

MONEY AND ITS INSTITUTIONAL SUBSTITUTES

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Money is ubiquitous, second-nature in the Western world, and a very non-trivial institution. Indeed, monetary theory has been concerned since Menger (1892) with the question, just *what* feature of the world makes money necessary?

The answer depends crucially on what the relevant analytical alternative to monetary exchange is. In what we will call the Coasean tradition, the alternative is a frictionless general equilibrium (GE) economy, in which direct barter is sufficient to achieve a Pareto-optimal allocation of resources. The key difference of the real world, of course, is the presence of frictions, or transaction costs. Answers from this perspective have included search costs and the lack of a double coincidence of wants (Kiyotaki & Wright 1993), information costs about goods quality (Alchian 1977), and lack of trust and moral hazard (Kiyotaki & Moore 2002, 2003; Ostroy & Starr 1990). Kroszner (1990) sums up the approach:

Rather than providing a basis for ‘representation’ of economic phenomena, the GE construct may be more usefully considered as a moneyless comparison point which is used to sharpen other approaches.

If the GE economy can make do with pure barter, where one good is as good as any other for exchange, it is useful to identify the relevant transaction costs that necessitate money in the real world, especially if technology or institutions can alter those transaction costs.

However, without impugning the validity of the Coasean approach, its central question – “What specific frictions distinguish the world from the GE model?” – is *not* the same as the question, “How did money in fact arise?”, a question we will identify with the “historical” approach. Goodhart (1998), for example, emphasizes the important role of taxation in promoting convergence around metallic monies. Wray (2004) emphasizes the total lack of “direct barter” societies in history – in fact, time-separated exchange (“credit”, in a broad sense) appears to be more basic than self-amortizing exchange that extinguishes its obligations on the spot. Rather than beginning with a frictionless model and introducing frictions to bump it out of a barter equilibrium, as in the Coasean approach, we may get a better sense of the relevant alternative(s) to monetary exchange by taking our starting point from the actual historical precursors to monetary exchange, as in the historical

approach.

Unfortunately, the two approaches have not to this point been clearly distinguished. Without the benefit of a detailed history, Menger's conjectural history of the evolution of monetary exchange out of barter has been taken both by friends and foes as an actual history, though more careful writers have given it a pure theory interpretation (e.g. Mises 1966, p. 408ff). Similarly, without the benefit of a detailed theory, proponents of the historical approach are often derailed by historical accidents and misidentify the necessary and sufficient conditions for the emergence of monetary exchange (cf. Salter & Luther 2014).

This paper, therefore, is an attempt at both a historically grounded theory and a theoretically grounded history of monetary exchange and its relation to the complexity of social organization. Taking evidence from anthropology, cognitive science, and evolutionary biology, it conceives of exchange institutions as involving a tradeoff between fixed and marginal cognitive costs. Up-front investment in increasingly higher fixed-cost exchange institutions lowers marginal costs of exchange, resulting in increasing returns to the division of labor. Those costs account for the persistence of more or less direct barter in more primitive societies, despite the “inevitability” of monetary exchange that seems to be a feature of Menger's story in “On the Origin of Money”. In identifying the relevant fixed costs of money and its institutional substitutes throughout the world, the paper advances a framework through which the successes and failures of modern development can be understood.

A Pre-History of Cognition and Exchange

The setting of the Coasean approach is one in which the prototype of exchange is exchange in *goods*. Menger's illustration¹ is of a man who has produced some wares, and now seeks to bring them to market in exchange for other items he desires – which suggests a barter society that has already achieved some degree of specialization in production.

Search costs, therefore, are the traditional operationalization of the Mengerian origin story (e.g. Kiyotaki & Wright 1993). In order to make a mutually agreeable exchange with a second party, I must not only have something they want, but they must also have something I want. In other

¹ Though Menger antedates both Coase and a full articulation of Arrow-Debreu general equilibrium by several decades, because his story centers on transaction costs, we locate him somewhat anachronistically in the Coasean tradition.

words, there must be a *double coincidence of wants* (DCW). If the probability of one party having a good desired by the other is $x \in [0,1]$, then the probability of executing a successful trade with another random agent will be x^2 . This baseline case of random meeting we will call “atomistic” barter. Because x will be a decreasing function of the number of regularly traded goods, to the extent that arranging trades is costly, members of such a society will rarely find it worthwhile to specialize.

Both Menger and Kiyotaki & Wright have to assume pre-existent specialization,² and it is this assumption that makes the story “ahistorical”. A sufficiently specialized society that somehow found itself without a medium of exchange would surely converge upon one. But specialization is itself a function of exchange institutions – an insight as old as economics itself. As Adam Smith famously put it in a chapter title (1776, bk. 1, ch. 3), “the division of labor is limited by the extent of the market” – i.e. by the extent of the money economy.

In order to see the problems monetary exchange solves with respect to its actual historical precursors, it will be necessary to look at the origin of exchange itself. Though exchange extends backward far beyond recorded human history, it is a fairly recent innovation in evolutionary time. We begin, therefore, at a point of *pure autarky*, from which point the first step toward social cooperation will be the exchange of *services*.

