Islamic Studies 63:2 (2024) pp. 241–253
https://doi.org/10.52541/isiri.v63i2.2847

A Probable Reason for Qur'ānic Prohibition of *Ribā*: Dissimilarity of Price and Interest Rate as Equilibrating Variables

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Abstract

*The Qur'ān bans interest (*ribā*) and declares its dissimilarity with price in commodity trading. This paper provides a numerical explanation for this dissimilarity. It argues that calculating accrued interest for any loan requires information about the interest rate and compounding period. The compounding period is generally not stated explicitly; rather, it is inferred from the repayment schedule of a loan and bond. For a given principal and interest rate, the interest amount changes in response to any change in the compounding period. Alternatively, for any timeline to repay a prescribed amount of loan more than once a year, three different rates are defined. These are nominal interest rate, internal rate of return, and annual percentage rate. Since various participants in the loanable funds market concentrate on different rates and the ranking of alternative loan options concerning these rates may be contradictory, the law of one interest rate with respect to any one of these three rates is highly implausible if not impossible to prevail in the loanable funds market.*

Keywords

interest, *ribā*, loan market, goods market.

1. Introduction

The objective of this paper is to understand the Qur'ānic verdict of dissimilarity of interest and price. The Qur'ānic verse 2:275 is translated, in economic terminology, as the following: "People who deal with the interest-based loaning claim that interest rate plays the same role in loanable funds market as does price in commodity trading. But Allah rejects their claim and declares trading as permissible and interest rate as impermissible." It indicates that the Qur'ān denies the equilibrating variable role of interest rate and approves that of price. Contrary to it,

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all textbooks of economics[1] show interest rate as the equilibrating variable in loanable funds and bond markets and the same was the argument of the pagans of Mecca, fourteen centuries ago, for rejecting the Qur'ānic prohibition of *ribā*. Similarly, previous research on *ribā* or interest rate has not challenged the equilibrating role of interest rate; rather, its emphasis has been on exploring the side effects of interest-based loaning. For example, mainstream writers of Islamic economics argue that interest-based loaning leads to unfair distribution of actual profit of underlying investment projects among its lenders and borrowers-cum-executors. Liberal jurists are of the view that it is only usury or excessive rate of interest, which is charged on loans for dire consumption needs, that is prohibited in the Qur'ān. They justify the prohibition of usury because of its exploitative nature but without questioning its equilibrating role. According to them, the interest rate charged in the modern banking system emerged centuries after the Qur'ānic prohibition of *ribā*. They endorse the market-clearing role of interest rate and thus consider it inevitable for the allocative efficiency of given financial capital. On the same lines, Iqbal (2010) and Iqbal and Shah (2019), accepting the equilibrating role of interest rate, prove that interest-based loaning generates a negative externality in the form of adding financial and bankruptcy risk with the unavoidable investment risk of the underlying project.[2]

This is pertinent to mention that we did not find such a contextual debate about *ribā* in the classical Islamic literature. However, the absence of such a debate in the literature produced by classical Muslim jurists might be due to the then non-existence of economics as a separate discipline of knowledge. We are of the view that the analytical tools of economics such as the current concept of equilibrium of demand and supply emerged centuries after the era of classical jurists. Therefore, the absence of such discussion in the work of Muslim jurists is quite understandable. Hence, we consider it an opportunity and gap which we want to fill. We are of the view that the Qur'ān does not recognize the equilibrating role of interest rates in the loanable funds market. On the other hand, the Qur'ān recognizes the equilibrating role of price in the goods market. But to our knowledge, this contrast of interest rate and

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[1] For example, see Fredrick S. Mishkin, *The Economics of Money, Banking, and Financial Markets*, 5th ed. (New York: Pearson, 2019) and Mishkin and Stanley G. Eakins, *Financial Markets and Institutions*, 12th ed. (New Delhi: Pearson, 2019).

