

HAND OUT 06

Transaction Costs and the Birth of Money

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Rising Transaction Costs and the Double Coincidence of Wants

As the economy continues to grow and people specialize, what transaction costs should arise? This can be an open discussion, but a clear one is what is called “the double coincidence of wants”. In short, if I specialize in picking berries, then at the end of the day, I have lots of berries. But if I need fish, then I have to hope that the person who specialized in fish is in need of berries or else I can’t trade. This is a cost to transacting via barter. And this particular transaction cost can get pretty high pretty quickly.

Throughout history, many solutions emerged to this. Can you think of any?

- **Forced sharing** (Kings, ancient societies, slavery, communism). It lowers transaction costs and in a brutal, but historically accurate way: in favor of those strongest in the society. [Note: The free market enterprise system is the only system yet devised that, when adhered to, forces “the strongest” to compete to serve the rest of society. Of course it requires a strong governmental and legal system to make it work, otherwise it devolves back into one of these forced systems.]
- **A weekend market.** Many societies developed a market location in town where everyone came together to trade. If everyone agreed that they would “go to market” on, say, Saturday afternoons, then it actually helped everyone coordinate and thus lowered the transaction costs involved in trading. You could just walk through the market offering to trade your goods for something else and then trade that for another thing and so on to get what you wanted.
 - Markets lower the transaction costs of the double coincidence of wants.
 - Markets however are a cost because you must now, in the terms of our island economy, work 40 hours during the week and then “spend” part of your leisure time, taking goods to market to trade and shopping. Those are evidence of the transaction costs that have arisen as the economy became larger and more complex.
 - In a good scenario, specialization allowed you to increase production so much that the gains far outweigh the added costs of going to market.
- **Trade Centers.** Trade for several different things and then find things the person you need also wants. This could lead to someone specializing in trading and opening up a trading shop. That would reduce transaction costs because if the fish person doesn’t want berries, then I could go to the trade shop and trade berries for something the fish person wants and then run them over to the fish person.

- When a weekend market was still prohibitively expensive, these might emerge. Imagine an output 500 years ago. There would be a center where someone traded different goods with explorers and so on. These were likely coastal towns.
- Why would these emerge? What additional transaction costs would they help reduce? Why coastal towns?
- Would there be any such locations inland? Why/why not?
- **Money.** Nearly all societies develop money to get around the double coincidence of wants problem.
 - How does money lower transaction costs? Think about this long and hard. There are many ways.
 - What could serve as money on our island?
 - Does the advent of money require that our islanders form a government? What are the costs or benefits of forming a government?
 - Probably after the economy gets large enough they will need a government to enforce contracts and adjudicate disputes. Again, think how these functions lower transaction costs in this island economy.

The Functions of Money

Money serves several functions once introduced

Medium of exchange

On our island economy, this is why they invented it. And it's what solves the double coincidence of wants.

Unit of account

Once invented and used, however, everyone starts keeping records in terms of money. So it becomes the "unit of account" that everyone uses. So, it harmonizes the way everyone counts stuff, hence allowing further comparisons. This lowers another transaction cost we hadn't thought of.

Wages and Labor Market expansion

Once the islanders have a unit of account, the input side of production becomes easier too. (A transaction cost that gets lowered that we might not even have noticed). A worker can now easily compare the costs and benefits of jobs based on which one pays the better wages.

How will wages be determined?

We saw earlier that $w = MPL = A$. This will still be true. But first we need to convert everything to currency terms. Let's assume this island economy calls their money, "dollars" and that they use the symbol \$ for accounting purposes.

The birth of prices

Once money is introduced, a new variable pops into existence in our economy, “the price” of something. We no longer have to always think about “the opportunity cost of good G in terms of H” and so on. I only need to know the prices and then I can compare apples to oranges, so to say.

The dimensions of a price are “dollars per good”. The price of a shirt is “dollars per shirt”. The price of a car is “dollars per car”. And so on.

Now I only need to know the Price of G, P_G , and the Price of H, P_H . These will be determined by market forces in the “output market”. For our islanders

Back to wages and the “input market”.

If I need to compare apples and oranges or G and H, I need the price. So, I multiply the price of G, P_G , by the quantity I want to consume, $P_G \cdot c_G$, for example. Then I'd know my total price for however many units of G I want to consume. This is the total market value of my consumption of G. I can then compare that with $P_H \cdot c_H$, the total market value of my consumption of H.

We do the same thing in production. What is the value of MPL or A for this industry? Answer: It's the market value at which the additional units produced get sold.

So, in the G-Industry, multiply A_G by P_G to get $A_G \cdot P_G$. What are the dimensions of this? (output of goods per hour)*(dollars per good). The q_G 's cancel leaving $(q_G/\text{hr}) \cdot (\$/q_G) = \$/\text{hr}$. Dollars per hour is a NOMINAL WAGE, W :

$$W = \text{MPL} \cdot P$$

In the G-sector it will be $W_G = \text{MPL}_G \cdot P_G$ and in the H-sector $W_H = \text{MPL}_H \cdot P_H$. You can check the dimensions to see it all works out.

