

UNSW Business School  
Centre for Applied Economic Research

# Money and the Measurement of Total Factor Productivity

W. Erwin Diewert and Kevin J. Fox

“Financial Services Indices, Liquidity and Economic Activity” Conference  
Bank of England, 23-24 May 2017

# Overview

- **Examine the holding of cash balances by firms, representing underutilized resources**
- **Explore implications for the measurement of productivity.**
- **Application to the US**

# Why hold cash balances?

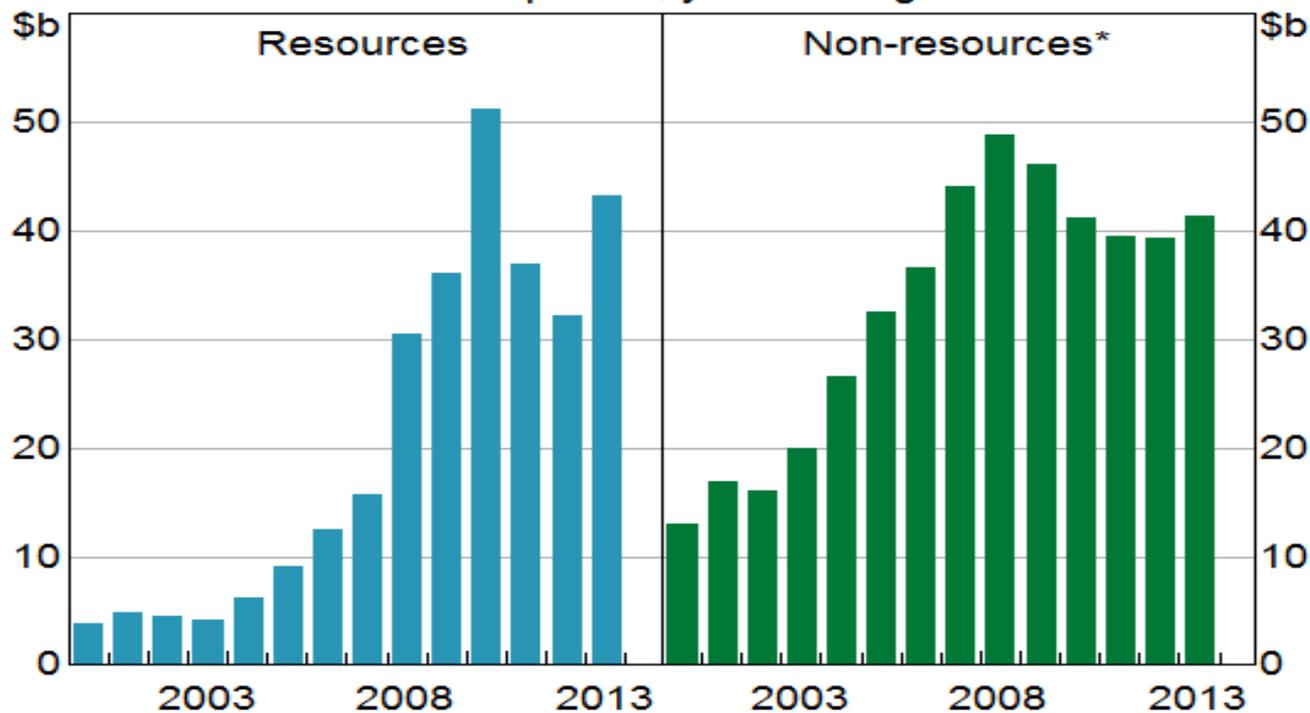
Motivations for holding such liquid assets, rather than e.g. investment assets, include:

- The need to cover immediate commitments (such as payments to suppliers, and the payment of dividends).
- Unexpected contingencies.
- Investment purchases.

These assets represent underutilised resources. If a firm can effectively keep such low-yield balances to a minimum, it can invest in higher return assets, such as physical capital that can produce more output.

