Structural Change and Economic Dynamics 39 (2016) 46–53

Contents lists available at ScienceDirect

Structural Change and Economic Dynamics

journal homepage: www.elsevier.com/locate/sced

Structural liquidity: The money-industry nexus

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ARTICLE INFO

Article history:
Received 15 June 2016
Received in revised form
24 September 2016
Accepted 27 September 2016
Available online 15 October 2016

JEL classifications:
E51
L16
B20

Keywords:
Money and industry
Liquidity
Credit demand and supply
Time-structure of production
Industrial interdependencies
Structural economic dynamics
Levels of aggregation

ABSTRACT

This paper addresses the relationship between liquidity and production activity. It argues that this relationship becomes fully evident only if one considers intermediate levels of aggregation, and in particular stages of production within each industrial sector and their interdependence across sectors. To illustrate this, the paper introduces the concept of *structural liquidity*, which denotes material funds that are endogenously formed within the productive system before one considers the provision of liquidity by means of money. Structural liquidity is analyzed by combining (i) the representation of the productive system as an arrangement of fabrication stages sequentially related in time; and (ii) the representation of the productive system as a set of interdependent industrial sectors. The analysis identifies the structural liquidity problem as the need to satisfy *both* a viability condition (deriving from sectoral interdependencies) and a full employment condition (deriving from the sequencing of fabrication stages). The analysis highlights previously unexplored trade-offs, which have wide-ranging implications for monetary and liquidity policy.

1. Introduction

The close relationship between production and financial arrangements has been a distinctive feature of modern economic systems at least since the First Industrial Revolution (Deane, 1965; Hicks, 1969; Crouzet, 1972; Kindleberger, 1984; Neal, 1990). The analysis of this relationship, however, often involves accounts that are only of the microeconomic or macroeconomic type. We will argue that the nexus between money and industry becomes fully evident only if one considers intermediate levels of aggregation, and in particular interdependent industrial sectors and stages of production within each sector.

To illustrate this, we introduce the concept of *structural liquidity*, by which we mean material funds that are endogenously formed within the productive system before one considers the provision of liquidity by means of money or the financial system. We show that structural liquidity is generated by interdependencies between productive processes of different lengths. Analysis of interdependencies thus allows us to appreciate the different liquidity needs of different sectors, and different reactions to liquidity provision from the monetary and financial systems.

Our analysis draws on two economic traditions. One is the representation of the productive system as a set of processes extended through time and consisting of arrangements of fabrication stages sequentially related with one another, in the tradition initiated by Smith (1776) and subsequently taken up by Böhm Bawerk (1890), Strigl (1934), Hicks (1973) and Lowe (1976). The other is the representation of the productive system as a set of interdependent industrial sectors, first formulated by Quesnay (1759) and systematized by Leontief (1928, 1941) and Sraffa (1960). The above representations shed light on different but equally important aspects of the production system. Yet they have very rarely been integrated with each other, much less have the implications of such integration been explored. We show that it is by doing so

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http://dx.doi.org/10.1016/j.strueco.2016.09.001
0954-349X/

that structural liquidity becomes apparent. In fact, the need to coordinate interdependent processes of different lengths requires the creation of flows of liquidity that compensate for different timings in the delivery of outputs.

The paper provides contributions along three main lines of inquiry. First, it combines the above analytical representations, thus bringing to the fore interdependencies between processes of different lengths, and the resulting interdependencies of material and financial flows.[1] Second, it identifies as structural liquidity the type of liquidity that is endogenously formed and required within the productive system. Third, it identifies the structural liquidity problem as the need to satisfy *both* a viability condition (deriving from industrial interdependencies) and a full employment condition (deriving from the sequencing of fabrication stages). The analysis of structural liquidity highlights a previously unexplored trade-off, which has wide-ranging implications for monetary and liquidity policy.

The paper is organized as follows. Section 2 outlines the conceptual premises of a structural theory of liquidity. Section 3 introduces the analytical building blocks of our theoretical framework by integrating John Hicks's analysis of the sequential dependence between different stages of a given process of production with Wassily Leontief's analysis of the interdependencies between productive sectors. Section 4 is the conceptual core of the paper. In this section we introduce a scale condition and a proportionality condition as the two separate prerequisites that liquidity provision should meet so as to allow full employment in a productive system of interdependent processes of different lengths. The section argues that there generally is a tradeoff between the two conditions and that in most cases liquidity provision may satisfy one or the other condition but not both. Section 5 discusses the implications of structural liquidity conditions for macroeconomic policy in different institutional set-ups. This section highlights the need of grounding macroeconomic policy in the internal structure of production systems, and of identifying policy objectives and policy trade-offs on that basis.