To get the REAL WAGE, w , which is the “wage in terms of goods and services” instead of money, or, “the amount of goods and services your wage buys you”, you have to take the nominal wage and divide it by the price.

$$w = W/P$$

and, therefore, w still equals MPL since $W/P = \text{MPL}$.

Real Variables in a 2-Sector Economy

Our island economy, in its most basic form has two sectors, G and H. So each good will have a price. So, when the islanders calculate their real wages, they'll need to compare in terms of each good they can buy.

Workers in the G sector would compare their wages, W , against each price

- $w_G = W/P_G$

dimensions: $(\$/hr)/(\$/G) = (\$/hr)*(G/\$) = G/hr$ “how many G goods they can buy with an hour’s work”

- $w_H = W/P_H$

dimensions: $(\$/hr)/(\$/H) = (\$/hr)*(H/\$) = H/hr$ “how many H goods they can buy with an hour’s work”

Workers in the H sector would compare their wages, W' , against each price

- $w'_G = W'/P_G$

dimensions: $(\$/hr)/(\$/G) = (\$/hr)*(G/\$) = G/hr$ “how many G goods they can buy with an hour’s work”

- $w'_H = W'/P_H$

dimensions: $(\$/hr)/(\$/H) = (\$/hr)*(H/\$) = H/hr$ “how many H goods they can buy with an hour’s work”

Aggregate Macroeconomic Calculations

This makes 4 real wages to consider in just our tiny little economy. Once an economy gets complex enough, we just don’t want to have to calculate that many wages. The number grows exponentially.

Sometimes we will still break the economy into one or two groups, especially when we are interested in seeing how well each group is doing. For example, let H represent “high tech” workers and goods and G represent “low tech” workers and goods.

Then we could look at the wages of high tech workers and consider how well off they are if their wages are growing at X% while the price of goods in difference H and G industries grow at other percentages. This is often done to compare the well being of workers in different sectors affected by trade or different genders or education levels and so on.

HAT ALGEBRA GAMES with different wages and salaries (see Notes on Hat Algebra)

- Rewrite $W_G = MPL_G * P_G$ and $W_H = MPL_H * P_H$ in hats. Consider the effects of different growth rates in different variables.
- Could MPL_G and MPL_H change independently? Explain why or why not.

The Price Level as an Index

Generally we might just want to consider how much a wage buys “in general” in the economy. When we do that, we need some way to compare against prices in general.

With our simple economy, we can actually do the optimal thing and calculate a weighted average of prices where the “weights” reflect how much each person consumes of each good. It could be different for each individual.

In a complex society like the USA, the government tries to calculate a Consumer Price Index which does just that. They take sample “baskets of consumption goods” and figure out what the average American consumer consumes and in what proportions (20% of income goes to “housing”, 30% to “food”, etc.) and then averages prices in each category and tries to estimate an overall price level.

In our simple economy, most macroeconomists would model the Price Level, P , by assuming it has a “Cobb Douglas” form or a similar form called CES¹ which is beyond the scope of this course.

$$P = P_G^\alpha P_H^{1-\alpha}$$

Where α is between zero and one. This is also known as a convex combination. This is a way of combining these two prices into one “price level”. Note, converting this to hats yields:

$$\hat{P} = \alpha \hat{P}_G + (1 - \alpha) \hat{P}_H$$

The percentage change in the price level is called “inflation” and this formula “decomposes” inflation into the inflation of G prices and the inflation of H prices.

This formulation turns out to be helpful in analyzing international and open economies with different prices in different currencies since you can break up the “inflation” of a foreign price paid by domestic consumers into “exchange rate inflation” and “foreign good price inflation”.

Money as a Veil Part 1: The Classical Dichotomy

Once money is introduced and prices come into existence it is clear that individuals in the economy become concerned with the prices of the goods they sell relative to the prices of the goods they buy. This is a distinction between “real” and “nominal” variables. Breaking all macro variables into these two categories is “The Classical Dichotomy”.

Nominal variables are the currency amounts of a variable. For example, suppose the nominal wage in the hunting industry, W , is \$10/hour. This is nominal because it’s still in “dollars”.

A consumer in this economy will be interested in how much that \$10 buys in terms of both H and G goods. That is, they’ll be interested in the real wage in terms of H and real wage in terms of G. Once they know the prices of both goods, they can figure these things out, as we saw above, by dividing their nominal wage by the price of each good.

- $w'_G = W/P_G$

¹ CES stands for Constant Elasticity of Substitution. I’ll post some more advanced notes on this topic. For now, just google it if you are curious.

- $w'_H = W'/P_H$

Finally, if the consumer knows the general proportions in which they prefer to buy H and G, then they can even figure out an “aggregate real wage” for themselves. Suppose they purchase in general in a proportion of 50:50, H and G goods. Then the price level is:

$$P = P_G^{0.5} P_H^{0.5}$$

Once you know each price, plug it in to get the price level. Divide the nominal wage, W' , by that price level to find the real wage in terms of the aggregate price level.