[2] Muhammad Mazhar Iqbal, "Prohibition of Interest and Economic Rationality," *Arab Law Quarterly* 24 (2010): 293-308; Iqbal and Anwar Shah, "Economic Rationale of the Prohibition of Interest: A New Aspect," *Islamic Studies* 58, no. 4 (2019): 503-17.

price is missing in the available literature, where the focus remained on highlighting the side effects of interest-based loaning. Therefore, this paper sheds light on this missing aspect and argues that the Qur'ān does not approve similarity of interest rate and price with regard to their equilibrating roles in loanable funds and commodity markets respectively.

The concept of interest rate though appears simple but is very complex in practice. Most people believe that the interest amount on any loan can be calculated if the nominal rate is given. In reality, this is not the case as in addition to the nominal interest rate, information about the compounding period for the principal must be known before such calculation of the interest amount. The issue is that the compounding period is usually not stated explicitly in loan contracts. Rather, the timeline of loan repayments is given, and the compounding period is inferred from it. Theoretically, whether a lender specifies the compounding period or sets the schedule for repayments of accrued interest, the total interest amount for a year turns out to be equal to or greater than the amount calculated using the nominal interest rate as illustrated in section four of this paper.

For example, a timeline having more than one repayment within a year for a one-year loan will lead to three different rates: 1) the nominal or stated interest rate; 2) the internal rate of return or yield to maturity; 3) and the annual percentage rate or effective interest rate. The nominal interest rate may roughly be defined as the total amount paid in addition to the principal over a year, expressed as a percentage of the principal. The internal rate of return (IRR) is defined as the discount rate which equates the present value of loan repayments to the amount of the loan. The annual percentage rate (APR) is defined as loan repayments within a year accumulated at the nominal interest rate till the year's end and then their sum plus the principal amount expressed as a percentage of the loan amount.[3]

Which one out of these three rates plays the role of equilibrating rate in the loanable funds market is still under debate. The lack of consensus on any rate as an equilibrating rate makes none of these three rates a strong candidate for *the* equilibrating rate in the loanable funds market. Thus, interest rates in the loanable funds market and prices in the goods market are different. There is consensus on the equilibrating

[3] For an understanding of IRR and APR, see Teresa Bradley and Paul Patton, *Essential Mathematics for Business and Economics*, 2nd ed. (New York: John Wiley, 2002), ch. 5 and Richard A. Brealey, Stewart C. Myers, and Alan J. Marcus, *Fundamentals of Corporate Finance* (New York: McGraw-Hill, 2010), ch. 8 and ch. 21 respectively.

role of price in the goods market but there is no consensus on the equilibrating role of interest rate in the loanable funds market.

The rest of this paper is organized as follows. Section two illustrates the complexity of interest rate calculation by comparing three different formulas; one without compounding, the other with discrete (annual) compounding, and the third with continuous compounding. Section three illustrates the multiplicity of interest rates attributed to more than one repayment within a year for a given loan. Section four highlights the dissimilarity between the interest rate and the price of a commodity. Section five concludes the paper and discusses some policy recommendations.

2. An Appraisal of Earlier Reasons for Prohibition of *Ribā*[4]

Earlier reasons to justify the Qur'ānic prohibition of *ribā* can be lumped under two main headings. One is that *ribā* is used by rich lenders to exploit poor borrowers.[5] The other is that the legitimacy of *ribā* results in the unfair distribution of ex-post profit of a commercial project among lenders and borrowers-cum-executors of the project.[6] The first view is supported by a minority of Muslim jurists. They argue that the main reason for lending and borrowing at the time of the revelation of the Qur'ān was for consumption needs such as medicine, food and dowry. Poor people had to borrow money from rich people to meet their basic and unavoidable consumption needs. Rich people used to lend money at high interest rates along with harsh terms and conditions such as enslavement of the borrower or doubling of interest amount if not paid on time. Supporters of this view translate *ribā* as usury and consider it a relic of the past. They argue that the interest rate charged by banks is different from usury. There is no element of exploitation in the case of bank interest as it is decided upon by the free will of lenders and borrowers. Since bank lending is mostly for commercial purposes, bank

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[4] The paper provides a discussion in the context of Islam. Future research can explain the state of interest in other Abrahamic religions, Hinduism, Buddhism etc. and how they deal with price and interest rates in such circumstances.

