
Currency Emergence in Absence of State Influence: The Case of Diablo II

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Abstract: This paper presents a case study of the emergence of currency from a barter economy, a process discussed theoretically by Menger (1892). In particular, we use this case study to attempt to adjudicate between chartalist and emergent theories of currency formation. Using the records of an online message board dedicated to facilitating trades within the game, we document the emergence of currency and its stability over time, and note that the environment lacks the sort of agent required to cause a currency to emerge in the chartalist theory.

Keywords: Chartalist, medium of exchange, Menger, money emergence, online societies, state theory of money

1 INTRODUCTION¹

The theory of money as an emergent phenomenon arising from market interactions is widely accepted. However, because of the remote historical nature of most barter economies, examples of the evolutionary process at work are generally exclusive to circumstances of extreme duress (Radford 1945) and/or state failure (Selgin 2008). In addition, the emergent theory of money is not unchallenged. Some theorists hold that it is the fiat of powerful elites, rather than market processes, that deserve the credit for the creation of money as a social institution. The increase in popularity over the last 15 years in online communities and games provides a fruitful, if simplified, environment for observing in real time which of these theories has greater explanatory power. We discuss the online community in the game Diablo II² and argue it provides an excellent example of the money emergence process. Importantly, the Diablo II environment

has nothing in it resembling a state—involuntary transfer of resources between players is ruled out completely—so our narrative speaks to the literature on emergent vs. state theories of money (discussed further below).

Our contribution engages the literature on the emergence of money, and in particular which theory regarding the historical emergence of money is most accurate. Many, if not most, economists accept Menger's (1892) formulation. Menger held that a monetary system was an example of an emergent order, brought about by economic actors pursuing their own interests. The actions of these actors resulted in an invisible-hand process wherein a small number of commodities, or even a single commodity, with certain desirable properties eventually came to be accepted as the economy's medium of exchange. Opposed to this is the chartalist, or state, theory of money. These theories will be described in more detail in the following section, but the common theme running throughout is that the imposition of liabilities

on weak groups by strong groups is the source of money.³ The quintessential modern example is fiat money, whose value according to this school derives from its ability to discharge obligations to the state.

Our work engages this debate by providing an account of monetary emergence which lies squarely within the Mengerian paradigm. In the environment we examine, there is no state in the sense of the state/chartalist theory, meaning there are no agents with the ability to impose obligations on others. The eventual emergence of a stable monetary order suggests that, while “strong” agents imposing obligations on “weak” agents may contribute to the demand to hold a particular commodity as a means of payment, it is not a necessary condition for the establishment of a commodity or commodities as money (Salter and Luther 2014).⁴

The environment which we examine is admittedly a simplification of reality, but the agents operating in this environment are purposeful human actors; as such, we believe the insights gained from examining this virtual economy validly illustrate the operation of universal economic phenomena. In addition, the case we present offers the rare opportunity to capture the emergent process almost in its entirety. In the real world, the Mengerian process can take thousands of years, depending on exactly where and when one decides money has “fully” emerged. In our account, economizing action on the part of goal-oriented individuals leads to a mature commodity-money system in just a few years. This offers an exciting opportunity for the examination of anthropologic-economic phenomena as yet unexplored.

Castronova (2006) details the use of other large-scale multiplayer game communities as tests of macro-level coordination effects. In the formation of currency, we see Diablo’s online community as a similar natural experiment of this particular large-scale coordination problem. While the size of the video game industry and the increasing prevalence of virtual goods commanding real money⁵ along with the difficulties of properly creating a virtual currency have led to those aspects of virtual worlds to have increasing relevance among economists⁶ the value of understanding the economics internal to these game environments has been somewhat overlooked, serving as a useful complement to our understanding of how these games interact with the “real world” economy.

The remainder of the paper will proceed as follows: Section 2 presents the existing literature on currency formation. Section 3 presents an overview of Diablo II’s exchange environment. Section 4 demonstrates the formation and de-

velopment of money within the forum over time. Section 5 concludes.

2 STATE VS. EMERGENT THEORIES OF MONEY

Our contribution engages the literature on the emergence of money, and in particular which theory regarding the historical emergence of money is most accurate. Many, if not most, economists accept Menger’s (1892) formulation. Menger portrays the monetary system as a spontaneous order –a system which nobody intended to create, but arose as a result of a multitude of purposefully-acting individuals pursuing their own self-interest. In Menger’s account, the motivation for a common medium exchange results naturally from the double coincidence of wants problem first articulated by Jevons (1885). The process by which a single (or small number) of commodities evolves into a common medium of exchange hinges on the concept of *saleability* –the ease with which that commodity can be traded for others. Saleability is important because of the epistemic limits of the individual actors –exchange ratios are not constant but always in flux, but it is beyond the cognitive capacity of individuals to keep track of all these data (Menger 1892: 242). The conditions which make a commodity more or less saleable include the number of actors within the sphere of exchange, their excess supplies (or demands) for the commodity relative to other goods and services, and the divisibility of the commodity. Spatial and temporal considerations, such as the geographical extent of the market and the cost of storing the commodity, are also of obvious importance.

