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Assessment of Risks of the Finnish Government Guarantee System

Juha Junttila

Juhani Raatikainen



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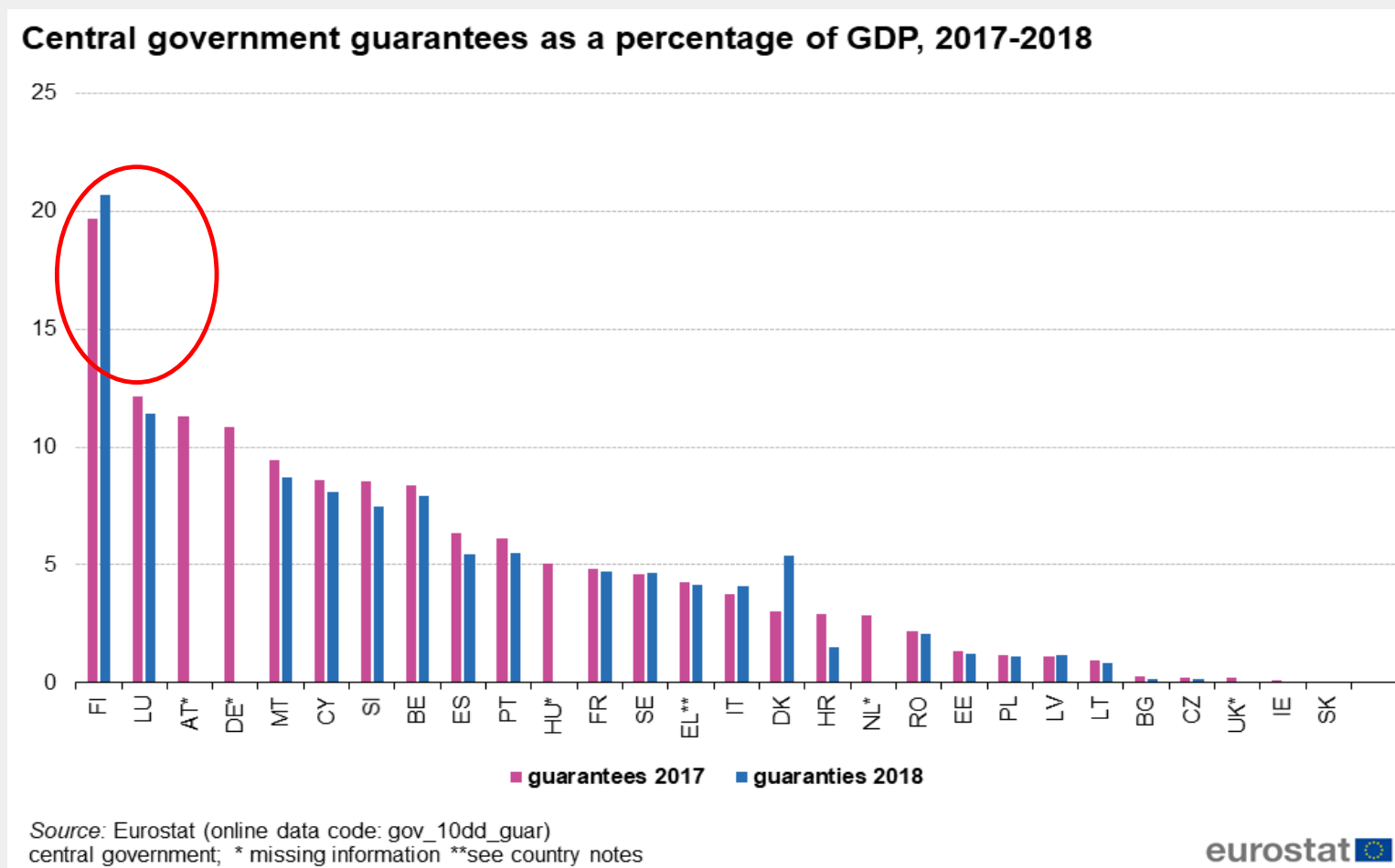
Background: Role of State Guarantee System

- Tool for the government to
 - / fill gaps in the supply of export finance
 - / increase the supply of affordable housing
 - / decrease barriers to education
 - / meet socially important goals
- System is internationally accepted and commonly used in many countries