[5] For example, see Chibli Mallat, "Tantawi on Banking Operations in Egypt," in *Islamic Legal Interpretation: Muftis and Their Fatwas*, ed. Muhammad Khalid Masud, Brinkley Messick, and David S. Powers (Cambridge, MA: Harvard University Press, 1996), 286-96.

[6] For example, see Muhammad Umar Chapra, "The Nature of Riba in Islam," *Hamdard Islamicus* 7, no 1 (1984): 3-24; Muhammad Ayub, "What is Riba?" *Journal of Islamic Banking and Finance* 13, no. 1 (1996): 7-24; Abdul Rahim Abdul Rahman, "Islamic Banking and Finance: Between Ideals and Realities," *IIUM Journal of Economics and Management* 15, no. 2 (2007): 123-41; Zamir Iqbal and Abbas Mirakhor, "Islam's Perspective on Financial Inclusion," in *Economic Development and Islamic Finance*, ed. Zamir Iqbal and Abbas Mirakhor (Washington, DC: World Bank, 2013), 179-202.

borrowers need not borrow money if the expected profit rate of the underlying project is less than the interest rate or its net present value is negative.

The criticism of this viewpoint is twofold. One is that it contradicts the lexical meanings of *ribā* and the other is that it denies the historical fact of lending and borrowing for commercial purposes in the early Islamic era. In the Arabic dictionary, *ribā* means an increase, an addition, and a bump whether small or big. Therefore, the translation of *ribā* as usury or exorbitant interest rate only does not fit with the Arabic language dictionary.[7] Moreover, many writers are of the view that commercial loans were quite familiar at that time. Members of trade trips to other tribes and countries used to accept funds on a partnership basis and interest basis.[8]

The majority view includes both bank interest and usury under the ambit of *ribā* and its reason for the prohibition of bank interest is unfair risk sharing of investment risk between lenders and borrowers. Every commercial project has some elements of risk. That is, its actual profit cannot be known with certainty at the time of launching it. However, the interest rate has to be agreed upon before or at the time of starting the project. If the actual profit exceeds the profit expected at the start of the project, it is unfair to the lenders who get only a small fraction of the actual profit. On the other hand, if the actual profit is less than the expected profit, it is unfair to borrowers-cum-entrepreneurs who work hard but get only a small fraction of the ex-post profit or even face a loss.

The criticism of this viewpoint is that it points out only a side effect of interest-based lending and borrowing, which is normative in nature. That is, unfair risk sharing is equally observable in exchange for many services as well. For example, like interest rate salary of a security guard is fixed at the time of hiring but he may get a serious injury or even lose his life while performing his duty. Similarly, the fare of a taxi ride is fixed beforehand whereas, during the journey, the taxi car may have an accident and thus may be damaged. Despite unfair sharing of risk, such services are commonly exchanged in everyday life which means that unfair risk sharing is taken only as a normative argument. In other words, had risk sharing been the prime reason for the prohibition of *ribā*,

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[7] See Muhammad Mazhar Iqbal, "Prohibition of Riba (Interest Rate) and Dissimilarity of Trading and Loaning," *Pakistan Journal of Social Sciences* 30 (2012): 1-17; Iqbal, "Prohibition of Interest and Economic Rationality," 293-308; Iqbal and Shah, "Economic Rationale of the Prohibition of Interest," 503-17.

[8] See Muftī Muḥammad Shafī', *Mas'alah-i Sūd* (Karachi: Idārah-i Ma'ārif, 1996) and Sayyid A. A. Maudoodi, *Interest (Sud)* (Lahore: Islamic Publications, 1977).

the exchange of these services would have also been banned in Islamic law or at least beneficiaries of these services would have been obligated to compensate providers of these services in case of any mishap.

3. Complexity of Interest Rate Using Different Formulas

To understand the complexity of interest rates, it is worthwhile to distinguish three periods relevant to a loan contract. One is the period for which the loan is contracted, another is the period for which the interest rate is negotiated, and yet another is the period for compounding the principal. The first period is unique for every loan; therefore, it is stated explicitly. The second one is taken, by default, a year even if the loan period is other than a year and it is supposed to be known to everyone in the loanable funds market. Therefore, it is not stated explicitly. The third period is stated explicitly only sometimes; mostly it is inferred from the frequency and the amount of loan repayments within a year. The case of explicit mentioning of the compounding period is considered first.