As Luther (2013) notes, the modern literature on search and matching models has formalized Menger’s insight, and it now forms the core of the paradigm that money is the emergent result of market interaction. The archetypal paper, which predates the modern search-theoretic literature, is Niehans (1971); The search-theoretic literature itself begins with Kiyotaki and Wright (1989, 1991, 1993).⁷ The most relevant branch of this literature for our purposes include Aiyigari and Wallace (1997), Li and Wright (1998), and Hogan and Luther (2014), which explore the role of government in securing a monetary equilibrium, i.e. an equilibrium in which monetary exchange exists. Our work can be considered complementary to these, in that we show empirically that while the state can anchor beliefs to create monetary equilibria, it is neither necessary nor sufficient.

Opposed to this is the chartalist, or state, theory of money. Building on the works of Georg Knapp (1924) and further

popularized by Abba Lerner (1947), this theory holds that money, to the extent it exists as a social phenomenon, cannot be conceptually divorced from its social context (Bell 2001). Adherents point to the historical record, which they believe shows money arose not spontaneously, but as a system of clearing debts between parties. Accordingly, the ability of one party to impose obligations on another, including the requirement as to what sort of payment can discharge the obligation, is regarded as the founding characteristic of money (Wray 2004). A modern-day interpretation holds that governments can determine the economy's medium of exchange by imposing tax liability on its citizens—literally, a state theory of money (Goodhart 1998; see Starr 1974, 2003 and Goldberg 2010 for formalizations).

Our work engages this debate by providing an account of monetary emergence which lies squarely within the Mengerian paradigm. In case under consideration, there is no state in the sense of the state/chartalist theory, meaning there are no agents with the ability to impose obligations on others. The eventual emergence of a stable monetary order suggests that, while “strong” agents imposing obligations on “weak” agents may contribute to the demand to hold a particular commodity as a means of payment, it is not a necessary condition for the establishment of a commodity or commodities as money (Salter and Luther 2014).⁸ The environment which we examine is admittedly a simplification of reality, but the agents operating in this environment are purposeful human actors; as such, we believe the insights gained from examining this virtual economy validly illustrate the operation of universal economic phenomena. In addition, the case we present offers the rare opportunity to capture the emergent process almost in its entirety. In the real world, the Mengerian process can take thousands of years, depending on exactly where and when one decides money has “fully” emerged. In our account, economizing action on the part of goal-oriented individuals leads to a mature commodity-money system in just a few years. This offers an exciting opportunity for the examination of anthropologic-economic phenomena as yet unexplored.

3 DIABLO II AS AN EXCHANGE ENVIRONMENT⁹

This section presents evidence that the exchange environment of Diablo II was such that there were significant gains to be secured through players coordinating their exchanges through a medium of exchange. Importantly, there is no

mechanism or institution in the game environment by which obligations to pay in material resources can be forced on players. As such, there is no state in the sense used by the chartalists.

Gameplay in Diablo II began with choosing one of seven character types (known as classes) each with different strengths and weaknesses at overcoming the computer-controlled monsters that populate the game world. Players venture into the game world and defeat monsters, becoming gradually stronger and acquiring items and equipment¹⁰ from slain monsters. Improved character ability and improving the quality of equipment being used by a character allow that character to defeat stronger monsters, earning rewards of a higher quality. Monster difficulty and corresponding reward continue to increase over the course of gameplay, eventually ending in the “end-game” containing the maximally difficult monsters, who have a chance to drop the rarest (and most powerful) items and equipment.

Equipment properties, while highly variable, are perfectly observable (they are displayed in the in-game description of the equipment itself). The algorithm that governs the obtained rewards from killing monsters does not take into account which items would be most beneficial for the player. As such, the large majority of acquired items and equipment, even if they would be useful for some other character or build, would probably be of no use to the character that obtained them. Items, while having comparatively little heterogeneity¹¹, still had significant variation. Finding a trading partner with whom a player had a mutual coincidence of wants thus became a paramount element of participation in the exchange environment.