# Cash Holdings by Sector

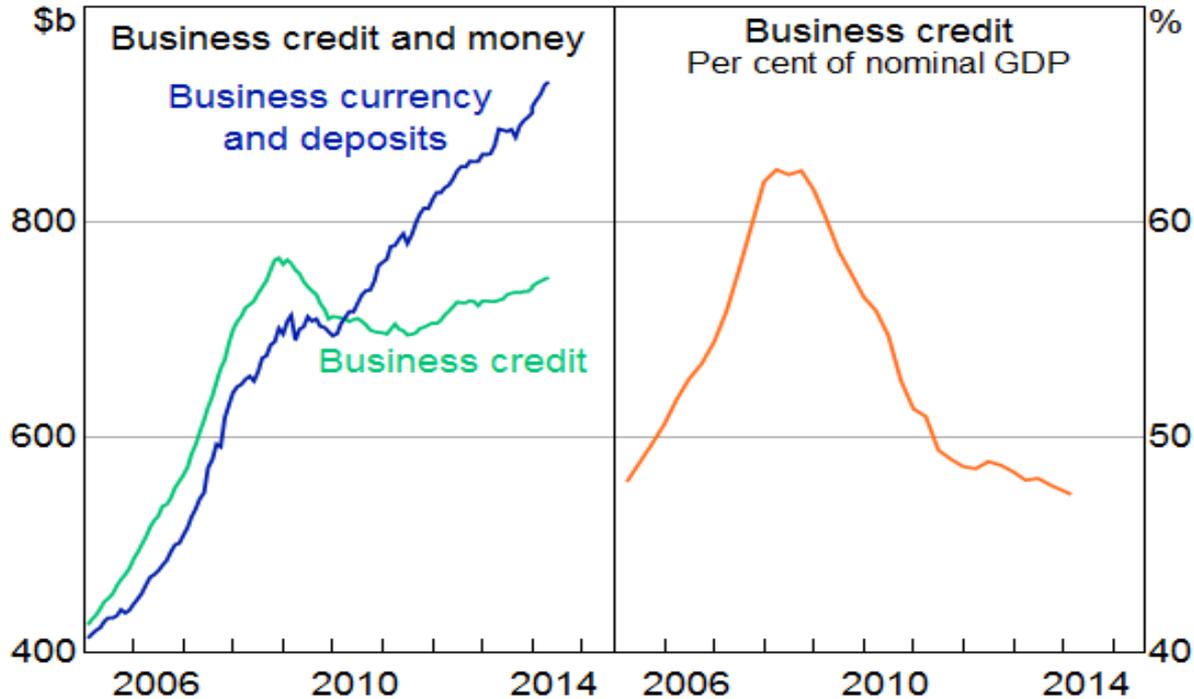
Listed companies, year-end figures



\* Infrastructure companies are double counted within the other cyclical and non-cyclical sectors

Sources: Bloomberg; Morningstar; RBA

# Business Finances



Sources: ABS; APRA; RBA

Glenn Stevens, RBA Governor, "The Economic Scene", address to CEDA Luncheon, Adelaide - 3 September 2014

<http://www.rba.gov.au/speeches/2014/sp-gov-030914.html>: "This data includes fund managers' holdings of cash assets, which from other data appear to have risen by close to \$200 billion since 2006. But overall, this comparison suggests a very marked improvement in the liquidity of the business (and fund management) sectors' balance sheet over the past five years."

# Cash Balances and Productivity

“My conclusion would be that many businesses are in a position to play their part in the growth dynamic over time.

