IARIW-ESCoE Conference
"Measuring Intangible Assets and Their Contribution to Growth"

The Reliability of the Contribution of Intellectual Property Products to GDP Growth

Dennis Fixler, US BEA, dennis.fixler@bea.gov
Eva de Francisco, US BEA, eva.defrancisco@bea.gov

The importance of intellectual property products (IPP) or intangible capital to economic growth has received a lot of attention in recent years. Of course, the reasons why we haven't been able to tackle this question before are twofold. First, measuring the value of intangible capital itself is difficult per se, and second and often times, measuring its impact on other inputs in production is entangled with this value.

Most of the attention in the recent literature has ranged from its impact on firm productivity to aggregate economic growth.

As mentioned before, the addition of IPP to national account statistics is relatively recent. The Bureau of Economic Analysis added Research and Development (R&D) in the 2013 comprehensive revision, and software was reclassified into IPP, as before it used to be reported together with Equipment. A bit later, Entertainment, literary and artistic originals (ELAO) was added to IPP. A history of the evolution of the treatment of R&D and extension to other IPP components can be found in Moylan and Okubo (2020).
This paper examines the compilation of national aggregates for IPP, both real and nominal, and most important the revisions to their components. In the U.S., IPP consists of three categories: R&D, Software, and ELAO. Deriving nominal values of the IPP investment categories and their attending price indexes is not straightforward. (The paper would provide a description of the how the measures are constructed—it would largely refer to material posted on the BEA web site on the Intellectual Property Products page.)
If one looks at the contributions of IPP to the growth rate of real GDP, there is considerable volatility. Part of this volatility is due to the timing of the source data flow for both nominal values and price indexes.

For example, for the period 2013q1 to 2019q4, the average contribution of IPP to GDP growth rate is about 0.24 percentage points, with software contributing about 0.13 percentage points, R&D 0.10 percentage points, and ELAO 0.01 percentage point. For reference, the average annual real GDP growth rate for the period was 2.47%, so the contribution of IPP to the GDP growth rate is around 10 percent. However, the coefficient of variation for the contribution of IPP is 0.7, with R&D having a coefficient of variation of 1.17, software of 0.63, and ELAO of 1.06. These indicate that there is substantial dispersion inside IPP.
To give an idea of the reliability of these estimates, one can look at the revision patterns. BEA estimates have: 3 current quarterly estimates—30,60 and 90 days after the end of the reference period; three annual revisions, each published the July of the subsequent year of the

first published quarterly estimate; and a comprehensive revision about every 5 years. The first current quarterly estimate is referred to as the advance estimate.
As a preview, Figures 1 and 2 show the evolution of the real and nominal growth estimates of IPP, from the advance quarterly estimates to the latest ones available.

