

Modern Surplus Approach.
Rethinking Economics: money, credit,
time, distribution and productivity

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March, 2020

Preamble

In pure economic theory there have been important foundational problems that have been known to be crucial for several decades, yet, they have not been solved. Interestingly, many economists have reacted to these serious problems with the least convincing solution: by assuming them away. For example, consider the theoretical problems related to the:

1. Neoclassical theories of production dealing with the definition and measurement of (disaggregate and) aggregate productions;
2. Distribution of national surplus

Needless to say, these two problems concern the very core and foundations of neoclassical economic theory and consequently, span a very sizeable part of economics as it is taught and practised. In the first case, the disaggregate and aggregate production functions are inconsistent with the neoclassical view. To be more precise, the implied marginal productivities of the factors of production (i.e labour and capital) are not monotonic functions of their prices. However, they are often forced to be so by assumption or postulation. What happens when we remove these assumptions rather than taking them for granted and investigate the underlying theory and examine the actual data?

When the postulate is removed, based on recent theoretical and empirical investigation (Zambelli, 2004; Fredholm and Zambelli, 2013; Zambelli et al., 2017; Zambelli, 2018a,c), we observe that the neoclassical production function does not ‘exist’. This has a serious implication for both theory and policy: the measures of productivities based on them are meaningless measures. Concerning the second case, similar conclusions prevail: neoclassical theories of the functioning of the labour market(s) (where labour demand is *assumed* to be negatively related with respect to the wage rate) and those concerning distribution of the produced surplus (determined by the marginal productivities of factors) are shown to be seriously flawed descriptions of the real world. More importantly, economic policies prescriptions that are derived by current orthodox economic theories, for instance by *assuming* the existence of a neoclassical production functions are not well-founded.

One might argue that in the history of economic thought, one routinely finds that certain crucial problems were often assumed away. This was done by classical economists

(Quesnay, Smith, Ricardo, Marx) as well as marginalists ones (Walras, Pareto, Wicksell, Fisher). Of course, this may be justified by the lack of appropriate analytical tools at the disposal of theorists. However, this is different from banishing the theoretical difficulties purely through assumptions and discarding research areas to fix these problems, despite new tools being available. This has led to a serious consequence: it has led to the disappearance from pure theory of important elements that concern real economies, such as *money*, *debt*, *credit* and *time*, from the core of economic theory. We are left with a superficial treatment of these concepts in both micro and macroeconomics.

Our research program is an attempt to rectify this pathology, by rethinking and reformulating economic theory on strong foundations, rather than assuming important fundamental problems and concepts away. Such a reconstruction of economic theory may take place by (a.) identifying the junctions were past great economists have made untenable simplifications and (b.) rigorously study whether it is possible to fix these problems in the light of new analytical tools and theoretical results currently at our disposal. In our view, the scope for such a reconstruction is enormous and economic theory can indeed be strengthened by retaining many valuable contributions of the great past thinkers and discarding the problematic ones. This process is a space where there is a complex interaction between theory, reality and the set of available tools. For instance, our own attempts at a reconstruction of economic theory employs insights developed by several important scholars (such as (de Finetti, 1970), (Keynes, 1936), (Sraffa, 1960), (Simon, 1997) e (Velupillai, 2010) – see www.assru.org/Manifesto.html).

A rethinking and reconstruction research program needs a coherent approach in order to be effective. We adopt an algorithmic approach to economic theory¹, which is a powerful method of analysis that was not available to the economists of the past. We believe that it might be an essential ingredient for solving the old problems and for removing untenable simplifications.

The algorithmic approach is precise and it also allows to tackle complex economic problems whose analytical solution is hard to find. Despite great developments in the area, a coherent algorithmic method is not yet central to mainstream economic theory, which continues to use classical mathematics², which is not algorithmic.

¹The algorithmic approach is fundamental to the element of Computable Economics, where the notion of computability with algorithms is central. Computability and algorithms are defined inside metamathematics as developed the 1920s and 1930s by Kurt Gödel, Alonzo Church, Emil Post and Alan Turing. On the relationship between computability and economic theory and its relevance, see Velupillai (2000, 2010), or Zambelli (1995). In a nutshell, an economic model is computable if there exists an algorithmic representation of it, i.e. a computer program. That is, if it can be, in principle, simulated by a modern digital computer. Our research group uses MATLAB for programming.

