



Economic calculation and the organization of markets

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Abstract Austrian economists have had mostly mixed feelings about transaction costs-based theories of the organization of economic activities. We argue that the two approaches, the Austrian and the Transaction costs, would gain from integrating their most important insights. In particular, we argue that both transaction costs and economic calculation are necessary analytical tools for a complete theory of the organization of markets. In a world without transaction cost, there would be no calculation problem because there would be no problem of the organization of markets. Only when transaction costs are positive will the scope of economic calculation be limited. At the same time, the optimal response to given transaction costs is itself the result of what we refer to as “secondary calculation.”

Keywords Economic calculation · Transaction costs · Organization of markets · Property rights

JEL classification B53 · D23 · L22

“It is *not* quite correct to say that a “firm” supersedes “the market.”
Rather, one type of contract supersedes another type.”
– Steven NG Cheung (1983, 10)

“Instead of asking ‘Why Firms?’ the difficult
question to answer is ‘Why Markets?’”
–Ekkehart Schlicht (1998, 255)

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1 Introduction

“Transaction costs are the costs of establishing and maintaining property rights” (Allen 2000). While, at first sight, this claim appears to be uncontroversial, Austrian economists have often struggled with it. They prefer to emphasize alternative concepts such as alertness (Kirzner 1973; Sautet 2002), entrepreneurial judgment (Foss and Klein 2012), calculation (Klein 1996; Lewin 1998), and evolutionary processes (Foss 1994b; Langlois 1992; Langlois and Robertson 1995), and transaction costs are considered of secondary importance for our understanding the market process.

This situation is mirrored by the non-Austrian economist’s treatment of the problem of economic calculation. The latter is almost always ignored, and when it isn’t, it is deemed unimportant or even misplaced:

Mises and Hayek note that the price system is much better at using knowledge and improving calculation than is central planning, but they emphasize the price system too much. It is not the price system per se that improves knowledge utilization. If it were, a socialist society could implement a price system, and some economists have urged just that (Abba Lerner, *The Economics of Control* (1947)). A socialist price system would yield prices that differ from those that would arise if ownership were private. The problem is not knowledge acquisition per se but motives to marshal and use particular kinds of information. (Demsetz 2002, 664 fn.18)

Shleifer and Vishny (1994) makes a similar point. Lange (1936), they argue, had successfully shown that calculation by entrepreneurs in a market economy is not a necessary condition for the efficient allocation of resources. Mises and Hayek were correct in pointing out that socialism was a fundamentally flawed system for the allocation of economic resources, but identified the wrong flaw. In their view, the incentives of the manager of the socialist firm will be necessarily influenced by political considerations and sacrifice economic efficiency.

We believe that both approaches, the Austrian and the transaction costs, are both fundamentally correct and entirely compatible. Our point is both methodological and analytical.¹ To the extent that both approaches are correct and consistent with the praxeological method, they are not only mutually consistent but must necessarily imply one another. The purpose of this paper is to attempt to provide one such synthesis. The Austrian understanding of economic calculation relies on the economic definition of property rights (that is, the ability to freely exercise control over an asset and its services). The fundamental contribution of the economic analysis of property rights has been to show that, if the enforcement of such rights were costless, every asset would be priced and calculation would dominate every aspect of human life. When this enforcement is not costless, on the other hand, the price mechanism would sometimes, and for some assets, be an ineffective system of resource allocation.

The domain of the price mechanism is not given to economic agents from above but is the result of the rivalrous market process. The precise limits of this domain will be

¹ In this, we follow the same approach as the one in Leeson (2012) who suggests that Austrian law and economics should embrace “posnerian” rather than “coasean” foundations.

determined by what we refer to as “secondary calculation.” We use “primary calculation” to refer to calculation in terms of money prices for every good in every stage of the production process. A firm deciding to buy either pine or oak on the market, in order to produce a chair, is performing primary calculation. Based on the entrepreneur’s expectations of future demand conditions and the relative prices of pine and oak, the firm will employ the resource that maximizes their present discounted (expected) profits. In other words, primary calculation is calculation guided entirely by market-generated prices. It broadly coincides with Mises’ notion of “monetary calculation” (Mises 1920). Secondary calculation differs from this in a fundamental way: it does not require that all relevant assets be priced in the market. Secondary calculation is possible within a system without complete markets for the means of production, but not within a system which suppresses all markets for the means of production. Indeed, it pertains exactly to the choice of whether to rely on the market at any step of the production process in the first place. Our chair-producer must not only decide what type of wood to employ in her factory, but whether to vertically integrate the production of the wood itself. By introducing this new notion, we want to emphasize the fact that, in the presence of positive transaction costs, entrepreneurs must solve two problems. First, they must allocate resources to their highest valued use. And second, they must choose how production should be organized.² Should it take place within the domain of a multitude of independent firms, each firm responsible for only one step, or under that of a fully integrated firm, responsible for every step from the extraction of natural resources to the delivery to consumers, or, finally, should it take an intermediate form in between these two extremes?

The implications of our synthesis are twofold. First, transaction costs are the fundamental determinant of the limits of primary calculation. Within these limits, calculation in terms of money prices allows for the efficient allocation of factors of production. Second, secondary calculation is the *sine qua non* of the efficient choice of contractual relations and allocation of property rights (including the absence of such rights) in society.

