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TAX POLICY, LEVERAGE AND MACROECONOMIC STABILITY

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INTERNATIONAL MONETARY FUND

TAX POLICY, LEVERAGE AND MACROECONOMIC STABILITY

October 7, 2016

EXECUTIVE SUMMARY

Risks to macroeconomic stability posed by excessive private leverage are significantly amplified by tax distortions. 'Debt bias' (tax provisions favoring finance by debt rather than equity) is now widely recognized as posing a stability risk.

Household debt bias **from mortgage interest deductions is a long-standing concern, while other housing-related taxes have come to be more purposively used for stability purposes.** This includes the use of transactions taxes to reduce the risk of erratic house-price developments—which have had mixed success. New evidence finds that recurrent property taxes curb house-price volatility, adding to their attraction as a fair and efficient revenue source.

Corporate debt bias**, induced by deductibility of interest but not equity costs for the corporate income tax (CIT), remains a key stability concern.** It increases debt ratios by on average 7 percent of total assets, including for financial institutions.

Rules restricting interest deductibility for the CIT have only partially addressed debt bias. Where rules target all debt, they have proven to be effective. However, rules often target only the use of borrowing between related parties to address debt shifting within multinationals (a form of tax avoidance); they are found to have no discernable impact on external borrowing of corporate groups—the relevant debt for stability.

An Allowance for Corporate Equity (ACE) has proved effective in mitigating debt bias—new evidence confirms large robust effects on corporate leverage, including for banks. The base-narrowing features of ACE could reduce CIT revenue by up to 12 percent; but the loss is much smaller if ACE is granted only to new equity. No major implementation problems have arisen with real-world ACE systems.

Stability risks from corporate debt bias remain a particular concern in the financial sector and may call for sector-specific tax measures. New analysis shows the significance of debt bias for regular as well as shadow banks. Among the remedies are a sector-specific ACE and bank levies that have reduced bank leverage in Europe.

Addressing debt bias should feature prominently in countries' tax reform plans in the coming years. Several approaches have proved to do so without causing significant difficulty.

Approved By
Vitor Gaspar

Prepared by staff from the Fiscal Affairs Department supervised by Michael Keen and Ruud de Mooij, and comprising Shafik Hebous, Sebastien Leduc, Oana Luca, Geerten Michielse, Tigran Poghosyan, and Alexander Tieman. Research assistance was provided by John Damstra, Victor Mylonas, Tarun Narasimhan, and Nate Vernon. Production assistance was provided by Claudia Salgado and Jeffrey Pichocki.

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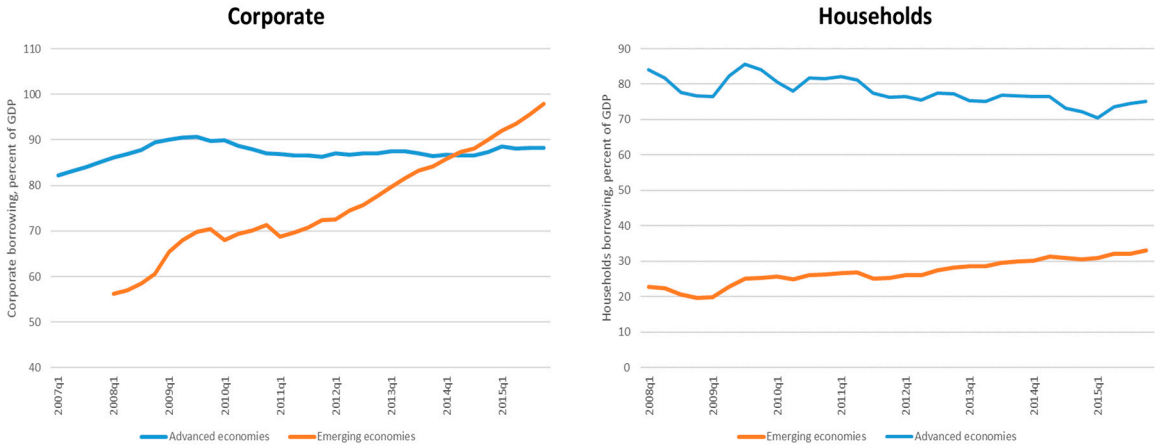
INTRODUCTION

1. High levels of private debt are a serious macroeconomic stability concern. They can be a critical component of the financial vulnerability of households and firms—in the financial and non-financial sectors—and ultimately a key determinant of macroeconomic instability. Indeed, excessive leverage is widely seen as having played a critical role in triggering, deepening, and prolonging the global financial crisis (GFC) (IMF 2011a). In recent years, gross corporate debt of non-financial corporations has reached 90 percent of GDP on average in advanced economies (AEs), while they have risen sharply in emerging market economies (EMEs), most notably in Brazil and China (Figure 1).[1] For the household sector, gross debt as a share of GDP has declined somewhat since the GFC in AEs, but has rapidly expanded in EMEs—albeit from lower levels. In the years to come, private debt overhang in AEs might hold back the economic recovery, while persisting credit growth in EMEs forms an increasing threat to macroeconomic and financial stability (IMF 2016a).

Figure 1. Trends in Private Debt



Source: BIS database.

Note: The left panel shows trends in borrowing of non-financial corporations as a percentage of GDP using PPP exchange rates. China compromised about 38 percent of this ratio for EMEs in 2008–12 and 60 percent in 2013–15, on average. The right panel shows a similar trend of household debt as a percentage of GDP.

2. Systematic tax biases run counter to regulatory and other policies that aim to limit excess leverage. There are several factors affecting private debt ratios and governments generally employ various policy instruments to avoid excessive leverage, such as regulatory capital requirements for financial institutions and regulations on mortgage lending to households (e.g., loan-to-value or debt-to-income restrictions) (IMF 2013). Many of these have

[1] Aggregate trends mask heterogeneity across countries. For example, the debt/GDP ratio in the non-financial corporate sector is stable in some, but rising/falling in other countries. If expressed in terms of total assets, private debt ratios in some AEs have declined somewhat in some countries since the GFC, but overall have been relatively stable over the last 15 years (see IMF 2016a).

been significantly tightened since the GFC. Nonetheless, tax systems in most countries continue to act in exactly the opposite direction: they provide incentives for corporations and households to borrow more than they otherwise would. In particular, most corporate tax systems induce a bias toward debt finance by allowing the deduction of interest but not of equity returns. And households often enjoy mortgage interest deductions but are not subject to tax on capital gains on primary residences and on imputed rents. By encouraging private debt accumulation, these tax designs amplify financial vulnerabilities and raise macroeconomic stability risks.

3. Since the GFC, there has been increased recognition of the stability issues raised by tax biases to debt finance, and several countries have acted to mitigate them—but they remain. The European Commission, for instance, now routinely addresses debt bias issues in the European Semester—the EU's annual cycle of economic policy guidance and surveillance. Moreover, many governments have introduced or tightened restrictions on the deductibility of interest for corporations and some have introduced allowances for corporate equity. Bank levies have been introduced to provide fiscal incentives for raising bank capitalization. To mitigate debt vulnerabilities of households, some countries have implemented tax measures aimed at reducing house price volatility, while others have reduced the generosity of mortgage interest deductions. While these tax policy reforms have supported private sector deleveraging, they have generally been insufficient to eliminate tax discrimination favoring debt. Indeed, most tax system maintain a significant "debt bias."

4. This paper builds on prior IMF analytical work, surveillance and technical assistance, in which these issues have been highlighted and possible solutions addressed. IMF (2009) offers an extensive analysis of the issue, while IMF (2013) and FSB and others (2015) provide brief updates. Recent studies by IMF staff and others have analyzed the role of tax policy in addressing externalities from the financial sector (IMF 2010; Claessens, Keen, and Pazarbasioglu 2010) and the importance of corporate debt bias in that sector (De Mooij and Keen 2016). Staff reports for Japan (2014), the Netherlands (2015), the United Kingdom (2012) and the United States (2016) have discussed options for an allowance for corporate equity to address corporate debt bias, while reports for the United States (2011) and Europe (IMF 2015) discuss reforms of mortgage interest deductibility. Technical assistance in tax policy has addressed policies related to corporate debt issues in, among others, Bangladesh, Colombia, Egypt, Georgia, Greece, Indonesia, Malawi, Peru, Portugal, Romania, Uganda, and Ukraine.

5. The aim of this paper is to deepen understanding of key tax distortions to leverage decisions, take stock of recent developments, and explore remedies. The focus is on debt bias, although interactions with debt shifting within multinational corporations will also be considered. The relationship between taxation and regulation is also discussed briefly. New empirical analysis assesses the impact of taxes on house price volatility and explores the importance of corporate debt bias in the financial sector, going beyond the existing literature by looking at non-bank financial institutions. The paper also takes stock of policy reforms implemented in recent years and explores their impact.

HOUSEHOLD DEBT BIAS

6. Taxes can have important macroeconomic stability implications through their effect on housing markets. There are various tax instruments and design features—taxes on imputed rent or capital gains, the tax deductibility of mortgage interest, transaction taxes and recurrent property taxes—that can affect household leverage and house-price developments. Each has its own distinct implications and these have been extensively explored in previous IMF work (IMF 2009, 2011b, and 2015). This section elaborates on two key issues: (i) mortgage interest deductibility, which is being reformed in a number of countries in light of its financial stability effects; and (ii) the use of taxes to steer house price developments—on which new research is reported.

7. Tax deductibility of mortgage interest generally provides incentives for household leverage, which can amplify financial stability risks. A textbook comprehensive income tax requires full taxation of imputed rents and capital gains on housing together with mortgage interest deductibility. However, as imputed rents and capital gains on primary residences are rarely taxed, mortgage interest deductibility becomes a net subsidy to housing—often as a deliberate policy to encourage home ownership.[2] Approximately two-thirds of AEs and a little over half of the EMEs surveyed in IMF (2011b) allow a deduction or credit for mortgage interest against the personal income tax (PIT). This can induce distortions in household leverage decisions. Specifically, a household will choose its optimal mortgage debt by comparing the return to investing a marginal dollar of its own resources in the house and the return of using that dollar to invest elsewhere and taking a mortgage for the house. Tax relief provided to mortgage interest should thus be compared to taxes applying to other investment returns: if the two rates are the same, there is no tax advantage to taking on more mortgage debt relative to investing more in other assets. Often, however, mortgage interest can be deducted against top marginal rates of PIT that exceed the tax rates on other investment income.[3] Tax systems thus provide an incentive for households to maximize their mortgage debt, making them more vulnerable to economic shocks, e.g., when they lose their job and house prices fall.[4] In recent years, several countries have taken steps to reduce this deductibility: Ireland and Spain have

[2] The rationale lies in the view that there are positive externalities from home ownership, e.g., in the form of positive neighborhood effects. Evidence on whether the tax subsidy has been effective in increasing home ownership rates in the US, however, is mixed (Glaeser and Shapiro 2003; Chambers et al. 2013); and the externalities in any case seem small. The tax subsidy can also reduce household mobility and produce negative externalities upon the labor market (Blanchflower and Oswald 2013). In any case, mortgage interest relief seems suboptimal as a way to encourage home ownership, including because of its distortionary impact on household leverage.

[3] For this reason, mortgage interest deductions are generally more valuable to high-income individuals who face higher marginal tax rates under a progressive tax rate schedule. Regressivity can be mitigated by providing relief only at a common rate or as a credit reducing tax otherwise payable, as several countries do.

[4] Increases in household debt have been identified as a major driver of financial crises (Mian and Sufi 2010) Empirically, it is difficult to establish a clear causal relationship between interest deductibility and the level of mortgage debt of households, although some studies do report such evidence (Dunsky and Follain 2000, Hendershott and Pryce 2006, Wolswijk 2005, and Jappelli and Pistaferri 2007, IMF 2009, Poterba and Sinai 2011, and Cerutti, Dagher and Dell'Aricca 2015).

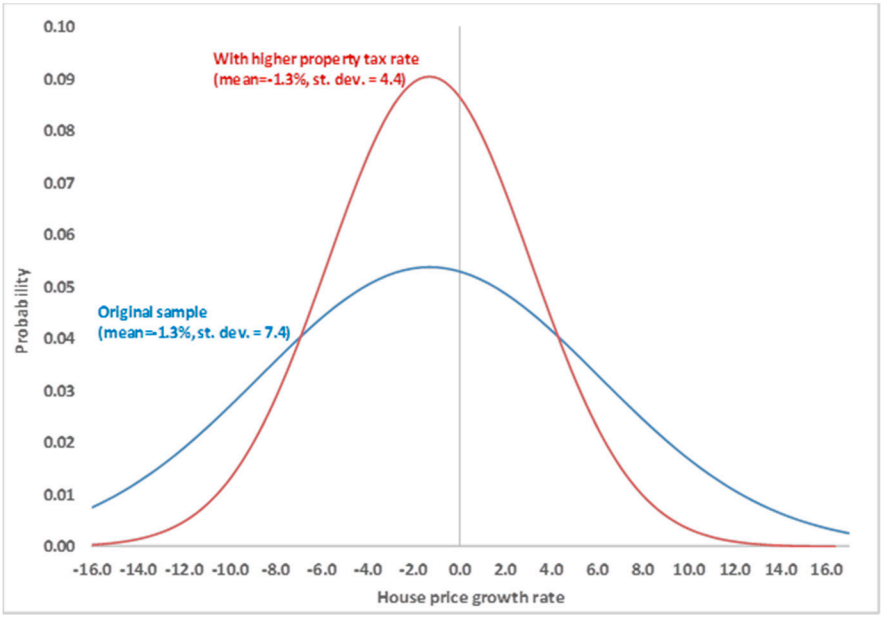
eliminated mortgage interest deductibility on new loans, while Denmark and the Netherlands are gradually reducing them (IMF 2015). Reforming mortgage interest deductions requires a cautious and gradual approach: house prices can respond rapidly with consequent risks to macroeconomic stability.

8. The tax treatment of housing also affects house prices. Shocks in house prices can have major consequences for macroeconomic stability, e.g., because of the impact on consumption, or due to the spillovers to the banking sector. This is especially important if households are highly leveraged (ECB 2003, OECD 2011a, EC 2012). To mitigate stability risk through housing markets, discussions have largely focused on employing monetary policy tools and macro prudential regulation, but both have their limitations (Crowe and others 2013). Tax policies can be important too, for both the level and the volatility of house prices.

- ***Price level.*** When the physical stock of housing is in fixed supply (e.g., in the short run or in countries where supply is tightly regulated) housing taxes will in principle be fully capitalized in house prices. Supply responses might ease such house price effects of taxes in the long run in countries with liberal building regulations. However, beyond these fundamentals are also subtler price effects. For instance, if higher property taxes finance local public expenditures of equal value for individual home owners (reflecting a pure 'benefit tax'), house prices should remain unchanged. And the price effect of stamp duties or real property taxes will depend on the frequency of market transactions. Most evidence for AEs suggest that housing taxes are to a large extent capitalized into higher house prices (Sialm 2009, Andrews 2010, Capozza and others 1996, Harris 2010), but there are also studies reporting limited or no price effect of, for instance, transaction taxes or capital gains taxes (ECB 2003, Aregger and others 2013, Besley, Meads and Surico 2014).

- ***Price volatility.*** Housing taxes can also reduce speculative demand for housing, which can be a source of short-term price instability and responsible for long-term price swings, reflected in housing bubbles (Abreu and Brunnermeier 2003, Allen and Carletti 2011, OECD 2011a). However, there can be countervailing forces too. For instance, by "thinning" the market, housing taxes can discourage transactions that would otherwise allocate properties more efficiently and reduce market liquidity. This can be associated with higher price volatility. Empirically, there are indications that favorable income tax treatment of housing in Europe has raised house price volatility (Van den Noord 2005, Raya and Kuncel 2016). However, evidence on the impact of housing transaction taxes on house price volatility is more ambiguous and this holds especially for long-term price volatility related to bubbles and crashes (ECB 2003, Keen, Klemm and Perry 2010, Crowe and others 2013, Aregger, Brown and Ross 2013). Annex 1 provides new research on the impact of recurrent property taxes on house-price volatility in U.S. states. It reports a significant negative impact: a 1 standard deviation increase in property taxes (equivalent to 0.48 percentage points) would reduce the standard deviation of house price growth from 7.4 to 4.4 percent (Figure 2). This adds another attractive features of recurrent property taxes as a relatively fair and efficient revenue source (Norregaard 2013).

Figure 2. The Impact of Property Taxes On House Price Volatility in U.S. States



Source: Poghosyan (2016).

Note: The blue line represents the distribution of house price growth rates using the mean and standard deviation from the sample of U.S. states over 2005–14. The red line represents the distribution of house price growth rates assuming 0.48 percent higher property tax rates, which would translate into lower volatility/standard deviation.

9. While some tax policies can be used to steer house price developments, appropriate timing can be hard. Box 1 provides examples of countries where tax policies have been used in an attempt to steer house price developments. An attractive feature of tax measures in relation to house prices is that implementation lags may be short in that tax changes are likely to be capitalized as soon as they are announced. This can make them a powerful instrument of fiscal stimulus (Best and Kleven 2016). The risk remains, however, that delays may result in measures becoming credible only once the immediate need has passed. Gaps between announcement and implementation can also create distortions, such as a flurry of last minute transactions right before a reform or delayed transactions in the expectation of reduced taxes. Given the difficulty of distinguishing bubbles from asset price movements reflecting fundamentals, the natural focus for tax policy is to ensure neutrality in the treatment of differing assets and forms of income. Successful cyclical interventions have been achieved in countries using property taxes (recurrent or on transactions), although mixed effects are sometimes reported on house price volatility (ECB 2003) and house price growth (Kuttner and Shim 2013).

Box 1. Property Taxes and House Prices

This box presents five cases in which tax policy measures have been used to influence movements in house prices. The impact of tax policy measures on house price fluctuations should be interpreted with caution, given the absence of a counterfactual and limited ability to control for other factors driving house price fluctuations.

Hong Kong. Driven by low interest rates and tight housing supply, house prices in Hong Kong more than doubled between 2009 and 2013. The possibility of a housing market bubble and financial stability concerns prompted the authorities to implement a range of macro prudential (caps on loan-to-value, loan-to-income, and debt-to-income ratios, limits on foreign currency borrowing, sectoral lending restrictions, countercyclical capital buffers) and fiscal policies to cool the market. In November 2010, the government introduced a seller stamp duty (SSD) of 15 percent for properties resold within two years. In October 2012, it raised the SSD rate to 20 percent and extended it to properties resold within three years. It also introduced a 15 percent buyer's stamp duty (BSD) on residential properties acquired by companies and non−locals, which had accounted for about 20 percent of the transactions. In February 2013, the government doubled the rates of existing BSD for transactions of all types of properties, except for local individuals with only one residential property. Empirical evidence suggests that these policies have been effective in constraining housing demand and restraining house price growth (He 2014).

Singapore. Between 2003 and 2012, house prices in Singapore almost doubled, with annual percent changes peaking in mid-2010. This was accompanied by strong growth in mortgages, which peaked at 18 percent of the banking system's credit to the non-banking sector. In the aftermath of the GFC, the authorities began implementing macro prudential and tax policies to cool the housing market. From February 2010, a series of tax increases were introduced. First, a SSD on all residential properties sold within one year of purchase at progressive rates between 1 and 3 percent was introduced. This was later extended to sales within four years of purchase and rates were raised to 16 percent for sales within a year. In December 2011, an additional BSD was imposed at rates of 10 percent on nonresidents and corporate entities and of 3 percent on second subsequent residential property purchase by permanent residents and third or subsequent residential property purchase by Singapore citizens. These BSD rates were later increased to 15 percent for nonresidents and corporate entities, 5 percent (10 percent), for first (second or subsequent) residential property purchase by permanent residents, and 7 percent (10 percent) for second (third and subsequent) residential property purchase by Singapore citizens. Macroprudential measures aimed at limiting the total debt service ratios for property loans were introduced in mid-2013. These measures helped moderate price appreciation in Singapore (Darbar and Wu 2015). As of the second quarter of 2016, residential property prices in private and public (resale) housing markets were lower by 9½–10 percent from their peaks in 2013 following a rise of about 50–60 percent since the troughs in 2008/09 in the public (resale) and private housing market. The decline in housing prices was also accompanied by a drop in overall transaction volumes in 2013 and 2014, with those for private properties declining by one-third in 2013 and by 50 percent in 2014. Transaction volumes rose in 2015, but housing loan growth continued to moderate to low single digit.

China. Fiscal stimulus in 2008 in China fueled a domestic credit boom that started in 2009 and 2010, including to the real estate sector, through loans to developers and residential mortgages. It resulted in overheating of the real estate sector and accelerating house price growth to around 40 percent. Consequently, the authorities adopted a series of measures (including fiscal and macroprudential) to curb credit growth and housing price inflation in 2010. Taxes were increased on the resale of properties within five years of purchase; and the exemptions of home purchases from stamp duties and of home sales from income taxes were abolished, except for cases involving a family's only home. After these and other measures were introduced, home sales rose by only 6 percent in early 2011 compared to 30 percent in the same period of 2010. Sales also declined sharply in major cities that had seen the largest increase in prices (Lim and others 2011).

Box 1. Property Taxes and House Prices (Concluded)

Sweden. A boom in the Swedish housing market at the end of the 1980s reflected the interaction of deregulation of credit markets from the mid-1980s, strong population growth, and generous property tax allowances and subsidies. House prices started to increase rapidly and excess capacity was created in some regions as dwelling completion reached more than double their average level in the 1980s, partly driven by interest subsidies and interest rate guarantees for construction projects up till 1993. Following a substantial tax reform in 1991, the portion of mortgage interest payments that could be deducted from tax liabilities was decreased to 30 percent, sharply reducing the after-tax return on housing investments. Other tax reforms around this time raised the holding cost for housing by imposing full VAT on a number of related activities. The cycle turned around and house prices plummeted by 17 percent in real terms to their mid-1980 levels, in part also affected by the economic slump associated with the banking crisis in the early 1990s. During 1995+2015 house prices and household indebtedness have risen again, with a relatively modest decline during the global financial crisis. The virtual abolition of the property tax in 2008, in favor of a municipal tax set at the lower of SEK 6,825 (around €969) or 0.75 percent of the property's assessed value may be a contributing factor to their continued rise. Policy responses since 2010 have been mainly on the macro prudential side.

Ireland. A housing boom in the late 1990s prompted the government to intervene through a number of adjustments to the stamp duty system, favoring transactions for first-time buyers and, to a lesser extent, owner-occupiers. Also, transaction taxes were hiked (with a progressive scale for stamp duties on residential property) and an anti-speculative property tax (on non-principal private residences) introduced for investors. These measures led to a slowdown in house prices as investors exited the market. In 2002, many of these measures were reversed, mainly in response to a shortage in the availability of rental accommodation. As investors returned to the market, house prices again began to increase until the GFC, which led to a large drop in house prices (more than 25 percent in real terms), in part reflecting overbuilding during the pre-crisis boom. The authorities eliminated mortgage interest deductibility on new loans taken out after December 31, 2012.

CORPORATE DEBT BIAS

10. Most corporate income tax (CIT) systems allow interest expenses, but not returns to equity, to be deducted in calculating corporate tax liability. This asymmetry distorts corporate finance decisions in two distinct ways:

- ***Debt bias.*** Corporations prefer debt financing over equity financing beyond the level which would have been otherwise chosen;

- ***Debt shifting.*** Cross-country differences in rates of CIT create opportunities for tax planning within multinational groups, by lending from low-tax countries to related entities in high-tax countries or by locating external borrowing in high-tax countries.