Object storage during the interim between acquisition and trade was also highly costly: characters had access to a limited amount of storage measured in indivisible ‘squares’ arranged in a set of grids of particular dimensions.¹² Objects themselves took up a variable number of squares, with a minimum size of 1 square, up to a maximum for the largest equipment of a 4x2 area. Additional storage required the creation of additional characters to serve only as warehouses, referred to in-game as “mules.” Inventory management between characters used by the player to actually engage in gameplay and these storage characters carried with it significant opportunity costs. Time spent engaging in inventory management meant forgoing engaging in actual gameplay, and mitigating the risks involved in transferring items¹³ often required involving other players, or access to a second copy of the game software and a second computer. In addition, newly created characters needed to spend a minimum

of several hours actually in games in order to not be deleted by the server. For players without access to a second copy of the game software and a second computer, “parking” each mule was an additional period during which no other gameplay could be conducted. Storage space on characters used to actually conduct gameplay was made additionally costly due to the existence of “charms”, a type of equipment which provided beneficial effects in exchange for directly occupying space in a character’s inventory. Non-mule characters thus faced a trade-off between power and extent of storage space.

The primacy of solving the double coincidence of wants problem to acquire useful items or equipment, along with the costly nature of inventory management and storage, meant that gems and runes, items that were highly saleable (desirable across many classes and builds), had minimal storage costs (occupied the minimum 1 square of inventory space), and relatively homogenous¹⁴ were well-positioned to be settled on as a focal money. As Section IV will show, gems and runes did in fact emerge as the monetary units within the Diablo II economy.

Exchange Institutions within Diablo II

That there would be significant gains to finding exchange partners during online gameplay was one of the elements built into the design of Diablo II, and the game developers did include some game functions meant to facilitate player-to-player exchange. One significant improvement over its predecessor, the original Diablo, was the introduction of a trading interface, by which two characters in a safe area (one in which there could be no hostile activity) could open an interface to exchange items where the actual transfer between inventories would be conducted by the server. This interface covered the game screen and allowed each player to display items in a 4x10 grid: after any negotiations, both parties could indicate that they wanted to conduct a trade by clicking a check marker. When both sides had indicated they consented to a trade, the contents of each player’s grid would be transferred to the other’s inventory (provided they had room to hold those). In contrast to more modern games which often have sophisticated exchange institutions to allow exchange between all members of a given game server, or allow trades to be conducted without needing a direct bilateral exchange, this trade interface is the only element of the in-game interface focused on exchange. While property rights over one’s own inventory was protected by the rules of the game environment no other property rights between players existed or were enforced¹⁵.

No in-game circumstance could cause you to involuntarily relinquish objects from your own storage. Of particular note for our argument is the complete absence of the sort of debt clearing or state obligations described as necessary to money creation in the chartalist framework. *Since there exists no mechanism by which any player could compel by force the transfer of items from one player’s storage to another, no mechanism exists for the chartalist account of currency formation to take place.* Other accounts based on the compulsion of payment of tax revenue similarly lack an analog in the Diablo II environment, since there is no person or group in a position to issue tax burdens or collect them.¹⁶

Using the available trade interface still required finding other players interested in trading, as opposed to game instances meant for cooperative gameplay: to that end, certain types of communication became focal to find potential exchange partners. One of the most common methods of communication was to title the instance of the game one was creating with a title that potential entrants would see indicated it as a space for exchange. Depending on the sort of exchange one wanted to conduct, these names could take one of two forms. For exchanges where the relative values of each item were relatively settled and only a currently interested counterparty was required, names would take the form of the desired exchange: X for Y, where (in general) one was in possession of object X and wanted to exchange it for object Y. However, game names were limited to only a certain number of alpha-numeric characters, so if one desired to create or join a game for more general exchanges or ones with more complicated terms, often the solution was to name the game in such a way as to indicate the game’s purpose was for trades. Over time, “trade” became the focal name for the first such game to be formed at any given time. However, if there were already the maximal number of characters in the game ‘trade’, a hierarchy of alternative game names could be created or joined.^{17,18}

Anecdotal Evidence on the Diablo II economy before 2004

The dataset that we examine to detail the emergence of currency begins in early 2004, but the state of the economy from the date of release until then is still anecdotally well known. Early on, the primary monetary unit was a unique ring, the “Stone of Jordan”.¹⁹ Along with its marketability, early versions of Diablo II unintentionally allowed for a much larger supply of this particular object than was intended. Even when these initial technical problems were fixed by Blizzard issuing game patches, other exploits present in

the code allowed for persistent counterfeiting of the existing supply of Stones of Jordan, leading to a significant inflation. Prices eventually stabilized during this period of the game's history, with the price level of the most desirable items often somewhere between twenty to forty Stones of Jordan.²⁰

The game environment remained relatively stable after the initial period of patching with the release of Patch 1.09 in August, 2001, until the release of Patch 1.10 on October 28, 2003. Meant as a way to revitalize interest in the game for longtime players, the patch drastically revised the difficulty of areas of the game, changed various areas of the skill system, and added new items and equipment. An effort was also made to create a new economic system, rather than introduce all of these additional features into the current system dominated by these prior counterfeit items.²¹ Rather than undo all of the effort expended by players to acquire the items and characters prior to the patch, Blizzard chose instead to create a new type of character, known as a "Ladder" character.²² Ladder characters had access to all of the new item combinations, and additional endgame monster encounters with powerful equipment rewards, but had to start from the beginning of character development again and were unable to interact with characters from the old (Non-Ladder) economy.²³ With these fundamental changes in the underlying variables that determined the demand for any particular good and the complete reset of the wealth level, the Ladder economy thus presents a clean slate from which to examine the emergence of the new monetary system.^{24,25}

