Introduction to the Symposium on Productivity and Well-being, Part I

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Articles published in the *International Productivity Monitor* have traditionally focused on the production sphere of economic activity and have seldom addressed the relationship between productivity and well-being. Recognizing the increasing attention to well-being issues by economists, government and the general public, this issue of the IPM goes some way to remedy this past lack of attention to well-being by publishing a first symposium of four articles on productivity-well-being linkages.[2] A second symposium of three articles on the same topic will appear in the next issue of the *International Productivity Monitor*. This introduction discusses the background and motivation of the symposium, the organizational process, highlights key issues related to productivity-well-being linkages, and provides a detailed synthesis of the contributions of the four articles.

Background to the Symposium

The Centre for the Study of Living Standards (CSLS), the Ottawa-based not-for-profit economic research organization that founded the *International Productivity Monitor* (IPM) in 2000, has always had a strong interest in well-being issues. In the late 1990s and early 2000s, the CSLS developed the Index of Economic Well-being, a composite index based on consumption flows, stocks of wealth, equality and economic security indicators (Os-

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2 The authors of the first three of the articles discuss their results in a podcast moderated by Bart van Ark found at https://player.fm/series/productivity-puzzles/productivity-and-well-being

berg and Sharpe, 2002). But there was always a firewall between the CSLS work on well-being and the IPM, with the journal narrowly focused on traditional GDP-based output measures to be used for productivity estimates.[3] The only instances where the IPM went beyond its focus of analysis of traditional productivity issues were articles on the relationship between labour productivity and real wages.[4]

In January 2021, the CSLS entered into a partnership agreement on the IPM with The Productivity Institute (TPI) in the United Kingdom. The mandate of TPI largely focuses on productivity topics, but also encompasses well-being issues. The relationship between productivity and well-being is consequently of great interest to the TPI. The editors Andrew Sharpe and Bart van Ark therefore decided to devote an issue of the IPM to the relationship between productivity and well-being. Dan Sichel, a Professor of Economics at Wellesley College, Chair of the Advisory Committee of the Bureau of Economic Analysis and a member of the IPM's International Advisory Council kindly agreed to join the two editors as a guest editor for the project.

In early 2021, a call for papers was widely distributed to productivity researchers. First drafts of the papers accepted in response to the call were presented at a virtual authors' workshop in November, 2021.[5] After going through the standard refereeing procedures, seven papers from the workshop were accepted for publication in the Symposium. Four of these papers are included in this issue of the IPM as Part I of the Symposium and the remaining three papers will be published as Part II of the Symposium in the next issue in the Fall of 2022.

Context for Understanding Productivity-Well-being Linkages

The productivity and well-being literature appear to exist in two different universes. Productivity is generally understood as relating to efficiency at the firm, industry and aggregate economy level whereas well-being is a much broader concept relating to a wide range of dimensions that contribute to overall life satisfaction and happiness. A full understanding of the complex relationships between these concepts, including the tradeoffs and complementarities, is in its infancy.[6]

The traditional perspective is that productivity is the key to real income growth and that higher incomes are important components of better well-being. It follows then that there is a positive relationship running from productivity to well-

3 The CSLS was of course always well aware of the close two-way relationship between productivity and well-being and addresses this topic in Sharpe (2002).

4 See, for example, the symposium on the decoupling of productivity and pay in the United States, Canada, and the United Kingdom in the Fall 2021 issue of the *International Productivity Monitor* and available at http://www.csls.ca/ipm.asp as well as earlier article on the issue by Sharpe and Uguccione (2017).

