A Barter Trade Chain—from a PaperClip to a Single-Family House: A View from General Value

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Abstract
This article analyzes a chain of fair barter trades that significantly increases the value in the hands of a trader. The idea of this analysis originated from the urban legend that a man was able to trade a paper clip into a single-family house with a series of barter trades. The major point is that all trades assumed no money payment and were fair for the trading parties. The economic analysis was conducted applying the theory of general value. The analysis described the economic mechanism of the trades and showed the feasibility of such a chain of fair barter trades that significantly increases the final value versus the starting value. An example discussed in this article shows that a skillful trader can easily grow initial value of 5 cents into 100 dollars in a reasonable number of barter fair trades.

Keywords: Economic trade • Barter • Value • Utility • Bounded rationality • Behavioral economics • Value theory • General value • Perception • Buying decision • Choice

Introduction
You may have heard an exciting story about an individual, who started with a paper clip and, through a chain of barter trades without additional payments, has turned it into a single-family house [1,2]. According to the publication, Kyle MacDonald from Canada has traded a big red clip into a house in 14 barter trades. That person started with a paper clip, then traded it for a pen, then traded the pen for a lighter, and so on, ending up with a single-family house without a single penny of additional payments in this chain of exchanges. The story is nice, but there is a question, whether it is possible from the economic standpoint. Every exchange is based on matching the values of the exchanged items. Thus, how is it possible to advance from a very cheap paper clip to a quite expensive single-family house? How did the trader managed to keep increasing the value in the chain of barter exchanges?

Driving forces of market exchange can be discussed in terms of neoclassical utility [3,4], but this approach requires rationality of choices from all players, which is hard to expect. Actually, market participants demonstrate “bounded rationality” [5] that gave rise to a new approach called behavioral economics [6–8] in the last quarter of the 20th century that has explained why and how people use the “rule of thumb” method in their decision making. Behavioral economics suggests that human psychology and behavioral patterns play a major role in making judgments, choices, and decisions. Utility of money provides some flexibility in the assessment of value by different individuals, but this attempt fell short of perception of nonmonetary values [9–11].

Consumer preferences play a significant role in purchasing decisions and market competition, providing competitive advantage to some firms and other producers. The revealed preference theory [12] assumes that consumers’ purchasing habits can reveal their preferences when consumers consider choices. Consumers may consider risky choices with different possible outcomes. Product price and differentiation for the analysis of competitive behavior was addressed in the theory of hedonic prices [13] for differentiated products, in which the entire set of implicit prices guides both consumers' and producers’ locational decisions in characteristics space. This theory utilizes the hedonic hypothesis on the basis of the theory of equalizing differences. The theory of compensating differences [14,15] has addressed the changes in utility with price, but still was confined within the concept of monetary utility. The Bertrand’s model of competition [16,17] describes market competition based in the presumption of undifferentiated products and the balance between production capacities and prices leading to the Cournot/Nash equilibrium.

The barter trade chain described in References [1,2] that started with a paper clip and ended up with a single-family house without any money payment being involved in the exchange cannot be explained with the existing economic theories without making extremely unrealistic assumptions about all players in the chain of trades.

In this article, we discuss this problem from the economic point of view by applying the theory of general value [18] and try to understand, how such a chain of barter trades may work. The theory of general value has already helped to clarify the principles and the course of competitive strategies [19], job selection decisions [20], and consumer buying decision [21]. The fundamental

The Principles of the Theory of General Value

Monetary and nonmonetary components of general value

The theory of general value was recently introduced [18] to explain deviations from money-based economic decisions. According to this theory, value has two components, monetary and nonmonetary. The concept of general value was defined as a linear composition of the monetary and nonmonetary components of value, i.e.
where \( V \) is general value, \( V^M \) and \( V^N \) are the monetary and nonmonetary components of value, respectively. The monetary component represents the respective amount of money or, more accurately, the perception of the amount of money, related to the job compensation, product purchasing, choice of service, and any other decision or activity. The nonmonetary component of value represents the level of satisfaction associated with the decision or activity, and not directly related to the money.

