Consumption of Media Products: Implications for Productivity and Inequality

NBER-Nielsen Media proposal by Ethan Ilzetzki, Loukas Karabarbounis, and Arlene Wong.

Research questions

Over the past decade, measured labor productivity growth in the U.S. has slowed significantly, from an annual growth rate of 2.8% over 1995-2004 to 1.3% over 2005-2015. At the same time, the U.S. has seen a steady rise in income and consumption inequality. What caused the slowdown in measured productivity? What are the implications for the standards of living of individuals at different parts of the income distribution? Answering these questions is critical for understanding the process of economic growth and for evaluating and designing policies to promote growth and social welfare.

There is an ongoing debate about the causes of the productivity slowdown and the extent to which consumption inequality has increased.[1] In this project we evaluate the extent to which the productivity slowdown and increases in consumption inequality reflect mismeasurement. Standard output measures from the national income and product accounts and hours worked measures from survey or establishment data do not fully capture the changes in media consumption during the digital age, during and outside work hours. The BLS attempts to adjust for quality and for new products in the national income accounts, but these adjustments only partially account for these changes.[2] In addition, new technologies have have lowered the cost of media consumption during working hours, raising the possibility that effective hours worked are mismeasured. The purpose of this project is to empirically quantify the implications of media consumption for measured aggregate productivity and measured income and consumption inequality. Specifically, the project will address the following research questions:

- How do consumers substitute between different forms of media and between media and other consumption and time uses? Have the patterns of substitution between media and non media consumption and time uses changed over time?
- How have media products changed effective hours worked and work conditions and what are the implications for welfare-relevant measures of wages per hour worked?
- Adjusting for the value of media products, how much has true labor productivity deviated from standard measures?
- What are the implications of these adjustments for consumption and wage inequality?

Estimating the value of new media products on and off the job is a challenging task. For many of these goods, direct expenses are relatively low and marginal costs are zero. The cost of these activities consists mainly of the opportunity cost of time. Therefore, for these goods, estimating price elasticities is difficult, and requires combined information about prices, time spent using the product, and consumption of different items at sufficiently disaggregated levels. We are not the first to look at the question of the mismeasurement

[1] See for example, Fernald (2014), Syverson (2016), and Aghion et al (2017) for various views.
[2] See for example Bils and Klenow (2001) and Nevo (2003) for a discussion of the issues.

of productivity and the value of new products.[3] However, the unique information from the Nielsen data allows us to overcome many data challenges that faced past studies and to make two key advancements to the existing literature on the measurement of productivity and consumption inequality:

- First, we will use Nielsen information on time spent (on websites, apps, television, radio), combined with consumption data for different demographic groups. This allows us to empirically estimate potential complementarities between consumption and leisure across a broad set of products. Studies in the past often focus either on narrow product categories where data on both expenditure and time use are jointly available[4], or only have time use data and not consumption data and therefore need to assume separability between consumption and leisure.[5]

  The main alternative dataset for the U.S. with a broad set of time uses is the American Time Use Survey (ATUS). Using data from the ATUS, the literature has documented the substitutability between home production, leisure, and market work (Aguiar, Hurst, and Karabarbounis, 2013). However, the information is provided at fairly aggregated levels. The Nielsen Data provides disaggregated information about particular TV programs and websites allowing us to estimate cross-product elasticities.

- Second, we will also examine a novel dimension of productivity measurement that has received less attention in existing literature, which we refer to as "leisure-on-the-job". To see how the marginal cost of an hour of work may vary with the presence of a new social media product, consider for example, the regular work day of a receptionist at a hotel. The receptionist needs to be present throughout the day for any arriving guests. With the invention of the smartphone, it is now possible to connect with friends during quiet times when there are no guests, whereas previously those quiet times may not have been utilized. The introduction of a smartphone and the ability to derive "leisure-on-the-job" would therefore, all else equal, lead to higher utility-adjusted wage than the raw measured wage. In other occupations with less down time, leisure on the job may also affect effective hours worked.

Our hope is that our empirical results will provide novel insights into the value of consumption adjusted for the utility from media consumption, the marginal cost of an hour of work, and aggregate productivity. These will be key inputs in determining the causes of the aggregate productivity slowdown, in measuring changes in inequality, and in evaluating policies aimed toward mitigating these trends.