“This is not some call for business leaders to play a role in driving growth out of a public-spirited desire to help the economy.... **My argument simply is that, at some point, it is going to be in the interests of the owners for investment to take place in new technologies, better processes, new lines of business and, in time, more capacity.** At some stage, the equity analysts, shareholders, fund managers, commentators and so on will want to be asking not ‘where's your cost cutting or capital return plan?’, but **‘where's your growth plan?’**”

Glenn Stevens, RBA Governor, “The Economic Scene”, address to CEDA Luncheon, Adelaide - 3 September 2014  
<http://www.rba.gov.au/speeches/2014/sp-gov-030914.html>

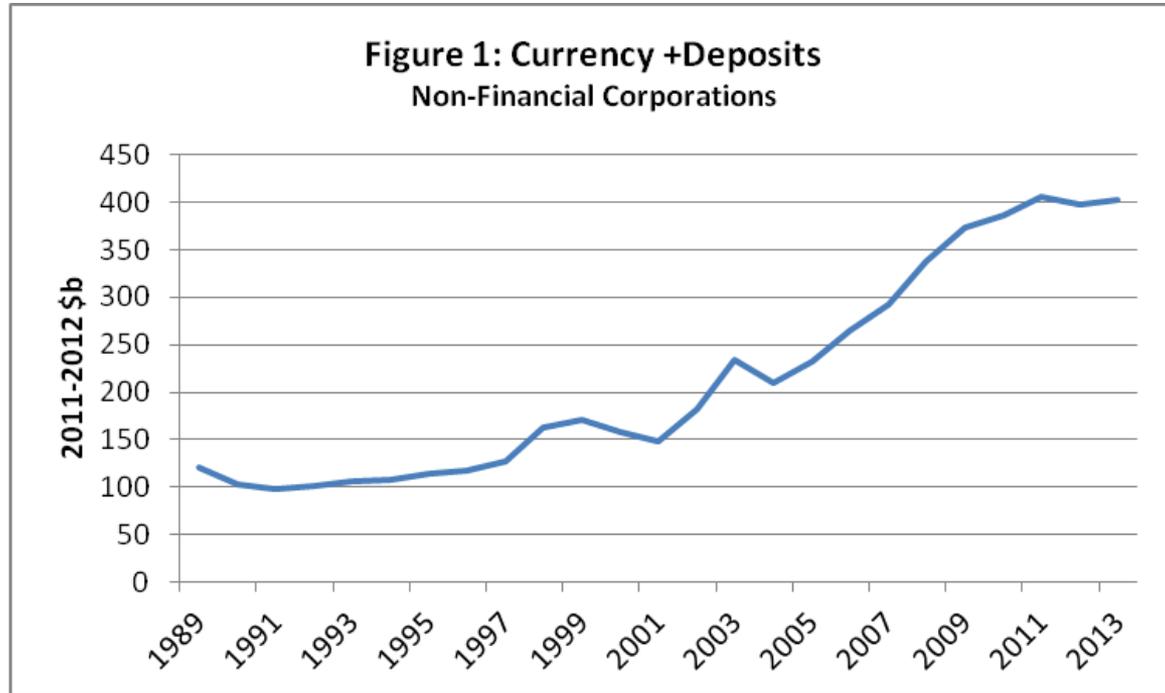
# Cash Balances and Productivity

- In times of uncertainty, such as during a financial crisis or a change in government policies, firms may choose to hold more **precautionary cash balances**. (IMF, 2014)
- An increase in unproductive cash holdings can then potentially **lower investment, output and productivity**.
- In assessing a firm's performance, ignoring cash holdings as an asset can then give a **misrepresentation of its productivity performance**.

