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Financialization more than globalization! The contribution of global cities to inequalities

Olivier Godechot, Nils Neumann, Lasse Henriksen, Are Skeie Hermansen, Feng Hou, Naomi Kodama, Zoltán Lippényi, Silvia Maja Melzer, Halil Sabanci, Max Thaning, Paula Apascaritei, Dustin Avent Holt, Nina Bandelj, István Boza, Marta M. Elvira, Gergely Hajdu, Alena Křižkova, Andrew Penner, Andreja Poje, William Rainey, Mirna Safi, Matthew Soener, Donald Tomaskovic-Devey

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Financialization more than globalization! The contribution of global cities to inequality[1]

Olivier Godechot[a], Sciences Po, CRIS-CNRS and AxPo, France

Nils Neumann*, University of Michigan, USA

Lasse Henriksen[b], Copenhagen Business School, Denmark

Are Skeie Hermansen[c], University of Oslo, Norway

Feng Hou[d], Statistics Canada, Canada

Naomi Kodama[e], Meiji Gakuin University, Japan

Zoltán Lippényi[f], University of Groningen, the Netherlands

Silvia Maja Melzer[g], Universitat de Barcelona, Spain

Halil Sabanci[h], Frankfurt School of Finance and Management, Germany

Max Thaning[i], Stockholm University, Sweden

Paula Apascaritei, Universidad Carlos III de Madrid, Spain

Dustin Avent Holt, Augusta University, USA

Nina Bandelj, University of California-Irvine, USA

István Boza, Institute of Economics, Centre for Economic and Regional Studies, Hungary

Marta M. Elvira, IESE Business School, University of Navarra, Spain

Gergely Hajdu, Vienna University of Economics and Business, Austria

Alena Křížková, Institute of Sociology, Czech Academy of Sciences, Czechia

Andrew Penner, University of California-Irvine, USA

Andreja Poje, Association of Free Trade Unions of Slovenia, Slovenia

William Rainey, University of Massachusetts-Amherst, USA

Mirna Safi, Sciences Po, CRIS-CNRS, France

Matthew Soener, University of Illinois at Urbana-Champaign, USA

Donald Tomaskovic-Devey, University of Massachusetts-Amherst, USA

*Corresponding author: neumannn@umich.edu

[a]French data; [b]Danish data; [c]Norwegian data; [d]Canadian data; [e]Japanese data; [f]Dutch data.

[g]German data; [h]Spanish data; [i]Swedish data.

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Abstract
Global cities contribute to earnings inequality by concentrating high-paying jobs. But how much and why? In this paper, we quantify the contribution of global cities to earnings inequality and examine whether this contribution is attributable to the financialization of cities or their coordinating role in the global trade of goods and non-financial services. Using administrative linked employer-employee earnings data in nine advanced capitalist democracies and published Internal Revenue Service tables for the United States between 1989 and 2019, we show that global cities account for a substantial portion of national and regional increases in inequality. This contribution to inequality is far greater in financial cities than in the most comparable non-financial cities. In addition, the divergence in pay levels between financial and comparison cities increases with the financialization of respective countries. Our evidence thus shows that the contribution of global cities to inequality is driven more by the concentration of financiers than by other functions of global economic coordination.

1. Introduction

The troubling concentration of income in the hands of the top 1% is widespread across high-income countries[1]. The "global city" thesis is a prominent explanation for this trend, contending that globalization concentrates high-paying jobs in global cities such as New York, London, Tokyo, and Paris and thus drives earnings inequality at the top, both locally and nationally[2,3]. While previous research has shown that occupational structures in global cities are indeed characterized by increased professionalization[4,5], it remains unclear just how much and through what mechanisms these cities have contributed to the rise in local and national earnings inequality.

First, and surprisingly, previous work has not yet established the contribution of global cities to the rise in national earnings inequality, particularly to the surge in top earnings shares. This contribution may be substantial given the documented sharp increase in top earnings shares in advanced capitalist economies since the 1980s[1].

Second, the mechanisms by which global cities contribute to inequality have not yet been identified. The global city thesis potentially conflates two distinct processes: globalization and financialization. The prevailing explanation is that of globalization: a globalizing economy promotes the concentration of high value-added communication, strategic control, and organizational jobs that replace decentralized manufacturing and logistics jobs. These new high-paying jobs are created in corporate headquarters located in global cities, which are becoming the control centers of global capitalism. However, global cities (such as New York, Paris, and Tokyo) are also global financial cities[6-8]. That is, they are emerging as the central geographical sites for expanding financial industries and attract many well-paid financiers. This is likely to contribute to inequality as previous research has shown that financialization has been a key driver of the rise in earnings inequality[9-13]. Therefore, the contribution of global cities to inequality could either be a by-product of globalization—and thus of the coordination of the global trade of goods and services—or a local consequence of financialization—and thus of the growing activity and centrality of financial markets. In addition, there are other urban trends that may explain part of the contribution of global cities to the rise in inequality. Many global cities are

political capitals, attracting government officials, lobbying activities, and other high-paying jobs in the political sphere[14,15]. In addition, these cities are growing metropolitan areas, and previous work has shown that earnings inequality increases with city size, both between and within urban areas[16-20].

In this article, we identify for the first time the magnitude and mechanisms by which global cities contribute to national and local earnings inequality. We leverage an unprecedented compilation of administrative data on earnings in nine countries (Canada, Denmark, Sweden, Norway, France, Germany, the Netherlands, Spain, and Japan) and IRS (Internal Revenue Service) data for the United States with more than one billion employer-worker-year observations.

We first measure the relative contribution of workers in the national financial cities (defined as the urban areas that host the main stock exchanges) to national and local inequality compared to that of workers in "comparison" large cities (defined as the largest cities that are neither the financial nor the political center). This within-country comparison between two cities helps us account for the "metropolitan effect," that is, that growing cities tend to drive up inequality. This novel methodology further allows us to distinguish between financial and non-financial global cities. We estimate the contribution of global city labour markets to national inequality in the two national comparison cities. Finally, we use these data in a country-level panel regression to estimate the effects of financialization and non-financial globalization on the relative contribution of global cities to national and local inequality.

Based on these analyses, we show that global financial cities contribute substantially to the increase in national and local earnings inequality, much more than comparison cities. If we rescale respective national comparison cities to reflect the same population size, financial cities contribute on average *six times* more to the growth of the national top 1% earning share than the comparison cities. In addition, the growth rate of the local top 5% earnings share is on average 1.6 times higher in financial cities than in comparison cities. Financial sector workers account for between one-third and 60% of the difference between the comparison cities' contribution to national and local inequality, respectively. Finally, regressions show that this contribution is largely driven by financialization rather than non-financial globalization.

2. The contribution of financial cities to national and local inequality

How much of the increase in national top earnings shares can be attributed to the rise in earnings of workers in financial cities relative to workers in other parts of the country? Table 1 provides a first decomposition to examine this for the inequality increase of last three decades. Over this period, the national earnings share of the top 1% increased in all countries, with increases ranging from 0.06 percentage points per year in Japan to 0.46 percentage points per year in the United States.

The absolute contribution of financial cities to the rise in national inequality is substantial. In some countries (Norway, Denmark, France, Sweden, and Japan), the greater part, and for some even the entirety, of the rise in the national earnings share of the top 1% flowed to workers in financial cities. Comparison cities, by contrast, contributed relatively little to the rise in top earnings in all countries. In fact, the increase in top earnings is almost entirely concentrated in the financial city. However, this result also reflects the fact that financial cities in these countries are large and host a significant portion of the labour force.

To neutralize this population size effect, we can use the proportion of the employed population in the city at the beginning of the observation period to rescale the contribution of the financial cities. This rescaling shows how much the city would contribute to inequality if it comprised 10% of the employed population at the beginning of the period, all other factors being equal. Even rescaled, financial cities still contribute more dramatically to the growth of the top 1% earnings share in all countries. In addition, this contribution is greater than the financial cities' rescaled share of the employed population (i.e., 10%), with some cities contributing from 15% (New York) to 85% (Stockholm) and on average up to 44% of the increase in top 1% earnings share. In contrast, not all comparison cities make a positive contribution to the increase in top earnings shares, and some even make a negative contribution (e.g., Osaka). Still other comparison cities do contribute positively, but less than their rescaled population size at the beginning of the period (Montréal, Lyon, Bergen, Aarhus, or Los Angeles). Most importantly here, however, is that financial cities in all countries contribute significantly more to the increase in inequality between 1993 and 2007

than the comparison cities. To summarize, rescaled comparison cities contributed only 7% of the increase in top 1% earnings share. Thus, rescaled to the same size, financial cities would contribute six times more to the top 1% surge than comparison cities. Even if we understand this as an approximation, this decomposition shows the specificity of financial cities' contribution to inequality goes far beyond the large metropolis effect.

