Journal of Financial Stability 69 (2023) 101176

Contents lists available at ScienceDirect

Journal of Financial Stability

journal homepage: www.elsevier.com/locate/jfstabil

Who consumes the credit union subsidies?☆

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ARTICLE INFO

Keywords:
Commercial banks
Credit unions
Profit inefficiency
Tax exempt status

ABSTRACT

Credit unions in the United States (US) are exempt (benefit from subsidies) from federal corporate income taxes, which are traditionally justified by their non-profit cooperative status and mission of meeting the financial needs of individuals of modest means. In recent years, the efficacy and fairness of these subsidies has been debated extensively as the traditional demarcation between banks and credit unions and their respective customer bases have blurred. To investigate how credit unions allocate subsidies to various stakeholders, we estimate a structural profit model for matched pairs of credit unions and commercial banks. We find that credit unions use most (approximately 90%) of their tax exemption for the benefit of their membership via above-market deposit interest rates.

1. Introduction

Credit unions are non-profit, tax-exempt cooperatives that provide financial services to their members. In this paper, we use a profit function-based approach where we compare the performance of US credit unions to similarly sized and located US commercial banks to investigate how credit unions allocate the subsidies derived from their non-profit, tax-exempt status across their various stakeholders.

The exemption from federal (and many state) corporate income taxes dates to the 1930s, and is justified by credit unions "specified mission of meeting the credit and savings needs of consumers, especially persons of modest means" (Credit Union Member Access Act, 1998).[1] Commercial banks contend that the tax exemption provides credit unions with an unfair competitive advantage, which they can exploit to provide additional costly services, pay above-market interest rates on deposits, and offer below-market interest rates on loans. Moreover, regulatory rulings have in recent years blurred the traditional competitive distinctions between credit unions and banks, chief among them a series of rulings by the National Credit Union Administration (NCUA) that relaxed the restrictions on credit union membership and financial activities.[2] One

☆ We are particularly indebted to Bob DeYoung for inspiring this research endeavour, framing salient issues and for many enjoyable hours of fruitful discussion. Thanks also to Allen Berger, Barbara Casu, Dimitris Chronopoulos, Anna Sobiech and David Wheelock for comments and discussions. We also thank seminar participants at the CUNA / Filene Research Institute / UW-Madison Center for Cooperatives first annual Workshop on Credit Union Research, University of Bristol, Bayes Business School, University of Edinburgh, European Central Bank, Federal Reserve Bank of Boston, Financial Engineering and Banking Society, HEC Paris, International Banking, Economics and Finance Association, University of Kansas, University of Limoges, and Queen's University of Belfast for useful suggestions. Finally, thanks to Iftekhar Hasan (Editor) and two anonymous reviewers and for constructive criticisms and comments, which led to material improvements in the paper. The usual disclaimer applies.

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[1] In exchange for this tax exemption, both the size and the scope of credit unions has been restricted by various federal and state regulations. For example, credit unions must specialize in providing retail financial services (consumer credit, mortgage finance, small savings vehicles, retail payment services, etc.) to members who must share a common bond (such as employment in the same organization or industry, residence in a specific geographic area, or membership of a social organization or religious institution).

[2] These include looser restrictions on the amount of business loans that credit unions can make to their members (February 2016), less restrictive field-of-membership rules for determining what constitutes a common bond (October 2016), allowing credit unions to raise financial capital from non-member external sources (January 2017), and allowing credit unions to securitize their loans (June 2017). A suit filed by the Independent Community Bankers of America (ICBA) against the business lending rule was dismissed in 2017. In July 2020 the US Supreme Court denied an appeal from the American Bankers Association (ABA) to void NCUA's field of membership (FOM) rule, a decision that marks the end of a four-year attempt by the ABA to undo the FOM rule.

https://doi.org/10.1016/j.jfs.2023.101176
Received 22 September 2022; Received in revised form 17 August 2023; Accepted 24 August 2023
Available online 28 August 2023
1572-3089/

reflection of this strategic repositioning and mission creep is the recent increase in US credit union purchases of commercial banks, with 42 such deals in 2018–2021 alone (Albicocco and Hayes, 2022). To many, these changes are contradictory to the traditional status of credit unions as small cooperative organizations, and have resulted in intense policy debates regarding the efficacy and fairness of the credit union tax exemption (DiSalvo and Johnston, 2017; Marshall and Pellerin, 2017).[3] However, while credit unions have enjoyed a loosening of regulation, they remain subject to restrictions on geographic scope, product offerings and the ability to raise outside capital.

The approach adopted in the present study is predicated on the view that in order to assess the extent to which credit unions utilise tax subsidies to serve their membership, one needs to use an integrated holistic approach which accounts for the relationship between input costs and output values across the array of the credit union product portfolios. Moreover, in order to assess whether credit unions operate efficiently, we require a benchmark upon which to measure relative efficiency.[4] Our main empirical analysis comprises four steps. First, we estimate a structural profit model (Berger et al., 1993; DeYoung and Nolle, 1996) for a balanced panel of 2580 small US commercial banks between 2005 and 2017. We specify the profit model to include activities that are closely associated with credit unions' legal mandate (such as attracting deposits and making loans) as well as activities that are not closely associated with credit unions' legal mandate (such as hiring labour and investing in securities). Second, we use the estimated model parameters to calculate the *profit inefficiency* of each bank, which we define as the foregone profits that each bank would have earned had it operated using best commercial banking practices. Third, we re-use the estimated model parameters to calculate profit inefficiencies for a separate panel of 1279 US credit unions that were operating during the same period. Fourth, we calculate the *profit inefficiency gap* for 1024 matched pairs of banks and credit unions, which we define as the credit union's profit inefficiency minus the bank's profit inefficiency. [5]

Lacking shareholders who expect a market return from placing their wealth at risk, credit unions may be compelled to spend rather than retain the cost advantage derived from not having to pay taxes on profits. They might accomplish this by consuming too many inputs, paying above-market prices for inputs, producing at non-optimal output levels, and/or charging below-market prices for those outputs. In other words, credit unions may operate in a profit-inefficient fashion relative to otherwise similar commercial banks, which we capture in our estimated profit inefficiency gaps. If one proceeds under the assumption that credit unions and small commercial banks compete against each other in local financial services markets, then these profit inefficiency gaps should be close proxies for the (otherwise unobservable) subsidies that credit unions enjoy. This is more holistic than simply looking at differences in prices or output quantities across individual deposit and loan categories, and allows us to draw inferences regarding relative credit union performance. Consequently, we feel that our approach and findings augment prior studies of credit union cost efficiency (Frame et al., 2003; Wheelock and Wilson, 2011) and productivity (Wheelock and Wilson, 2013), and complement prior evidence regarding credit union pricing (Feinberg, 2001; Tokle and Tokle, 2000; Jackson, 2006; van Rijn et al., 2021), and service provision (Cororaton, 2020; Shahidinejad, 2022; Li and van Rijn, 2022).

By way of preview, we find statistically and economically large profit inefficiency gaps. When we value inputs and outputs by their prices in local banking markets, credit union profit inefficiency averages 75 basis points per dollar of assets more than at their matched pair commercial banks. When we disaggregate this inefficiency gap across the inputs and outputs in our model, the overuse of deposit inputs by credit unions is by far the largest component. The financial services associated with these excess deposit inputs (safe-keeping, member liquidity, payments services, risk-free savings vehicles) are mandated services under the federal legislation cited above, a *quid pro quo* that credit unions provide in exchange for their tax exemption. We find only a small amount of outright operational inefficiency at credit unions(e.g., hiring too many workers, [6] paying above-market wages and benefits, earning below-market returns on portfolio of securities investments).[7] When we value inputs and outputs by the prices that credit unions actually pay or charge. Credit unions can and often do provide their members with prices more favourable than those that can otherwise be found at local banks. When the profit inefficiency gap is measured in terms of these prices, we find that 90% of the gap is comprised of *mandated* pricing inefficiencies. On average, these *mandated* pricing inefficiencies are accounted for almost entirely by above-market interest rates to member-depositors.

Our study contributes new evidence to long standing debates regarding how best to regulate credit unions. Proponents of the long-standing tax-exempt status of credit unions point to features that distinguish credit unions from commercial banks, with specific emphasis placed on the argument that credit unions are member-owned non-profit financial institutions with many members of modest means who may have difficulty accessing alternative sources of credit. Credit unions often do provide financial services (including financial literacy programs) at reduced costs, and their tax exemption provides a reservoir of resources that can be used to fund those services. Our results suggest that the average credit union does pass through most of its tax subsidy to its depositor members, with only a small portion of the tax subsidy diverted away from members due to inefficient asset portfolio management.

Opponents of the tax exemption, however, point out that credit unions have strayed from their original mission of serving households of modest means that lack access to financial services. Many credit unions have grown into full service financial institutions, the largest have millions of members and billions of dollars in assets. Indeed there is

[3] In a January 2018 letter to the National Credit Union Association (NCUA), Senator Hatch (Chair, US Senate Finance Committee), stated "the credit union industry is evolving in ways that take many credit unions further from their tax-exempt purpose." In February 2018, legislation was introduced in Iowa that would equalize the state income tax treatment of commercial banks and credit unions (American Banker, 2018).

[4] The holistic methodological approach adopted in our study is consistent with opinion expressed in a 2006 Report by the US Government Accountability Office (US Government Accountability Office, 2005), which (among other analyses) compares interest rates (prices) charged by banks and credit unions. The Report (p26) notes that: '*Our analysis showed that credit unions tended to offer better interest rates than similarly sized banks for a variety of products and loans, but rate data alone cannot be used to determine the extent to which the benefits of tax exemption have been passed to members.*'

[5] Although the methodological approach employed in our study has significant advantages there are nevertheless drawbacks. First, the matching process required to obtain matched pairs of banks and credit unions leads us to discard a significant number of credit unions for which a sufficiently closely matched bank was unavailable; however, variation in the matching criteria, and hence in the number of credit unions for which a matched bank was identified, did not materially affect the results. Second, our use of institution (bank and credit union) level call report data rather than product level price data does not allow for a disaggregated analysis of pricing differences across the specific saving and loan products offered by banks and credit unions.

[6] Hiring too many workers may not necessarily be outright operational inefficiency, but rather credit unions being more willing (than banks) to provide services catered to member needs. For example, 61% of US credit unions offer credit cards compared to only 18% of US banks. The 10 largest US bank holding companies have 90% of the credit card loans outstanding at banks reducing the motivation of smaller banks to provide this service to their customer base (Boehme et al., 2023).

[7] This finding comes with the caveat that employing excess labor may not necessarily represent absolute inefficiencies if additional employees are being utilised to meet the needs of members (through for example, financial education programs and related products and services). Unfortunately, we have no direct way of discerning this from the dataset and methodology employed.

(contested) evidence (discussed below) that credit union members have more formal education, are less likely to be unemployed, and are more likely to own their own homes, relative to customers at commercial banks. [8] Consequently, the continuation of the credit union tax exemption (estimated to currently cost over $2 billion per annum (Joint Committee on Taxation, 2020)) is likely to remain an area of lively policy debate. To ensure that the tax subsidy is only received by credit unions that fulfil their lawful mission of "meeting the credit and savings needs of consumers, especially persons of modest means," and not simply passed through to relatively well-off members, more comprehensive data on who credit unions serve is required.