This paper contributes to the Austrian literature on economic calculation. In particular, it shares Klein’s (1996) and Langlois’ (2013) focus on the relationship between calculation and market organization, specifically with respect to the theory of the firm. Langlois and Robertson (1995) is closest to our position, although he remains skeptical about whether transaction costs can fully explain the organization of markets by themselves (Langlois and Robertson 1995, 9). We also contribute to the transaction costs literature, by emphasizing the pervasiveness of economic calculation with respect to market and non-market institutions. Finally, our paper is broadly consistent with, and extends upon the “two-tiered entrepreneurship” framework. Leeson and Boettke (2009) argue that entrepreneurship operates on two levels. The first level is that of the allocation of resources within a given institutional framework. The second level pertains to the establishment of private governance institutions to overcome the possibility of private predation (theft, fraud,

² While in a world of positive transaction costs the latter problem is merely a subset of the former, this distinction is still analytically important. First, the problem of allocating resources to their highest-valued employment still exists in a world of zero transaction costs, while that of organizing production does not. Second, the two operate on different levels, as discussed in Leeson and Boettke (2009). For example, as we argue below, the former can generally rely on market-generated prices while the latter does not.

and other forms of opportunistic behavior). Broadly speaking, these two levels overlap with our notions of “primary” and “secondary” calculation.³

2 Transaction costs in Austrian economics

Many (including Coase himself (1937)) have noted the relationship between his theory and the firm and the calculation argument expressed by Mises and Hayek during the 1920s and 1930s (Boettke 1998). Austrian economists, despite anticipating a significant number of insights later developed in the transaction costs literature (Foss 1994a), never fully and systematically integrated these contributions within their own theoretical framework. This is apparent from the fact that “the firm is conspicuously missing from the main body of Austrian economics” (Foss 1994a, 31). Most attempts to develop a specifically Austrian theory of the firm tend to be critical of approaches focusing on transaction costs (Bylund 2009; Foss and Klein 2012; Sautet 2002). Following Frank Knight, Foss and Klein (2012) develop a theory of the firm in which entrepreneurial judgment plays a central role. They argue that “[f]irms exist not simply to economize on given transaction costs [...]. Rather, firms exist as manifestations of entrepreneurial judgment.” (Foss and Klein 2012, 186). Interestingly, Foss and Klein recognize that transaction costs considerations are necessary to explain why entrepreneurs use firms as a means to carry out their plans (Foss and Klein 2012, 139–140). This means that “entrepreneurial judgment” is not sufficient -nor necessary- to explain the existence of the firm. On the other hand, the existence of positive transaction costs is necessary and sufficient to explain why firms exist. Finally Bylund (2011, 2015), emphasizes the role of the division of labor on firm formation, independent of transaction costs and argues that transaction costs cannot explain firms emergence.

Overall modern Austrians have developed their theory of the firm around two theoretical pillars: Mises’ emphasis on monetary calculation (1920; 1949) and Hayek’s insight on the nature of dispersed economic knowledge (1945).

While it discusses many themes later discovered by new institutional economists, Mises (1949) does not explicitly identify transaction costs as a limiting factor on the scope of economic calculation. He does, however (Mises 1920), admit that the price system is, like all things human, imperfect. According to Mises, even in a relatively simple economy with diverse production processes and first-order goods, agents are willing to accept a certain amount of “calculational chaos” when the striking of Coasean bargains is very costly. Murray Rothbard (1962, 1974) builds on Mises by explicitly incorporating the calculation argument in the theory of the firm. While Mises restrains his argument about economic calculation to political institutions, Rothbard extends Mises’ theory to the case of non-priced capital goods within markets. Although he adopts the Coasean framework, Rothbard superimposes onto it the calculation problem to explain how it acts as a constraint upon vertical integration. Ultimately, Rothbard (1962, 649) endorses Coase’s contribution to the theory of the firm as “illuminating.”

³ Our approach implies that a sharp distinction between market and non-market decision making is invalid. In this way, we side with Leeson and Boettke (2009) and disagree with Kirzner (1973).

However, Rothbard is skeptical of many elements of the transaction costs approach. In particular, Rothbard emphasizes that “costs, including transaction costs, are subjective” (Rothbard 1979) and was critical of the original formulation of the Coase theorem on both economic and ethical grounds.⁴ Many Austrians have been at least equally skeptical of the transaction cost approach along similar lines. Like Rothbard, Kirzner (1984, 417) acknowledges Coase’s contribution to the theory of the firm and finds it compatible with his own contribution. Stressing the Hayekian knowledge problem, Kirzner (1984) writes:

Knowledge dispersed over a small geographical organizational area may mean a Hayekian knowledge problem that, unlike that relevant to large, complex entities, is solvable through deliberate search. Beyond some point, however, the knowledge difficulties will tend to reduce the profitability of firms that are too large. Competition between firms of different sizes and scope will tend, therefore, to reveal the optimal extent of such ‘central planning’.