# Money in the Production Function?

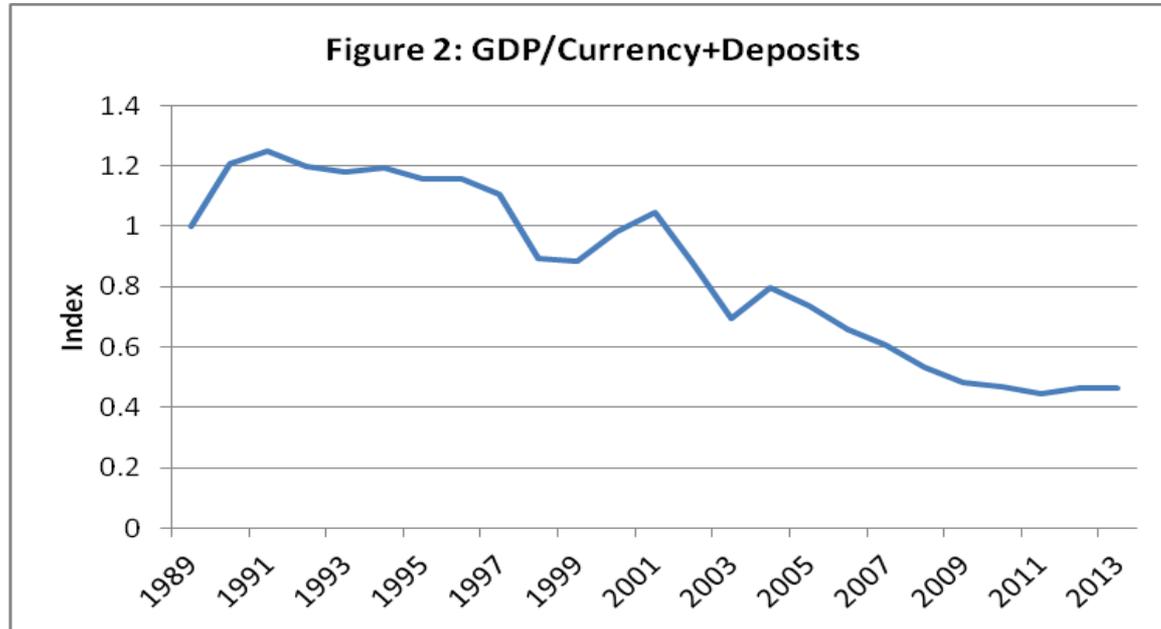
- Johnson (1969), Stein (1970), Friedman (1969), Bailey (1971)
- “an economy without money would have to devote effort in order to devote effort in order to achieve the multitude of ‘double coincidences – of buyers who want exactly what the seller has to offer – on which successful barter is based” (Levhari and Patinkin, 1968, 737-738).
- Moroney (1972): as an exchange innovation, money has broader implications than can be obtained from specifying money as an input.
- Davidson (1979): “there is no elasticity of substitution between money and real capital or labor services along an isoquant” (p.281)
- Fischer (1974): difficult to construct an index of money that measures the saving of resources from its use.
- Empirical support for the inclusion of money in the aggregate production function: Sinai and Stokes (1972), Khan and Kouri (1975), Short (1979). At disaggregate level, Nadiri (1969), Dennis and Smith (1978)
- Nguyen (1986): “money plays a role, not as an input, but as a factor whose growth rate contributes to productivity growth” (p. 150)

# Example: Cash Balances, Australia



Data sources: Australian System of National Accounts, 2012-13, Cat. No. 5204.0 Table 20 and Cat. No. 6401 - Consumer Price Index, All Groups CPI.

# Example: Cash Balances and Productivity



Additional data source: Australian System of National Accounts, 2012-13, Cat. No. 5204.0 Table 1.

Ratio falls more than 50% between 1989-90 and 2012-13

# Conceptual Issues and Data

A key issue is determining an **appropriate deflator for cash balances** (Fischer, 1974). The above data used the Consumer Price Index (CPI), but this is only one possible choice.

**Intermediate inputs price index:** Firms hold cash balances to pay suppliers, so an intermediate inputs price index appears to be a reasonable choice.

**Labour wages:** Cash is held to cover wage commitments.

**Capital price index:** Cash is held in preparation for capital purchases.

**Consumption price index** (such as, but not necessarily, the Consumer Price Index): Firms may be holding funds in trust for shareholders as they want to pay a dividend.