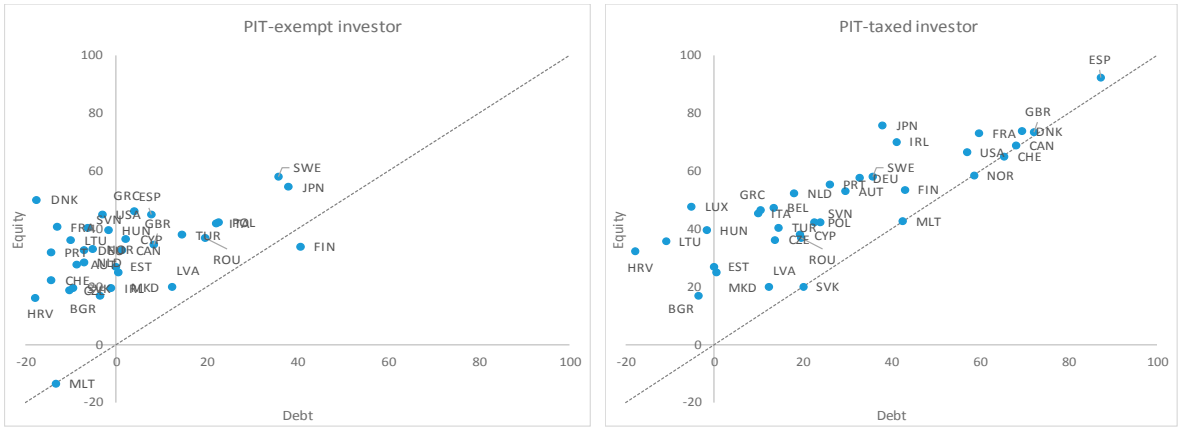
11. The primary macroeconomic stability concern is with debt bias, not debt shifting. Intragroup lending can result in significant levels of debt in affiliates of a multinational, without showing up in the consolidated financial statement of the group. As discussed in IMF (2014a), such tax planning can have major revenue implications, and has been a core topic of the OECD-G20 led BEPS initiative. However, as there is generally risk-sharing within the multinational group, debt shifting through internal borrowing likely has only limited stability implications (Huizinga and others 2008). Excessive levels of external borrowing associated with debt bias, in contrast, can be a source of macroeconomic instability, in both the financial and non-financial sectors.

While this and the next section will focus on debt bias, attention will also be paid to possible interactions with debt shifting, as well as policies targeted to address the latter.

12. Debt biases at the corporate level can be mitigated by personal income taxes (PIT), but remain large in most countries. The returns on both debt and equity—whether dividends paid to shareholders or capital gains on shares—may be taxed through the PIT and/or withholding taxes. This can modify the overall tax advantage of debt: relatively high PIT rates on interest, for instance, will reduce debt bias, whereas relatively high dividend or capital gains taxes will magnify it. Also integration of PIT and CIT[5] can mitigate the double taxation of dividends and reduce the disadvantage of new equity finance relative to both debt and retention finance. But these PIT effects may well fail to offset the bias induced by the CIT.

- ***Even taking account of the PIT, most tax systems for which we have data still favor debt over equity.*** Calculations for selected AEs and European EMEs suggest that in some countries the overall effective marginal tax rate (EMTR)—the effective tax burden on a marginal investment that just breaks even—for PIT-taxed investors (at the top marginal tax rate) is about equal for debt and equity (for instance in Canada, Malta, Norway, Slovakia, and Switzerland). For most countries, however, the EMTR is still significantly lower for debt than for equity finance (right hand panel of Figure 3).

Figure 3. Effective Marginal Tax Rates for Debt versus Equity



Sources: ZEW and IMF Staff Calculations.

Note: based on data for 2012. The 45-degree line corresponds to neutral treatment between debt-financed and equity-financed investment. The left panel is for PIT-exempt investors and the right panel for PIT taxed investors, assuming that the investment is financed by new equity.

- ***In many countries, a significant share of investment is sheltered from PIT, such as those by institutional investors.*** For them, debt bias is determined by the CIT alone, and so is usually larger than for PIT-taxed investors (left-hand panel of Figure 3). Foreign investors,

[5] Meaning that some credit is given against personal tax for taxes paid at the corporate level. Such 'imputation systems' are used in e.g., Australia, Canada, and Chile.

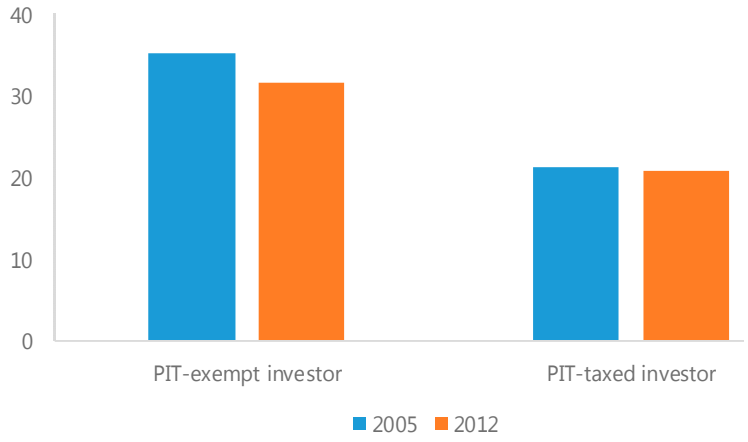
(continued)

moreover, are usually not subject to PIT in the host country, so that any offsetting through the PIT matters less in open economies.[6] In several countries, the EMTR on debt for PIT-exempt investors is even negative,[7] implying that the tax system effectively subsidizes the marginal debt-financed investment.

- ***Empirically, the effect of the PIT on corporate leverage ratios is less clear-cut than that of the CIT*** (Graham 2008), although some recent studies find that higher PIT rates on interest relative to dividends and capital gains reduce leverage ratios of domestic firms (Overesch and Voeller 2010; Lin and Flannery 2013).[8]

13. Debt bias has slightly decreased in recent years, but remains large. This can be seen by comparing the difference in EMTR for debt and equity—as an indicator of debt bias—in 2005 and 2012 (Figure 4). For PIT-exempt investors, this debt bias indicator fell in 23 out of 35 countries and increased in only four. This decline primarily reflects reductions in statutory CIT rates in several countries. For PIT-taxed investors, debt bias decreased in 19 countries, while it increased in 14. Hence, in some countries where reductions in the CIT rate have reduced debt bias, reforms in the PIT have offset this effect.

Figure 4. Changes in Debt Bias



Source: ZEW and Staff Calculations.

Note: Debt bias is measured as the difference in the EMTR for equity and debt. The indicator reflects the unweighted average across 35 countries.

[6] Withholding taxes on dividends and interest are not captured in these calculations and vary, depending on bilateral tax treaties. IMF (2014a) finds that, on average, withholding tax rates on dividends tend to exceed those on interest. Thus, if anything, they seem likely to reinforce debt bias.

[7] The pre-tax return necessary to make a debt-financed investment just profitable is then lower than the assumed required post-tax return. A key reason for this, along with interest deductibility, is accelerated depreciation for tax purposes—faster than economic depreciation—as this increases the present value of such allowances. Although subsidized at the margin, profitable investments financed by debt can still be taxed on average. Hence, debt-financed investment may still yield revenue for the government.

[8] Empirical work on the issues is challenging, as the tax variable may suffer from measurement error. Indeed, assessing the impact of the PIT on corporate debt requires assumptions regarding the marginal investor (PIT taxed or PIT exempt?). Moreover, there can be clientele effects—a sorting of different groups of tax payers with certain preferences for debt or equity, e.g., due to progression in the tax rate schedule—determining the effect of PIT rates on marginal investment incentives.

(continued)

Overall, the change in debt bias has been small. For PIT-exempt investors, for example, the difference in METRs still exceeded 30 points in 2012.[9]

14. There are no compelling reasons to treat debt more favorably than equity for tax purposes. The original rationale for allowing a deduction only for interest was that this is seen as a cost of doing business whereas equity payments are business income, a view also reflected in international accounting principles. In economic terms, however, both are a return to capital and there is no a priori reason to tax them differently (De Mooij 2012). From a legal and administrative perspective too, differential treatment is problematic as distinguishing debt from equity can be complicated. For instance, hybrid financial instruments (debt for tax purposes, but with equity-like characteristics) increasingly blur the distinction between the two.

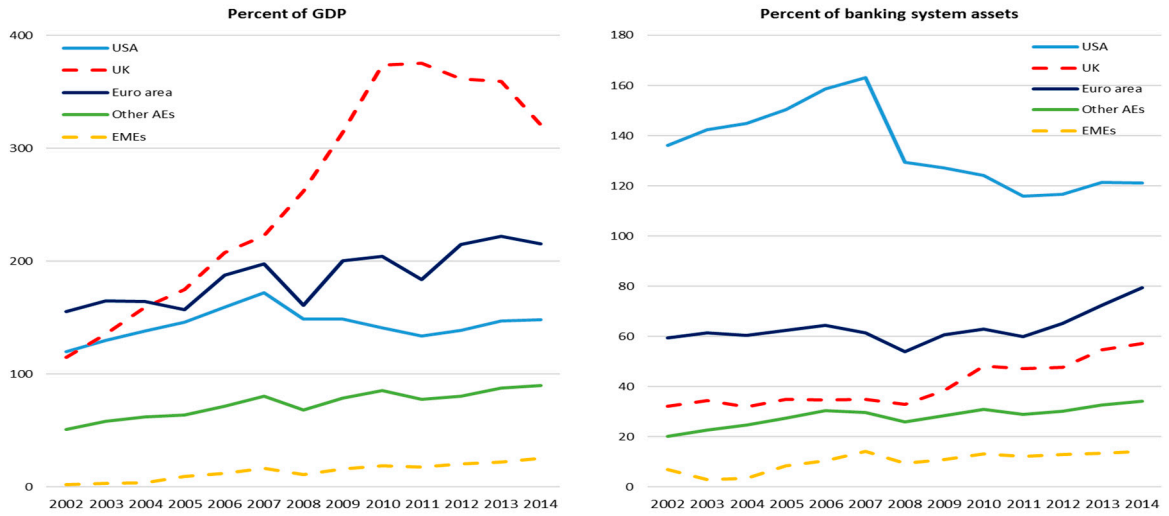
15. The rest of this section explores in turn the prevalence of corporate debt bias in the financial and non-financial sectors. Debt bias in the financial sector is explored separately because of the relatively large externalities associated with excessive debt in that sector and the distinct regulatory regime that applies.

A. Financial Sector

16. Excessive leverage of financial institutions, including that of shadow banks, is a major macroeconomic stability concern. Higher leverage raises the probability of bank failure, which is associated with significant externalities through contagion effects in the financial system, its consequences for the real economy, and the cost of public bail outs (Reinhart and Rogoff 2009; Allen, Babus, and Carletti 2009). The resulting costs of a systemic banking crisis can be very large (Laeven and Valencia 2012). Similar considerations apply to non-bank financial institutions—often labeled "shadow banks"—a broad group of bank-like financial intermediaries financed from sources other than deposits (such as money market funds), e.g., leasing and factoring companies, hedge funds, insurance companies, pension funds, etc. Some of these institutions can perform roles in the financial system very similar to banks, in, e.g., maturity transformation, risk sharing and the provision of liquidity. In several countries, the non-bank financial sector (measured by total assets) is large; in the United States even larger than the banking sector (Figure 5).

[9] These are the latest available comparative data for debt and equity-financed EMTRs for a large set of countries. Between 2012 and 2016, the mean CIT rate in OECD countries declined further from 25.3 to 24.7 percent, which will have further reduced debt bias. Moreover, during the same period, top statutory PIT rates on interest income rose on average by 1.7 percentage point for bank interest and 1.4 percentage point for bond interest, compared to an increase of 1.1 percentage point for dividends (OECD 2016). This also, on average, will have slightly reduced debt bias for investors subject to top marginal tax rates since 2012.

Figure 5. Trends in Shadow Banks' Assets



Source: Financial Stability Board.

Note: Data excludes insurance and pension funds. Advanced Economies (AEs): Canada, Hong Kong, Japan, Korea, Singapore, Australia, Switzerland, Chile, and Mexico. Emerging Market Economies (EMEs): Argentina, Brazil, China, India, Indonesia, Russia, Saudi Arabia, South Africa, and Turkey.

17. There is a fundamental tension between regulatory efforts that require financial institutions to hold more capital and tax incentives that induce them to hold less. To address externalities from excessive leverage, regulatory measures are generally adopted to require both banks and non-bank financial institutions to hold more capital than they otherwise would. However, tax systems do exactly the opposite through debt bias.[10] Of course, if the capital structures of financial institutions were driven entirely by regulatory capital requirements, taxes might not matter. However, financial firms typically hold buffers of equity beyond the regulatory requirements, implying scope for tax effects on leverage (see also BIS 2016). As tax policies and regulatory policies are usually in the realm of different government ministries or agencies, policy coordination may be required.

18. The impact of debt bias on financial stability depends on the initial capitalization of financial institutions. A marginal increase in a bank's leverage ratio induced by debt bias has a larger effect on its default risk, and thus the likelihood of crisis, at high levels of debt (i.e., low capitalization). For instance, at bank leverage ratios as high as they were in some crisis countries before 2008, De Mooij, Keen, and Orihara (2014) find that eliminating debt bias could have reduced the probability of a financial crisis in some countries by up to 40 percent (left hand panel of Figure 6). The associated expected output gain ranges between 0.6 and 13.3 percent of GDP over a four-year period. For European economies, Langedijk and others (2015) also find that elimination of debt bias could have reduced the expected direct bailout costs by between 17 and 77 percent. At lower bank leverage ratios prevailing in 2016, the marginal impact of debt bias on

[10] Taxes may also affect macro-financial vulnerabilities through other channels, e.g., the taxation of non-performing loans and loan write offs (Box 2).

the probability of a financial crisis is significantly reduced, but by no means negligible (Figure 6, right hand panel).

Box 2. Taxation and Debt Spillovers to the Financial Sector

Risks from excessive debt in non-financial corporates may spill over to the financial sector if the associated higher probability of distress or failure increase non-performing loans (NPLs) on the balance sheets of financial institutions. The importance of this spillover depends also on two other specific tac design choices of financial institutions.

The tax treatment of NPLs. Financial institutions can usually make provisions against, and write-offs of, impaired debts. These are deductible for the income tax, with claw back of this relief if a loan is subsequently repaid. But there can be several forms of tax avoidance opportunities associated with provisioning for bad debts. To address them, governments generally impose limitations to the provisions and write-offs that qualify for tax deductibility. For instance, countries often have tight conditions for banks on non-recoverability of bad debt to qualify for tax deductions. If these are too strict, however, banks' dealing with NPLs are inhibited and the banking system may end up with large portfolios of NPLs that prohibit new lending and amplify financial stability risks.[1] If too loose, provisioning for NPLs may open up a loophole in tax collection. The International Accounting Standards Board has issued international financial reporting standards (IFRS 9) aimed at aligning the criteria for provisions and write offs internationally, based on an expected credit loss model. Tax rules generally follow those accounting rules.

The treatment of deferred tax assets. Large provisions or write-offs in loan portfolios may result in significant losses in financial institutions. When carried forward, these appear as deferred tax assets (DTAs) on the balance sheets of these institutions, as they imply a reduction in future tax liabilities. These DTAs will only have monetary value if the institution makes profits in the future. Hence, DTAs have no loss-absorption capacity in periods when a financial institution makes losses. For that reason, since the GFC, regulators generally no longer qualify DTAs as bank capital. Currently, European banks in particular still feature significant DTAs on their balance sheets as a legacy from losses during the GFC. Some governments have intervened by transforming DTAs into so-called "deferred tax credits" (DTCs). These are claims on the government independent of whether the institution will become profitability in the future, i.e., the risk of not being able to use them is transferred to the government. Due to this transformation, DTCs qualify as regulatory capital. From the government's perspective, however, the transformation creates a contingent liability with possibly significant fiscal costs. Moreover, it reinforces the bank-sovereign linkages and, in the European Union context, could possibly be regarded as unjustified state aid.

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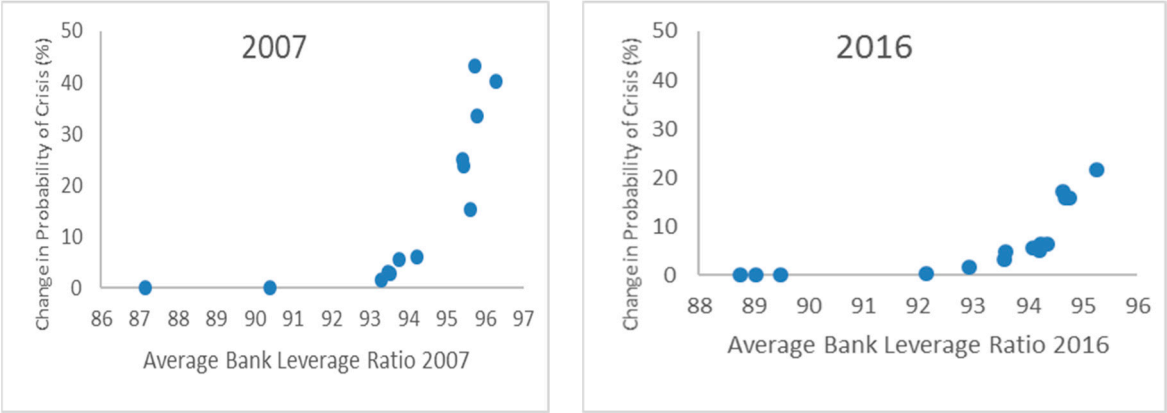
[1]A regularly encountered excessive restriction on write-offs is the requirement that all legal means of collection and legal action to execute collateral be exhausted before a loan is written off. In combination with a costly or slow judicial system this may prove disproportionally onerous.

Figure 6. Effect of Debt Bias on Probability of Crisis

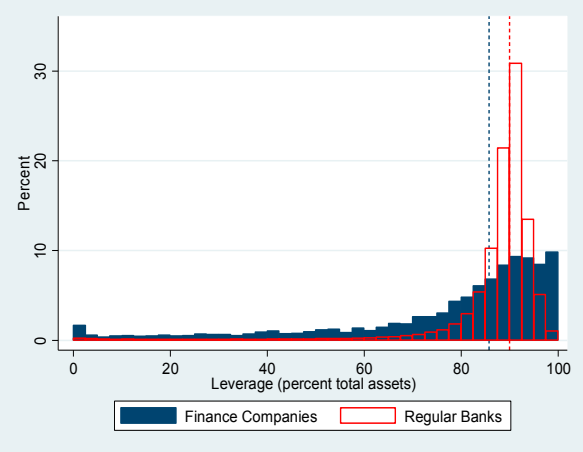


Sources: OECD (2012); BIS (2016); De Mooij, Keen, and Orihara (2014); and IMF staff calculations.

Note: Simulations, based on De Mooij, Keen, and Orihara (2014). The charts show how a decline in bank leverage as a result of eliminating debt bias (based on estimated coefficients) would reduce the odds ratio of financial crisis, for given initial levels of leverage. Data refer to: Australia, Belgium, Canada, Denmark, Finland, France, Greece, Italy, Korea, Netherlands, Sweden, Switzerland, Turkey, United Kingdom, and the United States.

19. Although the stability risks from debt bias in the financial sector have been mitigated by the strengthening of capital since the GFC, they remain a significant concern. New Basel III standards have increased both the level and quality of the required equity buffers of financial institutions (Box 3). However, the minimum capital requirements are still below the capital ratios that would have fully absorbed bank losses during past banking crises in AEs. For instance, Dagher and others (2016) report that total loss absorption capacity should have been between 15–23 percent of risk-weighted assets, which is well above the new minimum standards. Tax systems thus still put financial firms at a higher risk of default than would a tax system neutral to sources of finance. Moreover, shadow banks are generally less-tightly regulated than banks, which may allow them to operate with higher leverage. This can imply a higher marginal impact of debt bias on the probability of default. For instance, Figure 7 shows that, while most finance companies are less leveraged than banks, the fraction in the tail of the distribution (with very high leverage ratios between 95 and 100 percent) is relatively large. Although non-bank financial institutions are generally thought of as less systemically important than banks, the increased interconnectedness

Figure 7. Distribution of Leverage



Source: Bankscope.

Note: Vertical lines denote median values (90 percent for regular banks, 85.8 percent for finance companies).

of banks and shadow banks implies that debt bias in non-bank financial institutions can contribute significantly to systemic risk (IMF 2014b).

Box 3. Financial Sector Regulation

Banks are regulated by the Basel III framework, the provisions of which are to be fully phased in by 2019. The main regulatory instruments under Basel III are a minimum capital adequacy ratio (CAR), which specifies the minimum amounts of capital a bank needs to hold relative to its risk-weighted assets (RWA, see table)[1], and a minimum leverage ratio specifying capital to total assets of at least 3 percent. Individual country regulatory authorities can decide to increase capital above these minima, as risks differ across banks and economic circumstances (e.g., a systemic risk buffer of 1–3.5 percent of RWA or a countercyclical capital buffer of 0–2.5 percent). All these solvency requirements are intended to ensure financial stability and protect insured deposits, which represent the main source of funding for most commercial, savings, and cooperative banks. In addition to capital requirements, Basel III subjects' banks to liquidity requirements, principally the liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR). The LCR specifies that, at any time, banks must hold highly liquid assets in excess of their projected net cash outflow over the next 30-day period. The NSFR requires that stable funding (defined as all long-term loans, as well as a percentage of short-term loans and government and corporate bonds) be available to cover required funding (a function of liquidity characteristics and residual maturities of the various assets held by that institution, and taking account of off-balance sheet exposure) over a period up to one year. As with the CAR, individual country supervisors may require a higher LCR or NSFR. In addition, banks are obliged to hold buffers against operational risk (from inadequate or failed internal processes, people and systems).

Bank Capital Requirements under Basel III (in percent of risk-weighted assets)	
Common Equity Ratio	4.5
Capital Conservation Buffer	2.5
Tier 1 Capital	6
Total Capital	8
Total Capital + Conservation Buffer	10.5
Systemic Risk Buffer (for SIFIs)	country-dependent

Source: BIS

Investment banks are banks, often as part of banking groups, and hence subject to bank regulations including Basel III. They create, analyze, intermediate, and issue and underwrite securities, thus helping companies raise capital, and largely finance themselves on the wholesale market, relying less on retail deposits. For investment banks, the most binding regulatory requirements are likely to be the leverage ratio, liquidity ratios, as well as (new) trading book capital requirements that aim to ensure the bank has sufficient loss-bearing capacity against the risk in its trading portfolio (the securities its hold for trading purposes). Which of these restrictions are most binding depends on the business line and balance sheet of the bank.

Insurance and pension companies play a different role in the financial system, and hence are regulated differently. Their operations do not share some of the features that give rise to systemic risk in banks, such as the maturity transformation, liquidity risk, operations of payment systems, and interconnectedness through the interbank market. Instead insurers and pension funds aim to match assets and liabilities, while their liabilities are not callable (as deposits are), are net providers of liquidity to the financial system, do not create money, and are less interconnected than banks. Insurance and pension companies are thus not subject to bank-runs and less prone to cascading network effects.[2] Still, insurance and pension companies are financial intermediaries and, as investors, big players in financial markets.