Dispersed “knowledge of time and place” (Hayek 1945), as opposed to mere technological knowledge, is necessary to organization of production. For this reason, Kirzner is somewhat skeptical of the transaction cost approach. To him “the possibility of costlessly acquiring information concerning available desirable opportunities is by no means sufficient to ensure that these opportunities will ever be grasped. [...] Zero transaction costs do not by themselves guarantee that transaction opportunities will be discovered. (Kirzner 1973, 227).” Similarly, Sautet (2002, 46) argues that entrepreneurial discovery would still be necessary in a world of zero transaction costs because the absence of transaction costs does not mean the absence of “sheer ignorance.”⁵

In Lewin (1998), the firm is one of three institutions (along money and accounting practices) that allow effective entrepreneurial judgement. More specifically, the firm provides a set of conventions that allow the entrepreneur to evaluate the contribution of each factor of production to overall profits. Bylund (2011) criticizes the Coasean theory of the firm on the ground that it treats firms as being outside of the market. Finally, Klein (1996) reformulates Rothbard’s argument in the context of Williamson’s (1975, 1985) contribution to transaction cost economics.

References to Hayek’s (1945) “The Use of Knowledge in Society” have been common practice in the economic organization literature (Foss and Klein 2009) as have been the attempts to use “Hayek to rewrite Coase” (Langlois 2013). Williamson (1991) acknowledges Hayek (1945)’s dictum that “economic problems arise always and only in consequence of change.” Langlois (1992) and Langlois and Robertson (1995) address this issue by introducing the distinction between short-run and long-run or “dynamic” transaction costs, the former being the result of costly information and the latter those of radical uncertainty. As economic change leaves room for opportunistic behavior, firms need to invest in firm-specific capabilities. In other words, as

⁴ While Rothbard’s (2011) theory of property rights is explicitly normative, Mises (1949) defines ownership as control. For our positive analysis, we use Mises’ definition of ownership which is equivalent to Barzel’s (1997). See our discussion below.

⁵ As we discuss in the next session, however, this is only true if one endorses a very specific definition of transaction costs. If one were to adopt our preferred understanding of the concept, sheer ignorance would indeed imply that contracts cannot be fully specified, i.e. that transaction costs are positive.

technology and preferences change, the firm needs to adapt to the new economic reality. This might be easier to do within the firm than in the market. In the absence of economic change on the other hand, transaction costs will tend to diminish over time with the dissemination of knowledge.

Overall, many attempts to develop an Austrian theory of the firm have been too narrow in scope whereas fully integrating Mises' calculation argument to the property right approach gives us a comprehensive and generally applicable theory of the organization of markets.

3 The property rights approach

While he does not explicitly employ the term, Coase (1937) introduces the notion of transaction costs to the theory of the firm. To Coase, firms substitute the market process with a small, self-contained, centrally planned economy due to the cost of employing the price system in the allocation of economic resources. When this cost is large enough, it is more efficient to substitute away from markets and towards a command-based system where the entrepreneur, much like a dictator, allocates resources internally and according to a unified plan.

Unlike Coase (1937), Coase (1960) explicitly discusses the relationship between private property, economic organization, and transaction costs. In the classic formulation by Stigler (1966), the Coase theorem states that in the absence of transaction costs, all gains from trade will necessarily be exploited, leading to the Pareto efficient allocation. A corollary of this result is that resources will be employed in their highest-valued uses independently of the initial property right configuration.⁶ By implication, in the real world, the initial allocation of resources will matter and will generally lead to different outcomes, where these outcomes might also vary in their welfare properties.

Unfortunately, in his work, Coase never explicitly defines the term transaction costs and often used it inconsistently. This is reflected by the development of two alternative "transaction costs" paradigms. Allen (2000) refers to these as the "neoclassical" and the "property rights" paradigms. The former employs an often implicit definition of transaction costs as "the costs resulting from the transfer of property rights" (Allen 2000, 901), which is akin to treating transaction costs as mere "frictions." The latter approach relates the definition of transaction costs directly to that of economic property rights, where, following Alchian (1965, 817), these are defined as "the rights of individuals to the use of resources." Transaction costs, it follows, are "the costs of establishing and maintaining property rights" (Allen 2000, 898). The difference between the two approaches is clear with respect to Coase (1992)'s claim that "[i]f I were asked to imagine an economic system in which transaction costs did not exist, it would be a completely communist society." While consistent with the neoclassical definition,

⁶ Coase (1960), but also others working in his tradition (Demsetz 1964; Milgrom and Roberts 1992), usually add the provision that this result will only hold in the absence of wealth effects. For an Austrian perspective on the issue, see Rothbard (1982). See Allen (2015) for a critique of this provision.

it is inconsistent with the property rights approach according to which transaction costs are *ex definitione* prohibitively high under socialism.⁷

These differences reflect, more than a semantic disagreement, a fundamental divergence in the scope and goal of the analysis. The “neoclassical” approach focuses on the influence of technology on the level of trade between individuals whose property rights are taken as exogenously enforced.⁸ Here, the analytical function of transaction costs is to account for the inability of the economy to achieve its first-best level of trade as well as for differences in asset values under alternative property rights allocations. To the “property rights” approach, the scope of economic analysis is to explain the distribution of property rights among different individuals and groups of individuals. This includes the study of the way in which different transaction costs lead to alternative contractual choices as well as why some assets would ever be left unowned. Here, transaction costs do not merely emerge when an exchange is taking place in the market, but whenever two or more parties must agree on the allocation of rights and responsibilities over assets. Hence, the property rights approach sees the organization of economic activities other than through market exchange as within its scope. This includes the study of the economic firm (Williamson 1975; Grossman and Hart 1986; Barzel 2005), churches (Allen 1995), state bureaucracies (North 1990; Allen 1998; Lucas et al. 2018), the governance of natural resources (Libecap 1993), and criminal enterprises (Leeson 2007; Skarbek 2010; Piano 2018).

