Department of Economics

Athens University of Economics and Business

WORKING PAPER no. 03-2025

Wicksellian General Equilibrium

Angelos Angelopoulos

February 2025

The Working Papers in this series circulate mainly for early presentation and discussion, as well as for the information of the Academic Community and all interested in our current research activity.

The authors assume full responsibility for the accuracy of their paper as well as for the opinions expressed therein.

Wicksellian General Equilibrium

Angelos Angelopoulos[1]

Abstract

Wicksell's (1898, 1906) *cumulative process* on fuelling inflation has never stopped being a topical theory in banking, financial and monetary economics. The general rectifying idea behind this celebrated theory of propagation of prices (and of fostering disequilibrium) is that inflation can be mitigated in an economy by handling the appropriate interest rate. As the cumulative process gets correctly deactivated, herein inwardly and not outwardly, and the price level is stabilised, this paper theorises mathematically this process as one via which the prices-distribution general equilibrium of an almost neoclassical macro-economy of agents and markets gets innately restored and fulfilled. Thereupon, the concept of the stable (in time) and socially optimal, equitable and ethical *Wicksellian general equilibrium* arises. This is an implicitly long-run dynamic, but an explicitly random and explicitly monetary general equilibrium, concerning perfectly and imperfectly competitive markets. Generational interdependencies are not accountable. Rationality of decision makers, on the other hand, is critical. Conspicuously, the Wicksellian general equilibrium is a quasi-neoclassical macroeconomic general equilibrium. To this end, it prefaces the theory of Keynes (1936), while it stays *vis à vis* with entirely all the classical body, both the regular one (of Smith, Ricardo, Say, Mill) and the irregular Malthusian one.

[1]Adjunct Professor, Department of Economics, Athens University of Economics and Business.

Key Words: Wicksell, Say's Law, Banking, Finance, Monetary Economics, Agents and Markets, Worker, Entrepreneur, Banker, Decentralisation, Economic Liberalism, Cumulative Process, Inflation, Deposits, Loans, Endogenous Money Balances, Money Illusion, Money Neutrality, Imbalances, Interest Rates Gap, Investment Savings Gap, Wage, Profits, Spreads, General Equilibrium, Consumption Allocation and Prices, Production Function, Potential Inputs, Potential Output, Steady Sates, Distribution, Stability, Aggregate Utilitarian Welfare, Social Optimality, Maximum National Wealth, Morality, Theory of Value, Theory of Money,, Unbounded Rationality, Market Power, Imperfect Competition, Randomness, Information, Brute Luck, Risk, Ambiguity, Shocks, Bubbles, Business Cycle, Dynamism, Long run, Expectations, Synthesis, Classicals, Neoclassicals, Keynes, Paradox, Economic Policy.

Classification: B, D0, D5, D6, D8, E, G0, G1

1. The Wicksellian Synthesis

This section, the paper's preamble, explains the transition from the classicals to the Wicksellian neoclassical theory, and then to the theory of Keynes. Ergo, this section places the theory of Wicksell into the nucleolus of the history of economic thought.

One paramount lesson that can be learned from the explosively dispersed history of economic theory is that canonical socio-political economics are ultimately declared those which are designed upon some stylised system of agents and markets. And then that the dominant, bulkiest and most burgeoning and impactful ones are of the neoclassical style, in which market competition optimally serves and protects the agents' private interests, which then naturally promote and facilitate the public one. If nothing else, their unquestionable preponderance is mirrored to the whole literature germane to economics. Contemporarily, neoclassical economics are endowed with a broad context and assigned with a rich meaning. They refer to prosperous-like, quasi-decentralised and almost equitable and ethical humanitarian societies, of rational (in any respect and in any degree) agents and of competitive (in any respect and in any degree) markets, insofar as both markets and agents operate under the principles of political economic democracy. Historically, on the way to their current unified format of multiple features and flexible characteristics, neoclassical economics had to embody and absorb several (semi) neoclassical economists with rather atypical views, which were expressed, ranged and spread over miscellaneous directions. Such neoclassical economists with more extreme, in a manner of speaking, opinions emerged and often established their own (narrower) disciplines within the (wider) umbrella of behavioural neoclassicism.

To marshal ideas and organise facts, everything originates back to the expedition of the *laissez faire* economics. The former boil down to the seminal *physiocrats*' pre-classical theoretical conception of free markets and self-reliant agents, which tenet then became the cornerstone of the orthodox classicism, of specifically and most vibrantly Smith, Ricardo and Say, and later John Stuart Mill. This classical (capitalist) political economy was severely and aggressively critiqued by the explorations of Marx, which were purposeful and, in fact, exclusively dedicated to protect the manpower of an economy, by exposing its over-exploitable unique virtues as a factor of production. Howbeit, the force of classicism was unstoppable and the classical doctrine kept systematically escalating with mathematical rigour, until it was eventually reformed to neoclassicism and triumphed. This transition was sealed by the prevalence of the state of the art behavioural neoclassical economics, the ones equipped with (Bentham's) utilitarian welfarism. Jevons, Menger, Marshall, Edgeworth, Walras, Pareto, Cournot, Bertrand, Slutsky, and a multitude of others that followed them, popularised this voluminous version of neoclassicism, and made a breakthrough to economics. Nevertheless, the advent and outburst of that vintage epoch of the homogenisation of (neoclassical) economics into a mathematical-economic behavioural science was marked by several loud independent and somewhat heterogenous voices of neoclassicism as well. In between several extra-ordinary cult figures of back-then neoclassicism, say as a specimen Pigou, Cassel, Lindahl, Knight, Viner, Fisher or Schumpeter, Wicksell is definitely an exemplar of a monumental and radically-idiosyncratic classical to neoclassical

economist. Wicksell, as all the aforementioned prestigious economists, profoundly infused (neo)classicism with many distinct novelties. Perhaps the most outstanding innovative element in Wicksell's theory was that he managed to re-interpret, within elapsing time, the impervious template of neoclassicism as far as the inescapable self-fulfilment of general equilibrium is concerned. The enclosed potency is attributed to the fact that, by far, the formalisation of the supreme conceptualisation of the Smithian *invisible hand* is, by itself, a crowning achievement in economics, especially and more fruitfully when it is compatible with agents' individualism and subjectivism, and then with aggregation of all of them.

To furnish neoclassicism with his rarely exuberant and promising intellectuality, Wicksell adopted a multifaceted and synthesising methodology, by making ample use of both the already existing and the newly flourishing knowledge at his time. First of all, Wicksell did stay closely affiliated with the classical general equilibrium platform of Smith, Ricardo and Say, when he concurrently endorsed the odd classical Malthusian circumstances where an economy may be inherently refusing to reach general equilibrium of the Say's (1803) law of markets stereotype, and price stability, as money was not just an inessential (and needless to be modelled) veil to a humanitarian economic organisation. Remaining, as a consequence, tied with but sceptical towards the (already powerful at his era) Walrasian roots of static and microeconomic general equilibrium, he then focused mostly onto the *ad hoc* Say's law, the market competition and the related with them inter-temporal idiosyncrasies, deficiencies or fallacies that need to be mastered, on the economy-wide level directly. He did so without explicitly insisting onto the a-temporal rational behaviourism of the *homo economicus* as a unit. He did so, nonetheless, by implicitly embracing the background idea of acting in such a typical objective-maximising manner, i.e., of behaving rationally, along a time line. For Wicksell, as the values of economic quantities flow with time, the personalised qualities of rational agents who form expectations, which qualities are generic to macroeconomic neoclassicism, are also taken (silently) for granted; either when it comes to making presently optimal risky decisions using the past knowledge or history, i.e., the observed and appropriately processed information, or when it comes to relying onto the discounting of predicted future values back to the current decision-making date. Ultimately, the deviant disequilibrium beliefs of the unorthodox classical economist Malthus, which were then filtered by (before being partially passed to) the aberrant ideas of the singular neoclassical economist Wicksell, ended up constituting major influences on Keynes (1936)[1].

Heretofore, there is a sizeable number of puzzles, riddles and contradictions hidden in neoclassicism, which have concerned a number of researchers and scholars. There is a crowd of authors who raise acute objections against the neoclassical stance, or simply keep their reservations towards neoclassicism, and stay remote from it. Keynes, in turn, was a colossal such economist, who however signed positively neoclassicism in net terms, because with his groundbreaking and constructive ideas made a headway to the field of neoclassical macro-economics.

[1]Whose work on the demand-side multiplying effect onto the growing output was also foreshadowed by Kahn (1931).

More precisely, with direct concentration onto the aggregate level of an economy, Keynes eminently challenged the (neo)classical *status quo* and resulted, essentially, in providing an alternative understanding with regard to how much decentralised, non-regulated and non-institutional economic (neo)liberalism should pragmatically be. Contrary to the conventional wisdom of that time, Keynes advocated that the free-markets economics are not generally immune to pathogenicities, and that, specifically, economies should be susceptible to the idea of responsibly and carefully creating budgetary deficits and debts by expansionary fiscal policy if they aspire to repel or overcome economic stagnations, compel economic recessions to retreat, and push multiplicatively economic growth. He argued that two main culprits of tenacious economic downturns and hardship are the following. First, the realistically existing involuntary unemployment of workers due to the deficient demand for them by the (more powerful) entrepreneurs, which means that (neo)classicals view artificially and fallaciously the workers' full employment (with the recognition, however, of a naturally existing voluntary or involuntary unemployment quotient), hence, the attainment of the potential aggregate output. Second, the ability of traders to endogenously provoke bubbles, i.e., spuriously favourable and which actually evolve to unfavourable business cycles, as (for instance) they go on mimicking one the other when a crisis is ostensible and prefer liquidity, that is to say, they withhold money instead of throwing them into commerce or speculation, so demand cannot always match supply as (neo)classicists blind-fully believe. This in turn means that (neo)classicals may be sometimes fictitiously viewing exogenous drivers behind the fluctuations of the overall economic activity of shocked, according to them, economies. *De facto*, Keynes criticised fore-mostly and heavily that aspect of (neo)classicism which was built upon the (incumbent in any economy-wide site or province at Keynes' years) Says' law market-classicism, by providing an essential demand and disequilibrium role to money, but was not an anti-neoclassicist *per se*, neither attempted to renounce the canon in economics. So, the economic regime of Keynes was and is still translated as one of a capitalist economy by a non-moderate number of neo-classical economists, especially by those with non-behaviourally (but still micro-economically) founded macro-economic orientation, who trail Keynes into the neoclassical corpus. Neo-Keynesians and new-Keynesians synthetical neo-classical economists do so. On the other hand, economists exhibiting extended sympathy to market socialism and/or Marxian communism due to the unambiguously extant market failures and agents' imperfections of a capitalist economy, and who prior to everything else see little value into the behavioural quality of a decision maker acting as an individual of unique personality in the spectrum of collectivism, interpret more stringently the Keynesian economic environment. They do not detect any neoclassicism in it. Rather, they present it as one which highlights the fact that the mainstream neoclassical approach to economics is flawed and invalid, a fabrication that circumvents reality, both in the microeconomic and the macroeconomic level, thence, cannot be viable. Post-Keynesians and neo-Marxian economists do so.

At large, nevertheless, some boundaries are blurry, and it may be tough to attach labels to notable economists and theories, or it may be even harder to deduce which one preceded the other. Occasionally, titles as Ricardian capitalists versus Ricardian socialists,

or Keynesians versus anti-Keynesians[2], or even pure versus impure Marxians, cannot be easily administered. So to dodge the usual traps, myths and canards when it comes to introspectively scanning and tagging the non-consensual and heated debatable history of economic thought: whichever the case positively is, or should normatively be, for an agents-onto-markets economy, the previous discourse reveals transparently the decisive role that Wicksell played into the evolution of the science of economics as a whole, without having to take sides. Indeed, Wicksell objectively acted as a catalyst to economic theory, since he released, and then channelled through his successor Keynes, a different perspective to the creed of the neoclassical general dis-equilibrium versus equilibrium economics. There is no doubt that Wicksell's majestic and durable in time theory is a hub in economics, standing in the middle of (and reconciling) neoclassicism and Keynesianism.

The *magnum opus* of Wicksell's theory is his *cumulative process* on triggering and feeding endlessly inflation, as expounded in Wicksell (1898, 1906). Much earlier predecessors of this theory were Thornton (1802) and Joplin (1823, 1828, 1832), who first came close to the idea of this two (loan versus natural) interest rates inflationary process and, thus, deserve credit for it. This paper attempts a rigorous (holistic and coherent) visualisation of this timeless recycling theory of inflation, with emphasis on its price-distributional consequences. In particular, the paper constructs a (nearly neoclassical) *Wicksellian economy* and concludes with a mathematical formulation of an existing (impure neoclassical) *Wicksellian general equilibrium* upon this economy. The deep nexuses of this general equilibrium notion, which has a macro-economic portrayal, with the traditionally (and up to currently) reported trends of both monetary and fiscal policy are also underlined, at the closure of this paper.

Formal or informal pictures, but all of them colourful, of Wicksell's fractional or overall theory, and of various analytical genres, widths and depths, can be also found in Frisch (1952), Uhr (1960), Eagly (1966), Patinkin (1968), Baird (1970), Laidner (1972, 1997), Jonung (1979), Storm and Tholberg (1979), Leijonhufvud (1981), Humphrey (1986), Boianovsky (1995, 1998, 2013, 2014, 2016), Siven (1997), Malinvaud (2003), and elsewhere. Notwithstanding, to the knowledge of the author of this paper at least, none systematic treatment of Wicksell's theory as a pure general equilibrium endeavour, of any length, is documented in the literature. In retrospect, and as this paper verifies, Wicksell's theory is a complete *general equilibrium theory* in all respects. Indeed, it contains: (a) a *production theory*, i.e., a theory of how a nation's output or income and, evidently, wealth is generated, (b) a *distribution theory*, that is, a theory of how this social wealth is disaggregated and allocated to the shareholders of the economy, who are the economic units that are rightfully entitled to it because they have worked for its creation, (c) a *theory of value*, i.e., a theory of how commodities are priced in their marketplaces, and (d) a (quantity) *theory of money*. These of course are the four pillars that any general equilibrium expedition should be based up-onto. All a primal general equilibrium concept may legitimately lack are specifications in luck, time and space.

[2]Such as the monetarists, the new-classicals or other hard-core neoclassicals.

2. The Wicksellian Economy

This section erects an economy that is entrenched into Wicksell's (1898, 1901, 1906) treatises or, largely speaking, stems from Wicksell's collective writings (see, additionally to the previous, for example in Wicksell, 1889, 1893, 1904a,b, 1907, 1908). To accomplish this assignment, section 2 uses a more modern (mathematical) economic theoretic machinery, which is based on ideas that fully matured fairly after Wicksell, but was concocted and spurred by Wicksell's texts beyond reasonable doubt. The Wicksellian economy contrived in this section serves a unique analytical purpose: it will be the receptor of the Wicksellian general equilibrium (which is introduced in section 3).

Let a semi-neoclassical (post-classical and pre-Keynesian) *Wicksellian* monetary (banking and finance) macro-*economy* of fully (or unboundedly) rational agents and of eloquently imperfectly (abreast with a mass of perfectly) competitive markets. Notate it with $\mathcal{E}$ and illustrate it within a sufficiently short-termed strip of time, which involves yesterday, today and tomorrow when the time line is arbitrarily stretched forwards and backwards, as infra:

$$\mathcal{E} = \{\Re; \alpha, \gamma, \beta_E, q, \varrho_B, p_E, \mathcal{U}, \mathcal{W}, \mathcal{L}, \bar{\nu}, F_E, I_E, \bar{\ell}_B, C, S, D, \mathcal{F}_B, \rho_B, \sigma_B, s_W, \pi_E\},$$

where

$$\Re = [\mathbb{R}; (W, E, B, G); (\mathcal{H}, \Theta, Q, \mathcal{R} = \Omega \cup \mathcal{O}); \Phi].$$

From now on, for notational terseness, with $\bullet$ will be being compressed any parametrisation whenever it is not urgently informing.

Beforehand, $\mathcal{E}$ is an exceptional (socio-political) economic organism of agents and markets, the internal workings of which are for sure complicated, but are far from being a black box. Just to sense this, one needs to take a first crack to the elegant Wicksellian mentality by predominantly embarking onto the baseline and befitting mathematical-economic logic that is embroiled into $\mathcal{E}$.

To preliminarily address the foundational mathematics of this logic, $\mathbb{R}$ stands for the real numbers and its role is to attach real values to all the quantities that are intertwined with $\mathcal{E}$'s script. In the sequel, all the real quantitative parameters (constants, variables or functions) pertaining $\mathcal{E}$, either exogenous or endogenous, will be activated and utilised, as $\mathcal{E}$ will be being dressed, context-wisely, with technicalities and mathematical accuracy.

Simultaneously, as far as the crucial economic side of this logic is concerned, all the quantified (as real numbers) measures or indices that are entangled into $\mathcal{E}$' premises and are, by nature, nominal or monetary quantities, stay this way. There is no meaningful reason to distinguish between 'real' quantities (physical values) and nominal quantities (pecuniary values), with the ultimate intention to make the (unimportant) second inert. Money is not an inessential and needless to be modelled veil for $\mathcal{E}$ any longer. Deflation, i.e., eliminating the prices effect on quantitative outcomes by dividing with the price level which is set as the *numeraire* (or common factor) market price in a setting of relative

prices, is not anymore an instructive practice. Down this analytical line, the term (and purely neoclassical object or phenomenon) 'real money' does not exist in the Wicksellian economy's tale, but this does not signal to demonetisation, which tactic is not any useful in $\mathcal{E}$. This is because *money neutrality* does work in $\mathcal{E}$, since the potential output has been achieved, but *money illusion* does not work. That is, although money is indeed neutral for growing the output purposes, it is not an (irrational) illusion for mis-judging agents. It is, instead, something that people are sensitive and react or respond to, by actively demanding it in particular. With this and that, along with all the previously explained, $\mathcal{E}$ is not at all engaged into the casual (neo)classical money (supply) exogeneity schemes, in which the creation and provision of the required money balances in an economy is not decided privately. Money is endogenous in $\mathcal{E}$. As Say's law would suggest, the endogenous demand (or need) for some monetary quantity is ultimately determined by the exhaustive supply of a potential amount of money in $\mathcal{E}$, which is already endogenously determined as well. Evidently, a monetary policy maker in $\mathcal{E}$ would only be able to handle the interest rate, not grapple with money quantities. As it was already implied, finally, it is not purposeful to discriminate between (worthless to be accounted for) absolute values or quantities, and (worthy for consideration) relative ones. The interdependencies of markets through their interrelated prices are profound without the need to consider relative prices. In sum, the two classical dichotomies are vacuous in $\mathcal{E}$, because they have ambiguous effects.

Clearly, aside from discovering a perturbed and dis-functional Say's law *a posteriori*, as $\mathcal{E}$ rolls down, all these *a priori* admissions constitute a series of firsthand breakdowns to the macroeconomic neoclassical tradition, even if the backbone of $\mathcal{E}$ remains neoclassical. A loyal to (neo)classicism economist would immediately refute the Wicksellian theory as non-interesting (if not upsetting). A faithful to Keynesianism economist, oppositely, would consider the Wicksellian theory intriguing (if not exciting).

In the outset, by digging more deeply under the surface of $\mathcal{E}$, there is either a lean or a tedious economic story that can be narrated for $\mathcal{E}$. As usually, one can safely rely onto the slim version of this economic narration, instead of the thick one, without this tactic causing any significant loss or harm in the generality of the analysis. Indeed, with minor modifications into the tools of mathematics that the analysis avails itself of, all the deliverables of the paper remain intact if one wishes to add more tools of economics.

