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Jeremy Greenwood and Per Krusell, "Growth Accounting with Investment-Specific Technological Progress: A Discussion of Two Approaches"

A Rejoinder

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Abstract
The May 2007 issue of the Journal of Monetary Economics published a paper of mine entitled 'Investment-Specific Technological Progress and Growth Accounting' which critiqued the work of Greenwood, Hercowitz and Krusell. I argued that the Greenwood-Hercowitz-Krusell (GHK) model is a special case of a two-sector, neoclassical growth model with differing rates of technical progress in the two sectors; that a version of Jorgensonian growth accounting can be constructed for this two-sector model and hence for the GHK model; and that there is therefore a mapping between the growth accounting concepts of total factor productivity (TFP) growth in each of the two sectors, and GHK's concepts of investment specific and neutral technological progress. The same issue of the JME published a response by Greenwood and Krusell ('Growth Accounting with Investment-Specific Technological Progress: a Discussion of Two Approaches'). This paper is a rejoinder to theirs. It attempts to delineate both the common ground and the remaining areas of disagreement.

Keywords: Investment-specific technological change; embodiment, TFP, growth accounting.
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1. Introduction

I am grateful to Greenwood and Krusell (2007), hereafter GK, for their comment on my paper (Oulton, 2007), which clarifies the remaining areas of dispute. In this rejoinder I summarise where in my view we now stand.

In Oulton (2007), I made the following points (among others):

1. The Greenwood-Hercowitz-Krusell (GHK) model (Greenwood et al., 1997 and 2000) is a special case of a two-sector, neoclassical growth model with differing rates of technical progress in the two sectors.
2. A version of Jorgensonian growth accounting can be constructed for this two-sector model and hence for the GHK model.
3. There is therefore a mapping between the growth accounting concepts of total factor productivity (TFP) growth in each of the two sectors, and GHK's concepts of investment-specific and neutral technological progress.

In their original articles, GHK suggested that their model was fundamentally different from the model underlying Jorgensonian growth accounting and that the latter was conceptually flawed. In their comment, GK do not now dispute my points 1-3 and do not now (I think) maintain that the model underlying growth accounting is per se flawed.

However, GHK assign a much larger role to investment-specific technological progress (equivalently, TFP growth in the capital goods sector) in explaining U.S. growth than do comparable growth accounting studies (eg Jorgenson and Stiroh, 2000a). In Oulton (2007), I argue that this is for two reasons. The first reason is methodological. The GHK number is the answer to a different question to the one traditionally asked by growth accounting studies. The GHK model predicts that investment-specific technological progress (ISTP) will induce additional capital accumulation. Their estimate of the effect of ISTP includes the effect of this induced capital accumulation. Traditionally, growth accounting makes capital accumulation induced by TFP part of the contribution of capital, not of TFP.

The second reason that GHK get a bigger number for the effect of ISTP is that in their data, the relative price of investment goods is falling much more rapidly than it does in the U.S. NIPA. This is because they have adjusted the NIPA data to reflect the view of Gordon (1990) that there is an upward bias in the official estimates of the prices of capital goods.

In their comment GK defend their methodology, their data, and also their interpretation of the early growth accounting literature. In what follows I comment on this re-statement of their views.

2. Methodology

GHK set up a complete model of the economy. Their measure of the contribution of ISTP is the difference between what the growth of consumption actually was and what it would have been (according to their model), had ISTP been zero. As stated above, their measure is inclusive of the effect of capital accumulation induced by ISTP. In their section 3, GK portray me as opposed to this approach and instead as advocating the traditional growth accounting measure. In fact, I am not opposed in principle to their approach. I do point out that they are not the first to criticise growth accounting from this perspective, citing Hulten (1979) in support.

The complete model approach (what they call the quantitative approach) is clearly capable of delivering sharper answers to questions. But it comes at a cost: more assumptions. Thus the GHK model has to assume that production functions in the two sectors are identical up to a scalar multiple (TFP) and that the economy was in balanced growth (at least on average) during the observation period (which requires in addition that the production functions are Cobb-Douglas). These assumptions are debatable even for the U.S. economy, 1954-90, and still more so for other countries and periods. None of these assumptions are required for the growth accounting approach.