There is no doubt as to the historicity of autarky. A great number of mammals, including some primates, are essentially solitary. Given the relative rarity of social cooperation among animals, it seems reasonable to hold this condition as a backdrop to the later discussion of exchange institutions. One institution may have certain advantages over others, but *any* exchange institution will have to overcome the same basic impediments to the regularization of exchange.

It is very nearly a first principle in economics that voluntary exchange is a “pure gain” over autarky; that it benefits both parties. Consider, then, the prospects of two identical and autarkic individuals (call them Crusoe and Friday) considering an exchange of services. In this setting completely lacking in specialization, it will be useful to interpret x , not as the likelihood of running across someone carrying wares, but as the likelihood of receiving a service conditional upon performing an identical service (say, a back rub). In this more general sense, achieving a DCW is

² This parameter x in Kiyotaki & Wright is exogenous and “captures the extent to which real commodities and tastes are differentiated.” Our argument is that a historical approach model must endogenize this parameter and assign it an initial value of one (i.e. uniformity in tastes and production).

primarily impeded – not by search costs, since by hypothesis any individual is as good as any other at giving back rubs – but by *trust* costs.³ If I cannot trust my partner to return the back rub, there is no DCW – even with no specialization – and no exchange.

This is the sense in which credit antedates self-amortizing exchange. If exchange necessarily precedes specialization, then the first objects exchanged must be *services*, which – if our back rub example is a plausible prototype – cannot be performed contemporaneously.⁴ Indeed, credit in this broad sense is simply an economic term for what zoologists call more broadly “reciprocal altruism”, the time-separated exchange of costly “favors” in the context of an ongoing relationship (Trivers 1971).

In game-theoretic terms, the time-separated quality of exchange poses a prisoner’s dilemma and opens the door for free-riding. Crusoe and Friday are both better off exchanging back rubs, but both would rather receive a back rub and then go swimming without returning the favor. The relevance of this example can be seen more readily in the animal kingdom, where the fitness costs of being the “dupe” preclude most forms of cooperation and exchange. Just as in the previous example, two birds are better off grooming each other than if neither is groomed, but it is better for either bird to be groomed and then not groom in return (Dawkins [1976] 2006). Crusoe and the bird face the same problem: how to trust his fellow to return the favor?⁵

Prisoner’s dilemmas between two agents can result in a cooperative equilibrium with repeated play, and among agents in a larger group with social norms making cooperation conditional on reputation (Bowles & Gintis 2008). If we are not taking human agents for granted, however, the

³ The “time-dated goods” in Kiyotaki & Moore (2002; 2003) might be thought of as non-simultaneous services. Similarly, the “inside money” that arises in their model, as a claim to a specific time-dated good, is closer to pre-monetary credit (in the sense of time-separated barter) than to something like a demand deposit.

⁴ Services performed on the body of the other party – for example grooming or a back rub, which must be performed sequentially – are a more likely prototype for the first exchanges than other services that might be performed contemporaneously, because the latter are more difficult to monitor.

⁵ The difference is that trustful behavior in most animals is likely to be selected for at the evolutionary level rather than at the level of individual behavior. Human populations can learn to be more or less trustful at some margin; bird populations become more or less trustful due to differential reproductive success as between marginally more and less trusting birds.

problem is that the behaviors necessary to sustain repeated play and keep track of reputation require a good deal of cognitive capacity. Specifically, in order to prevent defecting from becoming a dominant strategy for other birds, a bird must first of all be able to 1) *recognize* other birds, 2) *keep an account* of who owes him and whom he owes, and 3) *punish* free-riding birds, usually by playing a tit-for-tat strategy.

The problem of cognitive capacity is why we begin with the exchange of *identical* services. Humans, of course, have a vastly more complex behavioral profile than birds and can readily exchange *different* services – for example, Crusoe fishes and Friday collects coconuts. The exchange of coconut-gathering for fishing readily evolves into the exchange of coconuts for fish; barter is in fact a special case of services exchange where the service consists in producing (or otherwise procuring) some good. Specialization introduces positive search costs, but has the potential to vastly increase the welfare of our agents.

The basic structure of time-separated exchange, however, evidently remains the same even under goods barter. Among the Yānomamö of the Venezuelan rainforest, for example, almost no exchanges are self-amortizing; indeed, to repay a gift immediately is seen as insulting (Chagnon [1968] 2009). Instead, exchanges are nominally gifts, but in reality are characterized by a complex set of reciprocal obligations. Scores are kept for who owes whom a favor and of what magnitude. In this way, cooperation and exchange in particular endeavors are marshaled on an ad hoc basis from a pool of long-term personal relationships within the village. Wiessner (1977) documents a similarly dense credit network among the !Kung San of Botswana. She argues the “gift economy”, among the San and hunter-gatherers throughout the world, functions as a social insurance scheme. A tribesman fails to repay a “gift” at his own peril.

We will call this structure the “natural credit economy”, which characterizes the most primitive tribal human societies. The credit aspect, the time separation, is necessary to ensure repeated play; self-amortizing exchange (including both atomistic barter and monetary exchange) would make it extremely difficult to punish defection in an illiterate and innumerate society.