Henceforth, to adhere to the genuine (neo)classical spirit of economic liberalism, one may be imagining that the government, G, is, in the normative position of $\mathcal{E}$ at least, just an observer and does not intervene at all into the domestic (or national) private sector of $\mathcal{E}$. So G exists distantly in $\mathcal{E}$, as an outsider, and does not get activated, i.e., will not become an insider, unless something goes wrong. All goods and services, of any nature, i.e., private goods, public goods, club goods or common pool resources, are tradable in the private markets of $\mathcal{E}$. At the same time, to keep the analysis within simplistic and credible limits, $\mathcal{E}$'s regional-peripheral and foreign-international sectors can be utterly suppressed. Geography or vicinity does not play any role in $\mathcal{E}$.

Remark next that since time is a critical factor which may be, realistically, forwardly elapsing in $\mathcal{E}$ forever, and backwards bottomlessly, it could have been accordingly considered and explicitly framed in the definition of $\mathcal{E}$. Albeit, to keep a concise notation,

time-indexing of $\mathcal{E}$ and its model parameters is not undertaken hereabout[3]. Brute luck, randomness and information are indispensable first principles that are explicitly and to the greatest possible extent embedded into the rationalism of $\mathcal{E}$'s agents (as the sequel analysis will reveal).

Other salient economic dimensions such as geographical space and localities, market extremities or other welfare-related market failures (due to informational asymmetries and incompletenesses, weak or erroneous private laws and legislations in markets, and so forth), extra-market frictions (for instance, unexpected shocks of the future status of nature of the world), agents' behavioural irregularities (for example, irrationalities, shortages in rationality or immoralities), and the like phenomena, which can hinder and/or dampen the normal operation and ideal explanation of $\mathcal{E}$, or at least disturb and complicate either of them, are not taken into account, in light of the instructive presentation of Wicksell's model in his paper. Still, soon after, the analysis will return and insist onto the significance of these benchmark topics that were forewarded here.

A quick stop now with some preliminaries about money (liquids: cash and its equivalents) is vital before going on. As of today, money remains a relatively crude subject in the economics literature. Due to its unparalleled diversity in the ways and the dimensions that it can be modelled, assuming of course that it is not a sterile mathematical-economic ingredient in the first place, it has essentially become an academic toy within the circles of economists, and not only. As it was prologued, money is based at the heart of the Wicksellian theory. So throughout this paper, in the (normative) absence of a state of laws in $\mathcal{E}$, i.e., of a legal (supervisory and custodial) central authority, the control (issuing, circulation and monitoring) of nation-widely acceptable domestic currencies in this economy, contained in some set Φ of currencies, which may (indifferently) be either fiat money or money that is backed by a physical commodity, shall be based up-onto private formal legislation, or even up-onto powerful informal private institutions, customs and multilateral agreements. A $\phi \in \Phi$ would be a decentralised, central bank free, but private banks inclusive currency. There is an undercover (mysteriously operating) network of *currency markets* in $\mathcal{E}$ in which the exchange (or conversion) rates between any two currencies of Φ are privately pair-wisely determined, and then remain paused, and are taken as given in $\mathcal{E}$. Money would then be fully loaded up-onto $\mathcal{E}$, that is, with potentially all its Jevonian (1875) properties. It would therefore be a means of storing private income, hence, private wealth. It would be then a separate commodity, with its own market, and an intrinsic market price and market value. It would also have the usual extrinsic (exchange) value, over all the rest of economy's markets and their trade. It would act, on this account, as a universally accepted medium of commercial transactions, and as common standard to which the values of all the market-related quantities of $\mathcal{E}$, of original monetary nature or not, could be converted and accounted, in order to be uniformly gauged, scaled and ranked[4]. If G were present in $\mathcal{E}$, then G could simply create and control, via the central

[3]Section 3 begins, nevertheless, with an explicit would-be depiction of $\mathcal{E}$ across time.

[4]Apart from the utilitarian welfare, which is a phycological quantity, the units of measurement of which are *utils*.

bank of $\mathcal{E}$, some other governmental currency as well, a centralised monetary institution $\phi' \in \Phi$. As already explained however, if one sticks to the script pf $\mathcal{E}$, G cannot manipulate ϕ' for the purposes of exercising monetary policy.

Next, to gain immediate (qualitative) humanitarian insights of $\mathcal{E}$, consider the family as being the basal economic unit of this economy, i.e., its key and universal private agent. This team, union, alliance, association or collaboration of individuals that stands out is dubbed 'household' in the contemporary neoclassical macro-economic jargon. In the original microeconomic neoclassical world, a household is simply a coalition of persons. Thereupon, say that the society of $\mathcal{E}$, which constitutes the public sector of this economy, can be captured by three 'household types'. Synonymously, assume that the grand coalition of $\mathcal{E}$ can be partitioned into three 'household characters', or 'household identities'. Further, for each one of these three categories of some particularised sort of households in $\mathcal{E}$ there is, broadly speaking, a representative household, upon which all analytical attention can be placed. One is allowed to think of it as an average or general household, of indicative behaviour or activity of all the panel of households it represents.

To orchestrate the analysis within a classical mould, $\mathcal{E}$ is governed by labor division and labor specification. So a representative household, of one of the three groups of households, uniquely projects a specific labouring identity, or an idiosyncratically specialised working role. It conveys more specifically, and in the anticipation of some reciprocal reimbursement, a job style that falls into one of the following three (mutually exclusive) scenarios. Scenario 1, a household can be a (plain) worker, i.e., an employed household. Notate with W the household that represents this strata of households. Otherwise, according to scenario 2, a household can be (or work as) an entrepreneur, i.e., an employer or a self-employed household, which is a both producing and supplying (or selling) firm-owner household. Symbolise with E the household that accounts for this cohort of households. Essentially, W and E are the two alternative productive working roles across the households' population in $\mathcal{E}$. If not W or E, finally, a household will be (working as) a banker, or else a financial or banking (i.e., a debit-credit) firm-owner household. Namely, a household with a non-productive working role. Rather, with a financial intermediary one. This is scenario 3. Denote the household that represents this last class of households with B. B is the intermediary between W and E. To wind up, $\{W, E, B\}$ is the workforce of $\mathcal{E}$. If one conceptually expands the calibre of the household W, E or B sufficiently so as to potentially include as well members who do not (for any lawful reason) belong into the labor-force of $\mathcal{E}$, then assuming that anyone who is in the position to work makes himself available for work, $\{W, E, B\}$ accounts also for the population of $\mathcal{E}$.

Hypothetically, once E and B establish their businesses in $\mathcal{E}$, the remainder households' population of/in W gets fully employed in either E or B (or both of them). This means full (plain) workers' labor employment for $\mathcal{E}$, when the workers' labor time, $L_W > 0$, is an eminent source (or factor) of production. Another distinct production factor in $\mathcal{E}$ is the (financially formed) physical capital quantity, $K_E \geq 0$, which amounts to any conceivable illiquid financial asset, found exclusively at the disposal of E. The actualised (= planned+unplanned) stock of this production input is also completely employed, and no back-up inventories of it are kept or stored. So in $\mathcal{E}$ there is zero unemployment,

all inputs are used in their maximum-optimum levels, and consequently the maximum-optimum product or output shall be attained. In other words, $\mathcal{E}$ reaches the potential level(s) of its quantitative resources by default.

For overall presentational clarity and smoothness, some normalisations are needful. First, it will be assumed in the follow up that the quantities of both production factors that B employs so as to run her enterprise are negligible, thus, of null magnitude. To perform her duties, therefore, B uses pre-specified and exogenous $\bar{\ell}_B > 0$ amount of (her own) labor time within the hypothetical time-slot that $\mathcal{E}$ is envisaged. This is the maximum possible workload for B, which cannot be exceeded. To round things up, finally, E will be visualised as both producing and supplying (entirely all the produced output). In particular, E does not delegate his sales to an exterior broker, nor his production to an external manager. E sets himself all the production-selling criteria and rules of his business, without using third parties, commissioned liaisons and dealers on these accounts. He is the proprietor, manager and seller of his firm and its products, respectively. He organises and administrates all the firm's resources and sales by himself. He takes on his own all the production and selling decisions.

Through her job related labor income, the labor role of a household character is conjugated with a spending versus non-spending role. Irrespectively of its occupational activity therefore, which can be either one of the previous three standardised ones, a representative household, W, E or B, also exhibits the two standardised activities, or options, with respect to its full usage and depletion of his work originated benefit, its so-called (private) labor income. Scilicet, W, E or B exhaustively spits her income between (i) consumption, which is the act of purchasing the produced and sold commodities, and (ii) savings, which is the opposite act of consuming, to wit, the option of not buying. The second action is executed for either precautionary purposes or investment scopes. To clarify, savings means either (i) insured storage, maintenance and management of money, or (ii) insecure augmentation of money. To substantiate further, savings either (i) are deposited to B, and generate a minor unit-payback to W or any other depositor, $\epsilon > 0$, in order to indirectly become unplanned physical capital for E, or (ii) are immediately capitalised by E himself into the planned illiquid assets of E, in which case savings procure a significant unit-payback, $\bar{r} > 0$, which is an already (endogenously to the system) calculated and stabilised marginal payoff, that covers its recipient for shouldering the danger of speculation. The first market-price of money ϵ, in contrast with $w > 0$ (the market-price of L_W) and r, is not immediately endogenously determined when W, E and B enter into $\mathcal{E}$. Meanwhile, same as with w and r, when eventually ϵ concludes to a specific value after its market adjustment process, it remains sticky. Under the preceding scheme, in which savings become essentially tantamount to the capital goods of $\mathcal{E}$, consumption and savings become eventually complement activities to the formation of the economy-wide (private) demand or expenditure, which stands right across the economy-wide (private) production and supply of $\mathcal{E}$'s composite product (output of durables and non-durables), which is a dual task that is carried out by E.

Essential is also to acknowledge that households do not have the excessive and compulsive (liquidity) preference to correspond money (i.e., their income) into activities beyond

what is necessary for their practical purposes, that is, outside of what is defined here as consumption and savings. For example, money hoarding or piling-up of money, instead of saving it, or betting of money, instead of investing it, do not occur in $\mathcal{E}$. The fact, in turn, that none monetary action in $\mathcal{E}$ is a gamble, thus, none action's return is a prize, is of paramount importance. It renders Θ, the luck concerning the future time of $\mathcal{E}$, brute luck and not option luck (for their distinction, see in the fascinating twin work of Dworkin, 1981a,b). So any probability distribution defined over Θ will not be a lottery, while it becomes then reasonable to assert that all the households in $\mathcal{E}$ averse the luck that is represented by Θ, which admission is then compatible with a concave social utilitarian welfare function for $\{W, E, B\}$, and generally with concavity of any function that assigns some kind of random (over Θ) return.

More nomenclature is in order at this point for $\mathcal{E}$'s labor-force. Within the modelled time-period, W earns a survival *salary*, $s_W > 0$, as her income from being employed into E, plus a reward for her savings. The two of them together constitute the *worker's income*, which shall be determined by the fixed pair $(\bar{w}, \bar{\epsilon}) \in \mathbb{R}^2_{++}$, once the two prices are endogenously determined. Within the same time-slot, a basic *profit*, $\pi_E \in \mathbb{R}_+$, which also contains an additional interest, are accrued for E as his gained *entrepreneurial income*. The entrepreneur's income shall be shaped by the triplet $(\bar{r}, \bar{w}, i) \in \mathbb{R}^3_{++}$, where $\bar{r}, \bar{w}$ are kept constant and only the (endogenous) i is let to fluctuate, where i is the second market-price of money. These proceeds refund E for his entrepreneurship, which is tantamount to the act of producing and selling, by employing and managing human capital and extra-human capital. Further, within the time-interval in reference, a *spread*, $\sigma_B \in \mathbb{R}_+$, aka financial *arbitrage*, which shall be also incremented by a savings reward, is being yielded for B as the *banker's income*. This income shall be formed by $(i, \bar{\epsilon}) \in \mathbb{R}^2_{++}$, where again i solely is allowed to variate, whilst $\bar{\epsilon}$ remains sluggish after its endogenous generation. This income compensates B for her mediation (among W and E) services.

Moreover, for analytical brevity again, $\mathcal{E}$ will be dismantled into representative markets. So $\mathcal{E}$ features: [1] a representative product (goods or services) market where W, E and B interplay and cross-trade either directly or indirectly, and which market sufficiently accounts for all the markets of all the private tradable-commodities in the economy, the ones of non-monetary and of non-human nature, [2] a representative market for workers (or human capital market) where W and E directly interact and [3] two types of banking or financial markets, of tradable liquids (or money), which stand as intermediary markets in the preceding market of [1], and in which B fills the communication gap between W and E. There is no market for the illiquid financial assets, since capital goods are subsumed into the market of [1]. Same as with the money markets of $\mathcal{E}$, $\mathcal{E}$'s product market bears, essentially, a twofold time-lagged representation. For simplicity for the time being, however, a single consolidated product market will be being considered for $\mathcal{E}$. $\mathcal{E}$ does not feature an underground sector. Unobservable (and immoral) subterranean (or under the table) trading economic activities, either lawful or illegal, which cannot be assessed or appraised, are not undertaken in either of the economy's markets.

In principle, W, E and B, the three agents of $\mathcal{E}$, are set out as being price takers in the four markets of $\mathcal{E}$. Until B, who naturally, by his idiosyncratic labour experience, expertise,

skilfulness and so forth, but mostly by his superior information, possesses and exercises within-market power in the two aforementioned markets of [3], but when ethically fulfilling his rational purposes (refer to the subsequent text of this section). There is a large volume of entrepreneurs in $\mathcal{E}$, large enough to disable an all-powerful E from immorally affecting market prices, and from deciding solely by himself for the employment of the inputs' quantities. E however, due to its occupational idiosyncrasy, possesses and exercises extra-markets power, when she also ethically serves her rational intents (see also afterwards). The gist is that the two business-men of $\mathcal{E}$, E and B, do have market-related advantages, but they do not cause moral harm to the society when they rationally exploit them (rather, they foster the social cohesion with their rational actions; find out further down). Across the opposite strand, the symbol W accumulates a massive (market powerless) number of workers, who also promote ethics with their overall activity.

In the routine neoclassical sense, $\mathcal{E}$'s human capital market, same as of course $\mathcal{E}$'s product market, remain perfectly competitive, but $\mathcal{E}$'s financial markets do obtain the 'imperfectly competitive' denomination (the reader will discover the validity of these statements in the sequel text of this section). Albeit, this says nothing for the denomination of $\mathcal{E}$ as a whole, because $\mathcal{E}$ is viewed in a small agents-markets operational scale, and not in a large one, in which the money markets may do not count significantly. So unwrap for a moment $\mathcal{E}$ back into its theoretical (but impractical) depiction, as an economy containing an extensive number of markets (of agents). Then, in mathematical parlance, $\mathcal{E}$ is defined as being not globally (i.e., not everywhere) perfectly competitive. This is not a cosmetic property for $\mathcal{E}$. When $\mathcal{E}$ rolls back to its traceable reduced form, this formal statement can justify and permit the potential existence of strictly positive income for all the three rivalrous representative household-agents of $\mathcal{E}$. Conversely, strictly positive incomes in $\mathcal{E}$ is a symptom of $\mathcal{E}$ sheltering vigorously imperfectly competitive markets (see also later on).

In advance, let $P > 0$ be the endogenous (volatile) price level of the market in [1] previously. The price-indices of the rest of the economy's markets are as follow: $\bar{w} > 0$ is the (endogenous) price of the market in [2] supra, and the (endogenous) bundle or combination of strictly positive interest rates $(i, \bar{\epsilon})$, in which the first is substantial, while the insignificant second is adequately close to nothing (but still strictly positive) in real life economies, are the prices of the twin markets in [3] above. There is an underlying mathematical relationship between P and i, the two flexible prices of $\mathcal{E}$, the validity and usefulness of which will be revealed afterwards. There is also a silenced in this section proportional or rational correlation between P and w, as w adjusts to its (general equilibrium) fixed value, or as w is pushed out of this value. Such relational phenomena are in congruence with the fact that the market-clearing pricing of commodities in $\mathcal{E}$ does not support personalised allocations that impart subjective utilitarian welfarism, as in the pure (microeconomic) neoclassical style. Instead, it finds its roots in the Smith-to-Ricardo classical (objective) theories of values, where P is formed by (or at least linked or tied with) the running marginal production costs, and i is the unit cost of financially creating physical capital, or of borrowing financial capital, i.e., of borrowing savings (money) funds in the first place.

To build some more intuition on the formal mechanics of the markets of $\mathcal{E}$, there is no *law of supply* to be found operating in either one of the markets of $\mathcal{E}$. Supply in a

market is not parameterised with respect to this market's price, and its realisation is not sensitive or responsive (i.e., is perfectly inelastic) to this market price. Then, whatever quantity is supplied independently onto this market price, i.e., as an already and by other factors endogenously specified and fixed quantity to its potential level, is all of it, without quantitative losses, demanded by some vibrant demand function in this market, which is connected with this market's parameters, and which certainly (and at least) satisfies the *law of demand*. This is how, by dint of Say's law, (fixed over market price) supply is equalised (i.e., crossed or intersected) with (variant over market price) demand in a market and the partial equilibrium price is emitted, under some degree of contestability, in this market. The 'equalise demand with the already optimal supplied quantity so as to find the optimal demanded quantity as well' is simply another neoclassical version of the usual market equilibrium procedure, which involves the usual inner market forces. In view of the proper definition of any demand function in the sequel, inversion of any demand function will be allowable, so the reader may be freely conceptualising the usual neoclassical optical aids of prices-versus-quantities planes (diagrams or plots of $\mathbb{R}^2_+$), in which notional figures, of course, supply functions are always straight lines, vertical to the horizontal quantities axes. Say's law, therefore, is an emphatically puissant and commanding hypothesis. If, by normalisation, zero quantities of commodities are intentionally or unintentionally kept away from trade as reserves[5] (and thus are not disposed) by the suppliers in any of $\mathcal{E}$'s markets, the law of Say additionally secures that zero quantities of commodities are intentionally or unintentionally kept as un-demanded reserves (and thus are not disposed) after the trade in any of $\mathcal{E}$'s markets.

In addition, to package the chaotically uneven personalities, phycological states, (in)sanities, cognitive capacities, instincts, emotions and proclivities of W, E and B into a conceptual box of purely economic rationale, so as to give a trustworthy mathematical context in the sequel, several crucial behavioural norms and standards are required for the agents of $\mathcal{E}$. (Totally or partially) out of the box characters for $\{W, E, B\}$ will be considered abnormal and illogical.

Above all, following Smith (1759), the genuine attitude and wishful belief of neoclassicism, which $\mathcal{E}$ preserves, is that although an economy may not be in the end comprised of ideally operating markets, it integrates ideally operating agents. Agents are sentimental human beings with moral thinking and attitude, so $\mathcal{E}$ is not populated by unethical (corrupted) agents, as for example rent seekers, with usually clandestine, and either licit or illicit behaviour. Likewise, all agents in $\mathcal{E}$ are benevolent. The supportive classical idea is that the substantial imperfect competition element in the markets of $\mathcal{E}$ cannot create by itself imperfections to the personalities of the markets' participants, even if the imperfect markets induce extra heterogeneity between the three representative household-agents, which could be exploited unethically by one in expense of the rest of them[6]. This is because,

[5]Or are destroyed.

[6]This is of course the substratum of Marx's criticism (1867, 1885, 1894).

by drawing upon the genuine ideals of classicism, autonomous[7] decision makers, who do act identically if of the same type, but independently on all the other peoples' behaviours[8], cannot realistically be adversaries or fierceful opponents, and cannot engage into market conflict or struggle, instead of benevolent (non-strategic) imperfect market competition.

