Supporting Information to

The macroeconomic money-nature nexus: Are growing money supplies a relevant obstacle on the way to an ecologically sustainable global economy?

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S5 Appendix

Description to Fig 3 | Macroeconomic Relationships in the Economy and with Nature
Macroeconomic relationships in the economy and with nature.

Source: Own presentation.

Note: The circles are interlocking gears. The arrows indicate the direction of rotation and at the same time the direction of influence, depending on whether the arrow is before or after the gearing. The gears with titles in italics, are located on a second or third level and are connected to the first level at the toothing points, but not at the crossing points. They illustrate further connections between the individual quantities of the first level. Own presentation. **Legend:** R & D = Research & Development; LD = Liquidity Demand; LS = Liquidity Supply; IL&C = Interest Level & Creditworthiness; AD = Aggregate Demand of Goods and Services; AS = Aggregate Supply of Goods and Services; I&B = Infrastructure & Buildings; NR = Natural Resources; NRE = Natural Resource Efficiency; TFP = Total Factor Productivity; CL = Commercialization Level; APP = Aggregate Purchasing Power; AFP = Aggregate Financial Power.

The size ratio of the two main wheels "Total Activities of Mankind" and "Total Nature Use of Mankind" is 1.69 : 1, since in 2016, the Ecological Footprint of all humanity was 1.69 Earths [1]. The activities of humanity are determined by 6 main factors: social development, production including the exploitation of natural resources, consumption by households, governments and corporations, construction activities (infrastructure and buildings), the subsistence use of resources for personal consumption and the money supply. Production, consumption, construction activities and subsistence activities have a direct impact on the natural environment, as they use natural resources (land, raw materials and energy) and discharge emissions and waste into the environment. Social development and the money supply influence these four environment-related factors and are therefore indirectly also highly relevant for the use of the environment. There are interactions between the six main factors, which are mainly characterized by
market processes and here in particular by the demand and supply for goods and services (AD-AS), for labor, for infrastructure and buildings (I&B) and for liquidity in the sense of freely available money (LD-LS). Demand and supply find each other on the market via the price, which is why the price level for goods and services as well as for I&B, the wage level for labor and the interest level for liquidity (IL) are of decisive importance. Whether demand or supply is to be regarded as the driver in these market processes is an open question, despite intensive economic debates, depending above all on the respective market situation or product as well as the chosen perspective. The greater the market penetration in a society (commercialization level – CL), the lower the share of subsistence activities.

Consumption and production of goods and services are known to be closely intertwined and together determine the gross domestic product (GDP). Generally, GDP is regarded as an indicator of the economic performance of a society, whereby both the subsistence economy and the quantity and condition of infrastructure and buildings are excluded. Consumption and production come together via the price level, whereby not only the relationship between demand and supply, but also the competitive situation, the availability and costs of labor, raw materials, energy and land influence the price level. If research and development (R&D) increases the efficiency of resource use (the NRE level) or the total factor productivity (TFP level) by means of technical progress and the use of energy and raw materials, regularly leading to a price reduction as production costs decrease and production volumes increase. The resulting rise in demand then usually results in an increase rather than a decrease in overall resource consumption (the efficiency rebound effect). R&D also promotes innovations in the field of resource exploration (e.g. fracking, photovoltaics) and new products and services (e.g. computers, smart phones, leasing) and is responsible for generating a corresponding consumer demand. In a market economy, consumption and production are limited by the aggregate purchasing power (APP) and the total financial power (AFP) of a society. The level of this purchasing and financial power depends on the ratio of available liquidity to the current price level for consumer and productive goods and services. The higher the available money supply in relation to the price level, the greater the purchasing and financial power.

Social development influences the five other main factors in several ways. Social developments cause consumption trends (e.g. SUVs) and changes in behavior (e.g. long-distance travel), which in turn lead to changes in production as well as construction activities and influence the type and extent of nature use. The type and extent of consumption, production and construction activities are also affected by population development and politics. Population development is not only a driver of the demand for goods, services, infrastructure and assets, but also a decisive factor in the availability of labor for production. Conversely, research and development as well as the availability of energy and raw materials influence the demand for labor via labor productivity (TFP level). The policies of parliaments and governments provide a framework for consumption, production and construction activities for the respective societies by means of law. At the same time, they determine the volume of the money supply and therefore the availability of liquidity by setting in particular the level of minimum reserves, the minimum equity ratios and key interest rates (policy rates) for commercial banks by legislation or by specifications of their central banks. The social developments mentioned above are, in turn, strongly influenced by the prevailing values, which differ from one society to the next due to, among other things, the form of government, religious beliefs, historical developments as well as ecological conditions and are subject to constant change. Furthermore, social and economic inequalities influence values as well as political preferences, behavior, trends (e.g. status consumption) and politics as such.
The money supply determines the availability of liquidity and thus the scope of productive, consuming and construction activities as well as investments in research and development. Due to the simple creation of money from nothing, the supply of liquidity (LS) can grow along with the demand for liquidity (LD) in a largely unlimited way and at low cost. The demand for liquidity depends primarily on the general level of interest rates (IL), the credit standing, the general economic development (growth prospects) and the investment and consumption opportunities. The interest level is determined not only by the relationship between the demand for and supply of liquidity, but also by the official interest rates for central bank money (reserves) as well as future price developments for goods and services (inflation). The credit standing of companies, households and governments is decisively influenced by the individual economic outlook and the performance of assets (e.g. real estate, bonds, equities, equity investments, gold) used as collateral. Rising asset prices (e.g. due to low interest rates and the increasing money supply) cause assets to grow in monetary terms. But this increase are not seen merely as (asset) inflation, due to the standard assumption „the value of capital is the discounted value of the expected income“[2 p. 327 et seq.]. If asset values rise, the value of commercial banks’ equity also increases, so that they are able to grant more loans despite minimum equity ratios. If, when granting loans, savings deposits are not merely passed on but new deposit money is created, the money supply and thus the supply of liquidity grows, so that a liquidity asset rebound effect exists here as a self-reinforcing loop. If the values of assets rise due to a growing supply of liquidity, then the social gap between wealthy and poor people or states also grows and the value of labor will be devalued in relation to assets [3,4].

Overall, the model shown in Fig 8 reveals that, contrary to widespread assumption, it is not so much production that is at the center of economies but rather the provision of money by central and commercial banks, since the availability of liquidity determines the level of production, consumption, construction activities and the values of assets. However, the amount of money supply can be controlled by politics, since it sets the framework conditions for money creation and the supply of liquidity and, via policy rates, also has a significant influence on the demand for liquidity. Conversely, the money supply also influences social developments and thus also politics through various feedback processes (including inequality, labor and trends).
References