4 CURRENCY FORMATION: EVIDENCE FROM FORUM BEHAVIOR²⁶

The limitations of the in-game exchange environment led many players to move to out-of-game institutions in order to better facilitate trade. One of the most durable types of out-of-game institutions were message boards (normally attached to fan websites), where one could post a message detailing one's current inventory and desires. These forum posts could be seen by (given sufficient participation) far more people than any in-game advertisement, remained visible and could be replied to even when a player was not actively engaged in trading. Along with these reductions in transaction costs, participation in a forum provided an opportunity to develop a durable reputation and, in line with the predictions of the money-as-memory literature, provides publicly visible knowledge regarding the desires and exchange-values of other players.²⁷

The particular message board we use for our dataset is the records of the trading forum for the USEast Realm during the period 2004-2008, beginning a few months into the new economic environment of Patch 1.10.²⁸ A typical forum post consists of a list of goods which represents the wants of the player posting the message,²⁹ and a list of one's current inventory of objects for trade.³⁰ These lists could range in sophistication and scope from simple requests for barter,³¹ all the way to extensive inventories of hundreds of items.³² Although there is no formal currency, even the earliest messages have a notion of differential salability of goods. Most commonly, this is noted by the inclusion of catch-all phrases into the list of wants. Along with indication that a trader would accept runes as a class of item, forum users in the early Patch 1.10 environment refer to a separate class of objects, "tradeables" which contains a variety of items with high salability and lower storage costs.³³ Most lists in this early period focus on searching for a few specific wants, with both runes as a class and tradeables as a class serving as backup wants.³⁴ The term "currency" is also in use contemporaneously during the early period, but is used almost exclusively to refer to non-ladder exchange. From the beginning of the data until the first ladder reset on July 7, 2004,³⁵ fewer than 20% of references to "tradeables" are in the context of objects in the non-ladder economy, while the opposite is true of references to "currency".³⁶ Over time, "currency" becomes standard in the ladder economy as well.

Along with the transition between the early idea of a class of highly marketable items and later ideas of a developed system of currency, the complexity of the terms of exchange offered would slowly increase over time. One such element of the advanced use of currency is the use of explicit pricing in terms of currency units. Often early on, these explicit prices are used when a player is trying to sell some inventory of low-to-moderate value items in exchange for bulk materials for crafting.³⁷ Explicit numerical reservation prices are a rarity early on; most lists give no indication of reservation price, or do so with less precision, generally by placing the items for sale into tiers based on the quality of rune the item could be expected to trade for.³⁸

Attempts to codify the general trend of exchanges on the forum and provide some of the memory functions of money exchanges are occasionally attempted by members of the forum and to varying degrees maintained over time.³⁹ Because of the tendency for queries regarding the relative exchange-values to push messages conducting actual exchange activity off of the front page of the message board, such requests were consolidated into a separate board, the Trade Values fo-

rum,⁴⁰ a location which also contained various price guides. These price guides, often meant to serve as an introduction to exchange on the forum, serve as some of the best indicators of the nature of the currency in use on the forum at any given time.⁴¹ These threads would generally contain a primer on the basics of the economy, a rough value (denominated often in runes or in ‘points’ where rune values were the benchmark⁴²) of much of the equipment in the game, and warnings against various common in-game fraud attempts and an injunction to beware of rampant counterfeiting, especially in non-ladder play. While these guides are far from definitive, they did serve as a reasonable reflection of trade values and practices of the time of their writing, especially exchange rates between currency items,⁴³ and statements, especially by infrequent traders, to the effect that the price guide served as a focal point for their expectations of exchange-values, are common.⁴⁴

Players who took it upon themselves to maintain the price guides often explain their methods in the introductory post, and their explanations support the view of the currency system in Diablo II as an emergent process, because their maintenance was primarily based on observation of the trades actually conducted on the forum itself and other similar forums.⁴⁵ Price lists updated based on trying to codify the exchange behavior that was already taking place, and chose to do so in terms of gems and runes because those were the benchmark, both as a medium of exchange and as the unit of account. Much as no in-game actor had the capacity to dictate a currency *ex nihilo*, price lists were meant only to document values that were being created through the trading process. Over the course of the dataset, the system of trade values became relatively stable,⁴⁶ although new patches added a few additional valuable objects to the economic system, their relative value was also established over time.⁴⁷ By 2007-2008, the use of explicit reservation prices had become commonplace, to the extent that a guide for new traders on the message board recommended the practice as central to quick trading.⁴⁸ Normally, these prices were expressed by some numerical value, with the correspondence between items considered part of the currency system and the numerical values listed as well.^{49,50} While the sophistication of the near-retail system of reservation prices described above is far from universal, it does reflect well the climate of exchange during the middle of a ladder season, where a stable currency of highly saleable items facilitates complicated exchange. The documentation of this system on the message board reflects the sort of economic environment that would have been accessible in-game, albeit with greater difficulty

owing to the limited in-game exchange institutions. By this period in 2007-2008 we argue that the evolution of the currency system itself is complete.