Beyond that, pure blooded (starting as egoistic) neoclassical agents, as the economic entities of $\mathcal{E}$, are rational decisional machines. Henceforward, this will be meaning two things. One, that they, in the individual level, completely satisfy or unboundedly maximise their objectives, without suffering from limited attention, forgetfulness, circumstantial moods, moments of spontaneity, habitual or cultural tendencies, caprices or obsessions, imitation, demonstration of disproportional salience, and other analogous decision making (i) subjective or objective and (ii) humanitarian or extra-humanitarian weaknesses, limitations and restrictions. Two, that they, either in the individual level or aggregatively, form (when their activation is needed) rational expectations, as they have perfect foresight and perfect backsight. This presupposes that all the available past or history, $\mathcal{H}$, is compiled and included into their personal backward-looking decisions, while the same happens for entirely all the available future or potential, Θ, that is needed for their subjective forward-looking decisions. Agents do not have a blurry vision of the time domain, no matter how long it is. They are not myopic or short sighted, but they are long sighted. This also presupposes that, by and large, all agents will be sharing the same knowledge, an exogenous set of totally distinguishable and absolutely exploitable information, regarding both the past ($\mathcal{H}$) and the future (Θ). When the premise is that all agents have equal and free access to all the available history and future, then they simply are publicly and completely informed. Yet, in effect, each representative agent has a heterogenous or private (i.e., differential) way or ability to process (organise, filter, decode and interpret) and utilise the uniform, open and full knowledge at her disposal, according to her personal learning (in time) capacities and idiosyncratic opinions or beliefs. Or, eventually, in accordance with his (exogenous) subjective probability evaluations, which are made conditionally on the knowledge, $\mathcal{H}$ or Θ. This is not a setback, with the proviso that $\mathcal{E}$ accommodates noble agents, who do not have incentives to lie, cheat, conceal knowledge and misinform so as to exploit the others using such arising asymmetries, which may be resulting into personalised advantages or privileges. Ultimately, in the collective decision making of the assembly of all economic units, there will have prevailed a grand and common subjective probability measure, which will have been exogenously assigned to the whole society=$\{W, B, E\}$ at once. When servicing its objectives, the society will use this prior probability distribution as a means of making probabilistic assessments, conditionally onto the existing information, $\mathcal{H}$ or Θ again.

Further ahead, as the economic plot of $\mathcal{E}$ unravels in more detail and the agents' personal morality and rationalism are blended together, more on (i) the configurations of the agents' triplet $\{W, E, B\}$ and (ii) the specifications of the product market, the human capital

[7]Selfish in the sense of minding their own business, not in the sense of being counter-social and parsimonious.

[8]And, thus, agents do not correlate their actions with other agents' actions, as the players in strategic game theory do.

market and the two money markets, will be being released gradually, in the text of both this and the forthcoming sections. In the end, the paper makes amends for all the heavy surmises that were employed so far, and the additional ones that will be injected into $\mathcal{E}$'s premises, by introducing and establishing the Wicksellian general equilibrium, which will be of fully normative properties. And then by conjecturing onto the extensions and contributions of this notion to (optimal) policy informing inside $\mathcal{E}$.

As a matter of mathematical priority now, the elemental functions that span $\mathcal{E}$ need to be set in motion, and then their prominence has to be exposed.

To carry on towards this intent,
(a) for the benevolent and rational agents W, E and B together, across all markets of $\mathcal{E}$, and for some sets $\mathcal{H}$, Θ, Q and $\mathcal{R}$ (explained in the aftermath),
(b) as K_E, L_W and Y get adjusted to their (endogenous) maximum-optimum general equilibrium levels, $K_E^\star$, $L_W^\star$ and $Y^\star$, respectively, which are then taken as given in $\mathcal{E}$'s agenda and cannot be expanded further,
(c) as the endogenous, and sensitive or responsive to $\mathcal{E}$'s *modus operandi*, i and P get stabilised to their general equilibrium levels, $i^\star$ (or $\bar{i}$) and $P^\star$ (or $\bar{P}$), respectively,
(d) for the (endogenous) already established and rigid $\bar{r} > 0$ and the motionless after their endogenous elicitation $\bar{w}, \bar{\epsilon}$, which are also taken for granted in $\mathcal{E}$'s proceedings,
let (A) $\bullet$ represent the shadow randomness factor at this point and (B) $\mathcal{M} > 0$ and $M > 0$ account for the two (not necessarily equilaterally segregated and suitably entitled) stands of money demand, and define $PY := y$.

Contiguously, then, define $\mathcal{E}$'s (private) aggregate or social:

(i) (gross domestic) *product* or *output*, $Y = F_E(K_E, L_W) > 0$, $F_E : \mathbb{R}^2_+ \to \mathbb{R}_{++}$,
(ii) *consumption function*, $C : \mathbb{R}^2_{++} \times \bullet \to \mathbb{R}_{++}$, with $C(P, y, \bullet) > 0$ and $PC(P, y, \bullet) = \bar{\nu}\mathcal{M} > 0$, where $\mathcal{M} > 0$ is the (demanded quantity of) money that is withheld and used, gone, lost or spent into commercial transactions, and the (exogenous) coefficient $\bar{\nu} > 0$ applied on $\mathcal{M}$ summarises the pay-as-you-go structure of the realised payments in $\mathcal{E}$'s markets[9],
(iii) *savings function*, $S : \mathbb{R}^2_{++} \times \bullet \to \mathbb{R}_{++}$, with $S(P, y, \bullet) > 0$ and $PS(P, y, \bullet) = M = D(i, \epsilon) > 0$, where, specifically as ϵ is still in the process of adjusting to its $\bar{\epsilon}$ value and as $i = E(\epsilon)$ (see in the sequel), $D : \mathbb{R}^2_{++} \to \mathbb{R}_{++}$ is the *left after transactions* (demanded quantity of) *money function* or *bank deposits* (demand) *function*,
(iv) (demanded) *liquidity* (quantity) *function* $\mathcal{L} : \mathbb{R}^3_{++} \to \mathbb{R}_{++}$, with $\mathcal{L}(y, P, i) > 0$,
(v) *wealth* (of nation) *function*, $\mathcal{W} : \mathbb{R}_{++} \to \mathbb{R}_{++}$, with $\mathcal{W}(y) > 0$, where as $i > 0$:
$y =$ [W's labour income$(\bar{w}, \bar{\epsilon})$] + [$E$'s labour income$(\bar{r}, \bar{w}, i)$] + [$B$'s labour income$(i, \bar{\epsilon})$],
and

[9]For example, the velocity of money circulation in trade. Or the times that money changes hands in commerce, within some presumed time frame. The iconic (neo)classical quantity theory of money, first stated in words by Mill (1848) and then formally by Fisher (1911), is included in Wicksell's theory.

(vi) *utilitarian welfare* (derived from consumption) *function* $\mathcal{U} : \mathbb{R}_{++} \to \mathbb{R}_{++}$, where $\mathcal{U}[C(P, y, \bullet)] > 0$.

First things first, in view of the Wicksellian general equilibrium project that rests submerged in the background in this section's analytical entry, all the functions that were propelled supra need to display some rudimental mathematical-economic properties.
(a) F_E is a *production function* that is exogenously assigned to E, which is continuous and increasing on each one of its arguments. F_E attends $\mathcal{E}$'s gathering with some (exogenous) algebraic expression that relates its two inputs. The particular formula of F_E represents some (exogenous) substratum technical relation(ship) or constraint, say t, between its two factors of production, the worker's labor time and the (physical) quantity of (illiquid) capitalised assets. Axiomatisation of this binary relation is not imperative, if not nugatory, since the input quantities of F_E are not chosen by E under the pure neoclassical philosophy. Following the classical tradition of Smith and Ricardo, and entirely neutrally for the analysis, if F_E is assigned with stricter mathematical properties, this function can be assumed to be displaying *decreasing returns to scale* on each one of its inputs[10]. Both production inputs are irreplaceable in F_E as time flows. F_E's vulnerable to progression (i.e., advancement or improvement) technical status, t, always (with some accelerating pace or speed in time) aligns with both inputs neutrally or equally, without being skewed towards one factor or the other. The two factors of producing output grow alongside in $\mathcal{E}$. Over time, they are not competitive in their employment, i.e., they are not subject to substitutability. Due to the non-retarding population growth in $\mathcal{E}$, the fully employed human capital of (plain) workers, which can be more or less seen as homogenous, remains inexhaustible. The (fully employed and homogenised as well) physical capital has (by its nature) the tendency to decay and get quickly obsoleted, i.e., lessen in value, worth or even physical quantity, and then get unavoidably, within brief time-segments, replaced by new one[11]. Its unequivocal

[10]In pure neoclassical macroeconomics, F_E would be tightly set to satisfy the conditions of Inada (1963). Even more narrowly, it would be (persistently in time) defined as a Constant Returns to Scale (CRS) Cobb Douglas (1928) (CD) production function. With little exception, CRS CD production functions are the workhorse in landscapes of neoclassical macroeconomics. They are selected because they work as magic in macroeconomic settings of perfectly competitive markets, which however are quite polarised to $\mathcal{E}$'s interface as already explained. Prior to everything else, such functions give back constant-zero profits (when, of course, profits are purely neoclassically defined). Thereabouts this central property, a storm of other desirable properties constitute this function the most ergonomic tool in neoclassical macroeconomics.

[11]This is more clear if $\mathcal{E}$ were re-constructed on a long term inter-generational basis with an aggregated in time, after being period-by-period discounted back to some initial decision (planning or programming) period, social (i.e., aggregated upon all private agents) utility. Then an exogenously posed (time-stationary for simplicity) depreciation factor $\delta \in (0, 1)$ could be applied to K_E-accumulated, as in the legendary work of Ramsey (1928), without of course having to conscript the idea of $\mathcal{E}$ being ruled by the all knowing and all powerful social planner G, who acts on behalf and for the sake of $\{W, E, B\}$, by taking the helm of $\mathcal{E}$. $\mathcal{E}$ would then, in addition to the aforementioned qualities, effectively transfer wealth-accumulated for its three representative households as

importance is ingrained into the idea that it is a reproductive commodity that necessarily (but undesirably) has to be used as a means of production up until output grows to its potential and steady level. Agents dis-like this commodity. It is a 'bad' and not a 'good'. It offers dis-utility. It curtails the potential-maximum utility from the consumption good. Rational (i.e., utility maximising) agents are impatient agents, and when they do not have to care or worry about their future generations, and provided that they are enjoying the maximum output, they will (sensibly) solely and exhaustively consume it.

(b) C and S are prototype well-behaved *Marshallian demand functions* of W, E and B collectively, which fulfil the neoclassical norm: they are intended to interpret the partial equilibrium of $\mathcal{E}$, whilst they are contingent on utility maximisation, which is realised in general equilibrium. *Ceteris paribus*, further-on, they both satisfy the law of demand with respect to $P > 0$ and they both refer to normal or superior demand activities with respect to the private income $y > 0$. Concurrently, they both conform to the classical Say's law, which states that supply creates its own demand and determines the size of it. Demand simply adjusts to supply. Put it differently, the demanded quantities become exclusively (in the end) a positive function of income or, equivalently, of the (value of the) produced and supplied output[12]. As trade, i.e. exchange of commodities in markets, takes place in the non-barter economy $\mathcal{E}$, C is transformed into a *money demand of type I function*, while S into the residual *money demand of type II function*. Immediately after and upon S, D is the bank deposits demand function, which refers to money quantities that stay outside the agents' commerce. This function is similarly understood as a well-behaved neoclassical demand function. It is, therefore, (at least two times) continuously partially differentiable and strictly decreasing on each one of its arguments. Ultimately, it holds that

$$\bar{\nu}\mathcal{M} + \mathcal{M} = \mathcal{L}(y, P, i) = PC(P, y) + PS(P, y) = PC(P, y) + D(i, \epsilon).$$

D with respect to i, C and S, and then of course $\mathcal{L}$, bear unspecified (exogenous) algebraic formulae[13] On the contrary, D with respect to ϵ is the only one endowed with a

time grows. Under a time profile with such sophistication, agents would enter in the inter-temporal $\mathcal{E}$ with positive personal initial endowments of accumulated income, or wealth, as in the familiar static neoclassical economies. A negative monetary bequest would mean that a household enters in $\mathcal{E}$ having borrowed and owning money, from and to B, so this household would have to repay its arrears by amortising them across time.

[12]The coincidence between income and output-or-product on the economy-wide level needs to be extracted; see soon after.

[13]In pure Keynesian macroeconomics C and S have specified algebraic expressions. In particular, $C(P, PY) = |a|P + cPY$ and $S(P, PY) = -aP + (1 - c)PY$, where $c \in (0, 1)$ is the marginal propensity of consumption, $(1 - c) \in (0, 1)$ is the marginal propensity to save and $a > 0$. Keynes (1936) deploys his analysis as $P > 0$ remains constant and unmovable. It can be then normalised to 1, so evidently $C(Y) = |a| + cY$ and $S(Y) = -a + (1 - c)Y$. The interpretation is: when $Y = 0$ (nothing is produced and zero income is created) then the society has to borrow $-a$ so as to consume $|a|$. This is of course the idea of the autonomous, i.e., the independent on Y, consumption (and savings). Invert now the two functions and realise that Y depends multiplicatively on elements

specified (exogenous) algebraic expression. This is because ϵ remains firm after its endogenous creation, so it can be solidly apprehended, together with any function that ϵ fully parametrises. In particular,

$$D(\bullet, \epsilon) = p_B - \alpha\epsilon, \text{ when } D : \bullet \times (0, \tfrac{p_B}{\alpha}) \to (0, p_B),$$

for some endogenously arising $p_B > 0$ and some exogenously given $\alpha > 0$. This function, with its parameters, will be analysed and meaningfully contextualised afterwards.
(c) $\mathcal{W}$ is continuous and increasing on the W, E, B-agents' (mutual or national) income, $y > 0$. $\mathcal{W}$ engineers the Smithian-to-Ricardian positive relationship between a nation's core element, the division and specification of the family-based work (of any ilk), and the generation of this nation's wealth. By definition, wealth is income-accumulated along time. Under $\mathcal{E}$'s short run consideration, however, income cannot not be seen as being stocked. So by construction, $\mathcal{W}$ is the identity function $\mathcal{W}(y) = y$ in $\mathcal{E}$, and $\mathcal{W}$ has consequently a specified (exogenous) algebraic formula. It makes no difference whether $\mathcal{E}$ is an open or a closed economy. Seen as operating either in the global economic arena or in autarky, $\mathcal{E}$'s number one purpose is to maximise its wealth. This is signalled by the olden nationalist theory of *mercantilism*, which was probably the very first (half) organised movement in economics.
(d) Utility, both cardinal or absolute and (more weakly) relative or ordinal, is the bedrock of neoclassicism. In $\mathcal{E}$, the quantifiable utilitarian welfarism, which is translated as well-being, i.e., quality or status of life, that is exclusively drawn by consumption under the pure neoclassical paradigm, is objective for (and directly assigned to) all the society together. It is therefore not based on first principles, i.e., on (the cumbersome) subjective agents' axiomatised preferences, but is still viable without theoretical pitfalls. In general, functions or maps that are set as performance indices and numerically capture in (specifically) real numbers the agents' behavioural hedonism, happiness, pleasure, satisfaction or joy, which is received as alternative outcomes by an uncountable infinite set of alternative (not necessarily consumption) actions, are suasive as long as they are, primarily, continuous on this action set. In $\mathcal{E}$, the mobilised $\mathcal{U}$ approximates the continuity property fluently and autonomously, without having to be backed by latent, unobserved and (here) superfluous axiomatic personal preferential systems for the decision makers, which are then aggregated to a social (mutual or collective) preference relation. Indeed, consider that $\mathbb{R}$ represents the economy's extended social choice (decision or action) set. Subsequently, $\mathbb{R}$ represents the extended social outcome (consequence or re-action) set of $\mathcal{E}$ as well. Then, let $\mathcal{E}$'s social

---

of demand. Thus, not only the transpose is true, as the classical Say's law suggests. In short, according to the Keynesian plan, if an economy is simply viewed the other way around, demand is capable of converting a shrinking or busting economy into an enlarging or booming one. Keynes' providence was to create bonds between aggregate supply and aggregate demand when the latter is an impetus for the first. And he did so by following the footsteps of the production or supply side (neo)classicism, in which the income or the output is a stimulus to demand.

utilitarian welfare map or function

$$v : (\mathbb{R}, \mathcal{B}(\mathbb{R})) \to (\mathbb{R}, \mathcal{B}(\mathbb{R})),$$

where $\mathcal{B}(\mathbb{R})$ is the Borel σ-algebra of $\mathbb{R}$, be measurable in the familiar mathematical sense. Conceptually, v allows for the provision of a real numbered social welfare mass, value or worth to some social choice. Let also μ be a finite non-negative regular measure on $\mathcal{B}(\mathbb{R})$. It then follows, by virtue of Luzin's theorem, that since the measurable space $(\mathbb{R}, \mathcal{B}(\mathbb{R}))$ is a Borel (measurable) space and v is a Borel (measurable) function or map, v is a nearly continuous function. Let finally $\mathcal{U}$ be the restriction of v to $\mathbb{R}_{++}$. To make, by pushing forward this argumentative path, $\mathcal{U}$ impeccable, it is maintained that imprinted in $\mathcal{U}$ are the known properties of neoclassicism, out of which only continuity and monotonicity are essentially required, while $\mathcal{U}$ is unique up to any monotone transformation, when some suitable algebraic format of $\mathcal{U}$ is originally (exogenously) equipped to the society of $\mathcal{E}$. Given that marginalism had become a permanent neoclassical principle and practice by Wicksell's time, the consumer price index $P > 0$ of $\mathcal{E}$, before getting anchored to its general equilibrium value for the temporarily only existing $\mathcal{E}$ through-in the whole dynamic horizon, has to agree with the first derivative of $\mathcal{U}$, i.e., the society's (strictly positive and strictly decreasing) marginal utility (with respect to consumption). This condition, when everything else that determines consumption is held constant, provides the actual negative mathematical relationship between C and P. These are the two chief variables of $\mathcal{E}$, the ones that equilibrate to particular values and characterise $\mathcal{E}$'s balance.

A couple of remarks are now compelling. Given the above mild mathematical description of $\mathcal{E}$, F_E attains a general equilibrium value, while for some $P^\star$ and $i^\star$, C, S, D, $\mathcal{L}$, $\mathcal{W}$ and $\mathcal{U}$ shall be also attaining their potential (maximum-optimal) values, whenever W, E and B shall be maximising their labour incomes. The last condition would secure the maximum income (thus, the maximum wealth) for $\mathcal{E}$. This, in turn, would ensure equi-conceptuality (practically, equality) between income and product-value in $\mathcal{E}$, because less than the maximum income could not reasonably demand and buy (consume and save) all the economy's maximum product that is supplied or sold. It should be also kept in mind that, to exhaust analytical precision, the set Φ should have indexed any monetary quantity of $\mathcal{E}$. Alternatively, any such quantity should have been a function of at least one $\phi \in \Phi$. This mode of parametrisation would have been prepared in the name of announcing and stressing that, in principle, the quantities of domestic money are expressed in a variety or mixture of currencies that are controlled by intra-agents mechanisms or protocols, and which are themselves also traded in their own currency markets, which are bypassed and muted here. Its undertaking in turn, would have been strongly advisable because the worth or value of any monetary parameter in $\mathcal{E}$ is dependable onto the currency (or cocktail of currencies) to which this parameter is expressed. Howbeit, to keep the analysis within reasonable limits and prevent it from being diffused into further unmapped lands, Φ is skipped for the rest of the paper and the analysis is being made currency-free. In layman's terms, it may be simply thought that all pecuniary quantities in $\mathcal{E}$ have been automatically

transformed towards their eventual measurement into a uniform currency. So the need to express money into their units of measurement has dropped off the analytical radar of this paper. The currency (in which money is represented) is simply a widget in $\mathcal{E}$. This ends up being a preemptive analytical manoeuvre: without currency markets the Wicksellian economy does not carry the burden to model the (rational) agents' lucrative investments or speculation inside them.

