Alternative Explanations for an Interest Rate Spread in Equilibrium

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Abstract

Credit market frictions, particularly asymmetric information, are often cited as the reason for why financial intermediaries charge a different rate of interest to borrowers than they pay out to savers. Exclusively for this reason, it is held that economic agents face a kinked budget constraint. This paper aims to reject the exclusivity of this view, arguing instead that if there is a financial intermediary, there should be different interest rates for depositors and borrowers even in the absence of credit market frictions. This is done on the basis of Austrian and neoclassical insights. Thus, whenever an economic model includes a financial intermediary, differential interest rates for depositors and borrowers should emerge, implying that the consumer's budget constraint should be kinked and Ricardian equivalence will not hold.

I. Introduction

Since the 1970s, asymmetric information has held a distinguished place in economic theory as one of the primary sources of market failure and as an important contribution to economics.[1] This is for good reason: it has led to promising analysis in a variety of other subfields.[2] For example, consider the standard analysis of credit market frictions, one of which is asymmetric information. Typically, this shows up when financial intermediaries cannot distinguish between borrowers who will default and those who will not. This, it is believed, is the fundamental explanation for the existence of an interest rate spread.

The present paper explores the veracity of this claim. I argue that while it is true that asymmetric information may exacerbate the difference between interest rates, it is not the exclusive cause of the spread. Instead, I argue that whenever a financial intermediary is present, there will be a difference between interest rates offered and charged regardless of credit market frictions.

Specifically, I argue that the introduction of a financial intermediary splits the loanable funds market in two, yielding separate, albeit closely related, loanable funds markets with related supply and demand curves. These curves have different shapes and elasticities, leading to a situation where the interest rates move together but may only coincide under special assumptions, e.g., if the financial intermediary operates at zero cost. In turn, this implies that indifference curve analysis should always include a kinked budget constraint for two-period models and that Ricardian equivalence will not hold whenever a financial intermediary is present.

This paper is organized as follows: Section II presents the case for asymmetric information as the cause of an interest rate spread. To provide a complete perspective, this is done by building up from a two-period model without a financial intermediary to an asymmetric information model with a financial intermediary typical of an intermediate macroeconomics textbook. In Section III, I fully present my argument, i.e., that separate interest rates could be expected to exist in equilibrium regardless of whether there are credit market frictions. I do this with four arguments, two of which are distinctly Austrian and two are neoclassical.

II. Asymmetric Information and Differential Interest Rates

Asymmetric information has been thoroughly examined and applied to multiple fields since Akerlof (1970) wrote his "lemons" paper. Since then, Stiglitz, Weiss, Williamson, and others have applied the theory to credit markets, finding that the friction causes equilibrium credit

[1] The arrival of asymmetric information as a prestigious subfield was signaled by the awarding of the 2001 Nobel Memorial Prize in Economic Sciences to Akerlof, Spence, and Stiglitz for their work in asymmetric information.
[2] Spence (1973) developed the signaling model, which has been theoretically and empirically applied to a critique of higher education by Caplan (2018). While asymmetric information has often been used as a cudgel against the free market, it has also been applied to government failure (see Anderson and Stair 2018).

rationing,[3] exacerbates adverse selection, and causes an interest rate differential to arise (Stiglitz and Weiss 1981). Williamson takes it further, finding that asymmetric information can lead to credit rationing "in spite of the absence of adverse selection and moral hazard" (1987, 144) and to the elimination of Ricardian equivalence (2016, 352).[4] However, the only important result for our discussion is that "this credit market friction then leads to differences between the interest rates at which consumers can lend and borrow" (Williamson 2016, 353).

To present their case most clearly, we will eschew the more advanced and formalistic models in favor of what would normally be presented in an intermediate microeconomics textbook.[5]

We will first consider a two-period model without a financial intermediary in which we examine a consumer's consumption-savings decision. Here, we have N consumers who can save or borrow, a government which can sell or buy bonds, and a credit market in equilibrium. In period one, consumers receive exogenous income y_1, pay lump sum taxes t_1, and save a sum s, which may be less than, greater than, or equal to zero.[6] This implies a current-period budget constraint of

$$c_1 + s = y_1 - t_1$$

Similar conditions apply in the second period, except that the consumer may pay back $s(1 + r)$ or receive that amount, depending on whether he is a lender or borrower. Hence the second period budget constraint is

$$c_2 = y_2 - t_2 + (1 + r)s$$

These conditions may be combined to yield the lifetime wealth budget constraint

$$c_1 + \frac{c_2}{1 + r} = we$$

From there, we can easily rewrite in slope-intercept form so that we can graph the budget constraint

$$c_2 = -(1 + r)c_1 + we(1 + r)$$

Consequently, the consumer has the following two-period budget constraint:

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[3] Stiglitz and Weiss write that "in equilibrium a loan market may be characterized by credit rationing" (1981, 393). Evidently, this refers to a mathematically based static equilibrium. It is not obvious whether this applies to the more dynamic Hayekian "pattern coordination" idea of equilibrium.