Both the level of satisfaction and the utility of money strongly depend on the subjective perception of an individual or a group of people, which reflects cultural, demographic, and other aspects of the individual or the group, as well as their specific circumstances. A schematic representation of general value and its monetary and nonmonetary components has been shown in Figure 1, where the general value is shown to be the sum of the monetary and nonmonetary components.

The same general value could be achieved with different combinations of the monetary and nonmonetary components as shown in Figure 2. Choices A and B in the figure show the same general value when their monetary and nonmonetary components are different.

A choice with the lower monetary value may look more attractive than a choice with the higher monetary value just because of its higher general value as shown in Figure 3.

The monetary component of general value can be measured in terms of the neoclassical utility of money, or in terms of the value function in behavioral economics \([6–8]\) or, in simple cases of neutral utility of money, just as the amount of money. It is important to note that due to the linear relationship between monetary and nonmonetary components of value presented in Eq.(1), these two components should be measured using the same units. However, this fact does not mean that these two components are identical by their nature.

The nonmonetary component of general value, or in short, nonmonetary value, represents the level of satisfaction directly unrelated to money. This includes a variety of factors such as satisfaction of using the product, the need in the product, brand name, fashion, convenience, ease of use, social perception, life style, habits, hobbies, acceptance by the group of people, and many other factors, which are not directly related to the cost or price.

**Measuring the nonmonetary component of general value**

To compare the nonmonetary components of general value of two choices A and B, one does not need to know the absolute levels of the nonmonetary satisfaction of these two choices. It is enough to measure the difference of the nonmonetary values of these two choices. The difference of the nonmonetary values of two choices A and B can be measured by applying the indifference principle. The indifference principle is based on finding the balance, when the individual is indifferent between two given choices \([20,21]\). Such a balance is reached when both choices offer the same general value, i.e.

\[
V_A = V_B
\]

The equality of general values of two choices as in Eq.(2) may occur with different monetary and nonmonetary values of these choices as was mentioned above and shown in Figure 2. At the indifference point, general values of two choices are equal and hence the difference of these two general values, \( \Delta V \), is zero, i.e.

\[
\Delta V_{AB} = V_A - V_B = 0
\]

In accordance to Eq.(1), Eq.(3) can be rewritten as

\[
\Delta V_{AB} = V^M_A + V^N_A - V^M_B - V^N_B = 0
\]

where \( V^M, V^N \) and \( V^M, V^N \) are the monetary and nonmonetary values of choices A and B, respectively.

At the indifference point, the difference of the nonmonetary values of the choices A and B is equal to the negative difference of the monetary values of these choices,

\[
\Delta V^N_{AB} = -\Delta V^M_{AB}
\]

where \( \Delta V^M_{AB} \) and \( \Delta V^N_{AB} \) are the respective differences in the monetary and the nonmonetary values of these choices,

\[
\Delta V^M_{AB} = V^M_A - V^M_B
\]

\[
\Delta V^N_{AB} = V^N_A - V^N_B
\]

Such a balance is referred to as the indifference point. The differences in monetary and nonmonetary components of general value are referred to as relative monetary and nonmonetary values choices A and B. At the indifference point, the relative nonmonetary value equals the negative relative monetary
value of the given choices. Thus, if the relative monetary value of two choices is known at the indifference point, one can easily measure the relative nonmonetary value of the given choices according to Eq.(5). The indifference point can be found by varying the relative monetary value of the choices for the individual or a group of individuals until the indifference point is reached [19–21].

### General Value of Products

The term product includes both goods and services. The monetary component of general value, \( V_M \), of product \( A \) is the consumer perception of its price, \( P_A \), or the cost associated with the product. Such perception can be measured in terms of utility of money, \( U(P_A) \), for a given individual as shown in Eq.(7),

\[
V^M_A = U(P_A)
\]  
(7)