This approach generally identifies two sources of transaction costs. The first source is uncertainty. Human beings live in a world where millions of scenarios have some positive probability of substantiating in the future. Even the contract governing the simplest exchange would have to specify the allocation of rights and responsibilities over an impossible number of potential outcomes. In the real world, the optimal contract will never be complete. Indeed, the higher the level of uncertainty, the more costly it is to fully specify a contract. Uncertainty also affects the ability of one party to perfectly observe whether the other party complied with the letter of the contract. For example, nature plays a huge role in determining the agricultural output of a given piece of land. This makes almost impossible to infer the level and value of an input by measuring its output. A second source of transaction costs lies in the multi-faceted nature of economic assets.⁹ When an asset is characterized by multiple features, different individuals might value these features differently. This opens the door to the divided ownership of these attributes. But under divided ownership, one individual might modify the asset in ways that are costly to predict and observe by the other owners. As the overall value of the asset is a function of all its features, this will be affected by any such modifications, creating incentives for agents to try to capture the wealth generated by them.

A useful classification identifies three broad categories of transaction costs (Milgrom and Roberts 1992, 29). First are measurement costs. These are the costs of acquiring information about the relevant attributes of an asset. Consider the case of a consumer shopping for oranges at a local grocery store. Some attributes of interest will be taste,

⁷ For an account of Coase’s argument for economic planning, see Bylund (2014).

⁸ See, for example, the treatment by Hirshleifer et al. (2005).

⁹ Thus, transaction costs are ultimately a subset of information costs. If information were perfect and complete across all agents, there would be no conflict over resources and transaction costs will be zero.

juiciness, and size. Because of the nature of the good, the consumer cannot, at first sight, evaluate how a given specimen performs over all of these margins. She will, therefore, invest some resources into its appraisal (Barzel 1982). A second category is that of monitoring or agency costs. These costs characterize principal-agent relationships and collective action situations. For example, a salaried employee has an incentive to supply less effort than the one stipulated in her labor contract. Knowing this, the employer will adopt some way of constraining the employee's ability to shirk. Some such ways would be to install cameras in the workplace, organize the latter in cubicles, or employ glass walls instead of concrete ones, and so forth. The third class of transaction costs is bargaining costs. These constitute the costs of bringing the relevant parties into agreement over the (more or less specific) provisions of the contract. When these costs are high enough, other forms of coordination, such as the allocation of the responsibility to direct the activities of all parties involved to just one individual, are likely to emerge (Alchian and Demsetz 1972).

This approach has several important implications for the study of the organization of economic activities. Wealth-maximizing individuals will respond in a predictable fashion to the specific transaction costs they face.¹⁰ One implication pertains to the relative scope of private and public domain (that is, respectively, the domain of those assets that will be owned by individuals and groups of individuals and the domain of assets left unowned). Absent transaction costs, any asset which has a positive value in the eyes of one or more members of society will be put in the private domain. Which is to say, every good will be owned by someone. This will not be the case when enforcing property rights is costly. When the costs of enforcing ownership over an asset outweigh its benefits, wealth-maximization demands that the asset be left in the public domain. An exogenous change in transaction costs or asset value can, of course, affect the exact circumstances under which the asset will be owned.¹¹ Technological innovation, for example, can lead to a change in ownership arrangements. Imagine that a cheaper way to produce door locks is now available. More locks will be purchased and employed, increasing the ability of owners to maintain control over their assets. This means that the innovation has lowered the minimum value at which ownership becomes economical. As a result, fewer assets will be left in the public domain.

A second implication pertains to the optimality of alternative contractual solutions under different sets of transaction costs. This approach explains, among other phenomena, why some labor services are governed by employer-employee relationships while others are exchanged in the market (Cheung 1983). Whenever it's more economical to measure a worker's input than her output, wage-rate contracts will be preferred to one-time contracts and vice versa. The same approach also predicts that the ultimate residual-claimant over an asset will be that agent that is more likely to affect its value

¹⁰ Scholars in the transaction costs tradition abstract from risk-preference considerations in order to focus entirely on the former as determinants of equilibrium institutions. This choice is also justified on methodological and empirical grounds. Arguments about risk-preferences are by definition taste-based and therefore untestable. Furthermore, risk-preference is at odds with many empirical results (Allen and Lueck 1995; Prendergast 2002). In our discussion, we adopt the same approach. We do so with one more justification. In developing a praxeological argument of market organization, one must rely exclusively on praxeological notions. Risk-preference is not one.

¹¹ Demsetz (1967) discusses the case of the increased demand for North American fur that resulted from the rise of trade with Western Europe. This led to a move to private ownership over land by Native American tribes in the North East.

