Measuring the 'Free' Digital Economy within the GDP and Productivity Accounts

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We develop an experimental methodology that values 'free' digital content through the lens of a production account and is consistent with the framework of the national accounts. We build upon the work in Nakamura et al, 2016, by combining marketing and advertising supported content and find that the impact of 'free' digital content on US GDP has accelerated in recent years, particularly since 2005. However, the explosion in 'free' digital content is partially offset by a decrease in 'free' print content like newspapers. Including these, real GDP growth would grow at 1.53 percent a year from 2005 to 2015 rather than the official growth rate of 1.42 percent, a tenth of a percent faster. Thus there is a substantive impact on 2005 to 2015 real growth, even when we do not measure the full consumer surplus benefits of free goods. In addition, from 1995 to 2005 real GDP growth including 'free' content would grow 0.07 percentage points faster, and in the earlier period from 1929 to 1995 0.01 percentage points faster. We further find that the PCE and core PCE deflators would have risen about 0.1 percentage points slower from 2005 to 2015. To analyze the impact of 'free' content on measured private business TFP growth, we account for inputs of 'free' content used in production. We find that TFP would grow faster by 0.08 percentage points per year from 2005 to 2014 and faster by 0.07 percentage points from 1995 to 2005.

The first contribution of this paper is to provide an argument that, yes; it is possible to measure many aspects of the 'free' digital economy via the lens of a production account. In particular, we modify the production account to separate the costs of producing 'free' digital content and equate these costs to their value. The output side of the production account corresponds to the Gross Domestic Product (GDP) and measures the production of goods and services, while the input side corresponds to Gross Domestic Income (GDI) and includes payments to the inputs used in production. The ratio of the quantity of output to the quantity of input is defined as total factor productivity (TFP) and this provides the link between the GDP and productivity accounts. The

motivations for framing our analysis within the production account are that 1) the other components of GDP and productivity are measured within a production account and 2) it highlights important consistency issues between the outputs of 'free' content and the inputs used to produce the content. To be clear at the outset, this approach does not provide a willingness to pay or welfare valuation of the free content. But this approach does provide an estimate of the value of the content that is consistent with national accounting estimates of production. We model the provision of free content as a barter transaction. Consumers and businesses receive content in exchange for exposure to advertising or marketing. Our approach reduces to treating the provision of the 'free' digital content as payment in-kind for viewership services produced by households and businesses. Put differently, the national accounts currently ignore the role of households in the production of advertising and marketing. In our methodology, households are active producers of viewership services that they barter for consumer entertainment.

Our experimental methodology has at its heart two balancing components. On the expenditure side, we impute content purchases equal to the cost of providing content services. These costs are paid by advertisers or marketers, so 'free' content is actually advertising-supported media or marketing-supported information that could have been supplied through other funding methods. Indeed, 'free' content can be thought of as having been bid away from alternatives. For example, driving directions can be downloaded from an advertising-supported website like Google or a subscriber-supported website like PCmiler. Similarly, when a journal like Science accepts advertising, it is enabled to provide more information services to the businesses that subscribe. This approach requires no major conceptual changes to the international guidelines for national accounts (System of National Accounts 2008 or SNA), and thus could be implemented without the major lag that usually accompanies revisions to international economic accounting standards.

The second contribution of this paper is to assess the empirical impact of the 'free' digital economy on measures of output, value-added and productivity at the aggregate and industry levels. We focus on two types of 'free' content: advertising supported media and marketing-supported information. Advertising supported media includes digital content like Google search, but also more traditional content like print media and broadcast television. Marketing-supported information includes digital content like freemium games for smartphones or recipes from BettyCrocker.com, but also more traditional content like print newsletters and audio-visual marketing. Conceptually, the barter transaction between the producer and user of free information is nearly identical to that with advertising-supported media. The main difference is that advertising viewership is almost exclusively 'purchased' by media companies from the general public and then resold to outside companies. In contrast, the marketing viewership that is exchanged for free information is generally 'purchased' by non-media companies from potential customers and used in-house.