Figure 1: Real and nominal IPP growth revisions

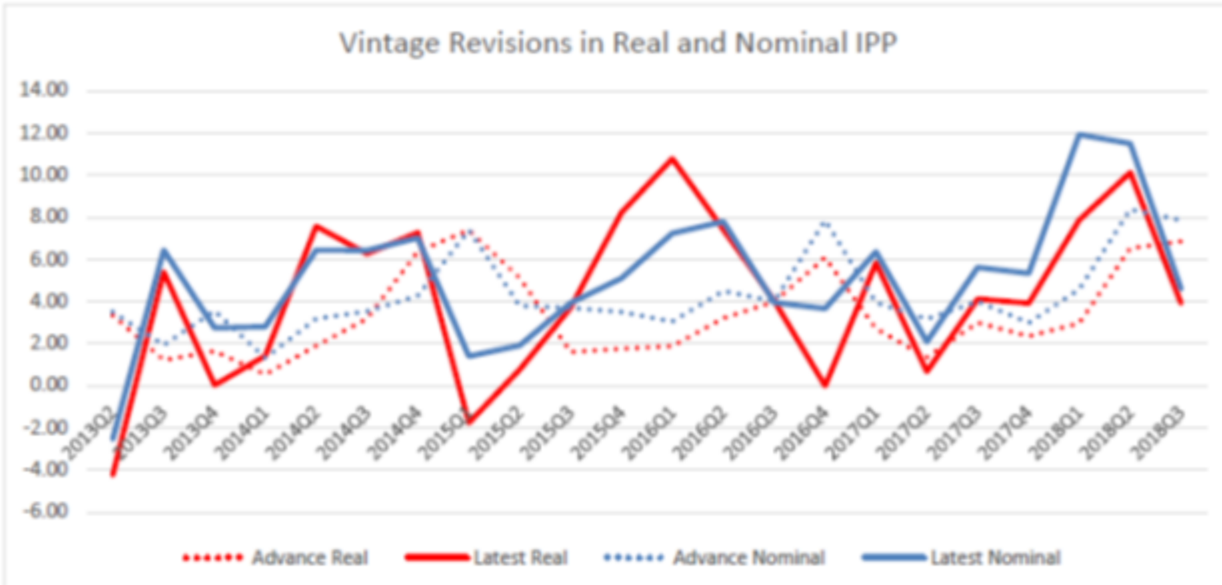

Figure 1 shows that even though the early estimates of real and nominal growth, as well as the latest estimates are positively correlated, since nominal growth includes real growth plus price growth, there is no systematic pattern between the advance and the latest series. Sometimes advance estimates of growth are above final estimates, but some other times they are below. And similarly, real and nominal growth estimates cross multiples times though the sample, showing no systematic pattern between the real and nominal series either.

Figure 2 shows the differences between the latest and advance growth estimates for the real and nominal IPP quarterly growth. As one can see, the differences in the revisions from latest to advance are very similar for both the nominal and real estimates, with maybe a noticeable gap between the two series at the end of 2015 and beginning of 2016, when there was a strong real growth in IPP, with a much more modest growth in nominal terms, indicative of falling prices at least for some of the components inside the IPP category.
The sources of the revision magnitudes largely arise from Software and R&D with the latter being the relatively more volatile as indicated by its coefficient of variation mentioned above.

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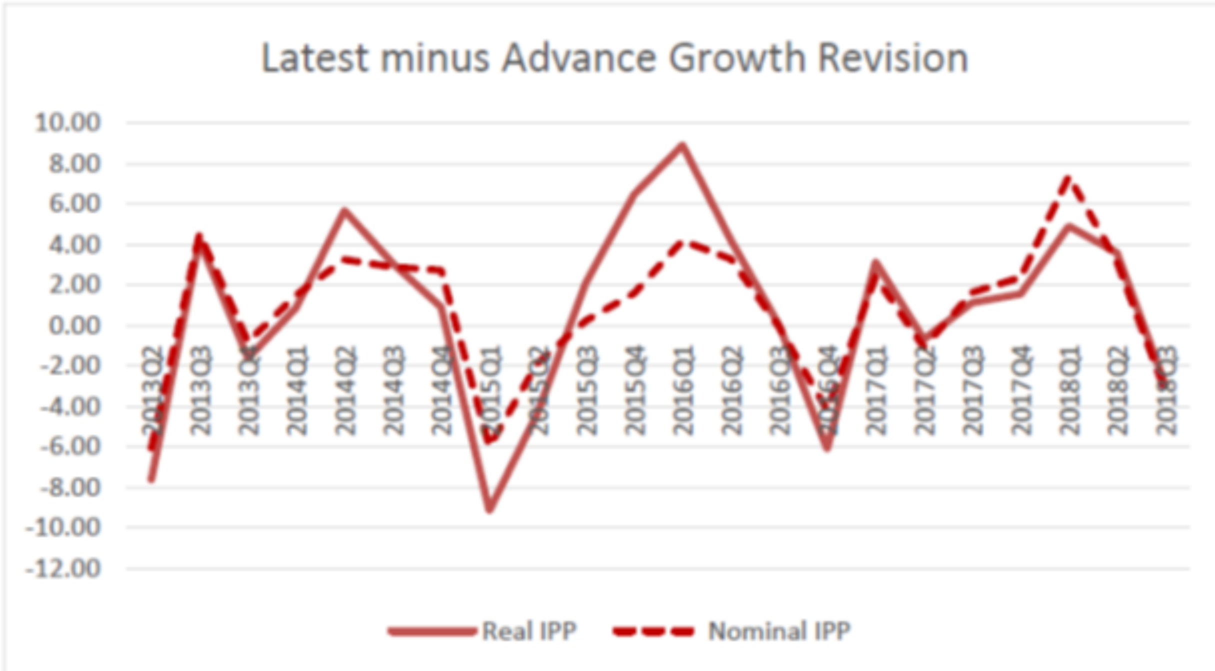
Figure 2: Real and nominal IPP growth revisions