GK asks us to choose between the two approaches. I would argue that no choice is necessary. As GK themselves argue (page 1301), growth accounting " … has allowed economists to catalogue invaluable stylised facts about total factor productivity (TFP) at aggregate and sectoral levels, both within and across countries". Despite its name, growth accounting is a theory, though not a complete one. Growth accounting is in fact based on the economic theory of production. One way to characterise it is as providing a technique for estimating important parameters such as TFP.[1] However, in traditional growth accounting, statements like "TFP accounts for x% of the growth of output and capital for y%" are

[1] Growth accounting theory is even more flexible than GK allow on their page 1301. Contrary to what they suggest, it is not necessary to assume that factors are mobile, nor that an aggregate production function exists. And it is possible to allow for imperfect competition.

frequently made. In the present context, does a statement like "TFP growth in the capital goods sector accounted for 26% of the overall growth rate of TFP" have any meaning? GK argue not. To the contrary, I would claim that such statements do give an indicator of the importance of embodied technical progress, even if the actual number differs from that in the GHK studies. For example, if this number had turned out to be zero, I would have taken this as strong evidence that TFP growth in capital goods industries had contributed little or nothing to overall growth. It is somewhat ironic that growth accounting is accused of underestimating the importance of embodiment when recent studies by Oliner and Sichel (2000) and Jorgenson and Stiroh (2000b) have emphasised the crucial role played by the accumulation of IT capital in explaining the U.S. improvement in labour productivity since the mid-1990s. Though these studies do not formally model the process, they make clear that the motor is the rapidly falling price of IT products. In turn, this is driven by rapid TFP growth in the IT sector. In Oliner and Sichel (2000), the overall contribution of IT to growth is the sum of IT's contribution to TFP growth and its contribution to capital deepening. This turns out to account for four fifths of the labour productivity improvement in the 1990s. Some part of non-IT capital deepening was no doubt induced by TFP growth in the IT sector, so their numbers still understate the IT contribution, in the GK sense. Nevertheless their numbers are still meaningful.

Utility

On page 1306, GK argue that their measure of the importance of ISTP, which relates it to consumption growth, can also be interpreted as a measure of welfare change. This is correct for their model where the depreciation rate is constant and the economy is in a steady state. Here depreciation is a constant proportion of output in nominal terms. Out of steady state or if depreciation rates were changing, this would not be the case. This is another way of making the point made in Oulton (2007, footnote 6): the GHK measure of output is gross, while for welfare we require a measure that is net of depreciation. The measure proposed by Weitzman, (1976) is nominal *net* output (consumption plus *net* investment), deflated by the price of consumption. Weitzman showed that this can be interpreted as a cardinal measure of welfare. Whether one employs a Divisia index of output (which is gross of depreciation) or the Weitzman measure of net output depends on whether one wants to measure output or welfare (Oulton, 2004). The GK measure, gross output deflated by the price of consumption, is a kind of hybrid, neither output not welfare. But in a steady state where in current prices

depreciation is a constant proportion of the value of output (as they assume), the GK measure and the Weitzman will grow at the same rate.

3. Data

First, a presentational point: GK refer to figures that are not their own as "Oulton (2007)".[2] In fact these are Jorgenson and Stiroh's (2000a) figures, so this is misleading. Since none of the data used in Table 1 of Oulton (2007) is original to me, for consistency they would have to refer to their own estimates that appear there as "Oulton (2007)" as well.

On page 1305, they say that "Oulton's (2007) estimates are predicated upon standard NIPA data." In fact, I give figures using both the NIPAs (the Jorgenson-Stiroh numbers) and figures based on the Gordon series (the GHK numbers). I did not state a view as to which dataset is better as it was not central to my purpose (but see now below).

How much does the use of GHK's rather than Jorgenson and Stiroh's data matter? On page 1303, GK say that they find my statement that the differences between GHK's results and those of Jorgenson and Stiroh relate more to data than to methodology "hard to understand". In fact, my reasoning is as follows. From Oulton (2007, Table 1), the growth accounting measure of the importance of embodiment using Jorgenson-Stiroh data is 0.26. Sticking with the same data but using the GHK measure, the measure rises to 0.37. Now using both the GHK data and the GHK measure, the measure jumps up to 0.58. In this sense, most of the overall difference (from 0.26 to 0.58) is due to data.

It is only fair to add that one could go the other way round the table. Start with the GHK measure and GHK data (0.58). Sticking with GHK data but using the growth accounting measure reduces this figure to 0.38 and using growth accounting data reduces it further to 0.26. Doing it this way, most of the difference is due to methodology. So perhaps I should have qualified my statement on the relative importance of data and methodology. However, I do not feel that a great deal turns on this.

