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Article

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European Journal of Economics and Economic Policies: Intervention (EJEEP)

Provided in Cooperation with:

Edward Elgar Publishing

Suggested Citation: von Weizsäcker, Carl Christian; Krämer, Hagen M. (2021) : On capital, saving, and investment in the twenty-first century: a reply to Hein, European Journal of Economics and Economic Policies: Intervention (EJEEP), ISSN 2052-7772, Edward Elgar Publishing, Cheltenham, Vol. 18, Iss. 3, pp. 303-309, <https://doi.org/10.4337/ejeep.2021.03.05>

This Version is available at:

<https://hdl.handle.net/10419/277521>

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On capital, saving, and investment in the twenty-first century: a reply to Hein

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With our book Saving and Investment in the Twenty-First Century: The Great Divergence (published as open access), we present a comprehensive theoretical explanation as well as empirical evidence for the phenomenon of low interest rates observed in the OECD countries and China and make various economic policy recommendations based on it. We have developed a new capital-theoretical approach to address these important issues. In what follows, we will discuss some of the more critical parts of Eckhard Hein's otherwise very sympathetic review of our book.

Keywords: *capital, saving, investment, macroeconomics, economic policy, public debt, neo-Austrian capital theory, Keynesian economics, natural rate of interest*

JEL codes: *E12, E13, E14, E20, E21, E22, E43, H63*

1 INTRODUCTION

We are grateful to Eckhard Hein for his review (Hein 2021) of our book *Saving and Investment in the Twenty-First Century: The Great Divergence* (Weizsäcker/Krämer 2021). His comments are thoughtful, carefully developed, and mostly sympathetic. They are obviously based on a close reading of our book. We were especially pleased with his labeling of our book as ‘thought-provoking’ (Hein 2021: 300). This is exactly what we had intended. Indeed, in Weizsäcker/Krämer (2021) we present a comprehensive new theoretical explanation, as well as empirical evidence for the phenomenon of low interest rates observed in the OECD countries and China. Moreover, we make various economic policy recommendations based on it.

To this end we have developed a new capital-theoretical approach to address these important issues that may not be immediately familiar to some readers. New approaches initially meet with disbelief and opposition from many commentators. Even those ideas that are ultimately generally accepted may not yet be adequately explained or fully understood; sometimes their time has simply not yet come. In addition, the persistence of well-established patterns of thought is a distinctive individual characteristic and also one that characterizes scientific communities (in the sense of Thomas Kuhn). The history of economic thought provides numerous illustrative examples of this. Here is a quote from John Maynard Keynes, which we have placed at the beginning of our book: ‘The difficulty lies, not in the new ideas, but in escaping from the old ones, which ramify, for those brought up as most of us have been, into every corner of our minds’ (Keynes 1936: viii).

Received 28 August 2021, accepted 30 August 2021

In what follows, we will address some of Hein's central criticisms. We start with his criticism of our understanding of capital in the book, which is related to the famous Cambridge/Cambridge controversy on the theory of capital. We shall then address the question of causality between saving and investment. We also defend our view that citizens' claims on social security must be treated as private assets and, at the same time, as implicit government debt. Finally, we discuss the connection between our new capital-theoretical approach and (post-) Keynesian theory or, respectively, the nexus between stock and flow variables.

2 MONOTONICITY OF DEMAND FOR CAPITAL

In Section 2.2, Hein (2021: 295–298) refers to the Cambridge/Cambridge controversy: the demand for capital, v , is not necessarily a monotonously decreasing function of the real rate of interest r , if the prices of capital goods (in terms of a consumption basket) depend on r . This (negative) result is correct, and we do not deny it. However, Hein may have overlooked the far-reaching implications of our 'meta-model.' It allows us the 'Austrian turn.'