(Barzel 1997, 9). For example, absentee landowners do not employ wage-based contracts in dealing with farmers, but rather transfer some of their residual claimancy to the latter in the form of rent or share contracts (Allen and Lueck 2002).

Finally, transaction costs determine the benefits and costs of vertical integration.¹² Consider the case of an industry that requires three separate steps from the acquisition of the original factors of production to the sale of the final output to consumers. Let the industry be characterized by high costs of measuring the output of the first two steps of the production process, compared to measuring the quality of the inputs employed in the first step. If the industry were to be organized into three separate firms, the firm operating at the second step would be tempted to blame any deficiency to the poor quality of the materials employed by the firm operating at step 1. Under these conditions, economies of scale emerge with respect to the measurement of the original inputs: if a single firm where to control all three steps, only one such measurement will be required (Barzel 1982, 41; Barzel 2005, 364).¹³

While broad and seemingly tautological (Allen 2015), the property rights definition of transaction costs provides the foundations for the development of a general theory of the organization of social interactions within as well as outside of markets strictly understood.

4 Implications

4.1 Mises' calculation argument

The debate concerning the feasibility of socialism in the 1920's led to the formulation of Mises' "impossibility theorem" according to which a socialist regime has no means of economic calculation and therefore cannot rationally coordinate economic activities. On a technical level, a "rational economic order" is impossible under socialism. As Mises (1920) argues, "without economic calculation, there can be no economy" because it is impossible to adequately apply a means to an end. Under socialism, "rational behavior could still be possible but not rational production." Mises started his reasoning from the nature of value. Valuation is about choosing and setting aside, about determining means, but it does not rely on a unit of measurement (Mises 1920). If value is ordinal and subjective, it is not possible to input the value given to multiple consumer goods to the many partially specific capital goods. In a complex economy with thousands of production stages, imputing value from lower order goods to higher order goods is impossible without money and private property.

If a socialist regime were endowed with consumer goods and perfect knowledge about consumer preferences, it would be possible for the planning bureau to arrive at a Pareto efficient outcome. It is only when capital goods must be combined into a complex structure that the calculation problem occurs. In such a world where

¹² On purely theoretical grounds, this is but a specific case of the influence of transaction costs on contractual solutions and ownership structure we mention in the paragraph above. Still, given the significance of this case in the literature, we discuss it separately.

¹³ This is not the only theory of vertical integration that relies on the "property rights" understanding of transaction costs. Other, often compatible, approaches emphasize such issues as asset specificity and quasi-rents (Williamson 1975; Klein et al. 1978; Grossman and Hart 1986).

production is a complex structure organized in multiple stages of production, imputation of value from lower to higher order goods is only possible when money can be used as a common denominator for all goods. To emphasize the importance of market prices for capital goods, Mises (1920) assumed a situation where consumer goods can be exchanged against money while production goods are *Res Extra Commercium*. Under such settings, money will not fulfill the same function as in a capitalist society because there is no pricing of the factors of production. This prevents entrepreneurs from adopting the economically most efficient production processes. While technology informs us about how to economize given inputs as much as possible in a specific production process, it cannot tell us how to economically use inputs between the almost infinite ways to arrange production when thousands of consumer goods are produced.¹⁴ The socialist administration may be capable to know the quality and quantity of its productions but will not know what the expenses for those productions are.

4.2 A reformulation

Before we discuss some implications of integrating the “property rights” definition of transaction costs into the calculation argument, we must first justify our preference for this over the “neoclassical” alternative. Our argument is threefold. First, Austrians and “property rights” scholars have a common understanding of the notion of economic property rights as the ability to freely exercise control over an asset.¹⁵ Second, the “neoclassical” approach to transaction costs treats the latter as any “friction” that makes the exchange between any two parties more costly. Thus, for example, transportation costs are included in this definition. Austrians should be skeptical of this understanding. Transportation costs affect the subjective nature of the good or service being moved from one place to another and are better characterized as production costs. Finally, the calculation argument is about the rational allocation of resources, which is to say, about the ultimate allocation of ownership, and not an argument about the volume of trade in the economy. Hence, the “property rights” definition is a better fit given the goals of the economic calculation argument.

When transaction costs are null, property rights over all assets are perfectly defined. When property rights over all assets are perfectly defined, markets and market-generated prices will exist for all such assets, and the achievement of a “rational economic order” (Hayek 1945) is guaranteed. Regardless of the original distribution of ownership, the logic of the Coase theorem ensures that all assets will end up employed in those production processes that make the most out of them. In such a world, relative prices will guide the decision of economic agents to exchange. That is, economic calculation is necessary and sufficient to attain the efficient outcome.

This is not the scenario Mises and Hayek envision in their contribution to the socialist calculation debate. The economy they describe is one in which change, uncertainty, and costly information are universal concerns. Under these conditions,

¹⁴ See the discussion of capital-multispecificity in Boettke and Piano (2017).

