

## 2 The Economics of E-Economies

*“There are three stages of scientific discovery: first people deny it is true; then they deny it is important; finally they credit the wrong person.” (Alexander von Humboldt)*

### 2.1 Fundamentals

The Internet of Products aims to improve the discoverability of product information across lingual and cultural boundaries. This chapter lays the fundamental economic foundations of commerce in general and electronic commerce in particular. It is shown how electronic markets create value and which impact they have on the welfare of a society. The economic concept of welfare, thereby, plays an important role, as it serves as key metric and motivation for determining the economic outcomes of an openly accessible Internet of Products.

The terms and concepts are introduced in the form of so called Galleries; that is listings of substantial literature that assign every term or concept a definition and that were authored by distinguished international researchers.

#### 2.1.1 Gallery of Economics

This section describes the fundamental economic basics of electronic markets, including their components, structures, and characteristics. A profound overview of relevant economic concepts is provided, which will later be used to argue for the need of an open exchange of product information in the Internet of Products. The introduced economic terms and concepts are distinguished into (general) macroeconomic, production and cost-related, and (market-specific) microeconomic (as (Samuelson’s) Gallery of Economics):

#### **Macroeconomics:**

[EcoMac01] “Economics is the study of how societies use scarce resources to produce valuable commodities and distribute them among different people” ([Samuelson 2005], p. 4),

[EcoMac02] Macroeconomics “is concerned with the overall performance of the economy” ([Samuelson 2005], p. 5). “Macroeconomics is the

study of the economy as a whole. The goal of macroeconomics is to explain the economic changes that affect many households, firms, and markets simultaneously” ([Mankiw 2011], p. 196),

- [EcoMac03] “A modern economy depends upon special features to become highly productive. Specialization creates enormous efficiencies; overproduction makes trade possible; money allows trade to take place quickly and efficiently; and a sophisticated financial system is crucial for transforming some people’s savings into other people’s capital” ([Samuelson 2005], p. 35),
- [EcoMac04] “Public goods are ones whose benefits are indivisibly spread among the entire community, whether or not individuals desire to purchase the public good. Private goods, by contrast, are ones that can be divided up and provided separately to different individuals, with no external benefits or costs to others. Efficient provision of public goods often requires government action, while private goods can be efficiently allocated by markets” ([Samuelson 2005], p. 370),
- [EcoMac05] “Economic activity involves forgoing current consumption to increase our capital. Every time we invest –building a new factory or road, increasing the years of quality of education, or increasing the stock of useful technical knowledge– we are enhancing the future productivity of our economy and increasing future consumption” ([Samuelson 2005], p. 34),
- [EcoMac06] “Economic growth involves the growth of potential output over the long run. The growth in output per capita is an important objective of government because it is associated with rising average real incomes and living standards” ([Samuelson 2005], p. 557),
- [EcoMac07] “Modern theories of endogenous growth attempt to explain the rate of technology progress [...]. These models try to explain the decisions that determine the creation of knowledge through research and development” ([Mankiw 2007], p. 241),
- [EcoMac08] “A nation has two major kinds of policies that can be used to pursue its macroeconomic goals –fiscal policy and monetary policy” ([Samuelson 2005], p. 413),

- [EcoMac09] “Macroeconomic policies for stabilization and economic growth include fiscal policies (of taxing and spending) along with monetary policies (which affect interest rates and credit conditions)” ([Samuelson 2005], p. 40),
- [EcoMac10] “An efficient system of fiscal federalism takes into account the way the benefits of public programs spill over political boundaries. The most efficient arrangement is to locate the tax and spending decisions so that the beneficiaries of programs pay the taxes can weigh the tradeoffs” ([Samuelson 2005], p. 325),
- [EcoMac11] “The incidence of a tax denotes the impact of the tax on the incomes of producers and consumers. In general, the incidence depends upon the relative elasticities of demand and supply” ([Samuelson 2005], p. 77),
- [EcoMac12] “Regulation consists of government rules or market incentives designed to control the price, sale, or production decisions of firms” ([Samuelson 2005], p. 342),
- [EcoMac13] “The international economy is an intricate web of trading financial connections among countries. When the international economy system runs smoothly, it contributes to rapid economic growth; when trading systems break down, production and incomes suffer throughout the world. Countries therefore consider the impacts of trade policies and international financial policies on their domestic objectives of output, employment and price stability” ([Samuelson 2005], p. 414),
- [EcoMac14] “The model of the large open economy makes a different assumption about international capital flows. To understand this assumption, keep in mind that the net capital outflow is the amount that domestic investors lend abroad minus the amount that foreign investors lend here” ([Mankiw 2007], p. 149),
- [EcoMac15] “When countries concentrate on their areas of comparative advantage under free trade, each country is better off. Compared to a no-trade situation, workers in each region can obtain a larger quantity of consumer goods for the same amount of work when they specialize in their areas of comparative advantage and trade their