Price indexes and the use of hedonics

It was not my purpose to defend the estimates of capital goods prices constructed by the Bureau of Labor Statistics (BLS) against its critics. These estimates are incorporated into the

[2] Actually, they refer throughout to "Oulton (2006)", but, to avoid confusion, in quoting their article I have changed "2006" to "2007" to conform to the date of publication.

U.S. NIPA and so find their way into growth accounting studies. But being for or against the BLS estimates is *not* the same as being for or against quality adjustment nor is it the same as being for or against hedonic methods.

For the avoidance of doubt, the standard view in the growth accounting literature is that price indexes should allow for quality change. This is also the standard view of national income accountants and statisticians (see eg Bureau of Labor Statistics, 1997, chapters 14 and 17). It is *not* the case that quality change was ignored prior to the advent of hedonic methods. The traditional method of statistical agencies, the matched models method, is the basic method employed by the BLS for the CPI and the PPI. The matched models method is *one* method of allowing for quality change. In certain circumstances, it can be shown that the matched models method accounts for quality change *perfectly* (Aizcorbe et al., 2000).

Nevertheless, Gordon (1990) cast grave doubt on the BLS's estimates of producer prices in the twentieth century up to 1983. Gordon's methods and data are transparent, while those of the BLS for this period are not available to independent researchers. Hence most academic researchers have accepted that the BLS made a poor job of applying their own methodology and that Gordon's results are closer to the truth over this period.

Most of Gordon's work also used the matched models method; only for a minority of products did he use hedonics. So GK's suggestion (at the end of the first paragraph on page 1306) that Gordon's results are due to the use of hedonics is misleading.

In practice, for some products, statistical agencies like the BLS now use hedonic methods in conjunction with the matched models method, to deal with the situation where an old model drops out and a new model is introduced. In the case of computers, it turns out that hedonic methods make the price index fall much more rapidly than would otherwise be the case. This is *not* however a necessary consequence of the hedonic method but rather a feature of the market for computers (and probably of other similar, hi-tech products). The introduction of hedonic methods into other areas, eg housing, has made price indexes rise *more* rapidly than would otherwise have been the case (Moulton, 2001). And Gordon (2005) finds that a hedonic index for clothing rises more rapidly than a matched models index that uses the same data.

Returning to capital goods prices, I believe that the Gordon data are superior to the BLS data, for the period where they overlap. However, the GHK studies go up to 1990, while Gordon's data only go up to 1983. Whether it is right to make a 1.5% p.a. downward adjustment as they do to the official figures in extrapolating from 1983 to 1990 is more open to question (Bils (2004) notwithstanding).

4. A doctrinal dispute?

In their "Conclusion", GK offer a version of the history of economic thought that I would dispute. I do not believe it is true that "… the idea of capital-embodied technological progress languished in the traditional growth accounting literature until Hulten (1992) attempted to revive it" (their page 1308). GK cite Jorgenson (1966) as somehow stifling debate on this issue but ignore the large growth accounting literature measuring TFP growth at a disaggregated level, eg Jorgenson et al. (1987).

The issue is not really how to interpret Jorgenson (1966) but whether there is some basic flaw in the whole growth accounting tradition. This tradition builds on seminal work by Domar (1961), Hulten (1978), Jorgenson and Griliches (1967), and Jorgenson et al. (1987) in particular, all cited in my paper. Numerous other researchers have applied this methodology as does the BLS in its official estimates of multifactor productivity growth. The methodology is now recommended by the OECD for adoption by all national statistical agencies (see OECD, 2001). So if there is a basic conceptual error in growth accounting, it has very widespread consequences and the issue is not just relevant to historians of economic thought.

It is therefore inappropriate to focus on one paper by Jorgenson written in 1966. Despite dismissing this as a doctrinal dispute, they spend some time seeking to justify their interpretation of this article ("Postscript", pages 1308-1309). The suggestion seems to be that a conceptual error in this article must somehow infect the rest of the growth accounting tradition. This is indeed the suggestion in Hercowitz (1998): "Solow (1960) argued that embodied technical change is dominant, hence investment is the key mechanism; while Jorgenson (1966) argued that from the data available then, one could not provide an answer about its relative importance. This controversy between Solow and Jorgenson is still actual, perhaps now more than in the 1960s, given the rapid development of new technologies in the production of capital goods since the middle 1970s. The appearance of Jorgenson's (1995) collected papers, which have greatly influenced ideas about the measurement of technical change, represents an important opportunity to review this debate and its implications." The suggestion that Jorgenson underplays the role of investment will read a bit oddly to anyone familiar with his empirical work. In particular his recent work on the impact of ICT

emphasises the accumulation of ICT capital as the crucial factor in explaining the recent labour productivity improvement in the U.S. (see above).