[4] Results such as these are generally used to prove that the first and second welfare theorems do not hold, implying that intervention in the market is necessary to maximize welfare. This is a not-so-subtle application of the Nirvana Fallacy (Demsetz 1969).

[5] The more advanced models are more powerful than what will be presented here, but they also severely impair clarity of presentation and analysis. We will draw from Williamson (2016).

[6] If $s < 0$, then the consumer is a borrower and he sells bonds. If $s > 0$, then he is a lender and he buys bonds. Here, one bond issued in the current period is a promise to pay $1 + r$ units of the consumption good in the future period, so that the real interest rate is r. In turn, this implies that the relative price of future consumption in terms of present consumption is $\frac{1}{1+r}$ (Williamson 2016, 309).

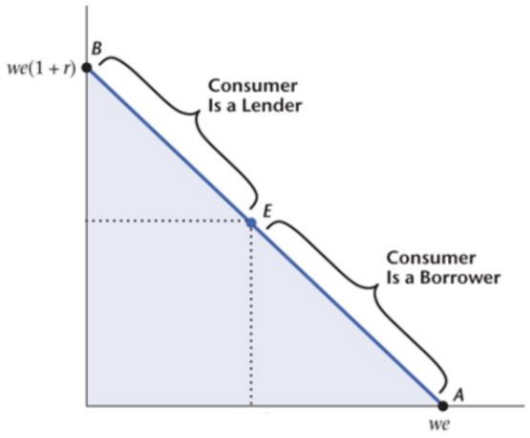

Figure 1 A Two-Period Budget Constraint

The vertical intercept is what could be consumed in the future period if the consumer saved all of his current-period income. The opposite extreme is given by the horizontal intercept, which shows what could be consumed if the consumer borrowed the maximum amount possible. Any bundle chosen between *BE* indicates the consumer is lender, and any bundle chosen between *EA* makes the consumer a borrower. The slope of the budget constraint is given by the prevailing rate of interest, however established. It follows that the budget constraint cannot be kinked.

The consumer chooses between consumption in the current-period and consumption in the future period. His choice is determined by a utility function $U(c_1, c_2)$ with convex preferences.[7] Optimizing over these conditions such that the budget constraint is satisfied, we graphically end up with a situation where the indifference curve is tangent to the budget constraint, i.e., when the marginal rate of substitution between current and future consumption is equal to the budget constraint:

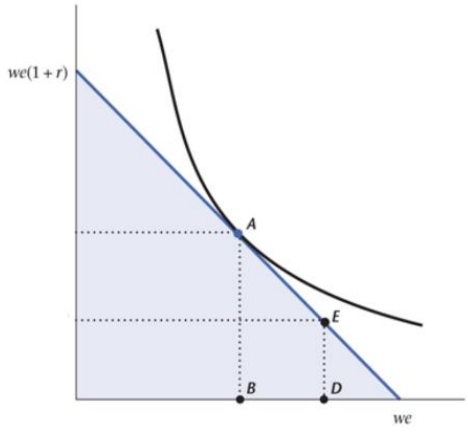

Figure 2 A Two Period Buget Constraint with Indifference Curve. Since A *is the point of tangency between the indifference curve and the budget constraint, it is the optimal consumption bundle.*

[7] An example of a utility function for this analysis would be $U(c_1, c_2) = \ln(c_1) + \beta \ln(c_2)$, where β is a discount factor. It is also assumed that preferences are monotonic, a diverse consumption bundle is preferred, and that current and future consumption are normal goods. This last condition means that consumption will be smoothed over time.

Also present in the model is a government which purchases G_1 consumption goods in the current period and G_2 consumption goods in the second period. These are funded by a mix of taxes and bonds depending on consumer preferences. In equilibrium, the credit market clears so that private saving equals public saving. Here, the important feature for us is the existence of a single interest rate.[8] This implies a budget constraint that is not kinked, perfect coordination between present and future markets, and Ricardian equivalence (Williamson 2016, 338).

Next, we add a financial intermediary and assume asymmetric information, while keeping the rest of what was demonstrated above. The financial intermediary market is perfectly competitive. In the primary market,[9] the bank borrows from depositors in the current period. Depositors lend a quantity q_1 to the bank and the bank pays back to the depositors a sum $Q_1(1 + r_1)$. In the secondary market, the bank takes its deposits in the current period and makes loans to borrowers. There are two types of borrowers. A certain percentage a are good borrowers, i.e., they will pay back their loans, while a percentage $1 - a$ are bad borrowers; they will default. Because there is asymmetric information, the bank cannot distinguish between borrowers who are good from those who are bad, but it does know the percentage of good borrowers.