Such societies must form the starting point for a theory of money. No atomistic barter society has ever been observed either in the animal kingdom or in human society, despite it not requiring the cognitive capacity to keep a running account of favors. The evidence suggests that long-term exchange relationships in the context of a tribe ensure trust costs low enough to sustain a good deal of cooperation, though it remains mostly ad hoc, with limited capacity for permanent

specialization (cf. Hooper et al. 2015). As compared with Menger’s story, these credit relationships render in-kind barter sufficiently tolerable to forestall the spontaneous development of money.

A Taxonomy of Exchange Institutions

It is a profoundly erroneous truism, repeated by all copy-books and by eminent people when they are making speeches, that we should cultivate the habit of thinking of what we are doing. The precise opposite is the case. Civilization advances by extending the number of important operations which we can perform without thinking about them. Operations of thought are like cavalry charges in a battle — they are strictly limited in number, they require fresh horses, and must only be made at decisive moments. (Whitehead 1911)

With autarky as the backdrop, the problem facing any exchange institution, including natural credit, will be: how to overcome the prisoner’s dilemma of reciprocal altruism to make exchanges self-enforcing? As Bowles & Gintis (2008) argue, because “dyadic interactions are generally private”, cooperation is difficult to monitor in an ad hoc n -person game. Such an institution must therefore facilitate 1) the “publication” of private information, making defectors more easily identifiable, and 2) convergence upon a punishment strategy for defectors out of the infinite possible equilibria.

Evidence from multiple fields suggests that mankind’s default “state of nature” – i.e. human organization in the absence of accumulated cultural learning – corresponds to organization along natural credit lines, and not atomistic barter. Natural credit, which characterizes hunter-gatherer society, is both the earliest known form of social organization in anatomically modern humans, as well as the form characterizing the most primitive societies today. Any institution more primordial would be properly pre-human.

Natural credit does so by making exchange *ongoing and personal*. Not only must I know my trading partner in order to trust him, but my trust in him consists in our being bound together in a wider network of ongoing mutual obligations for the foreseeable future (cf. Smith et al. 2016). For this reason the natural pool of hunter-gatherer cooperation is the *tribe*. With more or less definite membership boundaries, and each member having familiar knowledge of all or most other

members,⁶ the history of each member is more or less common knowledge. With these features, the tribe is able to scale up from a dyadic prisoner's dilemma into a *reputational* game.

Unfortunately, because cooperation in a reputational game depends on knowledge of the identity and history of each potential trading partner, it breaks down when a sufficient number of players are anonymous. The scale of natural credit organization is therefore limited by humans' cognitive capacity for keeping track of relationships and obligations. This capacity – represented by what has come to be called Dunbar's Number – is thought to average around 150 relationships (Dunbar 1992, 1995). Indeed, natural credit societies do not get far past 150 members before free riding and conflict become endemic, and such communities have regular institutions for cleaving once they get too large. Chagnon, for example, emphasizes the empirical reliability of *village fissioning* once village size exceeds about 300 – twice Dunbar's number. When a village gets to the size where any two individuals are as likely to know (i.e. to have ongoing mutual obligations with) each other as not, free-riding becomes the dominant strategy, conflict rends the village in two, and one half is forced to establish a camp elsewhere in the jungle. Wiessner documents a similar process of camp splitting among the San, though the process is less formal as camp boundaries are more fluid than village boundaries.⁷

At a scale of a few hundred people, permanent specialization beyond gender roles does not pay. There are simply not enough people for it to be worth it for any of them to relinquish food production and to specialize in, say, pottery manufacture. The problem in establishing larger communities will be to establish self-enforcing agreements with *anonymous* others. At a scale sufficiently large to preclude personally keeping track of one's trading partners, what are the

⁶ Bowles & Gintis (2008) also argue that the regular and honest publication of private information (“gossip”) is not incentive-compatible except on the assumption of some degree of other-regarding preferences (“true” altruism), including the willingness to inflict costly punishments on defectors. Tomasello (2009) demonstrates that humans do indeed possess such preferences innately (i.e. from birth), and uniquely in humans as compared to other primates. Bowles & Gintis (2004) construct a plausible model of their evolution.

⁷ This fluidity is due to their institution of *hxaro* that systematically extends a person's chains of mutual obligations beyond the camp, although such connections are always personal and based on an existing familial connection. Wiessner attributes this to the fact that environmental factors make the optimal risk pool much wider geographically in Botswana than in tribal societies with more strictly delineated villages.

prospects of publishing private trading histories and converging upon a punishment strategy for defectors?

Because the limiting factor at this point is cognitive capacity, it will be useful to think of institutions for exchange in terms of what cognitive scientists have called *extended cognition*. Clark and Chalmers (1998) argue that the human tendency to offload certain cognitive tasks into the environment is regular enough to qualify as an extension of cognitive capacity “outside the skull”. Writing is the prototypical example: we can extend our effective memory by replacing huge quantities of information with a reference pointer, so to speak; with the knowledge of where to look. Similarly, investment in the capacity to offload the accounting of exchanges into the environment – to publish trading histories in an objective form – has the potential to vastly increase the potential complexity of social organization. Per Whitehead’s observation above, the advancement of civilization consists in this process.