We denote the technique in use at the real rate of interest r by $\theta(r)$. It is then convenient to give the technique the 'house number' r . By definition we then have $\theta(r) = r$. We then consider any variable x in the steady state as being a function $x(r; \theta)$. And we can form partial derivatives $\frac{\partial x}{\partial r}$ and $\frac{\partial x}{\partial \theta}$. As we show in the book (chapter 2) and in the accompanying paper (Weizsäcker 2021a), this procedure allows us to define reasonable concepts such as the 'steady-state marginal productivity of capital.' Building on Hicks (1939) it also allows us to develop a modernized conception of the 'period of production' $T(r; \theta)$. We then derive the 'Böhm-Bawerk-inequality'

$$\frac{\partial T}{\partial \theta} \leq 0$$

(theorem 7A in Weizsäcker 2021a). On the other hand, due to the Wicksell effect, in general $\frac{\partial T}{\partial r}$ can be positive or negative. Indeed, most of the time it is positive. We now can define the 'coefficient of intertemporal substitution' $\psi = \frac{\partial(\frac{T}{r})}{\partial \theta} \geq 0$. It means: keeping the price system, induced by r , fixed; a higher rate of interest causes the reasonably defined period of production T to shrink. This corroborates Böhm-Bawerk's insight about the allocative function of the rate of interest. The coefficient of intertemporal substitution has an advantage over the conventional elasticity of substitution (between labor and capital) in that it is also defined when the real rate of interest is negative.

Moreover, we also have good reasons for the assumption that steady-state consumption is a continuous, indeed a continuously differentiable, function of r . It is important to understand that, in our thinking, as everywhere in neoclassical economics, there is not only a homogenous input factor labor, but a diversity of inputs, like labor of different qualifications, like land of many different physical and locational characteristics, like a great variety of entrepreneurial skills, and so on. This means that for any given real rate of interest, many different production methods are used simultaneously. Therefore, the steady-state 'technique' $\theta(r) = r$ really consists of a mixture of many coexisting production methods. Then, a 'small' change in r induces a 'small' change in the mixture of the different production methods. This is exactly what is meant by the assumption of continuous partial differentiability of $v(r; \theta)$ and therefore also of consumption per worker $c(\theta)$.¹

1. For a more detailed justification, see Weizsäcker (2021b: 173–174; a German language publication).

But even if one refrained from this differentiability assumption, the basic approach would remain the same. A theorem in the same spirit as theorem 7A mentioned above shows that a slightly higher rate of interest induces a shift in ‘technique’ such that – keeping relative prices the same – the period of production T is smaller, or, at most, remains the same. Indeed, this is what both Cambridges should expect at a switch-point from one technique to another. The (positive) period of production of any given technique is the percentage negative of the (negative) slope of its wage–interest curve. Thus, with a slightly higher rate of interest, at a switch-point, the economy switches from the technique with a steeper slope (with a higher period of production) to the technique with a smaller slope (with a lower period of production). Implicitly, both Cambridges have accepted this very ‘Böhm-Bawerkian’ result.

Our ‘meta-model’ allows for great heterogeneity of (non-capital) inputs. This is an advantage compared to the Cambridge–Cambridge models of capital theory. In the twenty-first century, the latter are not suitable for empirical macroeconomics. However, our meta-model can also cope with the (unrealistic) assumption of a homogeneous labor input. We then can apply it also to the case that steady-state consumption is not a monotonously rising function of the rate of interest r for $r < g$ and not a monotonously falling function of the rate of interest r for $r > g$. Even in this case the Golden Rule of Accumulation holds, as we show in chapter 2 of our book, as this assumption is a special case of our meta-model.

Assume now that for $r > g$ there exists a range \tilde{R} of interest rates such that $\frac{dc}{dr} = \frac{\partial c}{\partial \theta} > 0$ for $r \in \tilde{R}$ and $\theta = \theta(r) = r$. With w for the wage rate and v for the value of capital per worker we have the basic steady-state equation $c(\theta) + gv(r; \theta) = w(r; \theta) + rv(r; \theta)$. And we stick to the general capital-theoretic assumption that, for a given r , the value of $w(r; \theta)$ is maximized with respect to all available techniques θ (and hence $\frac{\partial w}{\partial \theta} = 0$ at $\theta = r$). We then obtain

$$\frac{\partial c}{\partial \theta} = (r - g) \frac{\partial v(r; \theta)}{\partial \theta} > 0 \quad \text{for } r \in \tilde{R}, \quad \text{and thus } \frac{\partial v(r; \theta)}{\partial \theta} > 0.$$

This is in itself a very implausible inequality. It means that, by making the cost of capital more expensive, the value of all capital goods evaluated at a given price vector (= neutralizing the Wicksell effect) rises. In other words: the quantity index of all capital goods employed rises, as the cost of capital rises and the cost of all other inputs (wages) declines. It is a fundamental violation of the ‘law of demand.’