Our analysis connects to several strands of literature. First, we contribute to the literature on the tax treatment of financial institutions. There has been a lengthy policy debate on the issue of whether credit unions should be taxed in the same way as commercial banks, in the interests of fair competition (Flannery, 1974, 1981; Cook and D'Antonio, 1984; Tatom, 2005). Central to this debate (discussed in detail in Section 2) is whether credit unions use their preferential tax treatment to the benefit of members. Prior research provides important albeit mixed evidence regarding the extent to which members benefit from the tax exemption (Frame et al., 2003; Feinberg and Meade, 2017). Our results suggest that the preferential tax treatment of credit unions does translate into large economic benefits for credit union members. However, a small portion of the tax subsidy gets diverted to non-member stakeholders. As such our results augment and complement research findings (using disaggregated product price data) that relative to commercial banking counterparts, credit unions offer members better terms (US Treasury, 2001; Van Rijn et al., 2021; Shahidinejad, 2022).[9]

Second, we contribute to literature regarding conflicts-of-interest between depositor-members of cooperative financial institutions seeking to maximize the return on their savings, and borrower-members who want access to low-cost credit. In early theoretical studies credit unions are modelled in static settings (Taylor, 1971; Smith et. al, 1981; Smith, 1984; Smith, 1986). More recent theoretical studies place credit unions in intertemporal settings, allowing them to vary the timing and magnitude of benefits across their saving and borrowing members (Rubin et al., 2013). The evidence as to whether credit unions tend to favor borrower-members, saver-members, or neither, is mixed and inconclusive (see McKillop and Wilson, 2011 for a detailed review). Our results suggest that credit unions appear to share the majority of the benefits of the tax subsidy with depositor-members.

Third, we extend a long-established literature that examines the importance of ownership form for the efficiency and performance of financial institutions.[10] Previous work comparing the efficiency of US shareholder and mutual financial institutions find that mutually owned banks operate more efficiently than shareholder-owned counterparts (O'Hara, 1981; Mester, 1989, 1993; Cebenoyan et al., 1993). Evidence from Europe appears to confirm that mutual banks are slightly more efficient than commercial banks (Altunbas et al., 2001; Makinen and Jones, 2015). In contrast, we find that cooperative depository institutions are less efficient than shareholder-owned banks. Unlike the aforementioned studies, our empirical analysis is conducted using a matching procedure, which enables us to better isolate the implications of ownership differences for financial performance.

Fourth, we contribute to the literature which investigates the extent of economies of scale at credit unions. Early evidence suggests larger credit unions incur lower non-interest expenses, pay higher interest rates to savers, charge lower interest rates to borrowers, and grow faster than smaller counterparts (Goddard et al., 2002, 2014; Wilcox, 2005, 2006). Wheelock and Wilson (2013) find that US (especially smaller) credit unions experienced decreasing cost productivity between 1989 and 2006, suggesting that changes in regulation and technology favoured larger credit unions. Wheelock and Wilson (2011) also present evidence of increasing returns to scale. The results of the present study complement the aforementioned findings by showing that any efficiency differences between banks and credit unions dissipate at the upper end of the size distribution.

The rest of this paper is structured as follows. In Section 2 we provide institutional details about credit unions and the regulatory environment. In Section 3 we present testable hypotheses: Section 4 provides an overview of the profit inefficiency model and introduces the key credit union profit inefficiency gap measure. In Section 5 we describe the data and the variables used to estimate the model. Section 6 presents our empirical results, while Section 7 concludes.

2. Background

Credit unions originated as self-help cooperatives for persons and households of modest economic means that are not served well by commercial banks.[11] Credit unions tend to be small but collectively have become a major supplier of consumer credit in the US. In the first quarter of 2018, there were 5530 federally insured (federal and state chartered) credit unions in the US, serving 112.7 million members with $972 billion in outstanding loans (Credit Union National Association, 2018). Approximately 71% of these credit unions are small institutions with assets less than $100 million. Membership in a credit union has traditionally been limited to depositors and borrowers that share a close common bond, such as employment in the same company, industry, or profession. Credit unions have traditionally offered their members a limited set of financial services, such as checking accounts, savings vehicles, personal loans, consumer credit, and home mortgages.

Credit unions offer an alternative to commercial banks, and may (in some cases) allow retail customers to circumvent credit constraints, which arise following exogenous shocks to the financial services industry. Smith and Woodbury (2010) and Smith (2012) suggest that credit unions are less exposed than commercial banks to business cycle fluctuations, and thus are better equipped to sustain lending during economic downturns. This appears to suggest that while banks contract commercial lending during periods of economic stress the opposite is

[8] Requiring more information on the characteristics of the members credit unions serve has been called for previously. For example, a key recommendation of the US Government Accountability Report of 2006 is that: ' …. *the NCUA Chairman systematically track and monitor the progress of federal credit unions in serving those of modest means…*'

[9] In a theoretical model examining the difference in governance and incentives of traditional firms and cooperatives, Hart and Moore (1996), (1998) show that traditional firms operate more efficiently, but cooperatives make better decisions from a welfare perspective. Empirical evidence suggests the member-oriented objectives of credit unions, lead credit unions to provide more loans during economic downturns (Smith and Woodbury, 2010; Smith, 2012) including the Great Recession (Cororaton, 2020). Nevertheless, during instances of particular stress more vulnerable credit unions constrain loans to members (Ramcharan et al., 2016).

[10] Prior research investigates the competitive discipline provided by credit unions in local deposit and loan markets. Findings suggest that credit unions play a significant role in disciplining bank behaviour, with banks offering higher deposit rates and lower loan rates in markets where there is a significant credit union presence (Tokle and Tokle, 2000; Feinberg, 2001; Hannan, 2003; Jackson, 2006; Feinberg and Rahman, 2001, Feinberg and Rahman, 2006).

[11] While the financial intermediation functions performed by credit unions and commercial banks are fundamentally the same, a parallel lexicon has developed to describe credit union activities. For purposes of clarity, we standardise where possible in this paper around banking terminology. For example, we use the commercial bank words "depositors, transactions accounts, profits, and dividends" rather than the credit union equivalents of "savers, share draft accounts, surplus, and patronage dividends." We retain the use of the word credit union "member" because the rights, powers and expectations of these credit union owners differ in fundamentally important ways from the rights, powers and expectations of bank shareholders.

true for credit unions. Li and Van Rijn (2022) show that relative to commercial banks, credit unions extended significantly fewer subprime loans before and during the global financial crisis, resulting in lower loan delinquencies. However, Ramcharan et al. (2016) note that US credit unions most exposed to the failure of large corporate credit unions (because of declining investment values) reduced real estate and consumer lending during the global financial crisis. Chatterji et al. (2015) find that US credit unions on average gained market share from banks following the financial crisis, while Cororaton (2020) shows that lending growth rates for credit unions were significantly higher than banking counterparts following the onset of the financial crisis, thus reducing the real effects arising from any reduction in overall bank credit supply. However, Maskara and Neymotin (2019) find that during the financial crisis, credit unions were no more likely than other depositary institutions to extend a home equity line of credit to households facing financing constraints, thus providing a counterpoint to those who have lauded credit unions for providing liquidity during times of crisis.

Regulators require credit unions to retain minimum amounts of equity capital as a buffer against future losses.[12] Credit unions begin their existence with little or no equity capital and meet this regulatory requirement gradually over time by retaining profits as they occur; as cooperative organizations, credit unions lack access to external capital markets. This equity capital belongs collectively to the credit union members, but members that wish to sever their ties with their credit union are not entitled to any share of this accumulated communal wealth. If a credit union generates excessively large profits, it can distribute these sums to its members by increasing deposit rates and/or by reducing loan rates, obviating an explicit financial dividend. Although credit union members sometimes receive taxable dividend earnings pay-outs, such payments are relatively rare.[13]

Credit unions are exempt from paying taxes on earnings. The rationale for this exemption is stated explicitly in the Credit Union Member Access Act (1998): "Credit unions…are exempt from Federal…taxes because they are member-owned, democratically operated, not-for-profit organizations generally managed by volunteer boards of directors *and because they have the specified mission of meeting the credit and savings needs of consumers, especially persons of modest means* (emphasis added)."[14] Clearly, this legislation assigns to credit unions a mandate to provide greater access to financial services. Although the legislation does not state specifically that the tax exemption should be used to subsidize better-than-market prices for their members, credit unions typically pay higher interest rates on deposits, and often (but not always) charge lower interest rates on loans, than commercial banks.[15]

Prior evidence suggests that members of US credit unions, tend to have above average household incomes and above average amounts of formal education. For example, a survey conducted by the Credit Union National Association (2015) finds that credit union members tend to be older (48.5 years old for credit union members versus 45.5 for non-members), employed full time (54% versus 39%), better educated (40% with college degrees versus 24% without), and own homes (76% versus 52%). US Government Accountability Office (2006) finds that 69% of credit union members have middle-to-upper incomes versus 59% for commercial bank customers, and only 31% of credit union members have low-to-moderate incomes versus 41% of commercial bank customers. In contrast, Filene Institute (2021) find that although members of credit unions do have a higher average income than the average US household, they have a lower average income relative to households that primarily use banks. DiSalvo and Johnston (2017) find that credit unions reject mortgage applications twice as frequently as small commercial banks in low-to-moderate income census tracts. Maskara and Neymotin (2021) find that low-income individuals are less likely to use the services of a credit union.

In contrast to credit unions, US commercial banks are for-profit, shareholder-owned corporations and are not tax exempt. For banks organized as corporations under Subchapter C of the US tax code, bank income is subject to double taxation: Earnings are taxed fully at the corporate level, and any post-tax earnings distributed to shareholders as dividends are taxed again at the personal level. For banks organized as corporations under Subchapter S of the US tax code, earnings are fully taxed at the personal level regardless of whether they are retained or distributed.[16] The Credit Union Membership Access Act of 1998

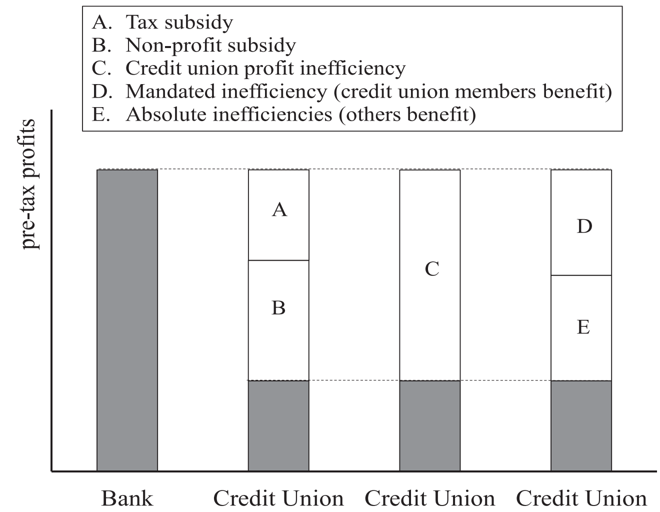

Fig. 1. How the Pre-Tax Profits of a Commercial Bank might be consumed at a Tax-exempt, Not-for-profit (but otherwise identical) Credit Union, This figure shows how the pre-tax profits of a commercial bank might be consumed at a tax-exempt, not-for-profit, but otherwise identical credit union. The darkened bars represent pre-tax profits at either the bank (first column) or the credit union (the remainder of the columns). Like the bank, the credit union will retain some of its profits to maintain its equity cushion, but neither pays income taxes (the tax subsidy A) nor distributes dividends (the non-profit subsidy B). Both subsidies are available to credit union management and will be consumed either in the form of higher expenses or deficient revenues (profit inefficiencies C). Some of these profit inefficiencies are prescribed by the legislation under which credit unions operate (mandated inefficiencies D) while the remainder are not (absolute inefficiencies E).