own production for goods in which they have a relative disadvantage” ([Samuelson 2005], p. 297). “Trade between two countries can benefit both countries if each country exports the goods in which it has a comparative advantage” ([Krugman 2011], p. 56),

[EcoMac16] “The theory of real business cycles is an explanation of short-run economic fluctuations built on the assumptions of the classical model, including the classical dichotomy and the flexibility of wages and prices. According to this theory, economic fluctuations are the neutral and efficient response of the economy to changing economic circumstances, especially changes in technology” ([Mankiw 2007], p. 545),

[EcoMac17] “Business fluctuations in output, employments, and prices are often caused by shifts in aggregate demand. These occur as consumers, businesses, or governments change total spending relative to the economy’s productive capacity. When these shifts in aggregate demand lead to sharp business downturns, the economy suffers recession or even depression. A sharp upturn in economic activity can lead to inflation” ([Samuelson 2005], p. 471),

[EcoMac18] “Technological change –which increases output produced for a given bundle of inputs– is a crucial ingredient in the growth of nations. The new growth theory seeks to uncover the processes which generate technological change. This approach emphasizes that technological change is an output that is subject to severe market failures because technology is a public good that is expensive to produce but cheap to reproduce. Governments increasingly seek to provide strong intellectual property rights for those who develop new technologies” ([Samuelson 2005], p. 567),

[EcoMac19] “GDP measures the total value of all goods and services produced in an economy” ([Krugman 2011], p. 41). GDP can be measured in two different ways: (1) as the flow of final products, or (2) as the total costs or earnings of inputs producing output. Because profit is a residual, both approaches will yield exactly the same total GDP” ([Samuelson 2005], p. 424-426),

[EcoMac20] “Net domestic product (NDP) equals the total final output produced within a nation during a year, where output includes net in-

vestment, or gross investment less depreciation” ([Samuelson 2005], p. 434),

[EcoMac21] “Gross national product (GNP) is the total final output produced with inputs owned by the residents of a country during a year” ([Samuelson 2005], p. 434),

[EcoMac22] Welfare is the “aggregation of utility of single individuals or groups” ([Varian, 1992], p. 556).”

The fundamental assumption, which the study of Macroeconomics underlies, assumes that resources are scarce [EcoMac01]. It studies how people use scarce resources to produce commodities that are then distributed among other people [EcoMac01]. The way resources are used depends on the willingness of individuals to invest [EcoMac02], [EcoMac14], [EcoMac20], on the availability of technology [EcoMac18], and on economic activities [EcoMac05]. The outcome of all economic activities within one country is quantified as GDP [EcoMac19], NDP [EcoMac20], or GNP [EcoMac21]. If the three before mentioned economic output measures increase over time, the economy is said to grow [EcoMac06]. The wellbeing of the individuals within one economy is measured as welfare [EcoMac22].

### **Production and Cost:**

[EcoProd01] “Business firms are specialized organizations devoted to managing the process of production. Production is organized in firms because efficiency generally requires large-scale production, the raising of significant financial resources, and careful management and monitoring of ongoing activities” ([Samuelson 2005], p. 118),

[EcoProd02] “Efficient production requires time as well as conventional inputs like labor. It is therefore distinguished between two different time periods in production and cost analysis” ([Samuelson 2005], p. 112):

“The short run is the period of time in which only some inputs, the variable inputs, can be adjusted. In the short run, fixed factors, such as plant and equipment, cannot be fully modified or adjusted” ([Samuelson 2005], p. 112),

“The long run is the period in which all factors employed by the firm, including capital, can be changed” ([Samuelson 2005], p. 112),