Current situation in Finland

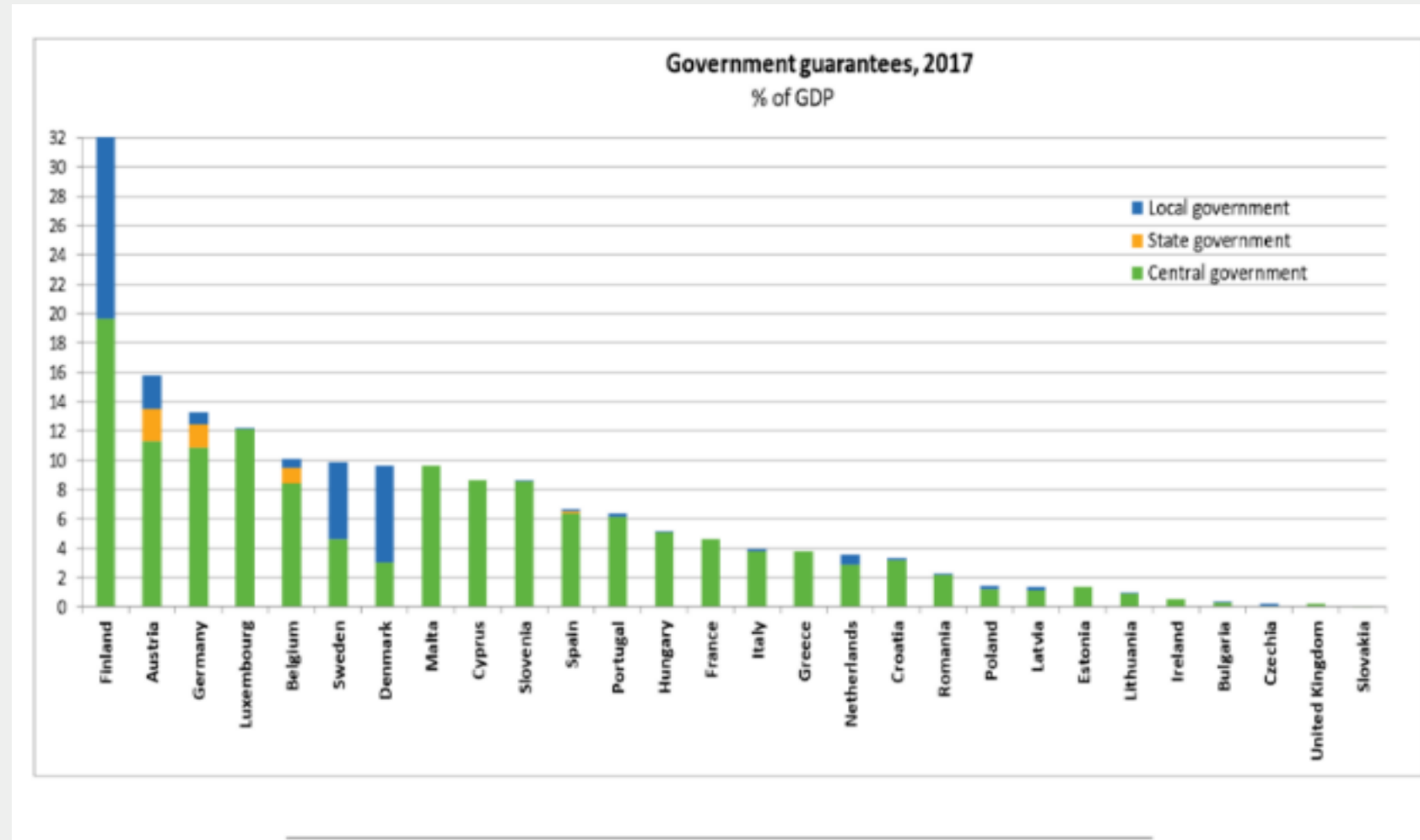
- Value of guarantees compared to the size of the economy is higher than in any comparable country
- In recent years the Finnish (central and general) government guarantee position's ratio to GDP has increased heavily while it has declined in all other countries

Figure 1. Central Government Guarantees (% of GDP)



Source: Eurostat

Figure 2. General Government Guarantees (% of GDP)

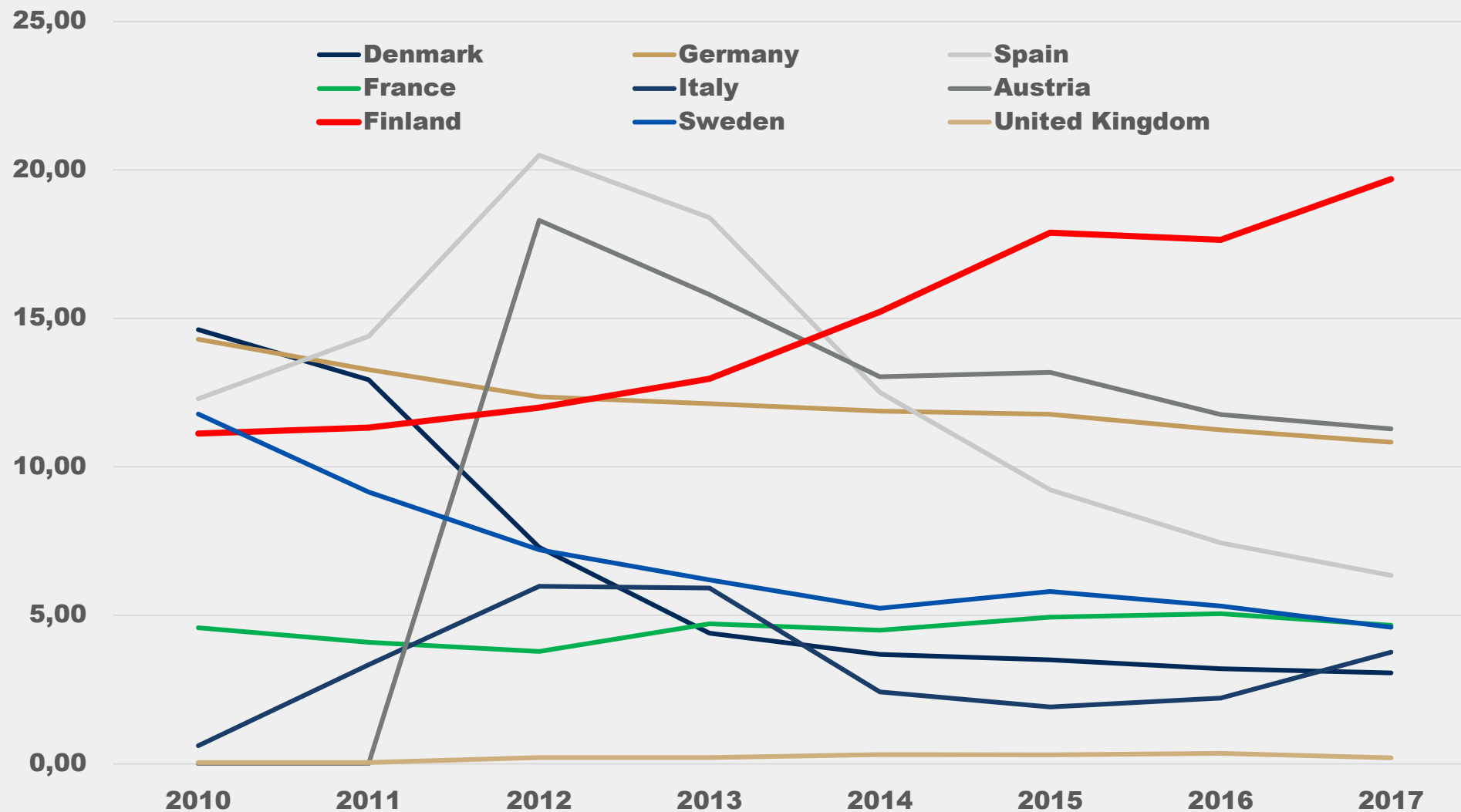


Source: Eurostat

Figure 3. Central Government Guarantees (% of GDP)