More specifically, we can think of these institutions as involving a fixed cost and a marginal cost. The environment does not present itself to us in such a fashion that we may costlessly use it to extend our cognition. To do so requires convergence on certain norms, symbols, and meanings. The necessary learning and habituation are what we will call the fixed costs of the institution, taking biological and evolutionary costs as given.⁸ In other words, any pattern of behavior can in principle be identified as having a joint basis in biology and culture. The cultural pattern may build upon, interact with, or even override biological patterns. Hayek (1960, p. 93), for example, argues that many of the social norms characteristic of Western society have the effect of suppressing some innate (biological) patterns of behavior. In this sense, the greater the cultural basis of an institution, the more distant from any biological basis, and the greater the extent to which it conflicts with or overrides biological instincts, the greater the institution’s “fixed cost”.

The marginal cost of an institution, on the other hand, is the cognitive load required to invoke it in a particular instance. Natural credit involves a relatively high marginal cost for each relationship – say, 1/150 of the brain’s social memory. Thus, despite its low fixed cost, high marginal

⁸ Language acquisition will be costly in the same way; however, those costs are biologically obligatory and largely pre-conscious for humans (Hauser, Chomsky, & Fitch 2002). For this reason we reckon them as sunk costs rather than fixed costs, not subject to change on the timescale of institutional evolution. Beyond natural language, however, convergence on symbols and meaning – though piggybacking on the language faculty (Clark 2006) – typically does involve conscious effort and (thus) positive cost.

costs of maintaining ongoing relationships mean that natural credit as a method of exchange and social organization exhausts cognitive limits at a very low scale. Monetary exchange, by contrast – as argued below – involves a high fixed cost but extremely minimal marginal costs. Any given transaction requires relatively little thought to accomplish, and once completed, can be safely forgotten in a way that would destroy the self-enforcing quality of natural credit exchanges.

The formulation of exchange institutions in terms of fixed and marginal costs suggests an analogy to capital theory, and a sense in which institutions can legitimately be called “social capital”.⁹ Lachmann (1956) asks the same question of physical capital that we have just asked of institutions:

It will not pay to install an indivisible [i.e. high-fixed-cost] capital good unless there are enough complementary capital goods to justify it. Until the quantity of goods in transit has reached a certain size it does not pay to build a railway. A poor society therefore often uses costlier (at the margin) means of transport than a wealthy one. . . . [N]ew indivisibilities account for the increasing returns [to capital].

Similarly, even for a society on the brink of subsistence, investing in high-fixed-cost institutions is not “worth it” – i.e. is not an equilibrium outcome – until a sufficient volume of exchange has built up to amortize the cost. Natural credit societies, limited as they are in scale, simply cannot sustain enough exchange to make the fixed cost of monetary exchange – namely, a system of writing and mathematics – worth the cost to develop and sustain.

The analogy is also appropriate in taking the form of a mutual feedback – in Lachmann’s example between investment in high-fixed-cost transportation capital and the demand for transport; in our case between investment in high-fixed-cost exchange institutions and the volume of exchange. This feedback is characteristic of increasing returns models with multiple equilibria, and makes it impossible to give either element strict causal priority. While the exchange institution limits the division of labor and the volume of exchange, so that investment in higher-fixed-cost exchange institutions makes possible increases in the volume of exchange, it is also the case that increases in the volume of exchange make investment in higher-fixed-cost exchange institutions

⁹ It might also suggest an analogy to the theory of the firm, in which high fixed costs imply economies of scale over some range. However, the important feature in our case is that marginal costs are a function of fixed costs, which makes the capital theory analogy more apt.

“worthwhile” (cf. Kaldor 1972). In this case there can be neither a Say’s Law, nor it’s Keynesian opposite.

We can say something, however, about the transition. If we assume a degree of random variation in exchange institutions, exogenous pressure on scale will select for higher fixed cost institutions, simply because a mismatch where the size of the society significantly outpaces the exchange institution will imperil that society’s continued survival. A society of 1,000 people forced to live in close proximity must find a way to overcome the limitation of Dunbar’s number, or face perpetual conflict and possibly extinction.¹⁰

One striking feature of natural credit societies is that they persist in areas with little to no *space constraint*. For the Yānomamö, the jungle is large, and though some places are more preferable than others, a displaced village generally will not lack a suitable place to set up camp. The San, on the other hand, have a birth rate sufficiently low on the whole (Wiessner speculates due to poor nutrition) that camps are as likely to merge as to split, assuming a symmetric distribution of camp growth centered around zero. Environmental pressure, then – whether high birth rates or more intense competition for land – is a likely candidate for the kind of exogenous synoetic pressure that would push a society out of the natural credit equilibrium, and into either extinction or a higher fixed-cost exchange institution.