The fact remains that Jorgenson (1966):

> does *not* employ an aggregate production function of the form attributed to him by GHK;
> *does* employ Divisia indices of aggregate input and output. These are derived by differentiating with respect to time an accounting identity (which states that the value of output equals the value of the inputs).

Jorgenson's (1966) statement that "one can never distinguish a given rate of growth in embodied technical change from the corresponding rate of growth in disembodied technical change" cannot be taken in isolation. The context is a discussion of the effect of errors in measuring the prices of capital goods. What he is saying (I believe) is that such a measurement error could conceivably cause what is in reality embodied technical change (quality improvements in capital goods, due to TFP growth in capital goods industries) to appear erroneously as disembodied technical change (TFP) in other industries. This article should also be read in the context of his other work already cited, eg Jorgenson and Griliches (1967) which showed the quantitative importance of careful measurement of capital and labour, and subsequent work such as Jorgenson et al. (1987).

GK state (page 1309): "It is true that no aggregate (or *any* other) production function appears in Jorgenson (1966) — this includes Oulton's (2007) sectoral ones". However, on his page 4 Jorgenson states: "Divisia index numbers have the fundamental *reproductive property*, namely, a Divisia index of a group of Divisia indexes is also a Divisia index of the components of each group. This property assures that no distinction need be made between a one-sector model with joint production of consumption and investment goods and a two-sector model with one sector corresponding to each output". And footnote 2 argues: "The analysis of total factor productivity can be carried out equivalently through index numbers or through production functions." This shows that Jorgenson's argument is quite consistent with either an aggregate model or a sectoral model of production and that he was well aware of this.

GK also state (page 1309), as if it were a point in their favour: "… Jorgenson (1966, page 10) clearly suggests that investment should be measured in quality-adjusted units, in addition to the capital stock". In fact, the growth accounting tradition has *always* maintained that

quality-adjusted prices should be used for *all* goods, whether consumption or capital. The only significant exception as far as I know is Denison (1957) and (1969) who wanted to count costless quality change in capital goods as part of TFP, not of capital input. But his view has not prevailed, either in the academic literature or in official statistical practice.

The relationship between Solow (1960) and Jorgenson (1966) is also in my view not what Hercowitz (1998) and GK suggest. In his 1960 article Solow simply *assumed* that *all* technical progress was embodied in new capital goods. Jorgenson's paper, insofar as it is viewed as a response to Solow, argues that the two Solow models (Solow, 1957 and Solow, 1960) are empirically equivalent. My interpretation of this statement is as follows. The prices of capital goods may be measured with error and the size of this error is unknown. Thus, *in the absence of any other information*, we cannot distinguish empirically using aggregate data, ie aggregate data solely on *Y*, *K* and *L*, between a model in which all growth is ultimately due to TFP growth in capital goods and one in which it is due to TFP growth in consumption goods as well.

Solow (1960) seems to have assumed that the NIPA estimates of gross investment are simply counts of "machines", with no allowance for quality change. In fact, the NIPA estimates *do* in principle allow for quality change. The main issue, raised by the work of Gordon (1990), is the extent to which they succeed in capturing quality change *in practice* (see above).

On page 1309, GK ask: "Specifically, is Oulton (2007) a modern transliteration of Jorgenson (1966)?" Their answer is no. I would argue the opposite and that there is no conflict between the 1966 article, Jorgenson's later work, and my own contribution. But the important issue is not the relationship of my paper to this nearly 40-years-old article, but whether or not my argument accurately reflects the growth accounting tradition as a whole.

5. Conclusion

There is no necessary conflict between what GK call quantitative theory and growth accounting. Viewed properly, a growth accounting study estimating important parameters like TFP growth in different sectors can be seen as the first step towards a more complete quantitative model of the economy. One of the virtues of the growth accounting approach is that it forces one to take measurement and conceptual issues seriously: how to measure

capital services when there are a multiplicity of assets, how to treat variable degrees of input utilisation, how to aggregate sectors together, to take but three examples. It goes far beyond a simple application of the original Solow growth model, justly celebrated though that contribution is.