To state the compounding period explicitly, there are three possibilities: no compounding at all, compounding for a year or any other discrete period, and compounding for an infinitesimally small period. For each case, there is a separate formula to calculate the interest amount as given below.[9] Each formula is explained by denoting by P_0 the original amount of loan or principal, by t the time for the loan contract, by r the annual interest amount expressed as a percentage of P_0 and by P_t the total amount including P_0 and the accrued interest after t years.

i) No compounding method $P_t = P_0 (1 + r \times t)$

ii) Discrete (annual) compounding method $P_t = P_0 (1 + r)^t$

iii) Instantaneous compounding method $P_t = P_0 e^t$

In the first formula, the principal of a loan contracted for longer than a year is not compounded for the whole period. In other words, the interest amount for each year of the loan is calculated using the same principal. For numerical illustration, if P_0 is Rs. 100, t is 2 years and r is 100 per cent, P_2 comes out to be Rs. 300, that is, Rs. 100 as the principal and Rs.100 as the interest amount for each year.

[9] For example, see Giuseppe Campolieti and Roman N. Makarow, *Financial Mathematics: A Comprehensive Treatment* (New York: CRS Press, 2014), ch. 1 and Bradley and Patton, *Essential Mathematics for Business and Economics*, ch. 5.

In the second formula, the principal of a loan having maturity longer than a year is compounded every year. In other words, only for the first year, interest amount is calculated using the original principal but for every subsequent year, the principal amount is increased. It is obtained by adding up the previous year's principal and its accrued interest, that is, the second-year principal (P_1) becomes $P1=(P_0 + rP_0)$ or $P_0 (1 + r)$, the third-year principal amount (P_2) becomes $(P_1 + rP_1)$ or $P_0(1 + r)^2$ and so on. For numerical illustration, assuming the same values for P_0, t, and r as mentioned above, the total due amount after the second year becomes equal to Rs. 400, that is, Rs. 100 as the principal, Rs. 100 as the interest amount for the first year that raises the principal to Rs. 200 for the second year and Rs. 200 as the interest amount for the second year.

The third formula is complex in the sense that the interest rate is prescribed for a year, but the principal is compounded instantaneously. That is, the original principal is used to calculate the interest amount for the first nanosecond only. For every subsequent nanosecond; the principal amount is scaled up by the amount of accrued interest. Assuming the same numerical values for P_0, t, and r as used above, the total due amount after the second year comes out to be equal to Rs. 739 (approximately).

If the compounding period is not stated explicitly, it is determined from the frequency of repayments of a given loan within a year. For example, if a borrower is not told straight about the compounding period but is obligated to pay the accrued interest annually for a two-year loan, compounding is annual as the amount paid after one year can be re-lent till the loan period. Consequently, the lender gets the same total amount after the second year as if the borrower were told yearly compounding explicitly. Similarly, if a borrower is obligated to pay the accrued interest quarterly, the compounding period is a quarter-year as the amounts paid after each quarter can be re-lent till the loan period and so on.

The significant difference in the total due amount after the second year (300, 400, and 739) using these three formulas poses a big challenge regarding the appropriateness of a single compounding period and the underlying reason for doing so. So far, this challenge has not been duly contemplated by academicians; that is why, there are no clear answers available in the literature. Without bridging this theoretical gap, nonetheless, only the second formula is used in the ongoing interest-based banking and financial system. Therefore, in the following section, only the annual compounding method is analysed critically.