In addition, for insurance, it is important to distinguish life and non-life (or property & casualty) insurance. For life companies, the life and annuity liabilities are mostly long term, and the main risks lie in changes to mortality and longevity. In non-life insurance, contracts are mostly for a horizon of up to a year, after which they can be repriced. The main risk is a low-probability catastrophic loss event (e.g., a natural disaster), which can be and often is partially re-insured with global reinsurance firms or directly on the capital markets through the use of catastrophe bonds.

Box 3. Financial Sector Regulation (Concluded)

Regulation of insurance and pension funds focuses mainly on long-term solvency, by setting regulatory standards for the ratio of the value of assets to the net present value of obligations to policyholders. In addition, companies are obliged to hold capital against market risk (related to their investments), credit risk, and operational risk. As with bank regulation, many of these regulatory requirements are risk-based, using internal models and market-consistent valuations.

Non-bank financial intermediaries that fall outside these categories are more lightly regulated. Traditionally, these 'shadow banks' were subject to market conduct regulation, but normally not to CARs or solvency requirements, as they do not operate under a banking license. Since the GFC, attempts to regulate this industry advanced though the financial stability board (FSB) in collaboration with national regulators, and center on five areas: mitigating banks' interactions with shadow banks, reducing the susceptibility of money market mutual funds to runs, oversight of shadow banks, aligning incentives between issuer and buyer of securitization products, and dampening the procyclicality in repo and securities lending (IMF 2014b). While some progress in these areas has been made by national regulatory authorities, recent FSB peer review findings indicate that implementation of this policy framework remains at a relatively early stage (FSB 2016).

[1] Banks need to adhere to all these ratios. Hence, the total capital + conservation buffer needs to be at least 10.5 percent of RWA, while capital needs to be above 8 percent of RWA, of which at least 6 points is Tier 1 capital, of which at least 4.5 points is common equity.
[2] Even so, in the United States, four insurance companies have been declared systemically important financial institutions, and so subject to Federal Reserve oversight.

20. New evidence suggests that the leverage decision of both banks and shadow banks are significantly affected by tax bias. Evidence on debt bias in the banking sector is scarce; and no study explores its importance for non-bank financial institutions. New empirical results reported in Annex 2 show that:

- ***Corporate taxes raise bank leverage ratios significantly.*** In the long-run, a 10 percentage point higher CIT rate increases the leverage ratio (debt over assets) of an average bank by between 1.9 and 3.6 percent. Eliminating the debt bias from a 25 percent CIT rate might thus reduce its leverage ratio by 4½ to 9 percent of its assets.

- ***The response of financial institutions' leverage to tax was strong before the GFC—and remains positive after that.*** Responses after the crisis are somewhat smaller than before it, and only significant in a sample excluding outliers.[11] The smaller effects post-crisis might be transitory due to the focus on rebuilding buffers, reflecting the implementation of more stringent Basel III requirements. These reduced the buffers that banks hold above regulatory minima and forced many to increase capital, irrespective of the tax regime. Indeed, the evidence suggests that the responsiveness of bank leverage to tax increases with the size of

[11] If the bottom and top 10 percent of observations in the leverage distribution are removed from the sample, the tax effect on debt is positive and significant, also post-crisis: each 10 percentage point of CIT then raises bank leverage by 1.5 percentage points in the long run. If the top and bottom 1 percent are removed, the coefficient for the tax rate, while positive, is no longer statistically significant in the post GFC period.

the buffer vis-à-vis the minimum capital requirement (De Mooij and Keen 2016, Bond and others 2016).

- ***Large banks are noticeably less sensitive to tax, but the distortions they face are nonetheless the greatest concern for financial stability*** (De Mooij and Keen 2016). Larger banks hold smaller equity buffers and thus regulation is a tighter constraint. This can explain why they are less responsive to tax. It does not mean, however, that debt bias is less important for large banks: even small changes in the leverage of very large banks could have a big impact on the likelihood of their distress or failure, and hence, given their often systemic importance, on the likelihood of financial contagion.

- ***Debt bias is also evident in financial institutions beyond the group of traditional commercial, cooperative and savings banks.*** In the pre-crises period, tax responses of non-bank finance companies (such as consumer finance, factoring and leasing, trade finance and credit card companies), for instance, are not significantly different from those of banks.

- ***For investment banks, significant tax effects are found only before the GFC.*** For the post-crisis episode, the impact of taxes on their debt is no longer significant. Possibly, during this transition period tighter capital requirements left no room for investment banks to respond to changed tax incentives.

- ***Insurance companies seem equally affected by debt bias, but the impact on macroeconomic vulnerability is lower.*** In insurance, leverage largely reflects a firm's business mix (Thimann 2014). Life insurance companies in particular feature technical reserves that are meant to cover future obligations to policy holders as the main liability on their balance sheets. These reserves are tightly regulated and typically comprise some 65 percent of total liabilities, with equity comprising another 23 percent on average. For the remaining limited stock of other liabilities, the results in Annex 2 show that debt bias is prevalent and indeed even more pronounced than in banks. In life insurance companies, each 10 percentage points of CIT increases the leverage ratio by between 2.8 and 4.8 percentage points in the long run. For non-life insurers the effect is more muted: 1.4–2.4 percentage points. However, as insurance companies are generally less systemically important than banks, the impact of debt bias for insurance companies on financial stability is also more limited.

B. Non-Financial Sector

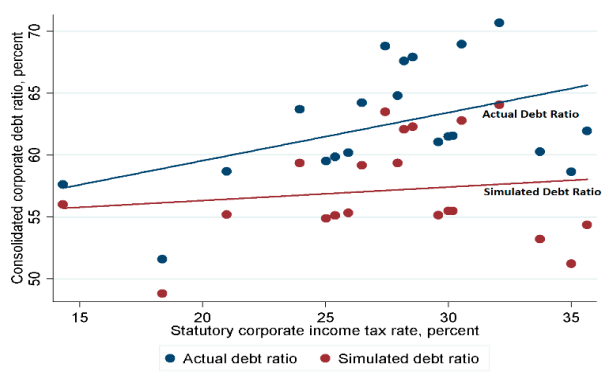
21. The traditional concern with debt bias in non-financial corporations has been the welfare loss from distortions in risk behavior and investment decisions.[12] Tax distortions to debt-equity ratios have real welfare costs, e.g., due to excessive agency costs (i.e., costs to incentivize managers to operate efficiently) which will be reflected in higher risk premiums. Using

[12] Taxes might also affect debt maturity structures. If taxes lead to shorter debt maturity, for instance, they would amplify rollover risks. Empirically, however, there is no strong evidence for maturity effects (Graham 2008).

an agency framework combined with empirical estimates from the literature, Sørensen (2014) estimates the deadweight loss associated with debt bias at a modest 2-3 percent of corporate tax revenue in Norway. Similar exercises for Germany and the United States suggest even smaller welfare costs (Weichenrieder and Klautke 2008, Gordon 2010).

22. Since the GFC, concerns have focused more on externalities associated with excess leverage, with an increasing body of evidence showing amplified macro stability risks.[13] Excess private sector debt can be seen as a systemic credit externality (Bianchi 2011). At the micro level, high debt ratios can increase the probability of a firm's bankruptcy in case of an adverse shock and amplify liquidity constraints after a shock, e.g., due to larger rollover risks and debt overhang. For instance, Giroud and Mueller (forthcoming) report that the decline in employment during the GFC was significantly more pronounced in highly-leveraged than in lightly-leveraged firms. This may create externalities operating at the macro level: through input-output linkages, a firm's default can spill over to others and amplify aggregate fluctuations in the economy (Acemoglu and others 2012). Empirically, Sutherland and Hoeller (2012) find that higher leverage ratios in the non-financial corporate sector are associated with a significantly higher probability of recession. Jordà and others (2013) find that the buildup of private credit during expansion periods tend to make subsequent recessions more likely, deeper and longer lasting.

Figure 8. Debt Bias in Non-Financial Firms



Note: This is a binned scatter plot using firm-level data containing about 500,000 observations and controlling for GDP growth, EBITDA share of assets, and the operating revenue ratio. The simulated debt ratios are calculated by subtracting from the actual debt/asset ratio the part that is induced by debt bias, calculated as the CIT rate times a consensus estimate of 0.28 reported in the text. Contrary to the actual debt ratio, the simulated debt ratio features no significant correlation with the CIT rate.

23. Debt bias in non-financial corporations is significant, although its extent varies between countries, sectors, and firms. Many empirical studies have estimated the extent of corporate debt bias in non-financial firms. Recent meta-studies derive a consensus value for the impact of the CIT rate on their external debt-asset ratio of 0.28 (De Mooij 2011, Feld and others 2013). This means, for instance, that a CIT rate of 25 percent (roughly the average in the OECD) might be responsible for leverage ratios that are around 7 percentage-points higher compared to a system that is neutral between debt and equity. The bias is larger in countries with higher CIT rates (Figure 8).[14] Further, debt bias is higher in sectors that are characterized by high tangible assets typically put up as collateral (Annex 4). Moreover, larger firms appear to be more

[13] These issues were also subject of intense debate in the mid-1980s, see for instance Federal Reserve Bank of Kansas City (1986).

[14] Most empirical studies on debt bias and debt shifting are for advanced economies. However, it also matters for developing countries (Fuest, Hebous, and Riedel 2011).

responsive to tax. (Heckemeyer and De Mooij, forthcoming). This is in contrast to banks, for which, as noted, size negatively affects their responsiveness to tax. This is important as large firms are likely to induce bigger spillovers to the rest of the economy and so are more important for macroeconomic stability.

NEUTRALIZING CORPORATE DEBT BIAS

24. What can governments do to eliminate or at least mitigate corporate debt bias? One option is to treat debt more similar as governments currently treat equity by limiting the tax deductibility of interest. Alternatively, governments can treat equity more similar as they currently treat debt by adding a deduction for corporate equity returns. Or they can do some of both. For the financial sector, there may be case for tax disincentives to debt finance in light of their larger negative externalities. This section explores these policy options in more detail.

A. Limiting Interest Deductibility

Thin Capitalization Rules (TCRs)

25. Limiting interest deductibility can reduce the social cost of debt bias. Scaling back interest deductibility is reminiscent to imposing a tax on interest, which can offset tax discrimination favoring debt. A proportional reduction in deductible interest—allowing only a fixed percentage to be deductible, as e.g. France does—would mimic a proportional tax rate on interest and would enhance neutrality across the board. However, credit externalities may arise mainly from excessive debt above some threshold. As a corrective device to mitigate these externalities, a non-linear tax that rises in the debt ratio may therefore be considered. This can be done by imposing a cap on interest deductibility.[15] This is what countries do with so-called 'thin capitalization rules' (TCRs), which limit tax deductibility of interest beyond a certain debt ratio.[16]

26. Many countries have introduced TCRs, but with important differences in structure—including whether they apply to all or only intra-group debt. First introduced in Canada in 1971, many countries adopted TCRs in the 1990s and especially the 2000s. Now, about 60 countries impose some TCR (Annex 3). One especially important distinction is whether the fixed ratio refers to debt-to-equity or to interest-to-earnings (an 'earnings-stripping' rule). Another is whether the rule applies to all debt or only to related-party debt. While highly technical, the issues at stake in the design and legal drafting of TCRs are considerable, and have become a significant focus of IMF technical assistance.

[15] Since credit externalities might be more important for large than small firms, the cap might apply only to larger companies.

[16] Strictly speaking, TCRs restrict interest deductibility beyond a fixed ratio of debt relative to equity, but today various other rules exist. In this paper TCRs refer to the full range of interest restrictions.

(continued)

27. New G20/OECD guidelines offer a common approach to designing TCRs, focused on debt shifting rather than debt bias. Action 4 of the G20/OECD project on base erosion and profit shifting (BEPS) proposes an earnings-stripping rule, which denies interest deductibility if the net total interest expense exceeds a certain percentage of earnings before interest, taxes, depreciation and amortization (EBITDA) (where countries can choose this percentage in the range between 10 and 30 percent).[17] The guidelines additionally include an option for a so-called group ratio rule, under which the interest remains deductible to the extent that the net interest/EBITDA ratio of an affiliate is below or equal to that of the worldwide group. This means that the TCR will address debt shifting within multinational groups (consistent with the objective of the BEPS action plan), but not debt bias associated with excessive third party debt, since the groups' consolidated debt ratio forms the effective cap for the denial of interest deductibility.

28. New evidence shows that TCRs that apply only to related-party debt have no discernable impact on debt bias (Annex 4)**.** Existing empirical studies have used unconsolidated accounting data and find that TCRs significantly reduce debt ratios of multinational affiliates. This reflects the combined effect of these rules on debt bias and debt shifting. However, economic stability concerns are related to debt bias. To empirically explore whether TCRs have affected third party debt, the exercise reported here exploits data on the consolidated accounts of non-financial multinational companies—i.e., accounts in which all intracompany transactions are eliminated.[18] The analysis is based on a large panel of firms in 42 countries between 2005 and 2014—a period in which several countries introduced TCRs. The results suggest that TCRs that apply only to related-party debt have had no significant impact on consolidated (i.e., external) debt ratios, i.e., they have not reduced debt bias. Although this might have been expected (since these rules do not target external debt ratios), it confirms that firms seem to choose their external financial structure without taking into account how they manage their internal allocation of debt.

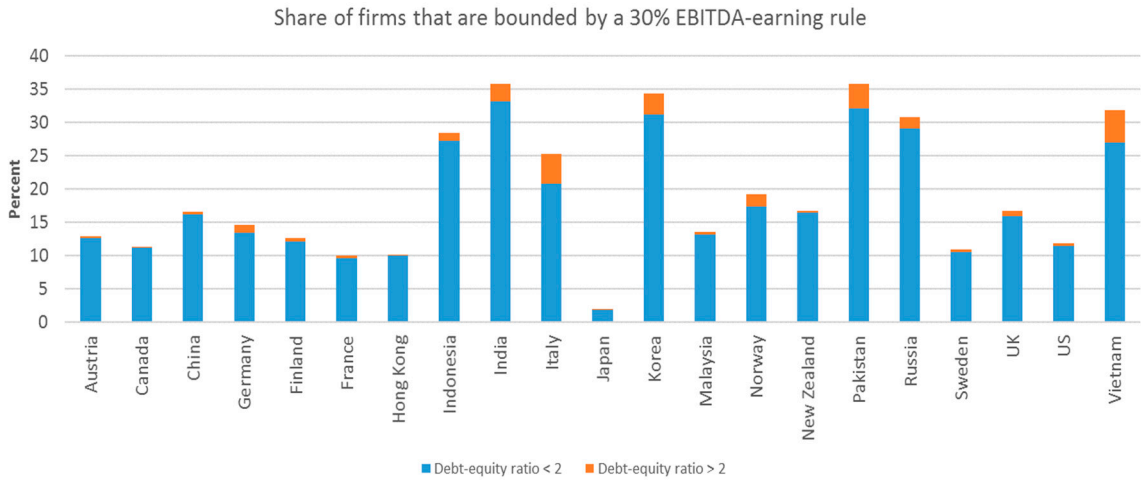
29. More comprehensive TCRs that apply to all debt, in contrast, are found to have significantly reduced debt bias. The results show that a rule applicable to all debt is associated with a reduction in the consolidated debt ratio of around 5 percentage points, an effect that is statistically significant and robust. Annex 4 also explores how these TCRs affect a more comprehensive proxy for corporate default risk, Altman's Z-score. This is to address the possibility that, while TCRs reduce debt ratios, firms simultaneously adjust portfolio risks so that their overall riskiness might not be affected. It seems, however, that they do not: the presence of

[17] The guidelines—not among the "minimum standards" that all countries committed to BEPS are expected to apply—allow for several options in design, e.g., whether to adopt an exemption to the rule if net interest expense is below a certain threshold, or whether to allow for the carry forward of denied interest expense, OECD (2015). Work considering application of the guidelines to the financial sector is currently ongoing with a follow-up report to be released at the end of 2016—but again with a focus on addressing debt shifting, not debt bias. The EU has adopted an Anti-Tax Avoidance Directive that includes a TCR that is broadly consistent with the G20/OECD guidelines (EC 2016a).

[18] The analysis identifies the impact of the TCR in the country where the parent resides on the group's entire (consolidated) debt. Of course, TCRs applied in other countries where the group's subsidiaries reside can also influence consolidated debt, but this effect cannot be explored with our data.

a comprehensive TCR reduces the probability of a firm facing high bankruptcy risk by 5 percentage points, whereas a TCR that targets related-party debt has no significant effect.

Figure 9. Share of Firms Restricted by an EBITDA Rule



Source: IMF Staff calculation based on consolidated firm-level data from ORBIS in 21 countries.

Note: The figure shows the share of firms that would be bounded by a 30-percents interest-EBITDA rule. Within this share, it distinguishes firms that would be thinly-capitalized as indicated by a debt-equity ratio greater than 2 and those that are not. Calculations are based on data for 2014.

30. Earnings-stripping rules are not specifically targeted at—and have a major drawback as a way to—addressing the risk of financial distress from debt bias. An earnings-stripping rule can address debt bias by denying interest deductions if total net interest expense exceeds a certain percentage of earnings (such as EBITDA). However, structural financial distress is more closely related to high levels of debt than high interest to earnings, as the latter is much more volatile. Indeed, an earnings-stripping rule will be binding not only for firms with a structurally high debt ratio, but also for firms with temporarily low earnings. The denial of interest deduction for these firms can reinforce financial constraints during periods of weak cash flow and magnify business cycle contractions.[19] Figure 9 illustrates this, showing that, on average, 19 percent of firms would be restricted by a 30 percent EBITDA rule. These firms are subsequently divided into those with debt-equity ratios below and above 2:1 (as an indication of being thinly capitalized). On average, less than one-in-five of the constrained firms are actually thinly capitalized. At the same time, 9 percent of the non-restricted firms in fact have a debt-equity ratio above 2:1.[20] Comparing the two types of rules, one key advantage of a TCR based on

[19] The rule in the BEPS Action 4 proposal recommends to introduce carry forward of disallowed interest expense to mitigate this effect. However, this will not eliminate the impact on liquidity.

[20] This is reminiscent to type I and type II errors. The type I error is that 80 percent of the firms that are restricted by the EBITDA rule are not thinly capitalized. The type II error is that 9 percent of the firms that are not restricted by the EBITDA rule are in fact thinly capitalized.

a fixed debt-equity ratio is that it is less sensitive to cyclical fluctuations than the interest-to-earnings rule, and might thus avoid creating a new source of financial distress.

31. Earnings-stripping rules seem well-placed, however, to mitigate debt shifting. Compared to a rule based on a fixed debt-equity ratio, an additional advantage of an earnings-stripping rule is that it also limits excessive deductions induced by the manipulation of intracompany interest rates. In technical assistance, IMF staff have therefore generally encouraged countries to adopt an earnings-stripping rule to counter debt shifting, similar to the new OECD-G20 common approach.

Full denial of interest deductibility

32. Debt bias would be fully neutralized by a "comprehensive business income tax" (CBIT), which denies all net interest deductions for all corporations. CBIT, as originally proposed by the U.S. Treasury in 1992, would also exempt the interest received by corporations to avoid double taxation. Hence, debt would be treated similarly to current equity treatment—neither would be deductible, while income received by a corporate owner would be exempt (or, if taxable, subject to tax credit). CBIT is consistent with a broad source-based tax on all capital income (including interest), withheld at the level of the firm.[21]

33. A CBIT system would encounter major transitional difficulties, especially when introduced unilaterally. An attractive feature of CBIT (apart from neutralizing debt bias) is that it involves a significant broadening of the CIT base. This could allow the statutory CIT rate to be reduced as part of a revenue-neutral reform.[22] A CBIT system would also be effective in countering intra-group debt shifting and eliminate the need for TCRs, which can prove challenging to administer and comply with. However, there are also important drawbacks:

- ***CBIT will raise the cost of capital and thus hurt investment.*** To offset this effect, CBIT could be combined with accompanying measures that reduce the cost of capital. One such option is to give an immediate deduction for all investment (rather than allow for tax depreciation over some years). This transforms CBIT into a so-called real-base (or R-base) cash-flow tax, which eliminates tax distortions at the margin of new investment. Such a system would distort neither the debt-equity choice, nor the scale of investment (Auerbach and others 2010).

- ***A unilateral CBIT might induce significant international distortions.*** CBIT is based on source taxation of interest income. Today, however, almost all countries tax interest on a residence basis. New international agreements would need to be developed to avoid either

[21] This might have implications for the taxation of interest at the personal level, where similar issues arise as with the double taxation of dividends and capital gains. These issues are not discussed here.

[22] Groenewegen, Mosch and Wierts (2016) estimate that the net overall revenue effect of interest deductibility falls in the range of 0.5 to 0.8 percent of GDP in major European countries in recent years.

international double taxation (both at source and residence) or non-taxation (neither at source nor residence) of cross-border interest income.

- ***Under a CBIT, banks' margins between the lending rate and the borrowing rate would be effectively untaxed***, i.e., banks would no longer be taxed on their primary source of income. This, in itself, would essentially be a matter of optics (since that margin would effectively be taxed in non-financial firms), but a potentially important one. One possibility, extending the logic of the R-base cash flow tax, would be to retain interest deductibility but also bring principal amounts into tax. This, when combined with immediate expensing, gives a real+financial (R+F-base) cash flow tax, which brings into financial firms' tax base the spreads generated by financial intermediation.

- ***CBIT would involve a long and complex transition period to cope with pre-existing debt.*** Moreover, if combined with full expensing, additional transitional complexities arise regarding the treatment of investments made prior to the reform and which have already benefited from standard depreciation allowances. Reflecting these difficulties, no country has ever adopted a CBIT, nor a fully-fledged R-base or R+F-base cash-flow tax.[23]

34. The idea of a CBIT system might be applied selectively to intracompany debt, for which there is some rationale. For a multinational parent that fully owns a subsidiary, the distinction between debt or equity as a source of investment finance is moot, as the parent will receive both fixed and variable returns, it will have both prior and residual claims in the case of default, and it will have all the voting rights, irrespective of the amount of intrafirm debt. There is little reason for tax systems to distort this choice of finance and enable tax arbitrage. A CBIT-like reform could neutralize this, e.g. all countries could re-characterize intracompany debt as equity and thus deny intracompany interest expense and provide double-tax relief for intracompany interest receipts. Intracompany interest would then be taxed at source, rather than residence. However, if only one individual country would do this, it might create either international double taxation or double non-taxation. Instead of eliminating deductibility, countries could also agree to allow interest on intracompany debt to be deducted only at the tax rate at which the interest income is taxable, i.e. in the country from which is borrowed.[24]

[23] Mexico used a cash flow tax for some period as a minimum tax. Estonia uses a variant of the so-called S-base cash flow tax (but applied to gross rather than net profit distributions). In the US, a so-called destination-based cash-flow tax is under discussion: it resembles an R-base (thus denying interest deductions), but with border adjustments that exclude revenue from foreign sales in the base and disallow foreign purchases as a deduction. Cash-flow taxes are more common in special fiscal regimes for the extractive industries (IMF 2012) and for small and medium sized enterprises (EC 2015).

[24] Another option to neutralize debt shifting entirely would be to adopt formula apportionment of the group's worldwide interest expense. In that case, the consolidated net interest expense of the group would be allocated across affiliates based on the location of assets or other variables, such as gross profits or gross debt.