We also assume that all good borrowers are identical and all bad borrowers change their behavior to *appear* the same as good borrowers. Consequently, all borrowers borrow an equivalent quantity q_2. In the second period, a percentage a of the total quantity Q_2 loans are paid back at a rate of $(1 + r_2)$. Hence the financial intermediary's profit is given by

$$\pi = aQ_2(1 + r_2) - Q_1(1 + r_1)$$

Since profits equal zero in equilibrium, the interest rate in the secondary market is given by

$$r_2 = \frac{1 + r_1}{a} - 1$$

Consequently, when $a \neq 1$, $r_2 > r_1$. As a result, the budget constraint will be kinked and Ricardian equivalence will not hold.

Intuitively, this makes sense. Depositors lend money to an institution which can be trusted. Banks lend money to a pool of borrowers, some of whom will default, though the bank does not know precisely which ones. The rate of interest will be pushed up until profits equal zero, which implies that the price of money in the secondary market will be higher than in the primary market because the financial intermediary is relatively less certain its funds will be recovered than depositors. One might think that this could provide an arbitrage opportunity for shrewd entrepreneurs, but the existence of asymmetric information puts an effective lower bound on the secondary market rate; it would be unprofitable to lower the interest rate since the expected revenue would be negative if the interest rates were equal. As a result, assuming the existence of a financial intermediary and this particular credit market friction, different interest rates will arise

[8] How meaningful this actually is depends on whether it is thought that a "natural" rate of interest would prevail in a multi-good economy. It is trivially true that a single rate of interest would emerge for a single homogeneous good.
[9] Henceforth, "primary market" refers to the exchanges between depositors and the financial intermediary, while "secondary market" refers to the exchanges between the financial intermediary and borrowers.

since banks are more trustworthy than the expected borrower of money. This also leads to kinked budget constraints since consumers can choose between the rates.

III. Multiple Interest Rates Without Credit Market Frictions

The purpose of this paper is not to challenge the asymmetric information doctrine, but to argue that there can be other causes of an interest rate gap.[10] Instead, I claim that the existence of an interest rate differential without asymmetric information can be demonstrated in at least four ways, two of which have Austrian foundations and two are more neoclassical.

As a preliminary matter, we must consider how best to demonstrate this. Of course, it is necessary to avoid asymmetric information as an assumption, though it is not obvious how to do this. Perfect information suggests itself, but that raises the question of why a financial intermediary would be needed. After all, if there is perfect information, then there is no need to coordinate between borrowers and savers since the agents will be aware of one another and make trades automatically, in which case a financial intermediary would be superfluous.[11]

The financial intermediary must fulfill some social function because it would not exist otherwise; there must be some problem which it must solve. This cannot occur under perfect information nor, by the parameters of this paper, can it be asymmetric information. Instead, we suggest that the proper assumption is "perfectly imperfect" information, i.e., would-be savers are unaware of would-be borrowers and vice versa, though knowledge of intratemporal markets is perfect and all other conditions for utility maximization are met.[12] The only barrier between savers and borrowers is then information. With this removed by the financial intermediary, the credit market can operate without frictions.[13] Hence the financial intermediary has some role to play; it

[10] See DiLorenzo (2011) for a theoretical challenge and reinterpretation of the problem, Tabarrok and Cowen (2015) on why asymmetric information is increasingly irrelevant, and Demsetz (1969) for a critique of market failure which may likewise be applied to asymmetric information. Although asymmetric information is not explicitly addressed, it may also be worthwhile to review a text along the lines of Kirzner (1973) for a view of how the market comes to eliminate information differentials.

[11] This suggests a separate possibility, i.e., that financial intermediaries can only arise in response to the existence of asymmetric information. This is because a firm only arises to solve an existing coordination problem, something which is not possible with perfect information and automatic equilibration. Here, we suggest instead that the financial intermediary arises to solve an imperfect information problem and not necessarily an asymmetric information problem.

[12] In a sense, this is an equilibrium because the opposing forces of intertemporal supply and demand are perfectly balanced since no forces exist—only frustrated inclinations with no outlet. We could also postulate a less stringent "perfectly imperfect" information condition. This would be the case where there some intertemporal exchanges take place, but not all possible. In short, there must be some coordinating function for the financial intermediary to fulfill and this can only occur if not all possible trades happen without it.