When a consumer compares choices for the buying decision, the monetary value of products (goods or services) contributes to the general value of the product with the negative sign because the appropriate amount would leave the consumer’s pocket, i.e. the consumer has to pay the given amount [19–21]. In contrast to the negative sign of the monetary value in general value for purchasing decisions, general value of a product for the barter trade without payment includes the monetary value \( V^M_A \) with the positive sign because no payment is involved in the trade and the monetary value positively adds up to the product’s general value. The nonmonetary component of general value, \( V^N_A \), of product \( A \) represents the level of satisfaction for the given consumer with the product or the need in it regardless of its price. Thus, the general value of product \( A \) for the direct barter trade (without payment) is

\[
V_A = U(P_A) + V^N_A
\]  
(8)

The utility of money may significantly differ from the amount of money, particularly, when the amount goes beyond the normal affordable range for the given individual. However, for the sake of simplicity and without losing schematic clarity, we will approximate the utility of money with the amount of money for the representation of monetary value. One can say that we assume working within or closer to the affordable range of money, where the utility of money is linear function of the amount,

\[
U(P_A) = P_A
\]  
(9)

Some possible deviations from a linear dependency of the utility of money on the amount would not compromise this approach at all but just make the calculations a little more complex. Thus, for simplicity, the monetary value of the product \( A \) can be represented by its price,

\[
V^M_A = P_A
\]  
(10)

### A Barter Chain Trader Versus a Consumer

A consumer makes a purchase or trade decision by considering general value of the product including both monetary and nonmonetary values, because the consumer has the need and intention of using the product obtained in the trade. On the other hand, a barter chain trader has no intention of using the product but keeps the chains of trades to grow his own monetary value. Making trading decisions, the barter chain trader ignores the nonmonetary value of the traded products. The trader may deal with different consumers in each trade.

Thus, the difference between a trader and a consumer is that the trader has no intention of using the product but only wants to trade it for a higher monetary value, while the consumer has a need for the product. This difference can be expressed in terms of the nonmonetary values of the same product for the trader and for the consumer. For the trader, the nonmonetary value of the product is zero, while for the consumer, the nonmonetary value should be positive because of the need in the product.

Suppose the trader is in possession of product \( A \) and the consumer is in possession of product \( B \). Let us analyze the consumer and the trader view on the potential barter trade, i.e. exchange of these products without additional payment. General values of products \( A \) and \( B \) in the perception of the trader are denoted as \( VT^T_A \) and \( VT^T_B \), respectively, while in the perception of the consumer they are denoted as \( VC_A \) and \( VC_B \).

The monetary and nonmonetary values of these products in the perception of the trader are \( VT^T_A \), \( VT^T_B \) and \( VT^T_A \), \( VT^T_B \) respectively. As soon as the trader is not interested in using these products, but just in their monetary values only, the nonmonetary value of these products in the trader’s perception is equal to zero,

\[
VT^T_A = VT^T_B = 0
\]  
(11)

and hence, the general values of these products in the perception of the trader are equal to their monetary values as

\[
VT^T_A = VT^T_B
\]  
(12)

On the other hand, the general values of these products in the perception of the consumer are

\[
VC_A = VC^T_A + VC^N_A \quad \text{and} \quad VC_B = VC^T_B + VC^N_B
\]  
(13)

where \( VC^T_A \), \( VC^T_B \) and \( VC^N_A \), \( VC^N_B \) are monetary and nonmonetary values of products \( A \) and \( B \) in the consumer’s perception, respectively. Note that the consumer is interested in both monetary and nonmonetary values of the products.

Figure 4 shows all possible combinations of monetary and nonmonetary values of products \( A \) and \( B \) in the perception of the trader and the consumer that would or would not lead to a barter trade (an exchange without payment from any side) of these products between the trader and the consumer.

It is reasonable to assume that the monetary values for each product are the same for the trader and for the consumer, which are the market values of the products, i.e.

\[
VT^T_A = VT^T_B \quad \text{and} \quad VT^T_A = VT^T_B
\]  
(14)

However, this assumption is not crucial for the analysis.

To perform a trade, the trader should agree to trade product \( A \) for product \( B \) with the consumer and the consumer should agree to trade product \( B \) for product \( A \) with the trader.