¹⁵ For example, Mises define private property as “full control of the services that can be derived from a good” and explicitly distinguish this from the “legal definition.” (Mises 1949, 678). Compare this with Barzel’s definition as “the individual’s ability, in expected terms, to consume the good (or the services of the asset) directly or to consume it indirectly through exchange” (Barzel 1997, 3). Barzel also supports a separation of economic and legal understandings of property (Barzel 2015).

there would still be room for economic calculation, and indeed *monetary* economic calculation only emerges when transaction costs are positive.¹⁶ Money, which is a necessary condition for economic calculation in a world with positive transaction costs, would not exist in a world of zero transaction cost. Money is by definition the most marketable commodity (Mises 1981), but with zero transaction costs, every commodity is equally marketable. Once transaction costs are assumed to be zero, money becomes useless and can be replaced by a *numéraire*.¹⁷ As contracts can be fully specified and are always respected, individuals in the evenly rotating economy can always arbitrarily use whatever *numéraire* they want as a way to input value from lower to higher order goods.

Mises himself (1920, 1949) is willing to admit that monetary calculation has limits. Economic agents often make mistakes in their evaluation of the future costs and receipts of a production process. Some goods and services are left unpriced and their contribution to production cannot be calculated in monetary terms. Social institutions, culture, a landscape are all examples of *res extra commercium*. They are therefore beyond the scope of monetary calculation. Mises recognizes that economic calculation faces some technical difficulties but does not provide a general theory of them.

Some “mistakes” cannot be avoided by economic calculation because of: (1) the difficulty to allocate overhead costs, (2) the difficulty to have access to some data with respect to the factors of production used, (3) uncertainty (Mises 1951, 131). Overhead costs and insufficiently determined data are both the result of measurement costs and uncertainty. Those are two sub-categories of transaction costs. The problems implied by those transaction costs, however, will be strictly limited by the use of secondary calculation. Hence, “errors [in economic calculations] can be confined [...] within certain narrow limits which do not upset the total result of the calculation” (Mises 1951, 131). Even though primary economic calculation cannot comprehend things which are not traded on the market against money, in many cases secondary economic calculation will be able to.

The internal organization of a household,¹⁸ a small egalitarian society and the modern vertically integrated firm are also beyond the scope of monetary calculation. As Coase and others have argued,¹⁹ the fact that such exceptions to monetary calculation exist seem to undermine the argument that this a necessary feature of a rational economic system. The case of the economic firm is particularly striking, as firms play a fundamental role in allocating resources within the context of a market economy.

Integrating transaction costs considerations demonstrates that this presumption (that the existence of “bubbles of planning” within a market economy is proof that the calculation argument is either wrong or of limited applicability) is unfounded. In order to see that, consider first Mises’ “impossibility theorem”:

¹⁶ Menger’s and Mises’ theory of the emergence of money implicitly rely on transaction costs considerations (Chavas and Bromley 2008).

¹⁷ We owe this point to Tate Fegley.

¹⁸ We only refer here to the productive activities undertaken within the household and not to redistributive or consumptive ones.

¹⁹ See for example Coase (1937) and Demsetz (2002). Stiglitz (1996, 12) argues that the fact that “most large firms are not run by owners but by hired managers” is a piece of evidence against the presumption that “the absence of well-defined property rights is the central problem” for the organization of economic activities.

Without private property over the means of production, there can be no markets for them. Without markets for the means of production, rational economic calculation is impossible.

We formulate this as follows:

Without the *possibility* of private property over the means of production, the rational organization of markets is unattainable.

A corollary of this is that, to the extent that socialism is defined as the absence of private property over the means of production, socialism can never achieve a rational organization of production.

Our formulation includes and extends the one given by Mises. We refer to “primary calculation” as any decision undertaken by an economic agent on the basis of observable market-generated prices. Our theorem relies on a broader definition of calculation, which we refer to as “secondary calculation.” This pertains to the decision to rely on primary calculation for the allocation of resources in the first place. Households might decide to outsource the production of their meals to the market rather than purchasing the necessary inputs themselves and doing so internally (secondary calculation), and will then pick one among the many available restaurants to patronize (primary calculation).

We define a situation where individuals can use secondary calculation as a one in which where market prices for inputs and outputs are either known or can be appraised but where some of the higher order goods involved in the production process are not priced on the market. Hence a firm, even though it has a market value, may not have access to prices for some of its assets or for some aspect of its assets.²⁰ Oppositely, primary calculation involves the pricing of all of the production factors involved in the production process as well as for the output. Thus whereas primary calculation involves profit and loss accounting at every single stage of production, this is not the case when the relative transaction costs lead entrepreneurs to rely on secondary calculation instead. Entrepreneurs using secondary calculation will need to appraise whom should control what assets inside the firm without realized market prices for some of the assets in question. The job of an entrepreneur in a context where only secondary calculation is available will be for a good part to put resources in the hands of those who he estimates can use them most efficiently despite the absence of primary calculation (Alchian and Demsetz 1972).