5 The program for the workshop is available at https://www.productivity.ac.uk/ipm/workshop-on-productivity-and-well-being-measurement-and-linkages/

6 For a recent survey of the literature on productivity-well-being linkages, see Sharpe and Fard (2022). This research was funded by the International Labour Organization (ILO) in Geneva.

being. This perspective finds support in the annual *World Happiness Report* published by the United Nations, which develops a framework to explain life satisfaction across countries with six explanatory variables. One of these variables is GDP per capita, which is highly correlated with labour productivity. This variable is found to be the most important of the six variables. A doubling of a country's real income would in principle and everything else equal, raise the average level of life satisfaction by 30 per cent. Real-world evidence of this productivity-income effect on well-being is shown by the fact that low-income countries on average (though there are exceptions) have much lower level of life satisfaction than high income countries.

But everything is not equal. Real income growth may be associated with greater work-related stress, longer commuting times, and degradation of the environments, among other negative consequences of economic growth. Since these non-economic factors also are important for well-being, higher productivity does not automatically translate into higher well-being. Indeed, life satisfaction in the United States and other countries has not increased during the postwar period, yet incomes have more than doubled. This is known as the Easterlin paradox and has generated considerable research (Easterlin and O'Connor, 2020). A key conclusion of his research is that well-being is directly related to social factors and is as much of a relative nature as it is of an absolute one. If one's income does not improve relative to one's comparison group, one does not necessarily feel better off even though one's income has increased in absolute terms.

Some of the key aspects in the debate on the relationship between productivity and well-being are highlighted below.

Two-way nature of the relationship between productivity and well-being

The relationship is two-way in nature, running from changes in productivity to changes in well-being and from changes in well-being to changes in productivity. The first direction is the most studied. Productivity growth is widely recognized as the only long-run source of increased per capita income. Increased incomes also generate tax revenues that can be used by governments for transfer payments for the disadvantaged, for public goods, and for the direct provision of government services such as health and education services. The second direction from better well-being to higher productivity is manifested, for example, by happier workers being more productive.

Differences between the level of well-being and well-being efficiency or productivity

Two of the articles in the symposium refer to the efficiency of the generation of well-being defined as the level of well-being attained in relation to the resources available such as capital and natural resources used to generate well-being. This differs from the level of well-being, which is the absolute level of well-being, measured for example, by life satisfaction, abstracting from the resources needed to attain that level.

Definitions of well-being

There is a fundamental distinction made between objective measures of well-being and subjective measures. Historically the focus has been on objective indicators of well-being, such as income, wealth, health, environmental quality. In recent years, subjective well-being, best captured by surveys of life satisfaction, has been receiving much more attention. The papers in this symposium use both measures.

A distinction can be made between overall well-being and economic well-being. The former includes all aspects of well-being, such as political freedom, spirituality, family life as well as standards of living. Economic well-being is obviously more narrow, focusing on material aspects of well-being.

The Symposium Articles

The symposium in this issue of the IPM contains four articles on productivity-well-being linkages. The next issue of the IPM will contain three additional articles. This section of the introduction provides a synthesis of these contributions. Two of the four articles in this symposium are by economists from New Zealand, a very disproportional contribution given the small population of the country. This appears to reflect the high level of importance given to both subjects in the country, as evidenced by the establishment of the New Zealand Productivity Commission in the 2000s and the release of its well known well-being framework for budgets by the New Zealand Treasury in 2019. The country definitely punches above its weight in its contributions to the international debate on productivity-well-being linkages.

A Capital Stocks Approach to Productivity and Well-being (Legge and Smith)

In recent years the capital stocks approach to productivity measurement has been gaining popularity. This approach goes beyond the standard measure of capital as physical investment goods and develops estimates for additional types of capital, namely human capital, natural capital, and social capital. It then uses the conventional total factor productivity growth accounting framework to estimate the contribution to labour productivity or income from the various types of capital.

The lead article in the symposium by **Jaimie Legge**, an independent economic consultant, and **Conal Smith** from the Victoria University of Wellington takes the capital stocks approach to productivity and income and applies it to well-being to estimate the degree to which countries generate well-being, as measured by life satisfaction, from the four types of capital. They find for a given well-being outcome, there is significant cross-country variation in the quantities of the different types of capital used, indicating different degrees of efficiency in the generation of well-being. The Nordic countries, for example, have high levels of well-being, but use considerable amounts of capital to generate these outcomes. On the other hand, certain Eastern European have nearly comparable levels of life satisfaction, but use considerably smaller amounts of capital to attain this level of well-being. From this perspective, these countries are more "efficient" or productive in the uses of the different types of capital.