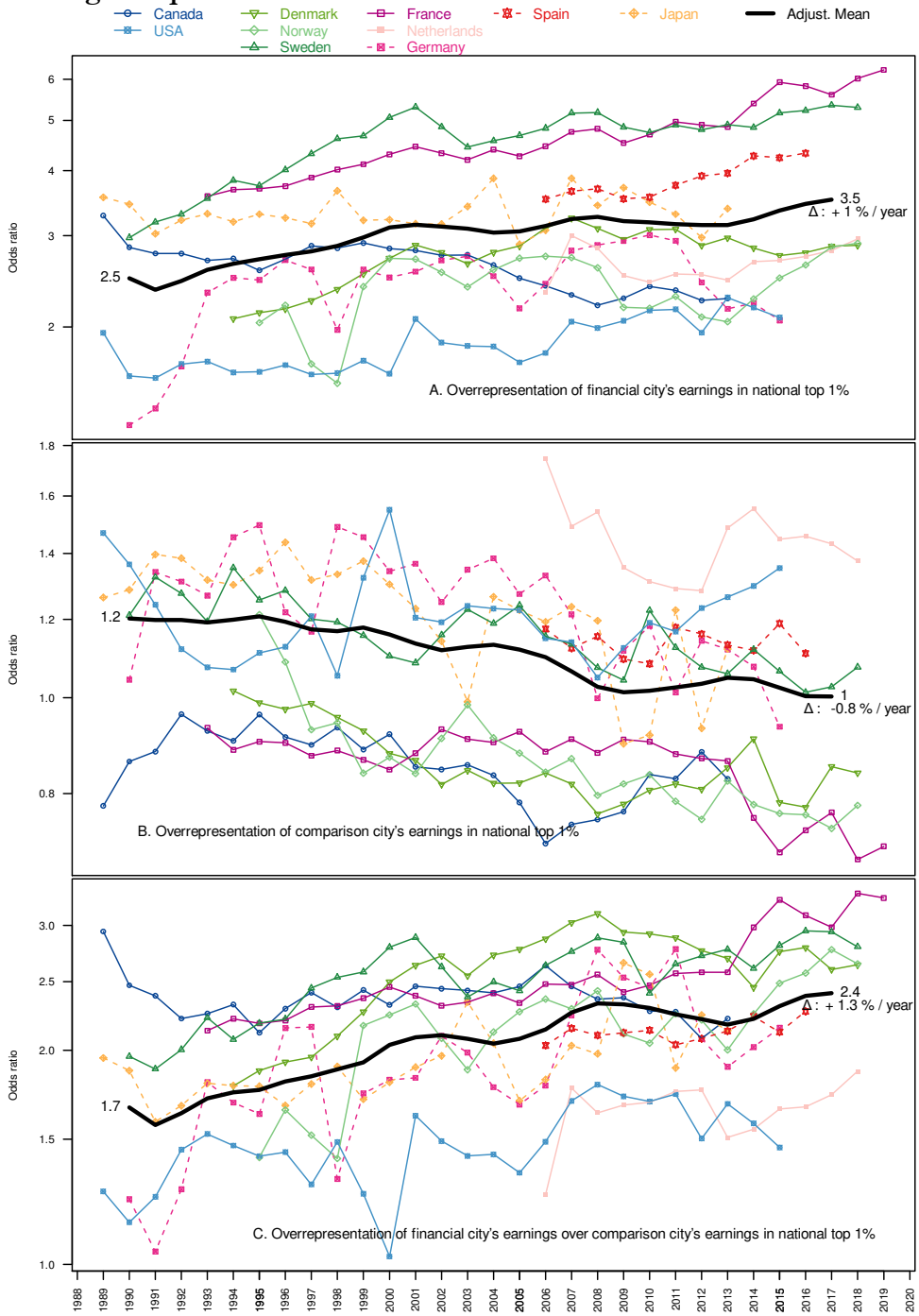
These decompositions yield remarkable results but are only measurable if there is a significant increase (or decrease) in national inequality. Therefore, we use a second indicator of the contribution of cities to national inequality, using an overrepresentation ratio of the earnings share of workers who are in the top 1% and work in that city within the national top 1% earnings bracket.

Table 1. Contribution of cities to the national increase in top 1% earnings share

Country	Start year	End year	Annual growth of the national top 1% earnings shares, %	Financial city	Financial city contribution, %	Financial city contribution rescaled, %	Comparison city	Comparison city contribution, %	Comparison city contribution rescaled, %
United States	1989	2012	+0.463	New York	10	15	Los Angeles	3.4	8
Canada	1992	2006	+0.312	Toronto	30	20	Montréal	3.8	3
Germany	1992	1998	+0.331	Frankfurt	5	33	Hamburg	4.7	20
Norway	1996	2007	+0.108	Oslo	62	35	Bergen	3.4	6
France	1993	2018	+0.082	Paris	107	41	Lyon	1.4	4
Netherlands	2009	2015	+0.18	Amsterdam	31	43	Rotterdam	10.5	26
Denmark	1994	2018	+0.048	Copenhagen	62	49	Aarhus	5.1	8
Japan	1997	2009	+0.057	Tokyo	87	58	Osaka	-18	-22
Spain	2006	2015	+0.083	Madrid	120	66	Barcelona	33.5	23
Sweden	1990	2007	+0.069	Stockholm	103	85	Gothenburg	9.2	15
Weighted mean	1994.2	2011.9	+0.171		61.7	43.6		4.6	7.3

Note: We isolate the interval in which inequality increases by taking the year of the national minimum of the top 1% earnings shares as the start year and that of the maximum as the end year. We calculate the financial contribution to inequality as the share of the increase in the national top 1% that is earned by wage earners in the financial city: $Contr = \Delta S_{top\ \&\ city}/\Delta S_{top}$ (see "Measures and methods," section 5). To rescale the contribution of cities to inequality, we estimate their contribution hypothesizing that they contain 10% of the population at the start of the period. To do so, we divide the city's contribution by its employment share at the start of the period (and multiply the whole by 10): $Contr\_rescaled = 10*Contr/E$, where E is the city's employment share at the start of the period. The table is ordered by the "Financial city contribution rescaled" column. The averages in the bottom row are weighted by the number of years of the inequality boom. Hence, in Sweden between 1990 and 2007, a period during which the national top 1% increased its share by 0.07 percentage points annually, 103% of this increase went to top 1% earners working in Stockholm. If we artificially rescale the financial city's contribution to a situation in which Stockholm accounted for 10% of the workforce, Stockholm contributed to 85% of the increase in the national top 1% share. Estimates are based on IRS tables for the United States and on the Comparative Organizational Inequality International Network's use of national linked employer-employee data sets (see Appendix A and Table A1).

Figure 1. Contribution of financial and comparison city to national earnings inequalities



Note: In Figure 1A and 1B, we plot for each country the odds ratios of two shares: $S_{top\ \&\ city}$ and $S_{top\ \&\ elsewhere}$, where $S_{\text{top \& city}}$ is the share of national earnings earned by wage earners who belong both to the national top fractile and work in the given location. In Figure 1C, we plot the odds ratio of the $S_{top\ \&\ fin\ city}$ and $S_{top\ \&\ co\ city}$ shares (See Measures and methods in Section 5.) We compute an adjusted mean that avoids artificial gaps caused by the variation in the number of countries in our sample (see Appendix B). Hence, in 1990, the earnings of the financial cities are on average 2.5 times more represented in the national top 1% than that of the rest of the country. In 2017, this average odds ratio increases to 3.5. This odds ratio increased at a growth rate of 1% per year. Estimates are based on IRS tables for the United States and on the Comparative Organizational

Inequality International Network's use of national linked employer-employee data sets (see Appendix A and Table A1).

Figure 1A shows the overrepresentation of earnings of workers in the national top 1% who work in financial cities compared to the earnings of workers in the national top 1% who work in the rest of the country. In all countries, the earnings of workers from financial cities are overrepresented, ranging from 1.3 to 5 times the earnings in the rest of the country. In most countries, this overrepresentation increases between 1993 and 2020. Only Canada has a linear negative trend. For the other nine countries, the trend is positive, and for six of them (Denmark, France, Germany, Spain, Sweden, and the United States) it is pronounced. Figure 1B shows the same indicator but with earnings of the comparison cities instead of the financial cities. As opposed to the first panel, the top earnings share in comparison cities is underrepresented in four countries (Canada, Denmark, France, and Norway), with odds ratios between 0.6 and 1, and only slightly overrepresented in the five other countries, with odds ratios between 1 and 1.5. Moreover, the representation of the earnings of the top 1% earners in the comparison city in the national top 1% earnings share declines significantly in six countries between 1993 and 2020 (Denmark, France, Germany, Japan, Norway, and Sweden).