[EcoProd03] “The production function specifies the maximum output that can be produced with a given quantity of inputs: It is defined for a given state of engineering and technical knowledge” ([Samuelson 2005], p. 108),

[EcoProd04] “The law of diminishing returns holds that we will get less and less extra output when we add additional doses of an input while holding other inputs fixed. In other words, the marginal product of each unit of input will decline as the amount of that input increases, holding all other inputs constant” ([Samuelson 2005], p. 109),

[EcoProd05] “Because any economy has limited resources, there are limits on what it can produce, and there are always trade-offs; to produce more of one good, the economy must sacrifice some production of another good. These trade-offs are illustrated graphically by a PPF” ([Samuelson 2005], p. 11). “The PPF (Production Possibility Frontier) represents the menu of goods and services available to society” ([Krugman 2011], p. 57),

[EcoProd06] “Productive efficiency occurs when an economy cannot produce more of one good without producing less of another good; this implies that the economy is on its production-possibility frontier” ([Samuelson 2005], p. 13),

[EcoProd07] Economic analysis is based on total costs (represents the lowest total dollar expense needed to produce each level of output) that summarizes the fixed costs (represents the total dollar expense that is paid out even when no output is produced) and the variable costs (represents expenses that vary with the level of output and include all costs that are not fixed) ([Samuelson 2005], p. 125). “The opportunity cost is the value of the most valuable good or service forgone” ([Samuelson 2005], p. 137),

- [EcoProd08] “Least-cost rule: To produce a given level of output at least cost, a firm should buy inputs until it has equalized the marginal product per dollar spent on each input” ([Samuelson 2005], p. 133),
- [EcoProd09] “Substitution rule: If the price of one factor falls while all other factor prices remain the same, firms will profit by substituting the now-cheaper factor for the other factors until the marginal products per dollar are equal for all inputs” ([Samuelson 2005], p. 133),
- [EcoProd10] “Rule for a firm’s supply under perfect competition: A firm will maximize profits when it produces at that level where marginal cost equals price” ([Samuelson 2005], p. 149),
- [EcoProd11] Shutdown rule: “The firm is better off going out of business [...] when the profits from producing nothing, and just paying the fixed costs, exceed the profits from producing where price equals marginal cost. [...] If average variable costs are greater than  $p$  (selling price), the firm would be better off producing zero units of output” ([Varian], p. 380),
- [EcoProd12] “Externalities (or spillover effects) occur when firms or people impose costs or benefits on others outside the marketplace” ([Samuelson 2005], p. 36).

Production takes place in firms, because efficiency generally requires large-scale production [EcoProd01]. Production is furthermore distinguished into short-run and long-run [EcoProd02], which differ in their variability of factor input. Functions of factor input adhere to the law of diminishing returns [EcoProd04]. Moreover, the production possibility frontier determines the maximum output that can be achieved with a given technology and the available inputs. When considering which inputs to use for the production of which outputs, the opportunity cost is the value that determines the most profitable option [EcoProd07].

### **Microeconomics:**

- [EcoMic01] Microeconomics is “the branch of economics which today is concerned with the behavior of individual entities, such as markets, firms, and households” ([Samuelson 2005], p. 5),

- [EcoMic02] “A market is a mechanism through which buyers and sellers interact to determine prices and exchange goods and services” ([Samuelson 2005], p. 26),
- [EcoMic03] “Money is the medium of exchange. Proper management of the money supply is one of the major issues for government macroeconomic policy in all countries” ([Samuelson 2005], p. 33),
- [EcoMic04] “Prices coordinate the decisions of producers and consumers in a market. Higher prices tend to reduce consumer purchases and encourage production. Lower prices encourage consumption and discourage production. Prices are the balance wheel of the market mechanism” ([Samuelson 2005], p. 27),
- [EcoMic05] “The equilibrium price and quantity come where the amount willingly supplied equals the amount willingly demanded. In a competitive market, this equilibrium is found at the intersection of the supply and demand curves. There are no shortages or surpluses at the equilibrium price” ([Samuelson 2005], p. 55),
- [EcoMic06] The theory of supply and demand “shows how consumer preferences determine consumer demand for commodities, while business costs are the foundation of the supply of commodities” ([Samuelson 2005], p. 45),
- [EcoMic07] “There exists a definite relationship between the market price of a good and the quantity demanded of that good, other things held constant. This relationship between price and quantity bought is called the demand schedule, or the demand curve” ([Samuelson 2005], p. 46),
- [EcoMic08] “Law of downward-sloping demand: When the price of a commodity is raised (and other things are held constant), buyers tend to buy less of the commodity. Similarly, when the price is lowered, other things being constant, quantity demanded increases” ([Samuelson 2005], p. 47),
- [EcoMic09] “Demand rule: (a) generally, an increase in demand for a commodity (the supply curve being unchanged) will raise the price of the commodity. (b) For most commodities, an increase in demand will



