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Wealth taxation in the United States

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Abstract

The paper analyzes the fiscal effects of a Swiss-type tax on household wealth, with a $120,000 exemption and marginal tax rates running from 0.05 to 0.3 percent on $2.4 million or more of wealth. It also considers a wealth tax proposed by Senator Elizabeth Warren with a $50 million exemption, a 2 percent tax on wealth above that and a 1 percent surcharge on wealth above $1 billion. Based on the 2016 Survey of Consumer Finances, the Swiss tax would yield $189.3 billion and the Warren tax $303.4 billion. Only 0.07 percent of households would pay the Warren tax, compared to 44.3 percent for the Swiss tax. The Swiss tax would have a very small effect on income inequality, lowering the post-tax Gini coefficient by 0.004 Gini points. The effect of the Swiss tax and Warren tax on wealth inequality is miniscule, lowering the Gini coefficient by at most 0.0005 Gini points.

Keywords: household wealth, income inequality, wealth inequality, wealth taxation, United States

1 INTRODUCTION

Both the extreme nature of wealth concentration in the United States (U.S.) and its rise in recent years provide some urgency to a consideration of potential policy remedies. Personal wealth is currently taxed in two ways on the federal level in the United States: realized capital gains (as part of personal income taxes) and estate taxation. Should we also think about direct taxation of the wealth holdings of households? Almost a dozen European countries have or have had such a system in place (see Table 1 and Table 2 below). On the grounds of equity, a combination of annual income and the current stock of wealth provides a better gauge of real living standards and thereby the ability to pay taxes than income alone. Moreover, there does not appear to be any evidence from other advanced economies that the imposition of a modest direct tax on household wealth had any deleterious effect on personal savings or overall economic growth. Indeed, there are arguments to the contrary that such a tax may induce a more efficient allocation of household wealth, away from unproductive toward more productive uses.

In Wolff (1995), I proposed a very modest tax on wealth (a $100,000 exemption with marginal tax rates running from 0.05 to 0.3 percent). My calculations for year 1989 showed that such a tax structure would yield an average tax rate on household wealth of 0.2 percent, which is less than the loading fee on most mutual funds, and would reduce the average yield on household wealth by only 6 percent. Even the top marginal tax rate of 0.3 percent would reduce the average yield on personal wealth by only 9 percent. These figures suggested that disincentive effects on personal savings would be very modest. Moreover, there are arguments to the contrary as suggested above that personal savings might actually rise.

I estimated that such a tax could raise $50 billion in additional revenue and have a minimal impact on the tax bills of 90 percent of American families. This is not a large amount, representing about 3 percent of total federal tax receipts in that year.

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However, on the margin such additional revenue could help provide the fiscal latitude to enact more generous social transfers to the poor and provide needed tax relief to the middle class.

This paper begins, in Section 2, with an overview of wealth taxation in the mid-1980s, Section 3 provides estimates of the impact of wealth taxes in the United States in 2016. Section 4 includes an analysis of the wealth tax proposed by Elizabeth Warren. Concluding remarks are made in Section 5.

2 PREAMBLE: SYSTEMS OF WEALTH TAXATION, MID-1980s

2.1 THE UNITED STATES

It is helpful to start with an historical overview of wealth taxation in advanced economies to see how this has devolved over time. I first summarize the forms of wealth taxation in place in the United States and other industrialized countries around 1985. In the United States, household wealth was (and is currently) taxed in two ways on the federal level: estate taxes and capital gains taxes. Federal estate taxes were first introduced in 1916, with major revisions in 1976, 1981, and more recently, a big overhaul in 2011. Capital gains were originally included in the personal income tax system, introduced into the country in 1913. Their provisions have been modified over time on a recurrent basis.[1]

The system in 1985 (and currently) provides for the taxation of the value of an estate at the time of death of an individual. The tax is levied on the value of the estate, in contrast to the value of an inheritance received. Moreover, the estate tax system is integrated with the gift tax, which refers to the voluntary transfer of assets from one (living) individual to another. Gifts are aggregated over the lifetime of the individual donor, and the lifetime aggregate of gifts is combined with the value of an estate at death. The estate tax applies to the full value of gifts and estates.[2]

In February of 2001, each individual was exempted from estate taxes on net worth up to $675,000. The basic exemption rose to $1 million in 2006. Wealth above that amount was taxed at marginal rates, which began at 37 percent and reached as high as 55 percent (for estates over $3.67 million). Estates of fewer than 48,000 individuals – about 2 percent of annual deaths – were subject to the estate tax. About half the total was paid out of estates worth $5 million or more – about 4,000 people. In 2016, the exemption on the estate tax was raised to $5.25 million for singles and $10.5 million for couples and the top marginal tax rate was 40 percent, up from 35 percent in 2012. The exemption level is now indexed to the consumer price index (CPI-U).

[1] A related tax is the property tax, levied on the value of all real property (buildings and land). Though this is often overlooked in current debates on tax reforms, the property tax was the third-largest source of household tax revenue in 1985 and has been rising steeply in years since then. This tax is generally levied by local governments in the United States and, as a result, will not be discussed in this paper. Of the twenty-four members of the OECD, all but Italy and Portugal had a separate tax on real property in the mid-1980s.

[2] Gifts within three years of death were (and still are) treated as transfers at death.

For gifts, the first $10,000 per recipient ($20,000 in the case of a married couple) was exempt from the combined gift-estate tax. In 2016 the figure was $14,000. There was (and is) also full exemption for transfers (both gifts and estates) between spouses. All forms of wealth are included in the tax base for calculating the gift-estate tax except pension annuities and life insurance. Assets are appraised at market value at time of death, though special rules apply to farm property, closely held business, and unquoted stock and shares. Several states also levy estate taxes, which are generally based on federal rules.

Capital gains refer to the difference between the selling price and purchase price of an asset. There are some adjustments made for the value of capital improvements in the case of real property (such as a home). These are figured in on a cost basis when computing capital gains. In the United States, capital gains are taxed as part of the federal income tax system (and state income tax systems). Only realized capital gains are included (that is, capital gains on actual sales of assets).

In 2001, capital gains on assets held more than five years were subject to a maximum tax of 18 percent (compared to the top marginal tax rate of 39.6 percent). In 2016, the maximum tax rate on long-term capital gains was 20 percent (also compared to the top marginal tax rate of 39.6 percent). Short-term capital gains are treated as ordinary income and do not receive tax preference. However, in the case of owner-occupied housing, there was no tax levied on capital gains in the case when a new primary residence was purchased whose price exceeds the selling price of the old home. There was also a one-time exclusion of $500,000 in capital gains on the primary residence. Capital gains on assets that enter an estate at time of death are exempt from taxation.

2.2 OTHER OECD COUNTRIES

Other member countries of the OECD have had much more extensive taxation of household wealth.[3] Besides taxation of estates at death and of capital gains, many countries also imposed direct taxation on household wealth.

In 1985, eleven OECD countries had systems in place with direct taxation of household wealth: Austria, Denmark, Finland, Germany, Luxembourg, the Netherlands, Norway, Spain, Sweden, and Switzerland (see Table 1). In addition, France had such a system in place from 1982 to 1987 and Ireland from 1975 to 1977.[4] Also, with the exception of Spain, most of these systems had been in place for at least sixty years. In all eleven countries, the wealth tax was administered in conjunction with the personal income tax. In all cases, except Germany, a joint tax return was filed for both income and wealth. Though actual provisions varied among these eleven countries, the basic structure of the tax was very similar in each.

[3] Most of the information in this section was garnered from the OECD (1988). The figures in this section are as of 1988 in most cases.

[4] Japan also had a direct wealth tax for a short period after World War II.

Table 1

Wealth taxation systems among OECD countries on personal wealth, mid-1980s

Country	Direct wealth taxation	Transfer tax at death and on gifts	Capital gains taxation	Wealth, death, and gift tax receipts as % of total tax revenue[a]
Australia	no	none	income	0.01
Austria	yes	inheritance	none	0.51
Belgium	no	inheritance	none	0.58
Canada	no	none	income	0.03
Denmark	yes	inheritance	separate	0.92
Finland	yes	inheritance	income	0.50
France	1982-87	inheritance	income	0.85
Germany	yes	inheritance	none	0.42
Greece	no	inheritance	none	0.94
Iceland	yes	inheritance	income	–
Ireland	1975-77	inheritance	separate	0.30
Italy	no	estate/inheritance	none	0.23
Japan	no	inheritance	income	1.19
Luxembourg	yes	inheritance	income	0.51
Netherlands	yes	inheritance	none	0.94
New Zealand	no	estate	none	0.19
Norway	yes	inheritance	income	0.61
Portugal	no	inheritance	none	0.83
Spain	yes	inheritance	income	0.49
Sweden	yes	inheritance	income	0.68
Switzerland	yes	estate/inheritance	income	3.06
Turkey	no	inheritance	income	0.19
UK	no	estate	none	0.64
United States	no	estate	income	0.77

Note: [a]Figures are for 1985.

Source: OECD (1988).

Countries differed in terms of the level at which the wealth tax took effect. The thresholds for married couples with two children ranged from a low of $9,000 in Luxembourg to a high of $155,000 in Denmark. In Germany, the threshold was $129,000; in the Netherlands, $51,000; and in France, it was (when the tax was in effect) $520,000. These threshold levels did not include the forms of wealth that are entirely excluded from the tax base (see below). Moreover, there were income exclusions in many countries, so that a joint income-wealth threshold must be passed in order for the wealth tax to become effective.

In several countries (such as Denmark, the Netherlands, and Sweden), there were also ceilings on the total amount payable in both income and wealth taxes combined. These ceilings were usually expressed as a percentage of taxable income (in the Netherlands, for example, it was 80 percent of taxable income).

Tax rates on household wealth tended to be quite low, in the order of a few percent at most. Five countries had a flat rate system: Austria (1.0 percent), Denmark (2.2 percent), Germany (0.5 percent), Luxembourg (0.5 percent), and the Netherlands (0.8 percent). The other countries had graduated marginal tax rates: Finland (1.5 percent at the threshold, rising to 1.7 percent at $296,000), Norway (0.2 to 1.3 percent, the latter at $47,000), Spain (0.2 to 2.0 percent, the top rate at $7.1 million), Sweden (1.5 percent initially, reaching 3.0 percent at $140,000), and Switzerland (0.05 percent, rising to 0.3 percent at $334,000).[5]

Countries also varied in the forms of wealth that were included in the tax base. All the countries except Spain exempted household and personal effects. Most included the value of jewelry above a certain amount. All except Germany included the value of automobiles, and all included boats.

Several countries exempted savings accounts up to a certain level ($4,600 in Germany, for example). All excluded pension rights and pension-type annuities. Other forms of annuities were generally exempt. About half the countries exempted life insurance policies, while the other half included some portion of them in the tax base.

Owner-occupied housing was taxable in all eleven countries. However, in Austria and Finland, a small deduction was allowed, while in the Netherlands and Norway housing was valued at only a small percentage of its actual market value. Other forms of wealth, including bonds, stocks and shares, and unincorporated businesses were included in the tax base in all countries.[6]

Most countries required an annual reassessment of the total value of personal property. However, Austria, Germany, and Luxembourg reassessed every three years and Switzerland every two years. In principle, all eleven countries with a wealth tax system based the valuation of assets on current market value. However, in practice, this procedure was not always easy to enforce. First, some assets were not traded in the open market and hence did not have a readily available market price (small businesses and unquoted shares, for example). Second, housing presented a particular problem, since the usual method, based on the sale of "similar" property, depended in large measure on the definition of the similar class. On the other hand, bonds, quoted shares and stocks, and bank accounts were rather straightforward in their valuation.

Most countries used an "asset basis" to value unincorporated businesses, defined as the sum of the value of the individual assets contained in the business. This

[5] In Switzerland, the wealth tax was (and is) actually a provincial (canton) tax, so that provisions varied among cantons. The example here is based on the Canton of Zurich.

[6] There was a technical issue related to debts on excluded assets. Since the wealth tax was based on the total value of assets less debts, the appropriate treatment would have been to exclude debts on assets that were themselves excluded from the tax base. However, because of the difficulty of assigning specific debts (such as bank overdrafts) to specific assets, countries varied in their treatment of this problem.

would typically understate the true value of the business, since no additional value was given to goodwill. Austria, Finland, and the Netherlands used a market value basis (the value of the business if it were sold immediately). Switzerland used a formula based on the capitalized value of the business' profits over time.

Whereas most countries based their valuation of real property on its open market value, Austria used a formula based on changes in the average costs of construction and changes in land prices. Germany used the assessed valuation for local taxes. Luxembourg used a formula based on the capitalized rental value of property.

Twenty-two of the twenty-four OECD countries had death or gift taxes, or both (see Table 1). The only exceptions were Australia and Canada. However, most of the OECD countries had "inheritance taxes" in lieu of the American-style estate tax. The difference between the two is that inheritance taxes are assessed on the recipient, whereas an estate tax is assessed on the estate left by the decedent. With an inheritance tax, the tax schedule is applied to each individual bequest, whereas with an estate tax, the assessment is on the total value of the transfer. The inheritance tax has certain advantages over the estate tax. First, it can be adjusted more closely to the ability of an heir to pay the tax. Second, preferential treatment can be accorded to immediate family, as opposed to more distant relatives or friends (so-called consanguinity basis).

Of the four countries with estate taxes – Italy, New Zealand, the United Kingdom, and the United States – the tax threshold varied from $20,000 for Italy to $600,000 for the United States (in 1985). Marginal tax rates ranged from 3 to 31 percent in Italy, 30 to 60 percent in the United Kingdom, and 37 to 55 percent in the United States. In New Zealand there was a flat rate of 40 percent. Spousal transfers were totally exempt in the United States and the United Kingdom but were taxed, with special treatment, in the other two countries. All four countries also had gift taxes. In Italy and the United States, these were aggregated over the person's lifetime and combined with the estate at death to determine the taxable base for the estate tax.

The structure of inheritance taxes was more complicated. Marginal tax rates varied with the relationship of the heir to the decedent, as did the tax thresholds. In France, for example, bequests to spouses had a threshold of $40,000, and the marginal tax rates varied from 5 to 40 percent, whereas bequests to non-relatives had a threshold of $1,500 with a flat rate of 60 percent applied to the transfer. All nineteen OECD countries with an inheritance tax also had an associated gift tax.

Fifteen of the twenty-four OECD countries also provided for a tax on capital gains (see Table 1). All fifteen taxed capital gains as they were realized (that is, at time of sale). In thirteen of the fifteen countries, capital gains were included as part of the personal income tax, whereas in the other two (Denmark and Ireland), a separate tax was collected. Interestingly, in eight countries – Denmark, Finland,

Iceland, Luxembourg, Norway, Spain, Sweden, and Switzerland – there was both a direct wealth tax and a tax on capital gains.

There was wide latitude in the tax treatment of these gains across countries. In the United States, long-term capital gains as of 2001 received tax preference, with a maximum tax rate of 18 percent. Short-term gains were treated as ordinary income. In Denmark, there was a flat rate of 50 percent; while in Switzerland, marginal rates ranged from 10 to 40 percent. In neither case was there separate treatment of short-term gains.

In Australia, Norway (with some exceptions), and Spain, both short-term and long-term gains were treated as ordinary income and taxed in accordance with the personal income tax schedule. In Canada, three-quarters of capital gains were included as ordinary income. In Japan, half of long-term capital gains were taxed as ordinary income, while short-term gains were treated as ordinary income. In Sweden, a proportion of long-term gains were taxed as ordinary income, with the proportion depending on the nature of the property and the period held, while short-term gains were treated as ordinary income.

In most countries with capital gains taxes, gains on principal residences were exempt from taxation. Exceptions were Switzerland, where such gains were fully taxable; Japan, where the first $178,000 of gains was exempt; Spain, where the exemption was subject to the purchase of a new residence; and Sweden and the United States, where only the excess of the sale price over the purchase price of a new residence was subject to taxation.

Though on the books, these wealth taxation mechanisms appear to be a formidable way of collecting revenue, in fact, such levies accounted for only a very small part of total tax revenue in the various OECD countries. The last column of Table 1 summarizes the total tax collections from direct wealth and death/gift taxes as a percent of total government revenue in 1985. Unfortunately, these totals do not include capital gains tax, since it was very hard to break out from regular income tax receipts. Among the twenty-three countries shown here, the average percentage was only 0.67. The shares ranged from a low of 0.01 percent in Australia to a high of 3.06 percent in Switzerland. Switzerland was, moreover, the only country in which the direct wealth tax collected more than 1 percent of total tax revenue – 2.25 percent in 1985. The United States was slightly above average, with 0.77 percent of its total tax revenue from estate and gift taxes. In terms of the receipts from death and gift taxes as a share of the total personal tax intake, the United States ranked fifth among OECD countries. In 1998, total federal tax collections from estate and gift taxes in the United States amounted to 24.0 billion, or 1.4 percent of total tax revenues (U.S. Council of Economic Advisers, 2001: 372).

One may wonder why these wealth taxes collected so little revenue, particularly when some of them were in place for more than seventy years, allowing plenty of

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time for refinement of their efficacy. Three possible reasons suggest themselves. First, particularly in Europe, tax proceeds from the personal income tax and the value-added tax on consumption were already quite substantial, so that relative to total tax revenues wealth tax collections appeared small. Second, there is the strong possibility of evasion or non-criminal avoidance. Unlike labor earnings and interest and dividend payments, which can be recorded at their source, it was much more difficult for a tax collection agency to obtain independent information on financial securities, stock holdings, or the value of a family business.

A third and related reason is that it is easy to transfer financial wealth holdings across borders. With the exception of real property and most small businesses, a family normally can purchase assets outside the country of residence with ease. A country that imposes an excessive wealth tax may induce substantial capital flight. As a result, most countries with a wealth tax tried to keep it more or less in line with that of other countries.

3 WEALTH TAXATION IN 2015

Almost thirty years have elapsed since the publication of the OECD (1988) report on wealth taxation. What was the state of wealth taxation in 2015? This is summarized in Table 2. Of the eleven countries with a direct wealth tax in 1985, only four still had one in 2015 – the Netherlands (on the provincial level only), Norway, Spain, and Switzerland (on the canton level). Spain abolished its wealth tax on January 1, 2009, but then re-introduced it in 2012. Austria and Denmark discontinued their wealth tax in 1995, Germany in 1997, Finland and Luxembourg in 2006, and Sweden in 2007. Iceland abrogated its wealth tax in 2006, reintroduced it in 2010 for four years, and then eliminated it in 2015. However, France reintroduced a direct wealth tax in 2011 and abolished it again in 2018, except on high-value real estate assets.[7] As of 2016, three of the original 24 OECD countries had a national wealth tax and two had a provincial (or canton-level) wealth tax.

[7] Separately, it introduced a 30 percent flat tax rate on capital gains, dividends and interest.

Table 2

Wealth taxation systems among OECD countries, 2015

Country	Direct wealth taxation	Transfer tax at death and on gifts
Australia	no	none
Austria	no	none
Belgium	no	inheritance
Canada	no	none
Denmark	no	inheritance
Finland	no	inheritance
France	yes	inheritance
Germany	no	inheritance
Greece	no	inheritance
Iceland	no	inheritance
Ireland	no	inheritance
Italy	no	inheritance
Japan	no	inheritance
Luxembourg	no	inheritance
Netherlands	yes[a]	inheritance
New Zealand	no	none
Norway	yes	none
Portugal	no	inheritance
Spain	yes	inheritance
Sweden	no	none
Switzerland	yes[a]	estate/inheritance[a]
Turkey	no	inheritance
United Kingdom	no	estate
United States	no	estate

Note: [a]Provincial (or canton) tax.

Sources: European Commission (2014); Deloitte (2014); OECD (2018) and Cole (2015).

With regard to inheritance, gift, and/or estate taxes, of the 22 countries with one form of these in 1985, all but four still had one in effect in 2015. New Zealand eliminated its estate duty in 1992. Sweden abolished its inheritance tax in 2005, Austria in 2008, and Norway in 2014.

Why the retrenchment in wealth taxes (both direct and inheritance)? One can think of the backlash on taxes in general that began with Reagan and Thatcher in the 1980s. This was followed by a conservative backlash in continental Europe in the 1990s and 2000s. For example, the conservative government elected to power in Sweden in the mid-2000s engineered the elimination of both the direct wealth tax and the inheritance tax.

3.1 SIMULATIONS OF DIRECT WEALTH TAXATION IN THE UNITED STATES, 2016

This section provides simulation results of the potential revenue effects of the Swiss wealth taxation system as applied to U.S. household economic data in 2016. These are based on the actual tax code of Switzerland updated to 2016 U.S. dollars. The distinctive characteristics of the Swiss plan are shown in Table 3.[8]

Table 3

*Details of the direct wealth taxation system of Switzerland, 2016**

Taxpayer type	**Thresholds ($)**
single person	74,000
married couple	121,000
Tax rate schedule (%)	**Tax base ($)**
0.05	to 180,000
0.10	next 295,000
0.15	next 493,000
0.20	next 722,000
0.25	next 710,000
0.30	over 2,400,000
Exclusions	
household effects	
pensions/annuities	
Ceiling	
none	

*Note: *Based on the Canton of Zurich. The original figures are converted to U.S. dollars on the basis of PPP exchange rates and updated to 2016 using the CPI-U.*

Source: OECD (1988).

The simulations were performed on the basis of the 2016 U.S. personal income tax schedules and the 2016 Survey of Consumer Finances (SCF). The procedure was as follows. First, I updated the income data, which are for 2015, to 2016 dollars on the basis of the CPI-U (a factor of 1.01465). Second, federal income taxes for each household were computed on the basis of the NBER TAXSIM model.[9] After the initial run, the estimation procedure could be calibrated. Total individual federal income taxes collected in 2016 amounted to $1,546.1 billion.[10] The tax estimation used here produced a total tax figure for all households of $1,594.1 billion, a 3.1 percent discrepancy. The tax estimates were subsequently reduced by 3.1 percent to align with the actual figure.

The 2016 SCF is the most recent one currently available. The survey consists of a core representative sample combined with a high-income supplement. The first

[8] The "Swiss" wealth tax used in the simulations here is based on the Canton of Zurich (see OECD, 1988: 252).
[9] Available at: http://users.nber.org/~taxsim/.
[10] See Table B-19 in U.S. Council of Economic Advisors (2018).

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sample was selected from a standard multi-stage area-probability design. This part of the sample was intended to provide good coverage of asset characteristics that are broadly distributed, such as home ownership. The second sample, the high-income supplement, was selected as a so-called "list sample" from statistical records (the Individual Tax File) derived from tax data by the Statistics of Income (SOI) Division of the Internal Revenue Service (IRS). This second sample was designed to disproportionately select families that were likely to be relatively wealthy. About two thirds of the cases come from the representative sample and one third from the high-income supplement. As a result, the SCF provides a good representation of very wealthy families. It should be noted, however, that by design, the SCF excludes the so-called Forbes 400 – a list compiled by *Forbes Magazine* of the 400 richest Americans. However, I shall include data from this list in Section 4 below.

The principal wealth concept used here is marketable wealth (or net worth), which is defined as the current value of all marketable or fungible assets less the current value of debts. Net worth is thus the difference in value between total assets and total liabilities. Total assets are defined as the sum of: (1) owner-occupied housing; (2) other real estate; (3) bank deposits, certificates of deposit, and money market accounts; (4) financial securities; (5) life insurance plans; (6) defined contribution pension plans, including IRAs and 401(k) plans; (7) corporate stock and mutual funds; (8) unincorporated businesses; and (9) trust funds. Total liabilities are the sum of: (1) mortgage debt; (2) consumer debt, including auto loans; and (3) other debt such as educational loans.

This measure reflects wealth as a store of value and therefore a source of potential consumption. I believe that this is the concept that best reflects the level of well-being associated with a family's holdings. Thus, only assets that can be readily converted to cash (that is, "fungible" ones) are included. Though the SCF includes information on the value of vehicles owned by the household, I exclude this from my standard definition of household wealth, since their resale value typically far understates the value of their consumption services to the household. The value of other consumer durables such as televisions, furniture, household appliances, and the like are not included in the SCF.[11] Another justification for their exclusion is that this treatment is consistent with the national accounts, where purchases of vehicles and other consumer durables are counted as expenditures, not savings.

Also excluded here is the value of future Social Security benefits the family may receive upon retirement (usually referred to as "Social Security wealth"), as well as the value of retirement benefits from defined benefit pension plans ("DB pension wealth"). Even though these funds are a source of future income to families, they are not in their direct control and cannot be marketed.

[11] On the other hand, the value of antiques, jewelry, art objects and other "valuables" are included in the SCF in the category "other assets".

3.2 REVENUE, INCIDENCE AND DISTRIBUTIONAL EFFECTS

Simulations of wealth taxation suggest that a combined income-wealth taxation system might indeed be more equitable than the income tax system alone. The wealth tax was, not surprisingly, progressive with respect to wealth. Its incidence also fell more heavily on older households than younger ones (older households were wealthier, on average), on married couples than singles (the former were also richer, on average), and on white individuals than nonwhites (white families were generally much wealthier). Although this approach did not take into account behavioral responses of families to the imposition of a wealth tax, the calculations nonetheless gave some guidance as to the overall magnitude of likely revenues and redistribution effects.

There are three questions of interest. First, how much additional tax revenue would be raised under a Swiss-style wealth taxation scheme (revenue effects)? Second, which groups would likely bear the burden of the new taxation of wealth (incidence effects)? Third, how would a wealth tax affect overall inequality in the population and within different demographic groups (distributional effects)?

Following the Swiss convention, thresholds and tax brackets were indexed to consumer price changes. Using the CPI-U, the exemptions in 2016 are $121,242 for married couples and $73,611 for singles. The top bracket (the 0.3 percent range) begins at $2.4 million. A restriction is now added such that the sum of income and wealth taxes cannot exceed total income.

A Swiss style wealth tax would have generated $182.1 billion in extra tax revenue in 2016.[12] This represents 1.0 percent of total personal income and 10.5 percent of total federal income tax revenue (see Table 4). This figure compares with actual U.S. personal income tax proceeds of $1,546.1 billion in 2016, or 9.6 percent of total income.[13] It also contrasts with total federal estate and gift taxes of about $20 billion in 2016.[14] While 44 percent of families in 2016 would have paid an additional wealth tax, only 20 percent of families would have seen their tax bill rise by more than $200 and only 15.1 percent by more than $500.

[12] It should be noted that in the simulation all assets are appraised at market value (since this is the only valuation available).

[13] The revenue effect estimated on the basis of the Swiss system (2.2 percent of total U.S. tax revenues) was not very far out of line with the actual experience of that country; in 1985, the Swiss wealth tax accounted for 2.3 percent of total tax revenues in Switzerland. More recent data are not available.