Figure 1C displays the relative overrepresentation of earnings of workers in the national top 1% in the financial cities compared to the earnings of workers in the national top 1% in the comparison cities. This graph helps inform our analysis of whether the contribution of financial cities to national inequality is due to increasing urbanization or specific characteristics of these cities. We find that in all countries the earnings of workers in financial cities are more represented in the top 1% than those of workers from comparison cities, with odds ratios ranging from 1 to 3.6. Moreover, we find that this overrepresentation increases significantly over the period on average and for almost all countries. A further way to summarize these trends is with linear trends by country, which is shown in the first column of Table 2. Here we see that the average rate of increase in our overrepresentation ratio follows a linear trend of an annual rate of increase of 1.3%. Decomposing by country, we find positive and significant trends for eight of 10 countries, with annual rates of increase in odds ratios ranging from 0.6% (Spain) to 2.2% (Denmark). The Netherlands shows positive

but nonsignificant rates of increase of 1.0% (note that the time span of the data is more limited than for the other countries and does not include data points during the steep rise in inequality from 1993 to 2007). Canada shows a negative but insignificant trend. On the basis of these results, we can confidently assert that, except for Canada, financial cities contribute more to national inequality than comparison cities.

At this point, we can turn to the results of the same exercise, but for local instead of national earnings inequality. We use the same indicators as before, but we use the local top 5% earner bracket instead of the national top 1%. Figure 2 shows the evolution of the local top 5% earnings share in financial cities (Figure 2A) and in comparison cities (Figure 2B) and their odds ratios (Figure 2C).

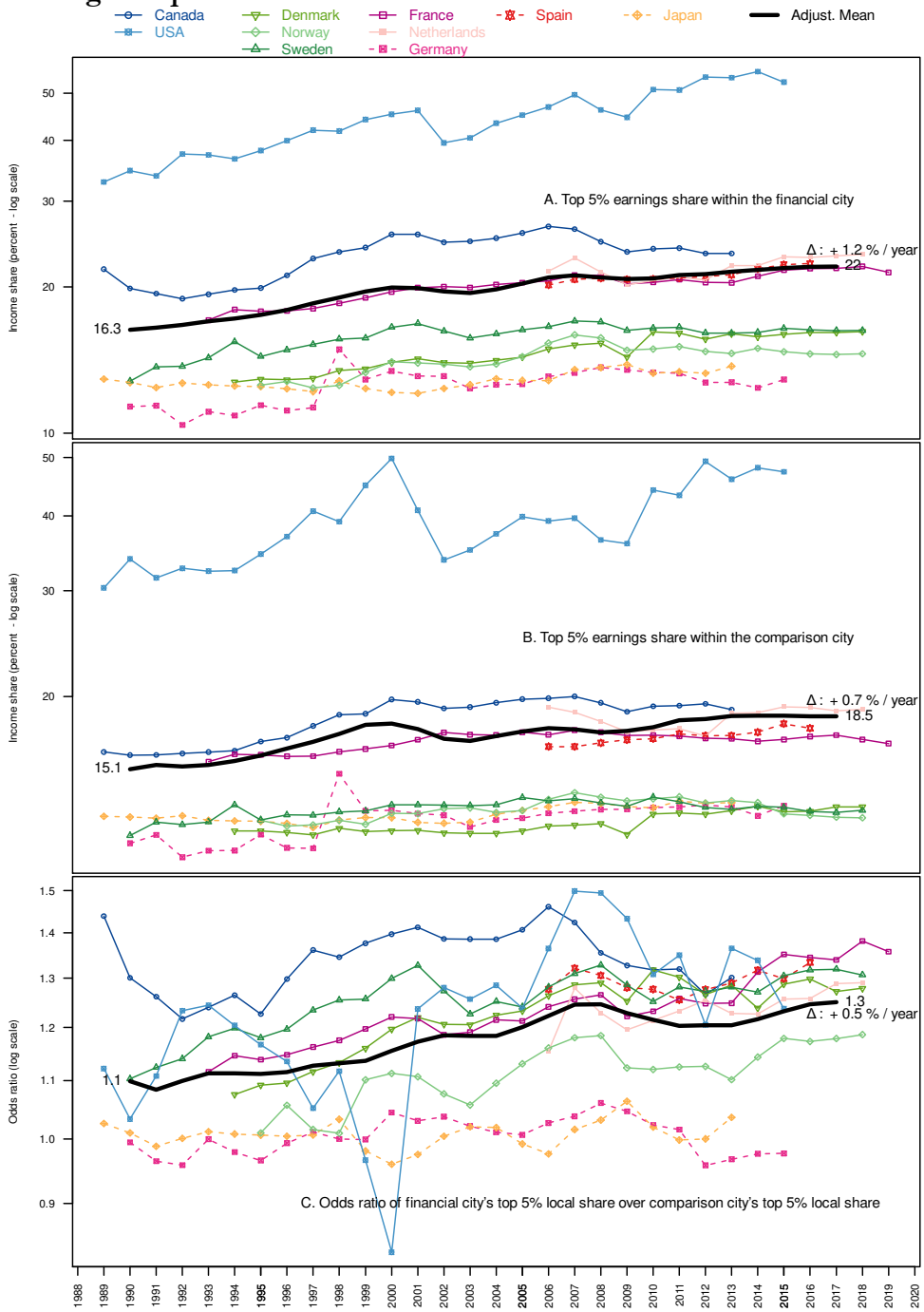
Figures 2A and 2B exhibit consistent increases in local inequality in all cities, whether they be financial cities or comparison cities. The linear trends of the local top 5% shares are positive and significant in all financial cities and almost all comparison cities (with the exception of Barcelona—with an increase of 1.0% per year, which is not significant due to the shorter time span). The positive and significant trends range for financial cities from 0.4% per year in Tokyo to 1.0% in Paris, 1.1% in Stockholm, 1.4% in Toronto, and 3.2% in New York, and for comparison cities from 0.3% in Osaka to 0.4% in Lyon, 0.5% in Gothenburg, 1.1% in Montréal, and 2.2% in Los Angeles. Finally, Figure 2C shows two intriguing results. First, in almost all countries, local inequality is more pronounced in financial cities than in comparison cities. Only in Japan and Germany is the magnitude of local inequality similar, with odds ratios between 0.96 and 1.04. Second, the divergence between local inequality in financial cities and comparison cities is increasing in almost all countries. As shown in the second column of Table 2, the linear trends are positive for all countries and significant for more than half of them, especially for Denmark, France, the Netherlands, Norway, Sweden, and the United States. On average, local inequalities increased in financial cities at a rate 1.6 times more pronounced than in comparison cities. In summary, these results show with remarkable consistency that financial cities not only contribute more to national inequality but also experience a larger increase in local inequality than comparison cities.

Table 2. Annual linear trends for the total period

	Financial cities' relative contribution to national inequality (log)	Financial cities' relative contribution to local inequality (log)	Relative contribution of finance to local inequality (log)	Relative contribution of financial cities to national inequality (excluding finance)	Relative contribution of financial cities to local inequality (excluding finance)
Figures	1C	2C	3C	A1A	A1B
Panel A					
Year	1.27***	0.47***	2.24***	0.93***	0.29***
	(0.14)	(0.05)	(0.25)	(0.13)	(0.06)
Country fixed effect	Yes	Yes	Yes	Yes	Yes
N	232	232	205	205	205
R^2 (full model)	0.78	0.80	0.77	0.54	0.88
Panel B					
Canada × year	-0.24	0.19	2.19***	-0.46*	-0.10
	(0.24)	(0.16)	(0.31)	(0.28)	(0.16)
Denmark × year	1.52***	0.73***	1.81**	0.56***	0.50***
	(0.35)	(0.09)	(0.72)	(0.21)	(0.06)
France × year	1.48***	0.69***	0.45	1.00***	0.63***
	(0.15)	(0.04)	(0.28)	(0.19)	(0.05)
Germany × year	2.19***	0.07	0.02	1.93***	0.07
	(0.52)	(0.09)	(0.46)	(0.58)	(0.09)
Japan × year	1.11***	0.06	2.28**	1.59**	-0.00
	(0.31)	(0.06)	(1.08)	(0.67)	(0.08)
Netherlands × year	1.10	0.53**	2.73	1.85***	1.16***
	(0.87)	(0.23)	(2.98)	(0.43)	(0.10)
Norway × year	1.95***	0.57***	5.41***	0.98***	0.35***
	(0.39)	(0.08)	(1.61)	(0.32)	(0.06)
Spain × year	0.61**	0.17	-1.59	0.82	0.24*
	(0.27)	(0.17)	(1.12)	(0.60)	(0.13)
Sweden × year	1.22***	0.47***	3.92***	0.76***	0.34***
	(0.16)	(0.07)	(0.42)	(0.11)	(0.03)
USA × year	1.00***	0.92***			
	(0.23)	(0.20)			
Country fixed effect	Yes	Yes	Yes	Yes	Yes
R^2 (full model)	0.82	0.84	0.82	0.59	0.92

Note: In panel A, we estimate yearly trends β thanks to OLS models $log(y)=\beta.year + c + u$ with country c fixed effects. In panel B, we add an interaction between the yearly trend and country fixed effects: $log(y)=\sum_c \beta_c\ year \times c + c + u$. Linear trends are multiplied by 100 to correspond to rates of increase in percentage. Thus, the relative contribution of financial cities to national inequality increases at a rate of +1.27% per year on average and by +1.48% per year in France. Estimates are based on IRS tables for the United States and on the Comparative Organizational Inequality International Network's use of national linked employer-employee data sets (see Appendix A and Table A1). We exclude the United States in models 3C, A1A, and A1B because we cannot disaggregate by sector with IRS data. Robust standard errors are clustered by year in parentheses. ***$p < .01$, **$p < .05$, *$p < .1$.