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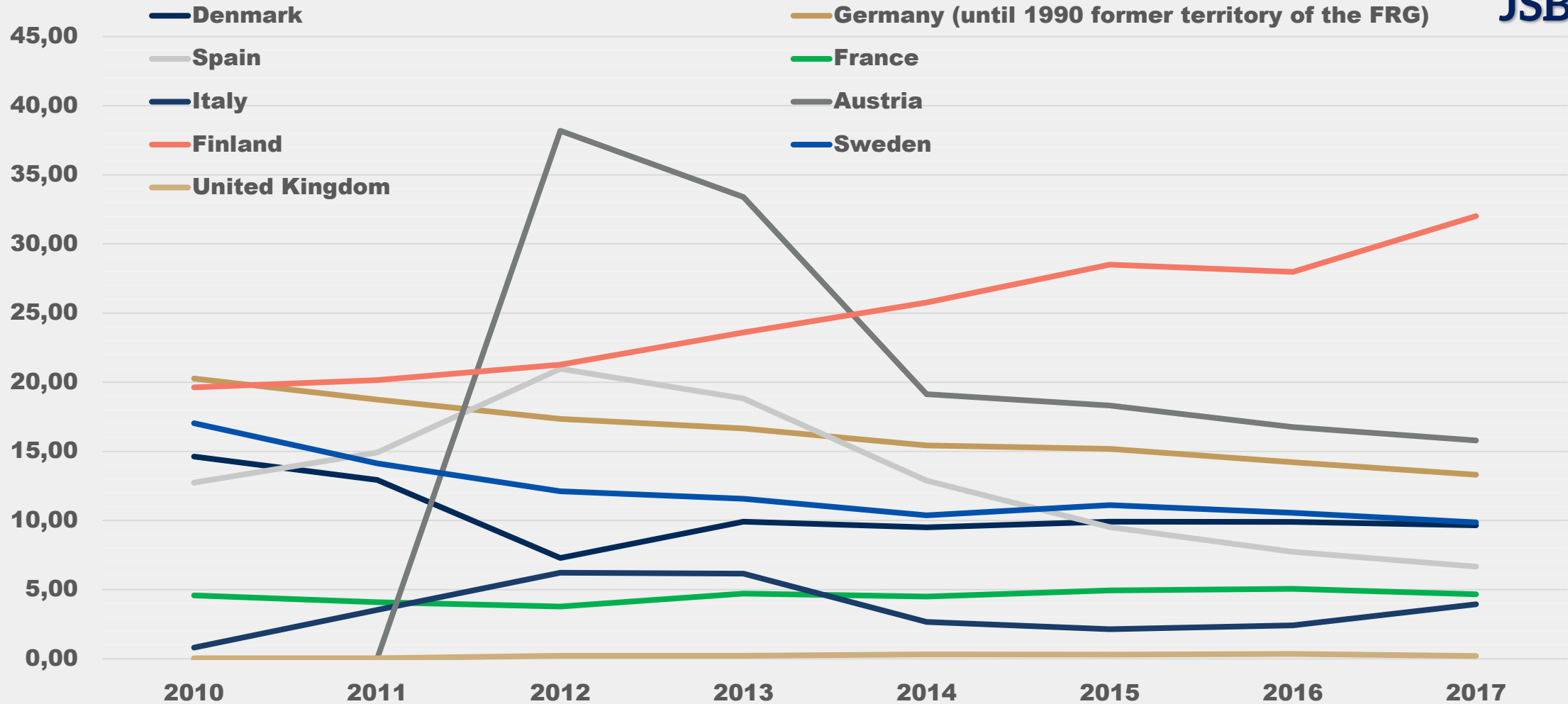


Source: Eurostat

Figure 4. General Government Guarantees (% of GDP)



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Source: Eurostat



International Comparison: Some Points

- There is a strong tendency to decrease the ratio of guarantee exposure to GDP, the only **strong European exception is Finland**
 - / also the ratio in Italy has been increasing since 2016
- Government guarantee exposures are decreasing also in monetary terms in several countries
 - / Denmark, Spain, Sweden
- Finland is not the only country where exposure in monetary terms increases (see also e.g. Italy and France)
- In the past also some other countries have had high guarantee to GDP ratios
 - / Banking crisis e.g. in Austria and Spain

International Comparison: Some Points

- In international comparison the Finnish guarantee exposure is not very large in monetary terms, but because of the ***small size of the economy (and its low growth) the ratio of guarantees to GDP is high***, which nevertheless may imply high risk levels