Of course, it is the absolute level of well-

being or life satisfaction that matters most, even if this level requires large quantities of capital inputs. But given resource scarcity, which certainly pertains to the different types of capital, it is very useful to identify which countries are able to transform limited amounts of capital inputs into respectable well-being outcomes. There may be lessons for other lower-resource countries on how to boost well-being.

The authors begin by highlighting two approaches to well-being measurement, that of subjective well-being and that of capabilities. The former is grounded in the utilitarian tradition and sees well-being as something experienced in the mind. The latter, based on the work of Amartya Sen, focuses on well-being as the ability of a person to live the kind of life they have reason to value. While the two approaches are conceptually distinct, the authors argue that in practice this distinction is much less clear and that evaluative measures of subjective well-being, such as overall life satisfaction, capture the most commonly identified capabilities.

The authors then point out that building on the report *The Measurement of Economic Performance and Social Progress* (Stiglitz, Sen, and Fitoussi, 2009), there has emerged a widely used framework for conceptualizing and measuring intergenerational well-being (OECD, 2011). This capital stocks model or framework (Smith, 2018) posits that well-being draws on the stocks of productive resources, namely produced capital, human capital, social capital, and natural capital. The flow of resources from the capital stocks can be used for current consumption, or invested for future consumption. A sustainable level of well-being can be defined as a state where the capital stocks do not decrease over time.

The authors recognize that extensive work has been done on the determinants of subjective well-being, but point out that few contributions to this literature have used the capital stocks approach. Where this approach has been taken, such as OECD (2015), the focus has been on the level of the capital stocks and not how efficiently they are used. The authors' objective is to fill this gap in the literature by developing estimates of total well-being productivity (TWP) based on different types of capital stocks that are methodologically comparable to traditional measures of total factor productivity (TFP). Just as TFP (whether the level of TFP or its growth rate) is a measure of the efficiency with which inputs are used to produce output or income, TWP is a measure of the efficiency by which inputs (the four types of capital) are used to produce well-being, as proxied by life satisfaction.

In the TWP framework, produced capital and human capital are measured and used in the same way as in the TFP framework. On the other hand, social capital and natural capital are generally not included in the TFP framework. In this study, social capital is defined in terms of productive shared norms and values such as trust and the rule of law that allow for constructive engagements between people. Natural capital is more complex and at the broadest level refers to all aspects of the natural environment that support human life and well-being. Many elements of natural capital cannot be monetarized, so natural capital has no single overarching measure.

The authors develop a production function for estimating the relationship between the four types of capital and life satisfaction. Just as TFP is a residual in the standard growth accounting model, TWP is the part of well-being that cannot be accounted for by the four types of capital. They put together a dataset on the four types of capital and subjective well-being for 22 EU countries. The Penn World Tables are used for produced capital, human capital and market TFP. The European Social Survey is used for life satisfaction. The Corruption Perception Index produced by Transparency International is used for trust. Natural capital is proxied by the Biodiversity Indicators Index developed by the UK Natural History Museum. This index captures the impact of human presence on ecosystems and is based on the percentage of original species that remain.

The regression results show that for the full capital stocks model, human capital, produced capital, and social capital are determinants of well-being, but that natural capital has a minimal effect. For market outcomes, the results are generally similar to overall well-being. In contrast, for non-market outcomes, produced capital is less important. An interesting finding is that no correlation is found between market and non-market TFP, suggesting that the production technologies of the two sectors are fundamentally different. The highest levels of TWP are found in Poland and Croatia, even though these countries do not have the highest levels of life satisfaction. It appears that these countries are particularly successful or efficient in transforming their capital stocks into well-being.