5 CONCLUSION

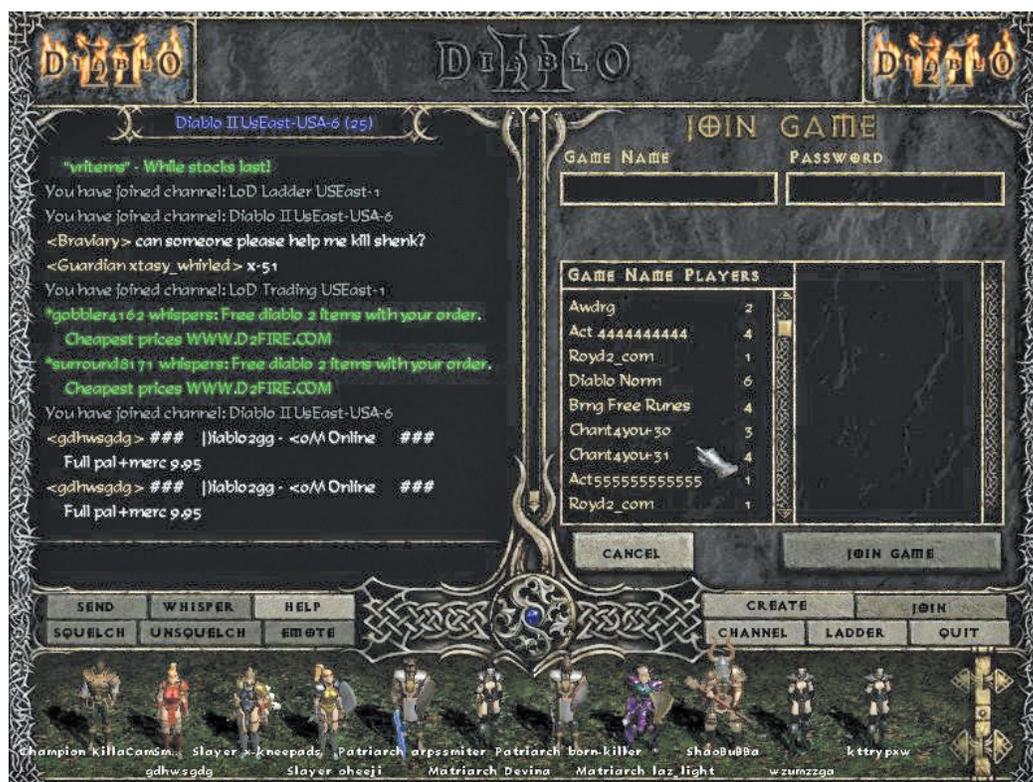
The multiplayer gameplay of Diablo II focused on item acquisitions and exchange. Players acted in a barter economy with limited institutions to resolve the exchange frictions that needed to be overcome for successful economic activity to take place. In addition, no central authority existed or could exist to provide an alternative currency or cause some other object to become the focal monetary unit. Nevertheless, the economic behavior of the community as a whole, as documented through the evidence provided by the records of message board trades, shows exchange behavior with a widespread and effective currency. While this does not show that the chartalist account of the formation of money—the imposition of obligations by the strong on the weak, with the goods in which these obligations are denominated acquiring value due to their ability to discharge the obligation—is not sufficient, it does suggest that it is not necessary. In contrast, the Mengerian account of the formation of money—convergence by market processes to a commodity, or commodities, which possesses properties amenable for use in indirect exchange—is sufficient, although we cannot say from our analysis whether it is necessary. While the historical emergence of monies contains elements of both accounts, it is nonetheless true that the key causal explanation lies in exchange behavior and emergent convergence (Salter and Luther 2014). Our analysis further highlights the importance of these mechanisms.

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APPENDIX A:
SOME SCREENSHOTS OF THE DIABLO II INTERFACE



The online interface: Left is the current chat channel (note the various advertisements), right is the join game interface (“Brng Free Runes” is another example of the game name as a communication medium). The bottom bar of characters represents the characters currently in the active chat channel.



The inventory itself, with some charms (the 3x4 collection of objects), the Horadric Cube and two Tomes (leftmost 2 columns), along with random items.