[12] In the US credit unions are subject to the prompt corrective action framework included in Section 301 of Credit Union Membership Access Act 1998 and implemented in August 2000 (Goddard et al., 2016).

[13] Credit unions refer to these pay-outs as "patronage dividends," and make these payments conditional on meeting predetermined levels of net worth, ROA and/or ROE. A survey of 466 credit unions by Callahan Associates (2015) found that only about four in ten credit unions consider making these payments in a given year, and only about one in ten actually make these pay-outs.

[14] 12 U.S.C. 1757a; Public Law 105–219, 112 Stat. 913 (1998). The tax-exempt status of credit unions dates to the Revenue Act of 1916 for state-chartered credit unions and to the Federal Credit Union Act of 1934 for federally chartered credit unions.

[15] See Figs. 2 and 3, which we discuss in detail in a subsequent section, for some pricing examples.

[16] Subchapter S of the Internal Revenue Code (IRC), introduced in 1958, allows small organizations to reduce their tax burdens by paying tax at the individual level rather than the corporate level. Banks were not permitted to elect Subchapter S status until 1996. The Small Business Job Protection Act of 1996 permitted US commercial banks with 75 or fewer shareholders to convert from Subchapter C to Subchapter S status, later expanded to 100 shareholders by the American Job Creation Act of 2004. Related family members are treated as a single shareholder. The number of Subchapter S banks increased from 606 in 1997–1841 (35% of all commercial banks) in 2018. Several states, including California, Connecticut, Louisiana, Michigan, New Hampshire, New Jersey, North Carolina, Tennessee, Utah and Vermont, do not recognize Subchapter S status and subject the earnings of these organizations to double taxation for *state* corporate taxes and *state* income taxes.

encouraged federally chartered credit unions to grow larger by permitting them to adopt multiple common bonds, enrol members from outside their original membership groups, and transact with any resident of a geographical area defined as a community. As a result, a growing number of credit unions are no longer locally focused organizations. In the first quarter of 2018, there were 294 federally insured credit unions with assets exceeding $1 billion. These credit unions comprised just 5% of the industry population but held 64% of total industry assets. There were 50 federally insured credit unions with more than a quarter of a million members each.[17] Total business lending grew approximately fourfold at credit unions between 2001 and 2014, at which point more than one thousand credit unions were at or near the statutory business loan limit of 12.5% of total assets.[18] In response, new federal legislation passed in December 2017 lifted the statutory cap on member business loans from 12.5% to 27.5% of assets.

The total dollar amount of the credit union tax subsidy is non-trivial. In a 2010 report on tax reform, The President's Economic Recovery Advisory Board estimated that eliminating the credit union tax exemption would raise $19 billion in government revenue over 10 years.[19] Banks argue that the tax exemption distorts competition in deposit and loan markets by conferring an unfair competitive advantage to credit unions. Current period cash flows that banks must transfer to the government are available free-of-charge to credit union managers to provide additional customer services and better-than-market prices. Banks also argue that the tax-subsidized stakeholder group now extends well beyond the original credit union mandate to include business borrowers, credit union employees, and member-depositors who do not truly share a strong common bond.

Credit unions also enjoy a second subsidy relative to commercial banks by nature of their different organizational form. Repeating the above passage from the Credit Union Member Access Act (1998), this time with a different emphasis added: "Credit unions…are exempt from Federal…taxes *because they are member-owned, democratically operated, not-for-profit organizations* generally managed by volunteer boards of directors and because they have the specified mission of meeting the credit and savings needs of consumers, especially persons of modest means." While the owners of banks hold equity shares, the member-owners of credit unions hold liquid, interest-bearing, insured deposit contracts; hence, unlike bank owners who put capital at risk, credit union members do not require a return on risk-taking. Retained earnings that would otherwise be distributed to equity holders are available free-of-charge to credit union managers to provide additional customer services and better-than-market prices. In our analysis below, we refer to this financial advantage as the non-profit subsidy.

3. Testable hypotheses

Credit unions differ from banks in terms of organizational form, corporate governance, capital structure, regulatory treatment and organizational objective. Prior literature suggests that rather than maximise profits, credit unions aim to balance the interests of their members (Hansmann, 1999; McKillop and Wilson, 2011). By legislative mandate (in the United States), credit unions are required to use tax and non-profit subsidies to the benefit of their members. If the credit union satisfies this mandate by paying above-market interest rates to its member-depositors, then it will appear to be cost inefficient relative to otherwise similar for-profit banks: Its total interest expenses will be higher not only because it is paying inefficiently high input prices, but also because these high prices will attract an inefficiently large volume of deposits.[20] Similarly, if the credit union satisfies its mandate by charging below-market interest rates to its member-borrowers, then it will appear to be revenue inefficient relative to otherwise similar for-profit banks: Its total interest revenues will be lower not only because it is charging inefficiently low input prices, but also because these low prices will attract an inefficiently large volume of borrowers. For the remainder of this paper, we refer to these inefficiencies as *mandated inefficiencies*. It is in this context that we state the first of our two hypotheses:

> Mandated Inefficiencies Hypothesis (H1): Given their legislative mandate to use their tax and non-profit subsidies to expand households' access to financial services, profits at credit unions will naturally be lower than pre-tax profits at otherwise similar commercial banks.

Like other mutually owned enterprises, credit unions are significantly different from shareholder-owned financial institutions in terms of their ownership, ethos and governance (Smith et al., 1981; Flannery, 1981; Deshmukh et al., 1982; Van Rijn et al., 2023). At shareholder-owned corporations, management is guided by the profit motive and is monitored by a board of directors elected by shareholders whose voting power is based on the number of shares they own. In contrast, at credit unions there is no profit motive to guide managers' resource allocation decisions, and credit union directors are elected by members with only one vote each regardless of their share of member deposits (Rubin et al., 2013). Management must balance the interests of multiple corporate stakeholder groups, including depositors, borrowers, and employees, one of which has a strong incentive to monitor managers. Member-depositors with large accounts at stake have little incentive to monitor, because they have no more governing power than members with small accounts.[21] Moreover, in the absence of externally held capital, and with no tradeable ownership rights to facilitate a hostile takeover bid, the market for corporate control is unlikely to constrain the actions of management. Relatively few members attend the annual general meeting, scrutinize the board's prudential measures, or otherwise actively monitor the board (Goth et al., 2012). Credit union directors are elected from the general credit union membership, and as such they have no greater financial stake in the credit union than the

[17] Data from the National Credit Union Administration (2018) and www.usacreditunions.com.

[18] Based on statements made by officials at, respectively, the federal credit union regulatory agency (NCUA) and the credit union industry association (CUNA), quoted in "Credit Unions Poised to Be Bigger Business Lending Foe," American Banker (2015). Ely and Robinson (2009) and DiSalvo and Johnston (2017) provide further analyses of credit unions' small business lending activities.

[19] Other studies find tax revenue effects of similar magnitudes. In a study for the US Tax Foundation, Tatom (2005) estimates that the credit union tax exemption resulted in a $2 billion annual loss of tax revenue, and an aggregate future loss of $30 billion over ten years. Joint Committee on Taxation (2017) estimates a $2.9 billion annual loss of tax revenue, projected to rise to $3.2 billion annually by 2020, for a five-year reduction of $14.4 billion. In contrast, a study prepared on behalf of the National Association of Federally Insured Credit Unions (Feinberg and Meade, 2017) concludes that requiring credit unions to pay income tax would result in a $38 billion decline in tax revenues over ten years, due to reduction in credit, lost jobs, and other indirect effects from a shrinking credit union sector.

[20] Throughout our analysis, we presume that banks and credit unions of similar size and location have access to the same production functions, face the same market prices for inputs and outputs, and compete for overlapping customer populations. If these structural presumptions are reasonable ones—and we believe that they are—then the concept of "otherwise similar for-profit banks" should be non-controversial. Aside from interest expenses on deposits and interest revenues on loans, all the other components of pre-tax profits (e.g., employee expenses, overhead expenses, investment revenues) should be the same for banks and credit unions in the absence of managerial inefficiencies.

[21] Ferretti et al. (2019) study co-operative banks and joint stock banks in Italy and find that banks with "one head-one vote" governance policies have greater agency costs than banks with "one share-one vote" governance policies.

members that elect them. Few if any of the members, who are essentially small savers, possess the experience or business acumen necessary to effectively monitor financial conditions and operations.

Given that internal stakeholders have little incentive, and external parties have no incentive, to monitor or discipline credit union management, credit union managers have greater opportunities to pursue their own self-interest via efficiency-reducing activities.[22] These activities might include shirking, empire building, overinvestment, excessive or deficient risk-taking, or the pursuit of a quiet life.[23] Such behaviour diverts a portion of the tax and non-profit subsidies away from credit union members. For the remainder of this paper, we refer to these inefficiencies as *absolute inefficiencies*. It is in this context that we state the second of our two hypotheses:

> Absolute Inefficiencies Hypothesis (H2): Given the weaker corporate governance environment at credit unions relative to banks, a portion of credit unions' tax and non-profit subsidies will be absorbed by non-maximizing behaviour, thus reducing the generation of mandated member benefits.

We illustrate the outcomes associated with hypotheses 1 and 2 in Fig. 1, which shows how a given amount of pre-tax commercial bank profits might be consumed at a tax-exempt, not-for-profit, but otherwise identical credit union. The bank has three uses for its pre-tax profits: Pay some to the government in tax expenses; distribute some to stockholders as dividends; and retain the remainder as equity capital. Like the bank, the credit union will retain some of its profits to increase, maintain or rebuild its equity capital cushion, but it neither pays income taxes to the government (the tax subsidy A) nor distributes dividends to risk-taking shareholders (the non-profit subsidy B). Both A and B are available to credit union management for other purposes and will be consumed in the form of higher costs (above-market interest rates for members, costly services for members, costly benefits to non-member agents, or pure excess costs) and/or lower revenues (e.g., below-market interest rates on loans to members, or lower financial services fees charged to members). We refer to the sum of these cost overruns and revenue shortfalls (relative to banks) as profit inefficiencies C. If banks and credit unions are vying for the same customers, and if they purchase inputs and sell outputs in competitive markets, then credit unions will not be able to operate inefficiently relative to banks over the long run without receiving subsidies. That is, the sum of the subsidies A + B enjoyed by credit unions must equal the total profit inefficiencies C generated by credit unions. Returning to our two testable hypotheses, the primary objective of this study is to determine the incidence of these credit union subsidies: To what extent can we attribute credit union profit inefficiencies to mandated inefficiencies D and absolute inefficiencies E?

4. Modelling relative financial performance

We modify the Berger et al. (1993) profit inefficiency model to test hypotheses H1 and H2. The model is derived from standard neoclassical assumptions that banks are price takers in both input and output markets and attempt to maximise profits through their choices of input and output quantities. While these assumptions arguably hold for the small commercial banks in our data, they clearly do not hold for credit unions. Given their cooperative status, credit unions lack a profit motive and routinely offer better-than-market prices to their member-depositors and member-borrowers. As explained below, we use the model to estimate best-practices input and output choices based solely on commercial bank data, and then evaluate the performance of every commercial bank and credit union in our data against those best- practices levels.