The findings from this analysis of the efficiency or productivity of well-being are important for public policy. First, there are large differences in TWP levels across EU countries ranging from 1.6 in Croatia to 0.4 in Bulgaria. This suggests there are ways to increase well-being that do not involve increasing the level of the capital stocks. Second, the different production functions for market and non-market outcomes implies that maximizing market output does not necessarily maximize total well-being as the non-market elements of well-being have very different drivers. In particular, investments in human and social capital, which have positive effects for both market and non-market outcomes, may have a larger effect on overall well-being than produced capital, which appears to have no effect on non-market outcomes. Third, unlike the other three types of capital, natural capital has no relation with overall life satisfaction. When outcomes are decomposed into market and non-market outcomes, natural capital has a negative effect with market outcomes, but a strong positive effect with non-market outcomes. This first finding may reflect the positive impact of resource depletion on market output.

This article represents a novel and highly innovative analysis of a new concept, namely that of well-being efficiency or productivity. But much work remains to be done, especially related to methodology and data, as recognized by the authors. Both TFP and TWP are estimated through a production function as residuals subject to error. The decomposition of TWP for the non-market productivity component is challenging given the different non-market consumption bundles across countries. The data used for the estimation of TWP also

needs significant improvement, especially natural capital.

Trust, Well-being and Productivity (Hazledine)

As shown in the first article of the symposium, social capital is increasingly recognized as an important determinant of both productivity and well-being, with social capital often proxied by a measure of trust. But the mechanism by which trust affects productivity and well-being is still poorly understood. In the second article in the symposium, **Tim Hazledine** from the University of Auckland sheds light on this topic.

Hazledine's objective is to measure the role of trust in explaining cross-country differences in the level of labour productivity and self-reported well-being in 136 countries. By trust, Hazledine means socially useful norms and values. He defines two trust variables: the first, called trust, is from a question asked in the World Values Survey; and the second, called deep trust, is estimated as a function of long-standing cultural, historical, geographic, and linguistic factors. He finds that both trust variables have significant bivariate relationships with productivity and well-being. But when these variables are added to standard models for productivity and well-being, they add no explanatory power. Hazledine explains this paradox as follows: while trust affects the determinants of productivity and well-being, it does not operate directly on the two variables but rather indirectly through its effects on the capital stocks. For example, deep trust has positive impacts on human capital, physical capital, and institutional quality, which in turn boosts productivity, while the trust variable similarly affects the determinants of well-being.

Adam Smith was the first to recognize that, for the progress of society, people need to learn to interact effectively with each other, in particular with strangers. More recently, Kenneth Arrow has stressed that every commercial transaction has within itself an element of trust and that much of the backwardness of the world can be explained by the lack of mutual confidence. Trust is essential for economic life and differences in economic success across nations may in part be accounted for by differences in levels of trust.

For his econometric estimation, Hazledine uses a standard neoclassical production function for output and productivity augmented with institutional quality. He also has a "production function for well-being" from the *World Happiness Report* produced by the United Nations. This model or framework explains cross-country differences in self-reported well-being or life satisfaction, in terms of six variables (per capita income, social support, healthy life expectancy, freedom to choose what to do with one's life, generosity with charity, and level of a country's corruption). To both these models, Hazledine adds the two trust variables, but finds they do not improve the fit.

Hazledine persuasively argues that:

> "high trusts levels do not in themselves make people happier or more productive. But high trust demonstrably encourages long-term investment in physical and human capital, and in good institutions, that generate economic prosperity. And

it somehow contributes to the various cultural and institutional factors that feed well-being."

Hazledine observes that trust is increasing throughout the world, except in the United States. An example of the importance of trust for the economy is the massive and unexpected growth in on-line or digital commerce, which requires that people are willing to buy from strangers. Hazledine points out in the podcast that this success relates in part to the development of rating systems of sellers by purchasers. People generally seem to trust that these ratings are accurate.