B. Allowing a Deduction for Corporate Equity

35. Another way to eliminate debt bias is by introducing an "Allowance for Corporate Equity" (ACE). The ACE is inspired by Boadway and Bruce (1984), who proposed to replace interest deductibility with a notional deduction for all capital, irrespective of whether it is debt or equity (an "allowance for corporate capital," ACC). In contrast, ACE maintains the current deductibility of interest and supplements it with a similar deduction for the normal return on equity.[25] ACE was first proposed in the United Kingdom by IFS (1991). Subsequently, it has been quite widely advocated by several economists (see for instance Mirrlees and others (2011) for the United Kingdom; Boadway and Tremblay (2016) for Canada; and Clausing, Kleinbard and Matheson (2016) for the United States as well as by IMF staff (IMF 2009, 2013)—and adopted by several countries. A more detailed textbook design of an ACE is described in Annex 5.

36. The ACE has proved to be straightforward to implement. The calculation of taxable profit under an ACE may be done much as under the current CIT. The company's financial accounts already include information on dividends, new share issues and acquisitions of shares in other companies, which are needed to calculate the equity base for the purpose of the ACE. From an administrative perspective, it should therefore be possible to introduce a full-blown ACE system from one year to the other. The ACE rate might be based on an average corporate or government bond rate. In previous work, IMF staff have discussed experiences of countries where variants of an ACE have been successfully used (Keen and King 2002, Klemm 2007, De Mooij 2012, Michielse and others 2014). Today, Belgium, Cyprus, Italy, and Turkey apply variants of ACE and none of these schemes have encountered major difficulties in implementation. Other countries, such as Denmark and Switzerland, plan to introduce an ACE. Most countries grant the ACE not only to large corporations, but also to smaller firms, including partnerships.[26] Annex 5 briefly describes the main features of some real world ACE regimes.

37. The ACE is known to have several attractive properties. In particular, by allowing a deduction for both interest and the normal rate of return on equity, the ACE charges no tax on projects with a return that matches the cost of capital. It is thus a tax on economic rents (the firm's revenue in excess of the opportunity costs of all its inputs, including financing costs). Such a tax has several important neutrality properties. In particular, the ACEs system:

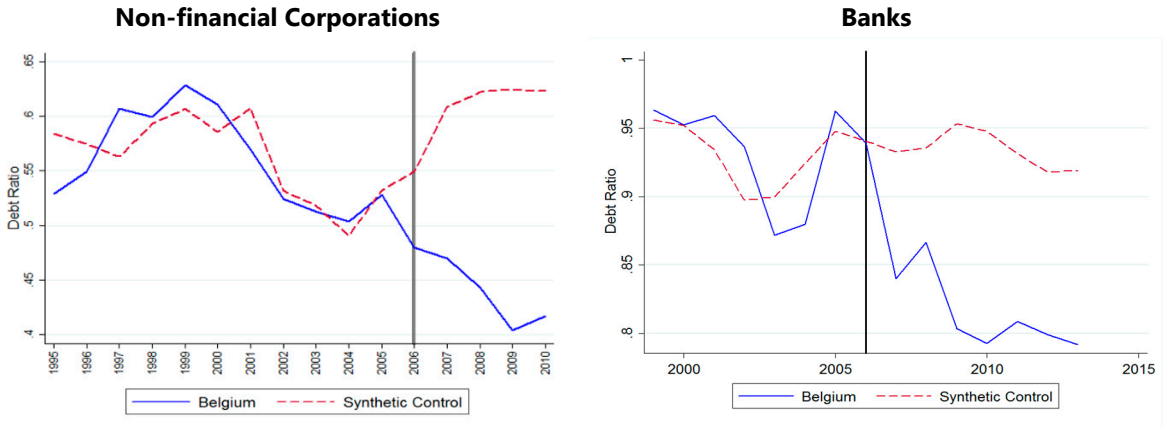
- ***Neutralizes debt-bias*.** Evidence suggests significant reductions in debt ratios as result of ACE, consistent with theoretical predictions (Princen 2012, Hebous and Ruf 2015). For instance, Figure 10 shows new empirical evidence regarding the impact of the Belgian ACE on consolidated debt ratios of both non-financial corporations (left panel) and banks (right panel), using the synthetic control method. The results suggest a significant treatment effect of the ACE: its implementation in 2006 reduced the average debt ratio in Belgium by almost

[25] The ACE differs from proposals for a dividend deduction, since the allowance is given irrespective of whether profit is distributed or retained. Moreover, ACE is granted at a notional rate, not the actual return.

[26] Between 2010 and 2013, Portugal applied an ACE only to small companies.

20 percentage points for non-financial firms (relative to the counterfactual) and by more than 10 percentage points for banks (see also Schepens 2016).

Figure 10. Belgian ACE and Leverage



Source: Hebous and Ruf (2015) and IMF Staff analysis based on Bankscope.

Note: The charts compare the actual consolidated debt-asset ratio of non-financial corporations (left) and banks (right) in Belgium with a counterfactual ratio simulated using the synthetic control method. For non-financial corporations, see Hebous and Ruf (2015) for details. For banks, the data contain 18,551 observations for 49 countries between 2005–13. Banks include commercial banks, cooperative banks, and investment banks.

- ***Renders the CIT neutral with respect to marginal investment decisions.*** As the ACE system charges no tax on projects whose return equals the cost of capital, the effective marginal tax rate is zero. Such a tax would not distort the scale of investment. Evidence on investment effects is scarce, however, and the outcomes of available empirical studies are mixed (see, e.g., Hebous and Ruf 2015, Aus dem Moore 2015).

- ***Removes investment distortions induced by differences between economic depreciation and depreciation for tax purposes.*** In particular, accelerated depreciation for tax purposes reduces the book value of assets in the tax accounts, thereby also reducing the ACE in later years. This exactly offsets the benefits from earlier depreciation in present-value terms. Hence, the present value of the sum of the depreciation allowance and the ACE allowance is independent of the rate at which firms write down their assets in the tax accounts. Neutrality of an ACE with respect to investment therefore holds, irrespective of the depreciation allowances in the tax system.[27]

38. One concern with ACE is that it may create (international) tax planning opportunities—but these largely resemble existing tax avoidance schemes and can be mitigated by counter measures. Annex 6 discusses the principal schemes and possible responses. ACE can also reduce some of the current tax avoidance problems induced by the differential tax treatments of debt and equity. For instance, it can make it less beneficial for a multinational company to lend excessively to subsidiaries in ACE countries, since equity would

[27] Also distortions induced by the absence of indexation of undepreciated assets for inflation are neutralized.

enjoy a similar deduction as debt. In fact, the neutrality properties of the ACE mean that if all countries were to adopt one, debt shifting would be significantly curtailed. Yet, ACE does not solve all forms of tax avoidance, while an asymmetric adoption of ACE by only some countries can induce new forms of tax planning. For instance, ACE can encourage strategies to take interest deductions in non-ACE countries through the creation of intracompany loans from the ACE country (where the loan is financed by equity). This imposes a revenue risk for the non-ACE country, as the excessive interest deductions erode their tax base. This form of tax planning is not fundamentally different, however, from classical debt shifting induced by differences in statutory CIT rates. Countries have been implementing counter measures to address such tax avoidance through TCRs. The adoption of an ACE or very low CIT rates by some countries will thus make TCRs more important for countries without an ACE and with relatively high CIT rates.

39. A second possible concern with the ACE is its revenue cost—but this can be mitigated. For a group of OECD countries, Annex 7 simulates the revenue effect of an ACE, granted to all equity at the ongoing 10-year government bond rate. The ACE reduces the sectoral CIT base in 2012 and 2013 by between 5 and 12 percent, depending on the sector (left panel of Figure 11). The reduction is least in the extractive industries, where the equity-to-assets ratio is lower and profitability higher than in services and manufacturing companies.[28] There are several ways to mitigate the revenue loss from an ACE.

- ***Design ACE in an incremental fashion,*** applying it only to equity increases relative to some base year. The incremental ACE has a much smaller effect on the tax base: the first-year impact based on our simulations, for instance, lies between 0.9 and 1.3 percent of pre-tax profits (right panel of Figure 11). Of course, the revenue effect under this variant will gradually increase over time as the new equity stock expands.

- ***Combine ACE with a limitation to interest deductibility.*** Parameters for rate of deductibility of equity (the ACE rate) and the constraint on debt (either a cap or a proportional limitation) can be calibrated such that revenue neutrality is ensured (see e.g. EC forthcoming). Model simulations with a CGE model for the EU predict a positive welfare effect of such a reform (De Mooij and Devereux 2011).

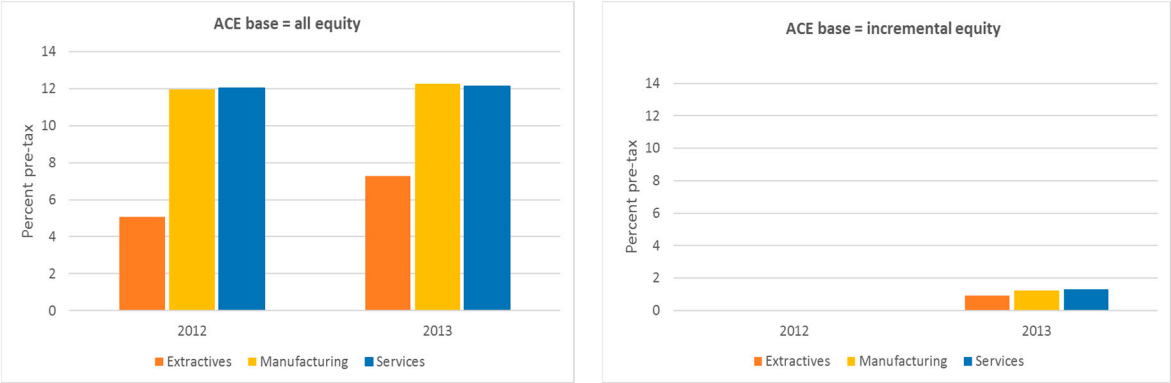
- ***Implement ACE in specific sectors where economic rents are important***, perhaps in addition to the ordinary CIT. For example, Norway has a special petroleum tax scheme under which the tax base equals taxable income for CIT minus an allowance of 7.5 percent of the

[28] These estimated revenue losses are considerably smaller than is sometimes reported, based on realized equity ratios (see e.g., Zangari 2014). However, the latter can significantly overestimate the revenue costs of ACE, as the expansion of equity reduces the amount of deductible interest. For instance, if ACE raises the equity share from 40 to 60 percent of total assets—as is estimated for Belgium in Figure 10—the assessed revenue loss (based on realized equity) will overstate the true revenue loss from the ACE by 50 percent. The overstatement of the revenue loss might be even larger as the expansion of equity (at the expense of debt) increases deductions according to the notional rate, but reduces them to the extent of the interest rate on debt, which is typically larger.

(continued)

investment cost for the first four years. This resembles an ACC. In Israel, a mining regime was adopted under which the tax base is calculated as operating income less allowable interest expense and a "yield on the amortized cost of capital," much as in an ACE.[29]

Figure 11. Reduction of the Tax Base from an ACE



Source: Staff calculations based on Orbis, see Annex 7.

Note: The ACE is obtained by multiplying the ACE base by the ACE rate, capped by the value of the pre-tax profit. The ACE rate is the long-term government bond rate in the country, while the ACE base varies between all equity (left panel) and incremental equity (right panel). The estimates presented are aggregations across all firms and countries and present the reduction in taxable income per sector in percent.

40. The structural attractions of the ACE have sometimes proved less politically salient than simply reducing the headline CIT rate or introducing investment tax incentives. The ACE now seems well-established in Italy, Switzerland is planning to introduce one and Denmark is considering doing so. Croatia and Latvia, however, removed their ACE, and Belgium is now reportedly considering doing so. In no case does this seem to have been due to issues of implementation or effectiveness, but rather in favor of cutting the statutory CIT rate and perhaps introducing explicit incentives. More generally, many countries have given priority to such measures over significant structural reform, such as adoption of an ACE. While there can be several considerations underlying these policy choices, misperceptions of the ACE play a role. For instance, ACE is sometimes seen as a tax break for profitable companies; but so of course is a reduction in the CIT rate or a tax holiday, and indeed those measures are more favorable than an ACE to companies that are already highly profitable. And while an ACE narrows the tax base, the revenue impact (especially given some of the safeguards mentioned above) may well be less than that from cutting the rate.[30] Also, ACE is sometimes perceived as especially vulnerable to tax planning and so associated with negative spillovers effects on other countries; but reductions in CIT rates and tax holidays are likely to induce larger international spillovers. Indeed, they directly affect incentives for profit shifting and so even if seen as protecting the domestic tax base, is likely to lead to similar responses from others and further intensify international tax competition.

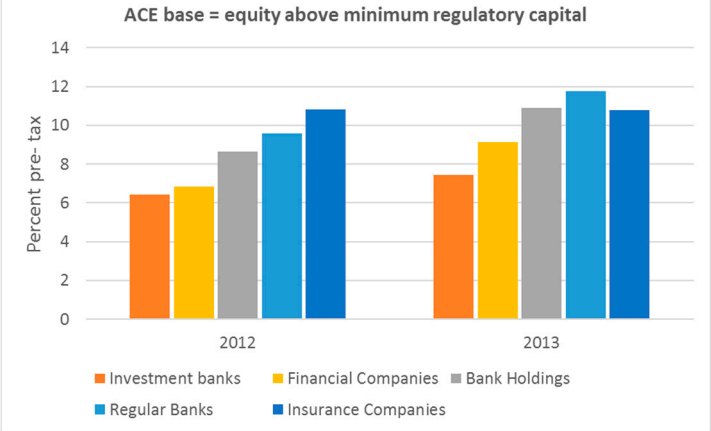
[29] This follows IMF technical assistance advise, see Keen and others (2014). Adding an ACE-based tax on top of the CIT may have significant appeal also in developing countries as a supplementary rent tax.

[30] Cuts in corporate tax rates have often but not always been accompanied by base broadening measures to mitigate the revenue effect (Kawano and Slemrod 2016).

C. Special Taxation of the Financial Sector

41. An ACE could be imposed only on financial institutions. This would neutralize debt bias where macroeconomic stability risks are the biggest concern, while limiting the revenue loss (however modest) that wider adoption of an ACE would imply. In some respects, this is a radical option since any sector-specific tax treatment brings its own risks of avoidance. However, the financial sector is a well-defined and intensely regulated sector, for which special provisions are common. The revenue cost of an ACE in the financial sector can be reduced by providing it only for equity in excess of the minimum regulatory capital requirement (Roe and Troege 2016). Annex 7 explores the revenue implications of such an ACE for financial institutions. It finds that the CIT base narrows by between 6 and 12 percent, on average across countries (Figure 12). If the financial sector accounts for 17.5 percent of CIT receipts (which is the average reported in Claessens, Keen and Pazarbasioglu 2010), then total CIT revenue would fall by between 1 and 2 percent.

Figure 12. Reduction of the Tax Base from an ACE in the Financial Sector



Source: Staff calculations based on Orbis and Bankscope, see Annex 7.

Note: ACE is obtained by multiplying the ACE base by the ACE rate, capped by the value of the pre-tax profit. The ACE rate is the long-term government bond rate in the country, while the ACE base comprises of equity in excess of the minimum capital requirement, which is set at 3 percent of total assets.

42. In the financial sector, there is a case to go beyond tax neutrality and actively discourage the use of debt. Taxes might be used as a supplement to regulatory efforts to induce financial institutions to hold more equity. There is a continuing debate in the literature as to the relative merits of taxation and regulation in addressing financial market failures, but the deeper conceptual issues remain largely unresolved (Keen 2011ab). For instance, some have emphasized that there are limits to the use of regulatory instruments to efficiently raise bank capital ratios, e.g., as regulators often have limited information about the riskiness of certain products or activities, which may complicate control (see, for instance, the contributions in De Mooij and Nicodeme 2014). Tighter bank regulation may also encourage a shift of intermediation and leverage towards shadow banks and thus shift financial stability risks. In these circumstances, tax incentives can usefully complement regulatory efforts to address excessive leverage.

Box 4. Recent Developments of Bank Levies in Europe

Bank levies have been implemented mostly in Europe during the years between 2010 and 2012 (see e.g. Devereux, Johannesen and Vella 2015 for an overview). Since 2015, however, several countries have started to reform these bank taxes. This box describes a selection of these reforms.

Belgium introduced a Financial Stability Contribution in 2012. The tax base consisted of total liabilities net of equity and insured deposits and the rate was 0.035 per cent. Recently, Belgium transformed it into a so-called "New Bank Tax." It has a predetermined revenue target of €805m, of which €500m is reserved for the contribution to the SRF. The tax base consists of the average of reported Belgian "debt towards clients" of the preceding year (not taking into account risk weighing factors) and the rate will each year be determined to achieve the revenue goal. For 2016 the tax rate is 0.13231 percent (KPMG 2016).

Cyprus introduced in 2011 a Special Tax on Credit Institutions. The base consisted of total bank deposits held in the previous year (restricted to a maximum of 20 percent of the total taxable profits and excluding deposits from foreign financial institutions and interbank deposits). The tax rate was initially 0.095 percent, but gradually increased to 0.15 percent in 2015. In 2016, however, Cyprus started to phase out its bank tax, with the rate reduced to 0.0375 percent (EC 2016b).

United Kingdom introduced a Bank Levy in 2011 on total liabilities net of equity and insured deposits. The rate was structured as a progressive schedule, with an exemption for up to £20 billion and subsequent rates of 0.088 percent for short-term unsecured liabilities and 0.044 per cent for long-term unsecured liabilities. Tax rates were subsequently gradually increased to, respectively 0.21 and 0.105 percent in 2015. For the coming years, however, the United Kingdom has announced that it will reduce the rates to 0.10 percent for short-term liabilities and 0.05 percent for long-term liabilities during the period 2015–21. At the same time, a new tax on banking sector profit is introduced in 2016 at a rate of 8 percent (U.K. Treasury 2015).

43. Over a dozen countries have adopted bank taxes broadly similar to the "Financial Stability Contribution" (FSC) proposed by IMF (2010), with some positive results. The simplest form of the FSC is a tax on uninsured borrowing by all financial institutions to address systemic externalities associated with excessive leverage. Recently introduced bank levies in Europe resemble such an FSC and have induced large consequent increases in capital ratios (Devereux, Johannesen, and Vella 2013): the average bank levy increased regulatory capital ratio by around 0.9 percentage points.[31] Since the adoption of the Bank Recovery and Resolution Directive (BRRD)[32] and the establishment of the Single Resolution Fund (SRF), bank levies in Europe are evolving in a variety of ways, ranging from gradual reductions (Cyprus, France, United Kingdom), to rate increases (Austria, Portugal) to a complete overhaul of their structure (Belgium) (see Box 4).

44. Taxes might also be specifically applied to shadow banks, to level the playing field with regulated banks. While banks and shadow banks compete on similar markets, they face

[31] Some of the reduction in funding risk, however, has been offset by an increase in portfolio risk. On balance, the study finds that funding risks only fell for banks with relatively high capital ratios. In contrast, Schepens (2016) finds that the Belgian ACE—which also neutralizes debt bias for banks, but in a different way—has reduced risk taking mostly by the least capitalized Belgian banks.

[32] The BRRD includes resolution financing arrangements that subscribe a contribution for an individual bank based on two factors: (i) a flat contribution based on the amount of liabilities, excluding own funds and covered deposits; and (ii) a contribution that is adjusted for portfolio risk. Yet, countries are also permitted to maintain their current bank levy.

two important differences. First, the funding costs for banks might be lower than for shadow banks due to implicit or explicit insurances provided by the government. Indeed, IMF (2014b) finds that debt financing for banks is considerably cheaper than for other firms as a result of government guarantees. Second, banks might face tighter regulatory constraints, which can drive up their funding costs. This can create regulatory arbitrage, whereby risky bank activities are moved into the shadow banking sector, where there is less monitoring and constraints. The balance of these two effects on the funding costs of banks versus shadow banks is not a priori clear. To the extent that, on balance, banks face higher funding costs, a tax on the leverage of shadow banks could be introduced to level the playing field and prevent a shift of risky bank activities to the non-regulated sector. Alternatively, bank levies could be extended to the shadow banking sector and rates differentiated between the two to broadly reflect differences in funding costs as a result of regulatory differences.

CONCLUSIONS

45. The amplification of stability risks by systematic tax distortions favoring debt over equity finance, more widely recognized since the global financial crisis, remains a significant concern. Such 'debt bias' commonly arises for both households and firms.

46. The primary source of household debt bias can be mitigated by gradually reforming generous tax deductions for mortgage interest—a long-standing and much studied issue. Such reforms should be implemented gradually to avoid creating house-price disruptions in the short run. Moreover, some countries have started to use housing-related taxes (such as transaction taxes) to stabilize house price developments. These have had mixed success, as properly timing and calibrating such policies can be hard. Therefore, it is generally preferred to design stable and neutral tax systems with respect to housing. Recurrent property taxes, in addition to their other merits of efficiency and fairness, could play a useful stabilizing role, as new evidence suggests that they can mitigate risks associated with house-price volatility.

47. Corporate debt bias remains a stability concern, including in the financial sector—despite strengthened regulation of financial institutions. Tax systems increase corporate debt ratios by between 4½ and 9 percent of total assets, including in financial institutions. New evidence shows that this is also true for non-bank financial institutions, including finance companies and insurance companies.

48. To address corporate debt bias, one option is to limit interest deductibility. One way to do this is through thin capitalization rules, but these are only effective in addressing debt bias (rather than tax avoidance through debt shifting) if applied to all debt (not, as most current rules do, to only the intragroup debt of multinationals) and should be based on a fixed ratio of debt-to-equity. Another is by some form of cash-flow taxation, although experience with these is limited.

49. Alternatively, corporate debt bias can be neutralized by adopting an 'Allowance for Corporate Equity' (ACE) system, which has now been effectively applied in several countries without creating major implementation problems. The most often-cited possible drawback of the ACE—a revenue loss due to a narrowing of the corporate tax base—can be mitigated by judicious design (such as granting the allowance only for incremental equity, or by combining it with limitations on interest deductibility). So too can new opportunities for tax avoidance under an ACE be mitigated by countermeasures.

50. For financial institutions, sector-specific tax measures might be warranted given the particularly large externalities from their over-leverage. Bank levies on non-core funding have been effectively used in Europe to reduce bank leverage. Consideration might also be given to a sector-specific allowance for corporate equity (above the regulatory minimum capital) to effectively encourage capitalization and resolve the tension between regulatory policies that encourage equity finance and tax policies that do the opposite.

51. In the coming years, addressing debt bias should feature prominently in national tax reform agendas to mitigate macroeconomic stability risks. Several approaches have proved effective, and others are possible; and their design can be tailored to countries' needs and circumstances. The feasibility of these reforms is currently facilitated by the low interest rate environment, which mitigates implications for both public and corporate finances.

Annex I. Property Taxes and House Price Volatility

This annex uses a novel dataset to analyze the relationship between property taxes and house price volatility in the United States. A more extensive analysis and description can be found in Poghosyan (2016). The analysis adds to a scant existing literature on the topic (Kuttner and Shim 2013, Claessens 2014, Cerutti forthcoming). Empirical evidence is mixed: some studies report that higher property taxes are associated with lower house price volatility in the United States (Crowe and others 2013) and a sample of OECD countries (Andrews 2010), while one study fails to find a significant relationship between capital gains/transaction taxes and house price volatility in Swiss cantons (Arreger and others 2013). None of the studies assesses whether the causality runs from property taxes to house price volatility or vice versa.