In our version of the model, banks maximise their short-run variable profits by choosing the levels of four variable netputs: Loans and investments are positive netputs, while labour and deposits are negative netputs. Banks take fixed factors as given (physical assets, risk-weighted assets, equity capital, and non-interest income), which we assume are pre-determined by long-run strategic business decisions that were made in the past.

More formally, let bank i compete in market s = (1,…,S) at time t = (1,…,T). The bank maximises variable profits $\pi^*_{i,t} = \pi(\mathbf{p_{s,t}}, \mathbf{z_{i,t}})$ by choosing its optimal vector of n netputs $\mathbf{x^*_{i,t}} = \{x_{j,i,t}$ for j = 1,…,n}, taking as given both the vector of n local market netput prices $\mathbf{p_{s,t}} = \{p_{j,s,t}$ for j = 1,…,n} and its own vector of m fixed factors $\mathbf{z_{i,t}} = \{z_{r,i,t}$ for r = 1,…,m}. We specify the variable profit function using a Fuss normalized quadratic functional form, and then we apply Hotelling's lemma to derive a system of n netput demand equations plus the parent variable profit equation. The parameters of this system are then estimated using a balanced data panel of T quarterly observations for each bank. (A more detailed presentation of the model is provided in Appendix 1.).

In a standard neoclassical profit model, one not only assumes that firms are price takers that seek to maximise profits, but also assumes a perfect information environment where principal-agent problems cannot fester. We relax this additional assumption and allow our model to reveal any profit inefficiencies in the data. For every bank in the data, we can recover n × T residuals from the estimated model. Averaging the residuals over time results in an n-vector of average residuals for each bank, with each bank having a separate average residual for each of its n netputs. We assume that random error attenuates to zero in the process of averaging, so that the average residuals contain only information about bank i inefficiency. Finally, we transform the average residuals into a set of netput inefficiency terms $\widehat{\xi}_{j,i}$ for each bank, where $\widehat{\xi}_{j,i} = 0$ for the least inefficient bank. That is, the bank with the most positive (least negative) average residual for outputs (inputs), becoming increasingly positive (negative) for banks that are more inefficient. Note that the best-practices bank for netput j need not be the best-practices bank for the other netputs. To summarize, the $\widehat{\xi}_{j,i}$ terms measure the under-production of outputs j (loans, securities investments) and the excess use of inputs j (deposits, labour) by bank i on average over the T years in the data, relative to the best practices bank in each of the n netput categories.

As discussed above, our model presumes that banks are price-takers and profit maximisers, assumptions that clearly do not hold for credit unions. Moreover, we know that banks incur tax expenses while credit unions do not. We deal with these inconsistencies as follows. First, we estimate the parameters of the profit inefficiency model using data from commercial banks only. Thus, the estimated parameters of the model capture the relationships between market prices, fixed netputs, variable netput choices, and ultimately profitability at firms for which the price taking and profit maximising assumptions arguably hold. Second, we define the dependent variable in the parent profit equation as bank net income before taxes, which is the functional equivalent of the non-taxable credit union 'surplus.' Third, we generate the netput inefficiency terms $\widehat{\xi}_{j,i}$ for credit unions and commercial banks using the exact same procedures: We calculate fitted netput values for both banks (which we used to estimate the model parameters) and credit unions (which we did not use to estimate the model parameters), generate residuals by subtracting those fitted netput values from actual netput values, and then transform the averaged residuals into the netput

[22] The seminal studies on the value-reducing incentives and behaviours of firm management include Berle and Means (1932), Fama and Jensen (1983), Jensen and Meckling (1976), Demsetz and Lehn (1985), Shleifer and Vishny (1986), Morck et al. (1988), and Laeven and Levine (2008). More recent contributions include: Roe (2021); Bebchuk and Tallarita (2022); and Chronopoulos et al. (2023).

[23] Compensation is typically lower at credit unions relative to banks (Branch and Baker, 2000). Moreover, opportunities for career advancement are limited. Consequently, credit union managers have at best weak incentives to run their organizations in a financially efficient fashion.

inefficiency terms $\widehat{\xi}_{j,i}$ using the procedures described above. For any credit union i in our sample, the $\widehat{\xi}_{j,i}$ terms can be interpreted as the netput inefficiencies generated at a price-taking, profit-maximising commercial bank that made the same netput decisions as credit union i. In other words, we allow credit unions to behave based on their non-profit maximising, non-price taking incentives, but then evaluate that behaviour against a profit maximising, price taking standard. Note that nothing in this procedure prevents credit unions from being less netput inefficient than commercial banks, nor does this procedure preclude a credit union from establishing the best-practices standard for any of the variable netputs.

With the netput inefficiencies terms $\widehat{\xi}_{j,i}$ in-hand for both banks and credit unions, we construct a variety of profit inefficiency measures. Our goal is to evaluate the relative profit performance of banks and credit unions, but $\widehat{\xi}_{j,i}$ are unit inefficiency measures (the volumes of loans, investments, deposits, and labour) not revenue and expense inefficiencies. We easily rectify this problem by multiplying netput inefficiency j by its associated price (loan interest rate, rate of return on securities, deposit interest rate, wage) in netput market j. Then profit inefficiency can be written as $Ineff_i = \sum_{j=1}^{n} \widehat{p}_{j,s} \widehat{\xi}_{j,i}$, where $\widehat{p}_{j,s}$ is the average prevailing price for netput j in market s during the sample period. The netput-specific profit inefficiencies $\widehat{p}_{j,s}\xi_{j,i}$ can be obtained by undoing the summation $\sum_{j=1}^{n} \widehat{p}_{j,s} \widehat{\xi}_{j,i}$ into its n parts. Profit inefficiency per dollar of assets is given by $Ineff_i / \widehat{assets}_i$, where $\widehat{assets}_i$ is the average assets of bank or credit union i during the sample period. Profit inefficiency per dollar of potential profits is given by $Ineff_i / \left(Ineff_i + \widehat{\pi}_i\right)$, where $\widehat{\pi}_i$ is the average profits of bank or credit union i during the sample period.

To test our hypothesis H1, we must compare the profit inefficiencies of banks and credit unions. We make these comparisons using the profit inefficiency gap:

$$\textit{profit inefficiency gap}_{pair} = (Ineff/assets)_{credit\ union} - (Ineff/assets)_{bank} \quad (1)$$

where the subscript *pair* indicates that we use matched pairs of banks and credit unions to calculate this measure. Eq. (1) is the quantified expression of the inefficiency gap graphically represented in Fig. 1. To test our hypothesis H2, we decompose the profit inefficiency gap (1) into its n netput-specific inefficiencies, which we can then use to calculate netput-specific inefficiency gaps.

All of the above inefficiency measures are expressed in terms of market prices, as is appropriate for valuing the social costs of inefficiency. However, this approach can misstate the costs of inefficiency to bank shareholders and/or credit union stakeholders. On the one hand, if a bank somehow pays less than the prevailing market price for its inputs, or charges more than the prevailing market price for its outputs, then our market value-based measures will overstate inefficiency by not capturing these internal pricing efficiencies. On the other hand, if a credit union pays more than the prevailing market price for its deposit inputs, or charges less than the prevailing market price for its loan outputs, then our market-value measures will understate inefficiency by not capturing these internal pricing inefficiencies. We can investigate this issue through the following decomposition:

$$\widehat{p}_{j,i}\xi_{j,i} = \widehat{p}_{j,s}\xi_{j,i} + (\widehat{p}_{j,i} - \widehat{p}_{j,s})\xi_{j,i} \quad (2)$$

where $\widehat{p}_{j,s}$ is the average market price for netput j in state s, and $\widehat{p}_{j,i}$ is the average price actually paid or charged by bank i for netput j. The left-hand term is *internal inefficiency*, i.e., netput profit inefficiency valued at internal bank prices. This term captures both the inefficiencies attributable to setting netput prices at non-market levels, as well as the inefficiencies from the suboptimal netput quantities that are attracted by these non-market prices. Internal inefficiencies are likely to be large for credit unions, which have a legal mandate to offer favourable prices to their member-depositors and member-borrowers. The first right-hand term is *market inefficiency*, which can be interpreted as the portion of internal inefficiency attributable to suboptimal netput quantity choices. This term values inefficiencies using local market prices. Given that market prices represent the value of a marginal unit of the netput allocated to its next best use, this term captures the social costs that occur when banks and credit unions purchase too many inputs and/or produce too few outputs. The second right-hand term is *pricing inefficiency*, which can be interpreted as the portion of internal inefficiency attributable to deviations from local market prices. For inputs, a positive pricing inefficiency term indicates internal pricing inefficiency; the institution is paying above-market prices.[24] For outputs, a negative pricing inefficiency term indicates internal pricing inefficiency; the institution is charging below-market prices.[25]

It is important to note that our primary measure of profit inefficiency *Ineff* does not distinguish between technical inefficiency and allocative inefficiency. This is a departure from the original Berger et al. (1993) model, which measured technical inefficiencies at the bank level and allocative inefficiencies at the industry level. The original model specifies a j-1 vector of parameters τ_j that absorbs allocative inefficiencies for the average bank in the data. Essentially, the presence of these terms in the model forces banks to the expansion path and isolates technical inefficiencies in the regression residuals. While this approach was an innovation in the estimation of parametric bank profit functions, it is not useful for the purposes of the present study. First, in order to calculate our inefficiency gaps, we require institution-specific estimates of inefficiencies for both banks and credit unions, not industry-average estimates.[26] Second, the very concept of allocative inefficiency has firms taking market prices as given, and then choosing non-optimal combinations of inputs and outputs that are inconsistent with those prices. However, this concept fails for credit unions, which have a legal mandate to choose non-market prices, and in practice choose netput prices that diverge substantially from market prices (as shown in Figs. 2 and 3). Instead, we restrict the parameters $\tau_j = 1$ (that is, we estimate the remaining profit function parameters assuming allocative efficiency), which forces allocative inefficiencies into the residuals where they are co-mingled with technical inefficiencies.[27] We then calculate overall profit inefficiency *Ineff* from the residuals and use our *pricing inefficiency* measure to extract the portion of *Ineff* that is related to divergences from market prices.

[24] A positive value could also indicate that the institution is purchasing higher quality inputs than other institutions in its local market. Our matched-pairs analysis should minimize this possibility by comparing similar banks in similar markets.

[25] A negative value could also indicate that the institution is selling higher quality outputs than other institutions in its local market. Our matched-pairs analysis should minimize this possibility by comparing similar institutions in similar markets.

[26] An alternative approach would estimate separate Berger (1993) profit functions for banks and credit unions, which would yield separate estimates of average allocative inefficiencies for both sets of institutions, which we could then use to construct an average inefficiency gap. But as we have discussed, estimating a profit function for credit unions is not appropriate because it violates the price-taking and profit maximizing assumptions of the neoclassical profit function.

[27] It is possible that the best-practice institutions that we use to benchmark the $\widehat{\xi}_{j,i}$ terms only appear to be the most efficient institutions because of large allocative inefficiencies—that is, they inefficiently under-use input j or inefficiently over-produce output j. In this scenario, we would be systematically over-estimating netput inefficiencies. We guard against this possibility by winsorizing the averaged netput residuals at the 5th and 95th percentiles of their distributions before benchmarking the $\widehat{\xi}_{j,i}$ terms. This is documented in Appendix 1.