²Many economists and students are presume and seem to be convinced that the mathematical formalization renders economics precise. But most of standard economic theories are *imprecise*, partly because they are not computable. Whether a theory is mathematically precise, in the sense of being computable, depends on the type of mathematics used. For example, not all real numbers, which are at the foundation of classical mathematics and economics, are computable, i.e. there is no explicit algorithm to compute a large majority of them. More formally, the set of computable reals has a measure 0 with respect to the set of all real numbers. If we embrace an algorithmic approach, we are led to conclude that vast majority of modern microeconomic theory (Debreu, 1959; Arrow and Hahn, 1971), which operates on magnitudes and functions defined on the reals, is not precise, in the sense that it is not computable. Also (Arrow, 1986, p.S399) has admitted that in economic theory “*Not everything is computable*”. At the end of their PhD training, the students interested in this line of research will have competences on algorithmic theories and computability in their analytical toolboxes.

Algorithmic production theory and modern surplus approach. *Research themes.*

There are several areas where the algorithmic approach, which we outlined earlier, may be applied to a variety of economic problems. One such important area concerns the generation and distribution of the social surplus³, which is central to economic theory and where serious simplifications have been made by both classical and neoclassical economists in the past. Algorithmic production theory is an active area of research within our larger research program. More details about the approach and potential areas of PhD supervision are listed below.

Some of the frontier issues in the surplus approach have been discussed and addressed by research papers utilising an algorithmic surplus approach. These research contributions build on expanding the scope of constructive methods developed by the Italian economist Piero Sraffa. Some of these have already been published by the members of the Algorithmic Social Sciences Research Unit: Velupillai (1989), Velupillai (2008), Zambelli (2004), Zambelli et al. (2017), Boglioni and Zambelli (2017), Boglioni and Zambelli (2018a), Zambelli (2018a), Zambelli (2018c).

The methods and lines of research outlined in these papers concerning the surplus approach can be further explored, deepened and improved. We welcome students who are interested in pursuing their PhD dissertation on one or more of the following themes:

- Production of Commodities by Means of Commodities and the Monetary Theory of Production
- Generalized dynamic Sraffian schemes with credit and debt
- Money is NOT a veil: the role of money, through the lens of the Keynes-Sraffa-Hayek debate
- World surplus and its distribution

Each of these areas are explained briefly below:

1. Production of Commodities by Means of Commodities and the Monetary Theory of Production.

This line of research attempts to introduce deferred means of payments (money, credit and debt)(Venkatachalam and Zambelli, 2020) inside the economic system, which is defined by Sraffain schemes. The ultimate objective is the construction of a robust monetary theory with this framework, which is also micro-founded.

There are at least four important reasons to introduce deferred means of payments inside Sraffian schemes by enlarging the framework already developed in Zambelli (2018c):

- (i) Walrasian General Equilibrium - which is the cornerstone of modern neoclassical theory, is not able to rigorously explain the need for and use of deferred means of

³The surplus is the amount that is left for consumption and new investment once the means of production used to generate it have been removed from the gross production. Surplus here is not to be understood as unidimensional or a single number measured as in the standard national accounting definitions. Instead, it is a vector or a bundle of physical goods. Recently available data-banks provide a detailed information about the uses of commodities as means of production and the amount of final produced good. Rigorous definitions are provided in Zambelli (2018c).

payments. Several scholars view Sraffian schemes as budget constraints similar to those present inside the intertemporal neo-Walrasian General Equilibrium (for example, see Hahn (1982)). Therefore, the insertion of money inside the modified Sraffian schemes is equivalent to the insertion of money as part of the budget constraints of Walrasian General Equilibrium;

- (ii) Sraffian schemes have been interpreted by many authors as a contribution towards the solution of Marx's transformation problem. Along these lines, a rigorous introduction of money inside the Sraffian schemes can be seen as a novel and fruitful contribution that can help understand the foundations of Marxian circuit of money-commodity-money (M-C-M') and the transformation of values into prices;
- (iii) Introducing money in the Sraffian schemes can help clarify and potentially resolve an interesting conundrum: whether monetary interest rate determines the rate of profits or vice-versa? This is a point which is close to Keynes' view expressed in the General Theory and that was hinted at by Sraffa (1960, p.33) himself:
"The rate of profits [...] is accordingly susceptible of being determined from outside the system of production, in particular by the level of the money rate of interest";
- (iv) Finally, several recently published papers (Zambelli et al., 2017; Boglioni and Zambelli, 2017; Zambelli, 2018a; Boglioni and Zambelli, 2018a), and others which are currently in progress, together constitute a sustained attempt to make modified Sraffian schemes useful for empirical, real world applications. Given that money, credit and debt are important constituents of any modern economy, any applied economic work that discards their role is certainly problematic. Placing all of them at the centre is one of the strong points of this approach.