Let us now proceed with the most inner intricacies of $\mathcal{E}$, so that additional mathematical economic precision regarding the components of $\mathcal{E}$ ensues. In particular, let us inquire more rigorously into how W, E and B, and possibly G, act and interact into the economy's (over the counter) markets. In section 3, as the ultimate G-free formal image of a Wicksellian general equilibrium is penultimately staged, a bunch of more technicalities regarding $\mathcal{E}$'s agents and markets will be mandated. From here and onwardly, this will be a laborious but inexorable course of action. Indeed, in section 3, entirely all the (accumulated up to that point) mathematical economic argumentative information is parcelled up together not only for the concise definition of the Wicksellian general equilibrium, but is summoned for the proof of the existence of this notion as well.

W, by relying onto un-modelled personal criteria, i.e., objective or subjective explanatory variables that are directly, indirectly or not at all related with the markets of $\mathcal{E}$, autonomously pre-decides what is the maximum or potential (and hence by default best for him, or optimal) labor time that he can possibly supply to E, and thus abstractly-endogenously determines and offers $L_E^\star$ to the market for workers. $\mathcal{E}$ does not go against the etiquette of neoclassicism at this bit. It is not trivial, but certainly not an action of insurmountable difficulty, to parametrise L_E with *cliché* variating determinants such as the price of the human capital market or the worker's leisure. In Wicksell's world, however, the human capital market is the less cloudy one, thence, the less attractive, because the law of Say clears up forcefully the way, and implements clearance or balance in this market.

The point to be made here is that (i) W has self-decided to set for rent all the time for which he can make available himself to work, so that practically there may still exist optionally or voluntarily unused working time which will be reasonably uncountable as unemployment, and then that (ii) E, who is equipped with some well-defined demand for work-time function, adjusts her demand appropriately, shifting it upwardly or downwardly versus the fixed (vertical line) supplied quantity of $L_E^\star$, sponges up all the quantity $L_E^\star$, and endogenously determines in this way the wage $w^\star > 0$ in this market, which then remains glued to this value and gets re-notated with $\bar{w}$. E, who is indeed in most of the control of the market for workers, is ethical and will take into account the most candid (classical to neoclassical) criterion with respect to how outwardly or inwardly will move her demand function, that is, how high or low will set the general equilibrium $\bar{w}$. In particular, classicals were originally the ones of the opinion that any demanded commodity, hence, $L_E^\star$ as well, has a (so called) *value in use*. Neoclassicals refine this idea, infuse it with marginalism, and become convinced that any demanded commodity, such as $L_E^\star$, should be priced according to the marginal benefit (here marginal profit) this commodity breeds to its demander (here E). A capable (skilful, talented, experienced, and so on) W with labor specification, and who is moral and sincerely devotes the potential (or full) toil and effort to his work, is more

productive, and by rising his marginal product, rises (*ceteris paribus*) E's revenues and, subsequently, profits (from sales). In market equilibrium, therefore, the (highest possible) wage, i.e., the unit or the marginal (or the rate of the paid) salary, will be equal to the (highest possible) marginal product of W, or equal to the (highest possible) marginal profit of E, which is increasingly[14] sourced from $L_E \to L_E^\star$, or equivalently from $L_E \in [0, L_E^\star]$.

All in all, $s_W = \bar{w}L_E^\star (> 0)$. Now the worker will spend her salary to buy quantities of composite product, which is sold by E. That is, W will consume and save her s_W. The savings of W will then create an additional (labour originated) income to W, which surmounts (and adds up to) her salary, so W's labor income will be comprised of these two components. This new additional income of W will not (make it to) be thrown into the product market of $\mathcal{E}$. In advance, exactly the same layout can be sketched for the banker, as long as one replaces infra W with B, s_W with σ_B and 'salary' with 'spread'. Notwithstanding, the result that $\sigma_B > 0$, hence, that $\pi_E > 0$ in general equilibrium, is one of the key findings of this paper's proceedings, and will be meticulously and independently analysed in the sequel.

Now, E singles out by possessing beyond $\mathcal{E}$'s markets power as well, since she has the exclusive privilege to arrange for her own rational sake, and then universally impose to $\mathcal{E}$, the value of r, which then stays put to $\bar{r}$ while $\mathcal{E}$ (temporarily) lasts. This 'outside the markets' power of E is not contextually paired with his power inside the human capital market of $\mathcal{E}$. Same as with the second, however, the first is rationally exercised by E without causing dampening effects to $\mathcal{E}$'s ethics. None (market) interest rate in $\mathcal{E}$ can be found above the calculable $\bar{r}$ (the origins of which are not explicitly found in $\mathcal{E}$'s markets). This can be inferred by simple means of contradiction, since the (about to be skimmed though right after) procedure itself by which E computes r implies that E would always keep asking for a higher rate of interest (above any market interest rate) in order to accept to invest in physical capital. Essentially, this financial technique adopted by E guarantees that $\bar{r} \geq i$.

So by setting a draft (at this point and for the rest of this section) lower time bound for $\mathcal{E}$, let Θ, an uncountably infinite set of states, or a state space if this set is filled with some topological, algebraic and order structure, traversing through $\mathcal{E}$ and going indefinitely beyond it. Θ contains all the known or unknown, by anybody, odds of $\mathcal{E}$, which together constitute all the practical or impractical, respectively, knowledge or information of anybody, regarding the future statuses of $\mathcal{E}$, starting from the lower time bound of $\mathcal{E}$, and going on up to infinity. Θ, additionally to $\mathcal{H}$ acting via the random variable i upon E (see in the sequel), creates extra randomness (risk or danger) for E's speculation, and is not only a vessel of transmitting exploitable information to and by E. In particular, E determines the random variable r via Θ and through an exterior to $\mathcal{E}$'s markets competitive condition. Namely, by a cost-benefit equalisation (and thus indifference or neutrality) principle.

In particular, with the drill that will be discussed soon after, E forms and owns presently a potential (planned and unplanned) financial capital that is corresponded to (the value of) his potential physical capital. He then invests (i.e., provides or makes available) into

[14]Not decreasingly, as pure neoclassicism upholds.

the firm that he owns entirely all this amount of capital. This action represents the (entrepreneurial) financial investment cost of E, i.e., the cost of using or sacrificing monetary capital for creating risky illiquid or fixed assets in the name of the enterprise that E runs. E is also exogenously assigned with (1) a subjective discount factor $\beta_E \in (0,1)$ and (2) a subjective σ-additive probability measure $p_E : \wp \to [0,1]$ that can quantify the probability of occurrence of (only) all the objectively (i.e., by anyone) distinguishable states of Θ, which are collected into the elements of the Borel σ-algebra $\wp$ of some non-empty subset Q of Θ, which may be assumed to be finite for reasons of practicality and determinacy of r. Each state inside any subset of $\wp = \mathcal{B}(Q)$ represents the following outcome: it is the (with some defined rule) accumulated in time future value, $\mathcal{V} > 0$, of the financial capital that would have been re-collected when the aforementioned initial or principal monetary fund, say $V \geq 0$, is currently invested by E into her business and into risky fixed assets. To avoid triviality at this point, it will be assumed that $V > 0$.

E then uses (1) and (2) as follow. With p_E E correctly finds the precise (expected) value of each future time-period's $\mathcal{V}$. E makes no expectation errors, since he forms rational expectations, so each expected value is the actually realised one. Then E applies prudently his β_E on each future time-interval's $\mathcal{V}$ and discounts this monetary amount back to today. Afterwards, in either discrete or continuous time, which can have an upper time bound, set by E for reasons of tractability, E will summate or integrate together all these discounted values so as to obtain $\mathcal{Y} > 0$. This quantity will be the total (accurately expected) future benefit or return of E from having invested V today. Finally, the equalisation of $\mathcal{Y}$ with V will deliver a value for the hunted interest rate $r > 0$. E will accept this r iff $r \geq i$. Otherwise, E will decline this r. For different upper time bounds, that is, for any longer and shorter investment life for V, E will repeat this process, and will accept all the cases in which $r \geq i$. He will then opt for the maximum r which satisfies this inequality. This is an optimal r because it maximises, *ceteris paribus*, the interest of the rational agent E. By finding the optimal r, E will have concurrently found the (endogenous) optimal investment horizon for his V.

Clearly inspired by Wicksell, Keynes (1936), whose analysis also involved two interest rates and the speculative danger of payments deferrals and defaults, was later calling *marginal efficiency of capital* the rate of interest that gets formulated, more or less, like r. Modern finance and monetary investment theory identifies a version of r as the *Internal Rate of Return* (IRR).

Let us not explore other aspects of the entrepreneurial activity. E transforms both (i) bootstrapped monetary funds, which are obviously not backed by assets in the name of the firm that E owns, and (ii) borrowed financial funds, or bank financed loans, into the monetary value of two production factors, $K_E \geq 0$ and $L_E > 0$. This amounts to the investment of (or coming from) E, I_E, which therefore has two separate branches, since I_E is undertaken by E on both human capital and extra-human capital. The second one, which is the one that randomises I_E as already explained, is:
(i) both *a priori* arranged or planned by E, referring to E's self-funding, that is, her savings that are drawn from his positive labour income, which are directly by E capitalised to what was previously understood as V,

(ii) and *a posteriori* realised or actualised as unplanned, referring to the monetary deposits of W and B that E absorbs (see for details in the sequel) so as to also capitalise them into V.

Formally speaking, since $\mathcal{E}$'s backcloth does not entail fluctuations of r, K_E and L_E after their potential or optimal determination, one has that

$$I_E : \mathbb{R}_{++} \to \mathbb{R}_{++}, \text{ defined by } I_E(i) = [wL_E + (r-i)K_E] > 0.$$

Above, $wL_E > 0$ captures the variable assets (or the variable production cost) of E, while $(r-i)K_E \geq 0$ represents the fixed assets (or the fixed production cost) of E. In classical terminology, they are wage fund and capital fund, respectively, that E has to put together and (have ready to) pay while $\mathcal{E}$ lasts.

More interesting of course is the term $(r-i)K_E \geq 0$, which was recognised as $V \geq 0$ in the prequel technical discourse. To understand this term, one needs to comprehend that the investment or speculative action of E endures marginal cost(s) $i > 0$ (and $w > 0$) and gets awarded with a unit or marginal return, or rate of collected interest, $r > 0$, that is, a *net interest rate* $(r-i) \geq 0$ applied to $(r-i)K_E \geq 0$, which is the entrepreneurial interest. This practically means that E can increment her wherewithals, and $\pi_E \geq 0$ can be topped up with a premium entrepreneurial labour income, E's interest.

So naturally and conclusively, the last (and most potent) element that has to be scrutinised regarding E is her profits. To cure her exigency for a basic labour income, primarily via the realisation of strictly positive entrepreneurial profits π_E, E has to come up with a cost-effective method to produce and sell her products. Following the classical (Smithian and Ricardian) tradition, the profits of E are defined residually, according to the pattern:

entrepreneurial profits =
(entrepreneurial sales revenues) - (entrepreneurial investment-to-production cost)

or in more fastidious language

$$\pi_E = s_W + \sigma_B - I_E(i).$$

Two realities have to be noted at this point:
(1) The rational E will go on (fully) employing or using the maximum physical or material quantity $K_E \geq 0$ to which the monetary quantity $(r-i)K \geq 0$ is corresponded, and so $K_E \to K_E^\star$, as $K_E \in [0, K_E^\star]$. This is because in this way, given F_E, E will maximise his production, hence, his sales, thus, *ceteris paribus*, his profits.
(2) The worker's salary is essentially cancelled out in the previous expression for the entrepreneur's profits. This verifies that the worker-household and the human capital market are functioning as gadgets in $\mathcal{E}$, namely, they are critical facilitating mechanisms towards $\mathcal{E}$'s general equilibrium. This is, of course, a blunt departure from the modern (pure)

neoclassical macroeconomics, in which, by transposing the blueprint, the same is true for any firm-household. Contemporary (neoclassical) macroeconomics are structured up-onto the microeconomic Walras' (1874) law of markets (refined by the Marshallian, 1890, techniques), and not the macroeconomic Say's law of markets. This renders their (behavioural) microeconomic foundations at the agent's individual level even more overwhelming.

Pure (or modern) neoclassical economics bring a macroeconomy into balance under the ideal of perfectly competitive markets. *Inter alia*, out of this normalisation and harmony in an economy, the zero arbitrage condition and/or the zero profit condition[15], should always and somehow formally emanate. If in $\mathcal{E}$ the two financial markets operated perfectly, without frictions, then the two of them would collide and fuse into a single banking (or loanable monetary funds) market. In that case, of no market segmentation in the financial sector of $\mathcal{E}$, $\epsilon = i$ would be the perfectly competitive market clearing price of this market, and of course spreads (or profits) would be flat zero. $\mathcal{E}$ would then be encapsulated into the truism neoclassical analysis.

In $\mathcal{E}$, however, the two financial markets are not frictionless, they function imperfectly, and do not coincide. This discrimination, as the neoclassical stream would simplistically perceive it, against the financial compartment of $\mathcal{E}$ happens because the firm-owner household B inherently possesses inside (bargaining or negotiation) market power, when the forces of supply and demand of loans are mixed and matched in the two banking markets of $\mathcal{E}$. In particular, within the monetary department of $\mathcal{E}$, B naturally exhibits the unique or monopolistic advantage to initially re-set the value of $i = \epsilon$ and drive it away from its perfectly competitive market clearing value towards its imperfectly competitive market clearing level $i > \epsilon$. B, subsequently, may naturally amplify this i to its peak value. These phenomena may be argued to be true even in a hybrid state-infused version of $\mathcal{E}$, i.e., in the co-presence of an official central or governmental authority[16] that is destined to mediate and set things straight, since the reality has shown that the powerful club or lobby of banks can influence and re-orient the public policy towards B's objectives, by using other market-related means of (social) pressure, or by exploiting outside market power, not necessarily coercive.

That being the case whatsoever, in $\mathcal{E}$, B can realise (maximum) strictly positive spread, equivalently E can attain (maximum) strictly positive profits (in general equilibrium). This is a statement, argument or proposition with intuitive validity so far, but one can see formally this situation actually being materialised in $\mathcal{E}$.

Start by realising that within the modelled time session of $\mathcal{E}$, no matter how tight it is, and between the two discerned loanable funds markets of $\mathcal{E}$, there exists a natural time-lag for the decision maker B, which can be technically modelled. In particular, as the transition from one market to the other takes place, B borrows financial capital from W, some (either discrete or infinitesimal) time elapses, and then B lends this amount of money to E so that the bank-financed investment in physical capital can occur. B (fully, according

[15]In section 3 it will be concluded that the profit for E and the spread for B are equivalent notions in general equilibrium.

[16]The additional household type or agent, G, for whom $\mathcal{E}$ distantly reserves a spot.

to Say's law) demands the monetary deposits of W, who supplies them as savings funds, with the demand function

$$D(:= D_B) : \bullet \times (0, \tfrac{p_B}{\alpha}) \to (0, p_B),\ D(\bullet, \epsilon) = p_B - \alpha\epsilon [=: D_B(\bullet, \epsilon)].$$

In the function above, the variable $p_B > 0$ formalises the eventual extant (degree of) market power of B in either of the two financial markets, whilst the exogenous constant factor $\alpha > 0$, applied on $\epsilon \in (0, \frac{p_B}{\alpha})$, contributes to the reduction of this market power of B according to how freely ϵ is eventually allowed by B to fluctuate in the '$W - B$ financial market'. In this market, where the worker's supply of savings is perfectly inelastic with respect to the variation of ϵ by virtue of Say's law, the banker's demand for savings function is shaped by a part (or an effect) from suppressing market competition, $\xi := p_B > 0$, and a counter-part (or counter-effect) from favouring market contestability, $\eta := -\alpha\epsilon > 0$, which is of converse direction, one that offsets or counterbalances the first one. Evidently, if the first piece quantitively prevails over the second, this market tends to be designated as imperfectly competitive, but if the second dominates quantitively over the first one, this market approximates perfect competition. There are, consequently, two opposite and conflicting forces for $D(\bullet, \epsilon)$, η and ξ; η quantifies the 'demand under existence of competition' element of the total demanded quantity $D(\bullet, \epsilon)$, while ξ quantifies the 'demand under lack of competition' component of the total demanded quantity $D(\bullet, \epsilon)$.

It instructive and useful for the sequel analysis to consider the two extreme cases for this market of $\mathcal{E}$:
(a) $\epsilon \to 0$; full or monopolistic market power for B; $D(\bullet, \epsilon) \to p_B$; the market power of B fully determines (i.e., quantifies) B's activated demand in this market; $\mathcal{E}$ is an impure neoclassical macro-economy.
(b) $\epsilon \to \frac{p_B}{\alpha}$; competition fully determines (i.e., quantifies) B's absence of demand in this market; vanished or deleted market power for B; competition, η, erodes or trims $\xi > 0$, the market power of B, and demand declines and drops down to zero, i.e., $D(\bullet, \epsilon) \to 0$; there is no present or visible demand by a sustainable B in this market; B has abandoned the market and needs not to be modelled at all, or is modelled neutrally and passively as a zero-spread mediation device; $\mathcal{E}$ becomes a pure neoclassical macro-economy.

Notably, pure neoclassical economics may not be in need of B, but this is certainly not the case for $\mathcal{E}$. Apparently, if competition conquers the financial markets of $\mathcal{E}$, so that B tends to disappearing as ϵ converges to its supremum value, $\mathcal{E}$ will be put in jeopardy, will be doomed to malfunctional disarray, and will deliver ill market prices and misallocations for its resources. This is when the also benevolent, i.e., committed to non-reciprocally serving the public interest, supplementary (household) governmental agent G gets drastically inserted into $\mathcal{E}$, in lieu of B, as B is creating a vacancy in $\mathcal{E}$[17]. More

[17]But G, in $\mathcal{E}$, is never meant to crowd out B, as the governmental expenditure is meant to crowd out the private spending (for consumption and investment) in Keynes' mind. G is an extra-ordinary, and never a normative, part of $\mathcal{E}$'s basic macroeconomic identity.

reliably, however, G may be accompanying a weak B[18]. In either case, as G is interpolated in $\mathcal{E}$, the degree of market freedom of $\mathcal{E}$ scales down by the bulk of G, say a gaugeable quantity $k \geq 0$. So, the neoclassical (dynamic and random) system of agents-onto-markets $\mathcal{E}$ has $(\xi - \eta) - k > 0$ degrees of market freedom.