But this implausibility is even stronger if you remember that at the same rate of interest r , and hence with the same technique θ , but with a different rate of growth $\hat{g} = r$, the opposite is true. This is so because then r corresponds to the Golden Rule. And for the Golden Rule, $\frac{\partial v(r; \theta)}{\partial \theta} \leq 0$.

Proof Due to the Golden Rule and continuous differentiability of $v(r; \theta)$ there exists a neighborhood Δ of interest rates around $r = g$ such that $\frac{dc}{dr}(r - g) = \frac{\partial c}{\partial \theta}(r - g) \leq 0$ for $r \in \Delta$.

But then, because of $\frac{\partial c}{\partial \theta} = (r - g) \frac{\partial v(r; \theta)}{\partial \theta}$ we obtain

$$\frac{\partial v}{\partial \theta} \leq 0 \quad \text{for } r \neq g \quad \text{and } r \in \Delta.$$

Because $\frac{\partial v}{\partial \theta}$ is a continuous function of r and θ , we then also have $\frac{\partial v}{\partial \theta} \leq 0$ for $r = g$.

And an analogous result obtains in a model with a finite number of techniques. As is well known in capital theory of both Cambridges, the Golden Rule of Accumulation then

still holds. We look at the first switch-point to the right of the growth rate, which is at the interest rate $r = g + \varepsilon$ with an appropriately chosen $\varepsilon > 0$. We generally have the steady-state equation $c(\theta) + gv(r; \theta) = w(r; \theta) + rv(r; \theta)$. In this case, for a different technique from the Golden Rule technique we obtain

$$c(g + \varepsilon) = w(g + \varepsilon; g + \varepsilon) + \varepsilon v(g + \varepsilon; g + \varepsilon).$$

At the same switch-point $g + \varepsilon$ the equation for the Golden Rule technique reads $c(g) = w(g + \varepsilon; g) + \varepsilon v(g + \varepsilon; g)$. At this switch-point, both techniques exhibit the same wage level. On the other hand, due to the Golden Rule, we have $c(g) \geq c(g + \varepsilon)$. It thereby follows that $v(g + \varepsilon; g + \varepsilon) \leq v(g + \varepsilon; g)$. At this rate of interest $r = g + \varepsilon$ the economy switches to a technique that uses less capital. This, then, is in the same ‘spirit’ as the result for the continuously differentiable function $v(r; \theta)$.

Similarly, we also can show that at the nearest switch-point below the Golden Rule point, a higher interest rate also leads to the use of less capital.

It is difficult to imagine a ‘technique’ $\theta = r$, which has the property that demand for capital (in physical terms, that is, for given relative prices) rises with a higher interest rate at some growth rate below the interest rate, and falls with a higher interest rate at a growth rate equal to the corresponding interest rate.

Economics is an empirical science. We ask Cambridge UK capital theorists: can they find any *empirical* evidence for a collection of ‘techniques’ with the property that the quantity index of capital goods rises with a higher rate of interest? As we look at the real world, more than 80 percent (in value terms) of physical capital is buildings and infrastructure. Is there any evidence that – other things being equal – the demand for buildings has this property, which contradicts the law of demand?

Referring to the Cambridge–Cambridge controversy, Hein (2021: 295) writes: ‘This controversy has shown that in a more-than-one-good economy the demand for capital is generally not a monotonously downward-sloping function of the real rate of interest.’ But, as our book shows, this is beside the point. We are, of course, aware of the Wicksell effect. However, the Wicksell effect in itself does not hamper us at all. The Golden Rule of Accumulation prevails – even with a Wicksell effect of any sign and magnitude. Our theoretical approach relies on the proposition that real consumption is a monotonously downward-sloping function of the rate of interest for $r > g$ and a monotonously rising function of the rate of interest for $r < g$. We therefore rely on the law of demand $\frac{\partial v}{\partial \theta} \leq 0$. We admit that in theory one can construct an exotic counter-example. The law of demand is reasonable until somebody can show an *empirically* realistic counter-example.