[13] Frictions prevent trade from being executed smoothly. With the financial intermediary, this is eliminated.

coordinates plans through intertemporal information transmission and allocation of resources such that equilibrium on the intertemporal market is achieved.[14,15]

Austrian Methods

1. Different Goods in Different Markets

Despite potential arguments to the contrary, the subjectivist paradigm defines the Austrian school to the exclusion of all others (Grinder 1977, 3-6). Precisely what that means in the context of the social sciences, where data must be interpreted in the context of human action and inconstant relations, is defined by Hayek: "Data mean[s] those facts, and only those facts, which were present in the mind of the acting person, and only this subjective interpretation of the term 'datum made those propositions necessary truths" (Hayek 1948, 39). Hence, when considering whether the objective data, i.e., externally given facts such as the existence of a cantaloupe, constitute a basis for action, it is necessary to defer to the interpretation of the economic subject.

In particular, it is meaningless to conduct a taxonomy of physical objects into the categories of economic "goods" and "bads" without reference to the subjective data. Further consideration must be given to whether multiple physical objects are treated as perfect substitutes or as heterogeneous objects from the subject's perspective. As Professor Murphy points out, whether external matter may be classified as an economic good is entirely dependent on whether agents treat it as such, and not on any physical characteristics (Murphy 2003, 142).

Indeed, two physically dissimilar objects may be treated as homogeneous, and two physically similar goods may be treated as heterogeneous since classification is dependent on the subject.[16] This is vital since whether a good is homogeneous with respect to other goods determines if prices for the good will tend toward uniformity (Rothbard 2009, 617). This has special relevance

[14] Although it is true that this meets the dictionary definition of asymmetric information, where it is defined as "a situation where economic agents do not all have the same information," (Black 2009, 15) it should be clear that this type of imperfect information is of an entirely different kind than the one discussed in the model above. In the first case, some borrowers are unable to pay back loans and the financial intermediary cannot identify which ones, whereas in this case loans will certainly be paid back and the financial intermediary is only necessary to coordinate between borrowers and savers.

[15] It is evident that, depending on the interpretation of the model, the financial intermediary should be interpreted as solving the problems a firm must solve: "The firm is not only a solution to the problem of cost, as many economists have already shown, but also a solution to a problem of true ignorance and coordination" (Sautet 2000, 83). Under our assumptions, the financial intermediary must solve the problem of "ignorance and coordination" because savers and borrowers are ignorant of each other and hence uncoordinated. However, it is not immediately clear whether the financial intermediary is solving a problem related to cost since the proximate issue is ignorance, not that transactions are costly. But it seems likely that part of the reason there is ignorance is that it is costly to acquire the information necessary to unburden from the weight of ignorance. After all, it would be completely realistic to postulate that some costs of discovery would exist in the absence of the financial intermediary, but the economies of scale brought by the financial intermediary allow for it to reduce transaction costs to minimal levels. However, much of this discussion goes beyond the scope of this paper.

[16] Of course, it is highly likely that physically similar goods will be treated as homogeneous, but we can imagine situations where that will not be the case. For example, a football used in an NFL game may be physically identical to one used by college students in the park, but they likely would not sell for the same price on the used ball market since they almost certainly would not be considered homogeneous goods by market participants. Indeed, they could not even be said to be on the same market.

for our problem since, if loans on the primary market are the same good as loans on the secondary market, then the two interest rates should be the same in equilibrium.

Experience shows that most physically similar goods will indeed be perceived as homogeneous, but that does not in itself prove homogeneity. Let us consider a relevant example. Will oranges in Alaska be considered economically homogeneous with oranges in Florida, that is, will they command the same price? Assuming similar demand conditions, prices will tend to be higher in Anchorage than Tampa Bay since we can reasonably expect supply to be lower in Alaska. Since transportation and storage costs are higher in Anchorage, greater revenue is required to make zero profit, leading to a lower supply ceteris paribus. This is a relatively straightforward proposition: "a difference in position with respect to consumers makes a physically identical thing a different good" and hence puts it in a different market (Rothbard 2009, 620). The price of oranges in Alaska will tend to be the price of oranges in Florida plus additional transportation and storage costs.[17]

Of course, the relevance to our particular situation is that loans on the primary market are not the same good as loans on the secondary market and thus will not command the same price. Depositors supply loans on the primary market, financial intermediaries demand them. Then, on the secondary market, financial intermediaries supply loans and borrowers demand them. Hence there is both a *temporal* and a *structural* component to the heterogeneity. Take one of Rothbard's examples:

> Suppose, for example, that wheat is grown in Kansas and that the bulk of the consumers of the wheat are in New York. The wheat in Kansas, even when ready for shipment, is not the same good as the wheat in New York. It may be the same physical-chemical bundle, but it is not the same *good* vis-à-vis its objective use-value to the consumers. In short, wheat in Kansas is a higher-stage capital good than wheat in New York…The price of wheat in Kansas will tend to equal the price of wheat in New York *minus* the necessary costs of transport from Kansas to New York" (2009, 618).