[14] The sources for this section are: U.S. Council of Economic Advisors (2018, table B-19) and BEA (2020).

Table 4

*Income tax and wealth taxes modeled after the Swiss system, 2016**

	Ratio of income tax to family income (%)	Swiss wealth tax		% of families paying wealth tax
		% of income	Ratio to income tax	
All families	9.6	1.0	0.10	44.3
A. Income class ($)				
Under 15,000	-3.1	2.0	–	14.6
15,000 – 24,999	-3.2	0.4	–	23.7
25,000 – 49,999	1.6	0.2	0.14	32.7
50,000 – 74,999	5.9	0.4	0.06	46.3
75,000 – 99,999	7.6	0.5	0.07	58.2
100,000 – 249,999	11.5	0.9	0.07	77.8
250,000 and over	23.4	2.2	0.10	98.1
B. Wealth class ($)				
Under 100,000	4.7	0.0	0.00	3.6
100,000 – 249,999	7.6	0.0	0.01	89.6
250,000 – 499,999	9.1	0.2	0.02	100.0
500,000 – 749,999	10.3	0.7	0.07	100.0
750,000 – 999,999	11.6	0.9	0.08	100.0
1,000,000 – 2,499,999	14.5	1.0	0.07	100.0
2,500,000 – 4,999,999	20.7	2.1	0.10	100.0
5,000,000 and over	25.1	3.8	0.15	100.0
C. Age class				
Under 35	5.8	0.2	0.03	13.1
35-54	13.6	0.8	0.06	40.9
55-69	14.7	1.6	0.11	59.4
70 and over	10.0	2.4	0.24	67.7
D. Household type				
Married couple	13.4	1.2	0.09	50.4
Males, unmarried	13.6	1.1	0.08	36.3
Females, unmarried	6.8	0.6	0.09	36.1
E. Race or ethnicity				
White	13.8	1.3	0.09	52.9
African-American	5.4	0.3	0.05	19.8
Hispanic	5.0	0.3	0.06	20.4
Other	12.4	1.2	0.09	46.8

*Note: *Based on the Canton of Zurich.*

Source: Author's calculations from the 2016 SCF. The figures are based on the Swiss tax schedule as spelled out in Table 3 with brackets updated to 2016 dollars on the basis of the CPI-U.

The incidence of wealth taxes depends on the joint distribution of income and wealth. If the two were perfectly correlated, then everyone would experience a similar proportional increase in taxes (depending on the wealth tax schedule). However, income and wealth are not perfectly correlated. There are certain groups, such as the elderly, that have large wealth holdings but relatively small income. On the other hand, some young households may have high earnings but relatively

little wealth accumulation (the "yuppies"). This new tax may thus shift the burden away from young households onto elderly ones.

The Swiss wealth tax system is generally progressive with respect to income, rising from 0.4 percent for the second lowest income class to 2.2 percent for the highest bracket. The percentage increase in total taxes paid would also be generally higher for upper-income families than lower-income ones. Moreover, the fraction of families paying any wealth tax would rise with income level, from 15 percent for the lowest income bracket (under $15,000 of income) to 100 percent for the highest income class ($250,000 of income and over). The wealth tax is also highly progressive with respect to wealth. The only groups that would pay an additional 1 percent or more of income in federal taxes are the millionaires. Upper wealth families would also see a higher proportionate increase in total federal taxes paid. Very few families (only 4 percent) worth less than $100,000 in net wealth would pay any wealth taxes, whereas virtually all families above this amount would wind up paying some wealth tax.

In terms of wealth tax incidence by demographic characteristic, the wealth tax would fall more heavily on older households than younger ones. Wealth tax rates on income would rise monotonically with age group, from 0.2 percent for the youngest age group (age 34 and under) to 2.4 percent for the oldest (age 70 and over), and wealth taxes as a percentage of income taxes would also increase with age, from 3.1 percent for the youngest age group to 24 percent for the oldest. The share of families paying a wealth tax would likewise rise with age, from 13 percent for the youngest to 68 percent for the oldest age group.

Under a Swiss wealth tax system, married couples would face a slightly higher tax rate than unmarried males, and female households would be taxed at the lowest rate. A higher percentage of married couples would pay any wealth tax compared to unmarried male householders and unmarried female householders. All three groups would see their overall tax bill grow by about the same percentage (between 8 and 9 percent).

Non-Hispanic white families, on average far better endowed than minority families, would have paid considerably higher wealth taxes than blacks or Hispanics. The "other" group – mainly, Asian-Americans – would face a similar wealth tax burden to whites. Likewise, white and "other" families would have seen their tax bill rise proportionately more than the other two minority groups. Whereas 53 percent of white families would pay some wealth tax and 47 percent of others, only 20 percent of Hispanic and African-American families would be subject to this tax.

One can measure the effect of wealth taxation on inequality in three steps. First, figure out the inequality (based on the Gini coefficient) in the distribution of pre-tax income. Second, calculate the Gini coefficient of after-tax income resulting only from the imposition of the personal income tax. Third, compute the same

measure for after-tax income resulting from both the income tax and the Swiss wealth tax system. The distributional effect of the wealth tax will depend on its progressivity with respect to income, its magnitude, and the proportionate increase in taxes it generates by income class.

Among all families, the Gini coefficient for pretax income was 0.574 in 2016, while the Gini coefficient for income after income taxes was 0.532 (see Table 5). Adding the Swiss wealth tax to the personal income tax results in a further reduction of the Gini coefficient to only 0.528 (0.004 Gini point difference). The reason for this rather minimal effect is mainly the small amount of revenue generated by the Swiss-style wealth tax relative to income taxes (10.4 percent).

The distributional effect of the wealth tax systems did show some variation by age group, family type, and race. The equalizing effects of the wealth tax exerts greater influence within older age groups than younger ones. The reduction in the Gini coefficient from adding the wealth tax to the income tax rises systematically with age, from 0.001 Gini points for the youngest group to 0.008 points for the oldest. The effects are stronger among married couples than unmarried individuals: among married couples, the Gini coefficient declines by 0.005 Gini points when wealth taxes are added to income taxes, compared to a decline of 0.004 among unmarried men and 0.001 among unmarried women. The equalizing effect is also larger among white and other (mainly Asian) families (a 0.004-point reduction in the Gini coefficient) than among blacks and Hispanics combined (0.001 Gini points).

Table 5

*Distributional effects of the Swiss wealth taxation system by age group, family type and race (Gini coefficients), 2016**

		Age group				Family type			Race	
	All	**18-34**	**35-54**	**55-69**	**70+**	**Married couple**	**Unmarried male**	**Unmarried female**	**Whites and others**	**Blacks and Hispanics**
Pre-tax income	0.574	0.439	0.548	0.612	0.574	0.538	0.575	0.438	0.578	0.437
Original post-tax income	0.532	0.407	0.504	0.572	0.537	0.491	0.530	0.404	0.537	0.403
New post-income/ Swiss wealth tax	0.528	0.406	0.501	0.568	0.528	0.487	0.525	0.403	0.533	0.401

*Note: *Based on the Canton of Zurich.*

Source: Author's calculations from the 2016 SCF. See text for details on tax calculations.

3.3 ALTERNATIVE WEALTH TAX BASE

I have been assuming that total net worth is the correct base for a wealth tax. It is true that most wealth taxes that have been employed use this (or some small variant) as the base. However, there are other possibilities which might be fairer or, at least, more politically palatable. Table 6 shows the effects of altering the tax base on wealth tax collections. The base case is net worth (excluding vehicles). It is first of interest to note the concentration of tax collections by socio-economic characteristic. The top income class, which comprised 4 percent of all households, would account for 66 percent of total wealth taxes, and the top two income classes, which amounted to 20 percent of all households, would pay 86 percent of the total tax bill. The top wealth class, 1.7 percent of all households, would pay 66 percent of all wealth taxes, and the top two, 3.7 percent of households, 80 percent of the total taxes. Age class 55-69, 26 percent of all families, would account for 46 percent of wealth taxes. Married couples, 57 percent of all households, would pay 85 percent of all taxes, and whites, 70 percent of households, would contribute 92 percent of tax revenues.

Table 6

*Percentage change in total wealth tax collection from changes in the wealth tax base, 2016**

	Baseline total wealth tax revenue (billions)	Exclude				Add
		Home equity on principal home	Businesses	Trust funds	Defined contribution pension plans	Defined benefit pension wealth
All families	182.1	-17.0	-29.9	-3.8	-19.1	9.1
A. Income class ($)						
Under 15,000	3.6	-17.5	-59.0	-0.2	-3.9	1.4
15,000 – 24,999	1.7	-40.8	-20.0	-1.6	-13.7	8.8
25,000 – 49,999	3.7	-47.3	-8.7	-2.3	-22.5	43.6
50,000 – 74,999	6.1	-30.7	-16.4	-3.7	-28.3	35.1
75,000 – 99,999	7.7	-28.9	-16.9	-0.1	-30.8	25.7
100,000 – 249,999	33.1	-22.6	-19.6	-3.8	-30.6	19.7
250,000 and over	107.1	-12.2	-34.8	-4.3	-14.7	2.2
B. Wealth class ($)						
Under 100,000	0.0	-68.5	-2.7	0.0	-44.5	–
100,000 – 249,999	0.8	-71.5	-5.9	-0.4	-37.4	223.8
250,000 – 499,999	2.8	-60.5	-5.8	-1.8	-40.9	123.7
500,000 – 749,999	5.9	-57.9	-10.5	-1.9	-47.9	31.7
750,000 – 999,999	6.0	-40.9	-10.3	-2.4	-42.7	13.6
1,000,000 – 2,499,999	16.6	-23.9	-12.7	-1.7	-32.1	17.2
2,500,000 – 4,999,999	23.7	-25.0	-24.0	-2.1	-28.8	6.0
5,000,000 and over	107.2	-9.0	-36.9	-4.8	-11.3	1.0

	Baseline total wealth tax revenue (billions)	Exclude				Add
		Home equity on principal home	Businesses	Trust funds	Defined contribution pension plans	Defined benefit pension wealth
C. Age class						
Under 35	3.0	-12.3	-54.3	-9.5	-5.7	1.4
35-54	47.2	-17.7	-42.9	-3.0	-15.9	4.3
55-69	74.7	-16.9	-25.5	-2.8	-22.2	11.8
70 and over	38.1	-16.8	-20.7	-6.3	-18.1	10.3
D. Household type						
Married couple	138.0	-16.2	-30.3	-3.2	-19.8	8.5
Males, unmarried	14.9	-15.4	-38.0	-5.5	-11.8	7.2
Females, unmarried	10.2	-29.8	-12.8	-9.9	-20.6	19.8
E. Race or ethnicity						
White	150.2	-16.5	-28.8	-4.0	-19.6	8.8
African-American	2.5	-19.0	-46.1	-3.0	-18.5	43.4
Hispanic	2.2	-24.1	-58.2	-2.4	-8.1	6.2
Other	8.1	-24.1	-39.0	-0.3	-13.5	4.8
Memo: Post-income and wealth tax Gini coeff. for all households						
	0.528	0.528	0.529	0.528	0.529	0.528

*Note: *Based on the Canton of Zurich.*

Source: Author's calculations from the 2016 SCF. See text for details on tax calculations.

I alter the tax base in five ways. First, I exclude principal homes (and the associated mortgage) from the tax base. One reason for this is that homes are already subject to a local property tax. Total wealth tax revenues now fall by 17 percent. The lower income and wealth classes would get the most benefit (the largest percentage reduction in taxes owed), as would families over age 34, unmarried females, and non-whites. However, there is no perceptible effect on the after-income tax and wealth tax Gini coefficient.

Second, small businesses could be exempted from the wealth tax since they are particularly difficult to value and their inclusion is likely to be opposed by a powerful interest group. This exclusion would cause the total tax bill to fall by 30 percent. The main beneficiaries would be upper income and wealth households (who own most of the businesses), as well as young families and, surprisingly, Hispanics. This restriction would result in a slight increase in the post-tax Gini coefficient (a 0.0014 change). Third, trust funds might be excluded since they are generally excluded from the estate tax base. The overall reduction in the wealth tax bill would be tiny, at 3.8 percent. Once again the main beneficiaries would be upper income and wealth households, as well as the youngest and oldest age group, surprisingly unmarried females, and whites. This change, however, would have almost no effect on the post-tax Gini coefficient.

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Fourth, IRAs, 401(k) plans, and other defined contribution pension plans might be eliminated from the tax base, since they are not taxed for income tax purposes. Overall, total wealth taxes would decline by 19 percent. The groups that would gain the most (that is, experience the greatest reduction in wealth taxes owed) are middle income and middle wealth families, age group 55-69, and whites. This restriction would cause the after-tax Gini coefficient to rise by a very small 0.0006 points. Finally, we might add defined benefit pension wealth to the base since this is an important component of augmented wealth. This would add 9 percent to the wealth tax intake. Middle income families would be hit hardest, as would lower wealth families, age groups 55 and over, unmarried females, and African-Americans (43 percent increase in wealth taxes). Overall, there is almost no effect on the after-tax Gini coefficient.

4 THE WARREN WEALTH TAX AND EFFECT OF WEALTH TAXES ON WEALTH INEQUALITY

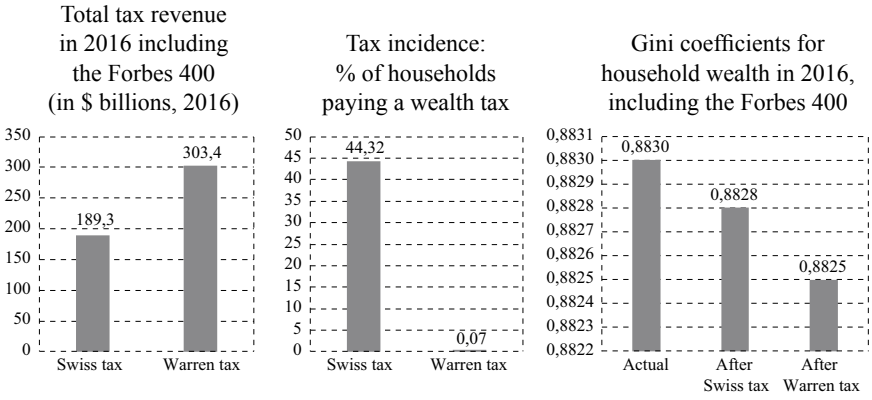
As noted above, Elizabeth Warren proposed a direct tax on household wealth in her presidential campaign. The structure is quite straightforward: there is a basic exemption of $50 million per family. The bottom bracket is 2 percent up to one billion dollars of net worth. The top bracket is 3 percent for one billion or more of net worth.

Let us first compare revenue effects. To do this, I first add data from the Forbes 400. In 2016, the combined wealth of the Forbes 400 is estimated to be $2.4 trillion (Forbes, 2019). Total household wealth in that year for all households is $84.1 trillion on the basis of the 2016 SCF. Thus, 2.86 percent of total wealth is excluded from the SCF. How does the inclusion of the Forbes 400 affect the estimate of total wealth tax revenue?

On the basis of the SCF data alone, the Swiss wealth tax would have yielded $182.1 billion in 2016. Including the Forbes 400 raises the amount to $189.3 billion, a rather small 4 percent increase (see figure 1, left-hand panel). The Warren wealth tax would have yielded $231.4 billion excluding the Forbes 400 and $303.4 billion including the Forbes 400. The Forbes 400 alone would have collectively paid $72.0 billion, or 23.7 percent of the total tax revenue. Including the Forbes 400, the ratio of total tax revenue between the Warren tax and the Swiss tax is 1.60. Another notable difference between the two taxes is their incidence. Whereas 44.3 percent of all families would be subject to the Swiss wealth tax, only a tiny 0.07 percent would pay the Warren tax (Figure 1, center panel).

FIGURE 1

Revenue, incidence and distributional effects of Swiss and Warren wealth taxes



Source: Authors' calculations.

What about the effect of these taxes on wealth inequality? The Gini coefficient for net worth based on the 2016 SCF data alone is 0.8771. The Gini coefficient drops to 0.8770 after application of a Swiss wealth tax and to 0.8768 after that of a Warren tax. In both cases, the effect is miniscule. When I now include the Forbes 400, the Gini coefficient for net worth rises to 0.8830 (Figure 1, right-hand panel). The Gini coefficient for net worth net of the Swiss wealth tax now falls by 0.0001 Gini points to 0.8828, almost exactly the same decline as before without the Forbes 400 included. Likewise, the Gini coefficient for net worth net of the Warren wealth tax declines by 0.0005 Gini points to 0.8825, also about the same reduction as before without the Forbes 400 included.

5 CONCLUDING REMARKS

The pronounced rise in wealth inequality since the early 1980s creates some urgency in policy remedies. The most telling statistic is that virtually all the growth in (marketable) wealth between 1983 and 2016 accrued to the top 20 percent of households (see Chapter 2 in Wolff, 2017). Indeed, the bottom 40 percent of households saw their wealth decline in absolute terms. This was compounded by the stark reality of a growing proportion of households with zero or negative net worth.

What, if anything, should be done about this? If one policy goal is to moderate the rising inequality of recent years, direct taxation of wealth is one proposed remedy. This would compensate for the reduced progressivity of the income tax system. The years since 1980 witnessed falling marginal tax rates on income, particularly for the rich and very rich. The top marginal tax rate fell from 70 percent in 1980 to 35 percent in 2012, though it was then raised to 39.6 percent under President Obama.

What do the simulation results of Section 3 suggest regarding a Swiss-style wealth tax? First, the current personal income tax system of this country helps mitigate the disparities in earnings, but its overall effects are modest. Second, the Swiss

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wealth tax system would have increased total tax revenues (over and above the personal income tax) by only 10 percent in 2016 – too small to have much distributional impact. Third, the wealth tax would have some desirable features from a demographic standpoint. It falls proportionately more on older families than younger ones; more on married couples than singles; and more on whites and Asians than blacks and Hispanics. Moreover, the equalizing effects of the wealth tax would be greater among older families, married couples, and whites.

Fourth, the rather modest Swiss-style system would have yielded an additional $189.3 billion of revenue in 2016, including the Forbes 400. However, in 2016 only 11 percent of families would have seen their federal tax bill rise by more than 10 percent and only 8 percent would have paid an additional $500 or more of taxes. In conclusion, a direct wealth taxation system like Switzerland's could ease the country's budgetary strains and provide greater equity across generational, racial, and familial categories. These characteristics argue in favor of its adoption in the United States.

Besides its desirable effects with regard to equity and revenue, are there any other characteristics of wealth taxation in its favor? Two other arguments have been advanced in support of a wealth tax. First, beyond considerations of overall ("vertical") equity, some have argued that a wealth tax can be justified in terms of "taxable capacity". Income alone is not a sufficient gauge of well-being or of the ability to pay taxes. The possession of wealth, over and above the income it yields directly, must be figured into the calculation. Two families with identical incomes but different levels of wealth are not equivalent in terms of their well-being, since a wealthier family will have more independence, firmer security in times of economic stress (such as occasioned by unemployment, illness, or family breakup), and readier access to consumer credit. Greater wealth thus confers on the affluent family a larger capacity to pay taxes; in the interests of "horizontal equity", wealth should be taxed along with income.

A second argument is that an annual wealth tax may induce individuals to transfer their assets from low-yielding to high-yielding investments, in order to offset the additional taxes. For example, a wealth tax might induce individuals to seek more income-generating assets in place of conspicuous consumer durables such as luxury cars and yachts.

It should be noted, too, that existing wealth taxation in this country works poorly. The estate tax has historically been extremely porous. The thresholds have been raised over time (from $50,000 in 1916, when the estate tax was first instituted, to $5.25 billion for singles and $10.5 billion for couples in 2016), so that only a very small percentage of estates (typically on the order of 1 or 2 percent) have been subject to estate tax. The threshold is currently indexed to the CPI-U and will continue to rise over time. Estate taxes on assets can even today be avoided altogether by setting up a trust fund. Moreover, gift exclusions allow a considerable

amount of wealth to be passed on exempt from taxation before death. Finally, the estate tax system has a provision that capital gains on assets are "forgiven" at death. This loophole by itself probably more than equals the total revenue collected by the estate tax system.

What are the counterarguments? Perhaps the strongest one is that direct wealth taxation will inhibit savings and lower capital investment. One unavoidable implication of wealth taxation is that the (after-tax) return to capital will be lowered. By exerting a strong disincentive on the already low U.S. savings rate, it may simply encourage increased consumption. Another possibility is that a wealth tax, by lowering the after-tax rate of return on financial assets, may encourage families to invest in nonfinancial assets, such as certain forms of real estate, collectibles, luxury items, and the like. The search for greater opacity to thwart the IRS could perversely result in household portfolios being shifted to unproductive uses; though, as suggested above, one can reasonably argue the opposite case – that taxing both income-yielding and non-income-yielding forms of wealth will induce households to shift to higher-yielding assets.

A second potential problem stemming from a wealth tax is capital flight. This argument applies to every tax, however, and if capital indeed moved like quicksilver, it would render any taxation of capital and wealth all but impossible. The very fact that the wealth tax proposal presented above is based on the Swiss model suggests that capital flight is unlikely to be a serious concern. Like Switzerland, the United States is a safe haven for international wealth, a status unlikely to be threatened by the very low wealth tax rates suggested here.[15]

The time is now ripe for the introduction of a personal tax on wealth holdings. The statistics point to an enormous degree of inequality in household net worth in this country today. On the grounds of (horizontal) equity, a combination of annual income and the current stock of wealth provides a better gauge of the ability to pay taxes than income alone. Moreover, such a tax may induce a more efficient allocation of household wealth, toward more productive uses.

What about the additional administrative burdens such a tax might create for families and the IRS? The wealth tax would be fully integrated with the personal income tax. The same tax form could be used for both. The family would be required to list the value of all assets and debts on a new subsidiary form (say, "Schedule W"). Verification of most of the assets and debts would be administratively easy to implement. Insofar as banks and other financial institutions provide records that list interest and dividend payments (Form 1099) to the IRS, such documents could be modified to include the value of the accounts as of a certain date (say, December 31). Moreover, financial institutions that provide the IRS with information on mortgage payments could now add the value of the outstanding

[15] Piketty (2014) has proposed a unified wealth tax across countries to address the problem of capital flight.

mortgage. Other types of loans (and loan payments) could be similarly recorded by these institutions. Insurance companies could provide the IRS with statements on the value of life insurance equity (they already send these to individuals).

The two main stumbling blocks are the current market value of owner-occupied housing (and other real estate) and the valuation of unincorporated businesses. For the former, there are several possible solutions, some of which are currently in use in other countries. The family could be asked to estimate the current market value (as is now done in household surveys). Alternatively, it could be asked to list the original purchase price and date of purchase, and the IRS could use a regional (or locale-specific) price index based on housing survey data to update the value. Another method would ask residents to provide the figure for assessed valuation of the property, and the IRS could provide a locale-specific adjustment factor, based on periodic survey data, to estimate current market value.

For unincorporated businesses, the simplest technique is to accumulate the value of individual assets invested in the business over time (these figures are already provided in Form C of the personal tax return). Another possibility is to capitalize the net profit figures (also provided on Form C), as the Swiss currently do.

Thus, for almost all families, record-keeping for the wealth tax will be fairly straightforward. For the very rich, with complex portfolios, there will be additional burdens on record-keeping but almost all such families already pay accountants to handle such tax matters.

On the administrative side, there will be additional costs incurred by the IRS to administer such a (new) tax. However, one saving grace is that the IRS does not have to re-invent the wheel. Most of the "machinery" is now in place since many of the procedures needed by the IRS to value asset holdings already exist for the federal estate tax and the estate tax code has been around for over 100 years.

Another concern is the extent to which a universal system of monitoring the assets of the entire population is acceptable to a liberal economy such as the United States in comparison to European economies and their citizens, who are more accustomed to greater control and influence by the state in society. However, it is not clear that a wealth tax will be viewed as any more intrusive than an income tax, which has also been in use in the United States for over 100 years. Also, as noted above the federal estate tax has also been around for over a century and this tax also entails a fairly extensive accounting of individual wealth holdings.

One might also consider some of the behavioral response of individuals and families to the imposition of a wealth tax.[16] First, there is the initial shock at the time of introduction of the tax. If the wealth tax is not anticipated, current holders of

[16] I would like to thank an anonymous referee for pointing out these issues.

assets may be forced to sell some of their assets at a discount in order to pay the wealth tax, particularly those people that have disproportionately high value assets compared to their current income. If so, they may be forced to sell the property at a (significantly) lower price than current market value, which means that a noteworthy portion of future taxes will be shifted (transferred) to the current owner of that property. As a result, current owners may bear the additional burden of the future owner-taxpayers after the price adjustment.

Second, as noted above, a wealth tax system opens the possibility (or at least induces) that existing properties be transferred to more productive uses – for example, to buy shares or stocks or to invest in entrepreneurial activity. However, this consideration neglects the government's ability to tax only the registered part of the property (savings in banks, stocks, real estate, vehicles, vessels, and so on). Available assets can be transformed into other forms (for example, artwork or jewelry) that are not likely to be taxed because the government does not keep records of their purchase. Moreover, as with an estate tax, the wealth tax could also be avoided through the establishment of trusts and even foundations.

Third, as I noted above, there are problems of identifying and continuously updating the value of the various assets held by a family, particularly real property and small businesses. What would be the impact of these difficulties on the fairness (or equality) of such taxes on taxpayers? Some taxpayers will avoid significant tax obligation either because of successful concealment of their assets or because of the inability of the tax administration to value them properly, while others may not be able to prove that their property is worth less than the tax administration estimates. Above, I suggested some solutions to these difficulties as used by other countries. The IRS likewise confronts many of these issues when auditing estate tax returns. Nonetheless, these difficulties may make many taxpayers feel that the wealth tax is unfair.

Despite these concerns, a wealth tax may make a lot of sense as an additional fiscal tool. If so, calculations show that a Swiss-based tax structure would yield an average tax rate on household wealth (as of 2016) of only 0.19 percent. Previous work indicates that the annual real rate of return on household wealth over the period from 1983 to 2016 averaged 3.1 percent per year (see Chapter 3 in Wolff, 2017). Thus, the new tax regime would reduce the average yield on household assets by only 6.2 percent. Even the top marginal tax rate of 0.3 percent would reduce the average yield on personal wealth by only 9.7 percent. These figures suggest that disincentive effects, if any, on personal savings would be very modest.

The proposed wealth tax would affect a very small percentage of the population. Only 11 percent of American families would see their overall personal tax bill (combining income and wealth taxes) rise by more than 10 percent. Only 15 percent would pay $500 or more of additional taxes. A full 56 percent would fall below the wealth tax threshold and would therefore be exempted from paying.