Figure 2. Contribution of financial and comparison city to local earnings inequalities



Note: In Figures 2A and 2B, we plot for each country the local top 5% earnings share in the financial and comparison cities, respectively. In Figure 2C, we plot the odds ratio of these two shares for each country. We compute an adjusted mean that avoids artificial gaps caused by the variation in the number of countries in our sample (see Appendix B). Thus, in 1990, the local top 5% within financial cities earned 16.3% of the earning bill. In 2017, this share increased to 22%. This share increased at a growth rate of 1.2% per year. Panel C shows that the overrepresentation of the top 5% in local earnings in financial cities relative to comparison cities moved from 1.1 in 1990 to 1.3 in 2017. Estimates are based on IRS tables for the United States and on the Comparative Organizational Inequality International Network's use of national linked employer-employee data sets (see Appendix A and Table A1).

3. The contribution of financialization and non-financial globalization to inequality

How can we explain this substantial contribution of global financial cities to national and local earnings inequalities? Is this contribution due to their coordinative role in non-financial globalization or to the financialization of the national economy; or is it simply an effect of the increasing urbanization of these cities? In this section, we will explore this question using decomposition methods similar to those that we used in the previous section. These methods have the advantage that they allow us to calculate the contribution of financialization and non-financial globalization and urbanization directly by observing the contribution of earnings of workers employed in different sectors.

We begin by decomposing the contribution of financial sector workers to local inequality. To do so, we calculate in Table 3 the proportion of the increase in the local top 5% earnings share that is accounted for by financiers, first for financial cities and then for comparison cities. In financial cities, financiers contribute significantly to the increase in local top 5% earnings shares. This contribution ranges from 4% of the increase in local earnings shares in Tokyo to 78% in Amsterdam, with an average of 52%. In most financial cities, more than half of the increase in local top earnings shares is due to the rising earnings of financiers. In contrast, perhaps unsurprisingly, financial sector workers contributed much less to the rise in inequality in the comparison cities, and in one urban area, Osaka, they even made a negative contribution. In all other comparison cities, except Hamburg, they contributed to less than half of the increase. On average, finance contributes 21% to the increase in inequality in comparison cities.

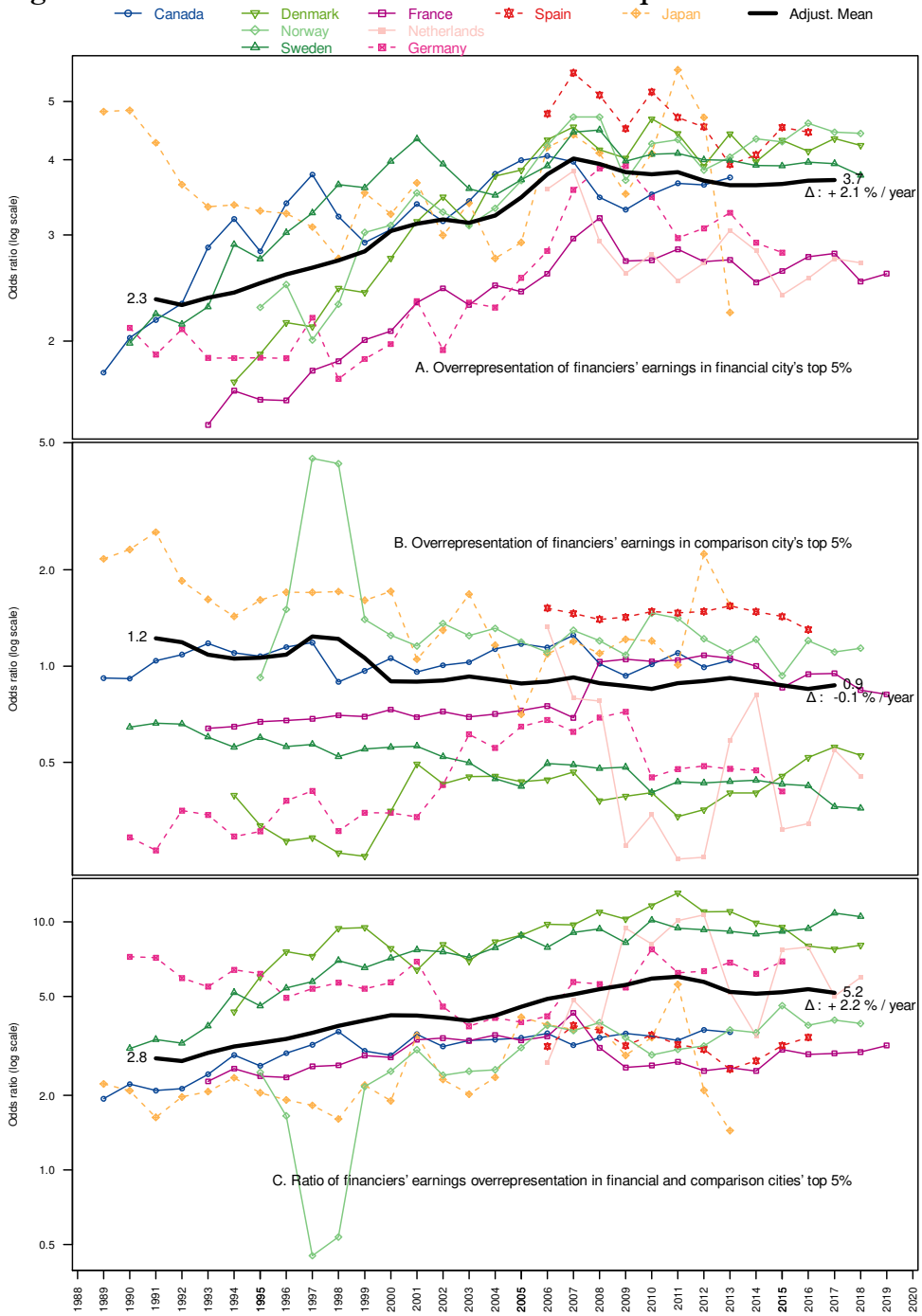
Table 3. Contribution of finance to local inequality during the national inequality increase

Financial city	Annual growth of top 5% earnings shares in financial city, %	Finance contribution, %	Comparison city	Annual growth of top 5% earnings shares in comparison city. %	Finance contribution, %	Period of measure
Tokyo	+ 0.138	4	Osaka	+ 0.085	-55	1997-2009
Frankfurt	+ 0.746	39	Hamburg	+ 0.678	15	1992-1998
Copenhagen	+ 0.143	48	Aarhus	+ 0.048	15	1994-2018
Toronto	+ 0.55	51	Montréal	+ 0.271	31	1992-2006
Paris	+ 0.198	60	Lyon	+ 0.055	69	1993-2018
Oslo	+ 0.287	62	Bergen	+ 0.152	17	1996-2007
Madrid	+ 0.227	63	Barcelona	+ 0.168	41	2006-2015
Stockholm	+ 0.247	69	Gothenburg	+ 0.105	9	1990-2007
Amsterdam	+ 0.474	78	Rotterdam	+ 0.295	35	2009-2015
Weighted mean	+ 0.334	52.7		+ 0.206	19.7	1996.6-2010.3

Note: We calculate finance's contribution to inequality as the share of the increase in the local top 5% that is earned by wage earners in the financial sector: $Contr = \Delta S_{top\ \&\ fin}/\Delta S_{top}$ (cf. "Measures and methods," section 5). The table is ordered by the "Finance contribution" column in financial cities. Averages in the bottom row are weighted by the number of years of the inequality boom. In Amsterdam, the top 5% increased their share of the earnings bill by 0.5 percentage points per year between 2009 and 2015. Financiers in the top 5% in Amsterdam contributed to 78% of this increase. (We use the same measurement period as in Table 1.) Estimates are based on the Comparative Organizational Inequality International Network's use of national linked employer-employee data sets (see Appendix A and Table A1).