The stash, an additional space for holding items. Note the various sizes items can occupy: the grey object is a rune, the other 1x1 objects being two models of rings and various gems.

NOTES

- 1 Parts of this section are largely reproduced from Salter and Stein (2014).
- 2 Diablo II, along with its expansion, *Diablo II: Lord of Destruction*, was released by Blizzard Entertainment in 2000 and 2001 respectively. Both games received tremendous critical acclaim and still have an active playing community to this day.
- 3 While this is a core tenant of the chartalist theory, readers should note this is a purely positive, not normative, statement. No ethical position is implied either way; it is merely a statement of interpersonal relations as it pertains to the discharge of involuntary debt obligations.
- 4 In addition, recent work by Luther and White (2012) suggest that government is not necessary to *sustain* a given monetary regime, regardless the role it played in that regime's emergence. This suggests the importance of established network effects (Luther 2013b).
- 5 A phenomenon very common in Diablo II as well, but not the topic under investigation here.
- 6 See Castronova (2004), the symposium in the *Southern Economic Journal* on Second Life (Vol 78(1)), or the recent news that industry leader Valve Software has hired an academic economist to handle the interactions of their virtual currencies (see <http://blogs.valvesoftware.com/economics/it-all-began-with-a-strange-email/>)
- 7 Kiytoaki and Wright (1989) cite Niehans' book-length exposition, rather than the article, but the development of the concept is nonetheless clear.
- 8 In addition, recent work by Luther and White (2012) suggest that government is not necessary to *sustain* a given monetary regime, regardless the role it played in that regime's emergence. This suggests the importance of established network effects (Luther 2013b).
- 9 This section is largely reproduced from Salter and Stein (2014).
- 10 For clarity, although players of Diablo II often did not distinguish between these two categories, we distinguish between equipment and items. Equipment meaning objects which were directly used by the character, in contrast to items, which were a class of rewards that served as inputs into equipment creation or improvement. These items, such as gems and runes, have, as we will discuss, particular economic properties (relatively homogeneity, high marketability, low storage costs) that made them a focal choice for a monetary unit.
- 11 The two major item classes, gems and runes, were subdivided only as follows: Gems came in five types and five grades of quality; each type provided some particular set of bonuses, which increased as quality increased. The highest quality gems (regardless of type) were also an element in equipment customization. Runes come in 33 different types (designated by 2-4 character combinations of English letters, such as 'Eld' or 'Jah'), each of which provided different properties.
- 12 Each character had access to a maximum of 96 total 'squares' of inventory space for items and equipment not currently being used. These were divided into a 4x10 inventory grid used for direct interaction with the environment (picking up objects when monsters were defeated, discarding unwanted objects), a 6x8 grid known as the stash meant for long-term storage, and an additional 12 total squares due to the Horadric Cube, an item which occupied a 2x2 area of a character's inventory but provided an internal 3x4 area of storage. (Images of the inventory and stash located below, see appendix A)
- 13 Two characters from the same account are not allowed to be logged into the server at the same time. Thus, transferring an item from one character to another on an account without risk involved enlisting a trusted second-party to hold the item while the player changed characters. Without the cooperation of another player, transfer generally involved joining a publicly available game, throwing the items to be moved on the ground (where they could be picked up by anyone who happened across them), leaving the game, rejoining the game the other character, and retrieving the items. Common risks during these transfers included having the items picked up by other characters, loss of internet connection during the process, or having all other characters exit the particular game instance (leading the server to close the game permanently and leave all items in it permanently unavailable).
- 14 While informational frictions are relatively limited due to the perfect observability of object properties, the comparative homogeneity of gems and runes does avoid having to perform comparisons of within-item variations that impact exchange values. That is, a Perfect Ruby is identical to all other Perfect Rubies, compared to having to evaluate equipment based on the realizations

of its random properties. To return to the example of the unique sword from footnote 14, the epistemic burden of remembering the exchange relationship between all possible realizations of the bonus physical damage to all other goods is far higher than for the relatively homogenous gems or runes, especially when many items had three to six such variable properties, the various realizations of each were independently distributed and required comparison. Using that same unique sword, along with the 100-200 physical damage percentage bonus, there could be an additional 30-50 percent bonus to attack accuracy, a variable bonus to amount of health, etc... evaluating the relative importance of these bonuses and thus the ultimate value of the item added an additional epistemic constraint to finding a mutually agreeable exchange.