In the situation shown in Figure 4(a), the general value of product \( B \) (offered by the consumer) to the trader is lower than the general value of product \( A \) (in possession of the trader) and for this reason the trader is not willing to trade his product \( A \) for product \( B \). From the consumer’s view, the general value of product \( A \) offered by the trader is lower than the general value of product \( B \) offered by the consumer and the consumer also does not want such a trade. There is no trade in this case. Note, that the barter chain trader considers only monetary value of both products, because he has no intention of using either product and is interested in them only as the objects for trading to increase his monetary value.

Figure 4(a) illustrates the situation where the general value of product \( B \) is greater than the general value of product \( A \) for the consumer. The trader is interested in the monetary value only. However, for the consumer, the general value of product \( A \) offered by the trader is lower than the general value of product \( B \) currently possessed by the consumer. Thus, the trader is willing to trade but the consumer is not. For this reason, the trade did not occur.
Figure 4: The trader and the consumer views on the general value of the barter trade and their trading decisions. In (a), (b), and (c) at least one party is not interested in the trade. In (d) both parties are interested in the trade and the trade takes place.

The situation shown in Figure 4(c) is the opposite to the situation in Figure 4(a). The monetary value of product B, which is equal to its general value for the trader, is lower than the monetary value of the trader’s product A and the trader is not interested in the trade. The consumer is willing to trade because the general value of product A is higher than the general value of product B for the consumer. The trade did not happen.

The situation shown in Figure 4(d) is the only situation where both participants, the trader and the consumer are willing to trade. The general value (the monetary value only) of product B is higher than the general value (the monetary value only) of product A for the trader and the general value of product A is higher than the general value of product B for the consumer. The trade takes place. As a result of this trade, both parties, the trader and the consumer, increase their general values.

**Marginal Value for the Trader and the Consumer**

In the trade situation shown in Figure 4(d), the trader has increased his monetary value by the difference in general values of two products, A and B, i.e. by the increment $\Delta VT$

\[
\Delta VT = VT_B^M - VT_A^M = \Delta VT^M
\]

where $\Delta VT^M$ is the difference of monetary values of products A and B,

\[
\Delta VT^M = VT_B^M - VT_A^M > 0
\]

We refer to the increment $\Delta VT$ as the marginal value of the trade and $\Delta VT^M$ as the marginal monetary value of the trade. The marginal general value for the trader is equal to the marginal monetary value, i.e. $\Delta VT = \Delta VT^M$ (Eq.(15)). Note that the trader and the consumer are both satisfied with the result of the trade because both have increased their general value. The consumer’s marginal general value is

\[
\Delta VC = VC_A - VC_B = VC_A^M + VC_A^M - VC_B^M - VC_B^M =
= VC_A^M - VT_B^M - VC_B^M - VC_B^M =
= \Delta VC^M + \Delta VC^M > 0
\]

where $\Delta VC^M = VC_A^M - VC_B^M$, $\Delta VC^M = VC_A^M - VC_B^M$ (18)

The rate of monetary value increment for the trader in this trade is

\[
RVT^M = \frac{\Delta VT^M}{VT_A^M} = \frac{VT_B^M - VT_A^M}{VT_A^M}
\]
The Chain of Barter Trades to Grow Monetary Value

The trader has increased his monetary value by margin $\Delta V_T^m$ in one barter trade as schematically illustrated in Figure 4(d). Suppose the trader has performed a series of $N$ sequential barter trades. In each trade $k$, the trader increased his monetary value by margin $\Delta V_T^m$ for $k = 1, \ldots, N$,

$$\Delta V_T^m = V_T^m - V_T^m$$  \hspace{1cm} (20)

where $V_T^{m,k}$ is the monetary value (equal to the general value) in the hands of the trader before trade $k$ and $V_T^{m}$ is the general value in hands of the consumer before trade $k$.