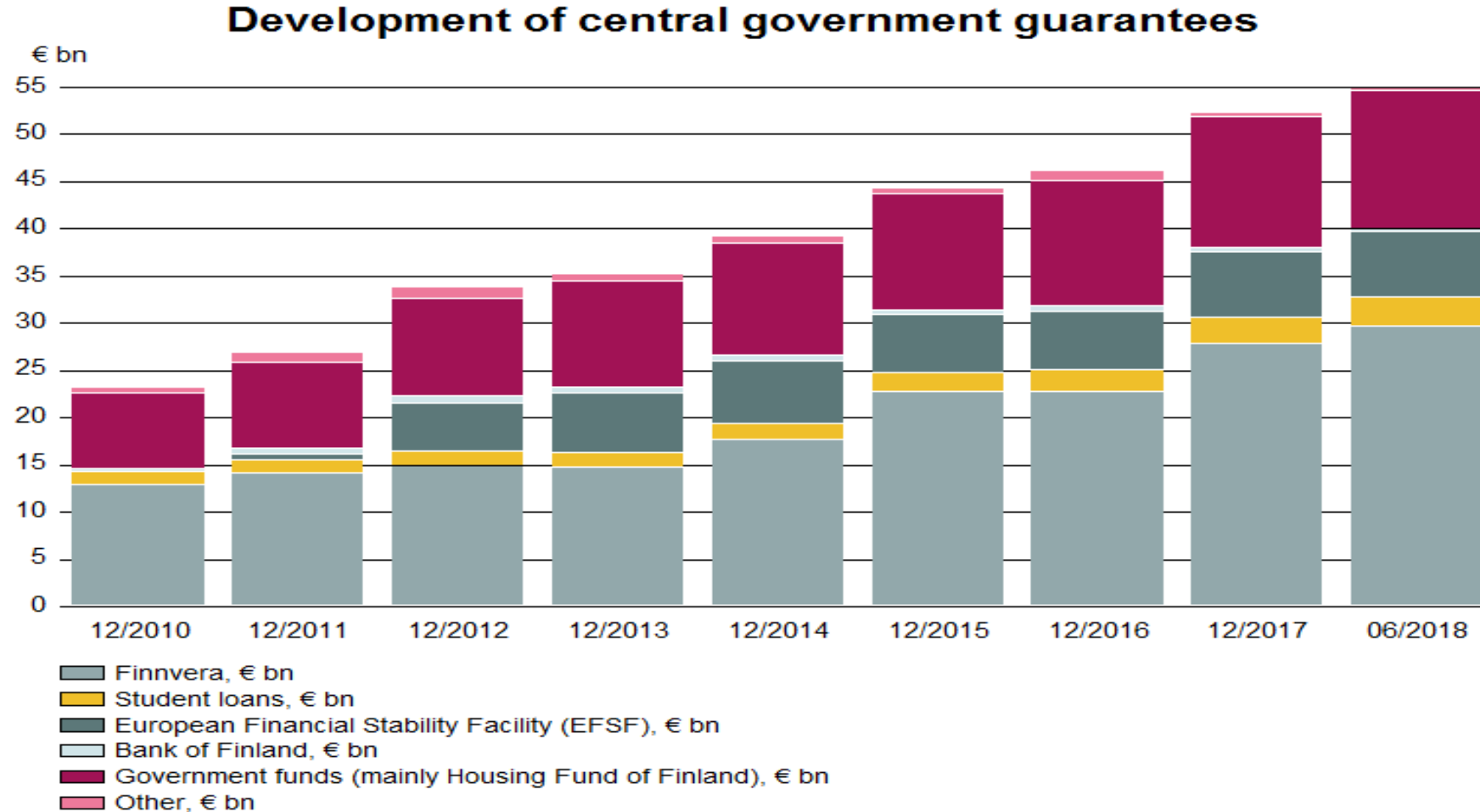
Table 1. Government guarantees in selected European countries, 2000 and 2017 (€ billions)

	General Government		Central Government	
	2010	2017	2010	2017
Denmark	35,19	27,76	35,19	6,24
Finland	36,72	71,68	20,81	44,07
Italy	13,04	67,92	9,72	64,94
Germany	522,85	436,11	369,04	354,95
France	91,33	106,69	91,33	106,69
Spain	137,71	77,65	132,81	73,92
Sweden	57,00	42,90	39,43	19,99

Source: Eurostat



Structure of the Finnish Central Government Guarantee Portfolio



State Treasury



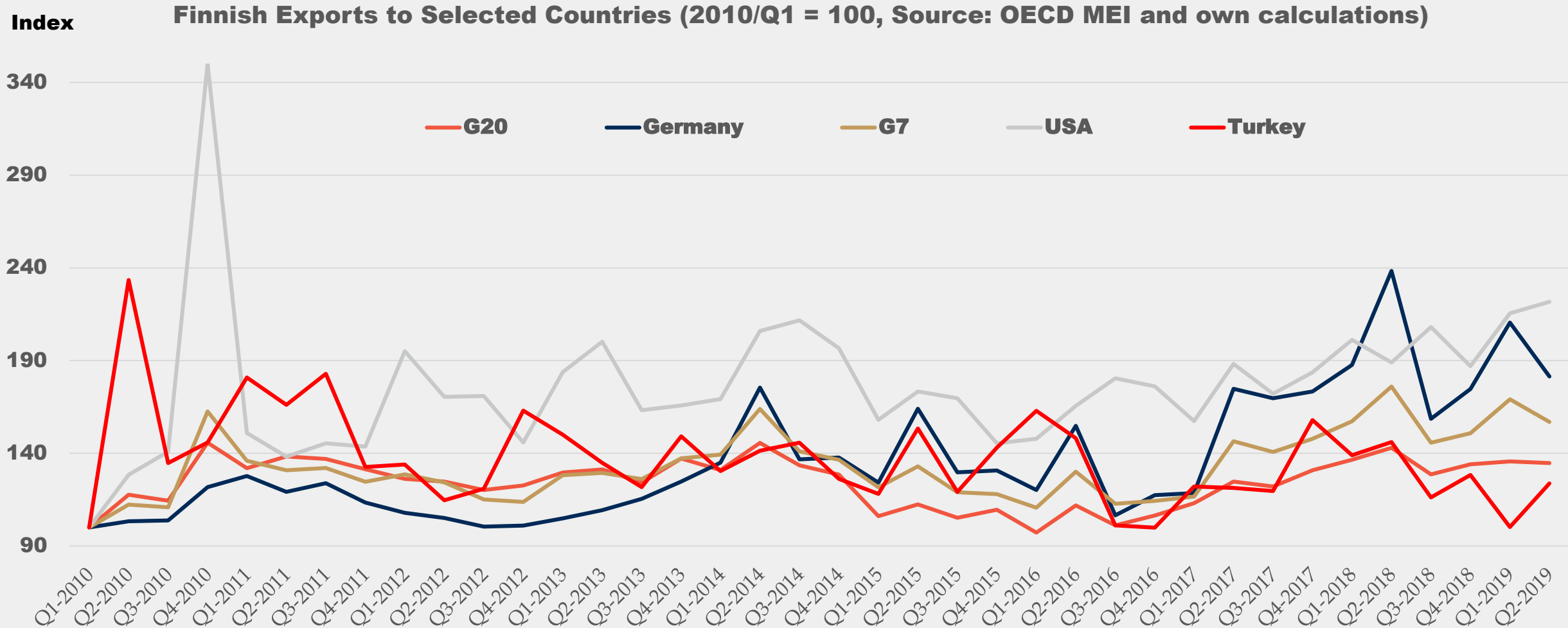
Structure of the Finnish Central Government Guarantee Portfolio