Similar to the indicators in the previous section, this additive decomposition depends on population size and growth. Figure 3 therefore displays the overrepresentation of earnings of financiers in the local top 5% earnings share in financial cities (Figure 3A) and in comparison cities (Figure 3B). The first panel shows that within financial cities, earnings of financiers are strongly overrepresented in the local top 5% (with odds ratios between 1 and 6) and that, except in Japan and Spain, their overrepresentation increases rapidly throughout the period, with odds ratio growth rates between 2.5% and 3.5% per year. In contrast, the earnings of financiers in the comparison cities are not notably overrepresented in the local top 5%, and their share remains largely constant throughout the period (Figure 3B). Moreover, the ratio of the two preceding odds ratios displayed in Figure 3C supports our interpretation. The relative overrepresentation of financiers' earnings in the local top 5% is much larger and increasing faster in financial cities than in comparison cities, with strong positive and statistically significant trends in five of nine countries (see the third column of Table 2).

Figure 3. The contribution of finance to local inequalities



Note: In Figure 3A and 3B, we plot for each country the odds ratios of two shares: $LS_{top\ \&\ fi}$ and $LS_{top\ \&\ non\text{-}fi}$, where $LS_{top\ \&\ fi}$ is the local share of local earnings earned by wage earners who both belong to the local top fractile and work in the financial sector. In Figure 3C, we plot the ratio of these two odds ratios. We compute an adjusted mean that avoids artificial gaps caused by the variation in the number of countries in our sample (see Appendix B). Thus, in 1991, the earnings of the financial sector are on average 2.3 times more represented in the local financial city top 5% than that of other sectors. In 2017, this average odds ratio increased to 3.7. This odds ratio increased at an annual rate of 2.1% per year. Estimates are based on IRS tables for the United States and on the Comparative Organizational Inequality International Network's use of national linked employer-employee data sets (see Appendix A and Table A1).

A final way to capture the role of financiers in driving the positive effect of financial cities to national and local inequality is to replot our two main variables (Figure 1C and Figure 2C) after excluding financiers from the sample. We perform this exercise in Figure A1A and A1B and the fourth and fifth columns of Table 2. When we exclude financiers from the sample, the relative contribution of financial cities to local and national inequality is significantly weaker. Only in two countries for national inequality and three countries for local inequality do we see a significant time trend in the contribution of financial cities to inequality. Comparing the first two and last two columns of Table 2, panel A, the global trends in the contribution of financial cities to inequality decline by between 30% and 60% once we exclude financiers from the sample.

Regressions

To this point, our findings strongly indicate that financiers' wages, and thus financialization, account for a large part of the contribution of financial cities to national and local earnings inequality. However, the fact that financial cities account for about 30% to 60% of the growing inequality gap between financial cities and comparison cities does not per se negate a driving role of non-financial globalization in this growing gap. That is, non-financial globalization could still account for the remaining part of the gap in the inequality contribution between financial cities and comparison cities. In our final empirical analysis, we therefore compare the effects of financialization and non-financial globalization on the contribution of financial cities to inequality. To do so we run in Table 4 country-level panel regressions with country and year fixed effects with two main dependent variables, the contribution of financial cities relative to the contribution of comparison cities to national and local inequality. We measure these respectively at the top 1%, 5%, and 10% level of the distribution to increase analytical precision and identify which parts of the earnings distribution are most affected by financialization and non-financial globalization. All models in panels A, B, and C of Table 4 include control variables for the log of national population size, the difference in employment share in financial cities and comparison cities, and the log of GDP per capita.

Table 4. The effects of financialization and commercial globalization on the contribution of financial cities to inequality

	Financial cities' contribution to national inequality (log)			Financial cities' contribution to local inequality (log)		
	Top 10%	Top 5%	Top 1%	Top 10%	Top 5%	Top 1%
Panel A						
Population (log)	-0.53***	-0.65***	-0.42***	0.23**	0.19*	0.04
	(0.10)	(0.11)	(0.15)	(0.09)	(0.10)	(0.14)
Difference between employment shares in financial cities and comparison cities	-0.06*	-0.09***	-0.13**	-0.06**	-0.08***	-0.13*
	(0.03)	(0.03)	(0.06)	(0.02)	(0.03)	(0.06)
GDP per capita (log)	-0.06	-0.07	0.29**	0.01	0.04	0.24
	(0.07)	(0.08)	(0.12)	(0.11)	(0.13)	(0.15)
FDI outflow (stock) to GDP	-0.17**	-0.12*	-0.04	0.04	0.12	0.07
	(0.07)	(0.07)	(0.08)	(0.09)	(0.09)	(0.09)
Stock-market volume to GDP	0.37***	0.25**	-0.03	0.40***	0.24*	0.13
	(0.11)	(0.10)	(0.14)	(0.12)	(0.13)	(0.14)
N	214	214	214	214	214	214
R^2 (full model)	0.58	0.60	0.58	0.43	0.45	0.42
Country fixed effects	10	10	10	10	10	10
Year fixed effects	30	30	30	30	30	30
Panel B						
FDI outflow (stock) to GDP	-0.11***	-0.10***	-0.04	0.06**	0.06*	-0.01
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Difference between local earnings share of financiers in financial cities and comparison cities	0.12**	0.12**	0.13**	0.11***	0.14***	0.16***
	(0.05)	(0.06)	(0.06)	(0.03)	(0.03)	(0.04)

Note: We estimate the following models $log(y_{c,t}) = \delta_1.financialization_{c,t} + \delta_2.globalization_{c,t} + X_{c,t}.\beta + c + t + u$ thanks to OLS with *c* country and *t* year fixed effects. All variables are country demeaned and standardized. All independent variables are lagged, except for the earnings shares. Panel B includes the first three control variables and the fixed effects used in panel A. For panel B, we do not include the United States because the US data do not allow for a disaggregation between financial and non-financial earnings. As a result, the number of observations in panel B is 203. Hence, 1 standard deviation of stock market volume to GDP increases the contribution of financial cities to national top 10% share by 0.37 standard deviations. Estimates are based on IRS tables for the United States and on the Comparative Organizational Inequality International Network's use of national linked employer-employee data sets (see Appendix A and Table A1). Robust standard errors are clustered at the year level in parentheses. ***$p < .01$, **$p < .05$, *$p < .1$.

In panel A we include two main independent variables, foreign direct investment (FDI) outflow to GDP as a measure of commercial globalization, and stock market volume to GDP as a measure of financialization. Panel A shows that our measure of financialization contributes positively and significantly to both national and local inequality, although this effect becomes weaker for higher earnings groups and is not significant for the top 1% nationally

and locally. That is, financialization has a positive and significant effect on the relative contribution of financial cities to national and local inequality at the national and local top 10% and 5% levels. In contrast, our indicator for non-financial globalization is negative and significant for the national top 10% and 5% and statistically insignificant for all other models. These models thus indicate that non-financial globalization has a negative effect on the relative contribution of financial cities to the national top 10% and 5% earnings shares and no effect on the national top 1% and on local inequality.

In panel B we estimate the same model as in panel A but replace the stock market volume to GDP indicator with an indicator that captures the difference between the local earnings share of financiers in financial cities and comparison cities. This measure captures the relative financialization of financial cities. This measure is positive and highly significant for both national and local inequality at all three included earnings thresholds. That is, the difference in the local earnings share of financiers in financial and comparison cities contributes significantly and positively to the relative contribution of financial cities to national and local inequality. The effect of this indicator becomes slightly stronger for higher earnings brackets at the national and local levels, which suggests that the difference in the local earnings share of financiers plays a more important role the more we move up the earnings distribution. This is likely because financiers mostly drive earnings inequality at the very top of the earnings distribution[10]. Here too, commercial globalization has a highly significant negative effect on the relative contribution of financial cities to national inequality at the 10% and 5% levels and no significant effect at the top 1% level. While FDI outflow to GDP does have a positive and significant effect on the relative contribution of financial cities to local inequality at the 10% and 5% levels, its amplitude remains much smaller than that of our financialization indicator.

In summary, these models show that the relative contribution of financial cities to national and local inequality that we identified in the previous two sections is largely caused by financialization and not by commercial globalization. Moreover, although we cannot fully preclude the possibility that non-financial globalization has played a role in the contribution of global financial cities to

inequality, at best it appears that the effect of commercial globalization has been overshadowed by the effect of financialization.

