshold, even though a few individuals may earn substantial amounts by participating in many surveys.
  - Medical ethicists often consider the payments to be compensation for inconvenience/pain rather than wage income.
  - Unfortunately, I was not able to find any data on this category.

# Conclusion

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- The SNA 2008 recommends that countries count do-it-yourself home improvement and home produced goods in GDP
  - The only category not explicitly mentioned is farm output for pet horses. But that category follows naturally from the treatment of dogs, cats and other urban companion animals.
- I focus on do-it-yourself home improvement
  - This category has the largest impact on recent GDP and the best data
  - Do-it-yourself investment tracks the overall housing bubble
- I also estimate home produced goods
  - Home-grown foods falls from 4% of GDP in 1929 to 0.1% in 2012
  - Home-sewn clothing also diminishes in importance
  - In contrast, farm output for pet horses has risen over time.
- Secondary businesses run from home are also worth study.
  - The business categories I found data on appear to be very small, so excluding them from output has little effect on aggregate GDP.