A substantial $189 billion would have been raised from levying such a tax in 2016. This is not a large amount, representing 5.8 percent of total federal tax receipts. However, on the margin such additional revenue could be critical. A direct annual tax on personal wealth could thus be a valuable addition to the fiscal toolbox.

The proposed Warren wealth tax would raise more tax revenue than the Swiss tax – $303.4 billion versus $189.3 billion. Moreover, only 0.07 percent of American households would pay any wealth tax, compared to 44.3 percent with the Swiss tax. How do the Swiss and the Warren wealth tax affect overall wealth inequality? On the basis of the Gini coefficient, there would be virtually no impact from either tax. Of course, the Gini coefficient by construction is not very sensitive to changes in the upper tail of the wealth distribution, particularly the very upper tail. It is much more sensitive to changes in the middle of the distribution. However, the main reason is that neither tax produces much tax revenue relative to total household wealth. So, if one objective of a wealth tax is to substantially reduce wealth inequality, neither of these taxes will make much of a dent in the high degree of wealth concentration.

One other point of comparison is with regard to the top marginal tax rate. The top marginal tax rate for the Swiss tax is 0.3 percent in comparison to 3 percent for the Warren tax. As argued above, the top Swiss tax rate is not likely to induce much if any capital flight. However, the top rate for the Warren tax would reduce the after-tax rate of return on investments by 97 percent if top households received the average real rate of return of 3.1 percent per year on household wealth. This might be viewed by many very rich households as "confiscatory" and would be likely to induce considerable capital flight.

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No potential conflict of interest was reported by the author.

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What drives banks' appetite for sovereign debt in CEE countries?

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Abstract

In this paper, we provide the first analysis of the level and determinants of sovereign exposure of banking systems in Central and Eastern European (CEE) countries, thus contributing to the existing literature on sovereign exposures and the sovereign-bank nexus. Results of descriptive analysis showed that exposure to sovereign debt securities in CEE countries is substantially higher than in euro area countries, which can be explained by the lower development of financial markets in this region. We also found evidence of home-bias in CEE and emphasized the role of different monetary policy regimes in explaining differences in exposure among CEE countries. Results of panel analysis showed that changes of debt securities in bank balance sheets in CEE countries are mostly determined by broader macroeconomic conditions and to a lesser extent by their regulatory frameworks. In addition, we did not find evidence of so-called reach-for-yield behaviour. Our results indicate that efforts to reduce sovereign exposure in CEE countries require strong collaboration of not only regulators, but also of fiscal authorities and other policy makers able to contribute to the development of financial markets in this region. Moreover, regulators should especially focus on reducing the home-bias in CEE.

Keywords: sovereign-bank nexus, banks' exposure to sovereign debt, CEE, panel regressions

1 INTRODUCTION

The European sovereign debt crisis, triggered by the global financial shock of 2008, exposed the strong links between European banks and governments, which became known popularly as the "sovereign-bank nexus".

The sovereign-bank nexus operates through various channels. According to Dell'Ariccia et al. (2018), banks hold large amounts of sovereign debt on their balance sheets so they are not only directly exposed to sovereign risk but also play an important role in financing government needs. Next, an increase in sovereign risk lowers the government's ability to assist the banking system if it runs into trouble, thereby hurting banks, while on the other hand, banking crises lead to costly resolution policies with negative effects on fiscal balances. Finally, increases in sovereign risk have contractionary effects on economic activity and can lead to losses and weakening of banks' capital position, which negatively affects banking system stability. Regardless of the channel, countries the banking systems of which have greater exposure to sovereign debt a have higher risk of the negative "doom loop" between bank risk and sovereign risk (Alogoskoufis and Langfield, 2018).

Thus, the problem of bank exposure to sovereign debt has come to the top of the agenda for European policy makers and regulators in recent years. Regulation (EU) no 575/2013 brought important changes in the treatment of sovereign debt securities in bank balance sheets as, according to this new regulation, risk weight of 0% can be applied only for local currency and not all sovereign debt securities.

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In 2015 the European Systemic Risk Board (ESRB) published a detailed analysis and discussion of the regulatory treatment of sovereign exposures (ESRB, 2015). In 2017 the European Parliament intensively discussed the proposal of regulatory disincentives against highly concentrated sovereign exposures of the euro area banking system in 2017 (Veron, 2017). Also, as Veron (2017) and Gros and de Groen (2018) stress, reduction of sovereign exposure in banks is one of the key elements and goals of the Banking Union. Therefore, although there is still no consensus on the new regulatory framework, we can expect that the completion of the Banking Union will bring various regulations and a mechanism aimed at breaking the bank-sovereign vicious circle (Schnabel and Veron, 2018).

Problems of sovereign exposure and the sovereign-bank nexus have also attracted the attention of the academic community. The research papers that address these problems have grown rapidly in number in the past decade, especially focusing on the euro area as a whole or periphery countries (e.g. De Bruyckere et al, 2013; Battistini, Pagano and Simonelli, 2014; Schnabel and Schüwer, 2017; Gomez-Puig, Singh and Rivero, 2019).

However, to our knowledge, there is no research concentrating on Central and Eastern European (CEE) countries, although the exposure of banks in the CEE region to sovereign debt is substantially higher than in most other EU and euro area countries. In addition, current discussions on sovereign exposures in the euro area will become even more relevant for those CEE countries that are preparing to join the ERM II and the euro area in the near future[1]. In this paper we seek to fill this gap in the literature by analysing the degree of exposure of banking systems in CEE to sovereign debt and by investigating the main determinants of banks' appetite for sovereign debt securities in this region.

This paper addresses two main research questions. First, why are banks in the CEE region more exposed to sovereign debt than euro area countries? Second, which theories of bank behaviour can explain the motivation for banks in the CEE region to accumulate sovereign debt in their balance sheets? These questions have not yet been posted in the literature. Besides the fact that this paper represents some pioneering research on banks' exposure to sovereign debt in CEE countries, we also contribute to the literature by expanding the set of potential explanatory variables of bank exposure to sovereign debt and by focusing on macro-level analysis, while most previous research has been based on bank-level micro data.

The following section presents a brief overview of factors that affect banks' appetite for sovereign debt securities. The third section provides an exploration of the level of bank balance sheet exposures to sovereign debt in CEE countries. The fourth section presents data and methodology, while the fifth provides discussion

[1] Bulgaria and Croatia have each sent a letter on participation in ERM II, while Romania has prepared the strategy on euro adoption.

of the empirical results. The paper ends with conclusions, based on descriptive analysis and econometric results.

2 WHY WOULD BANKS WANT TO HOLD SOVEREIGN DEBT SECURITIES?

Governments can borrow funds through various instruments, such as loans provided by local banks, bonds issued on the domestic bond market, international bonds and loans provided by international banking groups (Bajo, Primorac and Andabaka Badurina, 2011). In all these cases banks play important roles as they directly (by accumulating debt in their balance sheets) or indirectly (e.g. through the role of investment banks) finance the increasing financing needs of governments. However, in this paper we focus only on one instrument, debt securities, as the conceptual framework of our analysis is based on the "sovereign-bank nexus" that emphasizes the role of debt securities in bank balance sheets. So why would banks want to hold sovereign debt securities in their balance sheets?

Firstly, sovereign debt securities represent attractive assets to satisfy bank liquidity requirements, along with other important regulatory liquidity standards. This factor implies that banks are motivated to hold government debt due to regulatory requirements (Dell'Ariccia et al., 2018). In addition, the Basel Committee standardized approach to credit risk provides a widely used regulatory exemption that allows banks to apply zero risk weight to domestic government bonds in the local currency, whatever the sovereign risk, making them more attractive to banks (Acharya and Steffen, 2015). Rocamora (2018) refers to the importance of the so-called "flight to safety" effect that occurs when banks increase their preference for risk-free assets during times of crisis. Sovereign debt securities are also often used as collateral and are used in central bank open market operations (Brutti and Sauré, 2016). Similarly, Horváth, Huizinga and Ioannidou (2015) draw attention to cases in which central banks "create" additional demand for government bonds by accepting certain types of bonds as collateral for repo operations. Next, weak institutions and poor enforcement of creditor rights hamper the supply of financial assets by the private sector, so government debt may provide a store of liquidity to transfer idle resources to future use Dell'Ariccia et al., 2018). In addition, banks may hold debt securities as a part of an opportunistic strategy or so-called reach-for-yield behaviour (Altavilla, Pagano and Simonelli, 2016; Lamas and Mencia, 2018). Similarly, ESRB (2015) indicates that banks can also engage in carry trades during crises, meaning that they borrow at relatively low interest rates in the capital market of non-stressed countries to invest in the comparatively higher-yielding sovereign bonds of stressed countries.

As for other factors, Schnabel and Schüwer (2017) highlight the strong bias of banks to local government debt as an important determinant of the level of banks' exposures to government, and this view is also shared by some other authors (Schneider and Steffen, 2017; Dermine, 2018). Moreover, Asonuma, Bakhache and Hesse (2015) conclude that such home bias could postpone fiscal consolidation until after it is too late to avoid a crisis.

The collection of literature addressing credit crunches – which in some cases might be caused by government borrowing crowding out the private sector – also reflects some aspects of banks' preference for government debt. In this regard, Shetta and Kamaly (2014) explore the "lazy bank hypothesis", which suggests that governments with high financing needs discourage banks from granting riskier loans to the private sector in favour of government debt.

Finally, Dell'Ariccia et al. (2018) show that stronger economic growth encourages banks to increase lending to the private sector. On the other hand, in times of recession demand for private sector loans could be subdued, which leaves sovereign debt as the only investment opportunity for banks. Similarly, ESRB (2015) points out that any worsening of macroeconomic and fiscal conditions in some countries can lead local banks to absorb more domestic sovereign debt as "buyers of last resort" (Gros, 2017), because of moral suasion by governments or for the motive of self-preservation (to prevent the sovereign default that could lead to systemic crisis). These results indicate that macroeconomic and fiscal conditions strongly affect bank behaviour.

3 SOME STYLIZED FACTS ON BANKS' EXPOSURE TO SOVEREIGN DEBT IN THE CEE REGION

As previously noted, in this paper we focus on debt securities held by local banks because the conceptual framework presented in the previous section indicates that debt securities are the key concept in the sovereign-bank nexus literature[2]. However, before we continue with the analysis it is important to define the concept of debt securities. In this paper we use ECB Statistical Warehouse Database (SDW) data on debt securities held by banks, which are defined according to ESA 2010 methodology (AF.3). Local banks can hold both, domestic sovereign securities and eligible foreign sovereign securities. We discuss the structure of securities held by banks in CEE countries below, but first we start with data on the level of exposure.

In that regard, motivation for this analysis largely came from data presented in Figure 1. This figure shows the average share of sovereign debt securities in bank total assets in twenty-five members of the European Union (EU)[3] in the period from 2006 to 2018[4]. The data presented indicate that in most CEE countries there are substantially higher shares of sovereign debt securities in banks' balance sheets than there are in other EU countries. Slovakia, Hungary, Romania, Poland, Slovenia and Czechia are the countries with the highest shares, ranging between 12% and 17% of total assets. Although the share is somewhat less pronounced in Bulgaria (6.6%) and Croatia (7.7%), these countries are still above the median of the EU (6% of total assets). The right side of the figure shows that median share

[2] However, to get a complete picture on banks' exposure to sovereign debt one should also include data on loans to general government units. In addition, many banks are indirectly exposed to sovereign risk through assets of pension funds as banks are usually founders of pension funds.

[3] Data for Lithuania, Estonia and Latvia not available.

[4] ECB SDW data on sovereign debt securities held by banks for most CEE countries are available only from 2006.

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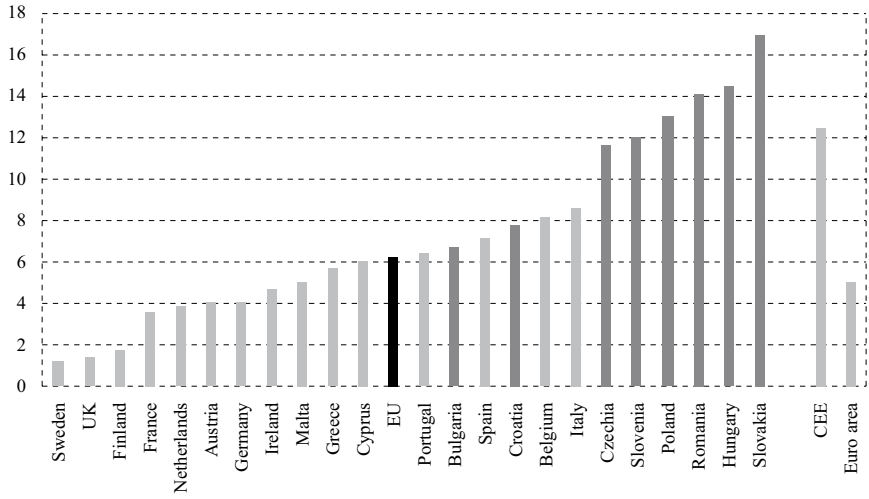
of debt securities in total assets of banks in CEE countries stands at around 12.5%, which is 2.5 times as much as that of the euro area countries (5% of total assets). Such differences clearly provoke research interest.

Figure 1

Share of sovereign debt securities in total assets (%), average 2006 to 2018 in the EU



Source: ECB SDW.

However, although surprising at first, these differences should be interpreted in terms of the level of economic development. As pointed out by Gennaioli, Martin and Rossi (2018), banks operating in less developed countries tend to have shares of government debt in their balance sheets during normal times that are high compared to those in more developed countries. Dell'Ariccia et al. (2018) explain that less developed countries also tend to have less developed financial markets, which limits (private) investment opportunities so sovereign debt securities play important role in financial markets.

Figure 2 shows the relation between level of economic development, measured by GDP per capita in PPS (EU 28=100) and the share of sovereign debt securities in total assets. Fitted line points to a relatively strong negative relation between the level of development and sovereign exposure, in line with the previous discussion. This additionally confirms the relevance of our focus on a relatively homogeneous group of CEE countries in terms of the level of economic development. The figure also indicates that we can identify three "clusters" of countries. The first cluster (black fill) includes CEE countries, which are in the focus of this analysis. The second cluster (no fill) includes the so-called PIGS countries (acronym for Portugal, Italy, Greece and Spain), Malta and Cyprus, most of which were in the focus of previous research (e.g. De Bruyckere et al, 2013; Battistini, Pagano and Simonelli, 2014; Schnabel and Schüwer, 2017; Gomez-Puig, Singh and Rivero, 2019),

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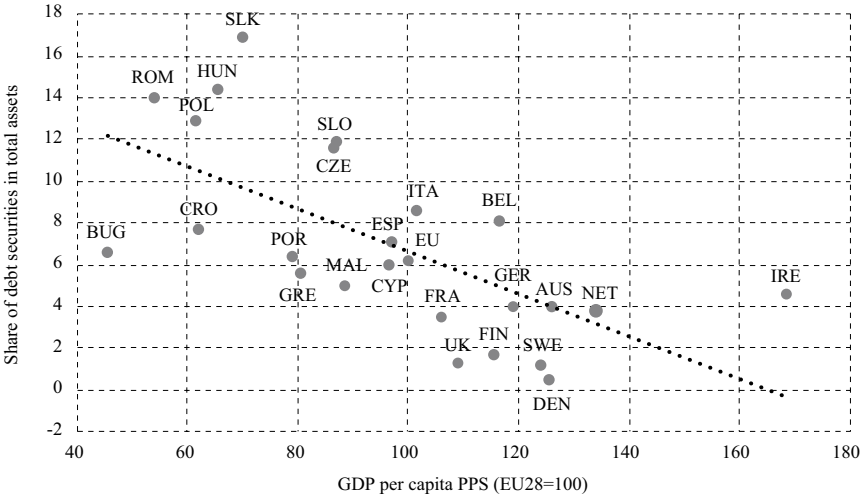
as these countries were in the centre of the European debt crisis. The third cluster (grey fill) includes most of the developed old-members of the EU, with low shares of sovereign debt securities in bank total assets.

Figure 2

Level of development and the share of sovereign debt securities in total assets (%) (average 2006 to 2018)



Source: ECB SDW; Eurostat.

Using the fitted line, we can compare the recorded shares of sovereign debt securities in total assets with the share suggested by the level of economic development. In this context, the figure shows that Slovakia, Hungary, Slovenia, Czechia, Poland and Romania have excessive shares of debt securities in their balance sheets, while the share in Bulgaria and Croatia is below the share suggested by the level of economic development. Thus, we can conclude that sovereign exposure in most CEE countries is very marked, even after taking into account the level of development.

It is also interesting to notice that Bulgaria and Croatia have a relatively low share of sovereign debt securities in total assets, compared to CEE peers. This can be, at least partially explained, by the fact that these countries operate under specific monetary policy regimes (peg and quasi-peg) while other CEE countries operate under inflation-targeting regimes (IT). The key difference between these monetary policy regimes is that in IT regimes sovereign debt securities play one of the key roles in the monetary policy transmission mechanism as eligible securities in repo operations that are usually a dominant monetary policy instrument in IT countries. On the other hand, in (quasi-)peg countries the key policy instruments are foreign exchange interventions, where sovereign debt securities do not play an important role. Box plots and mean differences tests presented in the Appendix confirm the significant difference in exposure to sovereign debt securities between non-IT and IT countries in the CEE region.

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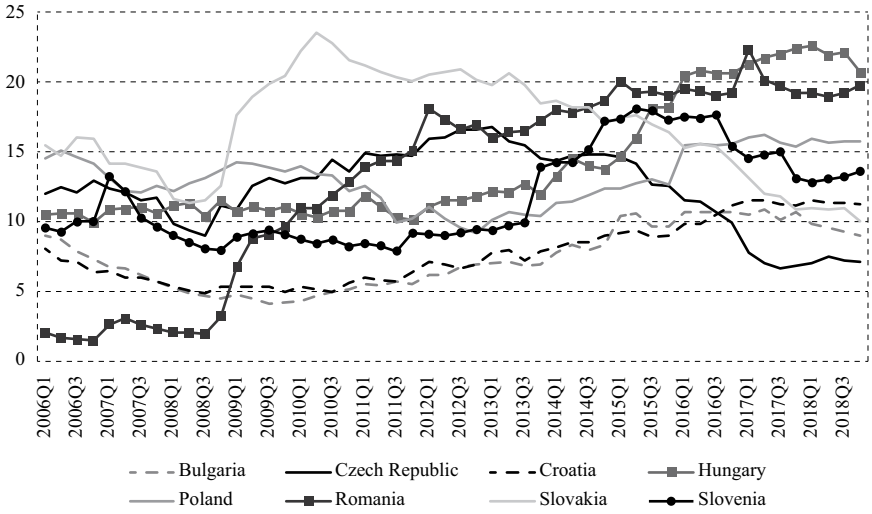
Next, we focus on the dynamics of the share of sovereign debt securities in total bank assets in CEE countries from 2006 to 2018. Figure 3 shows that the share of sovereign debt securities in total bank assets in the observed period increased in most CEE countries, with the strongest rise recorded in Hungary and Romania. In most countries the share of debt securities stayed on pronounced levels in the post-crisis period, except for Slovenia, Slovakia and Czechia. In these countries banks gradually decreased the exposure to sovereign debt. In Slovakia and Slovenia, this reduction can be explained by effects of the asset purchases program in the euro area launched in 2015[5]. On the other hand, trends in Czechia could be a result of the decision made by the Czech National Bank in 2015 to start applying an internal methodology for reviewing and evaluating the risk of systemic concentration of sovereign exposures under Pillar 2[6] (CNB, 2018).

FIGURE 3

Share of debt securities in total assets in CEE 2006-2018 (%)



Source: ECB SDW.

Finally, we turn to the structure of debt securities held by banks in CEE countries as the structure of sovereign debt holdings can also give useful information on banks' motives for holding sovereign debt. Figure 4 shows that domestic securities play a dominant role in all CEE countries, with the lowest average share of domestic securities in Croatia and Slovenia standing at the still high 87% and 70%, respectively. The relatively low share of domestic securities in Croatia can be explained by the Croatian domestic bond market having been relatively underdeveloped, with the government massively relying on external financing in the past. However, supply of domestic debt notably increased after 2010, leading to an increase in the share of

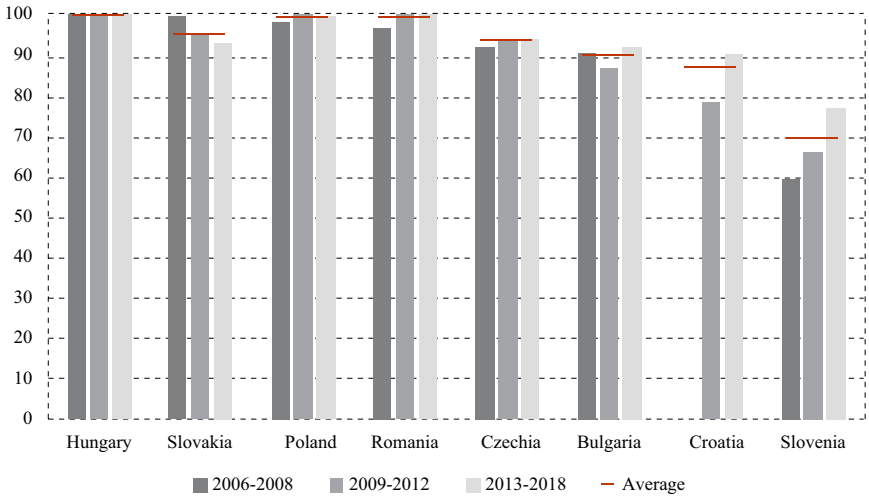
[5] Bechtel, Eisenschmidt and Ranaldo (2019) show that banks swap sovereign debt securities for reserves.
[6] Pillar 2 refers to bank-specific requirements imposed by the supervisor in addition to the generally applicable Pillar 1 (minimum capital requirement).

domestic sovereign securities in banks' balance sheets. Also, there were changes in asset-liability (A/L) requirements that led Croatian banks to reduce exposure to foreign debt securities, while Regulation (EU) no 575/2013 also motivates banks in Croatia to hold more domestic debt. As for Slovenia, the low share of domestic debt is mostly the result of a substantial increase in euro area securities in bank balance sheets in 2007, when Slovenia joined the euro area.

Thus, we can conclude that there is a clear case of home bias in CEE countries (see also Gereben, 2016). As Horváth, Huizinga and Ioannidou (2015) stress, home bias can be either voluntary or involuntary. In our view, home bias in CEE can be explained by both factors, as banks' decisions on the structure of debt securities portfolio depend on the level of development (size and liquidity) of domestic bond market, supranational and national regulations, supply of domestic debt, monetary policy instruments[7], yield differentials etc.

Figure 4

Share of domestic debt securities in total debt securities held by banks (%)



Source: ECB SDW.

In the methodological part of the analysis, presented in the next section, we use data on total sovereign debt securities held by banks, as we do not expect that splitting the bond holdings into the domestic and the euro area part will affect results due to pronounced dominance of domestic bond holdings in most countries[8].

[7] For example, the Hungarian National Bank announced a new interest swap facility in April 2014 that was designed to provide incentives to Hungarian banks to hold additional domestic public debt.

[8] Data on the structure of domestic bond holdings (LCY, FX, FX-linked) are not available.

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4 DATA AND METHODOLOGY

Having shown that banks in the CEE region are strongly exposed to sovereign debt, in this section we turn to the question of what drives their appetite for debt securities. We focus on various fiscal, economic and regulatory determinants important for understanding sovereign exposures in CEE countries.

4.1 DATA

As mentioned above, our sample includes eight Central and Eastern European (CEE) countries – Bulgaria, Croatia, Czechia, Hungary, Poland, Romania, Slovakia, and Slovenia. Due to limited data availability, the time dimension of our sample includes quarterly data from Q1 2006 to Q4 2018. To make our methodological approach more clear, in this subsection we group data in three main categories, dependent variable, main explanatory variables and control variables (graphical representation of control and explanatory variables is presented in the Appendix).

The dependent variable in our analysis is the yearly change in sovereign debt securities, calculated from ECB SDW data. As previously noted, debt securities are defined according to ESA 2010 methodology (AF.3) and we use total debt securities (domestic and euro area) held by banks.

Choice of our explanatory variables is based on the conceptual framework presented in Section 2. Following the literature cited in this paper we investigate which of the most common theories on banks' motivation for holding government debt can explain sovereign exposure in CEE countries.

To test the *deficit absorption hypothesis,* we use data on fiscal deficit (fiscal balance multiplied by -1) as a share of GDP, retrieved from Eurostat[9]. According to this hypothesis, rising deficits lead to higher financing needs and thus to a higher supply of government debt on domestic markets. In such circumstances banks act as "buyers of last resort" (Gros, 2017) or residual buyers of government debt ESRB (2015). To test the robustness of our results in the analysis we change deficit figures with change in public debt (obtained from Eurostat) as a proxy of *deficit* developments.

Next, we test the *reach-for-yield hypothesis*, based on data on yields on ten-year domestic government bonds, retrieved from Eurostat (convergence criteria interest rates). Higher yields are attractive for banks because they can improve their PNLs (profit and loss statements) and interest margins, especially if yields are higher than suggested by macroeconomic fundamentals as in such situation there is no real trade-off between risk and return (Altavilla, Pagano and Simonelli, 2016; Lamas and Mencia, 2018). As we use data on yields on domestic government bonds we also indirectly test the potential *carry trade behaviour* of CEE banks as these banks have access to favourable funding on core euro area markets,

[9] Due to volatility in the series we calculated four quarter moving averages.

which could have been used for investments in relatively high-yield bonds in some CEE countries, especially during the crisis. To test the robustness of our results and gain a better understanding of bank behaviour, in our models we change yields with spreads calculated over a German ten-year government benchmark bond yield, also obtained from Eurostat.

As for the *lack of opportunities hypothesis*, we use data on lending to the corporate sector as an indicator of the main alternative investment opportunity for banks. More precisely, we use data on yearly changes in loans to non-financial corporations from ECB SDW. If there is falling demand for corporate loans, banks will be motivated to invest more in sovereign debt (Dell'Ariccia et al., 2018). Also, the relation between changes in sovereign debt securities and corporate loans can provide some insights into the *lazy bank hypothesis* (Shetta and Kamaly, 2014).

The *Regulatory "arbitrage" hypothesis* and the *flight to safety hypothesis* indicate that banks are motivated to invest in sovereign debt in order to improve their capital adequacy ratios, which is mostly pronounced during a crisis (Acharya and Steffen, 2015; Rocamora, 2018). Thus, we expect a positive relation between CAR and sovereign debt securities. Data on CAR are obtained from IMF Financial Soundness Indicators Database[10].

