Home productivity

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ABSTRACT

This paper documents novel facts about the household sector to guide macroeconomic modeling, including the first estimates of aggregate U.S. home productivity. I derive the theoretically correct prices required to impute home production value added and productivity and apply this method to estimate annual U.S. home production accounts from 1929 to 2010. Both labor productivity and technical change grew steadily after World War Two, but slowed after the late-1970s. Capital intensity increased in the late-1970s due to increased consumer durables holdings, suggesting that the home production function must allow for more substitutability between capital and labor than Cobb–Douglas. Including home production significantly reduces the shift from goods to services production relative to published GDP. The productivity slowdown coincides with a shift to market services, suggesting that it was slower – not faster – home productivity that encouraged shifting production out of the home.

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1. Introduction

Home production is fundamentally linked to many current issues in macroeconomics. For example, analyzing the enormous increase in U.S. female labor force participation (LFP) without making reference to home production misses a significant part of that transition. Women historically specialized in home production, so their choice to increase market hours is also a choice to reduce home hours. Models that seek to explain this change need to know the returns to working both in the market and the home. This question is only one portion of a large theoretical literature that has included home production to answer macroeconomic questions.[1]

However, there is little direct data to guide modeling of the household sector. Practical considerations caused economic statisticians to exclude it from the National Income and Product Accounts (NIPAs).[2] Therefore, models must be parameterized without the discipline of data and the literature must resort to ad hoc assumptions. For example, Rogerson (2008) argues that the household sector is essential to understanding different labor market outcomes in the United States

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[1] Important contributions include Benhabib et al. (1991) and Greenwood and Hercowitz (1991) on business cycles, Parente et al. (2000) on the welfare costs of growth distortions and Rupert et al. (2000) on labor supply elasticities. Greenwood et al. (1995) surveys its inclusion in macroeconomic models. Recent work includes Aruoba et al. (2012), Aguiar et al. (2013) and Karabarbounis (2012).

[2] It was a concern during the original work on national income measurement (Kuznets, 1934). See Abraham and Mackie (2005) for an overview of the measurement issues and Gronau (1986, 1997) for surveys of more recent work.

compared to Europe. Since "measures of home sector productivity do not exist," he must use an imprecisely estimated elasticity parameter to back out this productivity.[3]

This paper fills this gap by documenting novel facts about the household sector to guide macroeconomic modeling, including the first aggregate estimates of labor productivity and technical change for home production in the United States. Using a standard macroeconomic model, I show that the theoretically correct returns needed to impute the value of home production can be found in the market. I solve the model assuming that home consumption is produced by market firms to find the market prices that correspond to the returns to the household factors of production. I then show that this equilibrium is equivalent to the one where home consumption is produced by the household. Using these theoretical results, I calculate annual home production, labor productivity and technical change for the United States from 1929 to 2010.

I find that home production compared to market production has generally declined in importance. However, its importance fluctuated significantly during the dislocations of the Great Depression and World War Two. If home production were included in GDP, it would have been 57 percent higher in the depths of the depression (1932) but only 30 percent higher at the beginning of U.S. involvement in World War Two (1942).

Home productivity grew at a rate similar to that of the market economy in the postwar period until the 1970s. Home labor productivity grew an average of 2.5 percent a year during the period 1948–1977, outpacing the 2.1 percent rate in market production. There is a severe slowdown in home productivity in the late-1970s. Labor productivity was nearly flat, growing an average of only 0.1 percent from 1978 to 2010. In contrast, market labor productivity grew 1.6 percent annually. I also find a slowdown in the growth of technical change. Like labor productivity, there was strong post-war growth up to 1978. Since then technical change has declined slightly, falling 0.1 percent annually off its 1978 peak.

My evidence can both help select appropriate models and parameter values and allow for richer detail within the household sector. For example, it helps in selecting functional forms for home production. I find significant shifts in how the household sector produces output. Labor has been progressively replaced by capital since 1978: Labor share fell from 0.64 to 0.54. Most of this decline is due to the growth of consumer durables stocks. This large change in labor share suggests that the household sector's production function must allow for substitutability between capital and labor, such as the CES form proposed by Greenwood and Hercowitz (1991), rather than Cobb–Douglas.

I also show how these estimates can help us understand the increase in female LFP. I show that productivity slowdown coincides with a shift in the source of services production. Increasingly, services that had been produced at home were purchased in the market. A consequence of this "marketization" is that a portion the observed structural shift from goods to services production is a reallocation of home to market produced services. Structural change is much less pronounced if home production is included. From 1929 to 2010, goods share of output only fell 14 percentage points with home production as opposed to 23 percentage points when it is excluded (assuming all household production makes services).

The increase in marketization and the slowdown in home productivity growth may be linked. A slowdown in home productivity will lead to a shift to the more productive market sector if home and market produced services are substitutes. The evidence suggests that this is the case within broad sectors like services. Perhaps it was slower home productivity, not faster as is often emphasized, that encouraged marketization and increasing female LFP. This mechanism was emphasized by Moro et al. (2015).

Home sector productivity is a topic that is rarely covered directly in the previous literature. As discussed above, a number of papers use models to back out home productivity. These papers are not interested in home productivity specifically, but use it as an input to answer other questions. An exception is Fang and Zhu (2012), which uses a model to identify productivity growth from changes in household time use. They also find a slowdown in the 1980s despite significant differences in methodology and sample. I compare their findings with mine in detail below.

The estimates help fill in the historical record on the size of home production by providing the better part of a century of consistent data. My estimates build on work done by researchers at the Bureau of Economic Analysis (BEA) (Landefeld and McCulla, 2000; Landefeld et al., 2009; Bridgman et al., 2012). These estimates only go back to 1946, while mine goes back to 1929. Other historical estimates include Eisner (1989) and Folbre and Wagman (1993). These estimates cover earlier time periods, very early (the 19th century) in the case of Folbre and Wagman (1993). International comparisons include Chadeau (2008), Ahmad and Koh (2011), and Schreyer and Diewert (2014). Bridgman et al. (2015) extends my methodology to 34 countries to form a comparable panel of home production and productivity estimates.

2. Methodology

This section lays out the methodology for the estimates of household production. I begin with a model that shows the theoretical justification for the imputations used in the estimation and provides a quantitative framework to organize the analysis. I then describe how the estimates were constructed.

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[3] A number of papers have already used the results from an earlier version of this paper, including Ngai and Petrongolo (2014) and Duernecker and Herrendorf (2015).