# Conceptual Issues and Data

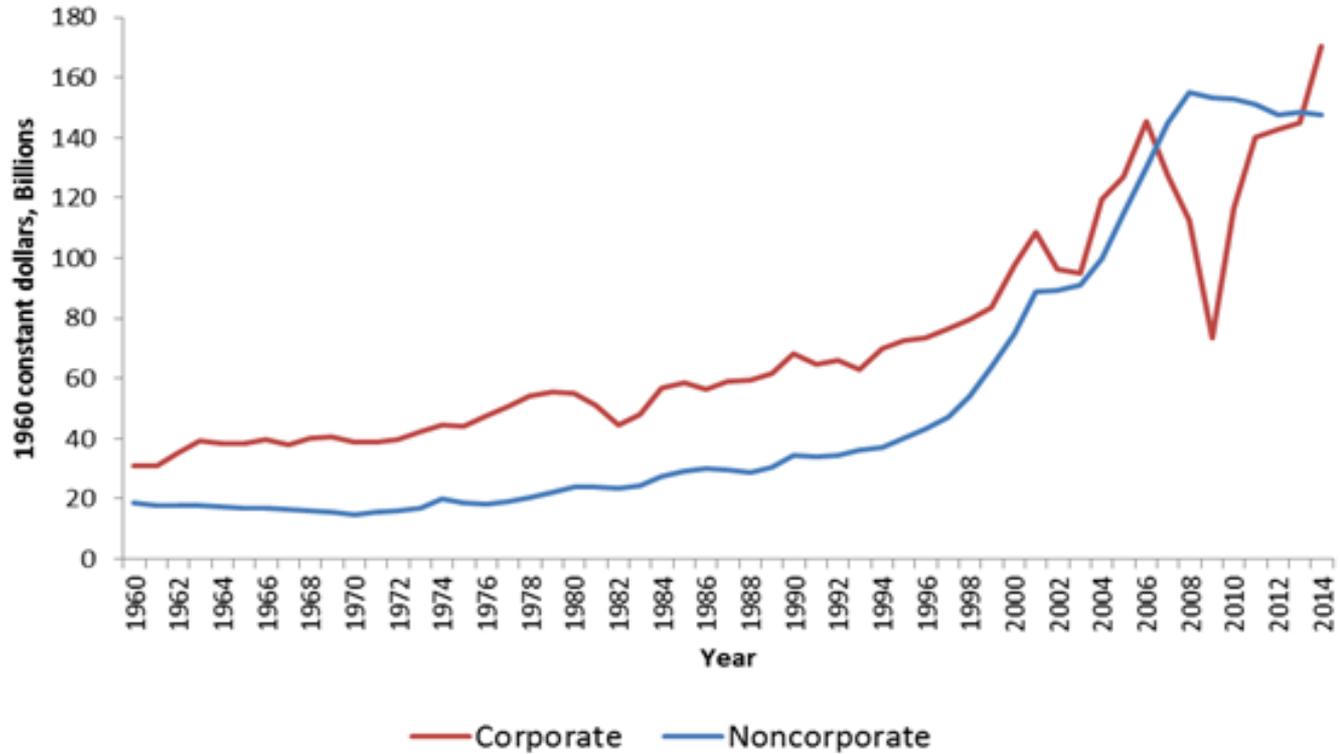
Another issue to consider is the manner in which to aggregate over different classes of assets with varying degrees of liquidity. (We leave this to future research.)