Our book is written with the mainstream ‘belief’ in the power of substitution. In this sense it corresponds to the Cambridge MA position.

3 S AND I: DOG AND TAIL

Hein correctly describes our theory in the book as a loanable funds theory. In other words: we look at a full employment state of the world. We do, of course, acknowledge that the actual economy may not be in full employment. We do this quite explicitly in chapter 11 of our book, which discusses the countries of the euro area. The focus of our book, however, is on the macroeconomic conditions of full employment. Here it is important to understand that price stability in conjunction with full employment puts savings in the role of the dog and investment in the role of the tail. The more people save, the higher are investments in a monetary regime of price stability and high employment. In a world

of underemployment and underutilized capacity, investments are the dog and savings are the tail. We believe it does not make sense to argue that *always I* leads and *S* follows, or the other way round, that *always S* leads and *I* follows.

In this context, our book also is *not* a book about income distribution. It is, of course, true that a more unequal income distribution raises the average private savings rate. We could have written another book of the same number of pages, which dealt with these issues of income distribution. Everyone is invited to write such a book. The distributional issues are difficult, and, of course, highly political.

At the theoretical level, the reader can see the difference between our approach and a model, which is suited to issues of income distribution. In our book, the rate r is the risk-free real rate of interest, which we also identify with the real rate of interest at which a Treasury like that of the US or of Germany can borrow. This means that w is not simply 'the' wage rate. There are many different wage rates. And w also contains land rents and risk premia.

We argue in the book (Weizsäcker/Krämer 2021: ch. 2) and in Weizsäcker (2021a: ch. 2, sec. 12) that the risk-free real rate of return is the best available price signal for the steady-state marginal productivity of capital. It may not be the ideal price signal for each investment project. Nevertheless, averaged over all investment projects, there is no better price signal than r . The main reason for this proposition is the following: either investment projects are risk-enhancing for the investor, or they are risk-reducing for the investor. We speak of 'offensive' projects (risk-enhancing) and of 'defensive' projects (risk-reducing). A preliminary survey of different investment projects indicates to us that there are more defensive than offensive ones (Weizsäcker/Krämer 2020).

This does not mean that there are no risk premia in the economy. However, in a majority of cases, these risk-taking premia are not closely linked with investment in physical capital. It is a major error in economics to link all risk-taking to investment in physical capital.

4 STOCKS AND FLOWS

Hein (2021: 299) complains about a 'theoretical imbalance of the book' and misses 'a more systematic comparison of the different theoretical perspectives.' As far as the latter is concerned, it seems that he would have liked to see more space devoted to (post-) Keynesian theory in chapter 7 of our book.

We want to take this opportunity to clarify that the main purpose of chapter 7 was not so much to establish a greater plurality in the book. Rather, a major objective of this chapter was to bridge the gap between a stock-size approach and a flow-size approach. In both the theoretical and empirical sections of the book, we worked with macroeconomic stock variables. This follows from the capital-theoretical approach used in the tradition of Eugen von Böhm-Bawerk and the concepts central to the book, such as the production period, the waiting period, the wealth desired by citizens, the private wealth of the private sector, and so on. In each case, these are stock variables. In the empirical part, the components of private wealth and their composition, such as the value of the stock of real capital, the value of land, and the capitalization of net claims of the private sector on the state are estimated for OECD countries and China. The (post-) Keynesian models favored by Hein, as well as most empirical studies based on national accounts, are primarily concerned with flow variables. They also play a major role in economic policy debates and are also more familiar to us as economists and generally more 'catchy' in terms of language. This is why the title of our book is *Saving and Investment in the Twenty-First Century*

and not *Desired Wealth and Private Wealth in the Twenty-First Century* – although the latter lists the notions we apply in the book. The nexus between these flow and stock variables is obvious. Based on stock variables, the macroeconomic equilibrium condition in our approach is $Z = T + L + D$.² It is equivalent to the well-known macroeconomic equilibrium condition in flow variables $S = I + (G - \tilde{T})$.³