Loans on the primary market are in the same position as Rothbard's wheat in Kansas. Without the financial intermediary to coordinate the credit market, the would-be loans sit unborrowed under the mattresses of would-be lenders. But the financial intermediary plays an analogous role to the freight company in the wheat example, meaning that it deserves its own place in the structure of production. Likewise, it must also incur costs; if it did not, then loans would automatically flow from borrowers to lenders in its absence and there would be no reason for its existence. Hence, the price of loans in the primary market will tend to equal the price of loans in the secondary market *minus* the cost of coordinating the quantity of loans from the primary to the secondary market.[18]

[17] We have to tread cautiously in this territory. Since it is unlikely that consumers will agree on which goods are the same, we may end up falling into a nihilistic, subjectivist trap where are completely unable to talk about economics since we end up saying that *all* goods are heterogeneous with respect to all other goods.
[18] We explore later why there must be a cost.

But they are also temporally different goods. To the lender, loans represent consumption in the future period, whereas to the borrower, loans are present consumption. If we assume two heterogeneous classes of people with internal homogeneity, one class lenders and one class borrowers, then they are also two classes of agents with different value scales and different time preferences. The only commonality is the coordinating financial intermediary.[19] Since the financial intermediary must have the same time preference in both the secondary and the primary market, but the borrower and lender by definition do not, then the interest rate must differ from one market to the other.[20]

2. Rothbard's Structure of Production

Consider the model in the context of the Rothbardian structure of production. We will need to make some alterations in order to make this possible. First, suppose we have an infinite period model in which there are two types of economic agents: borrowers and lenders (no government). Once more, all agents receive some exogenous income y_1 in period one and y_n in period n. There is no need for this income to be the same in all periods or for all consumers. Further, suppose there is no production except for the contribution of the financial intermediary.

Now, let us set that aside for the moment and consider Rothbardian production theory. Its essence is found in the all-pervasive nature of interest, which coordinates production across time.[21] It is easy enough to identify how the rate of interest is determined: in the market for the exchange of present goods against future goods, i.e., the time market (Rothbard 2009, 375). Since the interest rate is the price of a future good in terms of present goods, it functions as any other market price does. Just as the market process serves to smooth out irregularities in prices and approach a steady state where supply roughly equilibrates with demand and yield a common price, the same occurs in the time market.

The time market itself has two main components: a consumer's loan market and a market for factors of production. We need merely observe that in this market the lender loans money to the borrower in exchange for a claim to a future good, generally money. The future good is almost always a higher quantity of money than the present good—how much higher is determined by the prevailing rate of interest, which is itself determined by time preference.

In Rothbard's structure of production, producers purchase "a certain amount of net produce, discounted to the *present* value of that produce" (Rothbard 2009, 377). Here, interest—seen as the ratio between the price of present goods to future goods—is paid to capitalists who receive "an income representing the agio of present as compared to future goods" (Rothbard 2009, 374). As this permeates the whole structure of production, interest payments are advanced to capitalists

[19] If this is troubling, then perhaps it would be useful to think of the interest rate paid to lenders as a payment for storing money at the bank rather than a payment on a loan.
[20] See Rothbard (2009, 739-745) for an analysis of multiform pricing, of which this may be one particular instance.
[21] Rothbard, following Mises, writes as if there will be a single rate of interest in equilibrium. However, it has been noted that there are analytical problems with this by non-Austrians like Sraffa (1932) and Austrians such as Murphy (2003, 2010). These considerations go beyond the scope of this paper, but should be noted.

who produce goods and services in all stages of production as a payment for transforming future goods into present goods.

Now, what happens if we try to incorporate our financial intermediary model into this framework?[22] Think of it in the following way. In period one, banks purchase funds from lenders with the promise to pay that quantity back multiplied by some rate of interest. This is the equivalent of a second-order good, i.e., a good removed by one stage from consumption. Over the course of the next period, the bank sells a first-order consumption good to borrowers, i.e., an equilibrium quantity of funds. Throughout, the financial intermediary plays a completely analogous role to that of the supermarket, which buys materials from a wholesaler (lenders) and sells current consumption goods to consumers (borrowers) while also playing an entrepreneurial role by discovering borrowers and alerting them that the financial intermediary is selling loans.[23] Hence, it should receive an interest payment within Rothbard's structure of production because it plays an intermediary role within the structure.