For the US, use the BEA Integrated Macroeconomic Accounts:

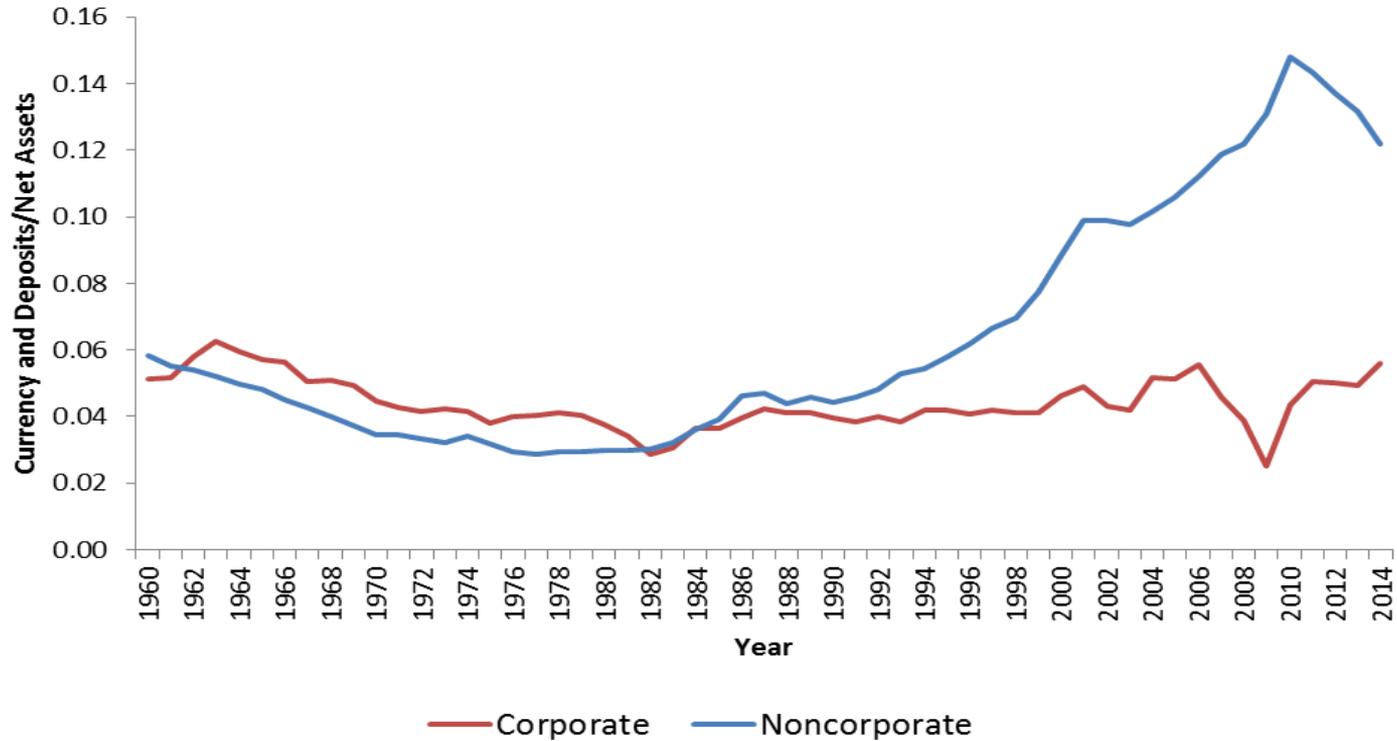
“They are part of an interagency effort to further harmonize the BEA National Income and Product Accounts (NIPAs) and the Federal Reserve Board Financial Accounts of the United States (FAUS).”

We focus on private business sector: **(1) Nonfinancial corporate; (2) Nonfinancial noncorporate**

# U.S. Real Currency and Deposits



# Ratio of Currency and Deposits to Net Assets



# A Noncorporate Phenomenon

- The previous figure reveals that the increase is a particular puzzle for the noncorporate sector.
- There is a dramatic deviation in ratios for the two sectors from the early 1990s.
- **It is not a phenomenon of behavior of multinationals in the corporate sector, or R&D intensive firms, but rather primarily of the noncorporate sector.**
- These firms are typically not under pressure from the “equity analysts, shareholders, fund managers, commentators and so on” mentioned in the Glenn Stevens quote.