Finally, according to ESRB (2015) and Dell'Ariccia et al. (2018) GDP developments, as an indicator of broader *macroeconomic conditions*, can have notable effect on bank behaviour. During expansions, fiscal deficits are low and demand for private credit is strong, which demotivates banks from investment in sovereign debt securities. On the other hand, negative GDP growth rates during recessions are strongly related to higher deficits and lower demand for private credit, which can motivate banks to increase their exposure to sovereign. Thus, in our analysis we use calendar-adjusted GDP growth rate from Eurostat to investigate the effects macroeconomic conditions on banks' investment in sovereign debt securities. However, as GDP growth rate is strongly related to deficits and demand for private credit, we do not include these variables in same models.

Finally, as regulators monitor sovereign exposures, as an indicator of the level of exposure we include data on the share of sovereign debt securities in the previous period. Here we expect that higher exposures in the previous period should reduce the growth rate of sovereign securities in banks' balance sheets. We treat this variable as a key control variable in our models.

A description of data and sources, along with expected effects of all explanatory variables on dependent variable, is presented in Table 1.

[10] We could not retrieve methodologically comparable data on capital adequacy ratios for all quarters in some countries. Thus, our models are unbalanced.

Table 1
Data description

Category	Variable	Unit	Source	Expected effect	Mechanism
Dependent variable	Sovereign debt securities	% change	ECB Statistical Data Warehouse		
Main explanatory variables	Budget deficit Change in public debt	% of GDP	Eurostat	+	Rise in deficit increases financing needs of the government, which leads to higher supply of government bonds.
	Yields Spreads	%	Eurostat	+	Higher yields on local government bonds make them more attractive for banks.
	Capital adequacy ratio (CAR)	%	IMF Financial Soundness Indicators	+	Banks are motivated to hold debt securities to improve their CAR.
	Private sector loans	% change	ECB Data Warehouse	–	Rising of corporate loans indicates that banks see investment opportunities in private sector.
	GDP	growth rate %	Eurostat	–	Stronger GDP growth has positive effect on demand for loans from private sector, i.e. during expansions banks have more investment opportunities.
Control variables	Exposure	%	Eurostat	–	Higher exposure to sovereign debt in previous period reduces the absorption capacity for additional sovereign bonds in banks' balance sheets.

Source: Authors.

4.2 METHODOLOGY

Most empirical papers that focus on determinants of banks' sovereign exposure use bank-level micro data for the country of interest (e.g. Lamas and Mencia, 2018; Gomez-Puig, Singh and Rivero, 2019). In this paper we follow an alternative approach presented in Dell'Ariccia et al. (2018) where authors use country-level panel regressions to investigate the determinants of banks' government debt holdings in the panel of developed and emerging markets. However, our model

differs in having a broader selection of explanatory variables[11] and a focus on a relatively homogenous group of countries.

Before selecting the appropriate model, we employed several identification tests[12]. According to the Lagrangian multiplier test (Breusch and Pagan, 1980) a random effects estimator was not appropriate, while the F-test for fixed effects model confirmed that the fixed effect model is suitable for our data. Additionally, F-test (Torres-Reyna, 2010) showed that time effects are significant so they were included in the model. Such an approach is also appropriate as the number of time periods (46) in our analysis is larger than the number of cross-section units (8) (Kiviet, 1995).

We estimate a fixed effects model of the following form:

$$y_{i,t} = \alpha_i + \beta X_{i,t} + \delta Z_{i,t} + \gamma_t + \epsilon_{i,t};\ i = 1, \ldots 8,\ t = 2007q1, \ldots 2018q2 \qquad (1)$$

where $y_{i,t}$ is the dependent variable, $X_{i,t}$ includes the main explanatory variables, $Z_{i,t}$ represents the vector of control variables, α_i are country fixed effects, γ_t time effects and $\epsilon_{i,t}$ is an error term.

In order to obtain robust estimates, we employed tests for serial correlation, contemporaneous correlation across units and group-wise heteroscedasticity. The Wooldridge test for autocorrelation in panel data confirmed first order autocorrelation within units. According to the Breusch-Pagan test for cross-sectional independence in the residuals of a fixed effects regression model (Baum, 2001), the null of cross-sectional independence was rejected, while the modified Wald test for unit-based homoscedasticity in the residuals of a fixed effects regression model (Baum, 2001) rejected the null of homoscedasticity across units. To control for all the above issues, we employed ordinary least square (OLS) estimates with panel corrected standard errors proposed by Beck and Katz (1995), therefore addressing heteroscedasticity across panels, contemporaneous correlation across panels and autocorrelation within panels. This estimator proved to have acceptable properties in longitudinal panels when $T > N$.

5 RESULTS

In this section we present the results of panel analysis. The estimation results are presented in Table 2. Here we present the results of our baseline specifications and robustness tests, while additional robustness tests are presented in the Appendix.

[11] As main explanatory variables Dell'Ariccia et al. (2018) use T-bill interest rates, real GDP growth, inflation, nominal exchange rate, public debt and several indicators of the level of financial development (as they base the analysis on heterogeneous sample of countries).

[12] All tests are available upon request.

Table 2
Estimation results

	(1)	(2)	(3)	(4)	(5)	(6)
Deficit	1.771***	1.771***				
	(0.271)	(0.271)				
Change in debt			3.300***	3.300***		
			(0.719)	(0.719)		
Yield	0.0688		0.559		0.328	
	(0.838)		(0.993)		(0.991)	
Spread		0.0688		0.559		0.328
		(0.838)		(0.993)		(0.991)
Loans growth	-0.0251**	-0.0251**	-0.0260**	-0.0260**		
	(0.0119)	(0.0119)	(0.0125)	(0.0125)		
GDP growth					-0.758**	-0.758**
					(0.363)	(0.363)
CAR (lagged)	0.277***	0.277***	0.175	0.175	0.226**	0.226**
	(0.0969)	(0.0969)	(0.109)	(0.109)	(0.106)	(0.106)
Exposure (lagged)	-1.716***	-1.716***	-1.316***	-1.316***	-1.740***	-1.740***
	(0.324)	(0.324)	(0.354)	(0.354)	(0.394)	(0.394)
_cons	12.10	11.83	13.45	11.22	20.57**	21.89**
	(8.382)	(7.903)	(9.146)	(8.599)	(10.44)	(9.876)
Country FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
N	286	286	286	286	286	286

Standard errors in parentheses.
** p < 0.1, ** p < 0.05, *** p < 0.01.*
Source: Authors.

Regarding the *deficit absorption hypothesis* our results indicate that there is a positive and statistically significant relation between deficit and change in debt (*proxy* for deficit) and growth of debt securities in all model specifications, meaning that the supply of sovereign debt securities is an important determinant capable of explaining the exposure of banks in the CEE region to sovereign debt. On the other hand, coefficients that show the relationship between yields and spreads and growth in debt securities have the expected sign, but they are not statistically significant. Such results suggest that bank behaviour in CEE in this respect cannot be explained by the *reach-for-yield* and/or the *carry trade hypothesis*. Relation between growth of private sector loans and growth of debt securities is negative and statistically significant in all specifications, meaning that these instruments can be understood as substitutes and that banks tend to invest less in sovereign debt securities when there is a demand for private loans. Thus, we can conclude that the *lack of opportunities hypothesis* contributes to the understanding of sovereign exposure in CEE region. This result is also supported by statistically significant and negative effect of GDP growth on the dependent variable, meaning that during economic expansions, when there is solid demand for private credit, banks invest less in sovereign debt securities. Also, this result is also supportive of

the deficit absorption hypothesis, as stronger economic growth implies lower public deficits and thus a lower supply of government bonds on the market. Statistically significant effects of GDP growth on sovereign debt securities growth in bank balance sheets support the view that *macroeconomic conditions* have a notable effect on sovereign exposure in CEE. Finally, there is a a positive and statistically significant relation between capital adequacy ratio and debt securities growth, which indicates that bank exposure to sovereign debt in the CEE region can be, at least partially, explained by the *regulatory "arbitrage"* and/or the *flight to safety hypothesis*.

To test the robustness of our results we conducted several adjustments to our baseline model specifications. First, as already noted, we used change in public debt and spreads as proxies for fiscal deficit and yields, respectively. Also, by including GDP growth we additionally tested the credibility of results related to the effects of fiscal deficit and loans to the private sector. These changes did not affect the main results, as was shown in the above table. Next, we excluded yields and spreads from the analysis, as the effects of these variables are not statistically significant. Exclusion of these variables did not have a significant effect on the main results. In addition, we estimated models only on the sample of non-euro area countries (i.e. excluding Slovenia and Slovakia) and only on the sample of inflation-targeters (i.e. excluding Bulgaria and Croatia). The results of these robustness tests, presented in the Appendix, show that our main results did not change notably.

6 CONCLUSIONS

In an attempt to reveal new insights into the determinants that contribute to high shares of sovereign debt in banks' balance sheets in the CEE region, we show that the level of development plays an important role in the explanation of differences between the sovereign exposures of banks in CEE countries and those of other EU and euro area members. Sovereign debt securities seem to have a more important role in the financial systems of less developed countries, which strongly affects the behaviour of both the government and banks themselves. We also found evidence of home-bias in CEE countries, which poses a challenge for regulators. As for differences in sovereign exposure among CEE countries, we showed that banks in IT countries tend to have higher shares of sovereign debt securities in their balance sheets than (quasi-)peggers (Bulgaria and Croatia) as these financial instruments are used for repo operations, which are the key policy instrument in IT countries.

Our empirical results indicate that changes in bank holdings of debt securities in CEE countries are mostly affected by the broader macroeconomic conditions that determine fiscal balances and demand for credit in the private sector. As our sample is marked by recession in most CEE countries, we can conclude that such a negative economic environment has significantly contributed to the increasing share of sovereign debt securities in banks' balance sheets. We also found a positive relation between capital adequacy ratios and changes in sovereign debt securities. Such findings support the view that banks use these instruments to improve

their capitalization indicators, especially during crisis periods. Finally, we did not find evidence of reach-for-yield and/or carry trade behaviour of banks in CEE. However, since our results are based on country-level data, we cannot exclude the possibility that some banks have been engaged in such trades.

These empirical findings bring us to a slightly provocative conclusion (in light of current high-level discussions) that regulators alone have fairly limited power over sovereign exposures in CEE countries because these exposures mostly depend on broader macroeconomic and fiscal conditions. Thus, all future efforts to reduce sovereign exposure in CEE countries require strong collaboration among the many stakeholders. These include the regulators, which can impose stricter regulations and/or monitoring of sovereign exposures on the national level (as Czechia), the fiscal authorities, that should pursue a prudent and counter-cyclical fiscal policy, and other policy makers that can contribute to the development of financial markets in this region. Diversified investment opportunities, solid credit demand from the private sector and a prudent counter-cyclical fiscal policy would probably demotivate banks from hoarding sovereign debt securities in their balance sheets. In addition, as well as ensuring that the regulatory framework does not strongly favour government bonds, regulators should focus on reducing the home-bias in CEE.

Finally, for better understanding of the level and determinants of exposure of financial systems in CEE to sovereign debt, future research should be extended to include other types of debt instruments (primarily loans to government and SOEs) and non-banking financial institutions, primarily pension funds and insurance companies. Instead of on countries, the analysis could also be done on CEE banks.

Disclosure statement

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FIGURE A1

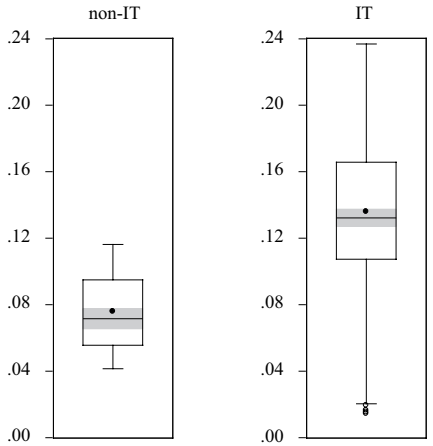
Graphical representation of variables

Source: Authors.

APPENDIX 2

FIGURE A2

Difference in sovereign exposure between IT and non-IT countries in CEE region



Source: Authors.

TABLE A2

t-test for difference of two means (non-IT vs IT)

t-Test: Two-sample assuming unequal variances		
Mean (%)	7.6	13.6
Variance (%)	0.05	0.20
Observations	103	311
Hypothesized Mean Difference	0.00	
df	350	
t Stat	-17.93	
P(T<=t) two-tail	**0.00**	
t Critical two-tail	1.97	

Source: Authors.

TABLE A3.1

Estimation results (yields and spreads excluded)

	(1)	(2)	(3)
Deficit	1.763***		
	(0.257)		
Change in debt		3.245***	
		(0.705)	
Loans growth	-0.0250**	-0.0259**	
	(0.0119)	(0.0125)	
GDP growth			-0.767**
			(0.364)
CAR (lagged)	0.278***	0.178*	0.217**
	(0.0965)	(0.107)	(0.108)
Exposure (lagged)	-1.701***	-1.293***	-1.785***
	(0.316)	(0.353)	(0.403)
_cons	11.80	11.19	22.00**
	(7.939)	(8.585)	(10.01)
Country Fe	YES	YES	YES
Time FE	YES	YES	YES
N	286	286	286

Standard errors in parentheses.

** p < 0.1, ** p < 0.05, *** p < 0.01.*

Source: Authors.

TABLE A3.2

Estimation results (Slovenia and Slovakia excluded)

	(1)	(2)	(3)	(4)	(5)	(6)
Deficit	2.794*** (0.651)	2.794*** (0.651)				
Change in debt			2.284** (1.058)	2.284** (1.058)		
Yield	1.266 (1.443)		0.765 (1.457)		0.264 (1.468)	
Spread		1.266 (1.443)		0.765 (1.457)		0.264 (1.468)
Loans growth	-0.0343** (0.0141)	-0.0343** (0.0141)	-0.0295** (0.0148)	-0.0295** (0.0148)		
GDP growth					-0.464 (0.446)	-0.464 (0.446)
CAR (lagged)	0.229** (0.101)	0.229** (0.101)	0.157 (0.111)	0.157 (0.111)	0.201* (0.115)	0.201* (0.115)
Exposure (lagged)	-3.169*** (0.529)	-3.169*** (0.529)	-2.570*** (0.562)	-2.570*** (0.562)	-2.687*** (0.555)	-2.687*** (0.555)
_cons	24.75*** (9.289)	19.69** (8.362)	21.06** (9.958)	18.00** (8.797)	25.54** (11.14)	24.49** (10.00)
Country FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
N	219	219	219	219	219	219

Standard errors in parentheses.

** p < 0.1, ** p < 0.05, *** p < 0.01.*

Source: Authors.

TABLE A3.3

Estimation results (Bulgaria and Croatia excluded)

	(1)	(2)	(3)	(4)	(5)	(6)
Deficit	1.795*** (0.486)	1.795*** (0.486)				
Change in debt			3.849*** (0.792)	3.849*** (0.792)		
Yield	0.786 (1.430)		2.172* (1.299)		1.191 (1.480)	
Spread		0.786 (1.430)		2.172* (1.299)		1.191 (1.480)
Loans growth	-0.0331** (0.0158)	-0.0331** (0.0158)	-0.0348** (0.0159)	-0.0348** (0.0159)		
GDP growth					-0.640 (0.495)	-0.640 (0.495)
CAR (lagged)	1.908** (0.919)	1.908** (0.919)	0.722 (0.903)	0.722 (0.903)	1.367 (1.009)	1.367 (1.009)
Exposure (lagged)	-1.811*** (0.369)	-1.811*** (0.369)	-1.154*** (0.318)	-1.154*** (0.318)	-1.612*** (0.385)	-1.612*** (0.385)
_cons	13.41 (15.23)	10.01 (12.95)	27.74* (15.00)	18.34 (12.97)	25.00 (16.75)	19.84 (14.72)
Country FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
N	227	227	227	227	227	227

Standard errors in parentheses.

** p < 0.1, ** p < 0.05, *** p < 0.01.*

Source: Authors.

Migration with pension reform expectations

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Abstract

Pension reforms, which imply a reduction in the generosity of pension benefits, are becoming widespread in response to the demographic transition. The scale, the timing, and the pace of these reforms vary across countries. In this theoretical article, the authors analyse individual migration decisions, by adding a component linked to the expected old-age pension benefits in sending and receiving countries in two cases: when the pension system rules are known, and when there is a risk of pension systems reforms. The results indicate that when individuals fail to take future pension wealth into account, they can make sub-optimal migration decisions.

Keywords: migration decisions, pension benefits, pension reforms, institutional uncertainty

1 INTRODUCTION

Public pension systems and public finance in general have been suffering from the consequences of the demographic transition; namely, from the disappearance of the demographic dividend, whereby the presence of a large younger generation in the labour market enabled countries to provide relatively generous pensions to older generations. The easily available and cheap method of rolling public debt is no longer effective.[1] In response to this shift, countries are looking for ways to reduce public expenditures, which generally include reforming the pension system, either currently or in the future. In the latter type of pension reform, the generosity of future pension benefits is reduced, and/or it is made more difficult for future retirees to claim benefits or other publicly financed transfers. Can we predict in which countries such reforms will be more extreme or will be implemented more quickly, and in which countries these changes will be introduced more gradually? If it is difficult for experts to make such predictions, it is hardly possible for ordinary people to do so. The only certainty is that pension systems will become less generous. However, the pace at which the pension reform process occurs is likely to vary greatly across countries.

Some individuals migrate internationally. According to the literature, the decision about whether and where to migrate depends on a number of factors. Among the most important factors are differences in the standard of living between countries. For economic migrants, these differences can be measured by the gap between the available wage at home and abroad. Migrants are usually also aware of the availability and the generosity of public transfers in the receiving country. Of these transfers, old-age pension transfers are the largest. But for migrants, who tend to be young, the issue of pension benefit levels is usually too remote to factor into their migration decisions. Thus, migrants are more likely to think about access to short-term income from unemployment or social assistance schemes than about income in retirement. However, when income allocation over the life course is considered, old-age pensions are quite significant.

[1] For more on the demographic dividend, see Góra (2013).

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Under most legal frameworks, benefits from voluntary additional pension schemes are transferable across borders. In most cases, however, the benefits from such additional schemes are small compared to the benefits from basic schemes, which are usually harmonised *ex-post* according to either binational or multinational agreements. This *ex-post* harmonisation does not reduce the *ex-ante* uncertainty that matters for migration decisions.

Our aim is to analyse migration decisions made in a hypothetical institutional environment that undergoes (also hypothetical) changes. The hypothetical cases are based on assumptions that reflect the general pension landscape, and the dominant forecasts of how this landscape will change in the pension literature.

We focus on permanent migrants who (if they move) plan to work legally and retire in the destination country. Temporary or return migrants, as well as migrants who engage in unregistered work, are thus beyond the scope of our paper. For temporary migrants who work legally, bilateral agreements or the harmonisation of European pension entitlements matter more than the pension system in the destination country. Migrants who work temporarily in the shadow economy only benefit from the difference in the available wages between their home country and their destination country.

Our main hypothesis is that a decision to migrate that does not take into consideration pension entitlements might not be optimal from the point of view of individual discounted lifetime incomes. The other side of that hypothesis is that awareness of lifetime income sensitivity to migration decisions may change actual migration patterns. Our assumption is that people are increasingly aware of the need for pension reforms that will lead to reductions in the generosity of pension benefits.

Large migration flows could change the sustainability of pension systems in both sending and receiving countries. We do not analyse that effect, since it can hardly be perceived *ex-ante* when migration decisions are taken. Moreover, flows of permanent labour migrants between countries will not significantly influence the probability of a pension system reform, as they are too small to have a lasting impact on the demographic structure of the population (see Bijak et al., 2013). We therefore analyse the impact of expectations regarding pension system reforms on migration, but not the impact of migration flows on pension systems.

2 PENSION DRIVERS BEHIND MIGRATION DECISIONS

In most countries, pension reforms are being discussed or have already been implemented. Thus, public awareness of the inevitability of diminishing pension generosity has grown. In light of these reforms, people expect to retire later, to have smaller benefits in the future, or to need more supplementary savings for their old age. However, all of the existing empirical analyses on this topic have focused on expectations or observed changes in the behaviour of people already living in a country that has introduced pension reforms; see: Okumura and Usui

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(2014) for Japan, Boeri and Brugiavini (2008) for Italy, or Dominitz and Manski (2006) for the United States. To our knowledge, our paper is the first attempt to include pension wealth and pension expectations in the analysis of migration.

Given this context, the following question arises: Will international migration lead to better, similar, or worse pension prospects for individuals? For instance, migration from a country where levels of pension generosity are decreasing quickly or steeply to a country where the reform process is occurring more gradually may lead to an increase in the lifetime income of an individual (assuming his/her wages remain the same), and *vice versa*. Thus, the pace and the extent of pension reforms in both countries will affect the outcome of migration, defined as the discounted lifetime income after migration. However, such theoretical and practical considerations may not enter into the individual's decision about whether to migrate.

Ambiguous expectations related to pension reforms cannot be analysed on the basis of data. In the second half of the 20st century – again, thanks to the demographic dividend – pension systems were very stable and predictable public institutions, and thus became a "natural" element of the institutional structure of European countries. The availability and generosity of other benefits may have fluctuated, but pensions were never threatened. In order to protect migrants, countries concluded bilateral or multilateral agreements on procedures for the establishment, the payment, and the financing of pension benefits for people who had worked in more than one country.[2] Because they felt protected by these agreements, most people did not take into account how their decision to migrate would affect their pension benefits. However, these social security and pension institutions are no longer stable. Moreover, the agreements to protect migrants are retroactive. This means they are activated *ex-post*, after a person finishes working career. When these institutions were stable, this system was sufficient.

Today, however, these existing regulations seem insufficient. This is the subject of not only professional but also of public debates. The media are full of messages stressing pension system problems. So potential migrants are probably increasingly aware of the need for pension reforms and other measures aimed at reducing expenditures in response to changing demographic structures. Thus, potential migrants are increasingly seeking *ex-ante* information on the coming changes. If individuals are unable to get such information, they may reconsider their migration plans because of risk aversion. Moreover, countries may apply (openly or surreptitiously) policies or regulations that are less beneficial for immigrants than for locals. For example, a country's pension system may provide more generous benefits to workers who contributed to the social security insurance for longer periods of time. Even if such policies have not yet been implemented, potential migrants may be worried about future pension system changes.

[2] Harmonisation of social security systems in the EU is an example.

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There are two broad strands of migration literature. The first strand focuses on macroeconomic theoretical models and empirical approaches, while the second focuses on the microeconomic analysis of migration decisions. Pension systems are not analysed separately as a factor that influences migration flows, as they are usually included in the destination country welfare system. At the macro level, researchers have analysed the fiscal effects or the net effects (the net present value of taxes and contributions paid by the migrant minus the welfare benefits received by migrant households). Over the last decade, the fiscal impact of immigration has become an increasingly important topic in policy debates (OECD, 2013). Recent examples of research on this issue include a study by Chojnicki and Ragot (2016) that focused on the impact of migration policy on the tax burden associated with the ageing population in France, and a study by Kaczmarczyk (2015) that described the effects of Ukrainian migration on Poland.

Microeconomic analyses have attempted to identify the drivers of the decision to migrate. Whether an individual decides to migrate depends on a number of factors. Starting in the 1960s, the theoretical literature focused on the theory of human capital investment. Most of this literature explained movements based on Hicks' (1932) idea that the main cause of migration is the difference between the wage levels in the home country and in a destination country. The upfront costs of migration were considered an investment that should be followed by a payoff in the future; i.e., higher wages. If wages measure returns to individual human capital, migration increases these returns (Borjas 1987; 1999). In the last decades of the 20th century, researchers suggested that differences in welfare state arrangements across countries may also influence the decision about where to migrate. These studies investigated whether migrants (or asylum seekers) move to countries with more generous welfare systems, and if they do, what type of migrant they are. They found that migration decisions are mainly influenced by the availability of short-term unemployment and family benefits (see Borjas, 1999; McKinnish, 2007; De Giorgi and Pellizzari, 2009; Kurekova, 2013; Josifidis et al., 2014). Some researchers, such as Razin and Wahba (2015), suggested that social security benefits could be more important to lower educated migrants, as they provide insurance against higher labour market risk. Generally, the welfare magnet hypothesis in the migration literature argues that the generosity of welfare systems may influence both the quantity and the skill composition of migration flows (Borjas, 1999; Razin and Wahba, 2015). However, in these studies, welfare systems were analysed as a whole, and pension systems were not treated separately.[3]

There is no existing literature on the role of pension system benefits in the decision to migrate, even though decisions about when and where to migrate influence not only a worker's wages, but also his/her income after retirement. The debate on social security in times of demographic change made has led many developed

[3] One of the reasons could be the small size of the retired migrant population in the most popular immigration countries. The migrants who arrived in Western Europe in the 1960s and the 1970s are approaching retirement age or are recently retired.

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countries to reform their pension systems (see, e.g., OECD, 2015). Some countries have introduced reforms that are more "actuarially fair", with a stronger link between pension benefits and individual contributions. In other countries, there is a broad spectrum of redistribution approaches, in which, for example, the replacement rates depend not only on individual contributions, but on other factors as well. An important aim of every pension system is to ensure its fiscal sustainability while providing adequate retirement income to protect older people against poverty.

In many countries, the reform process is ongoing, and insured individuals can be entitled to different pension benefit levels depending on their tenure and the time at which they entered the system. Reforms may affect the relationship between lifetime pension benefits and lifetime contributions (see, e.g., Fredriksen and Stølen (2017) for Norway), or they may change the relative pension wealth available to different generations (Miles and Iben, 2000).

Our model contributes to the existing knowledge on microeconomic determinants of migration. We do not differentiate between highly skilled and low skilled migrants, and instead focus on all legal permanent labour migrants. We assume that refugees have other reasons for migrating, and that temporary migrants do not think about the pension benefits in a receiving country.

3 THEORETICAL MODEL

We attempt to extend the model as presented in Burda (1995). The basis for his approach was the assumption that observed migration is sluggish due to uncertainty about the future development of wage differences between the home and the destination country, or about labour market conditions in general. Burda modelled procrastination using the value of the option to wait for information.

In Burda's basic model, a person can migrate in the first period, or postpone the decision until the next period. The migration costs are fixed and irreversible. As the benefits of migration are uncertain, waiting can allow for new information to become available. For the simple two-period analysis, an individual migrates in the first period when:

$$-F + W_1 + \left(\frac{p^G W_2^G + p^B W_2^B}{1+r} \right) > \frac{\left(W_2^G - F \right) p^G}{1+r} \tag{1}$$

where:
F – the upfront migration costs;
r – the discount rate between periods 1 and 2;
W_1 – the difference in income in period 1 between the home country and the destination country – for simplicity, measured as the difference in wages;
W_2^G – the difference in wages in period 2 in a "good" scenario (favourable for migrants);
W_2^B – the difference in wages in period 2 in a "bad" scenario (unfavourable for migrants);

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p^G – the probability of the good scenario;
p^B – the probability of the bad scenario;
and $p^G + p^B = 1$.