One might object that there really isn’t any difference in nature between primary and secondary calculation as long as a firm has its market value appraised by competition between investors on the stock market. In such a case, one might argue, every reallocation of resources will *ipso facto* be accounted for in the present market value of the firm. This would only be true if the structure of market prices was constantly in a situation of final equilibrium. Since this is obviously not the case, firms will still choose an optimal amount of internal “calculational chaos”. To clear any misunderstanding, we

²⁰ This notion applies to non-market decision making as well, even though these are not the main focus of our paper. Hence, it encompasses Becker’s own notion of “shadow prices” in the analysis of social interactions (Becker 1974). A difference (although arguably a semantic one) between Becker’s notion and ours is that we prefer to reserve the word “price” to the outcome of the market process in a money economy and believe that the traditional phrase “opportunity cost” is preferable.

must here point out that the very fact that a firm is priced on the stock market is an indication that some secondary is being used by the firm in question. Indeed, if using primary calculation were costless, which is equivalent to a situation where transaction costs are equal to zero, then there would be no point having a stock market as by definition every asset owned can be priced independently and costlessly. In a world of positive transaction costs, on the other hand, primary calculation can be substituted by secondary calculation on some margins. In a capitalist economy, the stock market plays a crucial role to operate secondary-calculation. The decision by firms to choose one form of organization over another can be economical only because the firm itself can be priced. Markets are needed to know when to rely on non-price allocation.²¹

Consider the case of an entrepreneur who must decide how to organize the production process of some consumer good (say, a smart-phone). We focus on our entrepreneur's choice with respect to two inputs (two "produced factors of production"): the screen and the processor powering the smartphone. Let the processor being a fairly homogeneous input sold by a variety of companies on the market, while the smartphone requires the production of a screen with unusual features (say, for example, its shape and width). Transaction costs considerations suggest that our entrepreneur is more likely to purchase the processor from some other company. If the entrepreneur has no specific technological advantage vis-a-vis existing producers, there are no benefits to the integration of the production of the processor within the firm.

The same considerations suggest that she is more likely to vertically integrate with respect to the production of the screen. Let the screen require a substantial investment to adjust existing machinery to fit the demand of the entrepreneur. This investment results in an increase in asset specificity, which in turn opens the door to opportunistic behavior on the part of the entrepreneur. For example, the latter might decide to take advantage of the resulting monopsonistic position and ask for a discount after the screen maker has already made the specific investment. If the screen maker expects this scenario to consolidate, she would not make the specific investment in the first place or would have to be compensated *ex-ante* by the entrepreneur. The alternative would be for the entrepreneur to acquire the screen maker and her machinery, make the appropriate investment, and employ the assets as she pleases. While by taking this action, she limits her own ability to consult market generated prices when it comes to the use of this asset (primary calculation), the action is itself the result of (secondary) calculation.

Whether or not the firm uses primary or secondary calculation will entirely depend on the structure of relative transaction costs. As long as they do not live in a simple autarkic economy, however, entrepreneurs will never engage in projects where they can neither use primary nor secondary calculation. In other words, it will remain true that "every single step of entrepreneurial activities is subject to scrutiny by monetary calculation" (Mises 1949, 230).

If the entrepreneur expects to make higher profits by vertically integrating screen-making than by purchasing screens from others, she would do so. This evaluation needs not be accurate and many errors can be expected to take place. But the same is also true for primary calculation. As is the case for the latter, thanks to market forces and the

²¹ This point is integral to Mises' theory of economic calculation. It is not surprising that Mises always emphasized on the primordial role of the stock market. Rothbard (1991) reports that Mises thought that the key to distinguish a socialist from a capitalist economy "is whether the economy has a stock market."

resulting profit and loss mechanism, entrepreneurs face the incentive to adopt the profit-maximizing (cost-minimizing) organizational form (Alchian 1950; Kirzner 1973; Klein and Leffler 1981; Mises 1949, 308-311). Similar considerations can be made with respect to a wide array of transaction costs arguments for vertical integration, including measurement costs (Barzel 1982), asset specificity (Williamson 1979; Klein et al. 1978) control over residual rights (Grossman and Hart 1986), the double marginalization problem (Greenhut and Ohta 1979), to name a few.

To be consistent with the rational organization of economic activity, a fundamental precondition is that entrepreneurs must be free to create property rights and contract over the means of production. Thus, to say that vertical integration is a movement away from markets and toward central planning would be fundamentally misguided. The decision to vertically integrate as a response to transaction costs could not have been made in the absence of markets. Without markets, without market-generated prices, without the ability to exchange assets and organize production in new and innovative ways, society could never be organized according to criteria of cost-minimization, where transaction costs must themselves enter into the calculation of such costs. This result also applies to the very limits of monetary calculation Mises (1920) identifies.

A rational economic order will not, in fact, have markets for all possible goods and services under all possible (future) circumstances. This is because, for some markets, the value of the resources that would be necessary to make them work (enforcing property rights and contracts) outweigh the value generated by the markets themselves. Secondary calculation operates towards this result. Examine the decision of an entrepreneur with respect to ownership of a piece of land. Assume that no third party exists to enforce her rights. Her optimal decision will have to take into consideration the trade-off between two scenarios. In the first scenario, she invests some resources into the enforcement of her control over the parcel of land by building a fence and having a few domesticated dogs serve as surveillance. She is now able to use the land as an input into the production of some fruit. This fruit can then either be sold at a local market or consumed by her household. In the second scenario, she makes no such investment and perhaps only uses the land for recreational purposes, or perhaps can risk planting one fruit tree or two, knowing others can damage it or take its products at will.²²

Will this land be owned in such a society? The answer will be negative whenever the net benefits of ownership are smaller than those of non-ownership, and positive otherwise. If the entrepreneur calculates that the money costs of building the fence and buying the dogs are higher than the money receipts from selling the fruit at the local market, then the land will be left in the public domain, insofar as the same is true for every other agent in society. The marginal cost and benefit of pricing an asset or a feature of an asset will be determined by the circumstances of time and place.²³ To apply Hayek (1945) to our problem, we argue that the knowledge necessary to know when not to price is never given in a concentrated and integrated form. In this sense, market prices are necessary to operationalize localized knowledge into both production and the organization of markets efficiently.