Eventually, B's demand in this market is a percentage of W's optimally (and fully) supplied savings, i.e., $D(\bullet, \epsilon) = \lambda P S_W(P, y, \bullet)$, for some $\lambda \in [0, 1]$, as P and y still procedurally variate. The two extreme cases $\lambda = 1$ and $\lambda = 0$ are appropriately corresponded to the extrema of $(0, \frac{p_B}{\alpha})$. The ambient idea is that when B has and exercises full or monopolistic market power, namely, the *net market power* of B, $\rho_B = (\xi - \eta)$, soars up to the attainment of its supremum value $\rho_B^\star = p_B - 0$, with this of course happening as ϵ eventually attains its infimum value, i.e., as $\epsilon \to 0$ (iff $\lambda = 1$ iff $k = 0$), she will ask for and deposit all the savings of W, because the supremum demand of B, $D(\bullet, \epsilon) = p_B = \rho_B^\star$, is also attained. Otherwise, for $\epsilon > 0$ (iff $\lambda < 1$ iff $k > 0$), some of W's saved money, although disposed to the '$W - B$ money market', will be left un-demanded in the relevant market and will be withheld by W himself, so the Say's law will not work successfully because of the subsequently occurring insufficient demand, which will be standing oppositely to the potential (and full) supply. A purely private $\mathcal{E}$, in which G is crippled, has $\rho_B^\star$ degrees of (market) freedom.

Equipped with the same banking or financial power p_B, but fully exercised over E now, B is going to transform his previous demand for savings-to-deposits into supply of savings-to-deposits into the '$B - E$ money market', as ϵ is expected by B to become (i.e., be reformed to) i. E will be (fully, according to Say's law) demanding these financial funds from B with a well-behaved demand function

$$D^1(:= D_E^1) : [\epsilon, \bar{r}] \times \bullet \to \mathbb{R}_{++},\ D^1(i, \bullet)[:= D_E^1(i, \bullet)] > 0,$$

of expedient properties and of some convenient algebraic formula.

Focus now onto B's history-based expectations that can be formed out the (vaguely so far) stipulated connection between the interest rates of the two money markets of $\mathcal{E}$. Pinpoint that when looking backwards from the specific time period that $\mathcal{E}$ is situated in the time line, $\mathcal{H}$ is a condensed set (naturally possessing the cardinality of the continuum) of all the data or evidence[19], that have occurred up until the lower time bound of the time interval that $\mathcal{E}$ is based and framed into. $\mathcal{H}$, in other words, is the objective history of $\mathcal{E}$. It represents all the already realised (and relevant to the context that is here in reference) knowledge or information of the past, when being located into $\mathcal{E}$. Further and more specifically, when B is at first placed at the '$W - B$ money market' of $\mathcal{E}$, as a proxy for the forthcoming interest rate in the '$B - E$ money market', i, B can reasonably rely onto ϵ. In

[18] If not a powerless W or a decrepit E in the first place, when the economy is shocked. For these issues, refer also at the ending part of this paper.

[19] Practically, recordings or observations. In general of any kind, but here eventually translated numerically to all the past values of ϵ. Hence, $\mathcal{H}$ gets identified with the interval $(0, \infty)$, for all possible values of $\alpha > 0$ and $p_B > 0$ of all the prequel to $\mathcal{E}$ economies.

particular, he can initially or basically use the abbreviated population (or else the sample) of ϵ-interest rates $(0, \frac{p_B}{\alpha})$, out of the whole theoretical population $[0, +\infty)$ of ϵ-interest rates. He can then personally upgrade or refine, and thus better explain and utilise, the information contained in this sample space using a subjective informational filtration, say $\mathbb{F}_B$, of all the past knowledge $\mathcal{H}$, i.e., a monotone (ordered non decreasing) time indexed collection of σ-algebras of $\mathcal{H} = (0, +\infty)$. Arguably, $\mathbb{F}_B = \{\mathcal{A}_B : \mathcal{A}_B \subseteq \mathcal{B}(\mathbb{R}_{++})\}$. The last term in the previous class is the Borel σ-algebra of $\mathbb{R}_{++}$. This personalised filtration of $\mathcal{H}$ is projected onto B's probabilistic judgements. Indeed, in this way, B updates his overlying personal belief, and associated expectation, regarding the chances of each one the ϵ forming or becoming i, privately-conditionally on everything that has occurred up to that prediction point. So accordingly, B performs a random experiment or test (of countable trials), the sample (or state) space of which is $\mathcal{S}$, which is the open interval $(0, \frac{p_B}{\alpha}) \ni \epsilon$ of $\mathbb{R}_{++}$ (of $\mathbb{R}$). All the randomly occurring alternative values of ϵ together will inter-act (with some personal probabilistic weight posed by B) as a point estimation of i. Thence, from what is already explained so far, $i = E(\epsilon/_{\mathbb{F}_B}) := \epsilon^e/_{\mathbb{F}_B}$. To make rigorous acquaintances with this idea, let ϵ be an absolutely continuous random variable, and let then the (subjective) probability density function, or probability (distribution) function, $\varrho_B/_{\mathbb{F}_B} : \mathcal{S} \to [0, 1]$, of B, which is conditional of $\mathbb{F}_B$. Then, using the Riemann integral, the (conditional on B's informational filtration of the existing history) expected value of ϵ is

$$E(\epsilon/_{\mathbb{F}_B}) = \int_{\mathcal{S}} \epsilon \varrho_B/_{\mathbb{F}_B}(\epsilon) d\epsilon \in (0, \infty).$$

Alternatively, in more accurate mathematical tongue, let the B's (subjective) σ-additive and conditional on $\mathcal{F}_B$ probability measure $\varrho_B/_{\mathcal{F}_B} : \mathcal{B}(\mathbb{R}_{++}) \to [0, 1]$, defined upon the measurable space $(\mathbb{R}_{++}, \mathcal{B}(\mathbb{R}_{++}))$. This prior belief of B provides the likelihood of the privately informationally (with all history) updated events of $\mathcal{S}$. Define $\mathcal{F}_B = \mathbb{F}_B \cup \{\mathcal{B}(\mathcal{S})\}$, where $\mathcal{B}(\mathcal{S}) \subset \mathcal{B}(\mathbb{R}_{++})$. Let then the random variable $\epsilon : \mathbb{R}_{++} \to \mathcal{S}$ be defined upon the (subjectively) filtered probability space $(\mathbb{R}_{++}, \mathcal{B}(\mathbb{R}_{++}), \mathcal{F}_B, \varrho_B/_{\mathcal{F}_B})$ of B. Finally, define the expected value of ϵ using the Lebesgue integral as below:

$$E(\epsilon/_{\mathcal{F}_B}) = \int_{\mathbb{R}_{++}} \epsilon d\varrho_B/_{\mathcal{F}_B} (> 0, < \infty).$$

As ϵ is transformed to i via the equality $i = E(\epsilon/_{\mathcal{F}_B}) := \epsilon^e/_{\mathcal{F}_B}$, B transforms his money (or deposits) demand (in the '$W - B$ money market') function D_B (see previously) into an intermediary money (or deposits) supply (in the '$B - E$ money market') function $D'_B : [\epsilon, +\infty) \to \mathbb{R}_{++}$, defined by

$$D'_B(\epsilon^e/_{\mathcal{F}_B}) = p_B + \gamma \epsilon^e/_{\mathcal{F}_B} + \theta_B,\ \gamma > 0 \text{ and } \theta_B \geq 0.$$

Above: (i) given an exogenous constant factor $\gamma > 0$ applied on $i \geq \epsilon > 0$, $p_B > 0$ is augmented by $\zeta := \gamma i$, according to how much i can be manipulated in the '$B - E$ money

market' by B, while (ii) θ_B is B's (endogenous) noise or residual in the previous estimation procedure, i.e., a disturbance term, or simply an error (bias, divergence or deviation) term of the previously described expectation (forecast or prediction) that is performed by B.

On account of the fact that all decisions in $\mathcal{E}$ are not intergenerationally time-related (see also in section 3), θ_B is not correlated with any other such term of any prequel or sequel economy to $\mathcal{E}$, while of course θ_B is certainly not correlated with any time period's i, the explanatory variable in D'_B. For the sake of empiricism, the (accredited as) normally distributed random variable θ_B may be authorised to be homoscedastic as well, exhibiting a stationary in time (finite) variance-value around its (finite) mean-value, which should be zero. Besides by definition,

$$\theta_B = i - E(\epsilon/_{\mathcal{F}_B}) \text{ and subsequently } E(\theta_B/_{\mathcal{F}_B}) = E(i/_{\mathcal{F}_B}) - E(\epsilon/_{\mathcal{F}_B}) = i - i = 0,$$

which means that B is an error-free decision maker, who forms rational expectations and makes always unbiased (accurate or correct) point estimations, literally $\theta_B = 0$. By construction, to continue, D_B is quantitively equalised with D'_B as the superjacent composition of the two money markets, with the intermediation of B, occurs[20] , which condition (the equation $D_B = D'_B$) finally amounts to

$$-\alpha\epsilon = \gamma i \iff \epsilon = -\tfrac{\gamma}{\alpha} i, \text{ where } i \geq \epsilon > 0, \text{ and therefore:}$$

(i) $\epsilon = i$ iff $\gamma = -\alpha$, which cannot hold because $\gamma, \alpha > 0$, whereas
(ii) $\epsilon < i$ iff $-\frac{\gamma}{\alpha} < 1$ iff $\gamma > -\alpha$, which is true because again $\gamma, \alpha > 0$.

So as a conclusive result thus far, it has been formally shown that B's rational expectations naturally cause a disparity between ϵ and i, in favour of i.

Obviously, in a flat world, pure neoclassicism would have it that everything in an economy that morphologically looks (*prima facie* at least) like $\mathcal{E}$, only that (critically) attaches a secondary, ancillary and income-less role to any firm activity and lets the worker be the protagonist, would work well, and this economy would reach general equilibrium with all of its markets clearing with their (aggregatively) supplied quantity being equal to their (aggregatively) demanded quantity, if none discrepancy among the interest rates $\{\bar{r}, i, \epsilon\}$ exists in it. That being the case, the worker's savings or monetary deposits, which are first fully demanded by the banker (opposite to their potential supply by the worker) and then fully re-demanded by the entrepreneur (opposite to their potential re-supply by the banker), would be directly equalised with the entrepreneur's investment in physical capital[21]. Within this duplicating process, firms would certainly run non-profitable and arbitrage-free businesses.

---

[20]The '$B - E$ money market' is composed with the '$W - B$ money market' and the composite '$(B - E) \circ (W - B)$ [or $W(\rightarrow B \rightarrow)E$] or money market' is engendered.

[21]Obeying, thereby, to the neoclassical 'savings become - and are equal to - investment' rule.

Nevertheless, in a spiky world as in $\mathcal{E}$, where neither the worker (household) nor the entrepreneur (household) pull the strings any more, but instead the banker-firm (household) runs the show, one needs to grasp the importance of having additionally reckoned at this point that $i > \epsilon$, as a repetition of the this particularised 'supply versus demand' mechanism takes place from one financial market to the other.

Thence, commence with the fact that because B generates a strictly positive spread, B (same as with W and E) will both consume and save (or self-deposit) her existing income. After being arranged to an optimal or potential level by B, her sudden (novel or extra) deposits will be exhaustively supplied to E again. Once more, Say's law has to make sure that E will eventually fully demand these financial funds from B and by a well-defined demand function

$$D^2(:= D^2_E) : [\epsilon, \bar{r}] \times \bullet \to \mathbb{R}_{++},\ D^2(i, \bullet)[:= D^2_E(i, \bullet)] > 0.$$

The sum of the two partial and independent savings-to-deposits demand functions of E $[D^1(:= D^1_E) + D^2(:= D^2_E)]$ is the E's total money demand function

$$D(:= D_E) : [\epsilon, \bar{r}] \times \bullet \to \mathbb{R}_{++},\ D(i, \bullet)[:= D_E(i, \bullet)] > 0.$$

By taking then jointly the separate and autonomous (savings-to-deposits) money demand functions D_B and D_E, of B and E respectively, then $\mathcal{E}$'s aggregate or social money demand of type II function D, which is jointly defined on both interest rates as arguments, is yielded. Afterwards, a general equilibrium for $\mathcal{E}$ becomes eminent.

There is, nonetheless, a glitch to the custom made, so as to be general equilibrium fulfilling, system of $\mathcal{E}$. Even when all barriers or obstacles to the attainment of a general equilibrium have been annihilated in the masterminded by Wicksell architecture of $\mathcal{E}$, $\mathcal{E}$ still incorporates a ponderous inner force which urges the economy to locate (i.e., diverge) itself into the outermost position with respect to some normative balanced (i.e., convergence) centre of its. And if there is not an interior counter-force to squash the adverse effect of the first force, then $\mathcal{E}$'s general equilibrium will be obliterated.

To see what actually happens, consider that because B runs a remunerative company and reaps spread, i.e., $\sigma_B > 0$, the supply of saved monetary funds in the '$B-E$ money market', which supply does not vary with i, suddenly (or unexpectedly for E) increases over an original demand for these monetary funds, that is, goes above a settled demand for financial formation of capital $[(\bar{r} - i)K_E \geq 0]$ in this market, so then i scales down, because the relevant vertical money supply line is shifted to a parallel line to the right. Consequently, investment in physical capital by E, $(\bar{r}-i)K_E$, unintentionally, and without the appropriate structural adjustments yet, soars up, since for a given $\bar{r}$ the *interest rates gap* $(\bar{r} - i) > 0$ opens up in $\mathcal{E}$, as i is falling. In other words, this new excess deposits or money supply-to-demand in $\mathcal{E}$' banking markets, translated as and embodied into the unplanned investment in physical capital, cannot be immediately corresponded to the savings of the composite product of $\mathcal{E}$, and exceed them. An *investment savings gap* is therefore secondarily created

in $\mathcal{E}$. Subsequently, when this extra deposited money gets represented by savings in $\mathcal{E}$'s product market, this incites an excess (partial to total) demand in this market. The (up)outward shift of the aggregate demand function in this market over a given vertical aggregate supply line increases the price $P > 0$ of this market, instigating it out of its cookie cutter level. In this way, the *investment savings gap* is transformed into a *product supply-demand gap*, which is then materialised as a *prices* or *inflation*(ary) *gap*[22]. Albeit, this unfortunate situation does not stop here, by stabilising $\mathcal{E}$ into an inflationary steady state. Increased prices will bloat the aggregate or social money demand of type I, to wit, new intensified excess (partial to total) demand in the economy's product market will be caused, from the consumption side of the composite product of $\mathcal{E}$ this time. So inflation will be sharpened, the phenomenon of runaway inflation will appear at $\mathcal{E}$'s front door, and $\mathcal{E}$ will be diverging more and more from its general equilibrium status.

The self-reinforced tsunami procedure of (up to) countable infinitely many rounds that was described supra is the reputable *Wicksellian cumulative process* (on inflation), aka as the *Wicksell effect*. This spiral process embodies the critical result that P and i are inversely related in $\mathcal{E}$. In particular, P is a negative (invertible) function of i. To codify formally this swap between P and i, define the continuous and strictly decreasing on its domain (bijective) function

$$P : [\epsilon, \bar{r}] \to \mathbb{R}_{++},\ P(i) > 0.$$

By a (masked so far) abuse of notation, the values $P(i)$ of the function P had been (and may continue to be) notated with P as well, so no confusion should arise.

According to the cumulative process, Say's law, which in this circumstance is translated as that there should not be a general glut in $\mathcal{E}$'s product market[23], cannot guarantee the existence of a general equilibrium in $\mathcal{E}$. This law is, in this occasion, critically violated and runs the danger of generally falling by the wayside. If universally the potential supply does not fully determine demand, the law of Say should be abandoned. Once Say's law is taken out in one market, a domino effect will be initiated in $\mathcal{E}$, and then multiplied due to the occurring spillovers from one market to the other, and this law will be demolished in all markets. So, if the cumulative process cannot be wiped out, the law of Say has to be eradicated. Furhermore, the firstly arisen gap in the previous sequentially switching from one to the other gaps, the *interest rates gap* $(\bar{r} - i) > 0$, i.e., the return on financial capital capital minus the cost of financial capital (for E), is the firsthand computable metric or index that approximates (evaluates or estimates) the degree of disequilibrium or imbalance in $\mathcal{E}$. The literature labels this *equilibrium gap* the *Wicksellian differential*. As long as this difference insists on being strictly positive, and wider and wider, $\mathcal{E}$ will have fallen into an *inflation-to-disequilibrium trap*, as inflation will be being self-fed on and on, iteratively. $\mathcal{E}$,

[22]Which Keynes (1936) also recognised later as the undesirable position to which a careless fiscal policy maker can bring an economy if expansionary fiscal policy is irresponsibly conducted after the economy has attained its potential level, multiplicatively, via autonomous demand boosts.

[23]Say's law means no hyper supply of products in this market. Equivalently, not undisposed products left as reserves in this market.

put is simply, will have ambushed itself into a vicious circle, or a maze. Creeping inflation will have been transformed into galloping inflation in $\mathcal{E}$, when simultaneously employment of inputs and, as a consequence, the output will have been clogged to their potential levels. Under these circumstances, economic austerity in $\mathcal{E}$, along with other socio-political detrimental phenomena, are lurking.

The question now is the following. Can $\mathcal{E}$ self-escape form this trap, by smacking the cumulative process and having all its inflationary spree evaporated? To rephrase, can $\mathcal{E}$ be self-corrected from within, without having to rely onto a (so far inconsequential) governmental force G, which can remedy this situation from the outside, prescribe policies, restore the order, and make everything in $\mathcal{E}$ fit to the plan?

The answer is positive, as long as B remains the boss of $\mathcal{E}$. In fact, as B's rationality was the sparkle that aroused and ignited the cumulative process (on inflation) for $\mathcal{E}$, B's rationality again will be the apparatus to put out this recursively flaming turbine, and balance $\mathcal{E}$ to a steady general equilibrium. To get to the point, the rational B will naturally want to maximise her spread. Hence, by exploiting her maximum (full or monopolistic) market power ($\rho^{\star}_{B} + \zeta > 0$) over E, which recall means that the same has first happened over W, or equivalently that $\epsilon \to 0$, B can re-set the terms and conditions in the '$B - E$ money market'. Ultimately, to be more precise, B can manipulate the actual (intentional) demand of E in the '$B-E$ money market', D^{2}_{E} [24], stir it up and navigate it (up)outwardly with respect to the fixed vertical money supply line in this market, and therefore raise i for his own benefit, up to the ceiling interest rate $\bar{r}$. When eventually rationality of B will administer the relationship $\bar{r} = i > \epsilon$, with $\epsilon \to 0 = \bar{\epsilon}$, $\mathcal{E}$ will balance to a steady state, with higher than before prices, but heightened to the minimum possible extent (see also in section 3). Without B, $\mathcal{E}$ cannot fillip and recover on its own, and is doomed to experience dramatic imbalances, with catastrophic side-effects to both its (consumption driven) national utilitarian welfare and to the materialistic quiescence of its national wealth.

Having gone this far, there is one more (camouflaged and unsettled) theme of interest in $\mathcal{E}$ that goes naturally with the flow of the analysis, and thus needs to be scrutinised. Given the entanglement and interplay of $\mathcal{E}$'s structural elements that are scattered all over, the randomisation of i inescapably randomises all actions in $\mathcal{E}$, of all agents, in all markets[25]. First of all, aside from the (measurable functions) $\mathcal{W}$, $\mathcal{L}$ and D which clearly become random variables (on i), I_E becomes random because K_E becomes random as well (because the i applied on it is stochastic[26]), so F_E becomes also random. But then $P(i)$ is a random variable as well, so consumption, savings and utility should also be random variables, directly on P, or indirectly on i. Furthermore, all variables of $\mathcal{E}$ can be also randomised with respect to the scenarios inside Θ, which envelops the future of $\mathcal{E}$, not only with (and possibly irrelevantly to) respect to the positions (or circumstances) inside $\mathcal{H}$, that covers the past of $\mathcal{E}$. This drill has already cryptically happened, since it has

[24] Practically, market or sell the new banking products to E.

[25] With the exception, of course, of the market for workers, in which there are no actual choices or decisions left to be made, since Say's law (potentially) arranges everything deterministically.