In the opposite situation; i.e., when

$$-F + w_1 + \left(\frac{p^G W_2^G + p^B W_2^B}{1+r} \right) < \frac{\left(W_2^G - F \right) p^G}{1+r} \tag{2}$$

a person should postpone the decision about whether to migrate to period 2.

The left-hand side of the inequalities above is NPV_1 – the net present value of expected income flows when migration takes place in period 1; and the right-hand side is NPV_2 – the net present value of the expected income flows when migration takes place in period 2.

Burda (2005: 8) defined the function V^W that could be called the *option value of waiting*. It is defined as "the excess of the value of the waiting strategy over the classical expected net present discounted value when migration is undertaken immediately". Generally, migration occurs when this value equals zero; when it is larger than zero, the optimal strategy is to wait and decide whether to migrate in period 2.

$$V^W \left(w_1 \right) \equiv \frac{F\left(r + p^B \right)}{1+r} - w_1 - \frac{p^B W_2^B}{1+r} > 0 \tag{3}$$

The value of this migration option decreases in the current wage gap and in the bad scenario wage gap in the second period, and increases in the fixed migration costs and the probability of the bad scenario. It is independent of the wage difference in the good scenario. The discount rate has an ambiguous effect on V^W. The option value increases in r when $(1 - p^B)F > -p^B W^B{}_2$ and decreases in r when $(1 - p^B)F < -p^B W^B{}_2$.

In our model, the gain or the loss from the decision to migrate stems not only from the wage differential, but also from the old-age benefit differential. Instead of two periods, we have three periods. The second and third periods correspond to the first and second periods of the models in Burda (1995), respectively. If the decision to migrate is postponed to the second period, then in the initial period, the person is working and accumulating pension rights in a sending country. Thus, a decision to migrate can be taken at the beginning of the first or of the second period. In our model, the risk is associated not only with wage dynamics, but also with the pace of pension reforms in both countries. In the last period, a migrant's pension benefit entitlement depends on the pension rights accrued in both the sending and the receiving country.

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3.1 MIGRATION WITH NO UNCERTAINTY ABOUT FUTURE PENSION SYSTEM RULES

First, let us consider the situation in which the rules of the pension system in the sending and receiving countries are known and constant. In this case, pension wealth depends on the linkage between wage levels, contributions paid, and pension benefits. Table 1 shows how pension entitlements should be incorporated into migration decisions.

TABLE 1

Returns to migration including pension entitlements without pension system reform

	Period 1	Period 2	Period 3
Migrate in p.1	Work abroad $-F + W_1$	Work abroad $p^G W_2^G + p^B W_2^B$	Retirement $B_3(W_1, p^G W_2^G + p^B W_2^B)$
Wait until p.2	Home country work	Work abroad $p^G(-F + W_2^G)$	Retirement $p^G B_3(W_2^G) + B_H$
Stay	Home country work	Home country work	Home country retirement

We introduced $B_3(.)$ – the difference in pension benefits depending on the wage levels and the pension system rules in the destination country and in the home country. Here, we should account for B_H; i.e., the pension rights an individual accrued in his/her home country before migration if he/she worked there in period 1. The other variables are the same as in the Burda approach.

When a person migrates in the first period, NPV equals:

$$NPV_1 = -F + W_1 + \frac{p^G W_2^G + p^B W_2^B}{1+r} + \frac{B_3\left(W_1, p^G W_2^G + p^B W_2^B\right)}{(1+r)^2} \tag{4}$$

When migration occurs in the second period, NPV equals:

$$NPV_2 = \frac{p^G(-F + W_2^G)}{1+r} + \frac{p^G B_3\left(W_2^G\right) + B_H}{(1+r)^2} \tag{5}$$

As in the case without pension benefits, an individual should migrate in the first period when $NPV_1 > NPV_2$, and should wait until the second period when $NPV_1 < NPV_2$.

The option value of waiting $V^{W,B}$ should now be $V^W(w_1)$ (formula (3)) increased by a change in the discounted pension wealth when a person migrates in the second period rather than in the first period; i.e.:

$$\frac{p^G B_3\left(W_2^G\right) + B_H}{(1+r)^2} - \frac{B_3\left(W_1, p^G W_2^G + p^B W_2^B\right)}{(1+r)^2} \tag{6}$$

It is the value of waiting for information on both wage development and the implemented pension system reforms. If the pension strongly depends on individual wages, waiting until the second period allows the migrant to gain more knowledge about lifetime income (including old-age pension benefits).

Migrants can return to their home country before retirement. If they retire according to the regulations of their home country their pension rights have local and foreign components. We do not cover return migrants in our model, as we assume that the additional risk stemming from the two factors is much smaller for temporary migrants than it is for permanent migrants. We also do not cover migrants who return to their home country after retiring in their receiving country, since as retirees from a foreign system, they remain subject to the regulations of that system even if they are living abroad. Pension reforms and their unknown scope and time dynamics do not directly affect decisions to return to the home country after retirement. As there is no pension system reform-dependent risk it is beyond the scope of our paper.

A person who migrates in the first period is treated as a local, while a person who migrates later has the status of a migrant. These two types of migrants may be affected differently by a reduction in future old-age benefits. This differentiation extends the model. Waiting has an additional value. Beyond including the conventional risk of waiting, we include the risk that the replacement rate reduction in the destination country will be larger than it is in the source country (or *vice versa*). The second risk is the possibility that migrants will be penalised *vis-à-vis* locals. In the source country, the individual who migrated is by definition a local; while in the destination country, he is considered a local if he migrated early, and he is considered a migrant if he migrated late.

This expression should be negative in countries where individuals who contribute for a shorter period of time but with higher wages just before retirement could expect a higher ratio of lifetime pension benefits to lifetime contributions. That is the case in some older types of public defined-benefit pension systems in developed countries.

To sum up, this simple example shows that expected pension wealth can have an impact on the optimal timing of retirement.

3.2 MIGRATION WITH UNCERTAIN PENSION REFORM

As we discussed above, many countries are considering or introducing changes to pension systems. As it is usually difficult to reach a broad consensus on the details of pension reforms (Holzmann, Orenstein and Rutkowski, 2003; Góra 2013), we assumed that there is some degree of uncertainty about future levels of pension wealth and the timing of the implementation of reforms. We assume that if reforms in one or both countries are implemented in period 2, they will influence the expected pension wealth of a migrant; but that if reforms are implemented in period 3 or later, only subsequent generations will be affected.

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Waiting until the second period to decide whether to migrate can allow the individual obtain more information not only about wage differentials, but also about the potential impact of pension system reforms.

Table 2 shows returns to migration when the direction or scope of the pension reform is uncertain.

Table 2

Returns to migration including pension entitlements with the pension system reform

	Period 1	Period 2	Period 3
Migrate in p.1	Work abroad $-F + W_1$	Work abroad $p^G W_2^G + p^B W_2^B$	Retirement $q^G B_3^G(W_1, p^G W_2^G + p^B W_2^B) + q^B B_3^B(W_1, p^G W_2^G + p^B W_2^B)$
Wait until p.2	Home country work	Work abroad $p^G(-F + W_2^G)$	Retirement $q^G p^G B_3^G(W_2^G) + B_H$
Stay	Home country work	Home country work	Home country retirement

Here, $B_3^G(.)$ denotes the pension benefit depending on the wages and the pension system rules if the reform is favourable for future employees (a higher ratio of lifetime pensions to lifetime contributions),

$B_3^B(.)$ – the pension benefit if the pension reforms in the destination country are less favourable for future employees than in the home country (a lower ratio of lifetime pensions to lifetime contributions),

and $B_3^G(.) > B_3^B(.)$.

q^G – the probability of the favourable pension reform scenario in the destination country,
q^B – the probability of the unfavourable pension reform scenario in the destination country,
and $q^G + q^B = 1$.[4]

Reforms in the home country and in the foreign country are implemented in period 2. Thus, in period 1, a potential migrant knows (or expects) changes with a certain probability; and in period 3, the pension rules for period 3 are known. Now, NPV when a person migrates in the first period equals:

$$NPV_1 = -F + W_1 + \frac{p^G W_2^G + p^B W_2^B}{1+r} + \\ + \frac{q^G B_3^G\left(W_1, p^G W_2^G + p^B W_2^B\right) + q^B B_3^B\left(W_1, p^G W_2^G + p^B W_2^B\right)}{(1+r)^2} \qquad (7)$$

[4] That further simplifies the calculations. The situation without uncertain pension reforms is described in section 3.1.

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NPV when the migration occurs in the second period after favourable outcomes in both the wage (labour market) and the pension system situations equals:

$$NPV_2 = \frac{p^G(-F + W_2^G)}{1+r} + \frac{q^G p^G B_3^G\left(W_2^G\right) + B_H}{(1+r)^2} \tag{8}$$

When $NPV_1 < NPV_2$ (the option value of waiting is positive), it is better to postpone migration.

When we set $W_2^e = p^G W_2^G + p^B W_2^B$, then the option value of waiting for additional information available in period 2 is:

$$\begin{aligned}
V^{W,B} &= NPV_2 - NPV_1 \\
&= V^W\left(w_1\right) + \frac{q^G p^G B_3^G\left(W_2^G\right)}{(1+r)^2} + \frac{B_H}{(1+r)^2} - \frac{q^G B_3{}^G\left(W_1, W_2^e\right)}{(1+r)^2} - \frac{q^B B_3{}^B\left(W_1, W_2^e\right)}{(1+r)^2} = \\
&= V^W\left(w_1\right) + \frac{q^G p^G B_3^G\left(W_2^G\right)}{(1+r)^2} + \frac{B_H}{(1+r)^2} - \frac{\left(1-q^B\right) B_3{}^G\left(W_1, W_2^e\right)}{(1+r)^2} - \frac{q^B B_3{}^B\left(W_1, W_2^e\right)}{(1+r)^2} = \\
&= V^W\left(w_1\right) + \frac{q^G p^G B_3^G\left(W_2^G\right)}{(1+r)^2} + \frac{q^B[(B_3{}^G\left(W_1, W_2^e\right) - B_3{}^B\left(W_1, W_2^e\right)]}{(1+r)^2} + \\
&+ \frac{B_H}{(1+r)^2} - \frac{B_3{}^G\left(W_1, W_2^e\right)}{(1+r)^2}
\end{aligned} \tag{9}$$

The important parts of our model are the probabilities of wage developments in the labour markets of both the sending country and the receiving country, and the probabilities of favourable and unfavourable reforms in both countries. Waiting until the second period decreases the risk of exposure to low wage differentials and unfavourable pension reforms (from an individual point of view), but increases the risk of exposure to a penalty for migrants *vis-à-vis* locals, whereby workers with shorter tenures in the destination country pension system are disadvantaged relative to workers with longer tenures.

The greater the difference $B_3{}^G(W_1, W_2^e) - B_3{}^B(W_1, W_2^e)$ is between "favourable" and "unfavourable" pension reform outcomes, the higher the option value of waiting. Larger pension entitlements for even short contributory periods in the home country also increase the value of waiting. Relatively high $B_3{}^G$ decreases the value of waiting, but it also depends on the probability of "bad" or "good" wage development.

In period 2, the person will decide to migrate if the situation is "good-good", but may be uncertain about the optimal decision if the situation is mixed ("bad wage-good pension" or "good wage-bad pension"). In both cases, NPV_2 is lower than in the "good-good" case and is equal to:

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$$NPV_2 = \frac{p^B(-F + W_2^B)}{1+r} + \frac{q^G p^B B_3^G\left(W_2^B\right) + B_H}{(1+r)^2} \tag{10}$$

in the "bad-good" case, or

$$NPV_2 = \frac{p^G(-F + W_2^G)}{1+r} + \frac{q^B p^G B_3^B\left(W_2^G\right) + B_H}{(1+r)^2} \tag{11}$$

in the "good-bad" case.

Contrary to the basic Burda model, a person may migrate in the second period even if the wage development scenario is unfavourable if the pension system changes provide for higher expected benefit levels at retirement in the destination country, thereby offsetting the lower wages.

4 GOING BEYOND THE BASIC MODEL

To the best of our knowledge, there are no data on the pension reform expectations of potential migrants over a horizon of decades. As it is impossible to test the model on real data, we have generated and discussed a number of hypothetical situations. Even if these expectations have little or no effect on current migration decisions, this may change as the pressure on pension systems becomes more acute. Our model is an attempt to create a conceptual framework for thinking about developments that will likely intensify as awareness grows of the impact of inevitable pension reforms on the generosity of retirement benefits. Thus, workers may be expected to become increasingly aware of how pension system changes will affect their lifelong wealth.

4.1 RELATIVE LEVEL OF WAGES

In line with Burda, our model starts with the standard assumption that migration only occurs when the expected wages in the destination country are higher than the wages in the home country. Thus, when the wages are the same or higher in the country of origin, people will decide not to migrate. The decision to stay is even more likely if people take migration costs into account.

Including pension benefits can change the optimal decision when the current or the expected pension formula gives more generous pension benefits for the same contributions.

4.2 RELATIVE LEVEL OF PENSION BENEFITS

Two cases are possible: a person is considering migrating from the country with a less generous pension system to the country with a more generous system, or *vice versa*. When the generosity of the pension system is the same in both countries, our model reduces to Burda (1995). Old-age pensions are neutral for migration decisions.

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In the more interesting case, the generosity of the pension system does not increase linearly with the contributory period, but individuals with a short working career in the destination country receive less than those who decided to migrate in the first period. Such a situation increases NPV_1 *ceteris paribus*.

4.3 VESTING PERIOD

Whether migrants receive pension benefits after a short vesting period in the sending country also matters. A positive change in pension wealth is more probable if a long minimum contributory period is a prerequisite for receiving pension benefits from the home country. In such a case, migrating in the first period becomes more attractive. A similar situation occurs if the receiving country's pension system rewards long contributory periods. There are three possible cases: no vesting period in the destination country, a short vesting period in the destination country (a migrant is entitled to full pension benefits after working for just one period in the new country), a long vesting period (a migrant is entitled to full pension benefits only after working for two periods in the new country).

The no vesting period case concerns countries that offer a basic, usually a flat-rate pension benefit to every person at retirement age. Such a case simplifies the initial analysis of a payoff from migration. In our notation, a change in the discounted pension wealth when a person migrates in the second period relative to when a person migrates in the first period – equation (6) – equals zero.

The second case, with the short vesting period, is the one presented in the models above.

The last case means that equation (8) reduces to:

$$NPV_2 = \frac{p^G(-F + W_2^G)}{1+r} + \frac{B_H}{(1+r)^2} \tag{12}$$

… decreasing the option value of waiting until period 2.

A long vesting period can be a way to treat natives and migrants differently in the pension system, just as regulations that have been discussed or adopted in existing welfare schemes aim to limit access to short-term social benefits, and especially social assistance (see, e.g., Fernandes 2016).

4.4 RISK OF A PENSION SYSTEM REFORM

In our model, the implementation of pension reforms in the sending country as well as in the destination country will happen in the second period. The reforms will not be coordinated, so they will generate different outcomes for workers. The reforms will inevitably lead to a reduction in the generosity of the systems. With probability q^G, the changes will be favourable for the migrant, and with probability q^B, the changes will be unfavourable for the migrant. Favourable changes mean

that for the same value of contributions paid, a person receives higher pension benefits in period 3 than he/she would if he/she had not migrated.[5] In our model, we can analyse two types of problems, namely: (1) how pension reforms will affect workers' lifetime income assuming they actually migrate; and (2) how pension reform expectations affect migration decisions. Let us first assume that the workers in question know the values of those probabilities. In this case, higher q^G influences discounted pension wealth in an ambiguous way – i.e., depending on whether pensions are closely linked to wages.

$$\frac{q^G p^G B_3{}^G\left(W_2^G\right)+B_H}{(1+r)^2}-$$
$$\frac{q^G B_3{}^G\left(W_1, p^G W_2^G + p^B W_2^B\right)+q^B B_3{}^B\left(W_1, p^G W_2^G + p^B W_2^B\right)}{(1+r)^2} \qquad (13)$$

Pension reforms may positively or negatively affect a migrant's lifetime income depending on the timing and the scale of the reforms in the sending country and in the destination country. The actual outcome will depend on the comparison of pension reform developments. *Ex-ante*, workers can only approximate the probabilities of elements of such developments, as these are subjective probabilities based on their expectations.

4.5 PERCEIVED RISK OF A PENSION SYSTEM REFORM

Workers are generally not aware of the possible positive or negative pension outcomes of their potential migration; or if they take such outcomes into account, future pension income is likely only one of a range of factors they are considering. We assume that this awareness will increase, and could start to affect migration decisions. Whether pension benefit levels represent a stronger or a weaker motivation to migrate will depend on subjective perceptions of pension reform risk. However, the growing awareness of the possible impact of pension reforms may also weaken the motivation to migrate, because of human risk aversion. Unpredictable old-age pension system reforms will frighten workers, who will prefer to stay rather than to migrate.

5 CONCLUDING REMARKS

In this paper, we pointed out that uncertainty about the future outcomes of participation in basic/public pension systems will increasingly affect migration decisions. While people are becoming more aware of the inevitability of pension reforms, the exact timing and the scale of future pension reforms are uncertain. Pension benefits should be taken into account in addition to other migration drivers when analysing changes in returns to human capital after migration. This analysis expands the literature on how welfare systems affect mobility patterns, which has up to now focused mainly on short-term welfare benefits.

[5] We analyse the pension reforms in the destination country, but the results for the unfavourable reform or the favourable reform will be the same in the sending country.

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According to microeconomic analyses of individual decisions about whether and where to migrate, the key driver of migration is the difference in wages. The literature has also suggested that the availability of generous short-term social benefits could motivate migration decisions. In this paper, we have attempted to extend the list of factors that could influence migration decisions by adding expected differences in the generosity of old-age pension benefits, and by showing that ongoing pension reforms introduce uncertainty about the level of pension benefits that will be available to workers after migration. Smaller or larger pension reforms will probably moderate rather than encourage migration.

Our main conclusions are:

- Today, when most countries have completed or are in the last stage of the demographic transition, people may make sub-optimal migration decisions if they do not take into consideration future wealth from pension benefits.
- Even if potential migrants know the current rules of the pension systems in both the sending and the receiving countries, they face uncertainty because of the risk of future pension system reforms. They may experience a reform-driven decrease in welfare stemming from the scope and the timing of the reforms in the receiving country *vis-à-vis* the scope and the timing of the reforms in the sending country.
- Including expected pension benefits in the analysis of migration drivers may change the optimal timing of migration.
- The more risk averse potential migrants are, the less motivated they will be to migrate when they are aware of the inevitability of pension reforms.

These are forward-looking conclusions based on a theoretical model that includes new factors reflecting developments that have just started to affect migration decisions.

Based on our findings we also see several areas of possible future research expanding our approach. First, the discount factor can change in time. Here e.g. the assumption about the hyperbolic discounting by individuals (see Frederick, Loewenstein and O'Donoghue, 2002) can to some extent explain why people do not take benefits from the pension system into consideration in their migration decisions. Second, in future, when data on migration and retirement behaviour in the reformed pension systems are available, it would be worth adding empirical analysis to the theoretical model.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Testing the characteristics of macroprudential policies' differential impact on foreign and domestic banks' lending in Croatia

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Abstract

In the aftermath of the 2008 financial crisis, macroprudential measures were labelled as policymakers' best response to systemic risk and macro-financial imbalances, with their effectiveness still largely unknown due to limited use of such measures. The purpose of this paper is to clarify the potentials and limitations of these measures by evaluating both the immediate and the overall impact of macroprudential policies on banks' lending to the non-financial private sector in Croatia. The findings reveal the divergent impact of macroprudential measures on banks' lending with regards to their direction, i.e. tightening or loosening. Policy makers should bear this in mind when opting for a tightening of their policy stance as the reversal of that action may not match the initial impact of its introduction. Additionally, from a policymaker perspective, this paper provides potential evidence of cross-border policy spillovers, which should be taken into account in order to conduct an effective macroprudential policy.

Keywords: bank lending, cross-border policy spillovers, effectiveness, impact study analysis, limitations, macroprudential measures, potential, systemic risk

1 INTRODUCTION

The global financial crisis showed that excessive bank lending can lead to impaired financial stability, which, if not addressed promptly and adequately, can have serious economic and social costs. Therefore, it is necessary to understand the underlying drivers of credit growth, especially in the case of emerging market economies with bank-centric financial systems, such as Croatia, where credit is the predominant channel of financial transmission. The impact of macroprudential (MP) policy actions on bank lending has gained in importance in the post-crisis period, as growing numbers of authorities have recognised the limitations of conventional policies in safeguarding financial stability and decided to take their policy toolbox into more unconventional, i.e. macroprudential territory.

Following the growing body of literature that recognizes both the importance of credit flows for the smooth functioning of the economy and their potential for major disruptions if proven to be unsustainable, numerous central banks put the preservation of financial stability among their main goals. In the pre-crisis period the vast majority of macroprudential measures were conducted by developing countries and were oriented at taming rapid and excessive credit growth. The introduction and application of macroprudential measures among developed countries intensified only after the crisis and with the introduction of the Basel III framework. Nevertheless, as these measures are still rather a new phenomenon, little is known about their effectiveness and they are still under-researched (Claessens, Kose and Terrones, 2011).

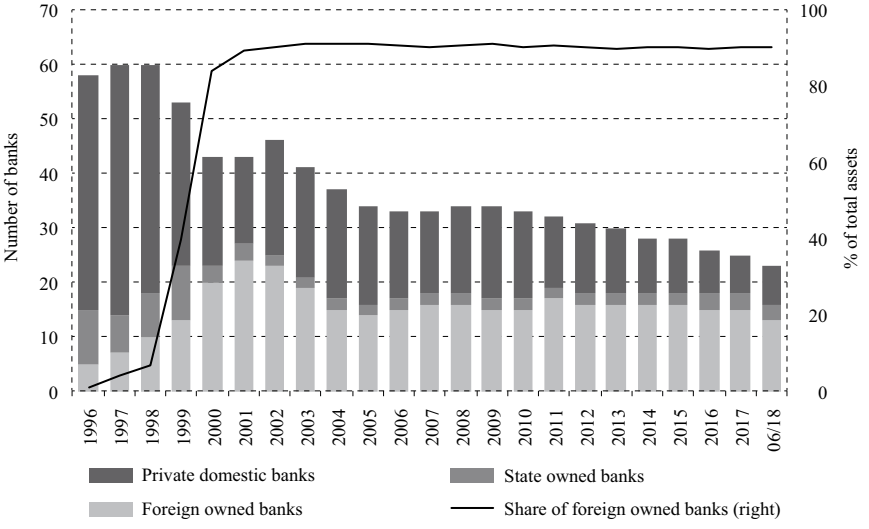
The macroprudential experience of Croatia from the beginning of 2000 is especially rich and still relatively unexplored. The Croatian National Bank (CNB) is one of just a few central banks during the last two decades to have relied heavily

on the use of countercyclical macroprudential policy in order to smooth out the financial cycle and safeguard the stability of the banking system (Lim et al., 2011; Dumičić, 2017; Budnik and Kleibl, 2018a). In the years preceding the global financial crisis, the CNB employed a great variety of measures in order to limit rapid credit growth and to increase the resilience of the financial system. Therefore, Croatia is an interesting candidate for a case study on the analysis of the potential effect of macroprudential policies on credit growth. Given the high share of foreign-owned banks[1] in the Croatian financial system (Figure 1), we investigate whether some differential effects of macroprudential policies can be observed for domestic and foreign banks. Differences in the business practices of foreign and domestic banks are well documented in the literature (Claessens, Demirguc-Kunt and Huizinga 2001; Kraft, 2002; De Haas and Lelyveld, 2006; Arakelyan, 2018), but the effects of macroprudential policies on their lending are still underexplored, which motivated us to differentiate the analysis on these two subsamples of banks.

Furthermore, taking into account the share of foreign banks in the Croatian financial system, the prudential policies conducted by authorities from countries that represent the home countries of foreign credit institutions should also matter (Emter, Schmitz and Tirpak, 2018). We shall explore the possible existence of outward macroprudential policy spillovers, which can be defined as effects of a macroprudential policy action carried out by foreign country on the domestic economy (ESRB, 2014). Therefore, we also include in the model the macroprudential stance of home authorities of Croatian banks in foreign ownership and explore their effects on lending activities in Croatia.

Figure 1

Ownership structure of the Croatian banking system



Source: CNB.

[1] In the late 1990s, the government decided to privatize banks. Consequently, the share of foreign owned banks in total assets rose from 6.7% in 1998 to around 90% in 2001 and has remained at this level ever since.

A micro data set containing highly granular supervisory data collected by the Croatian National Bank, spanning 19 years and taking in 31 banks is utilized in the analysis. The immediate impact of MP measures on bank lending was estimated on high-frequency 10-day data by employing event study analysis. To assess the overall effect of MP measures on bank lending, we used a fixed effects panel model on quarterly data; panel regression is particularly valuable as it allows us to examine the effects of macroprudential actions while also controlling for idiosyncratic characteristics of banks, unobserved heterogeneity among banks, and macroeconomic developments. We also looked for any shifts in bank behaviour during the crisis by looking at the pre-crisis and crisis periods separately.

Event study analysis reveals the asymmetric impact of MP measures with respect to direction, as the introduction of tightening MP measures had a statistically significant impact on banks' lending, whereas loosening MP actions of the central bank did not cause a significant shift in banks' lending behaviour. The results show that a few periods prior to the introduction of policy tightening measures, banks reacted procyclically, that is they increased their lending in anticipation of regulatory tightening. Through a series of estimations, we find that the regulatory environment was one of the major factors influencing lending in Croatia, and that this effect varies depending on individual bank ownership characteristics. Our findings suggest that the tightening of the aggregate macroprudential policy stance in Croatia primarily influenced foreign banks' lending and had only a limited effect on domestic banks. In addition, we provide some preliminary evidence for policy spillovers from regulatory policies in other European countries on lending activity in Croatia. Results show that regulatory spillovers are not only present through a direct parent-daughter channel, but also through indirect channels.

The rest of the paper is organized as follows: section 2 reviews the related literature. Section 3 describes the dataset and methodology used in empirical analysis. In section 4 the main results are presented and, finally, section 5 concludes.

2 LITERATURE OVERVIEW

Although the popularity of macroprudential measures has greatly increased since the global financial crisis, a proper evaluation of the effectiveness of these kinds of policies is still rather scarce. On one hand, in developing countries, where experience with the use of macroprudential policies is richer, there are still restrictions in terms of data availability thus limiting the possibility of evaluating the effects of different policies. On the other hand, in many developed countries macroprudential measures have been introduced only in response to the recent crisis, which also makes it difficult to assess empirically their effectiveness and transmission channels. Even if the literature on the effectiveness of macroprudential policies is still in an early stage, there is an increasing interest in evaluating the impact of different instruments through theoretical models or empirical examples.