- The key parts of guarantee portfolio are Finnvera plc export guarantees and the Housing Fund of Finland guarantees.
- We focus on **credit risk** caused by the two above key components of the guarantee portfolio – **the Finnvera plc and the Housing Fund of Finland guarantee portfolios**

Target in Export Guarantees: Enhance Export Activity



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Scale Problems in Active Export Promotion with Government Guarantees



- It seems that in Finland government guarantees have been used as an active tool in promoting export growth since the subprime crisis
 - / high dependence of the Finnish economy on exports
 - / severe hit to the Finnish economy in 2009, very sluggish recovery after that
- Scale problem in active uses of export guarantees
 - / Finnish companies are large in global scale
 - large projects
 - competition against large international companies
- Example: Assume the average size of an individual project is €50 million, and there are 600 projects implying financing need of €30 billion
 - / → this is 0.9% to GDP in Germany, but 12.7% in Finland
- Assume the size of an individual project is € 3 billion
 - / → 0.09% to GDP in Germany, but 1.27% in Finland.

Export Guarantee in Action

- Finnish Export Credit Ltd (FEC, fully owned by Finnvera plc), grants credit to a Finnish exporting corporation
- Finnvera plc issues a guarantee to FEC
 - / Especially in case of large projects, like ships, telecommunication networks, or construction of pulp and paper plants, Finnvera plc also grants a guarantee to the foreign buyer
- Guarantee is offered to a (foreign) bank financing the buyer
- The buyer makes payments to the Finnish exporter → the guarantee exposure to the Finnish exporter declines
- Exposure to the foreign buyer ⇔ use of the loan facilities guaranteed by Finnvera
 - / among the 20 largest Finnvera guarantee exposures there are several foreign customers buying or planning to buy Finnish products or services
 - / this is a common international practice that is also followed in other countries with export guarantee systems



Finnvera plc Guarantee Portfolio

- In our analysis we measure the Finnvera guarantee exposure *by guarantees in use and the guarantees already accepted by banks*
 - / The size of the exposure at the end of March 2019 was 19.3 billion euros
- NOTE: the official Eurostat measure of government guarantees includes also *guarantees offered to banks, but not yet accepted by them*
 - / → the official Eurostat measure about 5 billion euros higher than the size of the actual guarantee exposure
- We have individual *highly confidential client level information* about the Finnvera guarantee portfolio
 - / the 20 largest even by name, the others by size of the guarantee
 - / Other data: credit rating, loss given default evaluation, countries of their main operations, and industrial sector

Finnvera Portfolio



- The number of agents (guaranteed firms) in the guarantee portfolio is 677 and the number of countries is 38
- Exposure is highly concentrated:
 - / Largest counterparty accounts for 16%, 10 largest for 64% and 20 largest for about 80% of the exposure
 - / 55% of the exposure is in ship building, 19% in telecommunication, 10% in the pulp & paper cluster

Housing Market Guarantees

- Housing market guarantees consist of guarantees offered to individuals, to housing co-operatives, and to organizations offering rental housing
- At the end of 2018, the guarantee exposure amounted to 14.7 billion euros
- The guarantee portfolio is highly concentrated:
 - / 20 largest counterparties account for about 45% of the portfolio
 - / Helsinki accounts alone for 53%, and Helsinki, Tampere and Turku together account for 68% of the portfolio

Government Housing Guarantees by Municipal Areas in March 2019

TABLE 2

City/Area	meur	%
Helsinki	7794.10	52.96
Tampere	1212.42	8.24
Turku	951.69	6.47
Jyväskylä	669.66	4.55
Kuopio	461.56	3.14
Lahti	471.07	3.20
Oulu	630.24	4.28
Other	2525.00	17.16
Total	14715.74	100.00

Source: State Treasury

Housing Market Guarantees



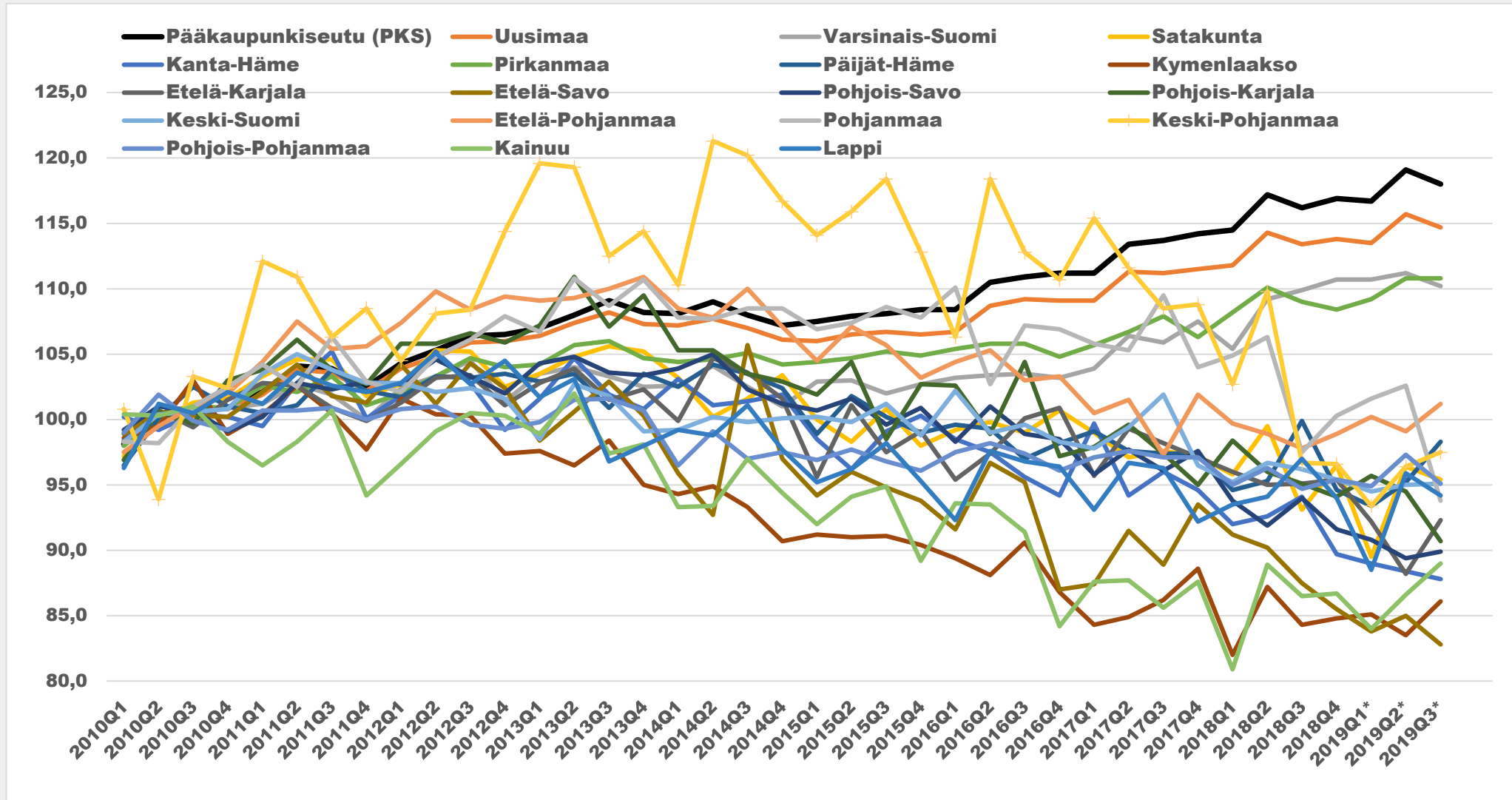
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- House price evolution in Finland has been geographically very heterogeneous
- After 2010, house prices in Helsinki have risen 26% and in the Helsinki metropolitan area by 18%
- Prices in Kotka and in Etelä-Savo area have gone down by 17% during the same time
- Regarding the guarantee portfolio, the high concentration in Helsinki is good news as long as Helsinki grows fast enough