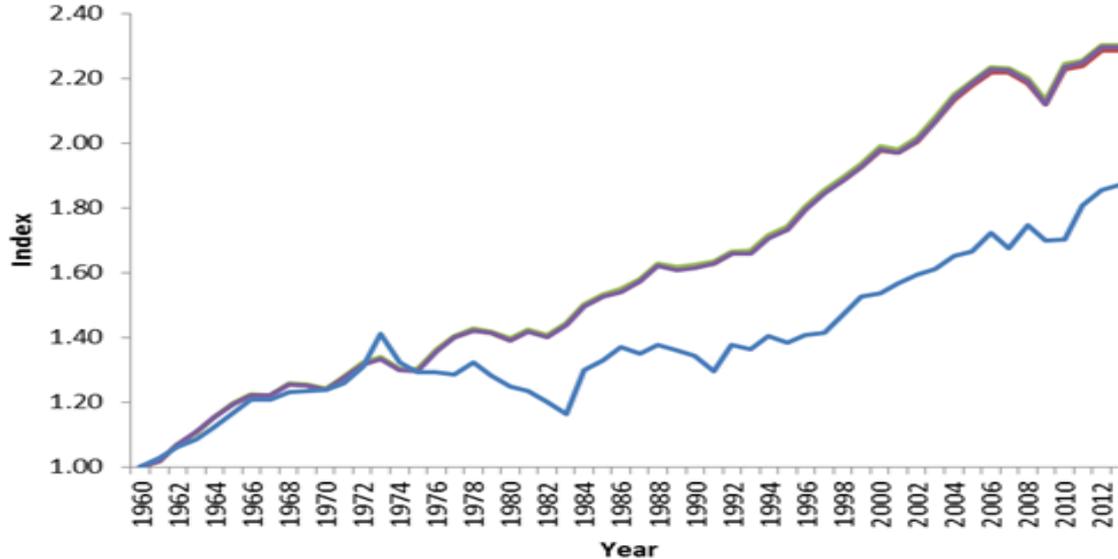
# Total Factor Productivity

- $TFP = (\text{Real Value Added}) / (\text{Törnqvist quantity index of inputs})$
- **Capital stock:** equipment, intellectual property products, nonresidential and residential structures, inventory stocks, land and holdings of currency and deposits.
- **Capital services** are constructed using a standard user cost approach, using BEA depreciation rates, endogenous (balancing) real rates of return and *ex post* inflation rates.
- **Some user costs were negative and user costs should not be negative!** So considered smoothed inflation rates in the calculation of user costs to remedy this problem.