Hazledine's article represents an original and important contribution to the literature on the role of trust in the determination of both productivity and well-being. Trust is crucial, but unlike say physical and human capital, it is not a proximate determinant, but an underlying factor or condition for a country's success in terms of both productivity and well-being. Harking back to Adam Smith, this is a common sense finding and we believe few would dissent.

Going forward, tougher questions are why some societies exhibit high trust and others low trust? Even more important, is the level of trust in a society fixed or can public policies, moral suasion or other factors change it? Should trust become one of the variables policy makers consider when developing plans to improve productivity performance or increase well-being, or is trust too bound up with the historical development of a society that it has limited, if any, direct policy relevance?

Time Use, Productivity and Household-Centric Measurement of Welfare in the Digital Age (Coyle and Nakamura)

The digital age has had major ramifications for all aspects of society and the economy, including time use, productivity, and well-being, that we are only just beginning to understand. In the third article in the symposium, **Diane Coyle** from Cambridge University and **Leonard Nakamura** from the Federal Reserve Bank of Philadelphia address the implications of the digital age from the perspective of developing a broader understanding of progress than the standard GDP statistics. Their ambitious objective is to lay the groundwork for a measurement framework for well-being that combines time allocation by activity with monetary measures of well-being and incorporates new ways of measuring productivity in digitalized activities.

Coyle and Nakamura point out that the true budget constraint is the 24-hour day. It cannot be expanded. With the digital revolution, time spent on-line has increased for work, household activities, and leisure. Which of these areas of time use contributes the most to well-being? Do some types of on-line activity actually decrease well-being? Does this overall trend toward increased on-line activity constitute societal progress? These are still open questions. What is needed to shed light on them is a "time lens for progress" that is time use data for the three types of on-line activity by level of satisfaction experienced.

Digital technologies can result in shifts in work tasks between paid and unpaid labour, with implications for productivity.

An example is the use by supermarket customers of self-check-out scanners. Sales are unchanged but paid labour, which is used as the input to calculate labour productivity, is reduced and productivity increases. We have still limited understanding of how important these developments are for both productivity and well-being.

The authors set out an ambitious agenda for measuring broader economic welfare and productivity in terms of a money metric of the well-being afforded by different allocations of time. They highlight the need to take into account the digitally-driven reallocations across the market/home production boundary and the work/leisure boundary. In terms of their perspective on valuation of time, they build on the full-income approach pioneered by Becker. The key requirement for the realization of their agenda is the availability of regular and detailed time use data, including digital activities.

The authors offer advice for statistical offices on how to move forward on this agenda. First, they recommend that statistical offices develop new measures of output that better capture the utility impacts of the changing economy and time use, and produce satellite accounts for these measures. Second, they make the case for statistical offices to broaden their regular collection practices to include data needed for the satellite accounts.

This is a wide-ranging article rich in ideas. It has the potential to stimulate further work in a variety of areas related to the impact of the digital economy.

Links between Productivity and Standard of Living (Oulton)

Unlike the first three articles in the symposium that largely focus on subjective well-being, the fourth article by **Nicholas Oulton** of the London School of Economics and the National Institute of Economic and Social Research relates to an objective measure or metric of well-being or welfare, namely living standards. The author starts out with the premise that it is productivity that accounts for the long-run growth in living standards. He then proceeds to show that this was indeed the case in the UK over the 1977-2019 period when labour productivity accounted for 92 per cent of the increase in living standards.