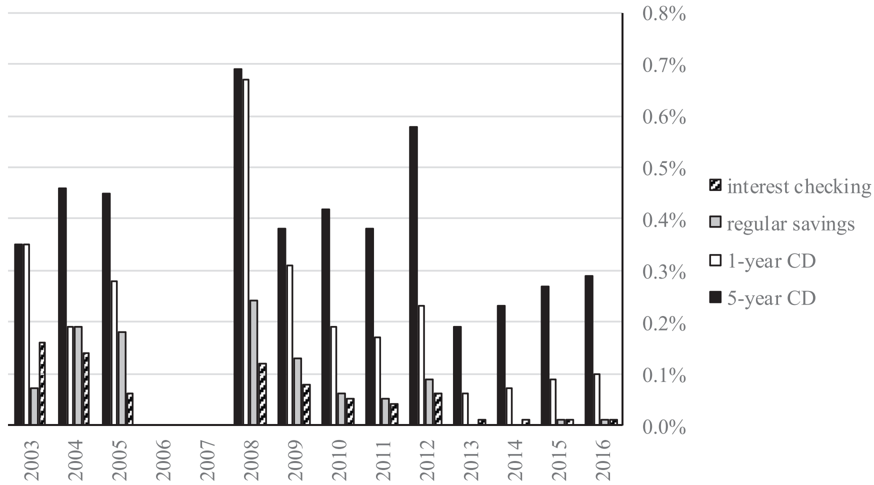

Fig. 2. Comparing Deposit Rates for Credit Unions and Banks, Average credit union interest rate minus average commercial bank rate for standard deposit products from 2003 through 2016. Data provided by the National Credit Union Administration (NCUA). Data for 2006 and 2007 are unavailable.

5. Data

All data used in this study are publicly available. The data for commercial banks come from the Reports on Condition and Income (Call Reports) published by the Federal Financial Institution Examination Council (FFIEC). The data for credit unions come from the Call Reports published by the National Credit Union Association (NCUA). Both sets of data are available via the S&P Global Market Intelligence (formerly SNL Financial) database. We construct two data sets: a balanced panel of quarterly data for 2580 commercial banks that we use to estimate the parameters of the profit function, and a balanced panel of 1024 matched pairs of commercial banks and credit unions that we use to test our main hypotheses. Both data sets begin in the first quarter of 2005 and end in the fourth quarter of 2017. Balanced panels are crucial for our methodology, as they allow us to calculate the averaged residuals for each bank or credit union using the same number of observations.

Table 1 summarizes the data selection process. We begin with the 4582 banks and 5621 credit unions that were in operation during all 52 quarters of our 2005–2017 data period. We then exclude extremely small institutions with average 2005–2017 assets less than $50 million,[28] as well as relatively large institutions with average 2005–2017 assets greater than $8.152 billion (the 99th percentile of the combined distribution of average assets for banks and credit unions). From this set of similarly sized banks and credit unions, we retain only those institutions for which we can observe/construct a full set of model variables (profits, netputs, netput prices, fixed netputs) in every quarter of the sample period. Finally, to prevent outlying values from influencing our estimates of profit inefficiencies, we exclude institutions with average 2005–2017 return on assets (ROA) in the 1st or 100th percentiles of the sample distribution.

This filtering process results in a balanced panel of 2580 commercial banks and 1279 credit unions. We estimate the parameters of the profit function using only the data from the 2580 commercial banks, because banks arguably conform with the assumptions of our neo-classical profit model but credit unions do not; as discussed above, credit unions are neither price-taking nor profit-maximising institutions. We then use those estimated parameters to generate profit inefficiency estimates for all 2580 commercial banks and all 1279 credit unions. Finally, we conduct formal statistical tests of hypotheses H1 and H2 using only the estimated profit inefficiencies for the commercial banks and credit unions that are in the smaller data set of 1024 matched pairs.

We retain Subchapter S banks in all of our samples.[29] The earnings of S corporations are exempt from corporate income tax, but shareholders must pay personal income taxes on 100% of annual corporate earnings. In exchange for this tax treatment, S corporations must remain closely held with no more than 100 shareholders. We include these banks in our data, together with the double-taxed banks organized as Subchapter C corporations, for two reasons. First, nearly 40% of all US commercial banks were organized as S corporations at the end of our sample period, so excluding these banks would seriously limit the size and diversity of our matched-pairs data set. Second, because Subchapter S banks are relatively small institutions, they are natural matches for credit unions which also tend to be small.

5.1. *Matched-pairs sample*

We draw the matched-pairs sample from the parent sample of 2580 commercial banks and 1279 credit unions. Given that credit unions are stand-alone entities, we eliminate all commercial banks that are affiliates of multi-bank holding companies prior to drawing the sample. For each credit union, we select a commercial bank that is (a) located geographically close to the credit union and (b) similar in size to the credit union.

It is important to match on geography because competitive conditions, economic conditions, business practices, government regulations, demographics, and cultural norms—all of which can influence the profitability and efficiency of financial institutions—can vary substantially across a country as large and as heterogeneous as the US. We measure geographic similarity as the distance in miles between the headquarters location of a credit union and the headquarters locations of banks with which it can potentially be paired. It is important to match on size because credit unions tend to be smaller than commercial banks, and as such are more likely at sub-optimal scale. There is near complete agreement among researchers that substantial scale efficiencies exist

[28] We exclude credit unions with assets of less than $50 million on the basis that in contrast to similar sized banks, these credit unions do not engage in significant small business lending activity. While such an asset size restriction may raise potential concerns regarding the generalization of results, this is more than offset by the need to ensure that our sample of credit unions are those most likely to be competing against banks in both the household and small business finance markets.

[29] Our baseline results presented in Section 6 remain robust when subchapter S banks are excluded from the sample.

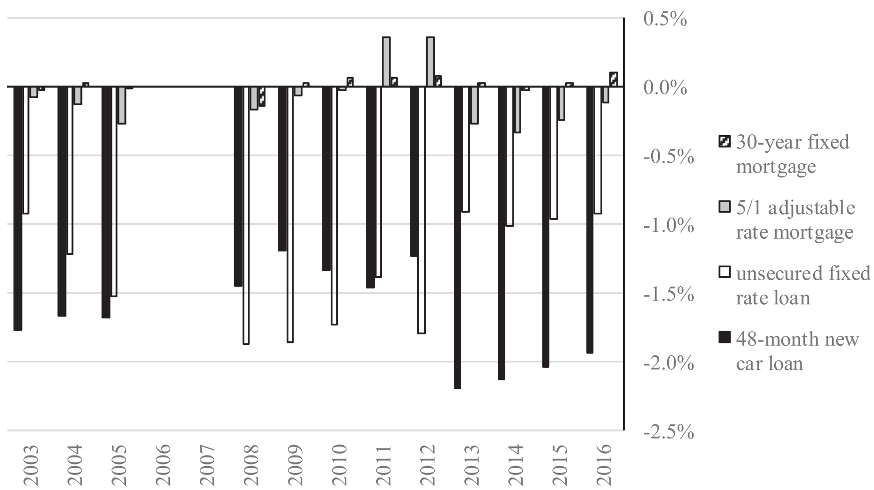

Fig. 3. Comparing Lending Rates for Credit Unions and Banks, Average credit union interest rate minus average commercial bank rate for standard loan products from 2003 through 2016. Data provided by the National Credit Union Administration (NCUA). Data for 2006 and 2007 are unavailable.

across the size range of the institutions in our sample (Berger and Mester, 1997; Wheelock and Wilson, 2011, 2012; Hughes and Mester, 2013, 2019).[30] We measure size similarity as the difference between a credit union's average asset size during our 52-quarter sample period and the average asset sizes of the banks with which it can potentially be paired.

We used a nearest-neighbour matching procedure to select the best matching bank for each credit union. The nearest-neighbour bank is the one that minimizes the value of a quadratic distance function, which is specified in terms of our geographic similarity and asset size similarity variables. We match with replacement, so that any given bank could be paired with multiple credit unions. We eliminate credit unions for which we cannot find a good match, rejecting all matched pairs in the top two deciles of the calculated distribution of quadratic losses. The resulting matched-pair sample contains 1024 pairs, consisting of 1024 unique credit unions and 569 unique banks.[31]

Our matching approach errs on the conservative side. Matching without replacement, imposing a tighter quadratic loss threshold for rejecting matched pairs, or requiring matched banks and credit unions to be located in pre-defined geographic areas (states, metropolitan areas, rural areas) reduces the size of the sample and results in larger estimated *profit inefficiency gaps* (see Appendix 2).

5.2. Variables

The line items in the credit union Call Reports do not match up perfectly with the line items in the commercial bank Call Reports. These inconsistencies prevent us from populating the netput and netput price vectors **x** and **p** as granularly as we would have liked. We take care to populate these two vectors as completely as possible, while including only those netputs and netput prices that are similarly measured in the two Call Reports. We display the two sets of Call Report definitions in Table 2 and report summary statistics in Table 3 for all the variables used to estimate and evaluate the profit model. The underlying bank and credit union Call Report data codes are displayed in Appendix 3.

We define *Profit* π as pre-tax net income at commercial banks and as total surplus at credit unions. Conducting our analysis in terms of pre-tax profitability is essential for comparing profit performance among double-taxed Subchapter C commercial banks, single-taxed Subchapter S commercial banks, and non-taxed credit unions.[32] We specify four variable netputs in **x**. *Loans* includes total on-balance sheet loans. *Investments* includes total securities currently held on balance sheet, plus deposits held in, loans made to, or stock held in other banks or credit unions. *Labour* is equal to the number of full-time equivalent (FTE) workers. Commercial banks directly report the number of FTEs, but credit unions separately report the numbers of full-time and part-time workers. We estimate FTEs for credit unions as full-time workers plus 0.50 times part-time workers.[33] *Deposits* is equal to total deposits and other borrowings, on which banks and credit unions may or may not pay interest.

We define local netput markets using the geographic borders of the 50 US states, and we assign banks and credit unions to these local markets based on the location of their headquarters offices. We calculate the netput prices $\mathbf{p}_{s,t}$ in these markets using the post-filtered data from 2580 banks and 1279 credit unions (Line D in Table 1) and the following formula: The market price for netput *j* in state *s* is equal to the aggregate revenue or expense flows for netput *j* at the banks and credit unions in state *s*, divided by the aggregate quantity of netput *j* produced or used by the banks and credit unions in state *s*, during quarter *t*. *Price(Loans)* is the aggregate interest revenues from loans divided by aggregate *Loans*. *Price(Investments)* is the aggregate interest and dividend revenues from

[30] There is less agreement regarding the relationship between institution size and technical efficiency, with some studies finding positive relationships and others finding negative relationships (see Berger et al., 1999 for a review).

[31] On average, the banks and credit unions in these matched pairs differ in asset size by about 8% and are located 54 miles distance from each other. When we instead sample without replacement, the average size difference is little changed at 7%, but the average distance increases to 152 miles. Hence, sampling without replacement to increase the heterogeneity of the matched banks would be achieved only at the cost of greatly reducing the localness of the credit union-bank pairs.

[32] Berger (1993) define π as pure variable profits $\sum_j^n p_j x_j$, which is constructed using only the revenues and expenses associated with the four variable netputs specified in the empirical model. In contrast, our net income before taxes definition of π captures 100% of bank and credit union revenues and expenses. When we re-estimate our model using the variable profit measure, the means value for *profit inefficiency gap* is.00919, substantially larger than the.00753 mean in our baseline model. Hence, our definition of π is a conservative choice that avoids overstating the size of the subsidies that credit unions enjoy.

[33] This follows industry precedent. The Credit Union National Association uses this weighting scheme to calculate FTEs in its *Credit Union Report, Mid-Year 2014*. Nevertheless, we test our results for robustness using alternative definitions of credit union FTEs using weights both larger and smaller than 0.50 (see Appendix 4).