The total increase of the trader's monetary value in the chain of $N$ trades is

$$\Delta V_T^{m,N} = \sum_{k=1}^{N} \Delta V_T^{m,k}$$  \hspace{1cm} (21)

The total rate of growth of the monetary value for the trader in this chain of barter trades, $RVT_m^{N}$ is

$$RVT_m^{N} = \frac{\Delta V_T^{m,N}}{V_T^{m}} = \frac{V_T^{m,N} - V_T^{m}}{V_T^{m}}$$  \hspace{1cm} (22)

where $V_T^{m}$ is the monetary value of the product in the hands of the consumer before the last trade $N$, which became the final monetary value in the hands of the trader after the last trade, while $V_T^{m,N}$ is the monetary value in hands of the trader before he initiated the barter trading chain.

The total rate of growth of the monetary value for the trader in the chain of barter trades, $RVT_m^{N}$ can be expressed as

$$RVT_m^{N} = \prod_{k=1}^{N} (RVT_m^{k} + 1) - 1 = [(RVT_m^{1} + 1)(RVT_m^{2} + 1)\ldots(RVT_m^{N} + 1)] - 1$$  \hspace{1cm} (23)

The average monetary rate for each trade, if $ARVT_m^{N}$ is defined as

$$(ARVT_m^{N} + 1) = \prod_{k=1}^{N} (RVT_m^{k} + 1)$$  \hspace{1cm} (24)

or

$$ARVT_m^{N} = \left( \prod_{k=1}^{N} (RVT_m^{k} + 1) \right)^{1/N} - 1$$  \hspace{1cm} (25)

Then according to Eqs.(25) and (23), the total rate of growth of the monetary value for the trader in this chain of the barter trades is

$$RVT_m^{N} = (ARVT_m^{N} + 1)^{N} - 1$$  \hspace{1cm} (26)

The initial monetary value in the hands of the trader was $V_T^{m}$ and the final monetary value in his hands after the completion of the chain of $N$ barter trades was $V_T^{m,N}$

$$V_T^{m,N} = V_T^{m,N}_{A} \quad \text{and} \quad V_T^{m,N} = V_T^{m,N}_{E}$$  \hspace{1cm} (27)

The final monetary value in the hands of the trader after completion of $N$ barter trades according to Eqs.(22) and (27) is

$$V_T^{m,N} = V_T^{m,N}_{A} \cdot \prod_{k=1}^{N} (1 + RVT_m^{k}) = V_T^{m,N}_{A} \cdot (1 + ARVT_m^{N})$$  \hspace{1cm} (28)

To grow the monetary value from $V_T^{m,N}_{A}$ to $V_T^{m,N}$ in $N$ barter trades, the trader has to achieve the average monetary rate

$$ARVT_m^{N} = \exp \left[ \frac{1}{N} \ln \left( \frac{V_T^{m,N}}{V_T^{m,N}_{A}} \right) \right] - 1$$  \hspace{1cm} (29)

Thus, to grow the monetary value from $V_T^{m,N}_{A}$ to $V_T^{m,N}$ with the average marginal monetary rate for each trade, $ARVT_m^{N}$, the trader needs to perform $N$ trades. This number can be calculated as

$$N = \ln \left( \frac{V_T^{m,N}_{A}}{V_T^{m,N}_{A}} \right) \ln(1 + ARVT_m^{N})$$  \hspace{1cm} (30)

From a Paper Clip to a Single-Family Home

Suppose the trader starts with a paper clip that has a monetary value of 5 cents—just a nickel. Also suppose that the trader can perform barter trades with average monetary trade rate $ARVT_m^{N}$. How many such average trades, $N$, does the trader need to perform to end up with a single-family house that costs $100,000? It means that the trader should grow his monetary value by $VT^{m,N}_{A}/VT^{m,N} = 2$ million times. The number of trades can be calculated according to Eq.(29).

Table 1 shows the number of barter trades needed to start with a paper clip (monetary value 5 cents) and end up with a single-family house (monetary value $100,000) in a chain of barter trades depending on the average trade rate.

As is evident from Table 1, the trader needs 153 barter trades with 10% average trade rate in each trade. This number drops to 36 trades, if the trader manages to do the barter trade chain with the average rate 50% in each trade. Such a chain trade is quite doable, and for a well capable trader, the goal can be achieved in a reasonable number of barter trades.