References

Aizcorbe, A., Corrado, C. and Doms, M., 2000. Constructing price and quantity indices for high technology goods. Washington, D.C.: Board of Governors of the Federal Reserve.

Bils, M., 2004. Measuring growth from better and better goods. NBER Working Paper no. 10606. Cambridge, M.A.

Bureau of Labor Statistics, 1997. BLS Handbook of Methods. Available at http://www.bls.gov/opub/hom/home.htm.

Denison, E.F. (1957). Theoretical aspects of quality change, capital consumption, and net capital formation. In Problems of capital formation : concepts, measurements and controlling factors, NBER Studies in Income and Wealth volume 19, Princeton: Princeton University Press.

Denison, E.F. (1969). Some major issues in productivity analysis: an examination of estimates by Jorgenson and Griliches. Survey of Current Business 49, May (Part II), 1-27.

Domar, E.D., 1961. On the measurement of technological change. Economic Journal LXXI, 709-729.

Gordon, R.J., 1990. The Measurement of Durable Goods Prices. Chicago: University of Chicago Press.

Gordon, R.J., 2005. Apparel Prices 1914-93 and the Hulten/Brueghel Paradox. NBER Working Paper no. 11548.

Greenwood, J., Hercowitz, Z. and Krusell, P., 1997. Long-run implications of investment-specific technological change. American Economic Review 87(3), 342-362.

Greenwood, J, Hercowitz, Z. and Krusell, P., 2000. The role of investment-specific technological change in the business cycle. European Economic Review 44, 91-115.

Greenwood, J., and Krusell, P. (2007). Growth accounting with investment-specific technological progress: a discussion of two approaches. Journal of Monetary Economics, 54, 1300-1310.

Hercowitz, Z., 1998. The 'embodiment' controversy: a review essay. Journal of Monetary Economics 41, 217-224.

Hulten, C.R., 1978. Growth accounting with intermediate inputs. Review of Economic Studies 45, 511-518.

Hulten, C.R., 1979. On the 'importance' of productivity change. American Economic Review 69, 126-136.

Jorgenson, D.W., 1966. The embodiment hypothesis. Journal of Political Economy 74, 1-17. Reprinted in D.W. Jorgenson, Productivity: Volume 1: Postwar U.S. Economic Growth. The MIT Press, Cambridge, MA.

Jorgenson, D.W., and Griliches, Z., 1967. The explanation of productivity change. Review of Economic Studies, 34, 249-283. Reprinted in D.W. Jorgenson, Productivity: Volume 1: Postwar U.S. Economic Growth. The MIT Press, Cambridge, MA.

Jorgenson, D.W., and Stiroh, K.J., 2000a. U.S. economic growth at the industry level. American Economic Review, Papers and Proceedings 90, 161-168.

Jorgenson, D.W., and Stiroh, K.J., 2000b. Raising the speed limit: U.S. economic growth in the information age. Brookings Papers on Economic Activity 1, 125-211.

Jorgenson, D.W., Gollop, F.M. and Fraumeni, B.M., 1987. Productivity and U.S. Economic Growth. Harvard University Press, Cambridge, MA.

Moulton, B.R., 2001. The expanding role of hedonic methods in the official statistics of the United States. Available at http://www.bea.gov/bea/about/expand3.pdf.

OECD, 2001. OECD Productivity Manual: A Guide to the Measurement of Industry-Level and Aggregate Productivity Growth. Paris: OECD.

Oliner, S.D. and Sichel, D.E., 2000. "The resurgence of growth in the late 1990s: is information technology the story?". Journal of Economic Perspectives, 14, Fall, 3-22.

Oulton, N., 2004. Productivity versus welfare: or, GDP versus Weitzman's NDP. The Review of Income and Wealth, 50, 329-355.

Oulton, N., 2007. Investment-specific technological change and growth accounting. Journal of Monetary Economics, 54, 1290-1299.

Solow, R.M., 1957. Technical change and the aggregate production function. Review of Economics and Statistics, 39, 312-320.

Solow, R.M., 1960. Investment and technical progress. Chapter 7 in Mathematical Methods in the Social Sciences, 1959. Edited by K.J. Arrow, S. Karlin and P. Suppes. Stanford: Stanford University Press.

Weitzman, M.L., 1976. On the welfare significance of national product in a dynamic economy. Quarterly Journal of Economics 99, 1-14.

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