Data

Table 1 summarizes the Nielsen media datasets that we plan to use. Other outside data we will use include the American Time Use Survey for non-media time use, CPS data on hourly wages and total hours, BEA data on GDP, Consumer Expenditure Survey data, and BLS price data.[6]

The data we plan to use from Nielsen include: (i) major websites and (ii) major apps (grouped by common type, e.g. news, social media, games, etc.) from the Nielsen modules on home and work computer and smartphones, (iii) TV from the Nielsen Advanced TV module, (iv) radio listening from the Nielsen

[3] See for example, Nevo (2001), Goolsbee and Klenow (2006), and Fernald (2014) for recent examples.
[4] For example, Goolsbee and Klenow (2006) focus on internet usage only.
[5] For example, Aguiar et al (2017) assume separability of consumption and leisure in the absence of consumption data.
[6] We have access to the confidential BLS micro CPI data, which gives price information at very disaggregated product levels.

radio module, (v) expenditure on other items, from the Scarbourough Survey. One useful split of the data is by work-hours (9am-5pm, weekdays) and non-work hours (as noted in Table 1). The split of the data by day-parts is available for radio and television use. From the description of the underlying data it appears that it could be possible to compile similar tables for the computer and smartphone modules. We are happy to work with Nielsen and devote resources to create this dataset if necessarily. An alternative measure we are also considering for obtaining the use of goods during work and non-work hours is to combine total time use data from Nielsen on different apps and sites with external (non-Nielsen) information, for example, the fraction of Twitter reports by hour, fraction of Instagram reports by hour, Facebook shares by hour, etc.

Table 1: List of Nielsen media datasets requested

Nielsen data	Metrics	Splits	Time frame
1 Home and work computer	Average frequency per user and average time spent per site	For each of the top 1000 sites, metrics by demographic groups, and usual time at work (9-5 weekdays) and times outside of this	Historical data for past 27 months.
2 Smartphone /tablet	Average frequency per user and average time spent per site and app	For each of the top 1000 sites and apps: metrics by demographic groups, and usual time at work (9-5 weekdays) and times outside of this	Historical data for past 27 months.
3 Advanced TV	"Average quarter-hour persons" (fraction of people viewing)	For each SVOD Status (Netflix, Amazon Prime, Hulu Plus homes): metrics by demographic groups, listening location (work and not at work), radio market, and time of day by daypart (i.e. early morning, workday, evening, weekday and	Historical data back to 2010.
4 Radio	Percent of people viewing ("US AA%" Total US Average Audience Percent)	By demographic groups and time of day ("daypart" i.e. early morning, workday, evening, weekday and weekends)	Historical data back to 2010.
5 Scarbourough Survey	Expenditure by major "buy categories"	By demographic groups	Historical data where available

Our general approach for using the data is as follows. We will model households' consumption choice between different types of goods. Consumption of the good involves time and market spending. This is in the spirit of Becker (1965) and more recently Aguiar and Hurst (2005) and Goolsbee and Klenow (2006). We extend this analysis by allowing for the possibility of consumption of these items during work hours. Combining Nielsen data with prices from the BLS CPI database, we will exploit the cross-sectional data (by demographics) to estimate the elasticities of substitution between different items and time, as well as cross-good elasticities of substitution. Using the estimated coefficients, we will then compute output adjusted for media consumption for the aggregate economy and for different demographic groups. This allows us to compute aggregate productivity and cross-sectional moments.

Research dissemination

The research will be written as a series of one or more academic papers that will be presented in seminars at academic and policy institutions and will be submitted for publication to academic journals.

Financial resources

We plan to submit proposals at our home institutions to utilize and complement the NBER resources. Specifically we plan to inquire for resources from (i) the Centre for Macroeconomics at the London School of Economics, (ii) the Heller-Hurwicz Economics Institute at the University of Minnesota, and (iii) the Louis Simpson Center at Princeton University. Finally, we plan to inquire whether the Federal Reserve Bank of Minneapolis would be interested in contributing resources through its new initiative, the Opportunity and Inclusive Growth Institute.

Researchers

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