4. Discussion

We used vast administrative linked employer-employee data from 10 countries to show that global cities significantly fuel national and local earnings inequality. Global financial cities account for a larger and increasingly significant portion of the evolution of national top 1% earnings shares compared to comparison cities. Moreover, global financial cities exhibit larger local inequality (as measured by the local top 5% earnings share) than comparison cities, and this divergence increases over the timespan that we analyzed. Financial sector workers contribute spectacularly to this growing dual divide. Using decomposition methods, we have shown that wages of financial sector workers account for between one-third and 60% of the increase in national and up to 78% of the rise in local earnings inequality between the early 1990s and 2018. Moreover, our country-level panel regression results show that financialization contributes significantly more to the rise in local and national earnings inequality than non-financial globalization. Hence, we show that global financial cities are significant geographical sites in which inequality is shaped.

Although our results are broadly consistent with global city theory, we intervene in two crucial respects. First, we distinguish between financialization and non-financial globalization. Previous research has erroneously subsumed these two distinct processes under the same global city phenomenon. Second, we denaturalize the assumed link between globalization and inequality by focusing on the effects of historically contingent financial labour market processes. Sassen's original formulation of the argument is not too dissimilar from the human capital and skill biased technological change approaches to inequality that are prevalent in economics[21]. Instead, we emphasize the effects of the accumulation of financial rents that contribute to the increasingly exorbitant salaries of workers in an extractive financial industry[22,23]. This process happens even in countries where the financial city is not quite as central to global commerce, such as in Sweden, Denmark, Spain, or the Netherlands. Moreover, we highlight the causal role of organizational processes in financial firms that

help financial professionals to appropriate large parts of the increase in financial rents that have occurred since the 1970s. Our results thus highlight the importance of the interaction between these macrostructural and organizational processes in understanding the contribution of global cities to inequality.

Limitations

We leave two countervailing phenomena uncovered that complicate our conclusion that the geographic organization of financial labour markets is the main cause of global cities' contribution to inequality. First, financial firms such as Goldman Sachs, Deutsche Bank, and BNP-Paribas are also global companies that coordinate economic activity worldwide. Their headquarters in New York, Frankfurt, or Paris host not only large trading rooms where standard financial market tasks are handled but also organizational managers who perform global coordination functions. Second, some authors suggest that non-financial firms are increasingly financialized, as financial income and assets play an expanding role on their balance sheets[24]. While the latter effect is probably not strong enough to significantly bias our results[25], future research needs to take this relationship seriously. Thus, it remains an intriguing avenue for future conceptual and empirical work to illuminate the relative analytic autonomy of globalization and financialization processes in general and their contribution to inequality in particular.

In addition, there is some cross-country heterogeneity in our results. For instance, we document strong contrasts between Scandinavian social-democratic countries and liberal market economies such as the United States or Canada. In Sweden and Denmark, financial cities and financiers contribute strongly to a modest rise of national top earnings share. In contrast, in the United States and Canada, financial cities only have a modest impact on a large increase in top earnings shares. In North America, finance contributed significantly to the rise in inequality in the second half of the 1980s, and wage-setting standards gradually spread from finance to other sectors (especially big tech), thus relativizing the high wages in the financial sector through high wages in other sectors. In Sweden, by contrast, financial markets remained a niche sector with unusually high wages in an economic structure that remained more egalitarian. These contrasts and their institutional foundations are important aspects of any study of inequality.

Finally, although we emphasize the role of the financial sector and financial cities as the geographic locus in driving inequality, our results should not be understood as indicating that undoing financialization in global cities or redistributing employees that currently work in financial cities would automatically decrease inequality. That is, our findings help us understand the factors that contribute to the current organization of inequality and do not readily translate into generalizations as to what would happen if these dynamics were altered. Our focus on finance also does not imply that we deny the importance of other industries in driving inequality. Other industries, which may be located in similar geographic areas, may also be driving earnings inequality and even the contribution of global cities to inequality. For instance, the rise of information technologies and the platform economy has spawned new economic giants (Google, Apple, Facebook, Amazon) that have contributed to a significant rise in inequality in the Bay Area and relative to the rest of the United States. Although the financial crisis and the prominence of tech billionaires have refocused media attention on the new tech-related inequality, financiers continue to receive exorbitant wages. For instance, in 2015 New York's 160,000 financiers each received an average of $150,000 in bonuses[26]. This made New York the county with the second highest inequality in the United States (after Teton, Wyoming, a famous vacation spot for billionaires), with the local top 1% earning an average of $9 million, or 113 times the income of the bottom 99%. In contrast, San Mateo and San Francisco Counties rank 22nd and 25th, respectively, with the local top 1% earning on average being $5 million and $4 million, 49 and 48 times that of the local bottom 99%[27]. In the coming years, the Bay Area may nonetheless continue to catch up and surpass New York City's inequality model. Thus, monitoring the respective socio-spatial contributions of finance and tech to inequality and their specific mechanisms is an important objective for future research on the geography of inequality.

5. Data, measures, and methods

Previous research on occupational structures in global cities has relied on census data, which contain only categorical information on income at the household level and no information on wages or individual level data[4]. Research on urban inequality has relied on narrow survey data that are unsuited for

comparisons across cities and over time. We go beyond these data limitations with our large-scale linked employer-employee data for nine countries: Canada, Denmark, Sweden, Norway, France, Germany, Spain, the Netherlands, and Japan (cf. Appendix A). With these data we base our analysis on nearly one billion worker-year observations and up to 210 million worker observations per year. Some countries such as Canada, Denmark, Norway, Sweden, the Netherlands, and France provide exhaustive information on the working population, which yields highly reliable earnings estimates of even small groups that would be difficult to study with most common surveys.

In some countries such as Germany, Spain, and Japan, we have sample sizes between 4% and 8% of the working population. Compared to common socioeconomic research, these samples are very large and provide reliable estimates of top earnings shares. These data allow us to measure local earnings shares and distinguish between workers in different sectors within cities. Compared with countries with exhaustive data on the working population, estimates of top earnings shares in smaller metropolitan areas may be less reliable. This is especially the case for Germany, where, in addition to a smaller sample, top earnings are top coded around the top decile threshold. To address this limitation, we imputed German top earnings (see Table A1).

As we did not have direct access to individual data for the United States, we process secondhand estimates of local inequality based on income tax declarations. For this aim, we combine county-level IRS tables and previous estimates on US state-level income inequality from Sommeiller and Price[27].[2] As we only have the average gross income per county for most of the period, we multiply state-level income tranches and income average in the tranches by the coefficient corresponding to average county income divided by the average state income. We then apply this distribution to the counties and aggregate counties to get metropolitan-area income distribution.

For each country, we define two types of metropolitan cities: the financial city, where the largest stock exchange in the country is located, and the

[2] The IRS county data set can be downloaded here: https://www.irs.gov/statistics/soi-tax-stats-county-data. The Sommeiller and Price data set can be downloaded here: http://go.epi.org/un-equalstates2018data.

comparison city, which is the largest city that is neither the financial city nor the political capital. Identifying the main financial city of a country is an easy task (Table A1), as secondary financial cities such as Lyon in France or Philadelphia in the United States tended to disappear with the centralization of finance. While in some countries, such as the United States, a secondary financial city, such as Chicago, continues to exist, they are usually much smaller than the main financial city. For most countries in our sample, their financial cities are the archetype of global cities such as New York, Tokyo, Paris, Frankfurt, and Toronto. Although less central and prominent in the global economy, Stockholm serves as the financial city for neighboring countries Norway and Denmark[28]. Copenhagen, Oslo, and Madrid are national rather than global financial cities.

For the identification of the comparison city, in addition to the criterion that it be the second largest non-political and non-financial center, we impose the additional criterion that this city be geographically distant from the financial city to avoid capturing the direct interdependence effect of the two metropolitan areas. In Japan, we therefore chose Osaka over Yokohama as the comparison city. In some countries, such as Germany, the choice of comparison city depends on the way the urban area is defined. We include financial cities such as Copenhagen, Oslo, Stockholm, and Madrid, which are less common in the global city literature, to capture case variation across the global economy and national economic context.

To measure the effect of financialization we use the measure "stock market total value traded to GDP" (series GFDD.DM.02) from the World Bank Global Financial Development Database (GFDD), which is commonly used in analyses of the effect of financialization on earnings inequality[12,10]. To measure the role of a country in coordinating global trade in goods and services, we use data on the ratio of a country's stock of FDI to its GDP published by the United Nations Conference on Trade and Development.[3]

Measures and methods

We use three methods to examine how global financial cities contribute to national and local earnings inequality. First, we decompose the evolution of national and local top earnings shares into the evolution of earnings of workers

[3] See https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx. Accessed July 4, 2022.

in the national top earnings bracket that work in financial or comparison cities. Second, we construct overrepresentation ratios of the earnings of workers in the national top earnings bracket that work in the financial or the comparison city to capture the relative contribution of cities to national and local inequality. Finally, we use OLS regressions with the relative contribution of financial cities to national and local inequality as dependent variables to analyze how financialization and non-financial globalization contribute to their evolution. In the following we describe each method.