This seems to present some difficulty because there is a finite amount of resources circulating through the financial intermediary. Consider a numerical example. Suppose the prevailing rate of interest is 5%. The bank purchases 100 units from lenders in period one and then, in period two, sells those 100 units to a group of borrowers.[24] In the next period, those borrowers pay back the financial intermediary 105 units, which then must go to the depositors. Clearly, this presents a problem for Rothbardian analysis because it would suggest that the intermediary firm, which plays a productive role, should receive an interest payment, but that is not possible when the interest rate is uniform; the firm receives nothing. Consequently, in this particular case, the Rothbardian must choose to hold on to a uniform interest rate or structure of production theory.[25] Here, it would seem to make more sense to hold on to production theory; else, there is no reason for an intermediary to exist, resulting in few or no intertemporal transactions taking place. As a result, it seems that differential rates must emerge between the primary and secondary market to support production theory.

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[22] This is likely permissible in the Rothbardian system because he writes that "borrowers of savings for production loans are not independent forces on the time market, but rather are completely dependent on the interest agio between present and future goods as determined in the production system" (Rothbard 2009, 379). By implication, this suggests that the consumers' loan market *is* independent of the production market. Hence, even though there is no production except for the financial intermediary's services, we may proceed.

[23] There are two major problems with this analysis. First, the assumptions are highly restrictive. Second, Rothbard himself distinguishes clearly between the production structure and the consumer loan market (2009, 390). However, it is not obvious within the context of this model whether that is a fair distinction. Indeed, this may suggest that the services produced by the financial intermediary should be considered within the production structure. The financial intermediary produces a service for both borrowers and lenders in reverse directions which takes time across periods. Rothbard's analysis at least suggests that the possibility of an interest return to the financial intermediary should be considered.

[24] We assume, completely unrealistically and impermissibly, that the financial intermediary has no costs. This is an impossibility for reasons to be discussed below. However, it is something we must assume here to demonstrate an essential point.

[25] Indeed, banking activity becomes problematic in this context because the above result suggests that there can be no revenue for the financial intermediary. This seems to suggest that it sprang into being without cost and operates without cost, two assumptions which are impermissible.

Neoclassical Methods

1. The Financial Intermediary's Profit Function

A separate approach is to alter the profit function of the financial intermediary so that it reflects costs besides interest payments to depositors. It may be valid to assume that there are no costs for the purposes of simplification, but a separate argument could be made that proper analysis of the financial intermediary must include costs. In economics, some assumptions may be completely unrealistic and necessarily so—assuming perfect information or a frictionless credit market is necessary for making observations and deducing the effects of change, as well as building up systems from the simple to the complex. But no assumption should be made that assumes away what equilibrium economics seeks to explain, i.e., the allocation of scarce resources.[26] Necessarily, this implies that cost must be accounted for in all cases when the costs involved are critical for analyzing the economic model. Thus, when analyzing a firm, it is impermissible to assume that the firm has no costs, or to assume away certain costs, which is exactly what the asymmetric information model does. Here, it is necessary to treat the financial intermediary as a firm with costs because otherwise we fail to approach the problem in an economically significant way.[27]

A full account of costs suggests that two changes must be made to the profit function. First, there must be some term which accounts for fixed costs, k. Second, there must be two additional variable cost functions added to the profit function, one which changes as a function of changes in savings deposits, and another which changes as a function of changes in loans taken out by borrowers. These will be given by $v(q_1)$ and $v(q_2)$.[28] Hence, we have the following cost function:

$$C(q_1, q_2) = q_1(1 + r_1) + v(q_1) + v(q_2) + k$$

With revenue given by $q_2(1 + r_2)$, we have the profit function as follows:

$$\pi = q_2(1 + r_2) - [q_1(1 + r_1) + v(q_1) + v(q_2) + k]$$

Since profits equal zero in equilibrium, we can isolate r_2 to find that

$$r_2 = \frac{q_1(1 + r_1) + v(q_1) + v(q_2) + k}{q_2} - 1$$

[26] It is recognized that allocation of resources is actually a secondary economic problem which is only solved after dispersed knowledge is discovered (Sautet 2000, 13).

[27] It also makes sense to include costs beyond repayment of loans because otherwise there would be no reason for the financial intermediary to exist. If transactions occur costlessly, then it is easy for borrowers and savers to discover each other even assuming initial ignorance, which would imply there is then no role for the firm in equilibrium (Coase 1937).

[28] Because equilibrium is assumed, costs are known (Vaughn 1980, 706).