House Price Evolution by Geographical Areas



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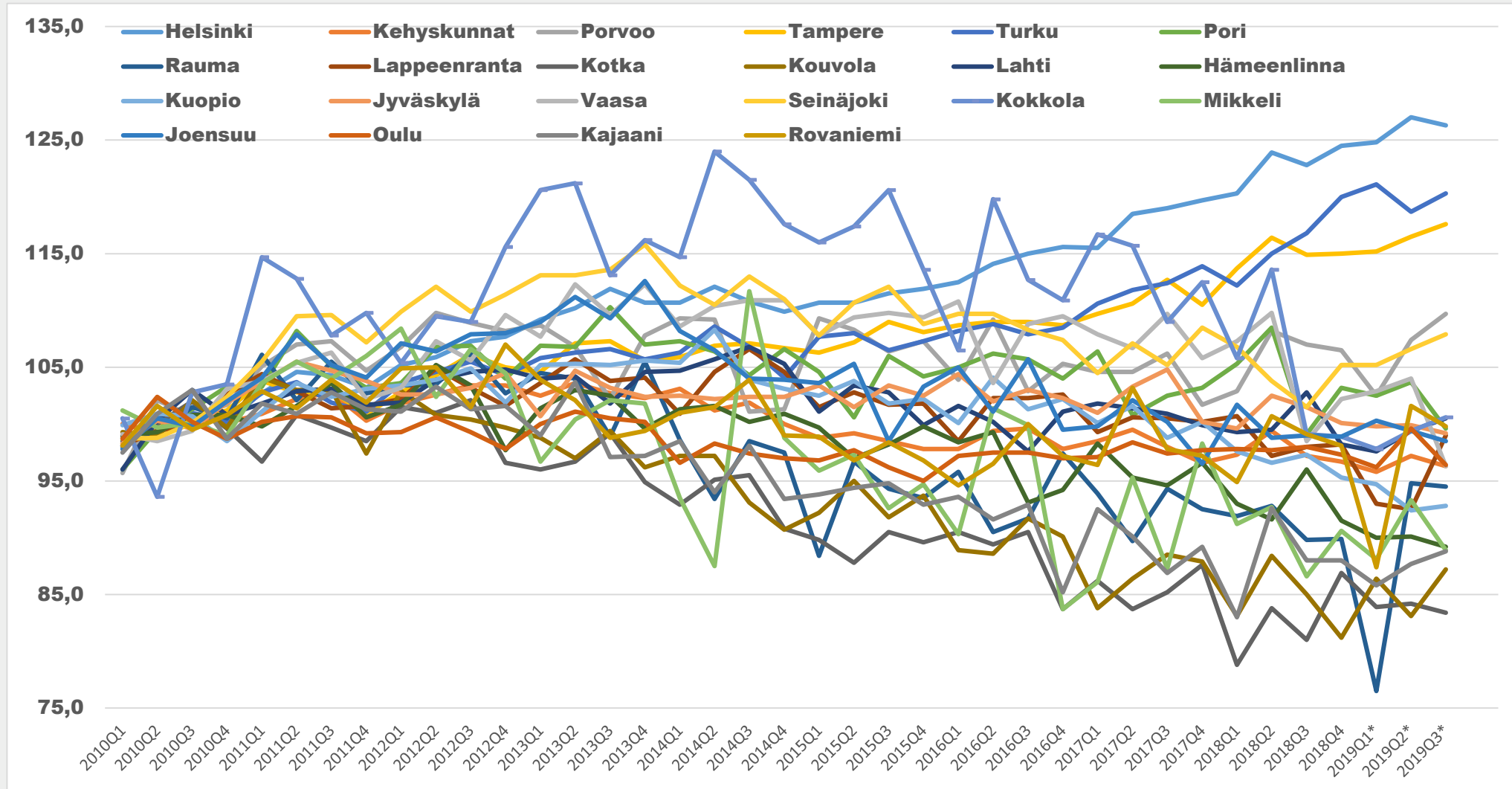