Oulton's measure of living standards is income-based, but it is not GDP per capita, which he recognizes has weaknesses as a metric of living standards. Rather he uses the concept of median equivalent household disposable income (MEHDI) employed by the UK Office of National Statistics (ONS). He makes the case that this measure is superior to GDP per capita for four reasons. First, the measure is based on median, not average income so it better captures the experience of a typical household in the wake of rising income inequality. If the income gains are concentrated in the top half of the income distribution, average income will rise faster than the median income. Second, given the existence of economies of scale in consumption, Oulton uses an equivalence scale to make adjustments to income for family size. Third, Oulton focuses on the household, not the individual. Household members pool resources, making the household the appropriate unit for decision-making related to

labour supply and spending and hence the tracking of living standards. Fourth, income is measured on a post-tax or disposable basis, indicating the purchasing power of the household over goods and services supplied by the market.

Oulton develops a framework to decompose changes in MEHDI into nine factors, with labour productivity measured as GDP per hour worked, being only one of the factors. These eight additional MEHDI determinants are income inequality, the equivalence effect linked to the parameters of the equivalence scale and family size and composition, the share of household income in total income, hours per person employed, the unemployment rate, the labour force participation rate, the relative size of the working age population (16 and over) in the total population, and the relative price of consumer goods compared to the GDP deflator. Over short periods, these factors can be very important for income growth, but over long periods, they are largely offsetting and contribute little to real income growth.

Oulton's results are instructive. He finds the MEHDI advanced at a 1.9 per cent average annual rate in the UK from 1977 to 2019. This was slightly faster than labour productivity growth at 1.7 per cent. Other factors that contributed to income growth were an increase in the household income share of GDP, a greater proportion of the population 16 and over, and a slower rate of increase in consumer prices than in the GDP deflator. On the other hand, median income growth was reduced relative to average income by growing income inequality (growth in average EDHI was 0.24 percentage points higher per year at 2.2 per cent) and by fewer hours worked per person employed.

The importance of productivity growth for living standards is well illustrated in the UK after 2007 when productivity growth plummeted. After averaging 2.3 per cent per year from 1977 to 2007, labour productivity growth collapsed to 0.2 per cent for the 2007-2019 period. MEHDI also fell dramatically, from 2.4 per cent in 1977-2007 to 0.4 per cent in 2007-2019. In other words, all of the 2.0 percentage point fall in living standards of the UK population after 2007 is accounted for by the 2.1 percentage point drop in productivity growth. If the UK wants to increase the living standards of its citizens, productivity growth is the royal road.

One issue that Oulton does not fully address is the implications of his choice of post-tax or disposable income over pre-tax income for the income measure. A comprehensive measure of living standards should extend beyond goods and services produced by the private sector to include the goods and services provided without charge by the public sector, such as health and education. The consumption of these public goods is not currently included as income in MEHDI. One can imagine a scenario where tax rates are increased, reducing disposable income, but the tax revenues are used effectively for the provision of additional and higher-quality public health and education benefits equally shared among the population. The fall in MEHDI would underestimate true developments in the living standards of the population. The effective delivery of public goods and their valuation by the recipients is challenging, but needs to be included in

any comprehensive assessment of the link between productivity and living standards. Progress on this front may be a long way off. In the short to medium term, an alternative perspective in living standards measurement is to use pre-tax income instead of disposable income. This is based on the assumption that in democratic societies, through the taxes they pay, citizens receive public services commensurate in value to private goods and services they can purchase with their disposable income.

Take-aways from the Symposium

So far, the symposium has generated some important takeaways (as mentioned, several other articles from the symposium will be published in the next issue of the IPM). The first take-away from the symposium is that it is crucial to differentiate objective or material well-being from subjective well-being or happiness. An income measure, such as the real disposable adjusted household income measure used by Oulton, is a reasonable proxy or metric for material well-being. Subjective well-being, also referred to as happiness, is best measured by long-term satisfaction with one's life. Over time, material well-being increases much more than subjective well-being, which may exhibit no trend. In any discussion on well-being, it must be clear whether material or subjective well-being is the focus of attention.

Second, productivity growth, the foundation of income growth, is much more important for material well-being than subjective well-being. This follows from the fact that many factors other than income affect subjective well-being. In addition, even higher income may not necessarily contribute to greater happiness if any positive long-term effect of income growth on happiness is offset through the effects of comparisons relative to others in the community.