[26] While the $\bar{r}$ applied on K_E has also been pinned down under randomness.

been viewed superficially, for the computation of $\bar{r}$ by E, and will now be the focal point for the society's consumption, savings and utilitarian welfare. The next section, in fact, investigates even more thoroughly this issue.

So let $\mathcal{R}$ be a finite (strict) subset of Θ of $\mathcal{E}$, concerning only $\mathcal{E}$'s state of affairs (see in the prequel for the definition of Θ). Then, partition $\mathcal{R}$ into two (finite) subsets, Ω and $\mathcal{O}$, in principle non-empty either of them. The first is the Knightian (1921) risk of $\mathcal{E}$, while the second is the economy's Knightian ambiguity (aka uncertainty). Unless $\mathcal{O} = \emptyset$, the society of $\mathcal{E}$ is exposed to both (a common) risk and (a uniform) ambiguity, both of them being exogenous and representing objective future information regarding the alternative scenarios or states of nature of the world. So $\mathcal{R}$ is a melange of both known and unknown prospects, which are jointly faced by the agents' community.

The grand coalition of $\mathcal{E}$, nonetheless, can only confront Ω. Section 3 elaborates on how the society of $\mathcal{E}$ battles with and successfully averts risk, but one first needs to understand why agents get into the trouble to do so, that is, how $\{W, E, B\}$ is actually benefited by taking advantage of Ω. If, first of all, the values of C and S are randomly occurring with respect to Ω, each state $\omega \in \Omega$ refers to a consumption and/or savings outcome. Next, either by acting on impulse or with forethought, given their primitive utility $\mathcal{U} = \mathcal{U}(C)$, for any C, rational agents are bound to maximise their derivative (binded with $\mathcal{U}$) expected utility $\mathbb{U} = \mathbb{U}(\mathcal{U}(C))$, for any C, conditionally on 2^{Ω}, the power set of Ω. Practically, conditionally onto all the available information that they mutually possess, the publicly (i.e., without rival and without exclusion) and completely accessed by all of them Ω. They are also in need, then, of an exogenous additive subjective probability measure $q : 2^{\Omega} \to [0, 1]$ which will compute the probabilities of all the events (subsets of states) of Ω. Note that the probability of occurrence of each known $\omega \in \Omega$ is calculable and known with certainty. So, to batch things together, the society faces the subjective probability (measure) space $(\Omega, 2^{\Omega}, q)$, which embodies the agents' risk, information and randomness. As an upshot, since the society is formed by rational households, agents collectively form rational, informationally conditional up-onto $\mathcal{P}(\Omega)$, expectations for the (maximisable) expected value of their forthcoming aggregate utilitarian welfare,

$$\mathbb{U}(\mathcal{U}(C), q, \Omega) = E_q(\mathcal{U}(C)|_{\mathcal{P}(\Omega)}), \text{ for any } C,$$

which are correct estimations (thus, do not carry along an estimation error). Extensive formality of this idea can be found in the next section. For now, it is important to have in mind two things. One is that since $\mathcal{U}$ does not require axiomatisation with preferences, the same holds for $\mathbb{U}$. Another is that all the mathematical-economic properties of $\mathcal{U}$ are fluently passed to $\mathbb{U}$. Remark finally that the lives of W, E and B extend beyond $\mathcal{E}$ but: (i) when the ambitious by default E is based into $\mathcal{E}$, he will naturally use for his investment activity information that falls out (and in front of) Ω or, roughly speaking, he will be facing the risk Q of the whole Θ, because his investment is not originally targeted so as to be completed within the time frame of $\mathcal{E}$, while (ii) W, E or B will naturally aim at consumption acts and/or savings actions that will have to be concluded within the time

slot of $\mathcal{E}$ by default, so the society will sufficiently use just the knowledge $\Omega \subset Q$, that is, face the risk of $\mathcal{R}$, for these types of economic activity.

It is equally important, nonetheless, to see what $\{W, E, B\}$ cannot practically do with respect to the utilisation of $\mathcal{O}$, the information of which is unbreachable and from nowhere penetrable, and which are the adverse consequences of this agents' inability. The unknown elements of this set are not expected, cannot be predicted or forecasted, and agents cannot form expectations over any random variable of $\mathcal{E}$ via the employment of $\mathcal{O}$, herein especially for their collective utilitarian welfare as seen previously. Agents do not have an outlook of $\mathcal{O}$. With respect to $\mathcal{O}$ agents face absolute ambiguity or uncertainty, or else, ignorance: none object of $\mathcal{O}$ can be quantified by a probability measure, i.e., agents do not know the probability of occurrence of these phenomena[27]. The mysterious content of $\mathcal{O}$ shall be called (events of) shocks for $\mathcal{E}$, not states. If (and only if) an exogenous shock unexpectedly occurs instead of an exogenous state, then $\mathcal{E}$ is shocked, experiences unbearable economic repercussions, fails to attain a general equilibrium, and collapses to disharmony. As a consequence, general equilibrium in $\mathcal{E}$ can only be destroyed from the exterior to it world, when the exogenously (shock driven) business cycle of $\mathcal{E}$ suddenly slopes downwards. Any such economic crisis of $\mathcal{E}$ ends up being translated as a financial meltdown, which means that B becomes rickety in such situations. This is when G should definitely meddle in, nurse and rescue $\mathcal{E}$. The larger the cardinality of $\mathcal{O}$ the closest to $\mathcal{E}$ should G stay, on stand by.

To gain more momentum as far as these analytical implications are concerned, it is worthwhile to add Keynes' (1936) point of view and excavate more latent junctions of $\mathcal{E}$ with Keynesianism, aside from the obvious ones with neoclassicism. Keynes was, is some sense, calling the disguised as favourable or unfavourable elements of $\mathcal{O}$ 'massive waves of optimism' and 'massive waves of pessimism', respectively. According to him, (the mass of) 'ignorant agents' can be lured by these waves (or bubbles) and condition their activity on them, thus, beget endogenous trade cycles. Only the 'expert agents', who are the rational ones according to the neoclassical standpoint, namely, the ones who condition their behaviour on Ω, will do the opposite. and protect themselves from the economy's danger or risk[28].

To tabularise the analysis so far with a generalised comment: after $\bar{r}$ has been determined by E, the interest rate and the utilitarian welfare of $\mathcal{E}$ will be expected, with any other variable quantity nested into them being random.

To conclude this section, agents' incomes can be seen:
(a) either as inflows; what money flow into a household; the left hand side of the three equations infra,

[27]Modern decision theory, of course, appoints ignorant or, more generally, ambiguous decision makers, who are traditionally ambiguity averse, with non-expected utility formats, in which case they overcome this predicament. In this way, disequilibrium can always be blocked by general equilibriumists.

[28]With the fundamental difference, of course, that all agents (not just some of them) are rational when they are put under the neoclassical analytical microscope.

(b) or as outflows; what money flow out of a household; the right hand side of the equations below.

Namely, (i) when $\bullet = (P, y)$, for the sake of economy in notation, and (ii) by parametrising solely consumption with $\omega \in \Omega$, since consumption will prove to be the uniquely essential random economic action, we get:

$$\sigma_B + \bar{\epsilon} PS_B(\bullet) = B\text{'s income} = PS_B(\bullet) + PC_B(\bullet, \omega),$$

$$s_W + \bar{\epsilon} PS_W(\bullet) = W\text{'s income} = PS_W(\bullet) + PC_W(\bullet, \omega),$$

and

$$\pi_E + (\bar{r} - i)K_E^p = E\text{'s income} = PS_E(\bullet) + PC_E(\bullet, \omega),$$

where supra:

1. $PS_W(\bullet) + PS_B(\bullet) = (\bar{r} - i)K_E^u$ (u=unplanned),
2. $PS_E(\bullet) = (\bar{r} - i)K_E^p$ (p=planned),
3. $(\bar{r} - i)K_E^u + (\bar{r} - i)K_E^p = (\bar{r} - i)K_E = PS(\bullet) = D(i, \bar{\epsilon}) = M$,

and

4. $\sum_{j=W,B,E} PC_j(\bullet, \omega) = PC(\bullet, \omega) = \bar{\nu}\mathcal{M}$

Above, $\bar{\epsilon} PS_W(\bullet)$ and $\bar{\epsilon} PS_B(\bullet)$ are insubstantial positive quantities, because $\bar{\epsilon}$ will have settled to an insubstantial positive value, one that is arbitrarily close to zero. They could be prematurely omitted w.l.o.g., since they get cancelled out in general equilibrium (see also in section 3). In addition, $\{s_W, \pi_E, \sigma_B\}$ are the survival or basic incomes of the three agents.

3. The Wicksellian General Equilibrium

This section squeezes $\mathcal{E}$ within specific (lower and upper) time boundaries and offers a proper general equilibrium notion for $\mathcal{E}$ all along its big time picture, which is now more appositely conceptualised.

Section 2 was a detailed roadmap to the acquisition of Wicksell's theory. Section 2, in particular, was a long detour that had to be taken on the way to the Wicksellian general equilibrium that is ultimately crafted in this section. Section 2 defined the transient in time Wicksellian economy, $\mathcal{E}$, which was tailored to Wicksell's cumulative process, equipped it with a necessary (truncated) agents-onto-markets economic structure, and then concentrated onto progressively building and presenting $\mathcal{E}$ as an macro-economic circuit of income-to-wealth flows between W, E and B, normatively without the co-existence and supervision of G. The completion of this project is a foundational insight in macroeconomics, which was first launched by the physiocrats' founder and leader Quesnay (1759). The groundwork of section 2, in particular, resulted into the mathematical economic contextualisation of $\mathcal{E}$ as a perplexed network of 3 (to 4) agents $\times$ 4 (to 5) markets $\times$ $|\Omega|$ states, where $Card(\Omega) = n \in \mathbb{Z}_+$ and (the predictable) $\Omega \subset \mathcal{R}$, where the latter had also an unpredictable (disjoint) part (of shocks, not of states), $\mathcal{O} \subset \mathcal{R}$, with $\Omega \cap \mathcal{O} = \emptyset$, which was exclusively responsible for the creation of exogenous trade cycles (and then and only then of insuperable disequilibria) in $\mathcal{E}$.

With respect to time, uncertainty, randomness-to-stochasticity and information section 2 also suggested several identifications: (i) $[0, +\infty)$ is the time line of $\mathcal{E}$, with $\mathcal{E}$ being situated in-between of $(0, +\infty)$, (ii) $[0, \mathcal{E})$ is the past (time) of $\mathcal{E}$, which includes $\mathcal{H}$, all the incidents of $\mathcal{E}$, and (iii) $[\mathcal{E}, +\infty)$ is the future (time) of $\mathcal{E}$, which includes $\Theta(\supset \mathcal{R} = \Omega \cup \mathcal{O})$, all the prospects of $\mathcal{E}$. Depending on the context, $\mathcal{H}$ and Θ were vaguely or to-the-point defined as uncountably infinite sets of elements or objects, to wit, time-stationary facts or phenomena, already realised or anticipated. Eventually, section 2, was devoted into browsing through Wicksell's theory and providing an agglomeration of this theory into a unified economic model that can set the artisan economy $\mathcal{E}$, that is associated with such a theorisation, in transit towards some optimal balanced steady state, or else stable general equilibrium. According to section 2, there are parameters of $\mathcal{E}$ that have been ascertained as being transported between temporaneous time gaps that are naturally created in $\mathcal{E}$, always in compliance with some related (but indefinite) tempo that underpins the workings of $\mathcal{E}$, but time tractability was clearly a missing element from $\mathcal{E}$. Section 2 was not in the business of fully explaining and laying out the pseudo (let alone the actual) dynamics inside (or outside) $\mathcal{E}$.

So $\mathcal{E}$, the manual and vehicle to general equilibrium, will be now captured more concretely, by being confined within some short-run time period, say τ, of two separate time instants, or time stages, the *ex ante* and the *ex post* one. Moreover, τ will be implicitly treated as a time slot that is endlessly replicated along the long-termed time spectrum, $T = \mathbb{R}_+ = [0, \infty) \ni \tau$. Scilicet, $\varepsilon = \{\mathcal{E}_\tau : \tau \geq 0\}$ will be the notional (intangible in this motif) dynamic unfolding of $\mathcal{E}$. If time is discrete, then one may simply denote the time horizon of ε with $\mathcal{T} = \mathbb{N}$ (and the notion of ε becomes tactile). For the deliverables of

some $\mathcal{E}_\tau$, for some τ, it is essential to comprehend that for $\mathcal{E}$'s τ it technically holds that $\tau = [ex\ ante, ex\ post]$. That is to say, any fragment or fraction of the time line, $\tau \in \mathbb{R}_+$ or $\tau \in \mathbb{N}$, that is corresponded to some $\mathcal{E}_\tau$, has two discrete snapshots of time, and there is a discerned time lapse between the two of them. For some τ, Θ of $\mathcal{E}_\tau$ starts exactly at (and then spreads out above or after) the *ex ante* date of τ, while everything strictly before or below the *ex ante* date is $\mathcal{H}$. Thus essentially, $\mathcal{R}$, hence, both the expected Ω and the unexpected $\mathcal{O}$ as well, are included as tiny subsets in Θ. So this is why Ω, same as $\mathcal{O}$, can be thought of as just a finite subset of the uncountably infinite set Θ.

General equilibrium in a replica (i.e., copy or reproduction) $\mathcal{E}_\tau$, $\tau \geq 0$ or $\tau = 0, 1, 2, ...$, or simply in an $\mathcal{E}$ from now on, thus by extrapolating, in the grand economy ε as a whole, will be instantaneously fulfilled in either of the two time points or dates of τ. Initially in the general case of the multiple states of the *ex ante* stage, and eventually, upon the *ex ante* fulfilment of the general equilibrium, in the case of the uniquely specified state of the of *ex post* stage. The same (enduring in time) markets exist all along T or $\mathcal{T}$, thus for every $\mathcal{E} \in \varepsilon$, but alternating agents are born, live (with arbitrary life expectancy) and die within some finite subset or ordered list of ε, i.e., for some only sequential economies $\mathcal{E}$ of ε. Then, the offspring of the three households enter into a new $\mathcal{E}$, the story starts all over again from scratch, and goes on perpetually[29]. Ergo, dynastic households and overlapping generations, thus, interdependencies and conflicts of interests among generations of households, are irrelevant in any $\mathcal{E}$ of ε. General equilibrium of $\mathcal{E}$ is not intergenerational. It concerns solely the markets and the agents of ε that are specifically captured inside an $\mathcal{E}$. More recently spawned in the literature sustainability of an inter-temporal general equilibrium of a growing economy in terms of the planet earth's ecosystem (which picks up a expiration date which is pulled more and more closely to each consecutive $\mathcal{E}$) or with respect to the non-renewable natural resources (which are here simply capitalised into K_E) are not pertinent to $\mathcal{E}$'s dealings.

$\mathcal{E}$, as a matter of fact, can be prudently endowed with a pure methodological visualisation at its designated (technical) time range τ, where $\tau = [ex\ ante, ex\ post]$. In particular, the following well-known contract writing method is proposed for $\mathcal{E}$. At $\mathcal{E}$'s τ, the product market of $\mathcal{E}$, when seen as an (over-the-counter) *spot product market*, opens, and the society of $\mathcal{E}$ trades *ex ante* by witting a consumption contract (or a security) for every state $\omega \in \Omega$. This is a permitted technique because the product market of $\mathcal{E}$ is complete, so the society can share among its members the existing risk, hedge it away, and get inured against this undesirable hazardous *status quo*. Then *ex post*, state-continently, i.e., upon some particularly revealed state of Ω, the (pending from the *ex ante stage*) delivery of the commodity (i.e., of some consumption quantity) does occur in $\mathcal{E}$'s *future product market*. At this time point, the consumption contract gets executed and some aggregate consumption and utilitarian welfare are actually realised. Then, the product market of $\mathcal{E}$ closes (and opens again after τ). Note that any *ex ante* written consumption contract by

[29]In the interim, until W, E and B die, their offspring are absorbed into their idiosyncratic household identities. The strong classical influences of $\mathcal{E}$ disable a member of a household to develop a labor role different than the family-based one.

the society will be definitely executed *ex post*, and the society will never renege, because it will be a socially optimal contract, and because the society consists of benevolent economic units. The bottom line is that the *ex ante* general equilibrium of $\mathcal{E}$ is an artificial or virtual depiction of all the potential *ex post* general equilibria of $\mathcal{E}$. For the society of $\mathcal{E}$, the *ex post* general equilibrium is the essential one. For the analytics of $\mathcal{E}$, however, the *ex ante* general equilibrium of $\mathcal{E}$ is the fundamental one. This will be a state-wise (i.e., state-by-state) general equilibrium.

In $\mathcal{E}$ finally, B (taken alone as a unit) is backward looking when being forward looking. Namely, she performs history based decision making, here, forecasting, when she looks ahead in time so as to predict the forthcoming interest rate of $\mathcal{E}$. On the other hand, E when isolated as unit, and the society=$\{W, B, E\}$ as a whole, are solely forward looking. They perform future based decision making without using empiricism. This is because, within $\mathcal{E}$'s τ, B, when acting solo, is the only one that naturally acquires non-fuzzy empirical data or evidence (observations or recordings in the language of empirics) to safely rely upon-onto. This condition can be interpreted as a private informational head start, advantage or asymmetry for B, over W and E, upon which the monopolistic market power of B in the financial markets of $\mathcal{E}$ is built. Every agent and in any decision problem, however, has the required informational capacity and acumen to react rationally. Thereupon, agents are not just sagacious decision makers, but they are perfectly functioning decisional engines, hitting always the bull's eye.

To rigorously cope with all these delicate, and seemingly compound and obscure, conceptualisations, so as to arrive to a palpable general equilibrium idea of $\mathcal{E}$, let us take an analytical shortcut, and start reversely by delving into the socially focal *ex post* general equilibrium conditions of $\mathcal{E}$.

Consider the peril-less *ex post* date to which ultimate attention is naturally placed. Upon $\mathcal{E}$ and its associated $\mathcal{H}$ and $\Theta \supset Q$, for exogenous $\{\alpha, \beta_E, \gamma, \varrho_B, p_E, q, \mathcal{F}_B\}$, for exogenously pre-calculated $\{\bar{\nu}, \bar{\ell}_B\}$ to their correct (potential) quantities, for some (exogenously given) suitably defined $\{F_E, I_E\}$ and $\{\mathcal{W}, \mathcal{L}, \mathcal{U}, C, S, D\}$, for already adjusted and immobile given general equilibrium values $\{Y^\star, K_E^\star, L_W^\star, \rho_B^\star, \bar{w}, \bar{r}, \bar{\epsilon}\}$, for P adjusting to its stable general equilibrium value $\bar{P} \iff P^\star$ as the stable general equilibrium value $i^\star \iff \bar{i}$ of i is attained, and for pre general equilibrium definitions $\{c := PC,\ s := PS,\ y := PY\}$, the economy-wide normative general equilibrium (or balance) conditions of $\mathcal{E}$ can be initially summarised by the following straightforward (first level) agents' and markets' expressions concerning the *resources constraints* of $\mathcal{E}$ for some revealed $(\mathcal{R} \ni)\omega \in \Omega(\subset \Theta)$[30]:

(1) *production* (or underlying *technical*, t) *feasibility*

$$Y^\star = F_E^\star(K_E^\star, L_W^\star)$$

[30]By which aggregate risk has been resolved and need not be taken into consideration any more.