Thus, we discover that $r_2 = r_1$ if and only if $q_2 = q_1$ and there are no costs, i.e., $v(q_1) + v(q_2) + k = 0$.[29] This would be a curious situation since it would require the financial intermediary to conduct its services entirely without cost. But then, why would the firm exist in the first place if transfers are costless and lenders can instantaneously discover borrowers who will borrow at exactly the correct rate and vice versa? How would it come into existence? Perhaps we can postulate that it was gifted exogenously and so there are no fixed costs, but that does not explain why there would not be any additional marginal costs. Hence, we are forced to conclude that, unless we make increasingly ridiculous assumptions, the rate of interest paid to depositors will not be the same as the rate charged to borrowers.[30]

2. Analysis of the Elasticity of Supply and Demand Curves

Here, we lean heavily on the idea that the primary and secondary markets are separate aspects of the credit market. This is defensible since in the primary market, the financial intermediary demands, whereas in the secondary market it supplies—in both cases, to different classes of consumers. Likewise, the suppliers in the primary market and the demanders in the secondary market are different people with different value scales. This disaggregation into two markets is particularly useful since it allows us to analyze behavior that otherwise would be overlooked.

Explicit in the disaggregation of the credit market is the notion that there are separate supply and demand curves in each market with different shapes and contours. Of course, it is true that the primary market is closely related to the secondary market. After all, the financial intermediary's demand for loanable funds in the former is closely linked to and to a large extent is derived from borrowers' demand for loanable funds in the latter. This is equally true in the sense that the demand for highly specific factors of production is derived from the demand for the corresponding output produced by those factors. Evidently, supply would be closely related as well. The quantity supplied of loanable funds in the secondary market is bounded above by the quantity supplied in the primary market.[31]

Next, we must consider whether these curves will share shapes and coincide in the same place. Preliminarily at least, the answer is no. In the first place, we cannot expect the elasticities to be the same. The elasticity of supply in the primary market must be greater than the elasticity of supply in the secondary market. In the primary market, a consumer chooses whether to supply a quantity of a good for present or future consumption, whereas in the secondary market, the financial intermediary has a stock of loanable funds it acquired from its interactions on the primary market which can be used for only one purpose. Consequently, elasticity of supply will

[29] We can think of a few possible costs, even in this simplified model, mainly related to increasing costs of transmission, storage, and discovery. If we alter our assumptions to allow for endogenous income, then it would make sense to include labor costs as well.

[30] The weakness of the neoclassical approach is illustrated by what was done above. If all we have to do is change a minor assumption to radically alter the implications of the model, then the analytical system probably is not very strong.

[31] Here, we abstract away from fractional reserve banking and assume that when lenders loan money to the financial intermediary, they do so as an investment, not merely as a means of storing money for the second period.

be relatively greater in the primary market since there are more competing uses for the loanable funds in that market.[32]

It is also likely that the demand curve in the primary market, i.e., the financial intermediary's demand for loanable funds, will be relatively inelastic, but not perfectly inelastic.[33] Even if we accept the supply curve in the secondary market to be perfectly inelastic and the demand curve to approach nearly perfect inelasticity in the primary market, there is little reason to believe that the elasticities of the remaining curves will be such that any shift in one market will lead to a perfectly corresponding shift in the other. Consequently, any shift in one market will likely lead to a shift in another which causes interest rates to move to a different degree, even assuming initial correspondence.

Suppose there is a demand shock. Demand shifts right in the secondary market, leaving quantity unaltered, but also shifts demand right in the primary market. As a consequence, both the interest rate and the quantity supplied increase. The financial intermediary transmits this information to the secondary market, resulting in a rightward shift of the perfectly inelastic supply curve, implying that the interest rate increases to a greater degree and the quantity increases as well (bounded above by the quantity supplied in the primary market—how close they are is dependent on the financial intermediary's costs).[34]

For the sake of argument, suppose the supply and demand curves in each market are initially situated such that the rate of interest is the same in both markets. What happens if there is a supply or demand shock from either side?[35] In either case, since the elasticities of supply are different and the elasticities of demand are unlikely to offset that difference, the rate of interest will shift to a greater extent in one market than the other.

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[32] Indeed, we can go so far as to speculate that the supply curve in the secondary market will be perfectly inelastic for the same reason a football stadium's supply of tickets will be perfectly inelastic: they are selling an existing stock rather than an alterable flow and no reservation demand exists (Samuelson and Nordhaus 2010, 72). The financial intermediary's acquisition of funds in the primary market must occur temporally before it is able to supply funds in the secondary market. Hence it has a stock of loanable funds which cannot be altered within given time constraints.

[33] A vertical demand curve would seem to imply a total indifference to cost considerations and is not supported by economic theory as a viable concept (Mises 1998, 92-98; Rothbard 2009, 21-33).

[34] Our only constraint is that the interest rate in the secondary market must be greater than or equal to the rate in the primary market. If this does not hold, then it will be impossible for the financial intermediary to break even. In the problematic situation where demand decreases first in the secondary market and causes r_2 to fall below r_1, the transmission mechanism must then go something like this: the financial intermediary decreases demand in the primary market, which causes r_1 to fall, but to a lesser extent than r_2 such that $r_2 < r_1$. In that case, the quantity supplied in the primary market also decreases (but since supply is perfectly inelastic in the secondary market, there was no shift in quantity there). Consequently, supply shifts left in the secondary market to the extent that $r_2 > r_1$ and $q_2 < q_1$. As the financial intermediary is assumed to discover lenders and borrowers and transmit information perfectly efficiently, this occurs instantaneously.