National Inequality

For our first additive decomposition, we draw on previous work that decomposes the contribution of financial sector earnings to the growth of national earnings inequality[11,29]. Here we decompose the increase in the earnings share of national top earners (S_{top}) into the increase of earnings of top earners who work in a given city (either in the financial or comparison city) and top earners who work outside these cities:

$$\Delta S_{top} = \Delta S_{top\ \&\ city} + \Delta S_{top\ \&\ elsewhere}, \quad (1)$$

$$\text{with } S_{top\ \&\ city} = \Sigma_i(w_{i,city} > P)/\Sigma_i w_i ,$$

where w_i is earnings of individual I and P is the P threshold of the national earnings distribution (i.e., P99, P95, or P90).

The contribution of a given city to the growth of national inequality is then defined as that proportion of the increase in the earnings share of national top earners that accrues to the top earners that work in the respective city:

$$Contribution_{city} = \frac{\Delta S_{top\ \&\ city}}{\Delta S_{top}}. \quad (2)$$

While this decomposition has the advantage of being additive, its results are contingent on the population size of the city. Moreover, meaningful results become visible only when there is a significant increase (or decrease) in the national top earnings shares.

For this reason, we create our second indicator, which compensates for the difference in population size between, say, Frankfurt and Paris. This indicator is an odds ratio of the earnings of workers in a given city in the national top 1%,

that is, an odds ratio of proportions that represents the local earnings share of workers that are part of the national top 1%:

$$OR_{top,city} = \frac{\frac{S_{top\ \&\ city}}{(1-S_{top\ \&\ city})}}{\frac{S_{top\ \&\ elsewhere}}{(1-S_{top\ \&\ elsewhere})}}. \quad (3)$$

Finally, we estimate our *first main indicator*, which captures the contribution of financial cities to national inequality net of the effects of population size and agglomeration. To do so we estimate an odds ratio between the earnings share of workers who are in the national top 1% and work in the financial city and the earnings share of workers in comparison cities that are part of the same (national) earnings bracket:

$$FCs'\ relative\ contribution\ to\ national\ inequality = \frac{\frac{S_{top\ \&\ fin\ city}}{(1-S_{top\ \&\ fin\ city})}}{\frac{S_{top\ \&\ co\ city}}{(1-S_{top\ \&\ co\ city})}}. \quad (4)$$

Local Inequality

In addition to measuring the contribution of cities to national inequality, we construct our *second main indicator*, which measures the relative contribution of cities to local inequality. To do so, we first calculate the (local) top earnings share in each city $LS_{\text{city}}=\Sigma_i(w_{i,\text{city}} > LP_{city})/\Sigma_i w_{i,\text{city}}$. We then calculate an odds ratio between the financial and comparison top cities' local top earnings shares.

$$FCs'relative\ contribution\ to\ local\ inequality = \frac{\frac{LS_{fin\ city}}{(1-LS_{fin\ city})}}{\frac{LS_{co\ city}}{(1-LS_{co\ city})}}. \quad (5)$$

We prioritize the top 5% threshold for local inequality for two reasons. First, because earnings in large metropolitan areas are high, the local top 5% earnings threshold is close to the national top 1% threshold in most countries. Second, in some countries (e.g., Germany, Spain, Japan), the estimation of the local top earnings share might be more fragile when using a higher threshold since we rely on subsamples of the total population (and especially in Germany due to the top coding of earnings).

Regressions

Finally, we use OLS regression to analyze the effects of financialization and non-financial globalization on the relative contribution of financial cities to national and local inequality. We include two main dependent variables: first, the relative contribution of financial cities to national inequality and second, their contribution to local inequality (equations 4 and 5). Although the two indicators appear similar, they may evolve differently over the same period. For instance, the earnings share of financial city workers in the national top 1% might increase due to an aggregate rise in local earnings, while local inequality might simultaneously decrease when the earnings growth at the bottom of the local distribution is higher than at the top.

In our base model we largely follow Godechot[10] and estimate a simple panel model with country *c* and year *t* fixed effects and lagged independent variables (by one year). To allow comparison of coefficients we use log constant dollars and country demeaned and standardized variables. We use two main independent variables: stock exchange volume to GDP (GFDD.DM.02) as a measure for financialization and FDI outflow (stock) to GDP as a measure of non-financial globalization. We control for population size, GDP per capita, and the difference in the employment share in the national financial and comparison city to control for the effects of economic and population growth.

$$log(y_{c,t}) = \delta_1.financialization_{c,t} + \delta_2.globalization_{c,t} + X_{c,t}.\beta + c + t + u. \quad (6)$$

In a subsequent model (panel B, Table 4), we use the difference between the local earnings share of financiers in financial cities and comparison cities as our alternative measure of financialization. This measure of financialization precisely targets the local dimension of financialization, and the relative magnitude of financialization of global financial cities over comparison cities. However, our data do not allow us to measure the variable for the United States.

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Appendix A. Comparative Organizational Inequality International Network (COIN) Data

Canada (1989–2013). Data were generated by Statistics Canada. The data are population level and include all sectors and industries and employees working in establishments of at least two workers. Statistics Canada provides firms' identification number but neither the establishment ID nor the precise geographical unit of the workplace (beyond the province).

Denmark (1994–2018). The data consist of population-level observations of both private and public sector workplaces extracted from the labour market statistic register (Den Registerbaserede Arbejdsmarkedsstatistik [RAS]) and wages from the job register IDAN. We selected workers working in establishments of at least two workers. Demographics such as age, gender, and nativity come from the population register (Befolkningsregistret). In contrast to other countries, substantial administrative variations in recording of marginal jobs make internally defined thresholds very volatile. Hence, we opted for an external benchmark, using one-fourth of the average yearly wage reported in OECD publications (https://stats.oecd.org/, variable: AV_AN_WAGE).

France (1993–2019). Our analyses use data from the DADS social security register (Déclaration annuelle de données sociales). Access to the DADS data was obtained through the CASD (Centre d'accès sécurisé aux données), which is dedicated to researchers authorized by the French Comité du secret statistique. The data consist of population-level observations of private sector workers. State civil servants are missing before 2009 and excluded in the following years for consistency.

Germany (1990–2015). Data come from a customized sample for the project "Dynamics of Organizational Earnings Inequality: Investigation within the Comparative Organizational Inequality International Network (COIN)" of the Integrated Employment Biographies Sample (IEBS) of the Federal Employment Agency. It covers roughly 5% of the German working population and about 20,000 establishments, spanning the years 1999–2015. Estimates are weighted to correspond to the complete workforce. Earnings not subject to social security because they are below the threshold for small-scale employment

(e.g., newspaper delivery), which is currently 450 euros per month, are excluded from the sample. The earnings are also top coded at the social contribution limit, which differs by year and for East and West Germany. To impute the top-coded earnings, an imputation strategy based on the imputation from Card, Heining, and Kline[30] was used, which accounts for individual and establishment wage prior to the censored period. However, rather than focusing on the mean individual and establishment wage prior to the censored observation as was done by Card, Heining, and Kline[30], we utilize information on lagged earnings. Given the limitation of our imputation, measures of exposure involving the top 1% should be therefore considered cautiously.

Japan (1989–2013). Data are from the Basic Survey on Wage Structure conducted by the Ministry of Health, Labor, and Welfare of Japan. The survey is a two-stage design in which a sample of private sector establishments with at least five employees are selected and then a uniform random sampling of workers among these establishments is taken. Firms' executives are not included in the data. Given this limitation and the small size of the sample, measures of exposure involving the top 1% should therefore be considered cautiously, but 10% thresholds are treated as more reliable. The sample covers 4% of the workforce working in an establishment with more than five workers. Estimates are weighted to correspond to the complete workforce.

Netherlands (2006–2018). Yearly data on employee wages and companies' sector and industry are provided by the Statistics Netherlands (CBS) within the System of Social-Statistics Database (SSB). We linked data on employees and employing firms to construct a data set with population-level coverage of wages across all sectors and industries. The analyses include the highest-paying jobs of each employee in a given year, and jobs with wages lower than the age-specific minimal hourly wage are excluded.

Norway (1995–2018). Data were generated by Statistics Norway and are population level, including all sectors and industries, although private sector identifiers are only available beginning in 1999. In contrast to other countries, substantial administrative variations in recording of marginal jobs make internally defined thresholds very volatile. Hence, we opted for an external benchmark, using one-fourth of the average yearly wage reported in OECD

publications (https://stats.oecd.org/, variable: AV_AN_WAGE). We selected workers working in establishments of at least two workers.