Third, material well-being is, in principle, important to the population. But it is often taken for granted, unless it is declining. The current conjunction where inflation is outpacing wage gains, illustrates the public concern for material well-being when living standards are falling. But steady increases in material well-being generate much less public attention.

Fourth, the digital age has resulted in major changes in time use, with much more time spent on-line for both work, household activities, and leisure. But the implication of these changing patterns of time use for productivity and well-being are unclear. Certainly, the rapid and extensive diffusion of ICT has reduced the labour needed for many routine tasks, boosting labour productivity. Perhaps workers can now devote themselves to more interesting non-routine tasks and obtain greater work satisfaction. Whether this is the case remains unclear.

Fifth, a robust finding is that generalized trust in strangers, which reduces transaction costs, contributes both to higher productivity growth, and to higher material and subjective well-being.

Sixth, through the article by Legge and Smith, this symposium is introducing the concept of total well-being efficiency (TWP) to the literature. In a sense, this is an intuitive concept. How can limited or scarce resources, defined in terms of the four types of capital (produced, human, social, and natural capital) be allocated

to produce the highest level of life satisfaction? As shown in the article, countries vary widely in the level of TWP. Understanding the reasons for this variance will occupy researchers for many years to come. For example, differences in TFP across countries are generally linked to differences in institutions and technologies. Does this also apply to TWP?

Seventh, there has been a long and intense debate in the well-being research community on the relative merits of a dashboard of well-being indicators versus a summary indicator or a composite index of well-being. Legge and Smith strongly favour the latter approach. Their preferred summary measure of subjective well-being, life satisfaction, is the dependent variable in their model. Indeed, econometric analysis of the determinants of well-being require summary measures of well-being.

Eighth, going forward, should more attention by both the research community and by public policy makers be given to attempt to quantify well-being in monetary terms so that central agencies of government can more easily incorporate well-being considerations in their budgets? Or should less attention be given to productivity and GDP given that well-being issues are more important and resonate more with the public? Expert opinions differ.

Ninth, none of the articles explicitly examine the role of public policy in improving productivity and well-being. These are big topics well beyond the remit of the articles. Both productivity and well-being are influenced by many factors. From a policy perspective, one must first identify what are the most important factors, then ascertain if these variables are indeed amenable to public policy, and finally determine which public policy levers are most effective. This is a long-term project.

Tenth, in the capital approach to well-being, the different types of capital are inputs in the production of the outcome of life satisfaction. But the inputs themselves may contribute to the well-being of the population and it may be difficult to separate this positive well-being effect from the from output of the "well-being production function." For example, students may experience positive well-being from attending school and the process of accumulating human capital. This is in addition to obtaining higher levels of life satisfaction that result from attaining the qualifications.

Eleventh, in terms of productivity, there is an on-going debate about the importance of digital technologies compared to the major innovations or general purpose technologies of the past, such as the steam engine and electricity. Analysts who see the digital as less fundamental than past major innovations point to the weak aggregate productivity growth in the digital age, except for the second half of the 1990s. Those who take a more positive view of the productivity-augmenting potential of digital technologies argue that the productivity benefits of the digital age are being currently underestimated because of measurement problems, or are forthcoming due to lag effects.

Finally, in recent years, many societies have become more polarized. Some argue that this development, which has implications for well-being, is related to disruptions caused by digital technologies, such as social media. It has been noted that the invention of the printing press in 1440 was

followed by two centuries of religious wars. The printing press represented a much less expensive way to communicate ideas, a challenge to conventional religious views. Equally, the digital revolution through social media fosters mass communications. One no longer needs a printing press to express oneself publicly. Gatekeepers are gone. In the long run, this democratization of speech likely represents progress for society. But in the short to medium term, this development can be disruptive and divisive for society, with potential negative implications for well-being.

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