also increase the quantity demanded. A decrease in demand will have opposite effects” ([Samuelson 2005], p. 155),

[EcoMic10] “The market demand curve is the sum of individual demands at each price” ([Samuelson 2005], p. 91),

[EcoMic11] In microeconomics the “price elasticity of demand (sometimes simply called price elasticity) measures how much the quantity demanded of a good changes when its price changes. The precise definition of price elasticity is the percentage change in quantity demanded divided by the percentage change in price” ([Samuelson 2005], p. 66),

[EcoMic12] “Marginal revenue is positive when demand is elastic, zero when demand is unit-elastic, and negative when demand is inelastic” ([Samuelson 2005], p. 176),

[EcoMic13] “The supply schedule (or supply curve) from a commodity shows the relationship between its market price and the amount of that commodity that producers are willing to produce and sell, other things held constant” ([Samuelson 2005], p. 51),

[EcoMic14] “Supply rule: An increase in supply of a commodity (the demand curve being constant) will generally lower the price and increase the quantity bought and sold. A decrease in supply has the opposite effects” ([Samuelson 2005], p. 155),

[EcoMic15] In microeconomics, “the price elasticity of supply is the percentage change in quantity supplied divided by the percentage change in price” ([Samuelson 2005], p. 72),

[EcoMic16] “The theory of efficient markets holds that market prices contain all available information. It is not possible to make profits by acting on old information or at patterns of past price changes. Returns on stocks will be primarily determined by their riskiness relative to the market” ([Samuelson 2005], p. 525),

[EcoMic17] “Markets do not necessarily produce a fair distribution of income. A market economy may produce inequalities in income and consumption that are not acceptable to the electorate” ([Samuelson 2005], p. 38),

- [EcoMic18] “In the world of scarcity one thing means giving up something else. The opportunity cost of a decision is the value of the good or service forgone” ([Samuelson 2005], p. 13),
- [EcoMic19] “Allocative efficiency (or efficiency) occurs when no possible reorganization of production can make anyone better off without making someone else worse off. Under conditions of allocative efficiency, one person’s satisfaction or utility can be increased only by lowering someone else’s utility” ([Samuelson 2005], p. 158). Allocative efficiency is sometimes also referred to as Pareto efficiency ([Varian 1999], p. 15),
- [EcoMic20] “The earnings in market economy are distributed to the owners of the economy’s factor of production in the form of wages, profits, rent, and interest” ([Samuelson 2005], p. 226),
- [EcoMic21] “Zero-profit long-run equilibrium: In a competitive industry populated by identical firms with free entry and exit, long-run equilibrium condition is that price equals marginal cost equals the minimum long-run average cost for each identical firm. This is the long-run zero-economic-profit condition” ([Samuelson 2005], p. 155),
- [EcoMic22] “The relationship between innovation and market is complex. Because large firms have made a major contribution to research and innovation, we should be cautious about claims that bigness is unmitigated badness” ([Samuelson 2005], p. 197),
- [EcoMic23] In financial markets, the “interest rate is the price paid for borrowing money. We usually calculate interest as percent per year on the amount of borrowed funds. There are many interest rates depending upon the maturity, risk, tax status, and other attributes of the borrower” ([Samuelson 2005], p. 505),
- [EcoMic24] “In a competitive economy without risk and inflation, the competitive rate of return in capita would be equal to the market interest rate. The market interest rate serves two functions: It rations out society’s scarce supply of capital goods or the uses that have the highest rates of return, and it induces people to sacrifice current

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