# Total Factor Productivity

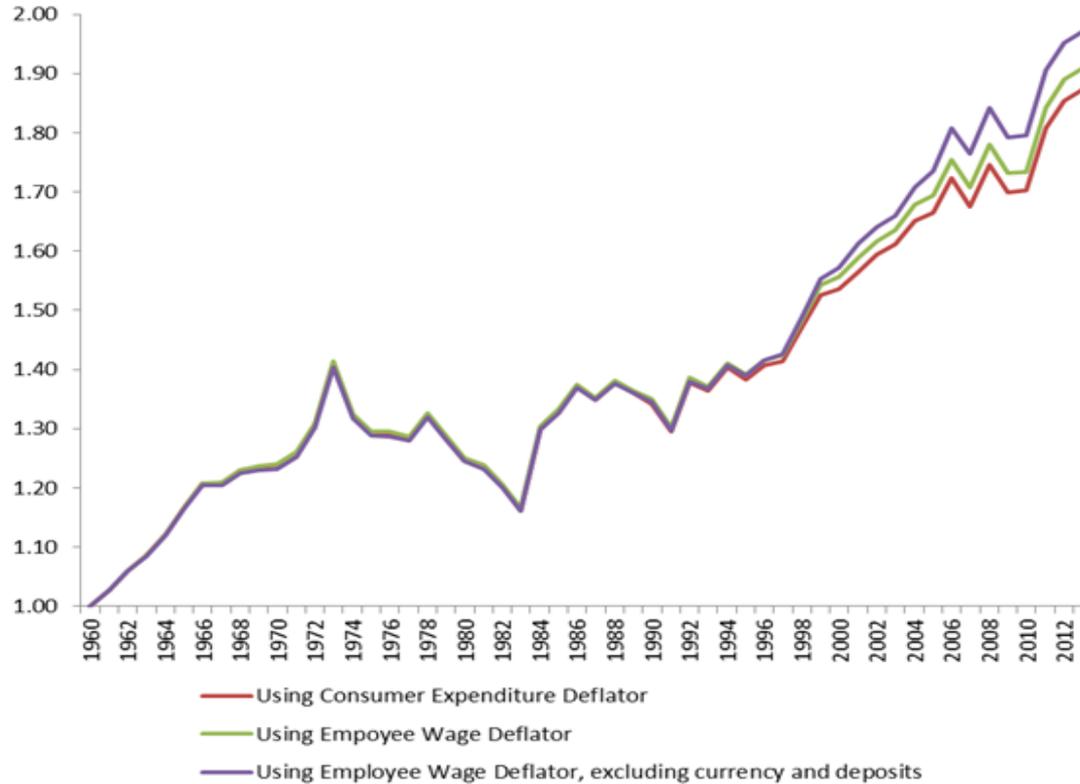
- **Labour: (non-quality-adjusted) hours worked, allowing us to calculate the average full-time wage rates (which we assume to be constant across the corporate and noncorporate sectors) from the total value of employee compensation.**
- **Assume that the self employed hours works are constant over the sample (as don't have actual data), and that they earn the annual private sector average full time wage.**
- **Take out self employed in Finance and Insurance (as looking at nonfinancial firms).**
- **Self employment imputation doesn't include unpaid family members.**

# TFP, Corporate and Noncorporate Sectors



- Corporate, Using Consumer Expenditure Deflator
- Corporate, Using Employee Wage Deflator
- Corporate, Using Employee Wage Deflator, excluding currency and deposits
- Noncorporate, Using Consumer Expenditure Deflator

# TFP, Noncorporate Sector



# Estimation of Cost Functions

Some results so far:

- CES for Noncoporate Nonfinancial Sector, single time trend: **Elasticity of substitution of 1/3.**
- CES with splines in the time trend (six break points): **Fit is much better, but elasticity is still around 1/3.**
- Leontief with equation specific time trend splines
- Normalized Quadratic cost function

# Conclusions

- Adding monetary balances to the list of assets (and treating these holdings as inventory items) does not change the productivity picture to any great extent for the corporate sector.
- This is because, even though there is some variation, the asset share is relatively small.
- **The impact on the noncorporate sector is larger**, especially in the latter decades of the sample, when currency and deposit holdings increased substantially.

# Conclusions

- *Ex post*, empirically it may make little difference to productivity growth estimates in most years at the aggregate level, but **this should not be a justification for its *ex ante* exclusion.**
- The relative **productivity of individual firms can be significantly impacted by differences in money holdings**, even if there is little aggregate effect at the sectoral level.
- Understanding **productivity differences between small and large firms** can be enhanced by taking into account currency and deposits; **small firms are often credit constrained** and therefore have greater cash holdings (IMF, 2014).

# Conclusions

- Accounting for cash holdings can provide an augmented understanding of productivity and profitability in **studies of firm dynamics**.
- Understanding **productivity differences between risky and less risky sectors and firms can be informed by differences in money balances**, where e.g. dependence on R&D is taken as a proxy for risk (Sánchez and Yurdagul, 2013).
- Preliminary estimation of cost functions: **elasticity of substitution of around 1/3**, much lower than typically used by macroeconomists.