Source: Statistics Finland

House Price Evolution by the Largest Cities



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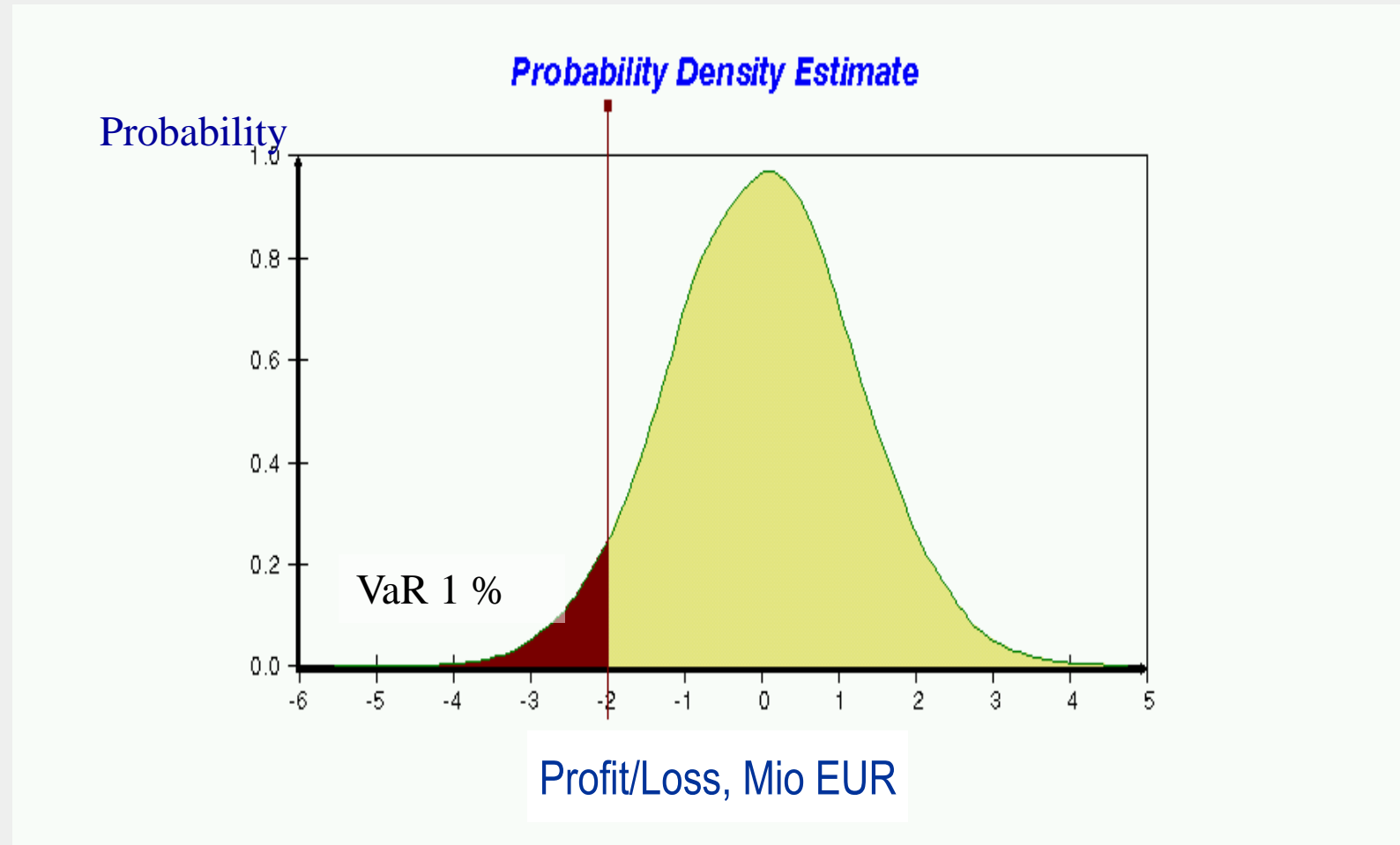


Source: Statistics Finland

Credit Risk Analysis Tools

- We estimate the credit risk based on Value-at-Risk (VaR) and Conditional Value-at-Risk (CVaR) concepts applied to the *valuation of the guaranteed firms, conditional on macro and financial market information*:
 - / Value-at-Risk: the largest loss at the chosen confidence level in the chosen time horizon (one year in our analysis)
 - / Conditional Value-at-Risk: expected loss conditional that the chosen VaR loss is exceeded

Figure 6. Value-at-Risk Distribution



- VaR (1% loss probability, 99 % confidence level) is the cut-off point where the red area starts
- CVAR is the probability of the brown area conditional that the loss exceeds the VaR cut-off point

Role of Macro and Financial Market Information in the Credit Risk Analysis

- Background: The Arbitrage Pricing Theory of Ross (JET, 1976)
- The set of country macro factors ($S_{k,t}$) varies by firms based on their statistical significance (in our case, p-value of the loading $< 0.1 \rightarrow$ include to the model for risk simulations)
- Starting set in the APT estimation for each firm
 - / Aggregate stock market return (always also tried the S&P500 return), real GDP change in the country (or countries) of main operations, inflation rate, change in nominal short-term interest rate (and the yield curve), and the change in nominal exchange rate (against USD)
 - / Other, not so traditional variables (EPU indexes, VIX, Ted Spread) were also introduced, but the only additional variable that remained significant for some countries (whose real economies are related to oil markets) was the crude oil price inflation
 - / All data quarterly observations, sample mostly starting from the mid 1990's
 - / *Among the key common risk factors for most countries proved to be the S&P500 index return, the European STOXX 600 index return, oil price changes, the US and Euro area real GDP growth, Latin American real GDP growth, and the US and German (or euro area) short-term interest rates*

Methodology



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- Merton-Vasicek approach
 - / Market valuation (and returns based on changes of market value) of the obligor follows a stochastic model; if the value of the obligor falls below the value of its debt (or some default trigger close to that level), the obligor defaults

One factor model

The market based stock return of obligor i is given as

$$X_{i,t} = S_t \sqrt{\rho_i} + Z_{i,t} \sqrt{1 - \rho_i}$$

where S_t is common $N(0,1)$ distributed risk factor, $Z_{i,t}$ is firm specific $N(0,1)$ risk factor (risk factors are uncorrelated), and ρ_i is correlation of the obligor i return with the market measure. Obligor i defaults, if

$$X_{i,t} < c_i$$

where the default trigger is estimated based on the Through-the-Cycle (TTC) default probabilities (estimated by Finnvera)

Methodology

- We use loss-given-default measures estimated by Finnvera
- In the above one factor model we estimate correlations based on the Basel rules:

$$\rho_i = 0.12 * \frac{1 - e^{-50 * P_i}}{1 - e^{-50}} + 0.24 * \left[1 - \frac{1 - e^{-50 * P_i}}{1 - e^{-50}} \right]$$

where P_i is the obligor i TTC probability.