3.1 Complexity of Interest Rate Due to More Than One Repayment Within a Year

In the current financial system, the interest rate is quoted for a year whether it is an overnight loan such as the one in the interbank market or a multiyear loan such as the one in the mortgage loan market.[10] However, the period for compounding the principal in this system is rarely stated explicitly; rather, it is understood from the schedule for loan repayments. To understand the synonymy of fixing the compounding period and fixing the frequency of payments of accrued interest, one can suppose that a one-year loan of Rs. 100 at a 100 per cent nominal interest rate is given with the condition of either compounding the principal semi-annually or paying back the accrued interest amount semi-annually. In the first case, the total interest amount is Rs. 125 such that Rs. 50 for the first half and Rs. 75 for the second half as the principal amount for the second half accumulates to Rs. 150. The borrower has to pay Rs. 125 as the interest amount at yearend. In the second case, the lender receives Rs. 50 as the accrued interest amount for the first half, which he, being rational, loans out at the same interest rate for the second half. Since the demand for loans, in literature, is assumed to be unsaturated, therefore, the lender is supposed to have no problem in loaning out the accrued interest. By the end of the year, it turns out to be Rs. 75. Adding it to the accrued interest of the second half, that is, Rs. 50, the total interest amount, which the lender gets, turns out to be Rs. 125.

To cope with this complexity of interest, two additional rates, IRR and APR,[11] which are calculated based on the frequency of compounding periods within a year and based on the amount paid at each compounding period, become relevant vis-à-vis the nominal interest rate for the same loan. For numerical illustration, one can suppose a loan of Rs. 100 for a year can be settled either by paying back Rs. 10 after 6 months and Rs. 110 at yearend or by paying back Rs. 60 after 6 months and Rs. 60 at yearend. In both options, the amount paid in addition to the principal is Rs. 20. Thus, the interest rate for a layperson is 20 per cent. The compounding period in both options is semi-annual but the amount

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[10] It is noteworthy that per year quoting of interest rate in every loan contract irrespective of its contractual period is not due to any theoretical merit but just because of convention adopted by the architects of the conventional financial system.

[11] The value of IRR is calculated by hit and trial method from the equation $P_0 = CF_1/ (1 + irr/m) + CF_2 / (1 + irr/m)^2 + \ldots + CF_m / (1 + irr/m)^m$ where P_0 is the amount of loan and CF_1, CF_2, . . ., and CF_m, are cash flows or the amount paid back each time out of total m times within a year. The value of APR is calculated as: $APR = [(1 + i/m)^m - 1]$ where i is the nominal interest rate and m is the number of times, the accrued interest is paid within a year.

paid at each compounding period is different. Hence, IRR, which financial economists consider the most accurate measure of interest rate, is also 20 per cent under the first option but it is approximately 26.2 per cent under the second option. Similarly, APR that is more relevant from the perspective of a lender comes out 21 per cent under the first option and 26 per cent under the second option assuming a 20 per cent annual reinvestment rate for the interim repayment in each case.[12]

To highlight the complexity of interest rates from another angle, one can suppose that Bank A offers a one-year loan at a 40 per cent interest rate and requires its borrower to pay back the interest along with the principal after a year. At the same time, Bank B offers a one-year loan at a 36 per cent interest rate and requires its borrower to pay back the interest quarterly and the principal after a year. For a financially untrained person, borrowing from Bank B is preferable as he/she looks at the nominal interest rate, whereas for a financially literate person, borrowing from Bank A is preferable as he/she looks at APR. If borrowing is from Bank A, APR comes out to be 40 per cent $[(1 + 0.4/1)^1 - 1]$ and if it is from Bank B, APR is approximately 41.16 per cent $[(1 + 0.36/4)^4 - 1]$. In such a situation, convergence of the nominal interest rate either to 40 or to 36 percent, under free market forces, seems highly unlikely. The reason is that financially illiterate people continue to borrow from Bank B because of its lower nominal rate without caring about its higher APR and financially literate people and firms, which have finance professionals on their payrolls, continue to borrow from Bank A keeping in view its lower APR.