All real and nominal variables work like this. In general you can divide a nominal variable by a price or the price level to convert it into a real variable. It's important to know what price and hence in what terms you are looking at your real variable.

Nominal versus Real Interest Rates

The only major exception is the real versus nominal interest rate. In that case you subtract the relevant inflation rate from the nominal interest rate to get the real interest rate. But this isn't as big an exception as you'd think.

Intuitively it's straight forward. The nominal interest rate is already in terms of “percentage change”. It is literally a rate of change from one period to the next. If you convert something to percentage changes, then you subtract them from each other and that's what happens here. It's just odd that there's no level-version of interest rates to see to make this obvious.

Try it with the real wage, $w = W/P$. If it were already in percentage changes (like an interest rate), then it would be $\hat{w} = \hat{W} - \hat{P}$ where “P hat” is the percentage change in the price level, aka “inflation”.

The nominal interest rate equals the real interest rate plus expected inflation. And the real is nominal minus expected inflation

$$i = r + \pi^e$$

$$r = i - \pi^e$$

where π^e denotes aggregate price level inflation.

Why *Expected* Inflation?

If you want to borrow money today for 1 year, what you care about is the inflation over the coming year, not inflation last year. So, borrower's care about inflation over the coming year. That is the inflation they *expect to see over the coming year*, not necessarily current inflation.

If someone wants to borrow money from you today for 1 year, what you care about is inflation over the coming year, not inflation last year. So, lender's care about the *inflation they expect to see over the coming year*.

It's easiest to see from the lender's perspective. Suppose someone borrows \$100 from you for 1 year at 5% interest. In 1 year, they repay you the \$100 plus interest of \$5, so \$105. What if

all the prices in the economy rose by 2% over that same time? Then while the nominal amount of money grew 5%, the real value grew by only 3%. So, your \$105 can only buy as many goods next year as \$103 can today. What if prices rose by 7%? Then the real value of your \$100 actually fell by 2%! So, you can buy less in a year than you can today! To avoid this, you need to be sure you accurately forecast the right *expected* inflation rate!!!

The Cost of the Veil

Money in this economy is basically “a veil” meaning it covers the real variables in the economy. Money itself is not of primary interest. In terms of the Classical Dichotomy, what we generally care about are REAL variables not NOMINAL and money is the fundamental nominal variable. It isn’t just “in terms of money/currency”, it is money/currency.

While this is generally true, don’t forget that money in this case was a social institution arising to minimize transaction costs. Without its existence, we wouldn’t get the same level of trade and the same degree of specialization and hence the same GDP output.

The difference, and the reason it’s a “veil” in terms of macro analysis is that it’s binary, 0 or 1, “on” or “off”. Once money exists, you get all the institutional transaction cost minimizing benefits. There’s no further benefit from more money or less money. IF anything, screwing up the money in an economy can lead to erosion of the transaction costs benefits. In hyperinflation economies, for example, real values become clouded and people bear really high transaction costs to use money because they have to transport it in trucks just to buy small items. And if money changes erratically, inflation isn’t predictable and we find that some people arbitrarily win and others lose. See the example of expected inflation.

So, while the existence of money has a huge positive effect, once it exists, the management of money is all about limiting any additional costs introduced into society because of money.

In some economies, the money was so poorly managed that they returned to bartering (mostly hyperinflation economies) while in other economies, when things get bad they just switch to using another country’s money (often called “dollarization” because countries with poorly managed money supplies just adopt the US dollar).

Final Institutional Considerations

Now that our economy has money, a final institutional question is “HOW”?

We won’t delve into the institutional details, but first think about options in our simple island economy.

- One person could become “the money guy”. Should they let there be multiple money people? Should they let them or even make them compete? Should it be exclusive to

one person? Will this affect GDP (yes, -1 L but the benefits of money outweigh the costs of -1 L).

- A private bank could be established and it could issue and manage all the money. Should they let there be multiple banks? Should they let them or even make them compete?
- Collectively the individuals could form a government and let it manage the money.

Historically all three have happened.

In small economies there was often a few local money lenders. This is easiest when money is a commodity (like gold) so they local money handlers don't have to worry about producing the currency.

In the US and the UK there were periods when there were just private banks issuing currency and competing with each other. In the US states issued currency for a while. The periods of banks issuing currency are called "free banking" arrangements and the aggregate quantity of money is market determined. I'm sure there are other historical examples. If you are interested google Prof. Lawrence White who wrote on free banking in the UK and related topics. Additionally you can look for Prof. Charles Calomiris who wrote about early banking structures in the USA. Finally, you can always google "free banking".

Most advanced economies today have a government determined money. And they usually allocate it all to a single "mega bank" called a "Central Bank" or a "National Bank". In the USA it's called "The Federal Reserve System" (actually a collection of regional mega banks with a central decision making body called the board of governors). In England it's the "Bank of England". In Japan, "the Bank of Japan". And so on.

Should it just be a free for all?

Think about COASE's Theory of the Firm. Under what conditions does it make sense to manage money through a single institution, multiple institutions or just a network of market arrangements? What is BitCoin?