Empirical specification

The baseline specification takes the following form:

$$VOL_{it} = \alpha + \beta TAX_{it} + \gamma' X_{it} + u_i + \omega_t + \varepsilon_{it} \quad (1)$$

where *i* denotes state, *t* denotes time, *VOL* is an indicator of house price volatility, *TAX* is the property tax rate, *X* is a vector of control variables, *u* is the unobserved state-specific heterogeneity (state fixed effect), ω is the unobserved time-specific heterogeneity (time fixed effect), and ε is the i.i.d. error term. The coefficient of interest is β.

If property taxes are immediately capitalized into house prices, one would not expect any impact on volatility. However, as supply might gradually respond to house price changes, there can be a transition period during which house prices could exhibit greater volatility in response to a demand shock if the level of property taxation is low. This is captured in a model developed by Van Den Noord (2005), which predicts a *negative* slope coefficient on the property tax rate variable for price volatility ($\beta < 0$). The intuition is that higher property taxes flatten the housing demand curve, which makes house prices less responsive to shifts in the demand curve and reduces their volatility. This annex empirically explores whether this has been the case in the United States.

Data

Data on property taxes and house prices are used for 51 U.S. states and several metropolitan statistical areas (MSAs) located in those states. The house price data are taken from the Federal Housing Finance Agency. Annual house prices are estimated as averages of four quarters within a year. Macroeconomic variables, including nominal and real GDP, GDP deflator, per capita GDP, and population are taken from the Bureau of Economic Analysis. Effective property tax rates are measured as the ratio of the median annual property tax payment to the median property value. Both series are taken from the American Community Survey maintained by the Census. The advantage of this measure is that it accounts for differences in property tax rates across counties

within the state and for property tax exemptions/adjustments. Unfortunately, the survey data do not extend back beyond 2005, so the series are restricted to the 2005–14 period. The volatility of house prices is measured as the standard deviation of prices estimated using five-year backward moving window, either based on annual growth rates or percentage deviations from the HP-filtered value.[33] The latter can be interpreted as measuring the extend of boom-bust cycles.

Annex Table 1.1 presents descriptive statistics of all variables used in the analysis. The panel is balanced, with 510 state-year observations. The average effective property tax rate in the sample is 1 percent, with standard deviation of 0.5 percent. The average volatility, measured by the standard deviation, of house prices is 5–6 percent, depending on the measure.

Annex Table 1.1. Summary Statistics

	Obs.	Mean	Median	St. Dev.	10th percentile	90th percentile	25th percentile	75th percentile
House price growth rate (%)	510	-1.30	-0.95	7.42	-9.67	6.94	-5.57	2.98
Effective property tax rate (%)	510	1.04	0.91	0.48	0.52	1.75	0.65	1.35
House price volatility (%, growth-based)	510	5.13	4.18	3.90	1.55	10.28	2.47	6.28
House price volatility (%, HP-based)	510	6.39	4.92	4.93	1.96	12.85	3.16	8.15
Real GDP per capita growth (%)	510	1.27	1.40	2.66	-1.69	4.16	0.16	2.54
GDP deflator growth (%)	510	2.23	2.10	1.88	1.09	3.50	1.67	2.84
Population growth (%)	510	0.84	0.75	0.75	0.11	1.73	0.35	1.24
Supply restrictions index (Saiz, 2010)	770	27.94	23.29	22.32	3.12	64.01	9.28	40.50
Regulatory restrictions index (Wharton)	770	0.10	0.03	0.69	-0.81	0.94	-0.38	0.61

Source: Poghosyan (2016).

Annex Figure 1.1 presents simple scatterplots of house price volatility and property tax rates. The slopes are negative for both definitions of house price volatility, suggesting a lower volatility in state-years characterized by high property tax rates. There is also some evidence of heteroscedasticity, with distribution of house price volatility being larger in state-years with low property tax rates. The latter suggests that robust standard errors should be used in the regressions to improve inference.

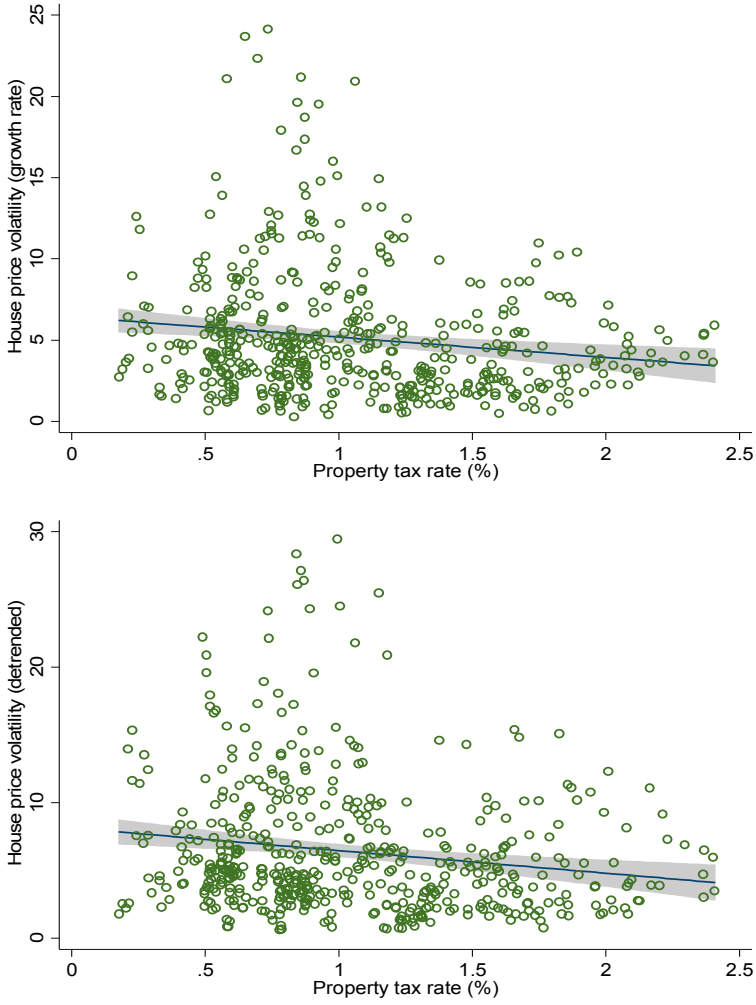
Results

Annex Table 1.2 presents estimation results from the baseline specification. Columns (I)–(IV) show results for volatility based on house price real growth rates, while columns (V)–(VIII) show results for volatility based on de-trended house prices. In all specifications the slope coefficient of the property tax variable is negative (and in most cases significantly so), supporting the theoretical prediction of the negative association between house price volatility and property tax rates. The economic significance of the coefficients is large: a 1 standard deviation increase in property tax rates (0.48 percentage point) leads to 1.3–1.7 percent reduction in volatility based on the standard deviation of the growth rate measure and 0.5–0.6 percent reduction in volatility based on the de-trended measure.

[33] Following the established practice for annual series, the smoothing parameter of the HP filter is set to 100.

Poghosyan (2016) shows that these results are robust to endogeneity (using average property tax rates in neighboring states as an instrumental variable or using dynamic GMM). Also a difference-in-difference approach using an interaction of state tax rates with MSA-specific index of supply restrictions shows that higher property taxes at the state level reduce house price volatility in MSAs with more rigid housing supply more compared to states with less rigid supply. The average economic effect across all regressions suggests that an increase in property tax rates by 0.48 percentage points leads to a 3 percent reduction in house price volatility.

Annex Figure 1.1. House Price Volatility and Property Tax Rates



Note: The sample covers 51 U.S. states for the period 2005–14. Upper figure is based on growth rate. Lower figure based on detrended series.

Annex Table 1.2. Property Taxes and House Price Volatility

	Volatility (house price growth)				Volatility (detrended house prices)			
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Property tax rate	-3.542***	-2.784***	-3.210***	-2.802***	-1.283**	-1.111	-1.347**	-1.177
	[0.674]	[0.884]	[0.789]	[0.893]	[0.610]	[0.750]	[0.626]	[0.746]
Lagged dependent variable	0.579***	0.551***	0.497***	0.526***	0.466***	0.462***	0.465***	0.474***
	[0.022]	[0.033]	[0.042]	[0.046]	[0.033]	[0.041]	[0.035]	[0.047]
Real GDP per capita growth			-0.239***	-0.048			-0.052	-0.038
			[0.064]	[0.052]			[0.053]	[0.057]
Inflation (GDP deflator growth)			-0.067	0.023			-0.048	0.091*
			[0.050]	[0.041]			[0.039]	[0.049]
Population growth			-0.165	-0.363*			-0.026	0.069
			[0.209]	[0.208]			[0.160]	[0.120]
Constant	6.186***	4.122***	6.792***	6.952***	4.861***	5.734***	5.113***	5.971***
	[0.699]	[0.880]	[0.976]	[1.002]	[0.602]	[0.895]	[0.721]	[0.800]
Economic significance	-1.7	-1.3	-1.5	-1.3	-0.6	-0.5	-0.6	-0.6
Time FE	No	Yes	No	Yes	No	Yes	No	Yes
# observations	459	459	459	459	459	459	459	459
# states	51	51	51	51	51	51	51	51
R^2	0.365	0.588	0.434	0.598	0.215	0.460	0.219	0.465

Note: Coefficients are obtained from panel OLS regressions with state fixed effects. The dependent variable is the house price volatility, measured as a five-year backward moving window standard deviation of: (i) house price real growth rates (columns I–IV); and (ii) deviation of real house prices from their HP-filtered values (columns V–VIII).

Economic significance measures the response of house price volatility to a 1 standard deviation (0.48 percent) increase in property tax rates. Robust standard errors are in brackets. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Annex II. Taxation and Financial Institutions' Leverage

This annex estimates the effect of taxation on financial institutions' leverage using firm-level data. The analysis draws on and expands the analysis in De Mooij and Keen (2016), which finds a significant and positive effect of taxation on bank leverage in a sample of commercial, cooperative and savings banks between 2001 and 2009. Other studies also find that taxes have a significant impact on bank capital structure decisions (Hemmelgarn and Teichmann 2014, Heckemeyer and De Mooij 2016, Schepens 2016). No previous study, however, has looked at these effects among investment banks, shadow banks, and insurance companies. Our analysis includes these institutions, as well as more recent data covering seven years since the GFC. This enables us to study whether a change in behavior has occurred since the GFC.

Empirical Specification

We estimate the following benchmark bank-panel specification:

$$Y_{it} = \alpha + \beta_1 Y_{it-1} + \beta_2 Tax_{it} + \beta_3 X_{it} + \lambda_t + \mu_i + \epsilon_{it}, \quad (1)$$

where Y_{it} is the leverage ratio of financial institution *i* in year *t*, calculated as total debt liabilities over total assets. Tax_{it} is the top statutory corporate income tax (CIT) rate in the country, and X_{it} is a vector of controls. The coefficients β_j , *j = 1,2,3*, are respectively the autoregressive coefficient, the debt bias coefficient—our coefficient of interest—and the vector of coefficients associated with the control variables. The controls include indicators of the *size of the banks* (proxied by the book value of a bank's total assets on a logarithmic scale, included as both a linear and a quadratic term), *profitability* (measured as pre-tax profits to assets), *economic conditions* (GDP growth and inflation), as well as *riskiness of bank assets* (measured as the ratio of risk-weighted assets to total assets). The inclusion of the lagged dependent variable captures sluggishness of the response of leverage. Specification (1) includes year fixed effects (λ_t) that capture year-specific effects that are common across all financial institutions in the sample (e.g., global economic shocks). It also includes firm fixed effects (μ_i) that control for unobserved firm (and country)-specific time-invariant heterogeneity.

In line with the literature, the coefficient of interest β_2 is expected to be positive, indicating a direct effect of CIT on leverage: the higher the statutory CIT rate, the higher the leverage. The size of the coefficient estimate indicates the strength of this debt bias in the short-run. The long-term effect of the CIT on leverage can be computed as $\frac{\beta_2}{1-\beta_1}$.

In departure from earlier work, we make a distinction between "regular" banks (i.e., commercial, savings, and cooperative banks), investment banks, and non-bank financial institutions (non-bank financial institutions are also referred to as shadow banks). As regulation varies between these different categories of financial institutions (Box 3), they may be expected to react differently to taxation. We allow for such difference by including interaction terms between group-specific dummies and the CIT rate, as specified in equation (2). Here, the coefficients β_4 and β_5 on the interaction terms give the differential effects of taxes on leverage for different types of banks. The non-tax effects are assumed the be the same across the different types of financial firms.

$$Y_{it} = \alpha + \beta_1 Y_{it-1} + \beta_2 Tax_{it} + \beta_3 X_{it} + \beta_4 (Inv_i \times Tax_{it}) + \beta_5 (Fin_i \times Tax_{it}) + \lambda_t + \mu_i + \epsilon_{it} \quad (2)$$

To correct for estimation biases arising from the use of a lagged dependent variable, and also to deal with endogeneity problems with the risk variable (the causality between leverage and risk can run in both directions), we estimate our specifications using the Blundell and Bond (1998) system GMM dynamic panel estimator. This estimator is appropriate because the panel dataset has a short time dimension (T=15) and a large bank dimension (N>14,000).

For robustness, we compute the estimates using a world sample of "regular" banks following De Mooij and Keen (2016) and an extended world sample of "regular" banks and other non-traditional banks, including investment banks and finance companies. We also employ a separate specification, where the data consists of insurance companies, differentiated by life and non-life insurers.

Data

Estimates are based on financial institution-level data from the companies' balance sheets. We use unconsolidated firm accounts to align the effect of tax rates and regulations to bank operations within a country's national borders. This strategy minimizes measurement error in the tax variable that may occur when foreign subsidiaries are consolidated into parent accounts, even though they are subject to a different CIT rate. The disadvantage is that the estimates may capture not only debt bias, but also debt shifting. Earlier studies have found that debt bias and debt shifting are both important for internationally operating banks (Gu, De Mooij and Poghosyan 2015; Heckemeyer and De Mooij 2016).

Data for banks and non-bank finance companies come from Bankscope by Bureau van Dijk. We obtain about 151,000 observations corresponding to almost 14,000 distinct banks and finance companies in 131 countries over the period 2001–15. This period is long enough to study bank behavior before and after the 2008 crisis. Almost 93 percent of firms in our sample are "regular" banks, followed by a small number of non-bank finance companies (5 percent) and investment banks (2 percent). Insurance company data come from the Orbis Insurance Focus database by Bureau van Dijk. Here, we use over 68,000 observations corresponding to more than 7,500 firms from 85 countries over the period 2005-2015. Of these firms, 30 percent are life insurers and 70 percent non-life insurers (property and casualty, health, and title insurance services). To control for outliers and preserve minimum consistency in both BankScope and Insurance Focus, all variables have been winsorized at the 1 percent level, except for tax, inflation, and GDP growth rates. Firms that did not report financial results for a minimum of three consecutive years were dropped from the sample, as were countries with less than 20 observations. Annex Tables 2.1 and 2.2provide summary statistics of the main variables.

Annex Table 2.1. Summary Statistics—Banking

Variable	Obs	Mean	Std. Dev	Min	Max
All banks [13,990 bank IDs; 131 countries]					
Leverage, pct total assets (winsorized fraction .01)	151,463	86.5	13.2	10.9	98.5
CIT rate (pct)	151,174	31.2	6.5	8.5	60.0
Log assets (winsorized fraction .01)	151,463	5.2	1.7	1.8	9.9
Log assets sq (winsorized fraction .01)	151,463	29.6	20.8	3.4	98.8
GDP growth (pct)	151,449	1.9	2.6	-62.1	104.5
CPI inflation (pct)	151,048	2.9	3.9	-37.2	359.9
Pre-tax profit, pct total assets (winsorized fraction .01)	151,120	1.0	1.9	-6.4	10.6
Risk (winsorized fraction .01)	100,663	0.7	0.2	0.2	1.0
Total assets, million USD (winsorized fraction .01)	151,463	1,119	3,194	6	20,753
Total equity, million USD (winsorized fraction .01)	151,463	93	270	1	1,971
Pretax profits, million USD (winsorized fraction .01)	151,120	9	31	-22	210
Regular banks (commercial, cooperative and savings banks) [13,047 bank IDs; 131 countries]					
Leverage, pct total assets (winsorized fraction .01)	144,552	87.0	12.2	10.9	98.5
CIT rate (pct)	144,309	31.4	6.4	8.5	60.0
Log assets (winsorized fraction .01)	144,552	5.1	1.7	1.8	9.9
Log assets sq (winsorized fraction .01)	144,552	29.1	20.2	3.4	98.8
GDP growth (pct)	144,538	1.9	2.6	-62.1	104.5
CPI inflation (pct)	144,165	2.8	3.8	-37.2	359.9
Pre-tax profit, pct total assets (winsorized fraction .01)	144,419	1.0	1.8	-6.4	10.6
Risk (winsorized fraction .01)	99,714	0.7	0.2	0.2	1.0
Total assets, million USD (winsorized fraction .01)	144,552	1,029	2,993	6	20,753
Total equity, million USD (winsorized fraction .01)	144,552	86	256	1	1,971
Pretax profits, million USD (winsorized fraction .01)	144,419	9	30	-22	210
Investment banks [308 bank IDs; 67 countries]					
Leverage, pct total assets (winsorized fraction .01)	2,477	72.6	27.2	10.9	98.5
CIT rate (pct)	2,467	26.5	7.4	8.5	45.2
Log assets (winsorized fraction .01)	2,477	6.1	2.6	1.8	9.9
Log assets sq (winsorized fraction .01)	2,477	43.5	32.2	3.4	98.8
GDP growth (pct)	2,477	2.4	3.4	-12.8	36.9
CPI inflation (pct)	2,474	4.1	7.5	-4.5	152.6
Pre-tax profit, pct total assets (winsorized fraction .01)	2,313	2.0	4.1	-6.4	10.6
Risk (winsorized fraction .01)	289	0.5	0.3	0.2	1.0
Total assets, million USD (winsorized fraction .01)	2,477	4,247	7,093	6	20,753
Total equity, million USD (winsorized fraction .01)	2,477	301	531	1	1,971
Pretax profits, million USD (winsorized fraction .01)	2,313	25	54	-22	210
Finance companies [635 bank IDs; 85 countries]					
Leverage, pct total assets (winsorized fraction .01)	4,434	77.0	23.3	10.9	98.5
CIT rate (pct)	4,398	27.6	6.7	8.5	40.2
Log assets (winsorized fraction .01)	4,434	5.7	2.3	1.8	9.9
Log assets sq (winsorized fraction .01)	4,434	37.5	27.0	3.4	98.8
GDP growth (pct)	4,434	2.4	3.2	-16.5	14.2
CPI inflation (pct)	4,409	3.7	4.0	-37.2	48.7
Pre-tax profit, pct total assets (winsorized fraction .01)	4,388	2.1	3.5	-6.4	10.6
Risk (winsorized fraction .01)	660	0.7	0.3	0.2	1.0
Total assets, million USD (winsorized fraction .01)	4,434	2,287	4,598	6	20,753
Total equity, million USD (winsorized fraction .01)	4,434	187	394	1	1,971
Pretax profits, million USD (winsorized fraction .01)	4,388	22	48	-22	210

Annex Table 2.2. Summary Statistics—Insurance

Variable	Obs	Mean	Std. Dev	Min	Max
Life insurance companies [2,294 firm IDs; 80 countries]					
Leverage, pct total assets (winsorized fraction .01)	19,469	11.5	16.1	0.0	73.0
CIT rate (pct)	19,419	28.3	7.5	8.5	39.0
Log assets (winsorized fraction .01)	19,469	6.1	2.7	-0.4	11.0
Log assets sq (winsorized fraction .01)	19,469	44.7	32.9	0.2	122.0
GDP growth (pct)	19,469	2.1	3.0	-15.1	15.2
CPI inflation (pct)	17,993	2.7	3.0	-21.0	48.7
Pre-tax profit, pct total assets (winsorized fraction .01)	19,411	2	7	-29	38
Total assets, million USD (winsorized fraction .01)	19,469	5,654	13,240	1	62,574
Total equity, million USD (winsorized fraction .01)	19,469	406	1,080	0	6,633
Pretax profits, million USD (winsorized fraction .01)	19,411	48	148	-94	866
Non-life insurance companies [5,348 firm IDs; 85 countries]					
Leverage, pct total assets (winsorized fraction .01)	47,899	13.9	13.6	0.0	73.0
CIT rate (pct)	47,760	29.9	7.3	8.5	39.0
Log assets (winsorized fraction .01)	47,899	4.7	2.0	-0.4	11.0
Log assets sq (winsorized fraction .01)	47,899	26.1	20.2	0.2	122.0
GDP growth (pct)	47,899	1.8	2.6	-15.1	26.2
CPI inflation (pct)	44,104	2.4	2.7	-21.0	48.7
Pre-tax profit, pct total assets (winsorized fraction .01)	47,811	4	9	-29	38
Total assets, million USD (winsorized fraction .01)	47,899	878	3,765	1	62,574
Total equity, million USD (winsorized fraction .01)	47,899	245	757	0	6,633
Pretax profits, million USD (winsorized fraction .01)	47,811	30	102	-94	866

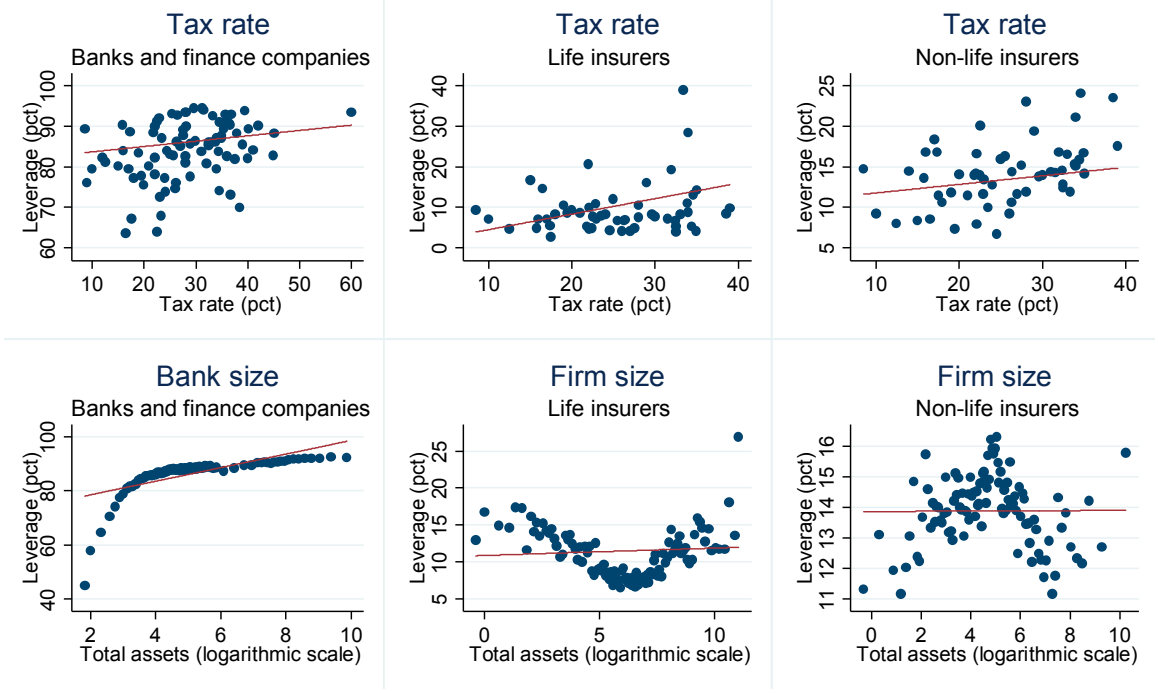
In terms of total assets, banks are on average the smallest in the sample, followed by non-bank-finance companies, and investment banks, with life insurance companies having the largest total assets on average. The average leverage ratio across the regular banks sample is 87 percent, with lower values for investment banks at 73 percent and finance companies at 77 percent. In calculating the leverage ratio of insurance companies, we consider liabilities net of technical reserves. Technical reserves represent the net present value of obligations to policy holders and are tightly regulated. Since the stock of these liabilities is driven mainly by regulation, it would presumably not be sensitive to CIT rates. In contrast, the stock of liabilities in excess of technical reserves could be driven by tax rates. Hence, for the insurance sample we focus on these excess liabilities, where the average leverage is 11.5 percent for life insurers and 13.9 percent for non-life insurers. The sample is dominated by observations in the United States (over 60 percent of the banking observations and over 40 percent of the insurance observations) and some other advanced economies.