Intermediate Equilibria: Customary Barter

With small societies whose exchange relationships are relatively permanent and settled in-kind, the scope for the division of labor is extremely small. The flat, egalitarian organizational equilibrium of hunter-gatherer society entails limited specialization and limited opportunities for specialization beyond ad hoc cooperative endeavors. Indeed, in the examples so far, the only ongoing division of labor to speak of is along gender lines, with men tending to hunt game and women attending primarily to domestic duties. The physiological differences apparently constitute a Schelling point

¹⁰ Whether learning or selection predominates in the transition is a question that requires further evidence. In either case, the fact that the scale of a society must bump gently on the ceiling set by its exchange institution seems to suggest that any “big push” effort to monetize a society is likely to fail, for the same reasons that “big push” investment failed as a development strategy: both elements of the mutual feedback must proceed *pari passu*, in this case to ensure either that the requisite learning is feasible, or that the scale does not outpace the natural variation in exchange institutions.

around which to organize ongoing specialization at low fixed cost.¹¹

This pattern of dividing labor across meaningful class divisions is the prototype for the emergence of *customary exchange*. Rather than exchange with particular people on the basis of their personal identity, customary exchange is characterized by the ability to exchange with people *as members of a more or less depersonalized class*, with the trustworthiness of the class from the perspective of that agent ensured by some combination of internal (e.g. Greif 1993) and external (e.g. North, Wallis, & Weingast 2009, ch. 2) forces. By “offloading” the cognitive accounting necessary to sustain the division of labor into such relatively objective Schelling points, specialization can be regularized into permanent patterns rather than being marshaled ad hoc. The more immediately obvious the class divisions along which to organize labor, the easier the convergence upon them as meaningful symbols, and therefore the lower the fixed institutional cost.

Consider village location as one such Schelling point. The Yąnomamö set up villages in a more or less undifferentiated jungle. Because they have no agriculture, the productivity of a particular village location varies more or less along a single dimension. There is competition for more desirable locations, but few opportunities for productive specialization without a fairly large institutional fixed investment which they have yet to undertake. By contrast, Melanesian society has available to it a geographical Schelling point in that it consists of both inland and coastal villages.¹² Because the society has some rudiments of agriculture, and because the ecology of the two classes of village is so distinct, the gains from trade become apparent: it pays to organize an ongoing division of labor between the coastal villages, which provide fish, and the inland villages, which provide vegetables.

Nevertheless, the investment in specialization is subject to considerable risk. In the first place, in order to make the investment in human and physical capital worth the cost, the investor must be assured of a steady – or at least predictable – demand for his product. It is for this reason that Schelling points are so essential for the *credible* organization of pre-monetary division of labor. Even if the gains from trade are substantial, a society just embarking on the division of labor will have extremely limited means of smoothing consumption. For a risk-averse agent, an increase in the

¹¹ The low fixed cost of organizing some division of labor by sexual dimorphism can be inferred from its appearance in numerous animal species, on the assumption that animal behavior never involves investment in institutions with nonzero fixed cost.

¹² This account is drawn from Malinowski (1926, ch. 3).

variance of his consumption is only worth it for a substantially higher mean (see the discussion in Wiessner 1977).

In addition to the variance problem, there is a holdup problem, familiar in more modern work on bilateral monopoly between firms (e.g. Williamson 1983). Having made the investment specializing in growing vegetables, the inland villages become vulnerable to opportunism by the coastal villages, which may be able to demand better terms.

An important way to overcome the risk of opportunism and bootstrap a Schelling point is through *ceremonial* exchange. Each year the Melanesian villages assemble and offer their respective goods amassed into bundles. Good faith is ensured by imbuing the ceremony with religious significance, religion being already an institution with relatively high fixed cost.¹³ In this way, and in the context of repeated dealings, each village can credibly commit to the other not only a continuing and predictable demand for their wares, but also to forswear the opportunity to demand better terms.

Similarly, within villages, the determination of occupation is largely hereditary – in the coastal villages, for example, one’s place on the fishing canoe, or as a builder of canoes, etc. The widespread ability to choose one’s own occupation is a relatively recent phenomenon in human history, one that is certainly not implied by a division of labor. Indeed, under a customary exchange regime, the division of labor entails such high organizational costs that rigid division along objective Schelling points appears as an empirical matter, in societies from the Trobriand islands to mediaeval Europe, to preclude any appreciable degree of social mobility. As Leijonhufvud (1977) noted,

In largely non-monetary economies, important economic rights and obligations will be inseparable from particularized relationships of social status and political allegiance and will be in the same measure permanent, inalienable, and irrevocable.

Because these Schelling points are the repository of information on the accounts necessary to

¹³ On the relation between religion and cooperative strategies, and the division of labor, see e.g. Shariff & Norenzayan (2011); Purzycki et al. (2016). The argument here is that exchange is a significant mediator of this relationship; the primary area in which a cooperative strategy benefits the group. Other possible mediators include the provision of public goods (Johnson 2005) – unfortunately, because the game structures are similar, literature that deals with religion’s effect on “cooperation” broadly speaking cannot distinguish the relative importance of regularized exchange and public goods.

sustain a division of labor, they cannot be modified except at great cost; certainly not at the whim of any single individual in an occupation. The convergence upon their meaning is the institution's fixed cost.

Self-amortizing exchange can already be seen in the aforementioned exchange ceremony. The regularization of exchange through a ceremony in the context of a geographical Schelling point substitutes, in some sense, for an ad hoc credit relationship as the arena in which defection can be punished. Such exchange is, far from the state of nature Menger imagined, already a major innovation over natural credit; and its initial forms are between *villages*, not individuals. If specialization lowers the value of x , the likelihood that in a random pairing one party has something the other desires, atomistic barter between individuals is still a non-starter. It will take a credible convergence upon certain patterns of behavior – which is to say it will take an institution with a positive fixed cost – to make it work.