We agree with Hein's remark at the end of his review that different theoretical approaches can arrive at the same conclusions provided they respect the same macroeconomic accounting identities, of which macroeconomic and financial stock and flow accounting relationships are undoubtedly one. Chapter 7 shows exactly this: that the widely used flow-based macroeconomic analysis of growth, employment, and distribution in the tradition of Keynes and Hansen leads more or less to the same results as the stock-based analysis used in our book.⁴

An increasing number of modern macroeconomic models and theories use both flow and stock variables and take care to ensure a correspondingly consistent relationship between these variables. We meet these requirements in our empirical calculations, for which we compile asset balances for various institutional sectors of the economy, such as firms, households and the government, using data based on the recently expanded System of National Accounts. We have thus shown that our stock-based explanatory model is equivalent to modeling with flow variables. With this and, more generally, with our new capital-theoretical approach, we are able to show that in societies characterized by increasing average life expectancy of citizens as well as by reaching the limit for greater productivity of more roundabout production and in which there is too little government debt, there is a stock *and* a flow imbalance. Its negative economic effects can only be addressed by a significant expansion of public debt in the interest of full employment and to avoid inflation and permanently very low interest rates.

5 IMPLICIT GOVERNMENT DEBT

An important point in our book, which is touched upon *en passant* by Hein (2021: 294), is the treatment of the claims of households on the state that have come into being as a result of contributions paid into pay-as-you-go social security systems (especially into public retirement schemes). For us, these entitlements represent assets of private contributors, while on the other hand they must be regarded as government debt. Since they are liabilities of a different kind than, say, government securities, we refer to them as implicit government debt, while conventional government debt is explicit government debt.

The inclusion of these asset claims is not only theoretically of importance. It is also heavily relevant to our empirics, since the present value of the future cash flows to which households are entitled represents an extremely important component of their wealth. According to our calculations, around one-third of private wealth in the

2. On the left-hand side of the equation, which was not by accident printed on the cover of our book, Z stands for desired wealth (or the waiting period), while on the right-hand side is private wealth; T stands for the production period, L for land, and D for the national debt. All variables are measured in units of time.

3. Here, as usual, S stands for private saving, I for investment, G for government expenditure, and \tilde{T} for net taxes.

4. Hein questions why we included Summers' approach in a chapter on Keynesian analysis. His is a New Keynesian approach (based on flow variables) which also holds the savings glut responsible for low interest rates and the current macroeconomic malaise (Summers 2015).

OECD plus China region consists of this kind of implicit government debt. Among these different forms, the public retirement scheme makes by far the largest contribution to this implicit public debt. Other branches of social security also add to implicit public debt. This is, above all, the case for public health insurance and nursing care insurance.

Our approach is consistent with the newly designed treatment of pension entitlements in the national accounts, as already introduced a few years ago in the System of National Accounts (SNA) 2008 and in the European System of Accounts (ESA) 2010. In a supplementary table to the core system of national accounts the capitalized ‘accrued-to-date pension entitlements’ in social insurance are now published regularly. These are determined by means of an actuarial calculation in accordance with internationally uniform rules. The concept of ‘accrued to date liabilities’ is used to calculate the net present value of the government’s liabilities from pension schemes. This method determines the present value of the entitlements that would exist if the pension fund were to close at the balance-sheet date. The OECD recognizes the importance of this extension of the provision of information on government debt: ‘This extension could have a major impact on the measurement of the government debt, because unfunded retirement plans ... involve heavy liabilities in some countries’ (Lequiller/Blades 2014: 447).

The social security system with its pay-as-you-go system is therefore ultimately designed like a private life-insurance scheme – but without a reserve fund. The missing reserve fund for the different branches of social security represents the implicit public debt. The government’s social security obligations are therefore to be treated as part of government debt.

6 FINAL REMARKS

We thank Eckhard Hein not only for his overall very positive assessment but also for his critical comments on our book. All the points of contention he raises concern issues that deserve further and deeper discussion. This should be particularly useful for those interested in a new approach that addresses a highly relevant contemporary macroeconomic problem and proposes concrete economic policy solutions. We hope that our response to his comments will advance this debate.

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