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In the theoretical literature related to evaluation of the impact of macroprudential policies on different economic dimensions, authors mostly use Dynamic Stochastic General Equilibrium Models (DSGE). Most of their findings show that macroprudential policies have a potential role in dampening the credit cycles and that they are more effective if used to complement monetary policies (Angelini, Neri and Panetta, 2011; Agénor, Alper and da Silva, 2012; Brunnermeier and Sannikov, 2014 etc.).

The empirical literature dealing with assessments of the impact of macroprudential policies on a wide array of economic variables of interest can broadly be divided into several areas depending on the information used. One strand of the literature employs aggregate information at the country level, where most of the papers have used aggregate macro data to evaluate the impact of different policies on some variable of interest like credit growth, housing prices or macroeconomic variables and they commonly use panel data regressions at the country level or event studies. They find that the tightening of macroprudential policies is associated with lower bank credit growth and house price inflation (Bruno, Shim and Shim, 2015; Cerutti, Claesens and Laeven, 2017; Akinci and Olmstead-Rumsey, 2018) and that these effects appear to be smaller in more financially developed and open economies (Cerutti, Claesens and Laeven, 2017). Moreover, macroprudential policies seem to be more successful when they complement monetary policy by reinforcing monetary tightening than when they act in opposite directions (Bruno, Shim and Shim, 2015). Regarding the second strand of the literature, authors use information at bank level to evaluate the impact of various macroprudential policies on individual banking indicators. Authors have mainly found that borrower-based measures like loan-to-value (LTV) and debt-to-income (DTI) caps seem to be somewhat more effective than capital requirements in containing credit growth (Akinci and Olmstead-Rumsey, 2018; Claessens, Ghosh and Mihet, 2013 and Lim et al., 2011). Other than that, Cerutti, Claesens and Laeven (2017) find negative effects of dynamic provisioning, reserve requirement measurements, limits on FX loans, and concentration limits on credit growth. Other papers find that the implementation of macroprudential policies can generate spillover effects. For instance, Aiyar, Calomiris and Wieladek (2014) study the effects of bank capital regulation in the UK and found that regulated banks reduce lending in response to tighter capital requirements while at the same time unregulated banks increase lending. More recently, to estimate the impact of macroprudential policies authors have used information that is more granular at the bank-debtor relationship level or credit registry data but there are still relatively few papers in the literature that have used this information to evaluate certain policies. For example, Jiménez et al. (2015) examine the effect of countercyclical provisions on credit growth in Spain and find that they were successful in reducing the effects of a credit crunch but they were not as successful in curbing the pre-crisis credit boom.

Empirical studies focusing on the effects of regulatory policies on specific institutions depending on their ownership status are still in their infancy and are mostly

focused on their role on financial stability and transmission channels of shocks. Papers focusing on the period prior to the crisis find evidence of a stabilizing role of foreign banks as they are a source of diversification and act as a shock absorber during local crises (De Haas and van Lelyveld, 2006; Arena, Reinhart and Vazquez, 2007; Havrylchyk and Jurzyk, 2011; Cull, Martínez Pería and Verrier, 2017). In the post-crisis studies, foreign ownership of banks showed a more divergent face. Some authors find supporting evidence for the view that foreign banks can act as a source of contagion, increase volatility and import economic or financial shocks from home to host countries (Cull and Martinez Peria, 2013; Cull, Martínez Pería and Verrier, 2017). Arakelyan (2018) adds to this strand of literature by using data on 16 CESEE economies and stresses the importance of monitoring the health of foreign parent banks as well as the potential regulatory changes in their home jurisdictions. On the other hand, authors also find that in some countries foreign banks continue to support a high overall degree of banking sector stability (Barboni, 2017).

For the case of Croatia, there are several papers but they mostly consider various aspects of credit growth analysis (Čeh, Dumičić and Krznar, 2011; Pintarić, 2016; Dumičić and Ljubaj, 2017). Other than that, some papers also discuss the role of policy makers on credit growth. Ljubaj (2012) confirmed the existence of a long-run relation between household loans, the macroeconomic environment factor and the monetary policy indicator, while no such relation was confirmed for corporate loans. The author concluded that it was probably due to the fact that enterprises raised substantial funds from abroad, while households were financed predominantly by domestic banks. Furthermore, Dumičić's (2017) estimation shows that macroprudential policies in CEE countries, including Croatia, were more effective in slowing credit to households than credit to the non-financial corporate (NFC) sector. This again can be attributed to the NFC sector's having had access to non-bank and cross-border credit in addition to domestic bank credit.

Even though, the issue of effects of regulatory policies on lending dynamics in Croatia is not new in the literature, we re-examine it by conducting an extensive analysis focusing on differences between foreign and domestically owned banks and by introducing a novel variable that takes into account the impact of the regulatory environment on credit intermediation, namely the macroprudential stance index.

Literature that employs event-study methodology to assess the impact of central banks' actions mainly focuses on the impact these measures have on financial markets. In recent years this stream of literature predominantly focussed on the impact of the ECBs' unconventional monetary policy on financial conditions in the Euro Area (Ambler and Rumler, 2017; Briciu and Lisi, 2015; McQuade, Falagiarda and Tirpák, 2015; Rivolta, 2014). To the best of our knowledge this is the first paper that deals with the issue of the immediate impact of macroprudential measures on banks' behavior, more specifically on banks' lending to private sector.

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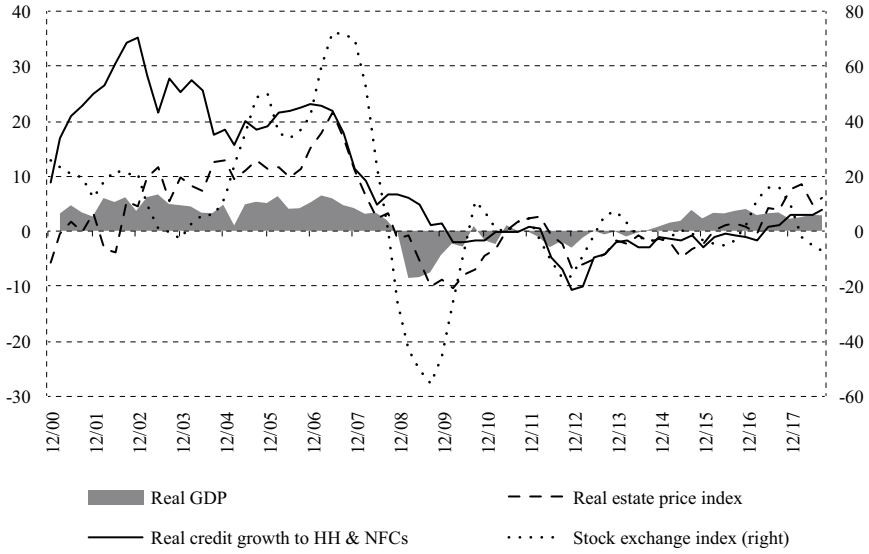
3 DATA AND METHODOLOGY

3.1 EXPERIENCE WITH MACROPRUDENTIAL POLICIES IN CROATIA

The beginning of the 2000s in Croatia was marked by rapid credit growth, which lasted until 2008. Conditions that contributed to the strong growth can be found in stable inflation and stable exchange rates that lowered the risk perception of the Croatian economy which, accompanied by a widened gap between expected return on investment in Croatia and the EU, attracted foreign capital and therefore positively contributed to credit growth (Rohatinski, 2015). Moreover, competition between banks for new clients became fiercer, as Croatia was seen as a country with a big financial deepening potential. On the demand side, the tendency towards spending and consumption was rapidly growing in both public and private sectors. Therefore, all the preconditions were met for the rapid credit expansion that followed. In the 2000-2003 period, according to CNB data, bank credit grew on average by 23.7% on a yearly basis, which was mainly financed by foreign capital inflows (Figure 2).

FIGURE 2

Real and financial cycle development (y-o-y in %)



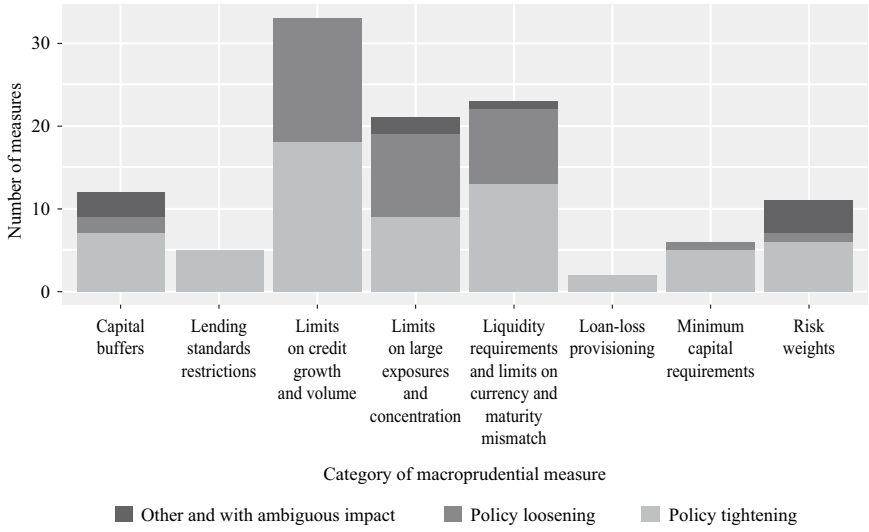
Sources: CBS and CNB.

In 2003, it was obvious that a lending boom was underway in Croatia and what is more, it was followed by increasing asset prices, implying the creation of a vicious cycle between financial and macroeconomic aggregates. Specifically, credit expansion led to increased asset prices, and this encouraged investors and raised the value of collateral, which furthermore fuelled credit growth (Figure 2). The central bank decided to act with a broad set of relatively unconventional measures, which at that time were not even known as "macroprudential", in order to curb booming credit growth. There were several reasons for the use of macroprudential

measures instead of more conventional monetary tightening measures. The inherent characteristics of domestic economy with respect to size, openness, high euroization level, strong capital inflows and relatively high foreign indebtedness severely limited the scope for a conventional monetary policy. This was additionally boosted by global developments characterized by financial liberalization, convergence process of emerging markets, high global liquidity and low risk aversion. In order to address these issues, different measures were implemented, but those used the most frequently were related to limits to credit growth and volume (Figure 3). The most important pre-crisis measures were the high level of the general reserve requirement, administrative restriction of loan growth, introduction of marginal reserve requirements, special reserve requirement and minimum required foreign currency claims. Other than that, the CNB increased capital requirements for currency induced credit risk and capital adequacy requirements. For more details about the macroprudential policy of the CNB in the pre-crisis period, the reader is referred to Kraft and Galac (2011), Dumičić and Šošić (2014), Dumičić (2017) and Vujčić and Dumičić (2016).

Figure 3

Frequency of CNB macroprudential policy actions by type of instrument category, 2000-2018



Note: Macroprudential measures are grouped into the instrument categories following definitions in Budnik and Kleibl (2018a).

Source: Authors' calculation based on CNB.

Other than in Croatia, a somewhat greater use of macroprudential policies in the pre-crisis period can also be observed in Central and Eastern European (CEE) countries[2] than elsewhere in Europe which is largely explained by the financial

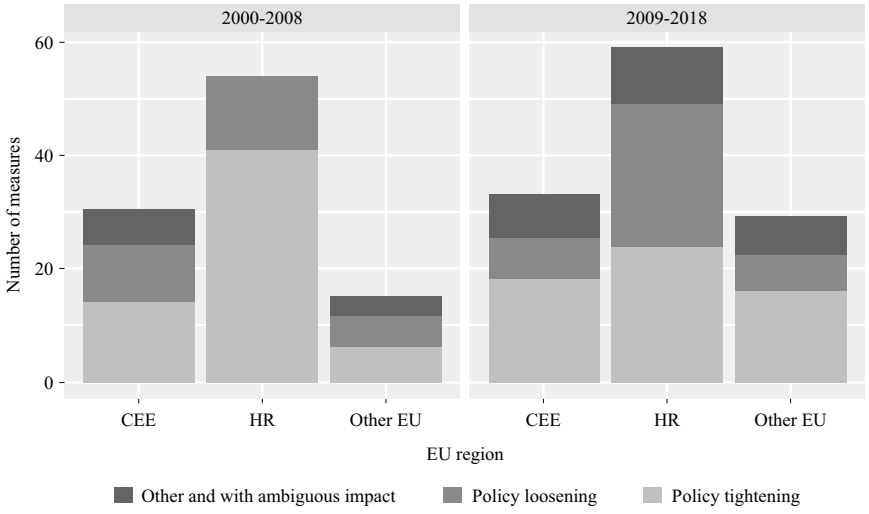
[2] CEE countries include Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia and Slovakia.

sector structure and the overall level of financial development in these countries (Figure 4). Other than the use of a great variety of macroprudential tools within countries, the data also show that CEE countries were active in changing the intensity of measures as well and Croatia is again one of the most active countries. Nonetheless, empirical studies focusing on the nature of macroprudential policies find evidence that only a few CEE countries in pre-crisis period used countercyclical macroprudential policies. These countries are Croatia, Bulgaria and Romania (Lim et al., 2011; Dumičić, 2017; Budnik and Kleibl, 2018a).

Macroprudential measures were able to partially slow down the accumulation of systemic risk, while strengthening banks' resiliency through a build-up of liquidity and capital buffers. It should also be noted that the efficiency of these measures was partially reduced due to their circumvention through the less regulated parts of the financial system or by the transference of operations from local banks to their parent banks. They also motivated banks to raise capital rather than borrow from abroad (Kraft and Galac, 2011; Vujčić and Dumičić, 2016). As a result of all these efforts, the Croatian banking system did not experience the fate of some other banking systems, as it remained sound, resilient and without major bank failures throughout the global financial crisis. After the onset of the global financial crisis, the CNB gradually released the previously accumulated reserves and credit growth restrictions were removed. Despite the fact that Croatia sidestepped the financial crisis in 2008, the economy experienced the longest recession of all EU countries; it lasted for six years until 2015. On the other hand, credit growth has only recently showed signs of recovery.

Figure 4

Frequency of policy actions by objective of the policy measure for CEE countries, 2000-2018



Note: More details about policy action definitions in Budnik and Kleibl (2018a).

Source: Authors' calculation based on CNB and ECB (MaPPED).

3.2 DATA

To evaluate the effects of aforementioned macroprudential policies on domestic and foreign banks' lending we use supervisory data reported by banks operating in Croatia at the unconsolidated level. The use of unconsolidated data enables us to explore solely developments in the domestic market, which is in the focus of this paper. The event study analysis of MP measures' impact was estimated on the most frequent available (10-day) data, while panel regression analysis was employed on quarterly data. This data is highly granular and it allows us to use a wide number of variables to control for various factors of banking activity. Other than that, we use the different macroeconomic variables reported by the different institutions, such as CBS, EC, CNB, etc.

This analysis focuses on a 19 year-period (December 1999 to September 2018) by using a panel dataset covering 31 banks. We impose the restriction that a bank must have been present in the market for at least half of the observed time period to enter into the sample. As not all banks were active during the overall observed period, the resulting panel is unbalanced. Furthermore, in panel regression analysis simple outlier treatment to dataset is applied. We eliminate outliers[3] from the sample across banks and time periods if the value of the annual credit growth to private sector exceeds 100%.

3.3 METHODOLOGY

3.3.1 EVENT STUDY ANALYSIS

The immediate impact of CNB macroprudential policies on banks' lending is estimated by applying event study methodology, where we check for a potential differential impact on domestic and foreign banks by splitting up the sample into two subsamples. We also differentiate according to policy action direction as we separately estimate the impact of tightening, loosening and other measures with ambiguous impact. In order to setup the event-study methodology, certain facets of the study design have to be specified. First off, we have to define what constitutes an event. Because MP actions of the CNB in certain instances occurred in clusters (i.e. they occurred in the same month), we treat the interventions in the same cluster as a single event. When this definition of an intervention cluster is used, the sample of events is reduced to 54 out of the initial 113 events. We assume that the direction of that event is tightening if more tightening measures occurred than loosening measures and *vice versa*. Next, we have to define the length of an event window on which the effect of MP measures' introduction on banks' lending is tested. Longer event windows allow for the possibility of a more gradual effect of an event, but at the same time banks' lending can be influenced by other drivers over longer event windows. We chose a window that starts 6 periods (2 months) before the event and ends 6 periods after the event. Moreover, in order to measure the effect of an event on bank lending, we have to calculate abnormal growth rates

[3] The number of eliminated outliers amounted to 26, which represents around 1.2% of total observations in the full sample. Furthermore, eliminated outliers were scattered across both time and bank dimensions of the sample and therefore it is assessed that their elimination should not impose bias into final results.

of bank loans to the non-financial private sector at individual bank level. We define them as the difference between observed growth rates and the "normal" growth rates of bank lending. For the estimation of normal growth rates, we chose the mean adjusted returns model which assumes that the expected growth rate of loans in the event window differs across banks and is equal to the average return of a bank observed in the estimation window, which in our case is defined as 36 periods (1 year) prior to event window. Even though the mean adjusted returns model is relatively simple compared to other models, Brown and Warner (1980; 1985) show that results based on this model do not systematically deviate from results based on more sophisticated models in short-term event studies. Finally, the statistical significance of MP events at period τ are estimated on cumulative average abnormal growth rate (CAAGR) statistics that can be defined as:

$$CAAGR_{\tau} = \frac{1}{N_{\tau}} \sum_{i=1}^{N_{\tau}} CAGR_{i\tau} = \frac{1}{N_{\tau}} \sum_{i=1}^{N_{\tau}} \left[\sum_{\tau=-k}^{k} AGR_{i\tau} \right] = \\ = \frac{1}{N_{\tau}} \sum_{i=1}^{N_{\tau}} \left[\sum_{\tau=-k}^{k} \left(GR_{i\tau} - NGR_{i\tau} \right) \right], \quad (1)$$

where $\tau \in \{-6, 6\}$ is a period from event window, N_{τ} is a number of banks active at date corresponding to period τ, $CAGR_{i\tau}$ is cumulative abnormal growth rate of bank i in period τ, $AGR_{i\tau}$, $NGR_{i\tau}$ and $GR_{i\tau}$ are respectively abnormal, normal and the observed 10-day growth rates of bank i loans to non-financial private sector in period τ.

3.3.2 PANEL REGRESSION ANALYSIS

In order to estimate the through-the-cycle effect of the cumulative macroprudential stance we use a panel regression model as panel data, with their cross-sectional and time dimensions, provides us with the necessary variability in data that is indispensable to be able to estimate the impact of macro variables such as macroprudential policy stance on bank lending, while avoiding the occurrence of spurious regression. Additionally, a panel data model allows us to test the hypothesis that the macroprudential policy actions of a central bank unevenly affect domestic and foreign banks by splitting the full sample into two subsamples. Specifically, we use panel regressions with fixed effects[4], since fixed effects estimation allows for arbitrary correlation between the unobserved bank specifics and the observed explanatory variables (Wooldridge, 2002). Furthermore, under the assumption of strict exogeneity, it also takes into account bank-specific differences. We prefer a static to a dynamic model due to the relatively low correlation between current and lagged values of credit growth. The static panel data model with fixed effects can be specified as:

$$C_{i,t} = \alpha + \beta X_{it} + \gamma Z_t + \delta MPP_t + u_i + \varepsilon_{i,t}, \quad (2)$$

[4] The Hausman test was performed and statistical evidence for the use of fixed effects approach was found. The results are available on request from the authors.

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where the subscripts i and t are indices for bank and time, $C_{i,t}$ denotes the dependent variable (quarterly credit growth on annual basis), α is the intercept, MPP_t captures the overall macroprudential policy stance of the country, X_{it} is a vector of bank specific variables, Z_t is a vector of macro variables, u_i is a bank fixed effect that enables us to control for unobserved bank-level characteristics and $\varepsilon_{i,t}$ is the idiosyncratic error term.

In order to check for any unspecified macro effect, time specific fixed effects are included in complementary specifications:

$$C_{i,t} = \alpha + \beta X_{it} + u_i + \lambda_t + \varepsilon_{i,t}, \tag{3}$$

where, along with other variables mentioned above, λ_t captures time fixed effects. Depending on the model specification, the exact choice of control variables differs. In order to minimize any endogeneity problems between explanatory bank specific variables and the dependent variable, we lag all RHS variables by four quarters. To control for possible multicollinearity issues between regressors, we include highly correlated variables in separate model specifications. We use bank-level clustered, robust standard errors to correct for heteroscedasticity. Any possible shift in banks behaviour in the crisis[5] period, relative to the pre-crisis period, is also examined in this paper. We use December 2008 as a cut-off date based on Wald structural break test[6].

3.4 DESCRIPTION OF VARIABLES

The dependent variable of interest is the year on year real credit growth to households and non-financial corporation sectors, i.e. the private sector. The nominal growth rate of credit to the private sector calculated from balance sheet stocks can be highly influenced by non-performing loan write-offs and, in the case of a banking system that is characterized by a high share of foreign currency lending such as the Croatian, by sudden changes in exchange rates. Therefore, in order to capture "pure credit growth", data on nominal credit growth was cleansed from these effects. Additionally, this variable is transformed into real terms to correct for the effect of price level change on lending (Figure 5).

[5] We refer to the whole period from 2009Q1 to 2018Q3 as the crisis period, although not all this period can be considered as crisis. The recession in Croatia lasted until 2015 and credit activity has been showing signs of recovery since 2017 (only on transactional basis).

[6] The results are available on request from the authors.

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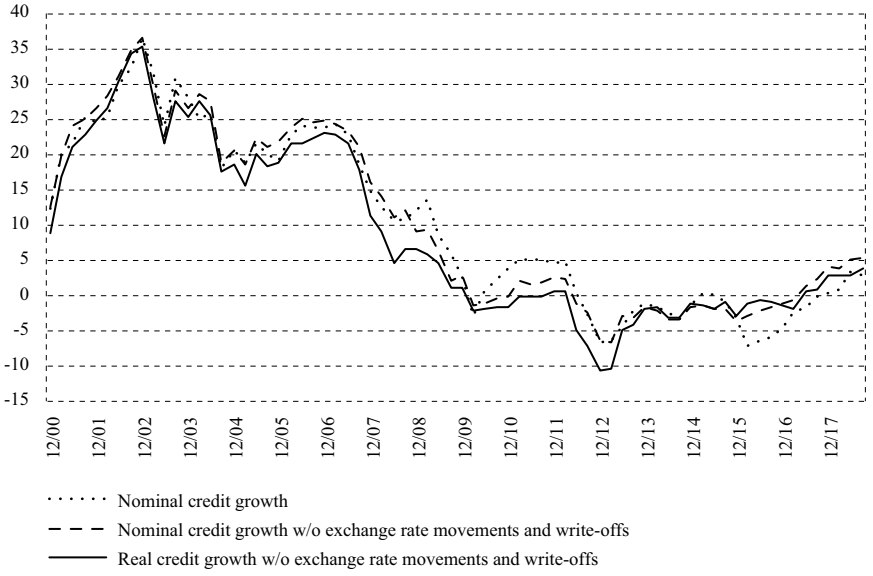
FIGURE 5

Nominal and adjusted growth of total credit to private sector (%)



Source: CNB.

In the measurement of policy intensity, several options are possible. The macroprudential policy index can be represented as a dummy variable, a number of instruments in place or as a cumulated index of net tightening. In this setting, the aggregate index used characterizes the macroprudential policy stance of a country by cumulating the number of tightening and easing events since end-1999 (Akinci and Olmstead-Rumsey, 2018; Budnik and Kleibl, 2018a), which can be defined as:

$$MPP_t = \sum\nolimits_{\tau\in[t_0,t]} T_\tau - \sum\nolimits_{\tau\in[t_0,t]} L_\tau, \qquad (4)$$

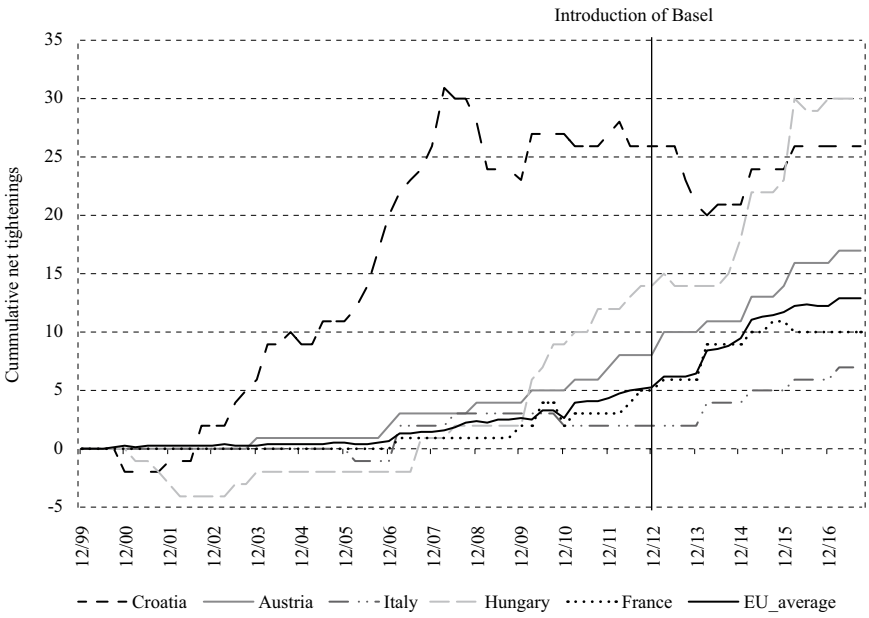
where T_τ is the number of tightening measures introduced in quarter τ, L_τ is number of loosening measures introduced in quarter τ and t_0 denotes the end of 1999 as a starting point in the sample. *MPP stance_HR* represents the simple CNB macroprudential policy stance (MPP stance) index.

As the goal of this research is to find some evidence on whether macroprudential measures had a significant effect in reducing bank risk-taking we employ this aggregate macroprudential policy stance. By using the simple index, we have overcome the problem of heterogeneity of instruments and multi-dimensionality of their calibration. At the same time, the information from higher precision of the measurement are not taken into account. As this paper assesses mostly the time dimension of systemic risk, we find that it is appropriate to use the simple index.