Table 1
Sample Selection.

	Commercial Banks	Credit unions
A. Institutions reporting positive assets in every quarter, 2005.1 through 2017.4	4582	5621
Less: Mean quarterly assets less than $50 million	(564)	(3451)
Less: Mean quarterly assets greater than $8.152 billion	(104)	(9)
B. Institutions with assets between $50 million and $8.152 billion	3914	2161
Less: Data needed to calculate variables is missing	(1335)	(856)
C. Institutions with complete data	2633	1305
Less: Mean ROA in 1st or 100th percentile of bank or credit union distribution	(53)	(26)
D. Filtered data	2580	1279
E. ***Estimation data set:*** Commercial banks used to estimate the profit function	2580	–
F. ***Parent sample:*** Institutions from which the matched sample is drawn	2580	1279
G. ***Matched-pairs data set:*** Institutions used to test hypotheses H1 and H2	1024	1024

This table summarizes the procedures used to filter out banks or credit unions with incomplete data, outlying values, or characteristics inconsistent with the requirements of our model and tests. Asset values are in 2010 dollars.

Table 2
Variable Definitions.

	Commercial banks	Credit unions
Profit		
Profits $\pi_{i,t}$	Pre-tax net income	Net income ("surplus")
Netputs		
Loans $x_{1,i,t}$	Total loans (excluding leases)	Total loans (excluding leases)
Investments $x_{2,i,t}$	Total securities investments	Total investments
Labour $x_{3,i,t}$	Full-time equivalent workers (FTEs)	Full-time workers + 0.5 *Part-time workers
Deposits $x_{4,i,t}$	Deposits and all other borrowed funds	Member shares, non-member deposits, and other borrowings
Netput prices		
Price(Loans) $p_{1,s,t}$	Interest income on loans/*Loans*	Interest income on loans/*Loans*
Price(Securities) $p_{2,s,t}$	(Interest income on securities + Dividends on securities)/*Securities*	(Interest income on securities + Dividends on securities)/*Securities*
Price(Labour) $p_{3,s,t}$	(Salaries + Benefits)/*Labour*	(Salaries + Benefits)/*Labour*
Price(Deposits) $p_{4,s,t}$	(Interest expenses on deposits and other borrowings)/*Deposits*	(Interest expenses on deposits and other borrowings)/*Deposits*
Fixed factors		
Premises $z_{1,i,t}$	Premises and fixed assets	Land, buildings and other fixed assets
Equity $z_{2,i,t}$	Equity capital	Net worth
Noninterest Income $z_{3,i,t}$	Non-interest income	Non-interest income
Risk-weighted Assets $z_{4,i,t}$	Risk-weighted assets (using Federal Reserve formula)	Risk-weighted assets (using NCUA formula)
Other		
Assets	Total assets	Total assets

This table reports definitions of the variables used in the profit function estimations and the matched-sampling procedure. Netput prices are calculated using aggregate industry data in the headquarters state of each bank or credit union. All other variables are observed at the individual bank or credit union. See the Appendix for variable definitions expressed in terms of the data codes in the FFIEC call reports and the NCUA call reports.

investments divided by aggregate *Investments*. *Price(Labour)* is the aggregate wages and benefits paid to employees divided by aggregate *Labour*. *Price(Deposits)* is the aggregate interest paid on deposits and other borrowing money divided by aggregate *Funds*. Table 3 displays statistics for both market prices $\widehat{p}_{j,s}$ (the unweighted average price for neput j in local markets) and internal prices $p_{j,i}$ (the prices actually paid or charged by bank i for netput j).

We specify four fixed factors in **z**. *Premises* includes the book value of land, buildings and other fixed assets; we include this to control for the effects of branches, ATMs, and other physical investments on profits. *Equity* is accounting net worth; we include this to control for the effect of financial leverage on profits. *Noninterest income* includes fees earned from providing transactions services to depositors, selling non-loan financial services, and capital gains income; we include this to control for the impact of profit-generating activities for which the data sources do not allow us to observe prices. *Risk-weighted assets* is the regulator-defined risk-weighted assets measure; we include this to control for the impact of asset risk on profits.

As indicated in Table 3, the matching process reduced *Assets* at both the average bank and average credit union by statistically and economically significant amounts. Accordingly, the mean values of all size-related variables in our data (*Profit*, netputs, fixed factors) also declined by statistically significant amounts. Changes to means netput prices (market and internal) were mixed and tended to be economically small. The sole exception is the economically large increase in the price of *Labor* for commercial banks (though not for credit unions). The average matched-pairs bank earned materially lower *Return on assets* than the average bank in the parent sample, again suggesting that our *profit inefficiency gaps* will be conservative estimates.[34]

5.3. Survivorship

Our structural profit approach necessarily restricts the data to banks and credit unions that survived the entire 2005–2017 data period. As shown in Table 4, the numbers of both commercial banks and credit unions in the US (with assets between $50 million and $8.152 billion) were in decline during our sample period, with the attrition rate at banks (41%) more than double the attrition rate at credit unions (16%). This difference is consistent with an active market for corporate control that exerts strong discipline on banks but not on credit unions. It also gives us pause to wonder whether and how this survivor bias might bias our

[34] We do not conduct difference-in-means tests for banks versus credit unions within our matched sample. In our theoretical model, banks choose their netput quantities and take market netput prices as given, and in our empirical application credit unions choose both netputs and netput prices. Because netputs and netput prices are the fundamental determinants of profit inefficiency, requiring the banks and credit unions in our matched pairs sample to have the same mean netput quantities and netput prices would be equivalent to rejecting our testable hypotheses by construction.

Table 3
Descriptive Statistics for Matched-pairs and Parent Samples.

	Panel A: Matched-pairs data set				Panel B: Parent sample			
	Commercial banks		Credit unions		Commercial banks		Credit unions	
	(n = 1024)		(n = 1024)		(n = 2580)		(n = 1279)	
	mean	std dev	mean	std dev	mean	std dev	mean	std dev
Assets ($ million)	309.0***	429.3	314.3***	449.3	410.3	747.8	399.0	715.3
Profitability								
Profit ($ million, pre-tax, annualized)	3.7***	6.2	1.9***	3.9	5.5	11.8	2.6	6.0
Return on assets (pre-tax, annualized)	.01082***	.00501	.00521	.00332	.01251	.00467	.00529	.00332
Netputs ($ million)								
Loans	193.9***	267.6	200.6***	295.8	263.9	499.5	254.5	470.0
Investments	82.3***	150.2	73.4***	139.5	104.6	199.9	95.2	224.4
Labour	73.7***	83.1	86.0***	91.2	103.6	190.6	101.5	138.4
Deposits	238.7***	343.5	278.1***	399.4	320.6	593.9	353.2	635.2
Netput market prices								
Price(Loans)	.01336***	.00214	.01353**	.00219	.01390	.00148	.01374	.00228
Price(Securities)	.00748***	.00051	.00754	.00061	.00753	.00042	.00756	.00067
Price(Labour) ($ thousand)	20.17***	4.30	19.85	4.13	18.03	3.10	19.84	4.07
Price(Deposits)	.00354***	.00041	.00354**	.00043	.00365	.00041	.00350	.00047
Netput internal prices								
Price(Loans)	.01556	.00237	.01470	.00179	.01552	.00183	.01474	.00235
Price(Securities)	.00884**	.00907	.00923	.00619	.00810	.00546	.00918	.00588
Price(Labour) ($ thousand)	16.28***	4.86	14.42	3.25	14.97	3.57	14.41	3.23
Price(Deposits)	.00364***	.00101	.01390	.00273	.00376	.00085	.01383	.00271
Fixed factors ($ million)								
Premises	4.6***	6.1	7.2***	9.3	7.1	12.8	8.5	13.0
Equity	31.7***	45.5	33.5***	47.4	43.2	83.0	42.2	74.7
Noninterest Income	0.8***	1.4	1.1***	1.6	1.1	3.6	1.4	2.4
Risk-weighted Assets	213.6***	304.2	201.1***	287.8	288.1	548.0	253.2	455.0

This table reports descriptive statistics for the variables used in the profit function estimations and construction of the profit inefficiency measures. Firm-quarter observations for 2005–2017. Number of firms are reported in parentheses. All monetary amounts in 2010 prices. Netputs, Fixed factors, and Other variables are end-of-quarter values. The netput market price and netput internal price variables are constructed using quarterly flows. Profitability variables are annualized. ***, ** and * indicate that the means for banks (credit unions) in the matched-pairs sample are statistically different from the means for banks (credit unions) in the parent sample, respectively, at the 1%, 5% and 10% levels.

estimates of credit union subsidies.

We can ascertain the direction of any such survivor bias in our estimates by comparing the profitability in 2004 for banks and credit unions that did or did not survive until the end of our 2005–2017 sample period. On average, 2004 ROA for surviving banks was 47.7 basis points higher than for non-surviving banks (.01163 minus.00686), while 2004 ROA for surviving credit unions was 95.4 basis points higher than for non-surviving credit unions (.00505 minus −0.00449). In other words, the profit-improving impact of survivorship was twice as large for the credit unions in our data than for the commercial banks in our data. This suggests strongly that any survivorship bias imposed by our methodology will understate the size of the credit union profit inefficiency gaps.[35]

6. Results

We use seemingly unrelated regression (SUR) techniques to estimate the parameters of the profit efficiency model, using data from the 2580 commercial banks in the parent sample. We do not include the 1279 credit unions in the parent sample in this estimation, because credit unions are neither profit-maximisers nor price-takers as assumed by the theory. We then use the estimated parameters to generate a vector of $n \times T$ residuals for each of the 2580 commercial banks included in the estimation; we use the same parameters to estimate a vector of residuals for each of the 1279 credit unions. The residuals are then used to calculate a complete set of netput inefficiency terms $\widehat{\xi}_{j,i}$and profit inefficiency measures $Ineff_i$ for each bank and each credit union. (More complete details are provided in Appendix 1.) Thus calculated, we can interpret $Ineff_i$ as the inefficiency that would have been generated by a price-taking, profit-maximising commercial bank that made the same variable netput decisions as did credit union *i*.

6.1. Profit inefficiency and profit inefficiency gaps

Table 5 displays our estimates of profit inefficiency for the 1024 matched pairs of commercial banks and credit unions (Panel A) and also for the parent sample of 2580 commercial banks and 1279 credit unions (Panel B). Our main focus here is on the matched-pairs results. All of the inefficiency measures displayed in this table are expressed in quarterly terms and are valued using average local market netput prices $\widehat{p}_{j,s}$.[36]

The estimated profit inefficiencies are large. For example, we estimate that the average matched-pair commercial bank incurred more than $6 million of profit inefficiency each quarter, which amounts to $0.0198 per dollar of assets each quarter (*Ineff/Assets*, which is our preferred measure of profit inefficiency) or $0.0792 per dollar of assets in annualized terms. To put this last figure into perspective, eliminating this much profit inefficiency would increase a bank's pre-tax ROA by 732% (0.0792/0.01082). While this result at first may seem to be too large, it conforms with the variation in pre-tax bank ROA in the raw data: Pre-tax ROA more than doubles as a bank moves from the 50th

[35] Appendix 5 provides further information regarding the number of survivors, annual rates of attrition, and average return on assets (ROA) among banks and credit unions.