Customary exchange, especially self-amortizing exchange within customary relationships, entails dramatically lower marginal cognitive costs than natural credit, and for this reason it scales up far better as a method of social organization. Rather than exchanging with a particular person in the context of an ongoing relationship, the trader gains the ability to trade with a member of a permanent class of people who specialize in some production, without worrying about the identity of his particular trading partner. As the society advances, natural Schelling points such as sex or geography are gradually extended into “constructed” classes of people – for example the residents of a conquered village can be enslaved and made to specialize in more menial production. Given the universal strength of egalitarian norms in hunter-gatherer society, it is not implausible to consider slavery and conquest as the first steps toward socially constructed Schelling points along which to organize the division of labor. The extensive stratification of customary barter society as compared to the natural credit economy consists in the construction of such additional relatively clear divisions among the population.¹⁴ And once an intra-society division becomes reified into objective differences in manner and custom, its persistence as a Schelling point can be guaranteed across

¹⁴ The natural credit economy and the customary barter economy correspond to the “foraging order” and the “open access order”, respectively, in North, Wallis, and Weingast (2009).

generations as well.¹⁵ In this way, because the delineation of its particular elements lies outside any single mind, the division of labor can reach far greater complexity than what was possible under a natural credit society.

Indirect Exchange and Increasing Returns

As in the theory of the firm, fixed costs only imply increasing returns to scale over a limited range. Though customary exchange extends these limits are far beyond Dunbar's number, only so much accounting can be kept track of through meaningful social divisions. The next intermediate institution in terms of the complexity of social organization it supports will be indirect exchange – the beginning of Menger's process of monetization.

In order to gain a foothold from which to grow, indirect exchange cannot immediately substitute for customary exchange and displace it. It must first *complement* it. Indeed, the first rudiments of indirect exchange seem to have *further* enmeshed people in the natural credit economy, rather than broken them free of it.

This appears to have been the state of exchange institutions on Rossel Island when Armstrong (1924) described it: its exchange institutions were certainly indirect, but not yet properly *monetary*. It had, by Armstrong's account, been organized on the basis of customary and ceremonial barter and natural credit in the somewhat recent past, as its neighboring islands still were. Large exchanges were still imbued with a great deal of ceremony. Their use of shell fragments as media of exchange had evidently evolved from ornamental use (Szabo 2005), and was still sufficiently nonstandardized as to involve relatively high marginal costs and circuitous exchanges involving multiple parties.

At the time of Armstrong's account, the seeds of specialization and substitution were

¹⁵ The fact that under customary exchange the division of labor is conceived in terms of relatively objective Schelling point characteristics can be seen in Plato's [1955, Part IV] "myth of the metals" discussion around 380 B.C., where he has Socrates advocate organizing a polity's division of labor along the lines of those characteristics bestowed by the gods (i.e. objective characteristics) which make certain men more suitable for some jobs than others. Though Plato himself seems to have perceived the constructed nature of some of the divisions, he also recognized their Schelling point value, calling them "useful falsehood[s]" (*γενναῖον ψεῦδος* – more traditionally translated "noble lie") and arguing that the convergence upon and acceptance of those Schelling points, even by those on the bottom of the hierarchy, is essential for the continuation of the polity.

becoming evident. The circuitous exchanges necessary to convert one value-gradation into another had become increasingly specialized into a “broker” role. Having developed a kind of impressionistic charging of interest in reckoning one shell in terms of another by the time for which it would be necessary to loan out the lesser in order to be repaid in the greater, it is not implausible that the island would have developed the rudiments of arithmetic independently if European contact had not been made. We may surmise based on Europe’s example the money economy “comes to its own” once indirect exchange becomes sufficiently standardized (a large institutional fixed cost) as to lower the costs of self-amortizing exchange so as to become a substitute for, rather than a complement to, customary and ceremonial exchange. This standardization involves investment in numeracy and literacy.

Numeracy and literacy are the large institutional fixed costs of a proper money economy that has mostly displaced long-term credit relationships.¹⁶ Like the transition from natural credit to customary barter, indirect exchange is a high fixed cost institution whose reduction of the marginal cost of establishing exchange relationships only makes the investment worth it after a certain volume of exchange is established. Certainly neither numeracy or literacy are “natural” to human society: pre-monetary societies are largely characterized by languages with no precise numbers beyond one, two, three, many; and in at least one case no exact numbers at all (Everett 2005).¹⁷ Indeed, the set of pre-monetary and pre-literate societies largely overlap; it is no coincidence that the earliest known example of human writing is a record of a monetary debt (Wray 2004). If the division of labor is limited by the extent of the money economy, the extent of the money economy is

¹⁶ Deheane (1997) gives a precise account of the cognitive requirements of basic numeracy.

¹⁷ This paper is controversial primarily because of its proposed causal direction: from the language’s lack of numbers to an inability to perceive numerical quantities with any precision. Linguistic orthodoxy is more consistent with the reverse: without any need for numeracy in the Amazonian jungle, there is no more reason for their language to have a word for “twenty” than for “penguin”. Either way is consistent with our argument.

limited in turn by the extent of numeracy and literacy.¹⁸ The periodic laments about innumeracy in the developed world (Paulos [1988] is the best known) come from an expectation of fluency in even more complex tasks like addition and subtraction, or even algebra and statistics. The basic tasks of counting indefinitely high and of comparing two arbitrarily large numbers, as non-trivial as they are, are taken entirely for granted in highly monetized societies.