The index is created according to the ECB's Macroprudential Policies Evaluation Database (MaPPED[7]). An increase in the constructed index signals net tightening while decline signals net loosening of macroprudential stance (Figure 6). Furthermore, in the sub-sample of foreign banks we also consider the evolution of MPP stance in countries that represent home countries for foreign credit institutions operating in Croatia (*MPP_stance_Home*) to check for possible macroprudential policy outward spillovers from foreign banks' home authorities. We also check for possible macroprudential policy spillovers from foreign countries onto domestic banks by constructing the variable of the MPP stance of EU countries constructed as the weighted average of individual countries' macroprudential policy stances, where the annual GDPs of the respective economies are used as weights.

FIGURE 6

Macroprudential policy stance index



Note: Data include all policy actions implemented or in force during 1999-2018 for Croatia, several other home countries and average index for all 28 EU countries. MPP stance per country represents a cumulative net tightening value (tightening minus loosening) of actions across years. December 31st, 1999 was set at zero for all observed countries to have comparable evolution over time.

Source: Authors' calculation based on CNB and ECB (MaPPED).

As mentioned above we divide control variables into two groups: macroeconomic and bank-specific variables. Descriptive statistics of bank-specific variables for the two bank sub-samples and the whole are given in Table 1.

[7] For more details about MaPPED see Budnik and Kleibl (2018a and 2018b).

3.4.1 MACROECONOMIC VARIABLES

GDP growth. Annual growth rate of quarterly real GDP serves as a proxy for demand factors in an economy. Higher GDP growth should be translated into higher demand for credit as both expectations of future developments and clients' perceived creditworthiness improve. Moreover, we were looking into subcomponents of GDP growth, particularly focusing on private *Consumption growth*.

Macro factor. Although real GDP growth is a relatively suitable proxy of economic development, this can also be described by other variables such as asset price growth, unemployment dynamics and growth in wages (as can be seen in Figure 2). Unfortunately, these variables are highly correlated to each other and therefore cannot be simultaneously included into the model. In order to capture the effect of the real cycle on credit growth as accurately as possible, we estimated a latent variable Macro factor that captures the dynamics of the real cycle. The macro factor was estimated by means of time series factor analysis using the following variables: real GDP growth, real estate price growth, stock exchange index growth (CROBEX) and nominal net wage growth. We use time series factor analysis[8] to perform a reduction in the dimensionality of the data and combine several variables into a latent variable that represents a macroeconomic aggregate.

3.4.2 BANK-SPECIFIC VARIABLES

Liquid Asset. The share of liquid assets in total assets represents the size of credit institutions' liquidity conditions. Higher levels of liquidity in the previous period should translate into elevated lending activity in the following period. Nonetheless, this might also reflect banks' willingness to take on risk, or their lack of it.

TCR. The bank total capital ratio represents the ratio between banks' own funds and total risk weighted exposure. Banks with higher levels of TCR have higher credit potential as they are able to increase their credit exposure and still meet their regulatory capital requirement without the needs for recapitalization. Therefore, the expected sign of the relation is positive.

Market Share. Share of assets in total banking sector assets is a measure of a bank's size. Market share is, in a way, a measure of bank inertia as it is much harder for larger banks to obtain high rates of credit growth than it is for smaller banks. Therefore, we expect a negative effect on credit growth.

LT Liabilities. The ratio of long-term liabilities to total liabilities, where liabilities are considered long-term if their initial maturity is longer than one year, is a measure of bank funds stability.

RIIR on Liabilities. The real implicit interest rate on liabilities is calculated as ratio of interest rate expenditures in bank's total liabilities. It is anticipated that higher cost of funding sources would have a negative effect on credit growth.

[8] The authors use following package in R: https://cran.r-project.org/web/packages/tsfa/index.html.

Substitutes. Year on year change in loans and debt securities to sectors other than HH's and NFC's, normalized by banks' total assets in the previous year. This variable is used to test for the existence of the crowding-out effect that can occur if lending to government and other financial institutions reduces lending to private sector. This effect could be especially pronounced in crisis period, as creditworthiness of private sector worsened while at the same time interest rates on sovereign loans and securities rose, which influenced some banks to increase sovereign lending. If the crowding-out effect is present, the expected sign is negative.

NPLR. The non-performing loan ratio is a share of partly recoverable and fully irrecoverable loans in total bank loans and represents banks' loan quality. Increased share of distressed loans on banks' balance sheets is expected to hamper future loan growth as they employ resources that could alternatively be used for granting new loans, so the expected sign is negative. In order to fully capture the effect of asset quality on future loan growth, the provisioned part of NPLs (*Coverage*) should also be taken into account. The expected sign is positive as, conditional on a certain level of *NPLR*, NPLs with higher coverage ratio have smaller negative effect on bank capitalization and consequently on lending activity. Moreover, we also include a *Net NPLR* variable that represents the share of unprovisioned NPLs in total loans and the higher values of this variable should negatively affect credit activity.

ROA. Return on assets is a measure of bank profitability, defined as ratio of income before taxes and total bank assets. The expected sign is positive as banks with better profitability can use their retained earnings to fund future loan expansion.

Table 1
Descriptive statistics of bank-specific variables

Sample/ Statistics:		Liquid Asset	TCR	Market Share	Substitutes	NPLR	Coverage	Net NPLR	RIIR on Liabilities	LT Liabilities	ROA
Domestic	mean	31.1	19.3	0.7	0.9	18.1	49.5	9.4	1.8	31.5	0.0
	p25	23.7	13.5	0.2	-2.1	7.9	35.7	3.6	0.6	17.5	0.0
	median	29.1	16.6	0.4	0.9	14.6	46.7	7.9	1.9	29.8	0.5
	p75	35.7	23.7	0.6	4.7	24.3	62.2	13.0	3.1	45.4	1.2
Foreign	mean	33.0	21.9	5.6	7.3	11.8	59.0	5.2	1.6	36.1	0.8
	p25	24.5	14.9	0.3	-1.3	6.0	45.1	1.8	0.2	25.2	0.3
	median	31.1	17.6	1.0	1.4	10.4	58.9	4.0	1.3	36.4	1.1
	p75	38.9	22.3	8.2	5.2	15.8	72.0	7.1	2.5	45.2	1.8
Total	mean	32.1	20.8	3.4	4.5	14.6	54.8	7.1	1.7	34.0	0.4
	p25	24.0	14.2	0.3	-1.7	6.6	39.7	2.3	0.4	20.4	0.1
	median	30.1	17.1	0.5	1.2	11.8	54.0	5.3	1.6	34.5	0.8
	p75	37.4	22.8	3.3	4.9	19.5	67.7	9.5	2.8	45.3	1.6

Source: Authors' calculations based on CNB data.

4 RESULTS

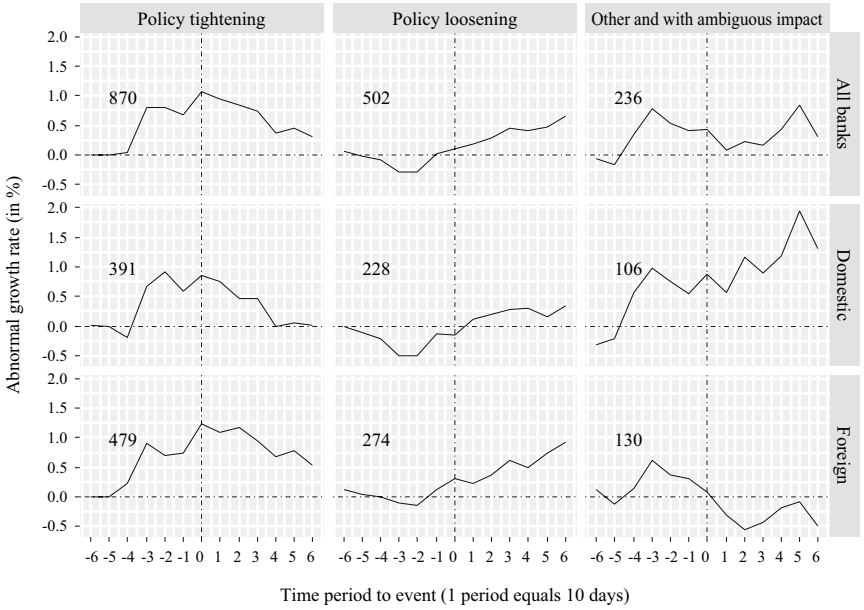
4.1 IMMEDIATE IMPACT OF MP MEASURES ON BANK LENDING

The main results of the impact analysis explained above can be found in Figure 7 and Table 2 below. Figure 7 clearly shows difference in banks' reactions to the introduction of MP measures according to whether it was a loosening or a tightening event. The analysis also shows that the reaction of foreign owned banks was more pronounced than that of domestically owned banks, which is in line with the systemic objective of macroprudential policy. This was the case in both loosening and tightening measures. It can be seen that a few periods prior to the introduction of policy tightening measures, banks reacted procyclically, that is they increased their lending in anticipation of regulatory tightening. This temporary lending surge gradually subsided in periods after the event and the same dynamics is observed both for domestic and foreign banks, whereas a lending surge is statistically significant only for foreign banks (Table 2). A similar reaction was also observed in cases in which the CNB introduced loosening measures; foreign and domestic banks slightly increased their lending immediately after the event, whereas foreign banks reacted in a more agile fashion than domestic banks. However, statistical significance tests do not reject the null hypothesis of CAAGR being equal to zero, which does not exclude the possibility that these measures had a more pronounced impact on banks' lending in periods that took place after the event window. A third group of measures, labelled other, with ambiguous impacts and without a clear policy direction did not have a statistically significant impact on banks' lending.

From the policymakers' perspective, these results affirm the importance of MP measures implementation dynamics, especially in case of policy tightening. On one hand the policymaker should announce the measure long enough in advance in order to minimise potential shocks in the market, but on the other, the longer the period between announcement and implementation, the more the room for banks to make a lending push before the measure enters into force.

FIGURE 7

Cumulative average abnormal growth rate of banks' loans to the domestic non-financial private sector



Note: The size of the sample, i.e. the number of bank-event combinations used to estimate the CAAGR is marked in the figure.

Source: Authors' calculations based on CNB data.

TABLE 2

Statistical significance of the cumulative average abnormal growth rate of banks' loans to the domestic non-financial private sector

	Time period to event (1 period equals 10 days)												
	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
	Policy tightening												
All banks	0.01	-0.01	0.04	0.80**	0.80**	0.70*	1.70**	0.94**	0.85*	0.74	0.37	0.45	0.31
	(0.96)	(0.97)	(0.85)	(0.02)	(0.02)	(0.06)	(0.01)	(0.04)	(0.06)	(0.14)	(0.47)	(0.39)	(0.62)
Domestic	0.01	-0.01	-0.20	0.66	0.92*	0.60	0.86	0.75	0.45	0.46	-0.01	0.06	0.01
	(0.97)	(0.97)	(0.47)	(0.21)	(0.09)	(0.26)	(0.18)	(0.26)	(0.49)	(0.52)	(0.99)	(0.94)	(0.99)
Foreign	0.00	-0.01	0.24	0.91**	0.70	0.75	1.24**	1.09*	1.17*	0.96	0.69	0.78	0.55
	(0.98)	(0.99)	(0.49)	(0.03)	(0.13)	(0.13)	(0.03)	(0.07)	(0.06)	(0.16)	(0.34)	(0.31)	(0.5)
	Policy loosening												
All banks	0.07	-0.02	-0.09	-0.29	-0.30	0.01	0.10	0.18	0.29	0.46	0.41	0.48	0.66
	(0.61)	(0.89)	(0.62)	(0.18)	(0.2)	(0.96)	(0.73)	(0.58)	(0.38)	(0.21)	(0.28)	(0.22)	(0.12)
Domestic	-0.01	-0.11	-0.21	-0.51*	-0.49	-0.13	-0.16	0.12	0.19	0.28	0.31	0.16	0.35
	(0.97)	(0.54)	(0.36)	(0.1)	(0.12)	(0.69)	(0.69)	(0.79)	(0.66)	(0.6)	(0.58)	(0.77)	(0.58)
Foreign	0.13	0.05	0.01	-0.11	-0.14	0.13	0.31	0.24	0.36	0.61	0.50	0.75	0.93
	(0.37)	(0.84)	(0.98)	(0.72)	(0.68)	(0.72)	(0.44)	(0.62)	(0.44)	(0.23)	(0.35)	(0.17)	(0.11)
	Other and with ambiguous impact												
All banks	-0.07	-0.16	0.34	0.78**	0.54*	0.41	0.44	0.09	0.22	0.16	0.43	0.83	0.31
	(0.7)	(0.44)	(0.25)	(0.01)	(0.1)	(0.22)	(0.39)	(0.87)	(0.69)	(0.79)	(0.52)	(0.24)	(0.68)
Domestic	-0.33	-0.21	0.57	0.98*	0.74	0.54	0.86	0.57	1.17	0.89	1.19	1.94	1.30
	(0.36)	(0.55)	(0.29)	(0.05)	(0.15)	(0.3)	(0.37)	(0.55)	(0.23)	(0.39)	(0.3)	(0.11)	(0.3)
Foreign	0.14	-0.12	0.15	0.62*	0.37	0.31	0.09	-0.31	-0.55	-0.44	-0.19	-0.07	-0.49
	(0.45)	(0.62)	(0.63)	(0.1)	(0.37)	(0.48)	(0.86)	(0.6)	(0.39)	(0.5)	(0.81)	(0.93)	(0.59)

Note: P-value of two-sided cross-sectional t-test of CAAGR significance in parentheses. The null hypothesis of the test assumes that the CAAGR is equal to zero.

**** $p < 0.01$, ** $0.01 < p < 0.05$, * $0.05 < p < 0.1$.*

Source: Authors' calculations based on CNB data.

4.2 OVERALL IMPACT OF MP MEASURES ON BANK LENDING

The main results from panel regression analysis can be found in the tables below. In particular, Table 3 and 4 depict the estimated coefficients from equation (2), while the results for model 7 presented in these tables derive from equation (3). Furthermore, we also evaluated the effect of the global financial crisis and divided the sample into a pre-crisis (1999Q4-2008Q4) and a crisis period (2009Q1-2018Q3) for both bank sub-samples. These results are presented in Table 5.

TABLE 3

Through-the-cycle impact of macroprudential measures on foreign banks' lending

	Sample:	Foreign						
	Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
MPP	MPP stance_ HR	-1.02***	-1.04***	-1.10***				
		(0.15)	(0.17)	(0.15)				
	MPP stance_ Homea				-1.15***	-1.10***	-1.16***	
					(0.36)	(0.35)	(0.27)	
Macro	GDP growth	0.22			1.04***			
		(0.24)			(0.31)			
	Consumption growth		-0.03			0.99**		
			(0.31)			(0.35)		
	Macro factor			0.17			1.17**	
				(0.35)				
Bank variables	Liquid asset	0.15*	0.14*		0.27**	0.25**		0.11
		(0.08)	(0.08)		(0.1)	(0.1)		(0.11)
	TCR			-0.14			0.14	
				(0.13)			(0.13)	
	Market share	-1.30*	-1.29*	-1.44**	-0.59	-0.68	-0.68	-1.46*
		(0.66)	(0.68)	(0.65)	(1.06)	(1.05)	(1.36)	(0.73)
	Substitutes	0.31**	0.30**	0.30**	0.32**	0.32**	0.39**	0.31**
		(0.13)	(0.13)	(0.12)	(0.14)	(0.14)	(0.15)	(0.12)
	NPLR	-0.12	-0.07		0.01	0.06		0
		(0.23)	(0.23)		(0.23)	(0.23)		(0.31)
	Coverage	0.03	0.03		0.15***	0.15***		0.03
		(0.06)	(0.06)		(0.05)	(0.04)		(0.06)
	Net NPLR			-0.13			-0.13	
				(0.47)			(0.49)	
	RIIR on liabilities	-1.97***	-2.10***	-1.97***	-0.01	0.27	0.51	-1.28**
		(0.55)	(0.61)	(0.57)	(0.44)	(0.44)	(0.46)	(0.44)
	LT liabilities	0.24*	0.23*	0.18**	0.19	0.21	0.12	0.23
		(0.12)	(0.12)	(0.08)	(0.13)	(0.13)	(0.12)	(0.13)
	ROA	-0.69			-0.21			-0.57
		(0.5)			(0.52)			(0.5)
	Constant	25.48**	25.82**	37.82***	-8.9	-9.08	7.58	29.34*
		(10.44)	(11.5)	(7.43)	(10.19)	(10.09)	(9.21)	(16.29)
	Observations	1,052	1,052	1,052	1,052	1,052	1,052	1,063
	R-squared	0.35	0.35	0.35	0.25	0.25	0.21	0.38
	Number of Banks	17	17	17	17	17	17	17
	Bank FE	YES	YES	YES	YES	YES	YES	YES
	Year FE	NO	NO	NO	NO	NO	NO	YES

[a] *MPP_stance_Home represents MPP stance from particular home country.*

Note: All RHS variables are lagged one year. Robust standard errors in parentheses.

**** $p < 0.01$, ** $0.01 < p < 0.05$, * $0.05 < p < 0.1$.*

Source: Authors' calculations.

TABLE 4

Through-the-cycle impact of macroprudential measures on domestic banks' lending

	Sample:	Domestic						
	Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
MPP	MPP stance_HR	-0.35*** (0.1)	-0.45*** (0.12)	-0.32** (0.11)				
	MPP stance_EUa				-0.54** (0.23)	-0.60** (0.25)	-0.54** (0.2)	
Macro	GDP growth	-0.37 (0.28)			-0.09 (0.24)			
	Consumption growth		-0.60* (0.3)			-0.15 (0.25)		
	Macro factor			-0.391 (0.36)			-0.105 (0.33)	
Bank variables	Liquid asset	0.47*** (0.15)	0.48*** (0.16)		0.53*** (0.15)	0.57*** (0.16)		0.52*** (0.15)
	TCR			0.35** (0.14)			0.49*** (0.12)	
	Market share	-5.26 (3.43)	-4.57 (3.54)	-9.13* (4.31)	-4.28 (2.5)	-3.57 (2.36)	-7.98** (3.11)	-1.67 (3.67)
	Substitutes	0.31* (0.16)	0.31* (0.15)	0.33* (0.16)	0.32* (0.16)	0.32* (0.15)	0.36** (0.15)	0.37** (0.17)
	NPLR	-0.34*** (0.06)	-0.39*** (0.05)		-0.25*** (0.07)	-0.31*** (0.06)		-0.26*** (0.07)
	Coverage	0.06 (0.06)	0.07 (0.06)		0.1 (0.06)	0.11* (0.06)		0.08 (0.07)
	Net NPLR			-0.61*** (0.18)			-0.51** (0.18)	
	RIIR on liabilities	-0.64* (0.33)	-1.01*** (0.3)	-0.94*** (0.29)	0.04 (0.47)	0.02 (0.49)	-0.22 (0.36)	-0.81* (0.42)
	LT liabilities	0.29* (0.14)	0.29* (0.14)	0.23 (0.2)	0.31* (0.15)	0.31* (0.15)	0.27 (0.2)	0.31** (0.14)
	ROA	0.52*** (0.16)			0.72*** (0.23)			0.77*** (0.21)
	Constant	-3.74 (10.15)	-1.34 (10.43)	11.91 (7.81)	-16.37* (9)	-17.38* (9.1)	0.43 (6.67)	-11.34 (14.72)
	Observations	837	837	837	837	837	837	850
	R-squared	0.27	0.28	0.24	0.26	0.25	0.23	0.31
	Number of Banks	14	14	14	14	14	14	14
	Bank FE	YES	YES	YES	YES	YES	YES	YES
	Year FE	NO	NO	NO	NO	NO	NO	YES

[a] *MPP_stance_EU represents simple average of individual EU countries' macroprudential policy stance indexes.*

Note: All RHS variables are lagged one year. Robust standard errors in parentheses.

**** $p < 0.01$, ** $0.01 < p < 0.05$, * $0.05 < p < 0.1$*

Source: Authors' calculations.

The results show that one of the major factors influencing loan growth in Croatia was the regulatory environment. The change in the MPP index, which captures the aggregate stance of macroprudential policy in Croatia, has a negative and significant effect on credit growth with more pronounced effect on foreign banks'

lending. Tightening of the CNB's macroprudential stance on average slowed down credit growth of foreign banks by 1 p.p. and for domestic ones only by 0.4 p.p. The CNB's macroprudential policy mix aimed at slowing down the buoyant credit growth can be rated as relatively more effective for foreign, mainly larger banks with systemic importance, which is in line with the objective of macroprudential measures, i.e. preserving the stability of the financial system. Furthermore, tightening of regulatory policies in home countries also has a significant negative effect on credit growth of foreign owned credit institutions in Croatia and that effect is comparable in size to the effect of domestic macroprudential policy actions. This result suggests that affiliated institutions' host country regulatory environment affects the behaviour of banking groups at the consolidated level, which eventually spills over into host countries. What is more, the estimation results show that overall tightening of regulatory policies across EU countries also has an impact on the credit activity of domestic banks in Croatia, albeit at a lower intensity, suggesting that regulatory spillovers are present not only through direct the parent-daughter channel, but also through indirect channels.

The relevant macroeconomic controls used in the specification mentioned above show a consistent significant positive impact on loan dynamics only for foreign banks. This is expected, as foreign banks are mainly larger banks with a relatively broad base of customers, while domestic banks are mainly smaller banks operating in specific niches that do not necessarily correlate with macroeconomic movements. Moreover, when looking into different subcomponents of GDP, the only consistent driver of foreign bank loan growth is private consumption, as other subcomponents proved to be insignificant. Additionally, when accounting for other indicators of the real cycle, such as asset prices growth, unemployment dynamics and growth in wages, through the latent variable *Macro factor*, we find quite similar results.

The complementary specifications robustly confirm that the unspecified macro effect is not present in the observed time period and that with macro variables included the model captured all the relevant information.

As mentioned before, the effect of macroprudential policies can also be affected by different bank-specific variables. The results show that in order to extend credit, banks need to have sufficient liquidity. This is even more pronounced for domestic banks and can be explained by the ability of foreign owned banks to turn to their parent banks when in need of funding, while domestic banks, on the other hand, can increase credit supply only if they have sufficient liquidity reserves. Measures of capitalization, such as total capital ratio are significant only in the case of domestic banks. In addition, as expected, the further increase in credit institutions' market share would have significantly negative effect on credit growth for both groups of banks. Moreover, the results do not corroborate the hypothesis that that a substitution effect between loans to private sector and placements to other sectors was present in Croatia, while in specifications where this

relation is significant it is positive. This suggests that on average, across the sample of all banks, a "crowding in" effect was observed, i.e. along with a growth in lending to the private sector, lending to government and other financial institutions also increased. Furthermore, stable funding, measured as the share of long-term liabilities in total liabilities is somewhat more relevant for domestic banks. On the other hand, the price of banks' funding sources had a somewhat more significantly negative effect on the credit growth of foreign banks, which is somewhat surprising, considering that domestic banks pay higher interest on their liabilities than foreign banks. This result can be explained by the notion that relatively small domestic banks value their relationships with clients more highly and are looking to extend a loan to that client despite the higher cost of its funding. We also tested how profitability affects credit growth and found out that higher profitability is one of the main prerequisites for the credit expansion of domestic banks. Profitability proves to be insignificant in the case of foreign banks, which is not surprising because they can rely on their parent bank's support, either by means of increasing liabilities or recapitalization. Asset quality, as documented by many studies in the literature, can have a limiting effect on credit growth. Interestingly results confirm that only domestic banks are constrained by the quality of their credit portfolio, while for foreign banks only the provisioned part of NPLs is statistically significant in some specifications. The robustness of these findings was further verified by testing the relation between net NPLRs and credit growth, which yielded similar results. This is in line with our finding that the level of capitalization impacts lending only in case of domestic banks as domestic banks have on average somewhat lower levels of regulatory capital and need to watch out for possible impact of non-performing loan on their capital reserves.

Table 5

Pre-crisis and crisis impact of macroprudential measures on foreign and domestic banks' lending

	Sample:	Foreign				Domestic			
	Variables	Pre-crisis		Crisis		Pre-crisis		Crisis	
MPP	MPP stance_HR	-0.95*** (0.26)		-0.94 (0.62)		-0.18 (0.21)		-0.3 (0.61)	
	MPP stance_ Home/EU[a]		-5.63** (2.06)		0.33 (0.35)		-7.12* (3.73)		0.13 (0.59)
Macro	GDP growth	0.44 (0.92)	-0.56 (1.08)	0.17 (0.22)	-0.2 (0.37)	-0.37 (0.84)	-0.1 (0.84)	-0.58 (0.46)	-0.73*** (0.23)
Bank variables	Liquid asset	0.40* (0.22)	0.63*** (0.21)	0.11 (0.1)	0.09 (0.12)	0.3 (0.27)	0.29 (0.26)	0.52** (0.2)	0.52** (0.2)
	Market share	-1.91 (1.15)	-1.4 (1.4)	-1.29 (1.2)	-1.52 (1.34)	-8.28* (4.26)	-7.37 (4.42)	-3.18 (10.53)	-2.78 (11.75)
	Substitutes	0.17 (0.23)	0.21 (0.29)	0.37*** (0.12)	0.38*** (0.12)	0.42* (0.2)	0.42* (0.21)	0.2 (0.13)	0.21 (0.13)
	Net NPLR	-0.74 (0.52)	-0.65 (0.65)	0.02 (0.68)	0.17 (0.72)	-0.55** (0.24)	-0.61** (0.24)	-0.37* (0.19)	-0.36* (0.18)
	RIIR on liabilities	-2.86 (1.81)	-0.17 (1.7)	-1.5 (1.02)	-0.98 (0.8)	-0.61 (0.39)	-0.87 (0.5)	-0.24 (0.59)	-0.11 (0.51)
	LT liabilities	0.33 (0.22)	0.26 (0.26)	-0.07 (0.21)	-0.04 (0.23)	0.59 (0.44)	0.62 (0.45)	0.16 (0.1)	0.16 (0.12)
	ROA	-0.06 (0.81)	0.29 (0.9)	0.06 (1.44)	0.03 (1.42)	0.46 (0.32)	0.46 (0.33)	0.71** (0.25)	0.71** (0.25)
	Constant	18.47 (17.38)	2.29 (15.6)	34.40** (15.06)	7.72 (10.53)	-3.22 (16.45)	-1.91 (16.16)	-4.59 (23.31)	-13.93 (10.67)
	Observations	443	443	609	609	364	364	473	473
	R-squared	0.21	0.17	0.07	0.05	0.14	0.16	0.18	0.18
	Number of Banks	17	17	17	17	14	14	14	14
	Bank FE	YES	YES	YES	YES	YES	YES	YES	YES
	Year FE	NO	NO	NO	NO	NO	NO	NO	NO

[a] MPP_stance_Home for foreign banks represents MPP stance from particular home country, while MPP_stance_EU for domestic banks represents simple average of individual EU countries' macroprudential policy stance indexes.