2. Structural liquidity: a framework

Liquidity is a fundamental structural prerequisite of any economic system that has attained a developed division of labour and specialization of production processes. For division of labour presupposes the technical and organisational coordination of specialized processes of different time durations.[2] In a 'primitive' phase, division of labour may take the form of a set of vertically integrated processes specialized in the production of final consumer goods; in an 'advanced' phase, division of labour may take the form of a circular system of interdependent processes of different time-lengths delivering intermediate inputs to one another (see Ames and Rosenberg, 1965). The coordination of processes of different lengths, which is required in the latter case, can only be achieved if 'short' and 'long' processes are connected with one another through *buffers* by means of which: (i) short processes can wait until the productive inputs delivered to them by the long processes are ready; and (ii) long processes can advance their products to short processes that have not yet started and that need them as intermediate (produced) inputs.[3] This condition derives from the internal structure of production and makes visible the structural need for borrowing and lending that leads to the emergence of 'material' debt-credit relationships. The material funds generated by these relationships, which logically precede the introduction of money and the emergence of the financial sphere in the ordinary sense, are what we call *structural liquidity*. The following example may clarify the concept.

Let us consider a simple economy consisting of one process delivering looms and one process delivering cloth. Let us also assume that the two processes are interdependent in the sense that cloth cannot be produced without looms, and that looms cannot be produced without cloth (this would be the cloth needed for the maintenance of workers needed for the making of looms). The distinction between cloth making and loom making, and the different time lengths of the two processes, introduce a lack of synchronization between the flows of products from one process to the other. Let loom making require 20 days from iron smelting to assembling, and cloth making 10 days from spinning to weaving and tailoring. This situation entails that loom makers would be required to deliver a given number of looms at definite times in the cloth manufacturing cycle. Similarly, cloth makers would be required to deliver batches of cloth at definite times in the loom manufacturing cycle. Given the different durations of loom making and cloth making, there would be the need of cloth advances from cloth makers to loom makers, which would allow loom makers to be provided with cloth while waiting for the actual delivery of looms to cloth makers. Correspondingly, the cloth makers would need to be able to produce cloth in sufficient amount so as to allow the accumulation of a 'cloth fund' available outside the cloth-making sector. The need for liquidity is generated by the time asymmetry between cloth making and loom making. The cloth fund would be needed for two different purposes: (i) cloth provision to cloth makers from the spinning stage to the weaving and tailoring stages; (ii) cloth provision to loom makers from one loom-making cycle to the other. This entails the formation of a physical *net product* (surplus) of cloth, which in turn explains the greater flexibility acquired by the economic system. For the availability of net produce allows a specific kind of structural 'waiting': loom makers can wait from the start of one cloth-making cycle to the start of another cloth-

[1] This paper considers a productive system in which processes consisting of sequentially arranged stages of fabrication deliver essential intermediate inputs to each other. The issue arises of which time arrangements are compatible with: (i) the full utilization of productive capacities and full employment of labour; (ii) the viability of any given system of specialized processes (sectors) delivering essential inputs to each other. Here processes delivering final products are kept distinct from the processes delivering the corresponding intermediate inputs, and there is no vertical integration across fabrication stages, either upstream from final products to intermediate and primary inputs, or downstream from primary and intermediate inputs to final products. This representation of productive activity highlights the relationship between utilization issues and viability issues once time-coordination prerequisites are considered. It is therefore distinct from the representation of production processes as activities vertically integrated along the time dimension (Hicks, 1973; Zamagni, 1984) as it does not explicitly consider bottlenecks arising from the time required to build the capacity needed to deliver final output. This approach is also distinct from the representation of productive activity as a set of vertically integrated subsystems derived from the interdependencies between processes delivering intermediate inputs to each other (as in Sraffa, 1960, Appendix A 'On Subsystems'; Harcourt and Massaro, 1964; Pasinetti, 1973, 1981, 1988; Quadrio Curzio, 1967, 1975, 1986, 1990). The emphasis of this paper is on the time-coordination constraints arising from the integration of specialized processes *of different lengths* in a system of interdependent activities. Its principal research question does not concern the timing of traverse from one fully settled position to another under the influence of horizontal and vertical bottlenecks (Baldone, 1996; Belloc, 1980, 1996). Rather, this paper is concerned with the coordination requirements arising from the interdependence of processes characterized by different lengths, and with the liquidity arrangements needed in order to meet those requirements.

[2] The classical treatments of division of labour in an integrated system of economic activities are provided by Smith (1776), Babbage (1832), and Young, 1928 (see also Robinson, 1931; Ames and Rosenberg, 1965; Bianchi, 1983; Kerr, 1993; Scazzieri, 1993, 2014; Yang and Ng, 1993; Yang, 2003).

[3] Following Hicks's *Capital and Time* (Hicks, 1973), we may associate short and long processes respectively with labour-intensive and machinery-intensive production activities (see also Böhm Bawerk, 1890; Strigl, 1934; Magnan de Bornier, 1980, 1990; Zamagni, 1984). Liquidity as a problem associated with material synchronization between short and long processes is identified in Menger (1892); Clark (1899); Strigl (1934), and Lachmann (1956); see also Hicks, (1969) (Chapter ix on 'The Industrial Revolution') and Amendola (1991).