We conjecture (on the basis of Zambelli (2018c)), that distribution of the surplus is at the very core and is the essential element of the whole analysis. Consequently, this work aims to set the foundations for the development of a non-neoclassical theory of distribution.

2. Generalized Dynamic Sraffian schemes with Credit and Debt.

Economists often tend to work with self-replicating systems and whenever time is considered in the model, the evolution path of the economy is presented along balanced stationary states. Stationary states imply that the system is in some form of equilibrium, where change at the sectoral levels is not allowed. Whenever changes are allowed, they are assumed to take place along paths that do not imply the use of deferred means of payments. This is theoretically unsatisfactory and is empirically untenable. We argue that the very existence of credit and debt are the demonstration that economic systems are not in equilibrium.

Using an algorithmic approach, we develop a framework in which out of equilibrium dynamic evolution is developed and where we allow for the existence of credit and debt. These dynamic possibilities can be studied in a rigorous way. A work-in-progress dealing with this issues can be found in Zambelli (2018b).

3. Money is NOT a Veil: studies on the role of money.

The claim that money has no influence (or that it is just a 'veil') in the determination and distribution of the physical output has been a contentious issue in economics

and has been debated for a very long time. Among the important contribution to this debate was the works of Hayek in the 1930s. This was heavily criticized by Keynes and Sraffa (Hayek, 1931a,b, 1932b,a; Keynes, 1931; Sraffa, 1932a,b).

The debate is still extremely relevant for monetary economic theory. The conclusions that one draws has implications for the design and choice of monetary policies. Modified Sraffian schemes, appropriately adjusted to include money, describing the functioning of economic theory (as done in research described above 1, 2) can be effectively used to formalize the views of Hayek and the critical remarks of Keynes and Sraffa.

The main conjecture in this project is that money cannot be considered as a “*veil*” and we strive to rigorously demonstrate this using the algorithmic approach. Work-in-progress in this direction can be found in Bracci and Zambelli (2018).

4. World surplus and its distribution.

This line of research emphasises the measurement of the national surpluses and the aggregate world surplus using the input-output data in WIOD (World Input-Output Tables - www.wiod.org). This data has been used in previous works (Zambelli et al., 2017; Boglioni and Zambelli, 2017; Zambelli, 2018a; Boglioni and Zambelli, 2018a). The entire approach is algorithmic and the specific algorithms utilised in published works cited in this document and those written in conjunction with the above research proposal areas (1, 2, 3) can be fruitfully extended.

The current literature on wealth (and the associated inequality) uses nominal aggregate values (or nominal aggregated deflated values). In our line of research, the produced surplus is a vector of real goods and services, which is not aggregated through the use of index numbers (as it is often done). Instead, it is treated as it is outlined in the theoretical work Zambelli (2018c). In short, the values distributed to the individuals in the world is measured as a share of the world surplus⁴.

This approach is supplementary and in some ways a robust alternative to the measurement of capital and income that is present in the work of Piketty (2014). Piketty and those concerned with the distribution of world wealth and income routinely use aggregated data, which is expressed in nominal terms (or presumed real terms, which are anyway nominally deflated values). In contrast, this line of work concerns the measurement of the world surplus in terms of quantity vectors, where the *numéraire* is not a reference currency, instead it is the world surplus. Work-in-progress on this topic can be found in Boglioni and Zambelli (2018b).

Concluding note

We welcome highly motivated doctoral students who are interested in pursuing one or more of the above mentioned research proposals or other connected research projects. They will be guided through the learning and mastering the algorithmic approach and also get individual coaching from the members of the research group.

The programming language that is used to the algorithms is MATLAB.

⁴The Appendix A *Actual and equivalent distribution of the surplus* in (Zambelli, 2018c, pp.816-817) shows how to transform individual vectors of consumption into fractions of the total generated surplus. Therefore, while it is evident that the individual consumption vectors are not proportional to each other, the transformation presented in the article, enables one to consider them as being equivalent to a fraction of the produced surplus.

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