[36] Appendix 6 provides estimates of profit efficiency of matched pair of banks and credit unions under various scenarios including: imposing the restriction that all matched pairs must have the same metro/micro/rural classification; imposing the restriction that all matched pairs must be more than 10 miles distant from each other; using sampling without replacement where each sample bank is eligible to be paired with no more than one sample credit union; and restricting the pool of banks available for matching to those located in states in the lowest two quartiles of the distribution of states by average corporate tax rate. Appendix 7 examines the sensitivity of measured inefficiency to survivorship/non-survivorship.

Table 4
Impact of Survivorship.

	Present at start of 2005	Survived to end of 2017	Did not survive to end of 2017	Difference	Attrition Rate
Number of commercial banks	6028	3578	2450	–	40.6%
Number of credit unions	2181	1837	344	–	15.8%
Mean assets at commercial banks	–	$536.5 m	$515.0 m	$21.5 m	–
Mean assets at credit unions	–	$421.4 m	$253.8 m	$167.6 m	–
Mean ROA at commercial banks	–	.01163	.00686	47.7 bps	–
Mean ROA at credit unions	–	.00505	-.00449	95.4 bps	–

This panel compares the asset size and return-on-assets for banks and credit unions that survived (and hence were retained in the data sample) and did not survive (and hence were removed from the data sample) from 2005 through 2017. Banks and credit unions present at the start of 2005 had assets between $50 million and $8.125 billion in 2010 prices. (Note: The numbers of observations in this table do not match the numbers of observations in Table 1, due to the different methodological objectives of the tables.)

Table 5
Estimated Raw Profit Inefficiencies.

	Panel A: Matched-pairs data set		**Panel B: Parent sample**	
	[1]	[2]	[3]	[4]
	Commercial banks (n = 1024)	Credit unions (n = 1024)	Commercial banks (n = 2580)	Credit unions (n = 1279)
Ineff ($ millions)	6.167	8.415	7.865	10.024
Ineff/assets	0.0198	0.0274	0.0206	0.0274
Ineff/(Ineff+π)	0.6903	0.8484	0.7227	1.0081
mean *Ineff/assets* by asset size:				
$50 - $100 million	0.0244	0.0321	0.0251	0.0310
$100 - $200 million	0.0173	0.0244	0.0190	0.0246
$200 - $500 million	0.0159	0.0243	0.0167	0.0243
$500 million or more	0.0220	0.0289	0.0206	0.0286

This table reports estimates of profit inefficiency for commercial banks and credit unions over the 2005–2017 data period. Mean values for the matched sample of 1024 banks and credit unions are displayed in columns [1] and [2]. Mean values for the larger parent samples of 2580 banks and 1279 credit unions are displayed in columns [3] and [4]. The raw estimated inefficiency measures were winsorized at the 5th and 95th percentiles of the sample distributions before calculating the statistics in this table. All of the Ineff data reported in this table are calculated in terms of local market netput prices and are expressed as ***quarterly magnitudes***.

percentile to the 99th percentile; nearly quintuples as a bank moves from the 10th to the 99th percentile; and increases seven-fold as a bank moves from the 5th percentile to the 99th percentile (see Table 6).

Profit inefficiency accounts for an estimated 84.84% of potential profits at the average matched-pair credit union, and 100.81% of potential profits in the parent sample. Again, these results may at first seems overly large, but upon reflection they are economically sensible: Not-for-profit institutions are expected to earn only enough profit to maintain/replenish their capital and liquidity buffers, and to direct any additional potential profit to their intended beneficiaries—in the case of credit unions, by providing extra financial services, better service quality, or favourable prices to their members (mandated inefficiencies).

Table 7 displays our estimates of *profit inefficiency gaps* and *netput inefficiency gaps* for the matched-pair data sample. As before, we value the estimated inefficiencies using local market prices: If loans, deposits, labour and investment securities are purchased and sold in competitive markets, then market prices represent the value of a marginal unit of these netputs allocated to their next best uses, and the estimated market-value inefficiency gaps displayed in this table represent the gross social costs of credit union inefficiency relative to banks.[37] All of the numbers in Table 7, and in all the remaining tables, are expressed in annual magnitudes.

We find economically meaningful *profit inefficiency gaps*. The mean estimated profit inefficiency gap is.00753 per year, indicating that the average credit union was 75.3 basis points of assets less profit efficient than the average commercial bank. This gap is the equivalent of 69.6% of the annual pre-tax profits earned by the typical commercial bank in our match-sample data (0.00753/0.01082).

Table 6
Distribution of Average Annualized Return on Assets.

Percentile	**Annualized ROA** 1024 banks in the matched-pairs sample
99th	.02475
95th	.01957
90th	.01733
75th	.01382
50th	.01045
25th	.00773
10th	.00506
5th	.00251
1st	-.00073

This table displays the distribution of average ***annualized*** return on assets (ROA) for the 1024 commercial banks in the matched-pairs sample, calculated using 52 quarters of data (2005–2017) for each bank.

6.2. *Mandated versus absolute inefficiencies*

We find strong support for the mandated inefficiency hypothesis H1. Valued using local market prices, the average credit union in our matched pairs data generated 72.1 basis points more mandated inefficiencies per dollar of assets than the average commercial bank. This mandated profit inefficiency gap is dominated by deposit-related financial services (safe-keeping, member liquidity, payments services, risk-free investment vehicles) with only a trivial portion consisting of credit-related financial services. Relative to the average bank, the average credit union overused deposit inputs by 70.9 basis points of assets and over-produced loan outputs by 1.2 basis points of assets; the former result adds to the *profit inefficiency gap* because it generates

[37] We refer to these are gross costs because they do not include the potentially offsetting intangible social benefits derived from redistributing income via the tax and/or non-profit subsidies. Measuring such benefits is a normative exercise and lies far beyond the scope of this study.

Table 7
Profit Inefficiency Gaps.

	[1] Profit inefficiency gap	[2] Loans	[3] Deposits	[4] Mandated (−2 +3)	[5] Investments	[6] Labour	[7] Absolute (5 +6)
All matched pairs (n = 1024)	.00753***	-.00012***	.00709***	.00721***	.00054***	.00002	.00056***
By asset size:							
$50-$100 million (n = 301)	.00764***	-.00001	.00707***	.00708***	.00063***	-.00006	.00057***
$100-$200 million (n = 292)	.00704***	-.00032***	.00676***	.00708***	.00049***	.00012*	.00061***
$200-$500 million (n = 258)	.00839***	-.00007***	.00815***	.00822***	.00033***	-.00001	.00031***
$500-$5260 million (n = 173)	.00687***	-.00004***	.00609***	.00614***	.00078***	.00005*	.00083***

This table reports mean values for the estimated ***profit inefficiency gaps*** for 1024 matched pairs of commercial banks and credit unions over the 2005–2017 sample period.

profit inefficiency $\text{gap}_{\text{pair}} = (\text{Ineff/assets})_{\text{credit union}} - (\text{Ineff/assets})_{\text{bank}}$

All of the *inefficiency gaps* reported in this table are calculated in terms of average netput prices in local markets and are expressed as ***annualized magnitudes***. ***, ** and * indicate statistically different from zero at the 1%, 5% and 10% levels.

Table 8
Extracting the Average Tax Subsidy.

(1)	(2)	(3)	(4)	(5)	(6)	(7) = (6) ÷ (1)
profit inefficiency gap	bank dividends	bank retained earnings	credit union retained earnings	retention difference	tax subsidy	tax subsidy % of inefficiency gap
.00753	.00361	.00499	.00521	.00022	0.00414	55.0%

This table evaluates Eq. (4): $t \bullet \pi_B = (\pi_B - \pi_{CU}) - div_B + (retain_{CU} - retain_B)$, where the left-hand side is the credit union tax subsidy and the three right-hand side terms are, respectively, the profit inefficiency gap, bank dividends, and the retention gap. All data are mean values for the matched-pairs sample of 1024 banks and credit unions and are expressed in annual terms per dollar of assets.

excess costs, while the latter result reduces the *profit inefficiency gap* (slightly) because it generates extra revenues.[38]

We find relatively weak support for the absolute inefficiency hypothesis H2. Valued at local market prices, the average credit union generated just 5.6 basis points more absolute inefficiencies per dollar of assets than the average commercial bank. This economically small absolute inefficiency gap is comprised almost entirely by the underproduction of investment outputs at credit unions. We find little evidence to suggest that credit unions overuse labour inputs, on average, relative to similar commercial banks. Although the raw data suggest substantial over-hiring by credit unions (as shown in Table 3), our model accounts for the additional labour inputs necessary to provide more depositor services than banks, and merely hints at positive labour inefficiency gaps in the second and fourth asset-based subsamples.[39]

Overall, when we use local market prices to value the netput inefficiencies estimated in our model, the credit union *profit inefficiency gap* is economically large and is explainable almost entirely by credit unions' legislative *raison d'être*. On average, for every extra dollar of absolute inefficiency that they generate relative to commercial banks, credit unions generate thirteen dollars of mandated inefficiencies. Moreover, although the absolute inefficiency gap is statistically greater than zero, it is economically small.[40] The overall *profit inefficiency gap* shrinks with asset size. This is caused by a reduction in the mandated inefficiency gap across the four asset-size subsamples, albeit these declines are relatively small and non-monotonic.

6.3. Tax subsidies versus non-profit subsidies

Decomposing the estimated profit inefficiency gap into its fundamental institutional drivers—namely, the credit union tax subsidy and the credit union non-profit subsidy—is of central importance to this study. Unfortunately, neither of these subsidies is observable directly. In this section, we attempt to back-out a reasonable decomposition, based on the logic of our analytic framework and the characteristics of the credit unions and banks in our matched-pair data. We begin by expressing the profit inefficiency gap as the simple difference in profits between a well-matched bank-credit union pair:

$$\pi_B - \pi_{CU} = [t \bullet \pi_B + div_B + retain_B] - [0 + 0 + retain_{CU}] \quad (3)$$

where π_B is pre-tax bank profits and π_{CU} is pre-tax credit union profits.[41] The first bracketed term indicates that the bank's pre-tax accounting profits equal the sum of three items: income taxes paid $t \bullet \pi_B$; earnings distributed to shareholders div_B; and earnings retained $retain_B$. In the

[38] Our analysis assumes no difference in the quality of the loans on credit union and commercial bank balance sheets. But credit unions make loans only to their depositor members, and those relationships could result in informational advantages that improve the quality of credit union loans—if so, then the loan inefficiency gap would arguably overstate credit union inefficiency relative to banks. Nevertheless, the data offer no support for this argument. Measured relative to total loans, average annual provisions for loan losses (.0067 versus.0039), loans delinquent more than 30 days (.0232 versus.0130) and loans charged off (.0084 versus.0050) were higher for credit unions than for commercial banks over our 13-year sample period (see Appendix 8).

[39] Our analysis assumes that a positive labour inefficiency gap represents absolute inefficiencies at credit unions relative to banks. But if those extra workers were employed to provide financial services consistent with credit unions' underlying mission—say, credit counselling for credit union members—then some or all of the labour inefficiency gap would be more properly classified as mandated inefficiency. Regardless, this turns out to be a moot argument in our analysis, given the very small labour inefficiency gaps in Table 7.

[40] Thus, we interpret our findings are thus inconsistent with Boyer and Kempf (2020) who show that (in the absence of bank mobility) regulatory contracts can be designed in such a way as to ensure that banks are regulated based upon their relative efficiency. The authors conclude that this optimal regulatory contract is supported by two instruments, comprising taxes on bank profits and liquidity requirements. In the present setting, where credit unions are at an overall level more inefficient than banks, this at first glance may appear that there are gains from regulating credit unions less permissively. However, such an approach would not be justified, given that we find almost all of the observed differences between banks and credit unions are attributable to mandated (rather than absolute) inefficiency.