If on average 10% of the annual growth rate in real GDP comes from IPP, then an understanding of the estimates is important for forecasting purposes as well as for modelling technological change in the economy. NIPA table 5.6.6 has approximately 25 components that make up IPP. This paper will examine these components for the behavior of revisions and their relationship to the estimates of IPP and real GDP growth.

Marko Melolinna, Bank of England, marko.melolinna@bankofengland.co.uk

Sudipto Federico, Bank of England, sudipto.karmakar@bankofengland.co.uk

In this paper, we study the effects of corporate investment and levels of debt on productivity in the UK, using firm-level data. At the aggregate level, UK data suggests a strong positive correlation between corporate debt and investment, whereas the correlation between debt and productivity is more tenuous. However, at the firm level, there is strong evidence in the literature suggesting that high corporate debt leads to lower investment, especially in times of crisis, with negative subsequent effects on productivity. In particular, in the existing literature, high corporate leverage has been identified as one of the leading indicators of firm vulnerability. Typically, leverage is assumed to be ""good"" in the boom phase, as it allows firms to invest in their productive capacity. Debt then becomes ""bad"" in a downturn owing to debt overhang reasons.

We take a somewhat different approach in our analysis. We hypothesise that one can distinguish between “good” and “bad” leverage more generally, by means of analysing the types of investments and uses of funds that firms undertake. We analyse firms’ investment and debt finance decisions to see how well they explain their productivity (measured by total factor productivity (TFP)). In other words, the mechanism through which firm debt should affect firm level TFP is through the investments firms undertake.

Methodologically, we first set up a stylised structural model to illustrate the theoretical channels that we study. We show how different types of investment can have different effects on TFP, and how higher TFP can be associated with higher indebtedness. The structural model we use builds on existing literature, but incorporates a novel way of using external debt financing for different types of investment. The model is used for illustrative purposes only, and is necessarily a partial equilibrium model, but it is useful in defining the channels through which investment and debt can effect TFP of a profit-maximising firm, with underlying assumptions that are standard in the literature.

In terms of the empirical analysis, we use a fairly large panel of financial accounts data for listed firms in the UK from 1990 to 2018. We apply standard panel regressions with firm and year fixed effects to study the relationship between TFP and a selection of relevant explanatory variables. We also introduce an interaction term between different types of investment and debt to analyse whether debt is always ""bad"" for TFP. However, endogeneity is likely to be an issue in the types of models we use; ex ante, it is not obvious whether investment and finance structure causes productivity, or the other way round. We mitigate this problem with, first, using lagged values of the explanatory variables and second, using a system-GMM approach with appropriate instruments.

Our main contribution to the literature is in showing that high levels of debt are not necessarily bad for TFP, if the debt is accompanied by high levels of productive investment. Our evidence suggests that a particular type of investment, namely intangible investment, is a good proxy for productive investment. We show its positive effects on TFP. We also show that a combination of high debt and high intangibles investment can be conducive to high TFP. On the other hand, we find no consistent evidence of positive TFP effects for other uses of funds, like tangible capital expenditure or dividends and equity buybacks.

The characteristics of firms with high level of intangibles investment is of special interest to our analysis, and so we detail some of these more broadly. Simple contemporaneous correlations in our sample suggest that intangibles stocks (and flows) are higher in firms that are less indebted, younger, smaller, more cash rich and less profitable than those with less intangibles. In terms of industry decompositions, high intangibles' firms are heavily concentrated in the manufacturing and ICT sectors.