²² Assume all other agents also face the same benefits and costs of property rights enforcement.

²³ See Leeson and Harris (2017) for a study of the potential “wealth-destroying” effect of forcing the establishment of private property rights over land onto a society characterized by high transaction costs.

As Hayek (1945) puts it, the question is who is to do the planning rather than whether or not there would be planning at all. Only through the market process is it possible to discover a satisfactory answer. Different individuals will face different transaction costs at different times and different places. The decision not to price in a complex economy, if it is to be economizing, has to be subject to profit and loss accounting and must take into account the knowledge of the particular circumstances of time and place.

Our formulation of Mises' argument has important implications for the socialist calculation debate. The Austrian argument on the impossibility of rational economic calculation under socialism becomes even more damning. Consider first the case of socialism as it was understood at the time Mises wrote his 1920 paper: a society characterized by the absolute lack of private property rights over the means of production. Such an arrangement is by definition incompatible with the rational organization of the economy as private property rights are prevented from emerging even where efficiency requires them.²⁴

The same is true of the various market-socialist "solutions" to the calculation problem, such as Lange's "trial-and-error" version of socialism. According to Lange, a socialist economy organized as to imitate the mathematical general equilibrium model of the market economy.²⁵ The central planner would not have to calculate the equilibrium price of all factors of production, but merely announce a vector of such prices (perhaps, even a random one) and then let the decentralized socialist firms plan their productions around these. This vector would not (if not by chance) instantaneously result in equilibrium. Instead, socialist firms will experience either shortages or surpluses. Using this information, the planner will adjust upwards (downwards) the prices of those factors employed in the production of those industries experiencing a surplus (shortage).

Our formulation illuminates a fundamental problem with Lange's model. The organization of the socialist economy is here assumed as given. But treating the the organization of production as exogenous does away with the problem of determining how production should be organized. Because economic organization is an endogenous product of the market process, one cannot assume the "given" production functions of "given" firms. Without secondary calculation, there is no way for the central planner to know not only the relative prices for all factors but also which assets should be priced and which should not at the given transaction costs. If the central planner could take the Walrasian model to the letter and price all assets, this would result in the paradoxical result of a socialist economy pricing more assets than a private enterprise system. Such a system would over-price, that is would price more than is efficient. If it is not possible for entrepreneurs to establish property rights, then there is no rational method to determine what should be priced.

²⁴ This problem was recognized by socialist economist Oskar Lange who admitted that "socialism does not need to abolish private ownership of the means of production" in those industries where it ensures a superior result than communal ownership (Lange 1937, 126).

²⁵ This is emphatically not how real life socialist economies actually organize. See Anderson and Boettke (1997) for a study of the economic organization of the Soviet Union.

5 Conclusions

In this paper, we showed how the property rights approach and the theory of economic calculation are complementary tools for the development of a theory of the organization of economic activity. We believe that the gains from trade between these two to be large. Austrians have been suspicious in the past of certain developments in the transaction cost literature. It seems that this skepticism mostly comes from the acceptance of the neoclassical definition of transaction costs, which cannot be fully integrated within their theory of economic calculation. New institutional economists, on their end, have downplayed or ignored the role of economic calculation in a well-functioning economic system. We hope our work will help build a bridge between the two and lead to further exploration of their interactions with respect to such topics as interventionism, entrepreneurship, and the economic analysis of law, just to name a few.

Perhaps the most important contribution of this paper lays in our reformulation of *Mises' impossibility theorem* in light of the contribution by the property right approach: when entrepreneurs are prevented from responding to alternative transaction costs considerations, the rational organization of markets is impossible. In order to respond effectively, economic agents must be able to calculate the relative costs and benefits not just of the different factors of production available to them but also those of the possible alternative organizational and property rights configurations. Even when some prices are suppressed due to transaction costs, there is no substitute for the price mechanism to achieve the rational allocation of resources and property rights in a complex economy.

This reformulation has important implications when it comes to the analysis of the organization of markets. Since some factors of production must be priced, it must be that the decision to price or not to price is the product of an intentional decision by entrepreneurs responding to relative transaction costs constraints. To appraise those constraints, we have argued, entrepreneurs must have access to what we call secondary calculation. We believe, with Cheung (1983), that “transaction costs and contracting will someday be regarded as a basis for analysis rivaling marginalism in neoclassical economics.” Nonetheless, the economic analysis of property rights cannot abstract from the problem of economic calculation if it is to develop a coherent theoretical framework.

Acknowledgements We wish to thank Peter Boettke, Christopher Coyne, Bryan Cutsinger, David Lucas, Tate Fegley, Patrick Newman, and Rosolino Candela for their thoughtful comments and suggestions. We are also grateful to two anonymous referees for their incisive criticisms. All remaining errors are our own. Piano thanks the Institute for Humane Studies for financial assistance.

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