The primary cognitive function of primitive money is its unit of account feature: values of disparate objects can be compared and debts reckoned with exactness, as compared to the loose and impressionistic accounting in pre-monetary exchange. In addition, money's major advance over customary exchange is that money balances embody *the accounts themselves*, rather than merely the relationships within which accounting takes place, as with the Schelling points of customary barter. The entire accounting apparatus by which humans organize the division of labor is now offloaded into a reified good which serves not only as a unit of account, but also as a store of value – i.e. an indication of a positive account in the balance of reciprocal altruism (cf. Kocherlakota 1996).

Recall the mutual feedback between investment in higher fixed-cost exchange institutions – in this case the extent of monetization – and the division of labor. In a fairly small or sparsely populated society, as discussed above, the probability of failing to find trading partners willing to buy one's wares in sufficient quantities to safeguard against starvation is high enough that investment in most specialized human capital is not worth the time. As population density increases, marginally unprofitable investments in human capital come to be seen as reliable sources of barter income by enterprising people. By the same token, as specialization increases, trust and search costs begin to impinge, leading to the familiar Mengerian pressures toward the development of a medium of indirect exchange. As a single medium emerges, the development of accounting and mathematics makes it easier to identify profitable opportunities for specialization, opportunities which could be seen only impressionistically in a barter economy. This specialization in turn increases the demand for and usefulness of the medium, and so on. It is no accident that the emergence and sustenance of a robust money economy has, from the ancient world to the eve of the

¹⁸ Mathematics, like the division of labor, is an important driver of the feedback loop between population density and monetization. The development of money provides a society not only with the original impetus to abstract away from the countable numbers into a system of accounting relationships in order to reckon terms of trade more precisely, but also with a division of labor fine enough to support occupations in which an abstract system of mathematics will pay.

industrial revolution, been a phenomenon associated with urbanization (Clower 1995).

The process works in reverse too. The increasing unreliability of the monetary unit at the collapse of the Roman Empire was associated with a dramatic ruralization and spontaneous dioecism of Europe. Rome's money economy fell into disuse. Bloch's description of the rise of feudalism (1966, p. 250f) can be understood in these terms:

Estate management requires careful account keeping, which became more and more difficult for average administrators, in the ignorance and disorder which the great distress of the opening Middle Ages brought with it. The repeated, and almost puerile, instructions which abound in the estate ordinances of the ninth century . . . show us how hard it was for the great men to make their subordinates apply the most elementary rules of book-keeping. To adopt tenancy as a solution was the line of least resistance. . . . [T]he new tone of social life and the new habits of mind were all against any effort to maintain the old, and far too complicated [i.e. high-fixed-cost], methods.

In other words, at some threshold population density between that of Roman cities and rural estates, and without a reliable monetary unit, specialization became a less attractive prospect. Enough people returned to subsistence agriculture that the whole process began to unravel, and Europe fell back for a time to the customary barter equilibrium. Without specialization, there was little need for a medium of indirect exchange, without which there was little need for numeracy and accounting skills. As these began to atrophy, the monetary economy became more and more defunct until feudal organization was settled into as “the line of least resistance” – simple enough in its basic form to be conducted largely without the aid of math or money.¹⁹

Market Prices and the Modern Era

Still, the emergence of indirect exchange, by itself, should not be oversold. The reader attempting to relate the narrative in this paper to the history of Europe will notice that monetary exchange is certainly not a sufficient condition for economic development. In the “hockey stick” graph of

¹⁹ The conquering Germanic tribes, for their part, “could not handle the mechanism of administration that they had inherited. . . . [T]he decline of trade and the growing scarcity of money made the extension, or even the maintenance, of a large salaried officialdom more and more difficult” (*ibid.*, p. 260). Bloch goes on to describe various monarchs' efforts to establish public order and regular exchange through new customary status relationships instead.

economic growth in world history, the kink does not correspond to the monetization of a premonetary society – indeed, it does not come until after indirect exchange had already been in use (with an interruption at the opening of the Middle Ages) for millennia.

Customary exchange, of course, is a broader category than customary barter. Exchange relationships could be, and were predominantly for millennia in Europe, both customary *and* monetary. Monetary exchange, in its early stages, reduces marginal costs for both customary and ad hoc exchange. Though the marginal cost of *establishing* customary exchange relationships is quite high, its advantage is precisely that the marginal cost of exchange *within* a customary relationship is negligible; lower indeed than ad hoc exchange.

But like the first transition to monetary exchange, the crucial transition to market prices comes when the marginal costs of monetary exchange fall sufficiently as to make monetary exchange a *substitute* for, rather than a complement to, customary exchange. If the costs of ad hoc exchange relationships are low enough, even if they are still higher than customary exchange relationships, the advantage of organization by status and custom becomes negligible in comparison to the cost of establishing customary relationships.

At this point, to money's initial embodiment of accounts is added the reification of global data on conditions of supply and demand as *market* prices in a common monetary unit, around which separate and anonymous (to each other) human actors can coordinate their plans impersonally at low (marginal) cost. The emergence of market prices reflects perhaps mankind's most significant cognitive advance since the dawn of language (cf. Horwitz 1992), a distinction borne out by the phenomenal explosion in economic growth following the widespread integration of disparate markets in Europe.