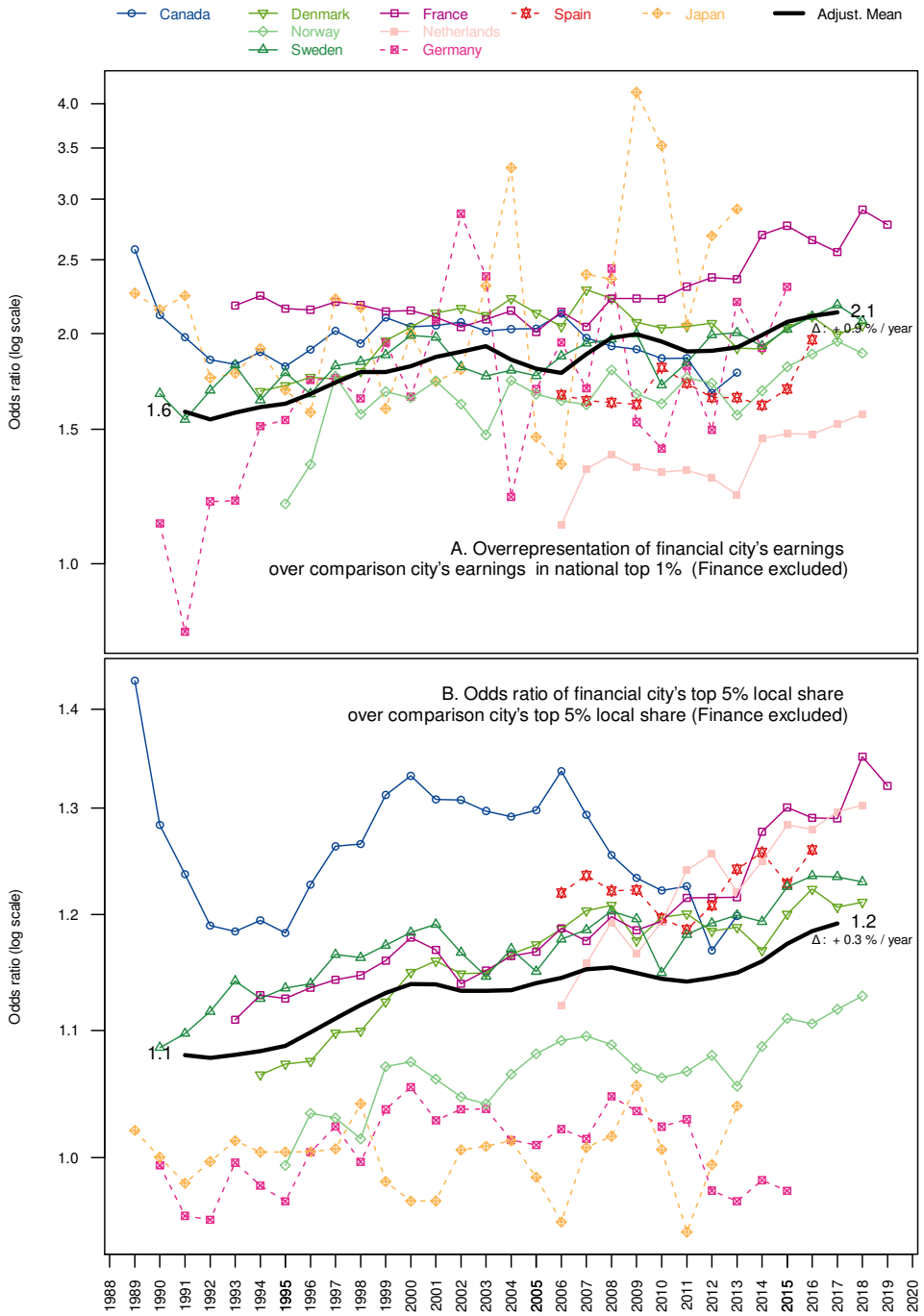
Spain (2006–2016). Our analyses use data from the Continuous Sample of Working Histories (CSWH) (Muestra Continua de Vidas Laborales con datos fiscales) from Spain's Social Security Office. The CSWH contains matched anonymized social security, income tax, and census records for a 4% non-stratified random sample of the population who in one specific year had any connection with Spain's social security system (whether via employment, self-employment, unemployment, or retirement). The CSWH provides information on individuals' complete labour market histories from 1980 (or the year the individual registers with social security) to the year of data collection.

Because earnings from the social security records are top and bottom capped, we use earnings from tax records containing uncensored gross labour earnings for each job (tax records are available from 2006 onward).

Sweden (1990–2012). The data used are from population-wide administrative registers from Statistics Sweden (the LISA database) and cover all sectors and industries.

United States (1989–2015). In order to compare the respective contributions of New York and Los Angeles to inequality, we combine Price and Sommeiller (2018; http://go.epi.org/unequalstates2018data) estimates on income inequality per state (based on the US IRS) and US IRS files containing counties' average income between 1989 and 2015 (https://www.irs.gov/statistics/soi-tax-stats-county-data). As we only have the average gross income per county for most of the period, we proceed as follows to compute tranches. We multiply state-level income tranches and income average per tranche by the coefficient corresponding to the average county income divided by the average state income. We then apply this distribution to the given county. Based on the new tranches, we use Pareto laws to estimate wages above national thresholds and local top wage shares. We finally aggregate county estimates to obtain the two urban areas' income distribution (i.e., Los Angeles and Orange Counties for the Los Angeles urban area and the counties included in the New York–Newark–Jersey City area).

Figure A1. Figure 1C and 2C excluding finance



Note: We exclude financial sector workers from the earnings distribution to recalculate Figure 1C and 2C. Thus, in 1990, after excluding finance sector workers, earnings in financial cities are on average 1.6 times more represented in the national top 1% than that of comparison cities. In 2017, this average odds ratio increased to 2.1. This odds ratio increased at an annual rate of 0.9%. Estimates are based on IRS tables for the United States and on the Comparative Organizational Inequality International Network's use of national linked employer-employee data sets (see Appendix A and Table A1).

Table A1. Presentation of the data

Country	Start	End	Sample	Definition of threshold	Threshold wage (last year)	Number of workers (last year)	Financial city	Comparison city	Source
USA	1989	2015	IRS	No threshold		165,033,000	New York	Los Angeles	US IRS and Price Somellier (2018)
Canada	1989	2013	Exhaustive	1/2 full-time full-year minimum wage	9207 Can $	13,867,085	Toronto	Montréal	Statistics Canada
Denmark	1994	2018	Exhaustive	1/4 OECD mean wage	109,412 Da. Kr	2,126,613	Copenhagen	Aarhus	RAS, IDAN, and BES
Norway	1995	2018	Exhaustive	1/4 OECD mean wage	98,905 No. Kr	1,513,442	Oslo	Bergen	Statistics Norway
Sweden	1990	2012	Exhaustive	1/3 prime age P50	100,660 Sw. Kr	4,519,342	Stockholm	Gothenburg	Statistics Sweden
France	1993	2019	Exhaustive private	1/2 full-time full-year minimum wage	8,024 €	20,671,976	Paris	Lyon	Base Tous Salariés (DADS)
Netherlands	2006	2018	Exhaustive	Age-specific minimum hourly wage	4 € per hour	8,867,793	Amsterdam	Rotterdam	CBS
Germany	1990	2015	Sample of workers (6%) in 20,000 establishments	1/2 full-time P10	12,871 €	1,120,354	Frankfurt	Hamburg	IEBS
Spain	2006	2016	Random sample of workers born since 1962 (4%)	1/2 full-time full-year minimum wage	2,799 €	380,804	Madrid	Barcelona	Continuous Sample of Working Histories (CSWH) and tax records
Japan	1989	2013	Sample of workers (4%) out of a sample of private sector est. of size >5	1/2 full-time P10	1,056,700 Yen	1,089,517	Tokyo	Osaka	Basic Survey of Wage

Appendix B. Adjusted mean in figures

Our adjusted mean is an average of the within-country evolutions on a constant perimeter. To calculate this adjusted mean, we proceed as follows.

1. For missing years that lie between the first and last available data points, we use linear interpolation for each country series.

2. We calculate the three-year moving average for all country series to prevent the capture of short-term fluctuations that result from inconsistencies in data collection.

3. Finally, we take the average of these transformed data:

3.1. When the number of countries is complete:

$$X_t = \Sigma_i (X_{it}/n),$$

where X_{it} represents series X for country i and year t.

3.2. When the number of countries is no longer complete:

$$X_t = X_{t-1} + \Sigma_i (\llcorner\!\lrcorner X_{it}/n),$$

$$\text{where } \Delta X_{it} = X_{it} - X_{it-1}.$$

3.3. When the number of countries is not yet complete:

$$X_t = X_{t+1} - \Sigma_i (\llcorner\!\lrcorner X_{it}/n).$$

We calculate this adjusted mean only if we can include data for at least three countries in year t.