Note: All RHS variables are lagged one year. Robust standard errors in parentheses.

**** $p < 0.01$, ** $0.01 < p < 0.05$, * $0.05 < p < 0.1$.*

Source: Authors' calculations.

When differentiating between the pre-crisis and the crisis period we find that CNB macroprudential actions primarily influenced foreign banks' lending to the private sector in the years before the crisis. Furthermore, tightening of regulatory policies in home countries also had a significant negative effect on the credit growth of foreign-owned credit institutions in Croatia in the pre-crisis period. We also confirm macroprudential policy spillovers from EU countries onto domestic banks, but only for the pre-crisis period. Results show that loan dynamics for foreign banks is influenced in years before 2009 by the level of their liquidity. Relation

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between macroeconomic developments and credit growth is present only in the bust phase of the economic cycle and only for domestic banks. Furthermore, in post-crisis period foreign banks' exposures to private and other sectors increased and/or contracted in a synchronized fashion. On the other hand, for domestic banks this holds true for the pre-crisis period. Results show that in the pre-crisis period domestic banks' lending is negatively constrained by deteriorated asset quality and increased market share. The impact of liquidity on domestic banks' credit growth is significant from 2009 onwards, when better profitability also become relevant.

5 CONCLUSION

In the aftermath of the 2008 financial crisis, macroprudential measures were labelled policymakers' best response to systemic risk and financial sector imbalances, with their effectiveness still largely unknown due to the limited use of such measures before the crisis. Croatia is a good example of a country that has employed a great variety of macroprudential measures to manage systemic risks in the economy, especially in the years before the 2008 financial crisis. In this paper, we analysed both the immediate and overall impact of macroprudential policies on foreign and domestic banks' lending in Croatia in a 19 year period. According to estimation results, CNB macroprudential actions influenced banks' lending to the private sector, primarily, however, affecting foreign banks' lending, the effect on domestic banks being limited. However, these measures were primarily aimed at the supply side of lending and were not able fully to address the excessive borrowing demand from the private sector, which through regulatory arbitrage induced stronger activity in other lending sources, outside of the Croatian banking sector. As a result, the private sector incurred relatively high debt levels and this poses one of the main hurdles that need to be resolved for a new lending cycle to be set in motion. Therefore, policy makers should actively monitor both the supply and the demand side of financial intermediation. Impact analysis shows that in a few periods prior to the introduction of policy tightening measures, banks' reacted procyclically, that is they increased their lending in anticipation of regulatory tightening. At the same time, the tightening of regulatory policies in home countries also contributed negatively to foreign banks' lending activity in Croatia, suggesting the presence of policy spillovers from other countries' regulation, because foreign owned banks control 90% of total banking assets in Croatia. An additional important finding is that regulatory spillovers impact not only foreign owned banks through the direct parent-daughter channel, but also other banks through indirect channels. This further emphasizes the importance of reciprocity arrangements and alignment of regulatory practices at the overall EU level.

The main conclusion of our study is that the macroprudential policies that have been heavily used in Croatia to deal with systemic risk have been relatively effective in stabilising credit growth. There is evidence that macroprudential policies have been effective in preventing the build-up of financial risks in particular for bigger banks mostly in foreign ownership. Moreover, there is some evidence that those policies helped decrease the credit risk of domestic banks as well. However,

even though the CNB acted countercyclically, i.e. it loosened its macroprudential policy stance, the results show that the effectiveness of these measures in the crisis period were not as effective as in the pre-crisis period. Findings further reveal the dissimilar impact of MP measures on banks' lending with regards to their direction, i.e. tightening or loosening, and policy makers should bear this in mind when opting for tightening of their policy stance as the reversal of that action may not match the initial impact of the measure's introduction. These results affirm the importance of MP measures implementation dynamics, especially in the case of policy tightening, as policy makers have to find an optimal strategy that minimises room for banks to make a lending push before a measure enters into force, while avoiding causing shocks in the market. In other words, policymakers should be encouraged by the impact of macroprudential measures in the upturn phase of financial cycle, but also be aware of their limitations in the downturn phase of cycle. As far as the results indicate, after a crisis has occurred, in order to revive the financial intermediation of banks, one cannot rely only on the loosening of macroprudential policy, as other policies need to be involved.

As a final point, our results suggest that the choice of the macroprudential instrument is non-trivial and should take into account the asymmetric effects of each instrument in order to utilize the most effective policy at hand for the chosen objective. Therefore, further exploration of this topic would be great public interest. In analysing the interconnectedness of macroprudential topics with other policies and their different effect in the boom and bust phases of the economy, data that are more granular would be required. Filling the, still existing, data gaps would also help to develop mechanisms to identify and monitor overall country systemic risk and measure efficiency in a more detailed approach, measure by measure, which is essential to make macroprudential policy operational.

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Over-bureaucratisation in public procurement: purposes and results

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Abstract

Most countries spend large sums of money (10 to 15% of their GDP) to procure goods, services and other work from private suppliers. Given this large public procurement market, it is clear that poor procurement practices might hinder sustainable development and negatively impact public finances and economic growth. This article uses data from the Czech Republic and Slovakia to show that these countries' procurement systems are over-bureaucratised, and tries to identify the causes and results of such a situation. Our findings confirm that the systems investigated are characterised by legislation that is both too detailed and frequently amended, and an administrative culture that prefers compliance to performance. With over-bureaucratisation, procurement officials opt for a Rechtsstaat administrative culture of "bureaucratic safety" that generates excessive levels of passive waste of public resources.

Keywords: public procurement, Slovakia, Czech Republic, bureaucracy

1 INTRODUCTION

Public procurement accounts for a very large proportion of public expenditure. Most OECD countries spend 10 to 15% of their GDP (Pavel, 2013) to procure goods, services and other work from private suppliers. Poor procurement practices might hinder sustainable development and negatively impact public finance and economic growth.

The core standard principles of public procurement are transparency, integrity, efficiency/economy, openness, fairness, competition and accountability (Pavel, 2013). The current practice stresses that organizations engaged in sustainable procurement meet their needs for goods, services, utilities and works with a view to maximizing own, but also broad social benefits, for example by taking into account environmental and social considerations. However, if too much bureaucracy is involved in public procurement, its individual and social goals are hard to achieve.

Higher transparency may, for example, in some cases lead to lower efficiency in the public procurement system, especially if it is translated into over-bureaucratisation of the procurement processes. Too much stress on process instead of results may prevent sustainable purchasing, as compliance and the lowest possible final price are the ultimate goals for purchasing entities. The above seems to afflict many developing countries, and countries with a *Rechtsstaat* tradition.

Our recent research mapped the core barriers limiting the efficiency of the Slovak public procurement system (Grega et al., 2019). We began with a small number of face-to-face in-depth interviews with specialist procurement advisors to contracting authorities. In the second stage, we sent questionnaires to 13,571 suppliers and to 4,300 contracting authorities. The final response rate was fully sufficient to be a representative sample. We received 211 answers from contracting authorities (4.91% response rate) and 626 answers from suppliers (4.79% response rate).

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Amongst other questions we asked respondents to choose up to three factors that, in their opinion, adversely affected the efficiency of public procurement. The representatives of contractors ranked excessive bureaucracy as the most important factor (143 answers); the suppliers ranked excessive bureaucracy as the second most important factor (369 answers), just three votes behind the non-ethical behaviour of public procurement officials.

The goal of this article is to use data from the Czech Republic and Slovakia to show that the situation is as complicated as the views of the Slovak procurement specialists interviewed and the respondents to our survey suggest, and to try to identify why that is, and what follows from such a situation.

The paper is based on a combination of simple quantitative and qualitative research methods. After a short literature review, the main section documents selected aspects of the over-bureaucratisation of both Czech and Slovak public procurement. This is followed by an identification of the core reasons for such over-bureaucratisation, and what consequences flow from it. A brief summary concludes.

2 TRANSACTION COSTS IN PUBLIC PROCUREMENT

Experts agree (e.g. Bandiera, Prat and Valletti, 2009; Pavel, 2013; Strand, Ramada and Canton, 2011) that excessive bureaucracy in public procurement increases transaction costs and may also decrease the level of competition, with negative impacts on the final outcomes from the procurement process.

Transaction costs limit the level of savings achieved by effective public procurement procedures. Table 1 indicates the differences between the estimated price and final contract price in Slovakia – we return to it in later in the text. Up to a certain level, increasing competition also positively influences the final price.

Table 1

The difference between estimated and contractual prices in Slovakia (%)

	2009	2010	2011	2012	2013
Non-weighted difference	7.9	8.8	11.8	15.0	11.4
Weighted difference (according to tender values)	-2.1	6.2	11.4	13.8	12.1

Source: Compiled by the authors using data from tender.sme.sk.

The theory of transaction costs is especially associated with Coase (1937; 1960). Later major contributions were made by, amongst others, Williamson (1985), Demsetz (1968), and Barzel (1985). Amongst Czech and Slovak authors who have written on transaction costs, Pavel (2007; 2013) created a taxonomy of the main types of transaction costs connected with public procurement. His scheme, with some adaptations by the authors, is set out in Table 2.

Table 2

Transactions costs in public procurement

Time / Sector	Ex-ante	On-going	Ex-post
Public sector	– Preparing tender documentation – Administering tender preparation fees to involved external experts – Legal expertise costs	– Administration of running tender	– Re-start of cancelled procedure – Costs connected with contract amendments – Costs of cancellation or delay – Costs connected to control/ remedy procedures – Legal costs
Private sector	– Preparing bid costs to fulfil qualification criteria – Guarantees	– Communication with tenderer	– Costs connected with contract amendments – Costs connected with delays and cancellation – Legal costs

Source: Authors, adapting Pavel (2007; 2013).

Other authors dealing with transaction costs for the Czech and Slovak Republics are Strand, Ramada and Canton (2011), Pavel (2013), Svejda (2010), and Sumpikova et al. (2015; 2016). Svejda's estimates of transaction costs in Slovak public procurement vary between 0.25 and 5.6% of contracts' value. For the Czech Republic Pavel (2013) calculated median transactions costs per participant at 0.4% of contract value. By factoring in the probability of success in bidding, his data suggest that the winning firm's transaction costs are 4.6% of the contract's value. According to Placek, Pucek and Ochrana (2019) the core factors determining the level of transaction costs in public procurement are the quality of the legislative and regulatory framework; the type and method of procurement; the expected volume; management's experience, especially on the procurer's side; post-award behaviour and the attitudes of participants.

Excessive bureaucracy may have a negative impact on competitiveness in public procurement procedures (an issue which is in the focus of academic research about public procurement). Gupta (2002) analysed 1,937 tenders for highway construction in Florida, for 1981-1986, and found that the lowest prices could be achieved with 6 to 8 bidders. Brannman, Klein and Weiss (1987) analysed US auctions for timber and oil exploration, while Kuhlman and Johnson (1983) analysed US highway construction projects in 1975-1980. Both studies confirmed the impact of competition on the final price. Similar results were obtained by Gilley and Karels (1981); Elberfeld and Wolfstetter (1999); Szymanski (1996); and Millet et al. (2004). Pavel (2010) analysed procurement for Czech road and railway infrastructure finding that on average an extra bidder led to a price fall of 3.27%. For Slovakia, Sipos and Klatik (2013) analysed all levels of procurement in 2012 with similar findings: the price decreases, at a decreasing rate, as the number of bids rises, up to a maximum of five. Similar results were confirmed by Grega and

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Nemec (2015a; 2015b), though the authors emphasise the fact that public procurement in Slovakia is the least competitive of all EU countries.

Too much bureaucracy might be one possible purpose for the limited competition in the Czech and Slovak public procurement. To participate in a public procurement procedure, potential suppliers need to cope with a lot of bureaucracy. Firms, for example, need to provide a lot of materials to confirm their compliance with the qualification requirements, generating extra costs and entry barriers, important especially for smaller firms.

3 SELECTED EVIDENCE OF "OVER-BUREAUCRATISATION" IN SLOVAKIA

The fact of excessive bureaucracy, and hence of excessive transaction costs in Slovak public procurement, was confirmed by Strand, Ramada and Canton (2011: 83) who estimated the administrative costs of public procurement connected with participation in above-EU threshold tenders, for 2008 (Table 3).

Table 3

Administrative person-day costs of EU procurement 2008 (selected countries)

Country	Contractors	Country	Suppliers
Bulgaria	68	Malta	34
Cyprus	44	Slovakia	30
Slovakia	38	Greece	25
Malta	12	France	10
Luxemburg	11	Finland	10

Source: Authors, adapting Strand, Ramada and Canton (2011).

During our own research in the Czech Republic (Sumpikova et al., 2016) we asked interviewed firms to estimate two things. First, the percentage of direct costs connected with the preparation of bids (including drafting a budget, a technical proposal, and bank guarantees). Second, the size of indirect transaction costs, such as legal costs in case of complaints and reviews, and fees for complaints. A summary of the responses from the statistically significant sample of building firms is provided in Tables 4 and 5.

Table 4

Direct costs of tender preparation by firms as percentage of estimated price

Direct costs	Micro	Small	Medium	Large
> 2	**			
3 – 5	*	**		
6 – 10		*	**	
10 – 15			*	***
15 – 20				
< 20				

*Note: The number of * shows frequency of answers, *** means the most frequent response.*

Source: Nemec et al. (2016: 1753).

Table 5

Indirect costs of procurement by firms as percentage of estimated price

Indirect costs	Micro	Small	Medium	Large
> 2	***	*		
3 – 5		**	*	
6 – 10			***	**
10 – 15				*
15 – 20				
< 20				

*Note: The number of * shows frequency of answers, *** means the most frequent response.*

Source: Nemec et al. (2016: 1753).

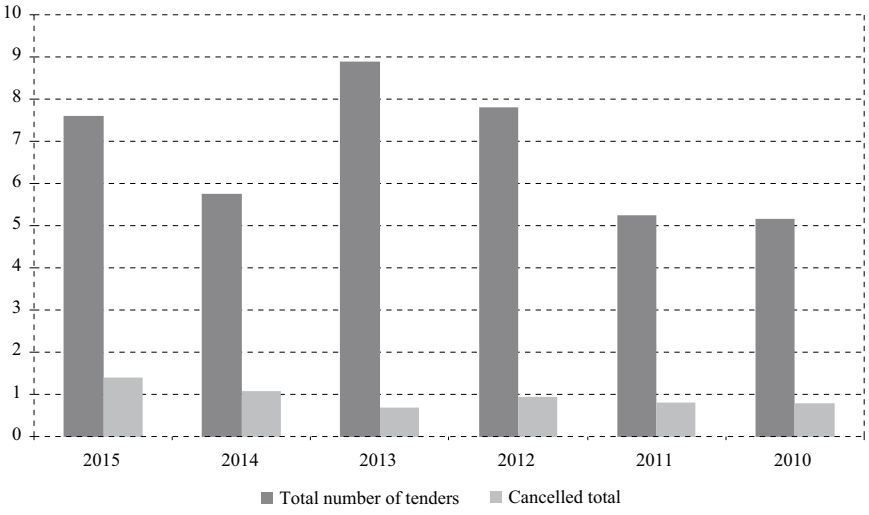
According to responses the core direct transaction costs are the salaries of involved employees, IT costs (especially the purchasing of necessary software), the need to purchase additional equipment (cars, copy machines, telephones), and the training of employees responsible for preparing the bid. The estimates of indirect costs are surprisingly high. The firms argued that building firms are subjects of "dirty" competition practices during tendering. Unsuccessful tenderers frequently submit complaints deliberately to slow down the tender realisation and to penalise winners. Note that winners may need to hire expensive legal services to defend their positions and their capacities reserved for this concrete bid may not be used because of tender delays. The practice may even go further – one interviewed expert in Slovakia confirmed that there are already firms that formally participate in the tender, but their aim is not to win the contract, but, when the bids have been ranked by the procurers, to contact the winner and ask for a special "fee" for agreeing not to file appeals and complaints.

Placek, Pucek and Ochrana (2019) have data showing that the probability of procurement process revisions in the Czech Republic procedures is rather high. For example, almost 1.5% of all open tenders are subject to the regulator's revision procedure. The fact that almost 20% of complaints are approved by the regulator may mean that procurers are not well qualified, but also may mean that the legislation is overcomplicated (see below).

Transaction costs also increase because of the relatively high number of cancelled tenders. In such a situation all direct and indirect costs incurred by firms are merely wasted resources. This has a really damaging impact on the procurement system (Figure 1).

Figure 1

Number of cancelled tenders in Slovakia (in thousands)

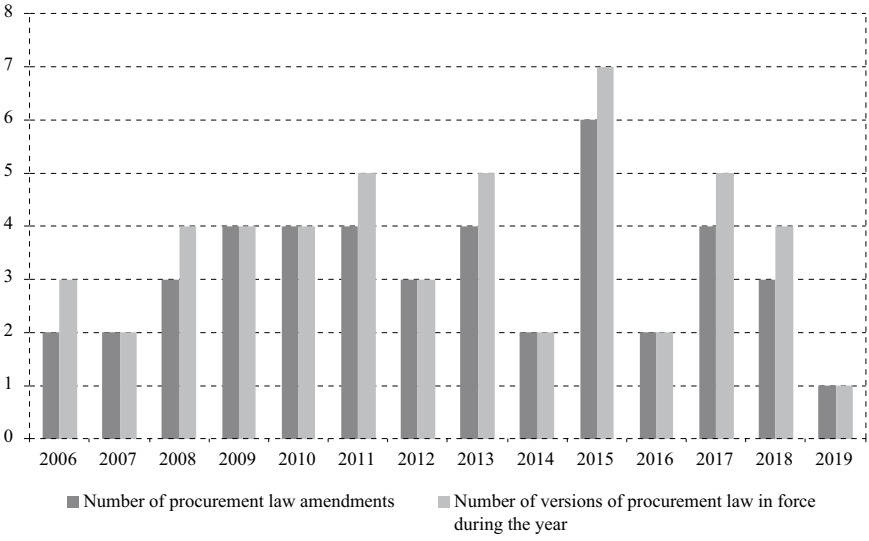


Source: Authors, data from www.uvo.gov.sk, 2016.

Over-bureaucratisation can also be documented by the legislative developments. The typical response of the Slovak and Czech governments to public procurement implementation problems, is to enshrine any changes in ever more detailed and complex legislation. We mapped two aspects – the number of changes to the Slovak public procurement law, and the number of pages of the law. This followed the methodology of Pavel (2013). Figure 2 and Table 6 show the results.

Figure 2

Legislative changes to the Slovak public procurement law



Source: Own calculations.

Table 6

Quantitative analysis of Slovakia's public procurement law

Law number	Validity date	Normalised pages	
		Main text	Including annexes
263/1993 Coll.	1/1/1994	14	14
263/1999 Coll.	1/1/2000	48	58
523/2003 Coll.	1/1/2004	89	98
25/2006 Coll.	1/2/2006	208	229
343/2015 Coll.	3/12/2015	259	275

Source: Own calculations (normalised page = 1800 signs).

Frequent changes reduce the chance to deliver procurement in a legally correct way – officials may not even be able to finish re-training for a new version of the law before the next revision is passed. The enlarged law generates many concomitant regulatory and internal administrative norms. This complicates procurement execution for both suppliers and contracting authorities. Both suppliers and contractors used their options to provide verbal comments on this issue, when responding to the questionnaire. Here are two quotes to document the situation:

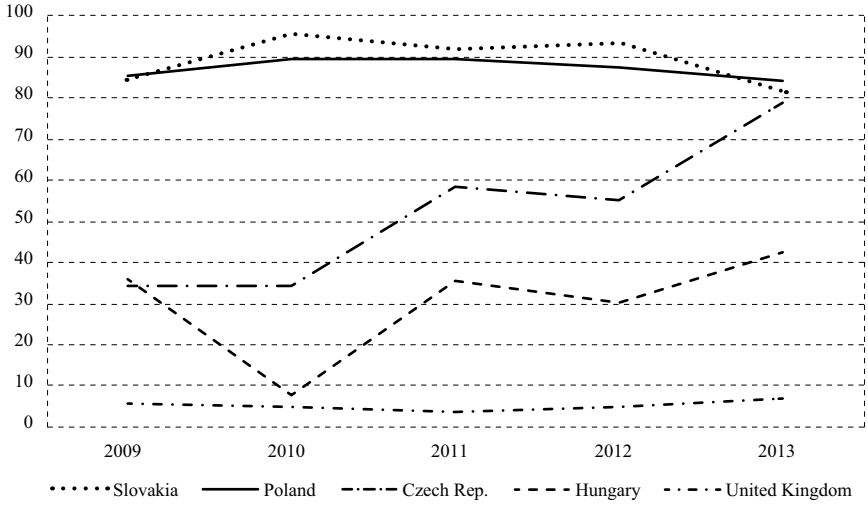
"The Slovak public procurement law is not for humans. It is complicated, extensive and difficult to understand. Some paragraphs lack explanations, links and implications. It requires too much in administrative actions, paperwork and time". (Contracting official)

The bureaucracy it is necessary to accept is unbelievable. I am not sure that it was proposed by a "normal human being". It must be designed by people who do not understand private business at all. (Supplier)

A comprehensive procurement bureaucracy delivers one more problematic outcome worth documenting. In a standard tender the contracting authority has the right to decide if it will select the supplier on the basis of the lowest price, i.e. the criterion of economy, or on the basis of the most economically advantageous bid, that is the efficiency criterion (the MEAT criterion). Figure 3 shows that the number of decisions based on the criterion of economy in countries like Slovakia is extremely high. This is despite the use of the criterion of economy for selecting future suppliers being a rather risky decision.

Figure 3

The frequency of the use of the lowest price criterion to select tender winners (in %)



Source: Authors, based on data from Tenders Electronic Daily.

The new EU procurement directives, effective from 2014, strongly recommend not using lowest price as the selection criterion for works and services, for reasons noted above. Table 7 shows that the EU advice has largely been ignored in Slovakia.

Table 7

Lowest price and MEAT criteria used in Slovakia (in %)

2018	Lowest price	MEAT	2019	Lowest price	MEAT
Works	89	11	Works	92	8
Supplies	93	7	Supplies	94	6
Services	94	6	Services	94	6

Source: Authors, data on completed tenders from Tenders Electronic Daily.

4 CORE SOURCES OF OVER-BUREAUCRATISATION IN SLOVAK PUBLIC PROCUREMENT

The core cause of over-bureaucratisation of public procurement, and of some other areas of public administration in Slovak and Czech Republics, is the administrative culture, which reflects wider societal and political culture and values. The European Public Administration Country Knowledge (EUPACK) summary report (Thijs, Hammerschmidt and Palaric, 2017) mapped the administrative culture in all EU countries and its connection to public administration being mostly procedural in the majority of them. According to this report, managerial public administration exists only in the Netherlands and the United Kingdom. The vast majority of new EU member states have procedural public administration systems, with the exception of Estonia, Croatia and Poland, which are characterised as mixed systems.

A connected result is the level of regulatory density. "Red-tape" – that is a high level of regulatory density – is characteristic of all new EU members, save the Baltic States, which are assessed as having medium regulatory density. The combination of a strong procedural logic and a high regulatory density confirms the continuing high persistency of a more traditional Weberian bureaucracy in most new EU member states. This judgement has been confirmed by the Coordinating for Cohesion in the Public Sector of the Future (COCOPS) project (Hammerschmid et al., 2016).

In Slovakia, administrative tradition and culture are definitely based on the tradition of the *Rechtsstaat*, characterised in general by the dominant role of law and legalism in the way the government thinks and acts. Compliance is much more important than performance. If such a *Rechtsstaat* tradition dominates the administration of the public procurement system, which is true for the Slovak Republic, the results can be very damaging, especially because such a situation will lead to what has been called a passive waste of resources. This phenomenon has been well mapped by Bandiera, Prat and Valletti (2009) who claim that passive waste has a variety of causes, but especially important are a lack of skills and incentives to minimise costs, and an excessive regulatory burden. Their example of this burden is from the US Military, whose procurement system includes a 26-page description of chocolate cookies or brownies.

Passive waste in public procurement in Czech and Slovak conditions was first explored by Pavel (2013), and later by others, such as Sumpikova et al., (2016). The findings suggest that for example, in relation to the above described over-frequent use of the lowest price selection criterion, procurement officials are reluctant to bear the risks and extra work of using more complicated criteria. They also have only limited access to information on how to apply the MEAT criterion appropriately. The data collected by OTIDEA (Langr, 2013) throw light on the situation in the Czech Republic, where, according to the responses, 85% of procurers use lowest price as winner selection criterion, because they are afraid of complaints by bidders.

These findings not only confirm problems noted by Bandiera, Prat and Valletti (2009), but also add an additional explanation to the variety of sources of passive waste: bureaucratic safety. Public officials are not only insufficiently motivated and inadequately trained to achieve savings, but their first priority is legal safety. This requires full compliance with regulations, and is independent of the financial results of an operation. Bureaucratic safety behaviour in an already over-bureaucratised system converts the will to achieve economy or efficiency in public procurement operations into a "mission impossible".

This preference of procurement officials for safety can also help explain the results reported in Table 1 at the beginning of this text. The savings look very optimistic, but their main purpose is to over-estimate the price in the tender documentation.

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Soudek and Skuhrovec (2013) analysing electricity and gas supplies, where market price comparisons are straightforward, as both commodities are homogeneous, confirmed that the expected price in tender documentation is normally over-estimated. However, they were unsure of the extent to which the over-estimates reflect a desire to show savings in the final deal or to which they just reflect caution.

5 CONCLUSIONS

This article documents the phenomenon of over-bureaucratisation of the public procurement systems of the Czech Republic and Slovakia. The data collected clearly confirm that the public procurement legislation is too comprehensive and generates high transaction costs, some of which may reflect the opportunistic/mafia type behaviour of certain tenderers.

The core finding of this paper is that in countries with *Rechtsstaat*-based administrative cultures, the over-bureaucratisation of public procurement, combined with limited incentives for public officials to make savings, and their preference for "bureaucratic safety", represent core barriers to achieving efficient public procurement. For most procurement officials, who focus on compliance, public procurement is simply an administrative process, and not a public financial management task. Such an environment generates excessive passive waste, whose size is as yet unknown in detail, but whose mapping may be a project for further research.

The practical question resulting from these findings is obvious: How can bureaucratic and management aspects of procurement be optimally combined, i.e. how can the level of bureaucracy in procurement be optimised? However, there is no simple answer to this question, especially for countries with administrative systems like the Czech or Slovak Republics. Long term systemic changes of the whole administrative system should be the base – the switch of focus from process to results (achieved by proper, but not too complicated procedures) is the core "medicine". Without this, although some marginal changes – like simplifying qualification procedures, formal preference to MEAT instead of price – might be possible, their impact on the system performance would be insignificant and real sustainable procurement impossible.

Disclosure statement

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