

Thank You very much for Your challenging and interesting reply.

I think we basically agree on the social planner and on maximization under constraints. We still disagree however on endogenous knowledge, stocks and flows and the skyline of Manhattan.

Endogenous knowledge In my paper knowledge can be increased and/or maintained by allocating factors (capital and labour) to the research sector. Since the planner decides on factor allocation, she implicitly decides on the optimal level of knowledge suitable for society, given all other model specifications. As long as the benefits of a marginal increase of capital and labour in research exceed the marginal costs, the planner will continue to develop the research sector. When benefits and costs balance out, the research sector has reached its optimal size. This means that knowledge is endogenous, since its level depends on all other model specifications. It is obvious, that this view only applies to “routine” operations in the research sector (normal science) and that no planner can decide that a novel Einstein should develop a new theory of the physical world by just allocating capital and labour to her research department. An economic model of knowledge production cannot predict knowledge “revolutions”, but only explain knowledge insofar, as it depends on economic factors. If a novel Einstein invents a new theory, the only thing we can do is to admit that the world has radically changed and modify our theories accordingly. There is no reason why in a dynamic framework matters should be different, since the planner decides the allocation of capital and labour at each point in time, with the objective of maximizing intertemporal welfare and she decides therefore also on the optimal *path* of knowledge accumulation.

Stocks and flows We agree that output is a flow and that capital is a stock. We disagree on labour. A reliable test is to look at the unit in which the variable in question is measured. Twelve hours a day is quite a lot of work, twelve hours a month is not very much. The unit of measurement for labour is hours *per unit of time* (e.g.: day, week, month, or year), whereas the unit of measurement of stocks does not need a time-specification. This is not in contradiction with the fact that labour is delivered by the working population (a stock). The same stock of labouring individuals can deliver more or less hours of labour per year, depending on the social legislation on working hours, which means that more or less labour can be delivered by the same working population. The crucial distinction is between the *labour force*, which is a stock, and *labour*, which is a flow. The distinction is the same as between *electric power* (measured in kW), and *electric labour* (measured in kW/h). What is relevant for yearly output is not the size of the labour force, but rather the number of hours worked in the reference period (the production year).

In any case, this whole issue is not particularly relevant, since it boils down to whether labour should be written with an upper case or a lower case letter, and nothing changes in the model structure.

Utility function I have clearly stated in footnote 3 of my paper that I am *not* concerned with architecture (and therefore I am not concerned with the skyline of Manhattan), works of art and gardens. What I am concerned with is only *production capital* (power plants, factories, industrial sites etc.). I am aware that attempts have been made to make production capital aesthetically attractive. An example is Hundertwasser's power plant in Vienna. It can be safely argued however, that such attempts remain marginal, and that productive capital can be basically viewed under two aspects. The first is positive (capital contributes to output), the second is negative (capital occupies natural spaces and negatively affects plant and animal life). Notice that I have not only assumed: $U_K < 0$, but also: $U_{KK} < 0$. This means, that the marginal impact of the first industrial plant is zero, and that it remains low for low levels of capital accumulation in society. At high levels of capital accumulation it is reasonable to assume significant negative impacts of further capital accumulation, since space is limited. Where should plant and animal life take refuge, if a significant portion of natural space is occupied by industrial settlements? This justifies in my view the assumption of low negative marginal impacts at low levels of physical capital and of rising negative marginal impacts as the quantity of capital increases.