- 15 Use of the online servers was subject to a Terms of Service, but only conduct which negatively altered the ability to provide service (such as intentionally inducing latency into the network connections, or attempting to directly alter the game client or server, or automation of the gameplay [known as 'botting']) were punished: no enforcement of player-to-player contracts was ever offered or enforced.
- 16 Some may object that the programmers and/or server maintainers of Diablo II constitute a 'state,' since they set, and can change, the institutions of in-game play. But taking this broad a definition of a state means that every social system must have a state, since every social system has some framework of rules by which it is governed. Rather than expanding the definition of a state to make its presence in the social world tautologous, we maintain the (implicit) Weberian categorization—a legitimized monopoly on the initiation of coercion—is the most useful.
- 17 Common names including: Trading, Trades, Tradez, Trade Here, Trade Post, etc. In general, the more the name departed from "trade", the less preferred or common the game name was.
- 18 The online interface before joining a particular game instance also included a series of chat channels, of which some of which were designated "trade channels" and were meant to be a focal location for exchange outside of particular game instances (where trades would be limited to cycling through individuals in the bilateral exchange interface displaying and bargaining over goods). These lobbies were just unmoderated chat channels, and the limited area of the chat displayed in the

interface represented a commons where each individual attempting to publicize their desired exchanges had an incentive to maximize visibility at the expense of all others attempting the same thing. Individuals who (in violation of the Terms of Service, but rarely if ever punished) were selling in-game items for real-world currency over time crowded out most individual in-game traders through the use of automated accounts to spam the channel with advertisements. These 'spambots' from various competing sites over time rendered the chat channels meant for trading unsuitable for this purpose, and players interested in conducting in-game exchange migrated away.

- 19 The Stone of Jordan in the early versions of Diablo II shares many of the properties of the runes and gems: it is a ring, a class of equipment with the minimum storage cost, properties that were totally fixed (minimal heterogeneity), and useful for any conceivable character.
- 20 This soft upper limit of forty likely the result of the trade interface: forty 1-square objects represented the maximum volume of currency that could be exchanged in a single transaction.
- 21 Along with the ubiquitous Stones of Jordan, several years of attempts to compromise the game's software had led to various other items outside of the scope of those intended by the developers. These 'hacked' items often trivialized the difficulty of the game, and were the subject of much fragmentation between players who enjoyed the powerful nature of hacked characters, and others who disliked the impact they had on the game.
- 22 Players reaching the highest experience levels the fastest in the new system would be displayed in a ranking by class (the ladder) as a public recognition of their skill.
- 23 Since most character abilities had been rebalanced and previous character customization could not be undone, this also provided an opportunity for all players to start anew.
- 24 Of particular interest in these changes to the game environment for the purposes of understanding the evolution of currency was the introduction of a large set of powerful "runewords", equipment that was created by combining multiple runes together. Many of the new runewords introduced became critical elements of end-game character builds. The particular types of runes needed (especially for some of the runes of medium-to-high rarity) to create any given runeword overlapped significantly, leading to these runes having nearly

- universal salability even before their role as currency was solidly established.
- 25 With all of the wealth (and along with it the money supply) of the old system removed and the drastic changes to the relative use-values of items it would be surprising if the same exact items had the right combination of qualities to be the monetary unit, but possible path-dependence was curtailed by Blizzard, who changed the item system to make the acquisition of Stones of Jordan go from common (1 in 59) to exceedingly rare (1 in 8809).
 - 26 This section is largely reproduced from Salter and Stein (2014).
 - 27 In addition, the differences between major trade forums also allowed players to select into a community depending on their views regarding counterfeit items or game exploits. The forum which provides the basis for our dataset attempted to enforce norms regarding the types of items that could be exchanged to facilitate “legitimate” play (that is, avoiding counterfeit or hacked items). In addition to regulations to ensure that the trade forum itself was orderly (such as restrictions on new post creation and sanctions for individuals documented to have violated contracts developed on the forum), the forum’s moderators also maintained a list of objects which were, as known counterfeits, banned from being exchanged. Other forums had a more permissive stance on these sort of items. As one of us argues elsewhere (Stein 2013), these differences are based on the difference in the currency systems adopted: while the “legitimate” forum did not offer any particular exchange instrument besides in-game currency, the forum with the more permissive trade regulations developed a scrip currency for the forum, obtained by donations to the administrators.
 - 28 <http://diablo.incgamers.com/forums/forumdisplay.php?161>. Our dataset begins in late January 2004 before when a server error has made messages inaccessible, and last until the end of 2008 when the ‘archival’ forum’s records end, subsequent exchanges being conducted in the (still active) current USEast trade forum.
 - 29 Referred to as one’s “In Search Of” and abbreviated ISO.
 - 30 Referred to as one’s “For Trade” and abbreviated FT.
 - 31 Similar in form to the game-naming conventions for simple exchanges: <http://diablo.incgamers.com/forums/showthread.php?130352> is a representative thread of this kind of simple barter request. The thread’s title (what would be seen while scrolling through the list of message board posts before examining any particular post in detail) is “[L] FT: Tals Full Set ISO: Vex” The [L] indicates that the items are being traded on the Ladder. “Tals Full Set” is a Set of high-level equipment, which this player is offering for a ‘Vex’ rune, one of the high-value runes. The body of the message is: “Well just as the title states, Tals Set for Vex Rune”, followed by his in-game and forum contact information.
 - 32 <http://diablo.incgamers.com/forums/showthread.php?127186> is typical of these warehouse-type postings, as well as being illustrative of the sheer number of accounts and mules required to store significant inventories of large items.
 - 33 Mainly, 1-square charms with desirable properties such as bonuses to acquired item quality or large amounts of bonus poison damage, which were considered another unit of currency besides Stones of Jordan in the non-ladder economy during this time, documented in various attempts at compiling price lists such as those here: <http://diablo.incgamers.com/forums/showthread.php?126925>.
 - 34 The following quoted formulation of an In Search Of list is representative:
Okey...
Currently, I am in search of
Harlequin Crest (--Main ISO--)
Runes (--Secondary ISO--)
Tradeables (--In case you have no runes or a Harlequin Crest--)
<http://diablo.incgamers.com/forums/showthread.php?126709>
 - 35 To avoid economic stagnation in the Ladder economy and to allow for another rush of new characters “climbing the ladder”, Blizzard would move all current Ladder characters into the non-ladder economy periodically. These ladder resets occur periodically over the whole course of the dataset.
 - 36 Over all the threads created in the dataset, 1,831 posts explicitly use either ‘tradeable’ or the most common alternate spelling, ‘tradable’. 1,029 of these are in the year 2004. In contrast, ‘currency’ is explicitly mentioned by 4,339 posts over the entire dataset, only 396 of which are in 2004. While compared to the total number of threads in the sample 100,141, these may be small numbers, they are indicative of the terms that would’ve been familiar to the expected audience. Most posts instead mention by item type at least one or more items that would be considered tradeable or a currency item rather than refer to them in the general form. Runes and