(2) *product distributional feasibility*

$$Y^\star = C^\star(P^\star, y^\star) + S^\star(P^\star, y^\star)$$

(supply equals demand; cake cutting: some of the pie is eaten and some of it is not)

(3) *spending versus non-spending feasibility* iff *liquidity feasibility* iff *budget constraint*

$$\sigma_B^\star + s_W^\star + \pi_E^\star = c^\star(\bullet)[:= P^\star C^\star(P^\star, y^\star)] + s^\star(\bullet)[:= P^\star S^\star(P^\star, y^\star)] = y^\star[:= P^\star Y^\star]$$

(income = value of demand = value of supply = money balances)

where

$$P^\star C^\star(P^\star, y^\star) = \bar{\nu}\mathcal{M}^\star,\ P^\star S^\star(P^\star, y^\star) = D^\star(i^\star, \bar{\epsilon}) = M^\star = (\bar{r} - i^\star)K_E^\star,$$

$$\mathcal{L}^\star(P^\star, i^\star, y^\star) = \bar{\nu}\mathcal{M}^\star + M^\star,$$

$$\sigma_B^\star = \max_{i \in [\bar{\epsilon}, \bar{r}]}[(i - \bar{\epsilon})\bar{\ell}_B] = (\bar{r} - \bar{\epsilon})\bar{\ell}_B,\ s_W^\star = \bar{w}L_W^\star,$$

and

$$\pi_E^\star = P^\star C_W^\star(\bullet) + P^\star C_B^\star(\bullet) - I_E^\star(\bar{w}, \bar{r}, i^\star),$$

$$I_E^\star(\bar{w}, \bar{r}, i^\star) = \bar{w}L_W^\star + (\bar{r} - i^\star)K_E^\star := \mathcal{I}^\star(\bar{w}) + \iota^\star(\bar{r}, i^\star).$$

(4) *wealth distributional feasibility*

$$\mathcal{W}^\star(\sigma_B^\star + s_W^\star + \pi_E^\star = y^\star) = \max_{i \in [\bar{\epsilon}, \bar{r}]} \mathcal{W}(i).$$

In all cases above, feasibility means, *ex post* instantaneously, a socially optimum and steady threshold that cannot be crossed. It means that the economy is restrained and cannot move further and beyond it. Note initially that (1) and (2) are non-monetary general equilibrium conditions for $\mathcal{E}$. Essentially then, (3) refers to the usual agents' (monetary) affordability or purchasing-power (i.e., budgetary) constraint. In this monetary macroeconomic identity, specifically, each one of its parts collects and describes the total money balances in $\mathcal{E}$. Remark further that by design

$$\mathcal{W}^\star(\sigma_B^\star + s_W^\star + \pi_E^\star = y^\star) = \sigma_B^\star + s_W^\star + \pi_E^\star = y^\star.$$

At the same time, (2) is simply implied by (3), i.e., the structure of the portfolio of the financial expenses in $\mathcal{E}$ determines the mode of how the output is shared, that is, allocated between consumers and savers. Eventually, since (1) can be also consolidated in (3), (3) alone constitutes the fundamental monetary general equilibrium constraint of $\mathcal{E}$, which sufficiently characterises the feasibility of the monetary and distinctively imperfectly competitive general equilibrium of $\mathcal{E}$. Previously, moreover, with $\iota^\star(\bar{r}, i^\star) > 0$ is denoted the part of the entrepreneurial financial investment that is corresponded to E's investment in physical capital, $(\bar{r} - i^\star)K_E^\star$, while with $\mathcal{I}^\star(\bar{w}) > 0$ is notated the other part of the entrepreneurial financial investment, the one in accordance with E's investment in human capital, $\bar{w}L_W^\star$. So concluding, in general equilibrium, $\mathcal{E}$'s budget constraint acquires the known form

$$y^\star = c^\star(\bullet) + \iota^\star(\bullet) \text{ or interchangeably } s^\star(\bullet) = \iota^\star(\bullet),\ \bullet = (P, y).$$

Ex post, by unravelling further the prequel system of the resources constraints of $\mathcal{E}$ in general equilibrium, which system is eventually reduced to a single budget constraint for $\mathcal{E}$, the following refined and subtler (second level) general equilibrium conditions or outcomes ensue for $\mathcal{E}$.

For $i^\star = \bar{r}$ (iff parity between the two financial rates of interest iff the natural or market-clearing interest rate equals the money-making or speculative interest rate), it holds that

1. $\sigma_B^\star = (i^\star - \bar{\epsilon})\bar{\ell}_B = i^\star\bar{\ell}_B$, as $\bar{\epsilon} \to 0[= \inf(0, \frac{p_B}{\alpha})]$,

and

2. $(\bar{r} - i^\star)K_E^\star = 0$,

which then jointly imply a series of facts [below $\bullet = (P, y)$]:

(i) $s^\star(\bullet) = \iota^\star(\bullet) = 0 \iff y^\star = c^\star(\bullet) \iff Y^\star = C^\star(\bullet)$.

(ii) $\mathcal{U}$ is maximised over consumption.

(iii) $I_E^\star(\bar{w}, \bar{r}, i^\star) = \bar{w}L_W^\star = s_W^\star$.

(iv) $P^\star S_W^\star(\bullet) + P^\star S_B^\star(\bullet) + P^\star S_E^\star(\bullet) = [(\bar{r} - i^\star)K_E^\star =]0$.

(v) $P^\star C_W^\star(\bullet) = s_W^\star$ and $P^\star C_B^\star(\bullet) = \sigma_B^\star$.

(vi) $\pi_E^\star = s_W^\star + \sigma_B^\star - s_W^\star \iff \pi_E^\star = \sigma_B^\star$.

All in all, below is the normative status for $\mathcal{E}$ that an *ex post* Wicksellian general equilibrium describes.

In an *ex post* general equilibrium: (i) there are no leaks in the resources constraints (or budget constraint) of $\mathcal{E}$ (ii) ubiquitously, every parameter of $\mathcal{E}$ has attained its potential-optimum capacity, by having simultaneously reached its steady-state quantity or degree, (iii) the Wicksellian differential has been nullified, the Wicksellian cumulative process on inflation has been terminated and inflation has been completely eliminated, (iv) since there are no excess-demands or excess-supplies in the economy's markets, even the imperfectly competitive ones, all the market-clearing prices have been adjusted and stabilised to their supply-equals-demand general equilibrium values, (v) apart from W, who maximises his labor income if and and only if E maximises her total investment (for production) cost[31], E and B maximise their labor incomes as well and the two of them end up earning exactly the same (equal or uniform) maximum income[32], (vi) because $\bar{\epsilon} \to 0$, W's (maximum) income = W's (maximum) salary, B's (maximum) income = B's (maximum) spread, while because $i^\star = \bar{r}$, E's maximum income = E's maximum profit, (vii) since illiquid assets have dried up, any firm in $\mathcal{E}$ eventually ends up investing in (i.e., employing) human capital only, (viii) motivated by the arisen economic stability, agents will sensibly stop abstaining from consumption, they will not at all be optimally saving or depositing demanded money for the precautionary or speculative creation of physical capital any longer, but they will be, instead, optimally demanding and spending all their money for consumption solely, as they reasonably become exclusively incentivised by their ephemeral gratification, (ix) $\mathcal{E}$'s income or wealth (from spreads, profits and salaries) and utilitarian welfare (from consumption) will have been maximised, while ultimately (x) $\mathcal{E}$ will have reached a level of full prosperity.

Last but not least, $\mathcal{E}$ fulfils wealth equitability, namely, non enviousness, in an *ex post* general equilibrium. It is easy to infer this, by realising that W does not envy the marginal return of B, equivalently of E. Or *vice versa*, 'B or E' is not jealous of the marginal return of W. Consider the direct case (the inverse scenario is analogously deduced). When the working hours of a fully employed agent cannot be changed but her marginal return could alter, assume that W were allocated with $i^\star$ instead of $\bar{w}$ and that $i^\star L_W^\star > \bar{w} L_W^\star (> 0)$, i.e., W envies the marginal wealth of B. This is a contradiction because $s_W^\star$ is the maximum salary for W, which means that $\bar{w} L_W^\star \geq i^\star L_W^\star$.

In sum, $\mathcal{E}$'s general equilibrium is consistent with the (neo)classical perception that a humanitarian economic society is, essentially, an organisation where rational and ethical autonomous human behaviours prevail, so that then an optimal and equitable general

[31]Which means that: the more investment for production undertaken by E, the more labor income yielded for W. So this is why W (even unintentionally) finances, through B, the investment for production of E.

[32]So once the economy has balanced to its normative status, someone will be indifferent between running a financial mediatory station or an industrial (productive and vending) plant, with arbitrages and profits becoming synonymous terms towards a unified version of a firm. All entrepreneurial ventures have become the same.

equilibrium of prices and allocated quantities emerges by itself. Normatively, $\mathcal{E}$ attains its potential wealth, i.e., its potential prosperity, across time.

Suppose now more stringently that, in an *ex post* general equilibrium of $\mathcal{E}$, there exists income or wealth equality, not just equitability, between 'B or E' and W, to wit, $s^{\star}_{W} = \sigma^{\star}_{B}$. This condition, according to which each household of $\mathcal{E}$ receives exactly the mean or average (i.e., the per capita or per household) income, translates as sheer indifference or neutrality in selecting occupational and employment type for the agents in general equilibrium. There is, in this case, an inbuilt condition of symmetry in $\mathcal{E}$ that renders equal, more specifically, marginal returns for W and 'B or E'. Indeed, $L^{\star}_{W} = \bar{\ell}_{B}$ because B and W work equal time, their full employment one. This then implies that $\bar{w} = i^{\star} = \bar{r}$. The last condition secures the *law of one price* in general equilibrium among the economy's human capital market and financial (or monetary) market(s).

Note. In the Wicksellian economy, parity between wage and the interest rate when the economy is balanced with economic equality would soundly mean, given the extant trade-off between P and i, that an increase in the minimum wage above its general equilibrium value, $\bar{w}$, would not create inflation, rather deflation. This is because, when everything else is partialled out, an increase in w decreases I_{E}, which then drags along the investment in physical capital into a descent. Then if the inverse relationship between inflation and unemployment of workers, i.e., the controversial *Philips curve* effect or policy dilemma, is true, pressure for a fall in the employment time of W is created, additionally to the tension of the same direction that is already created in the economy's market for workers. To wrap up, if $\mathcal{E}$ balances *ex post* with all the economic inequality being erased, and then the wage of workers exogenously rises above its general equilibrium level, then workers are likely to experience contractions in their employment by E, through different channels.

The analysis of this paper culminates with the definition infra. Consider the (more general) locally perfectly competitive Wicksellian economy $\mathcal{E}$ in the *ex ante* stage, where aggregate risk, i.e., $\Omega \subset \mathcal{R} \subset \Theta$, still exists. Let $\mathcal{F}_{B} \supseteq \mathbb{F}_{B}$, where the latter is a filtration upon $\mathcal{B}(\mathcal{H})$. Employ, to avoid notational proliferation, the casual parametrisation $\bullet = (P, y)$. Then the following definition, which summarises the analysis heretofore, ensues.

Definition. The (random) prices-consumption pair

$$\big(P^\star(i^\star),(C^\star(\bullet,\omega),\omega\in\Omega)\big)\in\mathbb{R}_{++}\times\mathbb{R}_{++}^{|\Omega|}\text{ or simply }(P^\star(i^\star),C^\star)$$

which
[as $\mathcal{E}$ attains its potential (maximum-optimal) values for its inputs and output which are combined by a technology F_E]
concurrently conveys

(1) (expected social utility maximisation subject to random monetary budget constraint)

$$\mathbb{U}^\star(C^\star)=\sum_{\omega\in\Omega}\mathcal{U}^\star(C^\star(\bullet,\omega)=Y_\omega^\star]q(\omega)=\max_C\mathbb{U}(C),\ C:\bullet\times\Omega\to\mathbb{R}_{++},\ C(\bullet,\omega)>0,$$
$$\text{s.t. }y_\omega=c(\bullet,\omega)+\iota(\bullet,\omega)\iff s(\bullet,\omega)=\iota(\bullet,\omega),\ \forall\ \omega\in\Omega,$$

when $\mathbb{U}[=E_q(\mathcal{U}\circ C|_{\mathcal{P}(\Omega)}]:(\bullet\times\Omega)^{\mathbb{R}_{++}}\to\mathbb{R}_{++}$ (expected utility functional)

and $q:2^\Omega\to[0,1]$ (subjective additive probability measure)

(2) (random equitable national financial wealth maximisation)

$$[\sigma_B^\star+s_W^\star+\pi_E^\star=]y^\star=\mathcal{W}^\star(y^\star)=\mathcal{W}^\star(i^\star=\bar{r})=\max_{i>0}\mathcal{W}(i)$$

(3) (market prices interdependencies: random price level stabilisation via the expected interest rate, with minimum variation of random prices)

$P^\star(i^\star)=\lim_{i\to i^\star}P(i)$, where $i=E(\epsilon/_{\mathcal{F}_B})=\int_{\mathbb{R}_{++}}\epsilon d\varrho_B/_{\mathcal{F}_B}$ (Lebesgue integral), and

$$P:[\epsilon,\bar{r}]\to\mathbb{R}_{++},\text{ with }P^\star(\bar{r}=i^\star)=\min_i P(i),$$

while $\varrho_B/_{\mathcal{F}_B}:\mathcal{B}(\mathcal{H})\to[0,1]$,
(subjective, σ-additive, conditional on $\mathcal{F}_B$, Bayesianly updated probability measure)

before $\epsilon\to 0=\bar{\epsilon}$ (iff $\rho_B^\star$) and after $\bar{r}=max\{r_E:r_E\geq i\}$ (optimal computation of r)

is called an *ex ante Wicksellian general equilibrium* of $\mathcal{E}$

(which is completely decentralised, monetary, unboundedly rational and dynamic).

Theorem. An *ex ante* Wicksellian general equilibrium exists for $\mathcal{E}$.

Proof. The proof follows from the analysis that is chained to sections 2 and 3 of the paper.

Remark 1. For $\mathcal{E}$, if an *ex ante* Wicksellian general equilibrium exists for any $\omega \in \Omega$, then the aimed *ex post* Wicksellian general equilibrium, the one actually realised for some specifically revealed $\omega \in \Omega$, also exists. The former general equilibrium notion draws naturally the attention from now on, and reference shall be being made exclusively to it.

Remark 2. An *ex ante* to *ex post* Wicksellian general equilibrium exists if: B attains her supremum net market power if and only if *ex ante* B has for each alternative state $\rho_B^\star$, and *ex post* exercises $\rho_B^\star$ for the actual state if and only if B is both rational in forming his expectations with respect to the economy's interest rate and rational in maximising his income. This baffling phenomenon shall be dubbed *Wicksellian paradox*. It is proclaimed a neoclassical enigma (see also in section 4) because although some agent has and exercises (over the rest of the agents) monopolistic power, there is zero deadweight loss in the society's utilitarian welfare, since it is maximised and the first best is attained, while the survival individual-to-aggregate income or wealth is also maximised in the society. When acting for their own benefit (and only), all agents maximise simultaneously their basic (and only) income or wealth. None of them is better off or worse off in terms of this condition. And none of them envies the lifestyle that this condition brings to the others, when the agents' standards of living are inter-personally compared.

Remark 3. As usual, the specific (quasi-neoclassical) general equilibrium consists of a *general equilibrium goods prices* and a *general equilibrium* (directly aggregate) *allocation of consumption*. Moreover, any Wicksellian general equilibrium is steady, i.e., attains steady (in each independent time slot) states for all the values of the parameters of the associated with it economy. First off, it is stable with respect to all market prices. In the aftermath, it is allocatively stable as well. This is because it is directly socially optimal, it is afterwards equitable (fair and impartial) as rational economic units maximise their independent income or wealth objectives, while it is by construction ethical as well, namely, it involves benevolent agents.

Remark 4. Clearly, the impressive Walrasian (1874) *tâtonnement process*[33] or the superb Edgeworthian (1881) *recontracting process*[34], which have microeconomic roots, are irrelevant here. So in the Wicksellian general equilibrium version, one should invent or retrieve the (neo)classical Smithian invisible hand that, when prices and allocations are

[33]The climax of which is the unprecedented Walras law of markets, which binds together the Walrasian general equilibrium, which in turn is the epitome of all general equilibria that are strongly flavoured with market competition.

[34]Which is the mother of all general equilibria that are strongly scented with market competition and coalitional cooperation of agents.

destabilised by hyper demand (or hyper supply), guides or drives $\mathcal{E}$ to a self-fulfilled (normative) adjustment or stabilisation, i.e., to a general equilibrium *price* and *consumption allocation* pair. In the Wicksellian economy and its Wicksellian general equilibrium, this inner self-regulating force is the agents' rationality itself. In particular, the rationally acting banker will internally lead $\mathcal{E}$ to its general equilibrium. Harmony in $\mathcal{E}$ is strongly (and non negotiably) tied with B. See also in section 4.

Everything that has been discussed so far in this section is true if and only if $\mathcal{O}$ is inert. Let us now see what can happen if $\mathcal{E}$'s ambiguity starts getting alive, and shocks make the economy shaky. Then, from the moment that any such general equilibrium of ε is elusive and ungetatable, or gettable and overthrown, the Wicksellian general equilibrium cannot be smoothly synchronised in time.

Remark 5. Suppose that a Wicksellian general equilibrium is not accessible because B is disempowered, so $\mathcal{E}$ features (out of necessity) some neoclassically acceptable degree of centralisation, i.e., one that comes without adverse market effects. Loosely speaking, under such an updated backdrop, say that the central bank, managed by G in $\mathcal{E}$, applies discretionary monetary policy by controlling, either directly or indirectly, and with the well known straightforward regulations and institutions, or through other (oblique) subsidiary policies and auxiliary programmes, the private banks' interest rate $i > 0$. This of course refers to a case-by-case monetary policy, applied with discretion, not to a stationary (fixed in time) policy rule. Then the government can alleviate (relief or de-boost) and up to totally extinguish $\mathcal{E}$'s undesirable inflation, the monetary policy target, by increasing i, the monetary policy instrument, to its propitious level, without enduring any deadweight losses into the maximum aggregate utilitarian welfare, the monetary policy social cost. In other words, just by taking advantage of the Wicksellian general equilibrium knowledge and guidelines, and as long as one adheres to an economic scenery that resembles to $\mathcal{E}$, the policy maker, G, who is the one now occupying the economy's public sector, can optimally administer the missing price-allocative stability. Such a monetary policy is contained into the toolbox of *optimal monetary policies* that a modern country or commonwealth can have access to and make use of. With them, in general, interest rates and/or money quantities are endogenously optimally governmentally set, namely, with the restriction of making sure that the free-markets objective of the maximum social utility, without distorting the maximum wealth distribution, is maintained and fulfilled upon and after the governmental intervention.

4. The Wicksellian Paradox

This section, the paper's epilogue, concludes with the paradoxical power of Wicksell's theory and, upon this paradox, the restricted policy maker's role within this theory, which is conditional onto the degree that the private banks manage to apply their inherent supremacy.

Wicksell, who scanned and stepped upon the most glorious classical texts[35], was more of a free-styled neoclassical (synthesiser) economist. Indeed, Wicksell's eccentric neoclassical theory resembles to both the prior to Wicksell classical theory and the posterior to him Keynesian theory. It is an amalgam, or a predicted synthesis, of both of them. It also bridges the theory of value with the theory of money. When permuted and viewed as a holistic theory, one that supersedes the cumulative process and transcends the whole history of economic thought, it clusters to a strenuous general equilibrium theory, one that unites and merges banking and finance with economics.