The macroeconomic data on inflation and GDP growth come from the IMF's World Economic Outlook database. Data on statutory CIT rates originate from the IMF's Fiscal Affair Department database. The mean of the statutory CIT rate in the banking sample is 31.2 percent with a minimum value of 8.5 percent and a maximum value of 60 percent (Libya in the early 2000s). In the insurance sample, the mean CIT rate is 29.4 percent.

Annex Figure 2.1 displays binned scatter plots of leverage ratios and size for banks (including investment banks and shadows banks), life, and non-life insurers, respectively. The top panels indicate a strong positive correlation between leverage and the statutory tax rate for these three

types of firms. The bottom panels show a strong positive correlation between leverage and bank size and a weak positive or no correlation between insurance firm size and leverage.

Annex Figure 2.1. Binned Scatter Plots of Leverage and Size



Source: Bankscope and Orbis Insurance Focus.

Note: Full sample of regular banks, investment banks and finance companies (2001–15) and separate samples of life and non-life insurance companies (2005–15).

Regression Results

Annex Table 2.3 presents estimation results from specification (1) on a sample of regular banks. This estimation updates the analysis of De Mooij and Keen (2016), using more recent data. Robust standard errors are clustered at the country level and reported in parentheses. In columns (1)–(2), the OLS regressions with and without fixed effects suggest that the tax rate has a strongly significant impact on leverage over the period of interest. Next, we explore these effects in system GMM specifications on the full sample and on two separate subsamples, before and after 2008. The basic GMM specifications in columns (3)–(5) confirm a positive and, over the full period and the period up to the crisis, statistically significant effect of taxes on leverage. At 0.24, the short-term effect in the period before the crisis is double the effect during the full period. The tax effect remains positive but is smaller and not statistically significant for the post-crisis period, possibly reflecting the impact of tighter regulation that required banks to build up additional capital and reduced the buffer of capital that they can flexibly adjust. The long-term effect is much larger in light of sluggish response. The long-run effect is 0.38 for the pre-2008 period and 0.17 for the entire period, reasonably close to the findings in De Mooij and Keen (2016).

Annex Table 2.3. Tax Rate and Leverage: Regular Banks

	(1)	(2)	(3)	(4)	(5)
	OLS		System GMM		
VARIABLES	noFE	FE	full period	before 2008	2008 onwards
Leverage, pct total assets (winsorized fraction .01). Lagged value.	0.81***	0.37***	0.34***	0.36***	0.69***
	[0.01]	[0.01]	[0.02]	[0.03]	[0.08]
CIT rate (pct)	0.04***	0.06*	0.11**	0.24***	0.05
	[0.01]	[0.03]	[0.05]	[0.07]	[0.04]
Log assets (winsorized fraction .01)	2.35***	8.83***	6.38***	6.74***	3.13***
	[0.68]	[1.69]	[0.62]	[0.61]	[0.85]
Log assets sq (winsorized fraction .01)	-0.17***	-0.40***	-0.44***	-0.51***	-0.21***
	[0.05]	[0.09]	[0.07]	[0.05]	[0.06]
Pre-tax profit, pct total assets (winsorized fraction .01)	-0.78***	-0.61***	-1.21***	-1.55***	-0.74***
	[0.06]	[0.05]	[0.08]	[0.03]	[0.10]
GDP growth (pct)	0.07**	0.11**	-0.07	0.09	0.03
	[0.03]	[0.06]	[0.07]	[0.15]	[0.04]
CPI inflation (pct)	-0.01	0.05	-0.03	0.19	-0.01
	[0.01]	[0.04]	[0.04]	[0.15]	[0.02]
Risk (winsorized fraction .01)			3.42**	8.81***	0.81
			[1.64]	[1.34]	[3.01]
Observations	131,118	131,118	91,950	38,372	47,104
R-squared	0.83	0.40			
Bank FE	NO	YES	YES	YES	YES
Year FE	NO	YES	YES	YES	YES
Cluster level	country	country	country	country	country
Number of id		13,024	9,970	7,405	8,563
Hansep			0.68	0.78	0.07
AR1			0.00	0.00	0.00
AR2			0.62	0.25	0.06
Long-term effect	0.23***	0.09*	0.17**	0.38***	0.17
	[0.05]	[0.05]	[0.07]	[0.11]	[0.12]

Notes: Data Sample: Regular banks, unconsolidated accounts. 2001–15.

Specifications: Columns (1)-(2) are estimated by OLS, and columns (3)-(5) by two-step system GMM with the lagged dependent variable and risk instrumented. FE = fixed effects. Lag limits is (2,1). Standard errors (between brackets) are heteroscedasticity robust and clustered within countries. *, **, and *** denote significance at the 10 percent, 5 percent and 1 percent level.

The main results of our analysis can be found in Annex Table 2.4. It summarizes results from estimating specifications (1) and (2) using an extended sample which includes regular, as well as investment banks and non-bank finance companies. Including investment banks and finance companies in the sample (columns (1)-(3)) does not change the overall coefficient estimate on the tax rate observed in Annex Table 2.3 (columns (3)–(5)). The interaction dummy for investment banks is significant, negative, and comparable in size to the CIT coefficient estimate for the whole sample. This implies that, for investment banks and looking over the entire sample period, the CIT rate is not a significant driver of leverage.[34] When splitting the sample period, investment banks exhibit much higher sensitivity to tax rates than regular banks in the period prior to the GFC. However, since the GFC, tax considerations no longer play a significant role for investment bank leverage. For finance

[34] A formal F tests confirms this result. The hypothesis of a zero net effect of tax on leverage for investment banks cannot be rejected either on the full or the post-crisis sample. As investment banks in our sample on average are more than 4 times larger than regular banks, this result is consistent with De Mooij and Keen (2016)'s finding that large banks are less tax-sensitive.

companies, the interaction dummy is significant (at 10 percent) and negative, but smaller in absolute value than the CIT coefficient. On balance, the CIT rate is not a significant driver of leverage for these shadow banks. In the pre-GFC period, however, the net effect of the CIT coefficient and the interaction dummy is positive suggesting that finance companies increased leverage in response to tax rates.[35]

Annex Table 2.4. Tax Rate and Leverage: Regular and Investment Banks and Finance

	(1)	(2)	(3)	(4)	(5)	(6)
	System GMM, Basic			System GMM, with interaction terms		
VARIABLES	full period	before 2008	2008 onwards	full period	before 2008	2008 onwards
Leverage, pct total assets (winsorized fraction .01). Lagged value.	0.34***	0.37***	0.65***	0.34***	0.37***	0.66***
	[0.02]	[0.03]	[0.09]	[0.02]	[0.03]	[0.08]
CIT rate (pct)	0.12**	0.23***	0.07	0.12**	0.23***	0.07
	[0.05]	[0.06]	[0.05]	[0.05]	[0.06]	[0.05]
Log assets (winsorized fraction .01)	6.26***	6.57***	3.66***	6.14***	6.53***	3.48***
	[0.61]	[0.68]	[0.88]	[0.65]	[0.73]	[0.84]
Log assets sq (winsorized fraction .01)	-0.42***	-0.49***	-0.24***	-0.40***	-0.49***	-0.23***
	[0.07]	[0.06]	[0.06]	[0.07]	[0.06]	[0.06]
GDP growth (pct)	-0.09	0.11	0.02	-0.08	0.12	0.03
	[0.07]	[0.15]	[0.04]	[0.06]	[0.15]	[0.04]
CPI inflation (pct)	-0.04	0.23	-0.01	-0.03	0.22	-0.01
	[0.04]	[0.15]	[0.02]	[0.04]	[0.16]	[0.02]
Pre-tax profit, pct total assets (winsorized fraction .01)	-1.22***	-1.56***	-0.79***	-1.21***	-1.56***	-0.77***
	[0.08]	[0.03]	[0.11]	[0.09]	[0.03]	[0.10]
Risk (winsorized fraction .01)	3.14*	9.20***	-0.26	3.13*	9.40***	-0.14
	[1.66]	[1.27]	[3.22]	[1.72]	[1.41]	[3.14]
Interaction term (CIT* Investment bank)				-0.17**	0.14***	-0.14*
				[0.08]	[0.02]	[0.07]
Interaction term (CIT* Finance companies)				-0.06*	-0.05	-0.02
				[0.04]	[0.05]	[0.03]
Observations	92,818	38,449	47,832	92,818	38,449	47,832
Number of id	10,173	7,446	8,760	10,173	7,446	8,760
Bank FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Cluster level	country	country	country	country	country	country
Hansep	0.75	0.69	0.19	0.71	0.71	0.18
AR1	0.00	0.00	0.00	0.00	0.00	0.00
AR2	0.77	0.23	0.03	0.77	0.24	0.03
Long-term effect	0.19**	0.36***	0.21*	0.19**	0.36***	0.21*
	[0.07]	[0.09]	[0.11]	[0.07]	[0.10]	[0.11]

Notes: Data sample: regular banks, investment banks, and non-bank finance companies, unconsolidated accounts. 2001–15.

Specifications: Coefficients are estimated by two-step system GMM with the lagged dependent variable and risk instrumented. Lag limits is (2,1). Standard errors (between brackets) are heteroscedasticity robust and clustered within countries. *, **, and *** denote significance at the 10 percent, 5 percent, 1 percent level.

To further investigate how sensitive our results are to outliers, we perform the same analysis on a sample where the highest and lowest 10 percent outliers are winsorized. The results are in Annex Table 2.5. Here, we see that the tax coefficients remain significant and positive, and now also are significantly different from zero for the post-crisis period.

[35] A formal F test confirms these results. The hypothesis of a zero net effect of tax on leverage for finance companies cannot be rejected either on the full or the post-crisis sample.

Annex Table 2.5. Tax Rate and Leverage: Regular and Investment Banks and Finance Companies–Alternative Treatment of Outliers

	(1)	(2)	(3)	(4)	(5)	(6)
	System GMM, Basic			System GMM, with interaction terms		
VARIABLES	full period	before 2008	2008 onwards	full period	before 2008	2008 onwards
Leverage, pct total assets (winsorized fraction 0.1). Lagged value.	0.80***	0.70***	0.77***	0.80***	0.70***	0.77***
	[0.02]	[0.02]	[0.05]	[0.02]	[0.02]	[0.05]
CIT rate (pct)	0.03***	0.06***	0.04***	0.03***	0.06***	0.03***
	[0.00]	[0.01]	[0.01]	[0.00]	[0.01]	[0.01]
Log assets (winsorized fraction 0.1)	1.28***	1.75***	1.39***	1.28***	1.74***	1.38***
	[0.19]	[0.28]	[0.16]	[0.18]	[0.27]	[0.16]
Log assets sq (winsorized fraction 0.1)	-0.09***	-0.14***	-0.10***	-0.09***	-0.14***	-0.10***
	[0.02]	[0.03]	[0.01]	[0.02]	[0.03]	[0.01]
GDP growth (pct)	0.02	0.09**	0.02	0.02	0.08*	0.02
	[0.01]	[0.04]	[0.02]	[0.01]	[0.04]	[0.02]
CPI inflation (pct)	-0.00	0.01	-0.01	-0.00	0.02	-0.01
	[0.01]	[0.06]	[0.00]	[0.01]	[0.06]	[0.00]
Pre-tax profit, pct total assets (winsorized fraction 0.1)	-0.61***	-0.57***	-0.63***	-0.61***	-0.57***	-0.63***
	[0.02]	[0.01]	[0.06]	[0.02]	[0.01]	[0.06]
Risk (winsorized fraction 0.1)	-2.12***	0.74***	-4.72***	-2.13***	0.75***	-4.70***
	[0.47]	[0.22]	[0.66]	[0.47]	[0.22]	[0.65]
Interaction term (CIT* Investment bank)				-0.02**	0.01	-0.03***
				[0.01]	[0.01]	[0.01]
Interaction term (CIT* Finance companies)				0.00	0.02*	0.00
				[0.01]	[0.01]	[0.01]
Observations	92,818	38,449	47,832	92,818	38,449	47,832
Number of id	10,173	7,446	8,760	10,173	7,446	8,760
Bank FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Cluster level	country	country	country	country	country	country
Hansep	0.49	0.72	0.38	0.50	0.80	0.38
AR1	0.00	0.00	0.00	0.00	0.00	0.00
AR2	0.84	0.50	0.63	0.84	0.50	0.63
Long-term effect	0.13***	0.19***	0.15***	0.13***	0.21***	0.15***
	[0.03]	[0.05]	[0.02]	[0.03]	[0.05]	[0.02]

Notes: Data sample: regular banks, investment banks, and non-bank finance companies, unconsolidated accounts. 2001–15.

Specifications: Coefficients are estimated by two-step system GMM with the lagged dependent variable and risk instrumented. Lag limits is (2,1). Standard errors (between brackets) are heteroscedasticity robust and clustered within countries. *, **, and *** denote significance at the 10 percent, 5 percent, 1 percent level.

Annex Tables 2.6 and 2.7 summarize results from estimating specifications (1) and (2) using separate samples of life and non-life insurance companies. These firms are analyzed separately because of their vastly different business models, and the different role leverage plays within each of these companies (Thimann, 2014). For life insurers, the short-term effect is 0.08 over the analyzed period of 2005-2015. When splitting the sample at the GFC, we see that the debt bias was strongest pre-crisis with a coefficient of 0.26. Post-crisis, the size of the effects shrinks to 0.09. Meanwhile, at around 0.28 the long-run coefficient estimated on the full period is larger in size than the long-run coefficient of 0.17 found for regular banks. For non-life insurers, we find a similar pattern with slightly smaller coefficient estimates ranging from 0.05 over the whole sample, 0.16 for the pre-crisis period and 0.06 post-crisis, with long-run coefficients ranging between 0.14-0.24. However, the diagnostics of the GMM are not satisfactory. For specifications (2) and (4) in Annex Table 2.7, we

reject the test for AR(1) errors in the Arellano-Bond Model, as expected. However, Hansen test of over identifying restrictions and the test for AR(2) errors indicate problems of auto correlation.

Annex Table 2.6. Tax Rate and Leverage: Life Insurance Companies

	(1)	(2)	(3)	(4)
	OLS		System GMM	
VARIABLES		full period	before 2008	2008 onwards
Leverage, pct total assets (winsorized fraction .01). Lagged value.	0.93***	0.71***	0.41***	0.82***
	[0.02]	[0.04]	[0.15]	[0.04]
CIT rate (pct)	0.03*	0.08***	0.26***	0.09***
	[0.02]	[0.03]	[0.09]	[0.03]
Log assets (winsorized fraction .01)	-0.32***	-0.80***	-0.79**	-0.68***
	[0.07]	[0.24]	[0.38]	[0.18]
Log assets sq (winsorized fraction .01)	0.03***	0.06***	0.11**	0.07***
	[0.01]	[0.02]	[0.05]	[0.02]
Pre-tax profit, pct total assets (winsorized fraction .01)	-0.03**	-0.04**	0.04	-0.04***
	[0.01]	[0.02]	[0.06]	[0.01]
GDP growth (pct)	0.05**	0.12***	-0.10	0.10***
	[0.02]	[0.04]	[0.11]	[0.04]
CPI inflation (pct)	-0.04	0.04	0.55**	0.02
	[0.04]	[0.06]	[0.26]	[0.04]
Observations	17,015	17,015	2,237	13,036
R-squared	0.88			
Bank FE	NO	YES	YES	YES
Year FE	NO	YES	YES	YES
Cluster level	country	country	country	country
Number of id		2,279	1,639	2,261
Hansep		0.51	0.33	0.94
AR1		0.00	e(ar1p)	0.00
AR2		0.45	e(ar2p)	0.86
Long-term effect	0.40	0.28***	0.43***	0.48***
	[0.25]	[0.09]	[0.14]	[0.14]

Notes: Data sample: life insurance companies, unconsolidated accounts. 2005–15.

Specifications: Columns (1) is estimated by OLS, and columns (2)-(4) by two-step system GMM with the lagged dependent variable instrumented. Lag limits is (2,1). Standard errors (between brackets) are heteroscedasticity robust and clustered within countries. *, **, and *** denote significance at the 10percent, 5 percent and 1 percent level.

Results also suggest that asset size is of different importance for insurance and bank leverage. For life insurers, the combined coefficient estimate on the log assets variable is -1.5, indicating a strong inverse effect on leverage: larger firms (by assets) are associated with lower leverage.[36] In contrast, for the sample consisting of regular banks, investment banks and finance companies, the relation between size and leverage is positive, at 21.3.[37]

[36] This impact is calculated by taking the coefficient estimate for log(asset) and log (assets) squared, and evaluating how the interaction between these two coefficient estimates works out for the largest firm in the sample -0.8 * 11 + 0.06 * 122 =-1.5.

[37] See previous footnote: 6.14 * 9.9 – 0.4 * 98.8 = 21.3.

Annex Table 2.7. Tax Rate and Leverage: Non-Life Insurance Companies

VARIABLES	(1) OLS	(2) System GMM full period	(3) System GMM before 2008	(4) System GMM 2008 onwards
Leverage, pct total assets (winsorized fraction .01). Lagged value.	0.86***	0.64***	0.34***	0.63***
	[0.01]	[0.03]	[0.12]	[0.03]
CIT rate (pct)	0.02	0.05**	0.16**	0.06*
	[0.01]	[0.03]	[0.08]	[0.03]
Log assets (winsorized fraction .01)	0.17	0.15	0.59*	0.27
	[0.15]	[0.33]	[0.32]	[0.40]
Log assets sq (winsorized fraction .01)	-0.02	-0.02	-0.06*	-0.03
	[0.01]	[0.03]	[0.03]	[0.03]
Pre-tax profit, pct total assets (winsorized fraction .01)	-0.02**	-0.03***	-0.08***	-0.02*
	[0.01]	[0.01]	[0.02]	[0.01]
GDP growth (pct)	0.07***	0.12**	0.47**	0.12**
	[0.02]	[0.05]	[0.19]	[0.05]
CPI inflation (pct)	-0.00	0.08	0.39*	0.05
	[0.03]	[0.05]	[0.23]	[0.06]
Observations	42,243	42,243	5,307	32,502
R-squared	0.74			
Bank FE	NO	YES	YES	YES
Year FE	NO	YES	YES	YES
Cluster level	country	country	country	country
Number of id		5,320	4,229	5,298
Hansep		0.03	0.67	0.01
AR1		0.00	e(ar1p)	0.00
AR2		0.00	e(ar2p)	0.07
Long-term effect	0.14	0.14**	0.24**	0.15*
	[0.09]	[0.07]	[0.11]	[0.08]

Notes: Data sample: non-life insurance companies, unconsolidated accounts 2005–15.

Specifications: Columns (1) is estimated by OLS, and columns (2)-(4) by two-step system GMM with the lagged dependent variable instrumented. Lag limits is (2,1). Standard errors (between brackets) are heteroscedasticity robust and clustered within countries. *, **, and *** denote significance at the 10 percent, 5 percent and 1 percent level.

Annex III. Thin Capitalization Rules

A large number of countries have introduced TCRs, but these rules are far from uniform. Annex Table 3.1 shows the variations, thereby distinguishing between two key dimensions. The first dimension is whether a TCR restricts interest deduction for all debt or only related-party debt. Approximately two-thirds of the rules are of the latter type. The second dimension refers to the criterion determining whether an interest deduction is denied. Here, three types of rules are distinguished:

- ***Fixed debt-equity rules.*** Annex Table 3.1 shows that 50 countries employ a form of TCR that denies deductibility if the debt-to-equity ratio exceeds some fixed value. The most common rule uses a ratio of 3:1, but rules vary between 1:1 to 5:1. When debt exceeds the ratio, different formulae can be used to compute the amount of interest that will be denied, e.g., different interest rates can be used to calculate this portion.

- ***Fixed interest/income rules (or "earnings stripping rules").*** By 2016, eight countries have replaced their TCR based on a fixed debt-equity ratio by a more elaborate "earning stripping rule." Commonly, these rules cap interest deductions to 30 percent of earnings before interest, taxes, depreciation and amortization (EBITDA)—a cash-flow indicator measuring a firm's ability to service its debt. Such a rule does not attempt to directly limit thin capitalization, but is more encompassing in that it also limits other elusive schemes via interest expenses, e.g., also when caused by excessive interest rates.

- ***Arm's length rules.*** A worldwide gearing test compares the ratio of debt to equity of any one subsidiary of a multinational group with that of the global enterprise to which it belongs. It will allow the subsidiary to deduct interest if it has leverage similar to that of the global entity. In Australia, for example, the rule permits up to 100 percent of that benchmark; in New Zealand the limit is 110 percent. Countries can also deny interest of an affiliate if net borrowing costs exceed that of the group. Kazakhstan, South Africa, and the United Kingdom adopt such rules—although the United Kingdom has recently proposed to replace it by an earnings stripping rule.

An increasing number of countries combine different approaches, such as Denmark, France and the United States. For instance, the United States defines excess interest expense as the net interest exceeding 50 percent of taxable income. This interest is disqualified for deduction only if the corporation's debt to equity ratio exceeds 1.5:1. Thus, excess interest is calculated according to an earnings stripping rule, but becomes binding only if the company's allowed debt is above the TCR.

TCRs differ in other dimensions too. For instance:

- ***Carry forwards.*** Rules may provide for carry-forward of denied interest in the current year. Sometimes this carry forward is allowed indefinitely; in other cases, there is a limitation in the number of years. Other countries re-characterize denied interest as dividends, with no allowance for carry forward.

- ***Exceptions.*** In only 15 countries listed in the Table does the TCR apply to financial institutions (often with a modified ratio); in all others, this sector is exempt from the rule. In many countries, the TCR only applies to firms that exceed a certain threshold of net interest payment.