- perfect-grade gems (referred to as pgems), are far more common, especially runes, which appear in one of four common permutations in 45,851 of the messages.
- 37 Conventions presented here that require explanation later become standard, such as presenting the “retail” or “Buy it Now” (abbreviated to BIN) price of any item with a number in brackets. User Seryph, for instance, presents a list of various equipment he is trying to for exchange for particular items: Perfect Amethysts, Ral runes, and Amn runes. He prefaces his list (written January 28, 2004) with this explanation of the system: “The numbers in the “[]” next to each items equal how much I need for that item. Example: M’avina’s Embrace [3]. That means you can give me 3 PAme, maybe 2 Ral and an Amn, maybe 2 Amn and a PAme. That’s pretty much it, bid away.” Had this same post been written later in time, adding such an explanation to the front of the post would have seemed strange, as such behavior was commonplace (only the particulars of his exchange ratio would have differed). (<http://diablo.incgamers.com/forums/showthread.php?126961>)
- 38 <http://diablo.incgamers.com/forums/showthread.php?128950>
- 39 The volume of trades and the tendency for at least some actual exchanges to be settled without explicit record on the message board made keeping complete records difficult.
- 40 <http://diablo.incgamers.com/forums/forumdisplay.php?25>
- 41 One such guide, written August 30, 2005, explains the basics of the economy as follows: Now, the trading scale of D2 is not measured, as some might expect, by gold, which is pretty much worthless. Instead, there are three key items that generally dictate the price of items in the D2 world. (1) Perfect Gems for the cheap items. (2) Um runes for the middle class items. (3) Ist runes for the very elite items. (<http://diablo.incgamers.com/forums/showthread.php?382411>)
- 42 This pointing system was meant to reflect exchange rates that would be stable during the later parts of any given ladder season (before a reset) to account for the eventual inflation as more and more players reached the endgame and the resultant acceleration of entry of items and equipment into the economy.
- 43 Since even currency was heterogeneous and indivisible, divisibility was added into the system by items of currency of different values serving as different denominations: Perfect Gems functioned as the smallest denomination, with runes of various rarity and marketability functioning as bills of various sizes.
- 44 Such as the introduction to <http://diablo.incgamers.com/forums/showthread.php?254626>: “I don’t do much (read: any) trading, so I’m only going off of the price guide and hoping most of that is still current“
- 45 Another forum that is referenced by players on the forum our data is taken from is no longer accessible.
- 46 Players having discovered over the course of several Ladder seasons approximately the contours of the relative exchange-values that would prevail over the course of the ladder season.
- 47 Some of these new items became units of currency due to their homogeneity, while the equipment that these items were an input into the creation of became some of the more commonly traded objects on the forum.
- 48 <http://diablo.incgamers.com/forums/showthread.php?605667>
- 49 Since the relative values of the various currency units differed between players (and the lack of any single individual or institution able to dictate relative exchange rates between currency units) providing a complete list was crucial.
- 50 <http://diablo.incgamers.com/forums/showthread.php?471376> is a typical post of this type.