In this paper, the Wicksellian economy $\mathcal{E}$ is pioneered as a nuanced plexus of agents and markets. For the Wicksellian economy of benevolent pro-social agents, this paper then coins the notion of the long run dynamic but not intergenerational, merely monetary, fully decentralised, of significantly imperfectly competitive markets, semi-neoclassical macroeconomic Wicksellian general equilibrium, which for every replicated brief time period: stabilises all market prices to their general equilibrium levels, maximises (to a steady state) social utility, and maximises equitably (to a steady state) the personal-to-collective income or wealth. Agents of the Wicksellian economy are endowed with absolute or unbounded (neoclassical) rationality, in all economic respects. On these grounds, they form rational expectations upon request, while they consistently maximise their objectives. Invariantly in time, decision makers are perfect foresighters and/or backsighters, and goal maximisers.

Paradoxically, the particular concept of a Wicksellian general equilibrium is robust if the mass society, W in conjunction with E more precisely, acknowledge and champion as just-and-neutral the surrounding idea that B should have and exercise financial power or authority over them. W, in particular, should come to terms with the fact that her prosperity in $\mathcal{E}$ is, tenaciously, B (thus, E) dependent. In the absence of a sustainable B, thus, E, $\mathcal{E}$ is disordered or collapses, by experiencing financial-banking melt downs, or at least severe monetary turbulences.

This then makes G's participation in $\mathcal{E}$ limited, and conditional on B's power as well. As it was already mentioned in section 2 and more elaborately explained in Remark 5 of section 3, therefore, a solid Wicksellian conclusion is that if, in some economy, B is or is about to become a void agent, then the economy's viability is seriously compromised, so the government has to be invoked and substitute B by deploying optimal monetary policy. On top of that, because the key role of B (passed then to E) is a *conditio sine qua non* in $\mathcal{E}$ for the fulfilment of its general equilibrium, in occasions and circumstances

[35]The ones of Smith (1759, 1776), Ricardo (1817), Say (1803), Mill (1844, 1848, 1863) and Malthus (1820).

where the free-markets trust between B and W is likely to be exogenously shocked or gets endogenously endangered and shattered, so that a strictly positive arbitrage for B and, subsequently, a strictly positive profit for E are at stake, the state has to step in and force or, more leniently, remind to the pro-social and altruistic W to support B (and followingly E) in the name of social cohesion, via the (optimal) government budget and its (optimal) redistributive fiscal policy. Remarkably, this practice, of this type of governmental transfer payments, is consistent with the majority of the sovereign economies, especially the most advanced and mature ones.

References

Baird, C., W., 1970, 'Knut Wicksell on the Integration of Monetary and Value Theory', Swedish Journal of Economics, 72: 101-10.

Boianovsky, M., 1995, 'Wicksell's Business Cycle', European Journal of the History of Economic Thought, 2: 375-411.

Boianovsky, M., 1998, 'Wicksell, Ramsey and the Theory of interest', European Journal of the History of Economic Thought, 5: 140-68.

Boianovsky, M., 2013, 'Fisher and Wicksell on Money: a Reconstructed Conversation', European Journal of the History of Economic Thought, 20: 206-37.

Boianovsky, M., 2014, 'Wicksell on Utility and Market Aggregation', SSRN working paper series.

Boianovsky, M.,, 2016, 'Wicksell, General Equilibrium, And The Way To Macroeconomics," Journal of the History of Economic Thought, Cambridge University Press, 38(3): 261-284.

Cobb, C., W., and Douglas, P., H., 1928, 'A Theory of Production', American Economic Review, 18 (Supplement): 139-165.

Dworkin, R., 1981a, 'What is Equality? Part 1: Equality of Welfare', Philosophy and Public Affairs, 10: 185-245.

Dworkin, R., 1981b, 'What is Equality? Part 2: Equality of Resources', Philosophy and Public Affairs, 10: 283-345.

Eagly, R., 1966, 'A Wicksellian Monetary Model: An Expository Note', Scottish Journal of Political Economy, 251-54, Reprinted in his 'The Structure of Classical Economic Theory', New York: Oxford University Press, 1974, 86-9.

Edgeworth, F., Y., 1881,'Mathematical Psychics: An Essay on the Application of Mathematics to the Moral Sciences', Kegan Paul, London.

Fisher, I., 1911, 'The Purchasing Power of Money', 2nd Edition, Macmillan Co., New York.

Frisch, R., 1952, 'Frisch on Wicksell', in H. W. Spiegel, ed., The Development of Economic Thought: Great Economists in Perspective. New York: J. Wiley.

Humphrey, T., M., 1986, 'Cumulative Process Models form Thornton to Wicksell', Economic Review, Federal Reserve Bank of Richmond, 18-25.

Inada, K-I., 1963, 'On a Two-Sector Model of Economic Growth: Comments and a Generalization', The Review of Economic Studies, 30(2): 119-127.

Jevons, W., S., 1875, 'Money and the Mechanisms of Exchange', New York, D. Appleton and Company.

Jonung, L., 1979, 'Knut Wicksell and Gustav Cassel on Secular Movements in Prices', Journal of Money, Credit and Banking, 11: 165-81.

Joplin, T., 1823, 'Outlines of a System of Political Economy', reprineted, New York: Augustus M. Kelley, 1970.

Joplin, T., 1828, 'Views on the Currency', London: J. Ridgway.

Joplin, T., 1832, 'An Analysis and History of the Currency Question', London: J. Ridgway.

Kahn, R., F., 1931, 'The Relation of Home Investment to Unemployment', The Economic Journal, 41(162): 173–198.

Keynes, J., M., 1936, 'The General Theory of Employment, Interest and Money', Macmillan, London.

Knight, F., H., 1921, 'Risk, Uncertainty, and Profit' Boston, MA: Hart, Schaffner Marx; Houghton Mifflin Company.

Laidler, D., 1972, 'On Wicksell's theory of price level dynamics', Manchester School, 40: 125-44.

Laidler, D., 1997, 'The Wicksell Connection, the Quantity Theory and Keynes', unpublished paper.

Leijonhufvud, A., 1981, 'The Wicksell Connection: Variations on a Theme. In Information and Coordination: Essays in Macroeconomic Theory, New York: Oxford University Press, 131-202.

Malinvaud, E., 2003, 'The Legacy of Knut Wicksell to Capital Theory', The Scandinavian Journal of Economics, 105 (4): 507-525.

Malthus, T., R., 1820, 'Principles of Political Economy Considered with a View to their Practical Application', in Pullen, J., M., Ed., 1989, 2nd edition of 1836, Variosum Edition, Cambridge University Press.

Marshall, A., 1890, ' Principles of Economics', Macmillan, London.

Marx, K., 1867, 'Capital: A critique of Political Economy. Volume 1', New York, International Publisher, 1977.

Marx, K., 1885, 'Capital: A critique of Political Economy. Volume 2', New York, International Publisher, 1977.

Marx, K., 1894, 'Capital: A critique of Political Economy. Volume 3', New York, International Publisher, 1977 and London: Lawrence and Wishart, 1984.

Mill, J., S.,1844, 'Essays on Some Unsettled Questions of Political Economy', London: John W. Parker.

Mill, J., S., 1848, 'Principles of Political Economy with Some of their Applications to Social Philosophy', London: John W. Parker.

Mill, J., S., 1863, 'Utilitarianism', in Crisp, R., ed., 1998, Oxford University Press.

Patinkin, D., 1968, 'Wicksell's Cumulative Process in Theory and Practice', Banca Nazionale del Lavoro Quarterly Review, 120-31, Re-printed in his Studies in Monetary Economics, New York: Harper and Row, 1972, 83-91.

Quesnay, F., 1756, 'Economic Table', https://www.marxists.org/reference/subject/economics/quesnay/1759/tableau.htm

Ramsey, F., 1928, 'A Mathematical Theory of Saving', Economic Journal, 38, 543-559.

Ricardo, D., 1817, 'On the Principles of Political Economy and Taxation', John Murray, London, In: Sraffa, P., Ed., The Works and Correspondence of David Ricardo, Vol. 1, Cambridge University Press, Cambridge, 1951.

Say, J-B., 1803, (2001), 'A Treatise on Political Economy (or the Production, Distribution, and Consumption of Wealth)', Reprint of the text translated by C. R. Prinsep in 1821: English translation of the fourth edition of the original 1803 French text 'Traité d'economie politique', Routledge, New York.

Siven, C.-H., 1997, 'Capital Theory and Equilibrium Method in Wicksell's Cumulative Process', History of Political Economy, 29: 201-17.

Smith, A., 1759, 'The Theory of Moral Sentiments', Andrew Miller, London and Alexander Kincaid, Edinburgh.

Smith, A., 1776 (2008), 'An Inquiry into the Nature and Causes of the Wealth of Nations', Reprint of the original 1776 text, Oxford University Press, London.

Storm, S., and Tholberg., B., 1979, ed., 'The Theoretical Contributions of Knut Wicksell', Palgrave Macmillan.

Thornton, H., 1802, 'An Enquiry into the Nature and Effects of the Paper Credit of Great Britain, reprinted, New York: Augustus M. Kelley, 1965 .

Uhr, C., G., 1960, 'Economic Doctrines of Knut Wicksell', Berkeley: University of California Press.

Walras, L., 1874 (2003), 'Elements of Pure Economics (or, The Theory of Social Wealth)', Translated by William Jaffé: English translation of a republication of the original 1874 French text 'Éléments d'Économie Politique Pure (ou Théorie de la richesse sociale)', Routledge, New York.

Wicksell, K., 1889 (2001) 'Bank Rate of Interest as the Regulator of Prices', Edited and translated by M. Boianovsky and H.-M. Trautwein, History of Political Economy. 33: 509-16.

Wicksell, K., 1893 (1954), 'Value, Capital and Rent', Translated by S.H. Frowein. London: Allen and Unwin.

Wicksell, K., 1898, 'Interest and Prices", translated by R., F., Kahn., London: Macmillan, 1936, reprinted, New York: Augustus M. Kelley, 1965.

Wicksell, K., 1901, 'Lectures on Political Economy, Vol. 1, 'General Theory', translated by E. Classen, edited by Lionel Robbins. London: Routledge and Kegan Paul, 1934, reprinted, New York: Augustus M. Kelley, 1977.

Wicksell, K., 1904a (1958), 'Ends and Means in Economics', In Knut Wicksell – Selected papers in economics, 51-66, Edited by E. Lindahl. London: Allen and Unwin.

Wicksell, K., 1904b (1999) 'The Monetary Problems of the Future', Translated by T. Chamberlain, In Knut Wicksell – selected essays in economics, vol. II, ed. by B. Sandelin, 12-31, London: Routledge.

Wicksell, K., 1906, 'Lectures on Political Economy, Vol. 2, 'Money', translated by E. Classen, edited by Lionel Robbins. London: Routledge and Kegan Paul, 1935, reprinted, New York: Augustus M. Kelley, 1978.

Wicksell, K., 1907 (1953), 'The Enigma of Business Cycles', Translated by C. Uhr, International Economic Papers, 3: 58-74.

Wicksell, K., 1908 (2001), 'A New Theory of Crises', Translated by V. Homolka, Structural change and economic dynamics, 12: 335-42.

ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ
ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS
ΣΧΟΛΗ ΟΙΚΟΝΟΜΙΚΩΝ ΕΠΙΣΤΗΜΩΝ SCHOOL OF ECONOMIC SCIENCES
ΤΜΗΜΑ ΟΙΚΟΝΟΜΙΚΗΣ ΕΠΙΣΤΗΜΗΣ DEPARTMENT OF ECONOMICS

Department of Economics
Athens University of Economics and Business

List of Recent Working Papers

2023

01-23 Real interest rate and monetary policy in the post Bretton Woods United States, George C. Bitros and Mara Vidali
02-23 Debt targets and fiscal consolidation in a two-country HANK model: the case of Euro Area, Xiaoshan Chen, Spyridon Lazarakis and Petros Varthalitis
03-23 Central bank digital currencies: Foundational issues and prospects looking forward, George C. Bitros and Anastasios G. Malliaris
04-23 The State and the Economy of Modern Greece. Key Drivers from 1821 to the Present, George Alogoskoufis
05-23 Sparse spanning portfolios and under-diversification with second-order stochastic dominance, Stelios Arvanitis, Olivier Scaillet, Nikolas Topaloglou
06-23 What makes for survival? Key characteristics of Greek incubated early-stage startup(per)s during the Crisis: a multivariate and machine learning approach, Ioannis Besis, Ioanna Sapfo Pepelasis and Spiros Paraskevas
07-23 The Twin Deficits, Monetary Instability and Debt Crises in the History of Modern Greece, George Alogoskoufis
08-23 Dealing with endogenous regressors using copulas; on the problem of near multicollinearity, Dimitris Christopoulos, Dimitris Smyrnakis and Elias Tzavalis
09-23 A machine learning approach to construct quarterly data on intangible investment for Eurozone, Angelos Alexopoulos and Petros Varthalitis
10-23 Asymmetries in Post-War Monetary Arrangements in Europe: From Bretton Woods to the Euro Area, George Alogoskoufis, Konstantinos Gravas and Laurent Jacque
11-23 Unanticipated Inflation, Unemployment Persistence and the New Keynesian Phillips Curve, George Alogoskoufis and Stelios Giannoulakis
12-23 Threshold Endogeneity in Threshold VARs: An Application to Monetary State Dependence, Dimitris Christopoulos, Peter McAdam and Elias Tzavalis
13-23 A DSGE Model for the European Unemployment Persistence, Konstantinos Giakas
14-23 Binary public decisions with a status quo: undominated mechanisms without coercion, Efthymios Athanasiou and Giacomo Valletta
15-23 Does Agents' learning explain deviations in the Euro Area between the Core and the Periphery? George Economides, Konstantinos Mavrigiannakis and Vanghelis Vassilatos
16-23 Mild Explocivity, Persistent Homology and Cryptocurrencies' Bubbles: An Empirical Exercise, Stelios Arvanitis and Michalis Detsis
17-23 A network and machine learning approach to detect Value Added Tax fraud, Angelos Alexopoulos, Petros Dellaportas, Stanley Gyoshev, Christos Kotsogiannis, Sofia C. Olhede, Trifon Pavkov
18-23 Time Varying Three Pass Regression Filter, Yiannis Dendramis, George Kapetanios, Massimiliano Marcellino

19-23 From debt arithmetic to fiscal sustainability and fiscal rules: Taking stock, George Economides, Natasha Miouli and Apostolis Philippopoulos
20-23 Stochastic Arbitrage Opportunities: Set Estimation and Statistical Testing, Stelios Arvanitis and Thierry Post
21-23 Behavioral Personae, Stochastic Dominance, and the Cryptocurrency Market, Stelios Arvanitis, Nikolas Topaloglou, and Georgios Tsomidis
22-23 Block Empirical Likelihood Inference for Stochastic Bounding: Large Deviations Asymptotics Under *m*-Dependence, Stelios Arvanitis and Nikolas Topaloglou
23-23 A Consolidation of the Neoclassical Macroeconomic Competitive General Equilibrium Theory via Keynesianism (Part 1 and Part 2), Angelos Angelopoulos
24-23 Limit Theory for Martingale Transforms with Heavy-Tailed Noise, Stelios Arvanitis and Alexandros Louka

2024

01-24 Market Timing & Predictive Complexity, Stelios Arvanitis, Foteini Kyriazi, Dimitrios Thomakos
02-24 Multi-Objective Frequentistic Model Averaging with an Application to Economic Growth, Stelios Arvanitis, Mehmet Pinar, Thanasis Stengos, Nikolas Topaloglou
03-24 State dependent fiscal multipliers in a Small Open Economy, Xiaoshan Chen, Jilei Huang, Petros Varthalitis
04-24 Public debt consolidation: Aggregate and distributional implications in a small open economy of the Euro Area, Eleftherios-Theodoros Roumpanis
05-24 Intangible investment during the Global Financial Crisis in the EU, Vassiliki Dimakopoulou, Stelios Sakkas and Petros Varthalitis
06-24 Time will tell! Towards the construction of instantaneous indicators of different agent-types, Iordanis Kalaitzoglou, Stelios Arvanitis
07-24 Norm Constrained Empirical Portfolio Optimization with Stochastic Dominance: Robust Optimization Non-Asymptotics, Stelios Arvanitis
08-24 Asymptotics of a QLR-type test for optimal predictive ability, Stelios Arvanitis
09-24 Strongly Equitable General Equilibrium Allocations, Angelos Angelopoulos
10-24 The Greek macroeconomy: A note on the current situation and future outlook, Apostolis Philippopoulos
11-24 Evolution of Greek Tax System, A Survey of Legislated Tax Changes from 1974 to 2018, Panagiotis Asimakopoulos
12-24 Macroeconomic Impact of Tax Changes, The case of Greece from 1974 to 2018, Panagiotis Asimakopoulos
13-24 `Pareto, Edgeworth, Walras, Shapley' Equivalence in a Small Economy, Angelos Angelopoulos
14-24 Stimulating long-term growth and welfare in the U.S, James Malley and Apostolis Philippopoulos
15-24 Distributionally Conservative Stochastic Dominance via Subsampling, Stelios Arvanitis
16-24 Before and After the Political Transition of 1974. Institutions, Politics, and the Economy of Post-War Greece, George Alogoskoufis
17-24 Gaussian Stochastic Volatility, Misspecified Volatility Filters and Indirect Inference Estimation, Stelios Arvanitis, Antonis Demos
18-24 Endogenous Realtor Intermediation and Housing Market Liquidity, Miroslav Gabrovski, Ioannis Kospentaris, Victor Ortego-Marti
19-24 Universal Choice Spaces and Expected Utility: A Banach-type Functorial Fixed Point, Stelios Arvanitis, Pantelis Argyropoulos, Spyros Vassilakis
20-24 Government Expenditures and Tax Policy Framework after the Political Transition, The Case of Greece, Panagiotis Asimakopoulos

2025

01-25 Democracy, redistribution, and economic growth: Some evidence from post-1974 Greece, George C. Bitros

02-25 Assessing Downside Public Debt Risks in an Environment of Negative Interest Rates Growth Differentials, Yiannis Dendramis, Georgios Dimitrakopoulos and Elias Tzavalis

03-25 Wicksellian General Equilibrium, Angelos Angelopoulos

ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ

ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

ΣΧΟΛΗ ΟΙΚΟΝΟΜΙΚΩΝ ΕΠΙΣΤΗΜΩΝ
SCHOOL OF ECONOMIC SCIENCES

ΤΜΗΜΑ ΟΙΚΟΝΟΜΙΚΗΣ ΕΠΙΣΤΗΜΗΣ
DEPARTMENT OF ECONOMICS

Department of Economics
Athens University of Economics and Business

The Department is the oldest Department of Economics in Greece with a pioneering role in organising postgraduate studies in Economics since 1978. Its priority has always been to bring together highly qualified academics and top quality students. Faculty members specialize in a wide range of topics in economics, with teaching and research experience in world-class universities and publications in top academic journals.

The Department constantly strives to maintain its high level of research and teaching standards. It covers a wide range of economic studies in micro-and macroeconomic analysis, banking and finance, public and monetary economics, international and rural economics, labour economics, industrial organization and strategy, economics of the environment and natural resources, economic history and relevant quantitative tools of mathematics, statistics and econometrics.

Its undergraduate program attracts high quality students who, after successful completion of their studies, have excellent prospects for employment in the private and public sector, including areas such as business, banking, finance and advisory services. Also, graduates of the program have solid foundations in economics and related tools and are regularly admitted to top graduate programs internationally. Three specializations are offered:1. Economic Theory and Policy, 2. Business Economics and Finance and 3. International and European Economics. The postgraduate programs of the Department (M.Sc and Ph.D) are highly regarded and attract a large number of quality candidates every year.

For more information:

https://www.dept.aueb.gr/en/econ/