[35] Strictly speaking, the initial shock can only come from the supply side of the primary market or the demand side of the secondary market; the financial intermediary cannot initiate a shift. Further, for reasons mentioned in earlier subsections, it is highly unlikely the interest rates could coincide initially since that would imply the financial intermediary is taking a loss.

Implications

Assuming any of the above arguments are correct, two important conclusions immediately follow. First, whenever a financial intermediary is introduced, a kinked budget constraint should be drawn when doing indifference curve analysis regardless of available information. Second, and as a partial consequence of the first, Ricardian equivalence can never hold when there is a financial intermediary.

1. Kinked Budget Constraint

The slope of the budget constraint is determined by the rate of interest. Since there are two interest rates depending on whether one borrows or lends, the budget constraint will be kinked. One can think of it most easily as a consumer facing two intersecting budget constraints, the slope of one given by r_2, the interest rate for borrowers, and the slope of the other given by r_1, the interest rate paid out to lenders. The kink is at the endowment point, where the consumer neither borrows nor lends. This is given by the following figure:

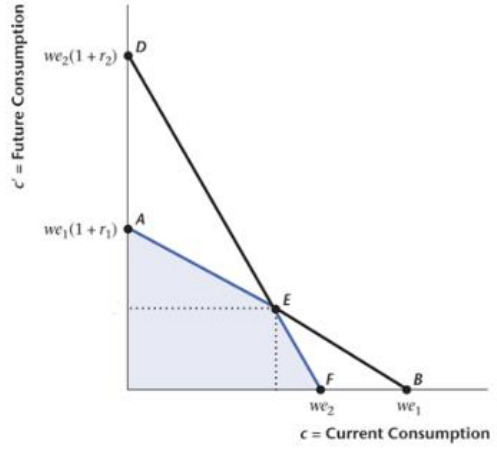

Figure 3 A Consumer Facing Different Borrowing and Lending Rates

Consequently, any models with a financial intermediary should include a kinked budget constraint.

2. Ricardian Equivalence

Ricardian equivalence holds when a change in the timing of taxes is neutral, that is, changes in taxes are exactly offset by future changes and do not affect either the interest rate or consumption behavior (Williamson 2016, 337). Put more simply, it is the notion that consumers anticipate the future, so they know that if tax cuts are financed by government borrowing, then taxes will rise again in the future. As a consequence, lifetime wealth is unchanged since consumers will smooth consumption across periods to pay for the tax increase, which also implies that tax cuts have no effect on aggregate demand.[36]

[36] For applications of Ricardian equivalence to Keynesian economics see Barro (1974) and Buchanan and Wagner (2000, 138-149). It is clear that if Ricardian equivalence holds, then fiscal policy is ineffective. However, the conditions are restrictive.

There are several key assumptions for Ricardian equivalence, one of which is that "there is a perfect credit market, in the sense that consumers can borrow or lend as much as they please, subject to their lifetime budget constraints, and *they can borrow and lend at the same interest rate* [emphasis added]" (Williamson 2016, 342). If our arguments are correct, then it must be the case that Ricardian equivalence will not hold because consumers do not borrow and lend at the same interest rate. This implies that fiscal policy will be effective (Williamson 2016, 356).

IV. Conclusion

Using results generated from distinctly Austrian and neoclassical sources, we have come up with four ways of establishing that multiple interest rates will exist in equilibrium with a financial intermediary regardless of the type of asymmetric information typically postulated by mainstream models. This is in contradiction to the generally accepted result. However, this does not mean that asymmetric information has no effect on differential interest rates. To the contrary, Stiglitz and Williamson are correct that asymmetric information will have an effect on differential rates. I simply argue that asymmetric information cannot be the sole originating cause of this differential.

Our results imply two conclusions for mainstream theory and prompt Austrians to consider two more. If our results our correct, then mainstream theorists will have to start drawing kinked budget constraints whenever a financial intermediary is included in the model. Further, whenever the financial intermediary is introduced, it must be accepted that Ricardian equivalence will cease to hold because the budget constraint is kinked. Additionally, Austrians must seriously consider how financial intermediaries fit into the structure of production. Money plays an outsized role in Austrian theory, so it would be strange if the money-generating institutions were ignored in their role as *firms*. Finally, Austrians must consider whether it is necessary to drop the evenly rotating economy and its uniform rate of interest as Murphy suggested (2003, 2010) and our results further prompt.

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