Annex Table 3.1. Thin Capitalization Rules[1]

	Related Party Debt	All Debt
Fixed Debt-Equity Rule	Argentina (1999); Belarus (2013); Brazil (2011); Canada (1972); Chile (2012); China (2008);* Czech Republic (2007);* Ecuador (2007); Egypt (2005); El Salvador (2012); France (2007),[2,] * Ghana (2000);* Gibraltar (2010); Japan (1992); Kenya (2006);[3]* Korea, Republic of (1997);* Lithuania (2002); Macedonia;* Mexico (2005);[4] Mongolia (2005); Mozambique (2008); Namibia (2012); Oman (2012); Peru (2007); Poland (1999);[5] Rwanda (2008);* Slovenia (2005); Sri Lanka (2006); Taiwan (2011);* Turkey (2006); Uganda (2013); United States (1989); Venezuela (2007); Yemen (2010)	Albania (2000);* Australia (1997);[6,]* Bulgaria (2006); Colombia (2013); Croatia (2005); Denmark (1998);[7] Dominican Republic (2013); Georgia (2018);* Hungary (2000); Indonesia (2016);* Latvia (2003); New Zealand; Papua New Guinea (2013); Romania (2006);[8] Serbia (2001); Zimbabwe (2011)
Fixed Interest-Income Rule (Earning Stripping Rule)	Finland (2013); Norway (2014)* Slovakia (2015)	Germany (1994); Greece (2010); Italy (2003); Portugal (1996);[9] Spain (1996)[9]
Arm's-length Rule	Kazakhstan (2008); South Africa (1995); United Kingdom (1999)	

[1] The year of introduction is stated between brackets. The year may differ from the one applied in 2016. For example, Germany introduced a TCR in 1994 in the form of a fixed debt/equity ratio while the interest stripping rule was introduced in 2008. Most countries with an interest stripping rule had a fixed debt-equity rule in the year of introduction but reformed the rule.
[2] Has both interest-EBITDA and equity-debt ratios.
[3] Kenya applies interest-stripping rules to foreign controlled companies.
[4] Not applicable to interest from any incurred debt used to invest in the production of electric energy.
[5] Companies are allowed to choose an alternative rule to compute allowable interest deduction. It specifies a threshold equal to total assets multiplied by a reference rate published by the central bank (firms can add 1.25 percentage point markup to this rate). This method applies to total debt, and if chosen by the taxpayer, it has to be used for at least three consecutive years.
[6]Australia applies one of the following tests: 1) a debt-equity rule, 2) arms' length debt test, and 3) separate worldwide gearing test are available for investors.
[7]There are two other sets of rules: i) Asset test ("net financing costs" are tax deductible only to the extent the expenses do not exceed a cap calculated as a standard rate of return on the tax base of the company's assets less certain. financial assets) and ii) EBIT test (limits the tax deductibility of net financing costs to 80 percent of EBIT).
[8]The Romanian TCR does not distinguish between related and unrelated party debt, but it allows full deduction of interest on loans from banks and other financial institutions.
[9]Net interest expense is fully deductible if it does not exceed €1million even if the interest-EBIDTA ratio is above the 30 percent.
*Means that there are exceptions for banks.

Annex IV. Thin Capitalization Rules and Corporate Sector Stability

This annex estimates the effects of TCRs on corporate debt ratios of non-financial corporations. It extends earlier literature by focusing on the consolidated accounts of firms, rather than the unconsolidated statements (see, e.g., Buettner and others 2012, Blouin and others 2014). The advantage of this, in thinking about financial stability, is that the focus is on debt bias, whereas other studies have assessed the combined impact of taxation on both debt bias and debt shifting. The analysis here extends previous work further by looking at the impact of taxation on firm's financial distress using the Altman Z-score.

Empirical Specification

The analysis is based on three different specifications. The first is the following benchmark firm-panel model:

$$debt_{isct} = a_0 + a_1 TCR_{ct} + a_2 Tax_{ct} + \beta X_{isct} + \lambda_t + \mu_s + \varepsilon_{isct}, \quad (1)$$

where $debt_{isct}$ is the consolidated total debt-asset ratio of firm i in sector s and resident in country c in year t. The variable TCR_{ct} takes the value 1 if a country of residence of the parent company adopts a thin capitalization rule in year t, and is zero otherwise. Tax_{ct} is the statutory CIT rate. X_{isct} is a vector of controls with an associated vector of coefficients β. Specification (1) includes year fixed effects (λ_t) that capture all year-specific effects that are common across all firms in the sample (e.g., changes in oil prices or global economic shocks). Further, specification (1) includes sector fixed effects (μ_s) that capture industry-specific time-invariant effects such as the capital intensity and external financial dependence. We also estimate a variant of equation (1) that includes industry-year fixed effects (θ_{st}) and hence allows industry-specific effects to vary over years.

The analysis explicitly distinguishes between a total-debt TCR (defined as a TCR that applies to the total debt ratio) and a related-party TCR (that applies only to related-party debt) by including in specification (1) TCR variables for both types of TCRs.[38] A negative a_1 indicates that a TCR lowers the debt ratio. We expect that total-debt TCR lowers the consolidated debt ratio, since it will restrict interest deductibility by the most leveraged corporations and thus increases the cost of debt finance. This will likely induce them to reduce their debt ratios. The expected impact of a related-party TCR on debt ratios in the consolidated statement is a priori unclear. In particular, such a TCR by definition does not restrict interest deductibility associated with external debt. Yet, restrictions to related party interest might indirectly affect external debt, as the ability to reallocate debt within the

[38] In addition to the distinction between total debt and related-party debt (i.e., the base of a TCR), one dimension of strictness of TCRs is the applied ratio, which can differ across countries (e.g., commonly 3:1 for debt-equity rules but some countries apply 4:1 or 2:1). However, these ratios tend not to significantly vary over time within a country, and hence cannot be meaningfully exploited in the empirical analysis. Moreover, for stability, the base of TCR is a dominant distinction because a related-party rule with some debt-equity ratio is very different from (and in fact less strict than) a ratio with the same value but applied to total debt.

firm may reduce the after-tax cost of borrowing. It is, however, an empirical question whether or not this effect is significant.

In line with the literature, the coefficient a_2 is expected to have a positive effect on the consolidated debt ratio depicting the debt-bias; i.e., high statutory CIT rates are positively associated with corporate debt. With this regard, the tax rate in country i may be an imperfect tax measure for a firm that operates in more than one country. However, for the link between stability and the debt bias in the home economy, this measurement issue is not crucial in that ultimately it is the association between domestic tax rate and consolidated debt what matters.

Second, a difference-in-difference specification is used in the spirt of Rajan and Zingales (1998) exploiting variations generated by an interaction term between an industry-specific variable and tax variables:

$$debt_{isct} = \beta_0 + \beta_1(Tang_s \times Tax_{ct}) + \beta_2(Tang_s \times TCR_{ct}) + \theta_s + \psi_{ct} + e_{isct}. \quad (2)$$

The industry-specific variable $Tang_s$ is a tangibility index computed as the industry median share of tangible assets in totals assets at the level of NACE revision 2 using U.S. data as in Rajan and Zingales (1998). Its base effect is captured by the industry fixed effects (θ_s). All country-year specific variable such as *TCR* and *Tax* are captured by the set of country-year fixed effects ψ_{ct}. The coefficients β_1 and β_2 on the interaction terms give the differential effects of taxes and TCRs on the consolidated debt ratio, varying by the degree of tangibility in the industry. Companies in industries characterized by a relatively high degree of tangibility can provide more collateral and hence may have more room for using debt finance than companies in low tangibility sectors. A positive β_1 would imply that this would also make them relatively more responsive to taxes Similarly, a negative β_2 would mean that the debt ratios of companies in high tangibility sectors are more negatively affected by TCRs.

Finally, the impact of taxation on a more comprehensive measure of financial distress, the so-called Z-score, is explored. The underlying idea is that that, while taxes may raise debt ratios due to debt bias, firms may (partly) offset the bankruptcy risk effect by adjusting risk exposure on the asset side of the balance sheet. By exploring the Z-score, the net impact on default risk is analyzed. In doing so, the popular bankruptcy prediction model of the Altman *Z*-score is used. This model identifies ratios that are significant predictors of corporate bankruptcy in manufacturing sectors based on a multiple discriminate analysis. Following the literature (for example, Altman and others, 2014, the Altman's *Z*-score (*Z*) for each firm in each year is calculated as follows:

$$Z = 3.25 + 6.56\,X_1 + 3.26\,X_2 + 6.72\,X_3 + 1.05\,X_4, \quad (3)$$

where X_1 is the ratio of working capital to total assets, X_2 is the ratio of retained earnings to total assets, X_3 is the ratio of earnings before interest and taxes to total assets, and X_4 is the ratio of the book value of equity to the book value of total liabilities.[39] A high Z indicates a lower risk of failure.

For the regressions, the Altman Z-scores from (3) is transformed into a binary variable that reflects the presence of bankruptcy risk. In particular, we set this financial distress indicator equal to one if the *Z*-score is below 2 and zero otherwise. With this cut-off point, firms in the lowest 7^{th} percentile are indicated as facing high bankruptcy risk. Indeed, firms in this lower tail of the *Z*-score distribution are thought to be in a zone of financial turmoil and are close to bankruptcy. Using this binary variable, the effect of TCRs on the likelihood of a firm to face financial distress is estimated.

Data

The source of the firm-level data is the ORBIS database of the Bureau van Dijk. It contains, inter alia, information on companies' balance sheet items, types of accounts (consolidated vs. unconsolidated), and the economic sector of the company. The sample in the analysis includes consolidated accounts for about 263,000 observations corresponding to 59,126 distinct firms in 42 countries in the period from 2005 to 2014. To control for outliers, variables are winsorized at the 0.5 percent level. Annex Table 4.1 provides summary statistics of the main variables. The average consolidated debt-to-assets ratio in the sample is 62 percent whereas the median is slightly lower at around 58.7 percent.

Annex Table 4.1. Summary Statistics

Variables	Mean	SD	Median	Min	Max	N
DebtRatio	62.07	39.36	58.74	4.380	226.1	262,727
ThinCap–all	0.769	0.422	1	0	1	262,727
ThinCap–total	0.187	0.390	0	0	1	262,727
ThinCap–partial	0.582	0.493	1	0	1	262,727
Z-score	5.171	7.317	6.324	-26.32	16.16	101,699
volatility	0.0884	0.194	0.0372	0.0002	1.647	190,409
citRate	28.16	4.978	28	8.500	37.80	262,727
ebitdaShareOfAssets	4.245	23.56	8.084	-114.5	35.42	262,727
interestRateReal	2.099	3.981	2.340	-42.31	44.55	262,727
inflationCpi	2.759	2.140	2.359	-1.343	22.39	262,727
gdpGrowth	2.822	8.135	2.428	-32.20	32.68	262,727

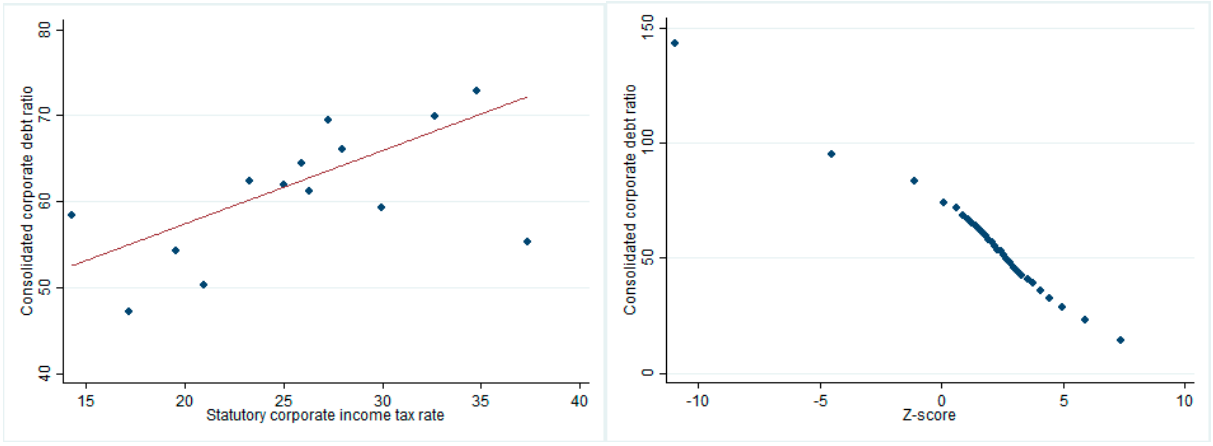
Source: ORBIS database and staff calculation.

[39] Similar results are obtained when we use the original Z-score of Altman (1968), and which includes sales to assets as another component.

The firm-level data are merged with macroeconomic variables such as inflation and GDP growth obtained from the IMF's World Economic Outlook database and real interest rate data from the World Bank World Development Indictors. Data on TCRs and statutory CIT rates are from the IMF's Fiscal Affair Department database. The mean of the statutory CIT rate in the sample is 22.2 percent. It has a minimum value of 8.5 percent and a maximum value of 37.8 percent. TCRs have been introduced in several countries in our sample period between 2005 and 2014.

The left panel of Annex Figure 4.1 displays a binned scatter plot of corporate debt ratios and CIT rates in our sample. In line with the evidence on debt bias, there is a clear positive correlation between both variables. The right panel of Annex Figure 4.1 shows a strong negative correlation between the *Z*-score and the debt ratio implying that highly leveraged companies have a low Z-score, i.e., they face higher financial distress and bankruptcy risks.

Annex Figure 4.1. Binned Scatter Plots of Debt Ratios, Z-Score, and CIT Rates



Note: We group the x-axis into equal-sized bins, calculate the mean value of debt ratios and tax rates for each bin, generate the scatter plot, and finally draw the population regression line.

Results

Annex Table 4.2 presents results from estimating (1) using the consolidated debt ratio as the dependent variable. Robust standard errors are in parentheses. The table presents six regressions that vary in the type of TCR that is included and in the use of different fixed effects to control for unobserved heterogeneity. In all regressions, the coefficient for the CIT rate is positive and significant, with values around 0.3. This is very close to the average value reported in the meta analyses of De Mooij (2011) and Feld and others (2013).

Annex Table 4.2. Thin Capitalization Rules and Corporate Debt Ratio

Dependent Variable	Debt Ratio					
	(1)	(2)	(3)	(4)	(5)	(6)
thinCap–all	-1.333***			-1.062*		
	(0.178)			(0.624)		
thinCap–total		-5.129***	-5.634***		-5.075***	-5.360***
		(0.171)	(0.225)		(0.597)	(0.719)
thinCap–related-party			-0.590***			-0.332
			(0.180)			(0.633)
citRate	0.301***	0.308***	0.313***	0.283***	0.293***	0.296***
	(0.0182)	(0.0181)	(0.0182)	(0.0492)	(0.0485)	(0.0501)
gdpGrowth	-0.178***	-0.203***	-0.210***	-0.177***	-0.205***	-0.209***
	(0.0105)	(0.0106)	(0.0107)	(0.0438)	(0.0420)	(0.0422)
inflationCpi	0.921***	0.703***	0.661***	0.992***	0.752***	0.728***
	(0.0408)	(0.0426)	(0.0431)	(0.118)	(0.126)	(0.127)
ebitdaShareOfAssets	-0.728***	-0.726***	-0.727***	-0.729***	-0.728***	-0.729***
	(0.00663)	(0.00658)	(0.00660)	(0.00954)	(0.00986)	(0.00959)
operatingRevenueRatio	-0.255***	-0.187***	-0.196***	-0.252***	-0.187***	-0.192***
	(0.0193)	(0.0189)	(0.0192)	(0.0452)	(0.0406)	(0.0407)
interestRateReal	1.587***	1.673***	1.681***	1.586***	1.674***	1.678***
	(0.0449)	(0.0448)	(0.0449)	(0.128)	(0.127)	(0.128)
Constant	35.00***	33.67***	33.60***	28.20***	27.10***	27.28***
	(12.92)	(12.82)	(12.82)	(2.936)	(3.044)	(2.967)
Observations	262,727	262,727	262,727	262,727	262,727	262,727
R^2	0.184	0.186	0.186	0.163	0.165	0.165
Industry	Yes	Yes	Yes			
Year	Yes	Yes	Yes			
Industry-year FE				Yes	Yes	Yes

Robust standard errors are in parentheses. ***p<0.01,**p<0.05, *p<0.1.

In column (1), the estimated coefficient for the TCR variable of −1.3 suggests that the presence of some form of TCR reduces the consolidated debt ratio on average by about −1.3 percentage points. Column (2) suggests that a TCR that applies to total debt, with a coefficient of −5.1, has a much stronger negative effect on corporate debt than do the generality of TCRs. In column (3), this effect is similar and can be compared with the coefficient for related-party TCRs, which is only one-tenth of that. A Wald test strongly rejects the hypothesis that there is no difference between total-debt and related-party TCRs (with a p-value of 0.00). Columns (4)–(6) in Annex Table 4.2 are the same as columns (1)–(3), except that they include industry-year fixed effects allowing industry shocks to be year-specific instead of industry and year fixed effects. The main results carry over, except that the coefficient for related-party TCRs become statistically insignificant. Hence, the results indicate that

total-debt TCRs help to address debt bias, with a robustly significant and large negative coefficient. However, the effect of related party-TCRs is less clear-cut and much smaller in size.[40]

Annex Table 4.3, reports results from estimating specification (2). In all columns, the estimated effect of the interaction term between taxes and tangibility on the consolidated debt ratio is positive, suggesting that the debt bias is higher in capital-intensive industries. This is consistent with the notion that firms that rely more heavily on tangible assets have a relatively easier access to credit and hence react more sensitively to corporate taxes. Column (2) adds the interaction between the TCR-variable and tangibility. This coefficient is statistically significant and negative. It implies that TCRs reduce debt ratios differentially more in industries with higher tangibility suggesting that these firms are more likely to be constrained in light of their higher debt ratios. Columns (3) and (4) show that this finding is driven solely by TCRs that apply to total debt; the coefficient for related-party TCRS is found to be statistically insignificant.

To get a sense of the estimated magnitude of the interaction term, consider the partial effect of a TCR applied to total debt on the debt ratio: $\frac{\partial debt}{\partial \text{thinCapTotal}} = BaseEffect + \beta_2(Tang)$. The base effect is nested in the fixed effects. The estimated β_2, in column 4 for example, is -0.088. We can retrieve a magnitude of the interaction effect by evaluating the partial effect at two different levels of tangibility and taking the difference. For instance, the implied interactive effect of thinCapTotal on the debt ratio evaluated at the value of the 25th percentile of tangibility is -0.71 percentage points (i.e., thinCapTotal decreases the debt ratio by 0.71 percentage points, compared to the base effect and given the 25th percentile level of *Tang*). The interactive effect of thinCapTotal on the debt ratio evaluated at the value of the 75th percentile of tangibility is -2.2 percentage points indicating that higher tangibility makes the effect of a TCR on the debt ratio larger (i.e., it reduces the debt ratio by 2.2 percentage points, compared to the base effect and given the 75th percentile level of *Tang*.) The difference between both interaction effects is -1.5 percentage points (-2.2+0.71).

[40] In case of a multinational, the results also suggest that a TCR reduces the leverage of the group as a whole, but we cannot infer whether there is an increase in debt in affiliates located in certain high tax countries where no such TCR is applicable.

Annex Table 4.3. Thin Capitalization Rules and Tangibility: A Difference-in-Difference Specification

Dependent Variable	Debt Ratio			
	(1)	(2)	(3)	(4)
thinCapAll × tangibility		−0.0261*		
		(0.0133)		
thinCapTotal × tangibility			−0.0853***	−0.0888***
			(0.0226)	(0.0233)
thinCapRelatedParty × tangibility				−0.00557
				(0.0139)
Citrate × tangibility	0.0064***	0.0064***	0.0057***	0.0057***
	(0.00141)	(0.00145)	(0.00133)	(0.00131)
ebitdaShareOfAssets	−0.767***	−0.763***	−0.764***	−0.764***
	(0.0249)	(0.0251)	(0.0250)	(0.0250)
operatingRevenueRatio	1.978***	1.892***	1.886***	1.886***
	(0.158)	(0.159)	(0.159)	(0.159)
Constant	21.67***	23.21***	23.59***	23.64***
	(2.881)	(2.906)	(3.011)	(2.989)
Observations	369,844	358,978	358,978	358,978
R^2	0.169	0.169	0.169	0.169
Industry	Yes	Yes	Yes	Yes
Country-year FE	Yes	Yes	Yes	Yes

Note: This table shows results from estimating a difference-in-difference specification described in equation (2)/.

Robust standard errors are in parentheses. ***p<0.01,**p<0.05, *p<0.1.

In Annex Table 4.4, the dependent variable is the financial distress indicator from equation (3). The columns vary by the model used (linear probability model versus logit model) and the employed fixed effects. In all columns, the coefficient for the TCR variable for total debt has a negative sign. This indicates a negative effect of these TCRs on financial distress and a positive effect on the likelihood of a firm to be in the safe zone. For example, the estimates from the linear probability model in columns (1) and (2) suggest that a total–debt TCR reduces the probability of a company facing bankruptcy risks by 5 percentage points. Logit estimates yield a similar pattern. The results also indicate that related-party TCRs have no significant effect on the financial distress indicator; in columns (3) and (4), it even appears with the wrong sign. Thus, from the perspective of bankruptcy risk associated with debt bias, total-debt TCRs are found to be effective while TCRs that apply only to related-party debt are not.

Annex Table 4.4. Thin Capitalization Rules and Corporate Stability

Dependent variable	A binary financial distress indicator based on the *Z-score*			
	LPM		Logit	
	(1)	(2)	(3)	(4)
thinCap–total	−0.050***	−0.050***	−1.493***	−1.495***
	(0.009)	(0.004)	(0.089)	(0.090)
thinCap–related-party	−0.003	−0.003	0.018	0.024
	(0.012)	(0.006)	(0.049)	(0.050)
citRate	−0.000	−0.001	−0.004	−0.004
	(0.001)	(0.000)	(0.004)	(0.004)
gdpGrowth	−0.002***	−0.002***	−0.028***	−0.029***
	(0.000)	(0.000)	(0.003)	(0.003)
interestRateReal	0.002***	0.002***	0.030***	0.031***
	(0.001)	(0.001)	(0.004)	(0.004)
Volatility	0.504***	0.510***	3.787***	3.916***
	(0.047)	(0.030)	(0.269)	(0.282)
Constant	0.078***	0.075***	−12.82***	−12.55***
	(0.025)	(0.013)	(0.574)	(0.993)
Observations	44,590	44,590	44,589	44,466
R^2	0.053	0.053		
Industry and year FE	Yes			
Industry-year FE		Yes		Yes

Note: This table shows results from estimating a linear probability model (LPM) or a logit model where the depended variable is a financial distress indicator coded 1 if the *Z*-score of a firm is blow 2; zero otherwise.

Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Annex V. Allowance for Corporate Equity

This annex describes the design of a text book ACE system. The ACE supplements the current deductibility of interest with a similar deduction for the normal return on equity. The deduction is derived by multiplying the ACE base by an ACE rate. Annex Table 5.1 describes some real-world variants of the ACE.

The ACE base

The base of the allowance is the equity stock. This can either be the entire equity stock, but it can also be defined as the increment relative to some base year. For instance, if last year's equity is used, the system is incremental relative to that stock. In the latter case, the ACE base is roughly speaking formed by new equity issues plus retention of after-tax profits, relative to last year. The boost to equity-financed investment per unit of revenue lost is then maximized.

To avoid duplication of ACE, equity participations in other firms should be subtracted from the equity base: these participations will already be included in the equity base of the company that issued the shares. If a firm has a negative balance of equity minus the value of participations in other firms—e.g., a holding company that finance participations primarily with debt—the ACE allowance will involve an addition to the CIT base, rather than a deduction. In this way the ACE system guarantees tax neutrality between debt and equity also for holding companies, since the negative ACE allowance offsets the amount of interest that the holding company is allowed to deduct from taxable profits. It ensures that holding companies have no tax incentive to finance acquisitions by debt rather than equity (see also Annex 6). Participations in foreign companies should be excluded from the ACE base, since foreign equity returns are not subject to domestic tax. Relief for double taxation in the residence country (credit or exemption) is usually granted, as the ACE system is generally deemed to have the character of an income tax (McLure and others 2014).