Market prices are crucial in the emergence of what North, Wallis, and Weingast's (2009) (NWW hereafter) call the “open access order”.

Limited access prevents market prices from allocating resources between competing uses [under customary exchange]. . . . Rather than capturing rents by charging a high price, the possessor of a privilege may exploit it by charging a low price and allocating the resource to political allies. . . . When elites charge less than market clearing prices to secure political ends, the result is that prices cannot be used for impersonal coordination of the behavior of individuals. [Customary exchange] thus cripple[s] the price mechanism as a means to convey information about marginal benefits, marginal costs, and scarcity. . . . [I]t is not surprising

that modern economic analysis of the price mechanism did not develop until open access orders with competitive markets began to develop. Competitive use of resources have existed since the dawn of human existence, but, with a few notable exceptions (such as ancient Greece), competitive markets with prices that convey information capable of coordinating human action are a recent development.

As we have seen, the lower marginal costs of impersonal market exchange enable low-cost impersonal coordination via prices rather than conscious direction. The fixed costs, NWW argue, are the interests of the elites, who stand to lose a great deal of privilege from impersonal coordination. Without denying the importance of interests vested in the old order, a more concrete fixed cost seems as well to be transportation and infrastructure. The emergence of market prices doesn't mean much in an isolated village; indeed, controlled prices may be observationally equivalent to market prices. It is only when markets begin to become *integrated* across long distances – requiring prior investment in navigable roads and rivers between them – that market prices begin to play a crucial role in driving anonymous trade and the rise of a merchant class.

NWW spend a great deal of time on the very transition with which we are here concerned, and identify “takeoff conditions”, individually necessary and (probably) jointly sufficient, under which the rulers of a customary society are impelled to set in motion changes to propel the society toward an open access order characterized by market prices. We defer in the main to this story. In the context of our own story on the development of exchange institutions, however, we can add to NWW's takeoff conditions a low marginal cost monetary system, without which ad hoc relationships can never displace customary relationships as the predominant basis for exchange. This entails a currency with a reasonably stable purchasing power and a high degree of standardization.²⁰ In other words, because indirect exchange lowers the marginal cost of both ad hoc and customary exchange, and because customary exchange has a default advantage, the monetary system must substantially reduce information costs in order to make ad hoc exchange a reasonably close substitute for customary exchange. A coin whose quality must be haggled over is not a solid

²⁰ Alchian (1977) argues that low informational costs (i.e. of assessing the quality) of some good are an essential quality for the emergence of money. If this is interpreted so as to be compatible with the account here, the fact that loosely standardized coinage persisted for so many centuries suggests, first of all, that the informational costs of exchanging non-cash goods under barter are *even higher*; and second, that the fixed costs of economic integration and standard coinage are also extraordinarily high.

foundation for the explosion of ad hoc exchange.

Having long ago substituted permanent specialization for ad hoc specialization with the adoption of customary exchange, the progressive substitution of ad hoc exchange relationships for customary relationships is equivalent with increasing social mobility. Thus, in the sense of expanding choice in both occupation and consumption, we may agree with Mitchell (1944) that money – once it comes to its own – is perhaps the most liberating institutional innovation in human history.

When money is introduced into the dealings of men, it enlarges their freedom. . . . As a society learns to use money confidently, it gradually abandons restrictions upon the places people shall live, the occupations they shall follow, the circles they shall serve, the prices they shall charge, and the goods they can buy.

Conclusion

Anthropologists studying hunter-gatherer societies, especially those on the verge of agriculture, are often impressed by the extent of the division of labor. Indeed, from a zoological perspective, the division of labor that can be sustained at essentially zero fixed institutional cost is one of humanity's great distinctives. Its impressiveness stands out, however, because the whole complex can (and indeed must) be grasped in its entirety. The division of labor characterizing modern society, though orders of magnitude more intricate than that characterizing hunter-gatherer society, fails to impress us precisely because such intricacy *does not have to be* (and indeed cannot be) grasped in its entirety by a single mind. The accounting is dispersed throughout the environment through convergence on the meaning of money. When Hayek (1945) argues that “the ‘data’ from which the economic calculus starts are never for the whole society ‘given’ to a single mind which could work out the implications”, we might add that this is true only of those societies which have advanced beyond customary barter. Of course, for any society which today enjoys an appreciable level of development, customary barter lies quite a ways back.

Situated at the dawn of the era of impersonal exchange, Adam Smith (1776, bk. 1, ch. 2) observed mankind's “propensity to truck and barter”, and tentatively suggested it as “one of those original principles in human nature”. Evolutionary biology supports this observation. Institutions for regular and predictable exchange are a hallmark of human behavior, endowed by a long process of biological evolution. This is no less true of the language faculty, which enables humans to offload cognition into the environment through coordination upon meaningful symbols. It is no surprise,

then, that the evolution of institutions for exchange, moving progressively more of the burdens of accounting and coordination out of the head and into the environment, is the primary driver of the advancement of human behavior and cognition in a span much faster than could be provided in evolutionary time.

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