[41] The pre-tax difference in profits $\pi_B - \pi_{CU}$ provides an appropriate representation of the inefficiency gap because, for a well-matched pair, the inefficiencies of both institutions are estimated by comparing their profits to the same place on the efficient bank profit surface.

second bracketed term, the credit union neither distributes earnings nor pays income taxes but does retain some earnings $retain_{CU}$.[42] Rearranging (3) provides a formula useful for calculating the relative size of the two credit union subsidies:

$$t \bullet \pi_B = (\pi_B - \pi_{CU}) - div_B + (retain_{CU} - retain_B) \tag{4}$$

The *tax* subsidy is given by $t \bullet \pi_B$, taxes that the bank must pay, but from which the well-matched credit union is exempt. The *steady-state non-profit subsidy* is given by div_B, the return to risk capital in a hypothetical steady state (in which earnings neither grow nor shrink, so that the dividend payment fully accounts for the shareholder's required rate of return) which in the absence of shareholders the matched credit union need not pay. In this hypothetical steady state, the well-matched bank and credit union each retain only the earnings necessary to maintain their required equity cushions, and as such the "retention difference" $retain_{CU} - retain_B = 0$. Hence, the tax subsidy $t \bullet \pi_B$ becomes calculable because we have estimates of the profit inefficiency gap $\pi_B - \pi_{CU}$ and we can observe the bank dividend payments div_B. This simple arithmetic is depicted in Fig. 1 as A + B = C.

The special case in which $retain_{CU} - retain_B = 0$ is hypothetical and hence unobservable, but the actual values for the retention difference are easily observable in the matched-pairs data, and can be used along with Eq. (4) to roughly decompose the profit inefficiency gap into its two subsidy roots. As demonstrated in this accounting identity-based equation, the tax subsidy increases with the retention difference: Holding bank dividends constant, a larger retention gap indicates higher bank profits relative to credit union profits, causing the bank's tax bill to increase. These calculations are displayed in Table 8. At least on average, the tax and non-profit subsidies are about equally responsible for the poor relative performance of the credit unions in our data: the tax subsidy accounts for 55% of the profit inefficiency gap at the average bank-credit union pair.

The average retention difference is small, only about two basis points per asset dollar, and accordingly has only a small influence on this result. Indeed, if we had allocated the retention difference to the non-profit subsidy instead of to the tax subsidy (an action for which we have no justification), the calculated tax subsidy would decline only from.00414 to.00392 and would still account for 52.1% of the profit inefficiency gap. It is perhaps surprising that the average retention difference is positive. In 56% of the bank-credit union pairs, the credit union retains more earnings per dollar of assets than the bank. There are reasonable explanations for why incentives to retain earnings (at the margin) could be stronger at credit unions than at commercial banks. First, a dollar of earnings retained and reinvested at an un-taxed credit union will generate a larger expected *after-tax* return than at a bank. Second, a dollar of earnings retained and reinvested imposes a liquidity cost on bank shareholders because it requires the bank to distribute smaller dividends but imposes no such cost at credit unions.

6.4. Valuing inefficiencies using internal netput prices

We have thus far valued our estimated profit and netput inefficiencies at local market prices. Using this approach, the profit inefficiency gap is the social cost of the resources a credit union uses *in excess of* those used by an otherwise similar commercial bank. However, if credit unions transact with their members at better-than-market prices, a market-value approach will understate the pecuniary benefits that credit unions provide those members. We address this issue by decomposing our estimated profit and netput inefficiencies into *internal inefficiencies*, *market inefficiencies*, and *pricing inefficiencies* per dollar of assets, using the relationship in Eq. (2). The results of this decomposition are displayed in Table 9.

On average, internal inefficiencies (.02037) and market inefficiencies (.01948) are very similar for banks. Equivalently stated, pricing inefficiencies per dollar of assets are very small for banks. This result is consistent with our maintained assumption that commercial banks are price takers, and it infers that profit inefficiency at banks is associated almost entirely with the overuse of inputs and/or the underproduction of outputs. We find starkly different results for credit unions, where internal inefficiencies (.09393) dominate market inefficiencies (.02737). Equivalently stated, in addition to over-using inputs and/or underproducing outputs to a larger extent than do banks, credit unions transfer a portion of their subsidies to their members (and/or other agents) in the form of favourable netput prices. When value the profit inefficiency gap using the actual prices that credit unions charged and paid for netputs, 89.8% of this performance gap can be attributed to non-market pricing by credit unions (.06603/.07356).

The prices paid on credit union member deposits are the dominant component of these transfers. For loans (.00010), investments (.00085), and labour (−.00060) netputs, pricing inefficiencies per dollar of assets were small and not terribly different from those at the commercial banks. On average, credit unions are paying near-market prices for these three netputs, and the pricing inefficiency gaps associated with these netputs are either statistically non-significant (for investments) or economically small (credit unions charged lower rates on loans and paid lower wages/benefits to labour).[43] The large credit union pricing inefficiencies are nearly entirely associated with above market prices for deposits. These results suggest that credit unions deploy their tax and non-profit subsidies as pass-through benefits for their members; it is the dominant channel through which these subsidies flow.

Our pricing inefficiency results are qualitatively consistent with interest rate data collected annually by the NCUA.[44] Fig. 2 graphs the difference in average annual interest rates (credit unions minus commercial banks) for selected deposit products in 2003 through 2016. According to these data, credit unions have on average paid premiums over commercial banks as high as 69 basis points on certificates of deposit (CDs), 19 basis points on regular savings accounts, and 16 basis points on interest-bearing checking accounts. Fig. 3 graphs the difference in average annual interest rates for selected loan products and shows that loan prices are not always lower at credit unions than at commercial banks. Credit unions consistently under-price commercial banks by 100–200 basis points on automobile loans and unsecured consumer loans, products that most commercial banks have deemphasized. However, interest rates on residential mortgages (which account for approximately half of the assets in credit union loan portfolios, and which are priced in highly competitive national financial markets that leave little room for strategic pricing) are relatively similar for credit

[42] The interest payments that credit union members receive are not returns to ownership. Credit union members lack some of the most basic ownership characteristics: (a) they only very infrequently receive distributions (Callahan and Associates, 2015), which are called "patronage dividends" which itself suggests something very different from ownership, (b) they do not receive payments in exchange for ownership rights when their credit union is acquired, and (c) their interest income is not an entrepreneurial return to risk taking because they are not placing any capital at risk (and in most cases, their deposits are fully insured).

[43] It is possible that our results for loan netputs reflect unspecified differences in the business models of banks and credit unions. To investigate, we re-estimate our model after expanding the vector of fixed netputs $\boldsymbol{z}$ with two additional control variables: the level of *business loans* (important to most commercial banks, but unimportant to most credit unions) and the level of *real estate loans* (which vary idiosyncratically in importance at both banks and credit unions). Our results—shown in Appendix 4 are robust to making this change.

[44] A caution to the reader: The deposit interest rate differences in Fig. 2 and the estimated deposit pricing inefficiency gap in Table 9 are not directly comparable. The former are raw interest rate differences, while the latter are interest rate differences multiplied by an estimated inefficiency term. While we would expect these two measures to be qualitatively similar, one would not expect them to map into each other quantitatively.

Table 9
Internal, Market, and Pricing Inefficiencies.

	Total	Loans	Deposits	Investments	Labour
Profit inefficiencies					
Banks					
Internal inefficiency/assets	.02037	.00085	.01605	.00211	.00136
Market inefficiency/assets	.01984	.00068	.01582	.00145	.00190
Pricing inefficiency/assets	.00053	.00017	.00024	.00066	-.00054
Credit Unions					
Internal inefficiency/assets	.09393	.00066	.08912	.00283	.00132
Market inefficiency/assets	.02737	.00056	.02290	.00199	.00192
Pricing inefficiency/assets	.06657	.00010	.06622	.00085	-.00060
Profit inefficiency gaps					
Internal inefficiency gap	.07356***	-.00019***	.07307***	.00073***	-.00004
Market inefficiency gap	.00753***	-.00012***	.00709***	.00054***	.00002
Pricing inefficiency gap	.06603***	-.00007***	.06598***	.00019	-.00006**

This table decomposes ***profit inefficiencies*** and ***profit inefficiency gaps*** into internal inefficiency, market inefficiency, and the pricing inefficiency according to Eq. (2): $\widehat{p}_{j,i}\xi_{j,i} = \widehat{p}_{j,s}\xi_{j,i} + (\widehat{p}_{j,i} - \widehat{p}_{j,s})\xi_{j,i}$
Data are mean values for 1024 matched pairs of commercial banks and credit unions over the 2005–2017 sample period. In Panel B, the ***, ** and * indicate statistically significant differences at the 1%, 5% and 10% levels, respectively. All numbers are expressed as ***annualized magnitudes*** per dollar of assets. All variables are defined in the text.

unions and banks.

7. Conclusions

In the US, credit unions are exempt from paying federal income taxes. Yet they compete directly in credit and deposit markets with small commercial banks that pay both federal and state income taxes. The tax exemption dates as far back as 1937, when the Federal Credit Union Act of 1934 was amended to exempt credit unions from income taxes at federal level. The tax exemption was designed to encourage credit unions to organize and supply credit to low- and moderate-income households, at a time when neither commercial banks nor savings banks made many consumer loans. Today in the US, credit unions remain the sole organisational form amongst mainstream financial institutions to enjoy a federal tax exemption.

In this study, we investigate how US credit unions utilize their income tax exemptions as well as their non-profit status, and how the subsidies derived from their institutional differences with commercial banks are allocated to credit unions' various constituents. We begin by estimating a structural profit inefficiency model for a quarterly data panel of small US commercial banks between 2005 through 2017. In doing so, we establish a theoretically complete performance surface with which to compare the efficiency with which credit unions intermediate between savers and borrowers. We use the estimated model parameters to evaluate the relative performance of 1024 matched pairs of US credit unions and commercial banks. When we use average local market prices to value inputs and outputs (an appropriate benchmark for the opportunity benefits and costs of government policy), the estimated profit inefficiency gap between credit unions and commercial banks is an economically substantial 75 annual basis points of assets.

When we value input and outputs using average local market prices, our results show that over 90% of the inefficiency gap is generated by credit unions' production of depository services (safe-keeping, member liquidity, payments services, risk-free savings vehicles) over-and-above those produced by otherwise similar commercial banks. However, when we value inputs and outputs using the actual prices that banks and credit unions pay and charge (allowing for the fact that credit unions often provide better-than-market prices to their members) the results suggest that the bulk of the credit union subsidies are passed through to credit union member-depositors in the form of higher interest payments. Moreover, (and inconsistent with our priors that weaker governance arrangements and less effective monitoring incentives at credit unions allow managers to operate more inefficiently than comparable commercial banks) we find little significant evidence that operational inefficiencies are any greater at the average credit union than at otherwise similar commercial banks.

Overall our findings suggest that credit unions use most (approximately 90%) of their tax exemption for the benefit of members. However, the changing nature of member demographics at credit unions (demonstrated by contested evidence using household income surveys) suggesting that individuals of "modest means" are not necessarily always the beneficiaries is likely to mean that intense debates regarding the efficacy of the tax exemption are likely to continue.

Data availability

Data will be made available on request.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jfs.2023.101176.

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