4. Comparison of Price and Interest Rate as Equilibrating Variables

The price of a commodity is a uniquely defined concept that is easily understood even by illiterate persons. A potential user of a new commodity in the market, on one side, can promptly conceive a maximum price which he/she might be willing to pay for it. An existing as well as a potential producer of this commodity, on the other side, having information about the production cost, can easily fix its minimum price which he/she might be willing to accept. Then their mutual bargaining, under free market forces, ends up with a single price. Such mutually agreed prices between individual buyers and sellers may be different in the beginning but, assuming quick dissemination of price information in the market, they ultimately tend to converge to the

[12] For example, see Mishkin, *Economics of Money, Banking, and Financial Markets*, ch. 4, and Mishkin and Eakins, *Financial Markets and Institutions*, ch. 3, for mentioning IRR or yield to maturity as the most accurate measure of interest rates. For their calculation, see Bradley and Patton, *Essential Mathematics for Business and Economics*, ch. 5.

average or market price. That is, if a seller sticks to a relatively higher than the market price, purchasers no longer buy from him/her and if a seller sells at a relatively lower than the market price, his/her supply finishes but market demand remains unsatisfied at that lower price. Therefore, purchasers unable to buy at lower prices, continue to demand at the market price. Similarly, a rational buyer never offers higher than the market price and if he/she offers relatively less than the market price, none of the sellers sells any quantity to him/her. The convergence of initially different prices of a commodity ultimately to the market price is termed, in economics terminology, the law of one price.[13]

On the contrary, the nominal interest rate which is stated in loan contracts and on corporate and government bonds can act as *the* equilibrating variable in the loanable funds market if and only if every loan and bond is for one year and its repayment including both principal and accrued interest is at the year-end. In reality, however, the contract period for many loans and bonds is other than a year and repayment of many loans and bonds comprising of accrued interest only or both accrued interest and a fraction of principal is more frequent than once a year. Therefore, both IRR and APR, which inculcate compounding period and the amount paid at each compounding period, also become competing candidates to equilibrate the loanable funds market. Since these rates do not always move in tandem; rather, they can move in opposite directions as explained above, any of them cannot be designated as *the* equilibrating variable in the loanable funds market. That is why, the law of one interest rate is less likely to prevail in the loanable funds market.

Besides the complexity of interest rates as explained above, the status of interest rate as the most dominant factor for the demand and supply of loanable funds as the price is for the demand and supply of a commodity is debatable. It is evident from the fact that every seller of a commodity accepts the highest bid price from any purchaser without caring about any of his/her social and/or economic characteristics. Likewise, every purchaser looks for the lowest offer price from any seller without requiring any further information about him/her. Contrary to

[13] For example, see J. Pippenger, "Arbitrage and the Law of One Price: Setting the Record Straight," *Theoretical Economics Letters* 6 (2016): 1017-33, Pippenger, and L. Phillips, "The Law of One Price: An Interpretation of the Literature and Some New Evidence," *Journal of Academy of Business and Economics* 8 (2008): 71-84, and P. K. Goldberg and F. Verboven, "Market Integration and Convergence to the Law of One Price: Evidence from the European Car Market," *Journal of International Economics* 65 (2005): 49-79.

this, a potential lender gives, probably, equal weight to the interest rate that a potential borrower bids to pay and to his/her creditworthiness. A less creditworthy borrower may not get any loan by bidding higher interest rate. This phenomenon is known, in the literature, as credit rationing and it is visible even in financially developed economies such as the USA.[14] Similarly, a potential borrower probably pays equal attention to an interest rate that a lender is willing to charge and the degree of monitoring it wants to exercise at the time and during the period of the loan. It is probably for this reason that commercial banks, at times of need, prefer to borrow from other banks in the interbank loan market at higher interest rates rather than from the central bank at a lower policy rate. They do so to avoid frowning costs and subsequent monitoring rights of the central bank.[15]

Moreover, interest rate determined by free market forces in interbank and other loan markets is monitored regularly by almost every central bank. As soon as the market-determined interest rate crosses the prescribed limit set by the concerned central bank, the central bank intervenes to change it to the desired level. It means that, unlike price in a commodity market, interest rate in the loanable funds market is not allowed to move freely; rather, it is manoeuvred by the central bank daily.[16]

5. Conclusion

In conventional banking and financial systems, the interest rate is deemed an equilibrating variable for the loanable funds market just like a price for a commodity market. On the contrary, Islam has emphatically

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[14] For example, see Margery Austin Turner et al., *What We Know About Mortgage Lending Discrimination in America* (n.p.: Diane Publishing, 2000); William Hunter, "Discrimination in Mortgage Lending," *Chicago Fed Letter*, no. 95, July 1995, 2-4, https://www.chicagofed.org/publications/chicago-fed-letter/1995/july-95; and Alan S. Blinder, "Credit Rationing and Effective Supply Failures," *The Economic Journal* 97, no. 386 (1987): 327-52.