Figure 5 shows the growth of the trader’s monetary value $VT^{m}$ with the number of barter trades at a given average marginal growth rate, $ARTV_m$, when the trader starts with 5 cents and ends with $100,000. The higher average marginal rate, the lower number of trades is needed to achieve the goal.

The dependence of the number of barter trades for achieving the goal, $VT^{m,N}_{A} = 100,000$, starting with $VT^{m,N}_{A} = 5$ cents (i.e. grow the trader’s monetary value by $VT^{m,N}_{A}/VT^{m,N} = 2$ million times), on the average monetary growth rate, $ARTV_m$, is presented in Figure 6, explicitly showing that the number of the required trades is decreasing with the growth of the average monetary growth rate, $ARTV_m$.

As is evident from Figure 5, the trader’s monetary value grows exponentially, showing a quite shallow growth in the beginning and rapid growth as the trade chain progresses, which is typical for the exponential

| Table 1: Number of barter trades needed to start with a paper clip (monetary value 5 cents) and end up with a single-family house (monetary value $100,000) in a chain of barter trades |
|-----------------|----------|---------|---------|---------|---------|
| $ARTV_m$        | 10%      | 20%     | 30%     | 40%     | 50%     |
| $N$ (number of trades) | 153 | 80  | 56  | 44  | 36  |

| Figure 5: Dependence of the trader’s monetary value $VT^{m}$ on the number of barter trades at different average monetary growth rates, $ARTV_m$ |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| $ARTV_m$        | 10%             | 20%             | 30%             | 40%             |
| $N$ (number of trades) | 153 | 80  | 56  | 44  |
| $ARTV_m$        | 50%             | 70%             | 90%             | 110%            |
| $N$ (number of trades) | 36  | 32  | 28  | 24  |
function. It is important for the trader to maintain the monetary value growth rate in each trade. The higher the rate the faster the trader will reach the target monetary value.

Conclusions

This paper has analyzed a chain of barter trades for the purpose of growing the trader’s monetary value. The analysis was performed from the perspective of the theory of general value. General value is a combination of monetary and nonmonetary values. In each trade, the trader performed a barter trade with a consumer, possibly different in each trade. The trader was interested in the growth of the monetary value, while the consumer was interested in the growth of the general value. Focusing on the monetary value, the trader can relatively quickly grow the monetary value. Thus, a chain of barter trades can grow the trader’s monetary value from a very small initial amount to practically any target amount.

In each trade, the trader and the consumer increase their general value. This is a criterion for agreeing on the trade. The consumer trades with the goal of growing the general value, which included both monetary and nonmonetary values. The trader, on the other hand, was trading for increasing his monetary value only. For this reason, both parties consider each trade to be fair. The consumer was satisfied with a trade, even giving up some monetary value but increasing the nonmonetary value above the loss in the monetary value, which resulted in the growth of the consumer general value. The trader, who was interested in the monetary value only, has increased his general value in each trade by the increment of the monetary value. A series of the targeted trades may result in a significant growth of the trader’s monetary value.

In the example given in this paper, the trader started with a paper clip that costs 5 cents and in a series of chain trades, ended up with a single-family house with the monetary value of $100,000, i.e. the trader has grown his monetary value by 2 million times in a reasonable number of barter trades.

Coming back to the case mentioned in the beginning of the paper, where Kyle MacDonald has traded a big Red paper clip into a house in Kipling Canada in 14 barter trades, we can assess this barter chain as the following. We have no actual data but may guess that the price for a big Red paper clip, as it was shown in the publication, was about $3 and a house in Kipling, Canada, was about $10,000 at that time. Then according to Eq.(28), the trader should conduct the trades with the average monetary growth rate $\text{ARTV}^M = 84\%$ per trade to achieve the final result. Such a rate is quite high but reasonable for a good salesman, particularly, with all the excitement of this unusual experiment.

References


Figure 6: Dependence of the required number of trades, $N$, to grow the trader’s monetary value in a barter trade chain by 2,000,000 times (from $\text{ARTV}^M = 0.05$ to $\text{ARTV}^M = \$100,000$) on the average monetary growth rates, $\text{ARTV}^M$.