The ACE rate

To obtain full tax neutrality under the ACE, the imputed rate of return must be equal to the rate at which shareholders discount the tax savings from the company's future ACE allowances. This discount rate will depend on the degree of riskiness attached to these tax savings. If the tax law allows full loss offset and the CIT rate is fixed over time, shareholders will receive the tax benefit from the ACE allowance with full certainty. Hence, they will discount the tax savings from the ACE system at the risk-free rate of interest (Bond and Devereux 1995). To ensure tax neutrality, it is then sufficient to set the notional rate of return equal to the risk- free rate, e.g., proxied by the interest rate on government bonds. In practice, tax laws do not allow full loss offsets: losses can only be carried forward for a limited number of years, they are never carried with interest added, and unutilized losses when a firm goes out of business cannot always be offset against other taxable income. Hence, there will be some risk attached to the ACE deductions.[41] The risk will differ across

[41] There are also political risks associated with changes in the ACE rate or even abolishment of the ACE.

companies, depending on how much they are affected by the restrictions on loss offsets. A substantial part of the risk is likely to stem from the probability that the company goes bankrupt. This risk will be reflected in the rate of interest at which the firm can borrow, so setting the imputed rate of return equal to the interest on the company's long term debt would presumably ensure rough neutrality of the ACE. However, for administrative reasons it is common to use a single notional rate of return for all companies rather than applying firm-specific rates. In countries with a well-developed market for corporate bonds, the average interest rate on such bonds would be a natural benchmark for choosing the imputed rate of return to equity under the ACE.

Annex Table 5.1. ACE Systems in Practice[1]

Country	Period	Base	Rate	Notes
Belgium	Since 2006	Book value of equity; not incremental system	Average monthly government bond rate of year preceding fiscal year by 2 years. The rate was initially capped at 6.5 percent, but was lowered to 3 percent in 2013. Special SME rate is 0.5 pp higher.	The notional return is deductible. In 2013, new legislative changes eliminated carrying forward of the unused allowances and levied a tax on distributed dividends of large firms.
Italy	Since 2012	New equity (the amount of increase in equity over a 2010 base equity amount); an incremental system	For the first three fiscal years (2011, 2012, 2013): 3 percent; 4 percent for the 2014 fiscal year; 4.5 percent for 2015; 4.75% 2016; for subsequent years the rate will be based on the Italian public debt securities' average return and a risk factor and will be annually set by the Minister of Finance.	Italian resident companies and Italian permanent establishments of non-resident companies can deduct the NID (with certain exclusions and deductions). The new equity does not include any profits from that year. It can be calculated based on qualifying upward and downward equity adjustments after 2010. It may not exceed the company's equity at the end of the given fiscal year.
Liechtenstein	Since 2011	Modified equity	The applicable interest rate is specified annually, depending on the market development (currently: 4 percent).	The notional return is deductible.
Portugal	2010–2013	Share contributions during 2010 until 2013 respectively the share capital	SME's held by individuals, venture capital companies and business angels can benefit for a three-year period from a notional interest deduction of 3 percent on the amount of cash contributions by shareholders to share capital made during 2010 through 2013; from 2014, individual-owned micro, small and medium-sized enterprises may deduct 5 percent of the company's share capital for three years (limited to EUR 200,000).	The notional return is deductible.

Annex Table 5.1. ACE Systems in Practice (Concluded)

Cyprus	Since January 2015	New equity defined as any equity introduced in the business on or after 1 January 2015 in the form of issued share capital and share premium (provided it is fully paid); an incremental system	The interest rate of the 10-year government bond yield of the country in which the new equity is invested increased by 3% having as a lower limit the 10-year government bond yield of the Republic of Cyprus increased by 3%.	
Turkey	Since July 2015	Cash capital increase of the paid-in capital; an incremental system	50 percent of the annual weighted average interest rate applied to Turkish Lira-denominated loans provided by banks	The benefit does not apply to companies with high passive income or high financial assets, shares in subsidiaries or participations.

Source: Hebous and Ruf (2015), Klemm (2007), European Tax Handbook (various editions), E&Y publications.

[1] In 2016, the Swiss parliament voted to adopt an incremental ACE system. Denmark has proposed to introduce an incremental ACE in its 2017 budget, to be implemented in 2019. Brazil has a system that has features of an ACE, but in fact is closer to a dividend deduction scheme, since the notional deduction is only granted for equity returns that are distributed. For that reason, Brazil is not included in this Table.

Annex VI. Tax Planning with ACE and Possible Countermeasures

A concern with the ACE is that it might create new tax planning opportunities that could unduly erode tax bases and reduce revenue. The literature identifies different tax planning schemes in real-world ACE regimes, such as in Belgium and Italy (Huyghe and Bombeke 2005, Peeters and Hermie 2011, Quaghebeur 2007, Michielse and others 2014, Zangari 2014). This Annex discusses concepts of the most important schemes, namely: (i) cascading of ACE relief; (ii) asymmetries in ACE structures; (iii) asymmetries across countries in the application of ACE.[42] We also discuss how design choices of the ACE and other countermeasures can protect against tax planning.

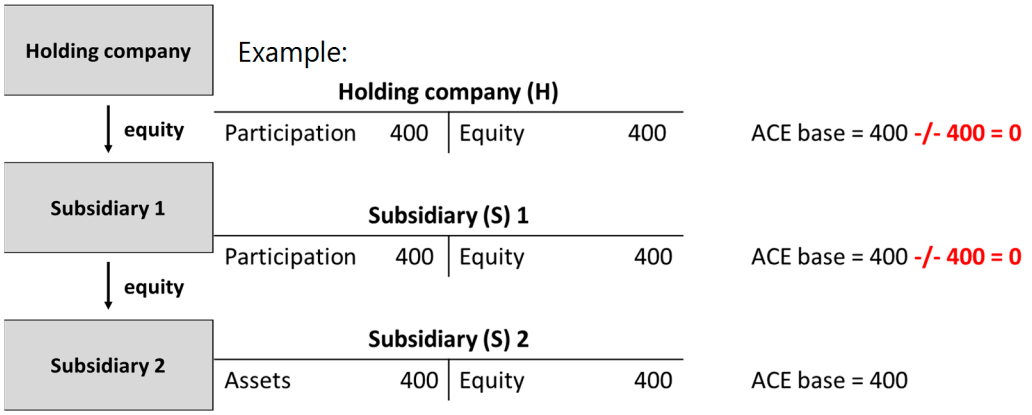
Cascading of ACE

A basic tax planning opportunity of ACE is cascading of the allowance. Consider a company for which the consolidated account shows assets and equity of 400. Thus, the ACE base for this company is 400 and, if the ACE rate is 10 percent,[43] gives rise to an allowance of 40. If, however, the firm were organized as a chain of subsidiaries as in Annex Figure 6.1, each holding equity in the other, the ACE base could cascade: every firm in the chain might be eligible for a deduction of its equity. In the example, the total allowance could expand to 3 x 40 = 120. To eliminate the possibility of such cascading, it is necessary that equity represented by participations (domestic and foreign) be subtracted from the ACE base. This can be called an 'anti-cascading rule'. It is a critical element of the ACE discussed in Annex 5; and it is also part of all existing ACE regimes. In Annex Figure 6.1, these subtractions (in red) reduce the ACE base for company H and S1 to zero. The total ACE base of the group is thus reduced to 400 and the allowance to 40 (granted to S2). Hence, the anti-cascading rule restores neutrality with respect to the firm's organizational structure.

[42] There are also other forms of tax planning not discussed here. One is that ACE can make existing forms of tax avoidance more attractive. An example is equity-financed investment in assets that are not functionally related to the business, but which generate private benefits for its management (art, luxuries, antiques). Specific anti-avoidance can disallow these assets to be deducted from the ACE base, as is the case in Belgium (Huyghe and Bombeke 2015). Second, avoidance schemes can be specific to a certain ACE design. The incremental ACE, for example, might be subject to abuse through the transformations of old into new equity, e.g.,,if a firm is liquidated and the assets transferred into a new start-up. Such transformation might be costly though, especially where liquidation of assets gives rise to capital gains taxation. Special or general anti-avoidance rules can effectively limit such avoidance, as is done in Italy (Zangari 2014). Finally, tax planning can occur if ACE differs between corporate and non-corporate businesses. ACE regimes generally also grant the allowance to non-corporate firms.

[43] An assumption used throughout this annex.

Annex Figure 6.1. ACE Duplication and the Anti-Cascading Rule



Asymmetries in ACE

Suppose that the value of participations on a firm's balance sheet exceed the value of its equity, e.g., as participations are financed by debt. In that case, the ACE balance is negative and the ACE should give rise to an addition to the tax base. However, in most countries, the ACE base is capped at zero, such as in Belgium, Italy, and Liechtenstein. It is this asymmetric feature of ACE that creates opportunities for domestic tax planning.

The easiest way to see this is by comparing two companies that have the same consolidated balance sheet, but with different ownership structures. This is shown in Annex Figure 6.2. Company C shows the consolidated balance sheet, with assets of 400, financed by 300 of external debt and 100 of equity. The balance sheet of group U is split into a holding company (H) that holds the shares of subsidiary (S), which is the production company. We assume that both entities are resident in the ACE country.

Company C has an ACE base of 100, which gives rise to an allowance of 10. If a negative ACE base is possible, the ACE base of group U is also 10: an allowance of 40 is granted to company S (10 percent of 400); but there is a negative ACE base of 300 for company H (corresponding to its debt, since the anti-cascading rule denies any allowances for its equity in S), which creates an addition of 30 to its tax base. Since the allowances are equivalent for C and U, the ACE is neutral to the organizational structure and there are no opportunities for tax planning.

Things are different if the ACE base has a zero lower bound. The ACE base of company H then becomes zero instead of – 300 and there is no longer an addition of 30 to its tax base. The ACE granted to company S, however, remains 40. On balance, group U enjoys a larger overall allowance than company C and tax planning through restructuring becomes attractive. Effectively, the asymmetry in ACE blunts the anti-cascading rule discussed before in cases where participations are financed by debt.

Annex Figure 6.2. Tax Planning in the Presence of a Zero Lower Bound for ACE

Consolidated (C)

Company (C)

Assets	400	Equity	100	ACE base = 100
		Debt	300	
	400		400	

Unconsolidated (U)

Holding company (H)

Participation	400	Equity	100	ACE base = 100 -/- 400 = 0 **(-/- 300)**
		Debt	300	
	400		400	

Subsidiary (S)

Assets	400	Equity	400	ACE base = 400

To minimize the risk of tax planning through ACE, countries should thus permit the ACE base to be negative so that ACE can generate tax payment for some companies. However, countries typically impose a zero lower bound, as they may fear for an exit of companies (such as holding companies) if these would be confronted with an ACE addition (see below). Given this asymmetry in real-world ACE regimes, it is necessary to develop anti-avoidance measures.

One way to address tax planning is by implementing either specific or a general anti-avoidance rule. The total allowance for group U, for instance, might be capped if the group's structure is deemed artificial and only aimed at avoiding tax. Belgium adopts both of these instruments to counter tax planning. In specific cases where the zero cap on the ACE base is binding, the government may deny interest deductions if the sum of participations exceeds its debt. And finally, a comprehensive thin capitalization rule (or earnings stripping rule) would cap interest deductions and thus limit tax avoidance. For instance, company H in Annex Figure 6.2 has a debt-equity ratio of 3:1. If interest deductions were capped at a ratio of 1:1, the interest deduction would be reduced from 30 to 10.

International Tax Planning

The final tax planning strategy arises due to international differences. If one country adopts an ACE and the other doesn't, it becomes attractive to locate equity in the ACE country and finance it by debt from the non-ACE country. This is reminiscent to classical debt shifting, which also exists due to international differences in statutory tax rates.

To see how this form of tax planning arises, consider a company with an ownership structure as described in Annex Figure 6.3. Each entity can reside either in the ACE country, which we refer to as country A, or in a country without an ACE regime, which we refer to as country F. It is assumed that country A adopts an ideal ACE, with an anti-cascading rule that allows the ACE base to be negative, i.e. the allowance can become an addition to the tax base. For simplicity it assumed that country F adopts a standard income tax and that CIT rates in the two countries are the same.

Annex Figure 6.3. Tax Planning through Intra-Company Loans

Holding Company 1 (H1)				Resident in ACE Country	Resident in non-ACE Country
Participation	100	Equity	400	ACE base = 400 -/- 100 = **300**	
Loan S1	300			**Taxable interest**	**Taxable interest**
	400		400		
Holding Company 2 (H2)					
Participation	400	Equity	100	ACE base = 100 -/- 400 = **- 300**	
		Debt	300	**Interest deduction**	**Interest deduction**
	400		400		
Subsidiary (S)					
Assets	400	Equity	400	ACE base = 400	

The firm described in Annex Figure 6.3 has consolidated assets of 400 that is fully financed by equity, similar as in Annex Figure 6.1. The consolidated balance sheet thus yields an ACE base of 400 and the associated allowance is 40. This is the benchmark against which alternative ACE allowances will be compared. In the chain of subsidiaries, S is the production company that holds the assets and whose equity is owned by holding H2. The latter is subsequently financed by holding H1 through an intra-company loan of 300 and an equity injection of 100. The external shareholders hold the shares of H1.

The two columns on the right of Annex Figure 6.3 show the ACE allowance, the interest deduction and the taxable interest income if each entity resides in either country A or F. The treatment of interest is the same in the two countries. No ACE applies in country F, neither positive nor negative. In country A, a positive ACE allowance is granted to company H1 and S of, respectively 30 and 40, on account of their balance of equity and participations. A negative ACE is applied to holding H2 on account of its negative balance. These tax treatments have several implications. In particular, the group will find it attractive to locate:

- ***Production subsidiary S and holding company H1 in country A***, since ACE generates an allowance. More generally, an ACE system will attract both production companies and holding companies that are financed by equity.

- ***Holding H2 in country F***, since this avoids an addition to the tax base on account of the negative ACE in country A. This may explain why ACE countries generally put a zero lower bound to the ACE, as it prevents companies like H2 from exiting the country. If H2 resides in country F, ACE in country A becomes excessive, relative to the consolidated treatment (our benchmark) in country A. Indeed, the total allowance is 70 instead of 40: 30 is granted to company H1 and 40 to company S. This occurs because the negative ACE is circumvented by placing the subsidiary deducting intracompany interest in the non-ACE country. This reflects tax planning.

Interestingly, it is not the ACE country itself, but the non-ACE country that suffers from a narrower tax base as a result of tax planning. In particular, while country A grants an ACE of 30 to company H, country A also levies tax on intracompany interest receipts of 30. The residence of H1 thus does not reduce the overall tax base of country A. However, the presence of company H2 in country F gives rise to an additional interest deduction of 30 in the non-ACE country. When subsidiary S can offset this deduction against other income, it erodes the tax base of country F.

Such international tax planning induced by the ACE is reminiscent to classical debt shifting, induced by differences in CIT rates. Indeed, if the CIT rate in F would exceed that in A, the group would also have an incentive to borrow in F (to deduct interest at a high rate) and lend from A (where the interest is taxed at a low rate). Country F can take counter measures to mitigate base erosion, such as by strengthening its thin capitalization rules.[44] Hence, somewhat paradoxically, the adoption of ACE by one country will make it more, not less, important for other countries to protect their base through thin capitalization rules. This is in sharp contrast to a global adoption of ACE, which would make thin capitalization rules redundant.

[44] Country F could also deny interest deductions for debt that is used only to finance participations in foreign companies (see Desai and Dharmapala 2015). The United Kingdom, for instance, adopts such an anti-avoidance rule (although ECJ case 168-01 rules out its application for intra-EU transactions).

Annex VII. Estimated Base Narrowing from Introducing an ACE

This annex describes simulations of the revenue impact of introducing an ACE regime, using firm-level data for OECD countries. The calculations are necessarily stylized, given availability of data. For instance, they are based on commercial accounting data, which does not necessarily coincide with tax accounts. Moreover, for non-financial firms and insurance companies, there is no information about share participations in other firms—which would in practice be subtracted from the ACE base. Thus, these calculations will represent an upper bound of the expected revenue effects. Despite these shortcomings, the simulations give a reasonable indication of the extent to which ACE will narrow the CIT base and, if tax rates remain the same, reduce CIT revenue. In doing so, the analysis distinguishes between non-financial and financial firms and explores alternative designs of the ACE.

The calculations for non-financial sector are based on firm-level data from ORBIS by Bureau van Dijk. It exploits unconsolidated accounts for a sample of over one million firms in OECD countries during 2012–13. Observations are grouped into three sectors: extractive industries, manufacturing and services. The data for financial firms are based on Bankscope data, which contain balance sheet and income statements of financial firms across the globe; the sample is complemented with insurance company data from ORBIS. It consists of unconsolidated accounts for over 10,000 financial institutions in OECD countries during 2012–13. Observations are grouped into five subsectors: "regular" banks, which comprise of commercial, savings and cooperative banks; investment banks; bank holdings; finance companies; and insurance companies, comprising both life insurance and other insurance. While the country coverage spans all OECD countries, although Belgium, Italy, and Portugal are excluded from the analysis because they already had some form of ACE in place during the period analyzed.

For each firm, the ACE allowance is computed by multiplying a country-specific ACE rate and a firm-specific ACE base. The ACE rate is set at the long-term government bond yield in each country, mimicking a notional risk-free rate of return to equity. The ACE base is varied in different scenarios. For non-financial firms, two scenarios are considered: i) the book value of total equity; and ii) the equity increase in 2013 relative to the base of 2012. For financial firms, we explore the same two scenarios, but a third scenario is added in which an allowance is granted only for equity in excess over the minimum regulatory capital of 3 percent of assets (as required by Basel III). For financial firms, the calculations correct for participations in other firms (which is especially relevant for bank holding companies). The ACE amount per firm is corrected in cases where the ACE exceeds the before-tax profit of a firm, as the ACE would then create a negative tax liability. Hence, it is assumed that no refunds are given. If unused ACE could be carried forward, however, this might affect the ACE amount in subsequent years, which our calculations do not reflect. The correction is generally small though (see Annex Table 7.1). For each country, the dollar-amounts of the ACE granted to each firm are aggregated and the total ACE allowance granted is subsequently expressed as a percent of the underlying pre-tax profit. This reflects the percentage change in the CIT base as a consequence of the ACE. If the CIT rate remains unchanged, this will be equivalent to the percentage change in CIT revenues as a result of ACE. Annex Table 7.1 reports these findings, along with the underlying inputs into the calculation and some country averages of the ACE rate and the CIT rate.

Annex Table 7.1. Estimated Base Narrowing from Introducing and ACE

Data in million USD unless otherwise specified										ACE1 base: all equity				ACE2 base: equity above min capital				ACE3 base: equity above base year equity			
Sector	**Year**	**Number of firms**	**Total assets**	**Total equity 1/**	**Total Pre-tax Profit**	**Total Tax**	**Equity-to-Assets ratio (pct)**	**ACE rate 2/ 3/ (pct)**	**CIT rate 2/ (pct)**	ACE base	Notional ACE = base*rate	ACE used 4/	**ACE used (pct pre-tax profit)**	ACE base 5/	Notional ACE = base*rate	ACE used 4/	**ACE used (pct pre-tax profit)**	ACE base	Notional ACE = base*rate	ACE used 4/	**ACE used (pct pre-tax profit)**
Extractive industries	2012	3,533	875,250	448,101	207,451	103,813	51.2	2.4	27.1	448,101	11,064	10,497	5.1					--	--	--	--
Manufacturing	2012	209,142	5,339,895	2,572,378	442,000	101,354	48.2	2.2	25.3	2,572,378	57,632	52,937	12.0					--	--	--	--
Services	2012	876,407	9,720,080	3,892,087	700,579	175,752	40.0	2.4	26.8	3,892,087	98,230	84,320	12.0					--	--	--	--
Regular banks	2012	7,765	17,123,715	1,414,992	165,400	50,983	8.3	1.6	29.7	1,414,992	23,938	23,669	14.3	909,437	15,972	15,832	9.6	--	--	--	--
Investment banks	2012	68	1,830,732	55,879	4,425	1,208	3.1	1.8	25.2	55,879	941	898	20.3	18,472	289	285	6.4	--	--	--	--
Bank holdings	2012	101	307,955	44,694	7,481	1,517	14.5	1.8	34.5	44,694	815	812	10.9	35,470	648	647	8.6	--	--	--	--
Finance companies	2012	181	616,418	59,953	15,762	5,060	9.7	2.3	27.7	59,953	1,438	1,394	8.8	44,118	1,096	1,077	6.8	--	--	--	--
Insurance companies	2012	2,406	12,592,165	1,436,287	199,700	36,438	11.4	1.9	29.5	1,436,287	28,321	27,937	14.0	1,096,089	21,798	21,594	10.8	--	--	--	--
Extractive industries	2013	3,533	919,372	480,439	173,692	82,444	52.3	2.8	26.9	480,439	13,385	12,642	7.3					60,498	1,701	1,582	0.9
Manufacturing	2013	209,142	5,363,950	2,627,907	430,658	95,090	49.0	2.1	24.2	2,627,907	55,554	52,803	12.3					198,350	5,416	5,319	1.2
Services	2013	876,407	9,802,863	4,025,312	691,468	165,717	41.1	2.2	25.9	4,025,312	92,412	83,881	12.1					359,028	9,692	9,105	1.3
Regular banks	2013	7,765	17,559,133	1,500,419	178,124	55,172	8.5	1.9	29.3	1,500,419	30,710	30,553	17.2	981,099	21,023	20,936	11.8	112,200	2,433	2,432	1.4
Investment banks	2013	68	1,637,638	59,438	4,587	1,462	3.6	2.1	24.0	59,438	1,156	951	20.7	20,725	347	341	7.4	4,779	110	110	2.4
Bank holdings	2013	101	323,679	47,077	7,975	1,275	14.5	2.4	34.5	47,077	1,107	1,097	13.8	37,380	879	870	10.9	3,265	77	77	1.0
Finance companies	2013	181	650,628	61,772	14,050	4,143	9.5	2.5	27.2	61,772	1,699	1,652	11.8	45,379	1,300	1,283	9.1	5,767	193	193	1.4
Insurance companies	2013	2,406	13,250,773	1,522,872	249,815	41,273	11.5	2.2	28.9	1,522,872	34,995	34,415	13.8	1,171,339	27,357	26,927	10.8	149,844	3,563	3,554	1.4

Note: Bankscope and Orbis OECD firms with consecutive reporting during 2012-2013, and positive reported values for equity, assets, tax paid, and pre-tax profits.

1/ Total equity is corrected for equity in associates (except for extractive industries, manufacturing, services, and insurance).
2/ The ACE rate applicable to each firm is taken as the long-term government bond in the country.
3/ Average rates across the sector are weighted by country assets to world assets.
4/ ACE used in a year is the notional ACE (obtained by multiplying the ACE base by the ACE rate) capped by the value of the pre-tax profit. Estimations are static, i.e. unused ACE is not carried forward from one year to another.
5/ The minimum regulatory capital in ACE2 is set at 3 percent of assets.

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