[15] For example, see Huberto M. Ennis and David A. Price, "Understanding Discount Window Stigma," *Economic Brief*, April 2020, https://www.richmondfed.org/-/media/RichmondFedOrg/publications/research/economic_brief/2020/pdf/eb_20-04.pdf; Olivier Armantier et al., "Discount Window Stigma during the 2007–2008 Financial Crisis," *Journal of Financial Economics* 118, no. 2 (2015): 317–35; and Renee Courtois and Huberto M. Ennis, "Is There Stigma Associated with Discount Window Borrowing?" *Economic Brief*, May 2010, https://www.richmondfed.org/-/media/RichmondFedOrg/publications/research/economic_brief/2010/pdf/eb_10-05.pdf.

[16] For example, see Laura J. Hopper, "What are Open Market Operations? Monetary Policy Tools Explained," August 21, 2019, https://www.stlouisfed.org/open-vault/2019/august/open-market-operations-monetary-policy-tools-explained; Ann-Marie Meulendyke, *U.S. Monetary Policy and Financial Markets* (New York, NY: Federal Reserve Bank of New York, 1998), https://files.stlouisfed.org/files/htdocs/aggreg/meulendyke.pdf.

negated the claim of their similarity. This paper has tried to highlight the complexity of interest rates by distinguishing the period for which interest rate is negotiated and the period which is meant for compounding the principal. For every loan whether its period is equal to, less than, or greater than a year, the interest rate is contracted, by default, for a year. The period for compounding the principal could be the period of the loan, a discrete number such as a year, or an infinitesimally small period. It is stated explicitly only rarely; mostly, it is understood from the given frequency and the amount of loan repayments within a year.

If the compounding period is stated explicitly, which could be no compounding at all, compounding annually, or compounding continuously, there is a separate formula to calculate the amount of interest for a year or the whole loan period. It has been illustrated numerically by taking the same amount of loan, the same nominal interest rate, and the same period of loan contract for each of these compounding periods. The total amount including both principal amount and accrued interest comes out significantly different from one another. It signifies the importance of a compounding period for the calculation of interest amount and therefore of having consensus about this period. Anyhow, without attributing any theoretical merit to it, the discrete compounding method is followed in the current financial system.

If the discrete compounding period is not stated explicitly, it is determined from the frequency of loan repayments, comprising accrued interest only or accrued interest plus a fraction of the principal amount, within a year. If such a partial payment is quarterly or monthly, the compounding period is considered a quarter or a month respectively. For a loan having less than a year of maturity and having no partial repayment before maturity, the period of the loan is considered the compounding period. In all such cases, the nominal interest rate does not represent *the* equilibrating interest rate. Two other rates, IRR and APR, are defined for the same repayment stream of the loan. Out of these three rates, which one is *the* equilibrating rate remains debatable so far.

To put it differently, in the literature, three different rates (i.e., nominal, IRR and APR) are defined for the same repayment schedule of a loan or bond having more than one payment within a year. In this situation, the ranking of various loan options concerning any two of these three rates, particularly concerning nominal interest rate and APR, may not match. In the real world, individual borrowers who are generally less trained financially focus on the nominal interest rate to

compare alternative loan options, whereas lending and borrowing institutions which generally have financial experts on their payrolls focus on APR. Since one loan option may have a lower nominal interest rate but a higher APR as explained numerically in the text, the law of one interest rate rarely prevails in the loanable funds market.

Besides the multiplicity of interest rates for a given less-than-yearly repayment schedule of a loan, none of them is probably the major factor affecting the demand and supply of loanable funds as the price is for the demand and supply of a commodity. If any of them were the major factor, individual lenders and lending institutions would not refuse credit to higher interest bidders but less creditworthy borrowers and commercial banks would borrow, at the time of need, not from the interbank market at a higher interest rate but from the central bank at lower interest rate without caring about its frowning cost. Moreover, central banks would not intervene daily to change market-determined interest rates.

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