- In the one factor model *the common single risk factor is the $N(0, 1)$ standardized world real GDP growth rate*



Multifactor model

Systemic part

Idiosyncratic part

$$X_{i,t} = \sum_{k=1}^K \lambda_{i,k} S_{k,t} + \sqrt{1 - \sum_{k=1}^K \lambda_{i,k}^2} Z_{i,t} \quad (i = 1, \dots, n)$$

where $S_{k,t}$ are $N(0,1)$ common risk factors (which may be correlated), $Z_{i,t}$ are the firm specific $N(0,1)$ uncorrelated risk factors, and $\lambda_{i,t}$ are the macro risk factor loadings for the statistically significant macro risk factors

- **Factor loadings are estimated individually for each of the 20 largest counterparties, and for the rest of the counterparties the above one factor model is used**
- Credit risk analysis is conducted based on Monte Carlo simulations (1 000 000 simulation rounds) of this equation



Results for the Finnvera Guarantee Portfolio

Country-specific multifactor model
(as of macro factor values on
30th Nov 2019), meur

Prob.	VaR	CVaR
0.05	98.89	141.21
0.01	146.61	246.71
0.005	202.06	323.11

Basel approach and the world real
GDP growth as the only factors (as of
macro factor value on 30th Nov 2019), meur

VaR	CVaR
128.48	309.47
324.23	872.93
903.83	1103.20

- Fairly low risk estimates compared to the size of the exposure
- Efficient diversification of especially the telecommunication sector risk
- Good macro conditions, on especially the part of heaviest risk concentrations (especially the US market)



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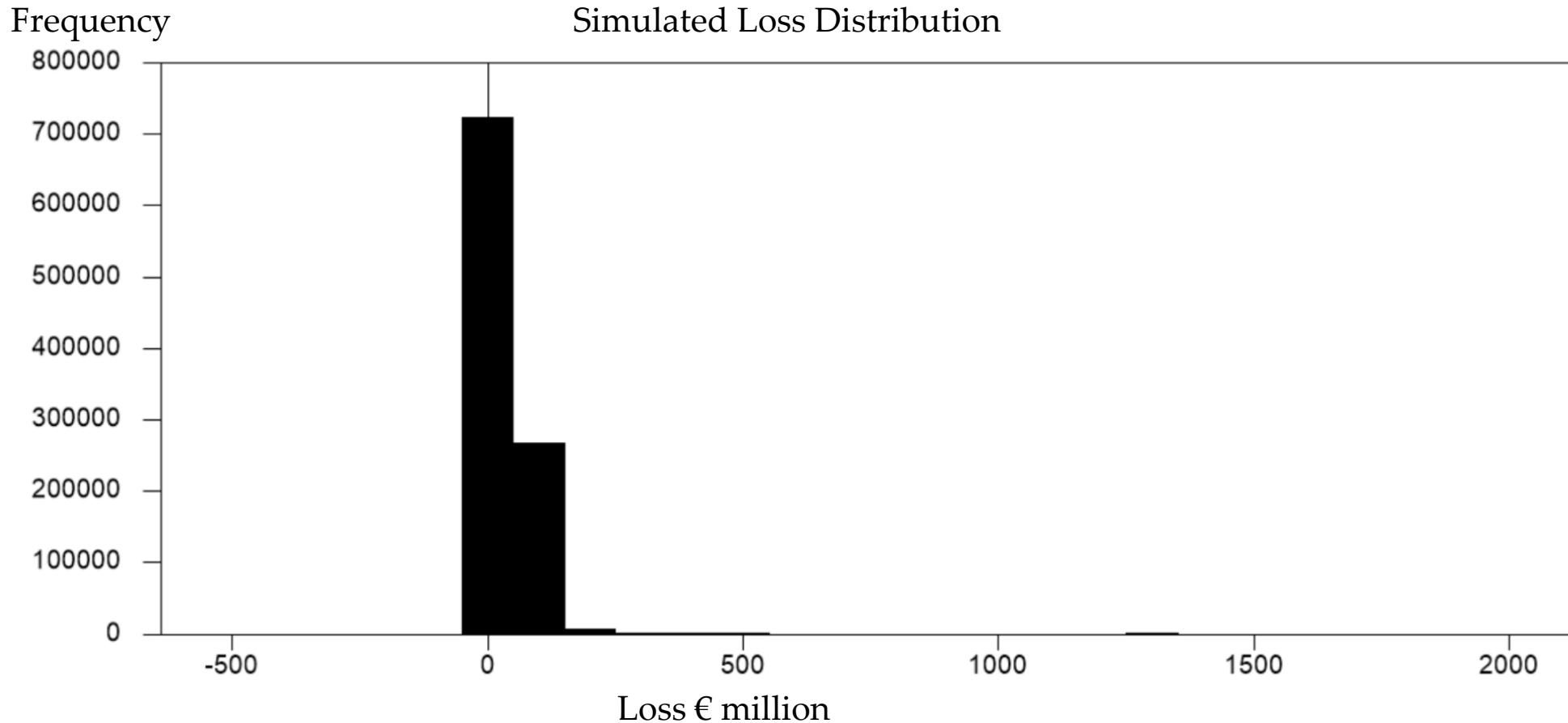
- We have also run the analysis based on 2008 Global Financial Crisis (GFC) scenario. In this case the risk concentrations on the US and European market risk factors increase the levels of risk significantly

Country-specific multifactor model
(as of macro factor values during
2008-2009 crash), meur

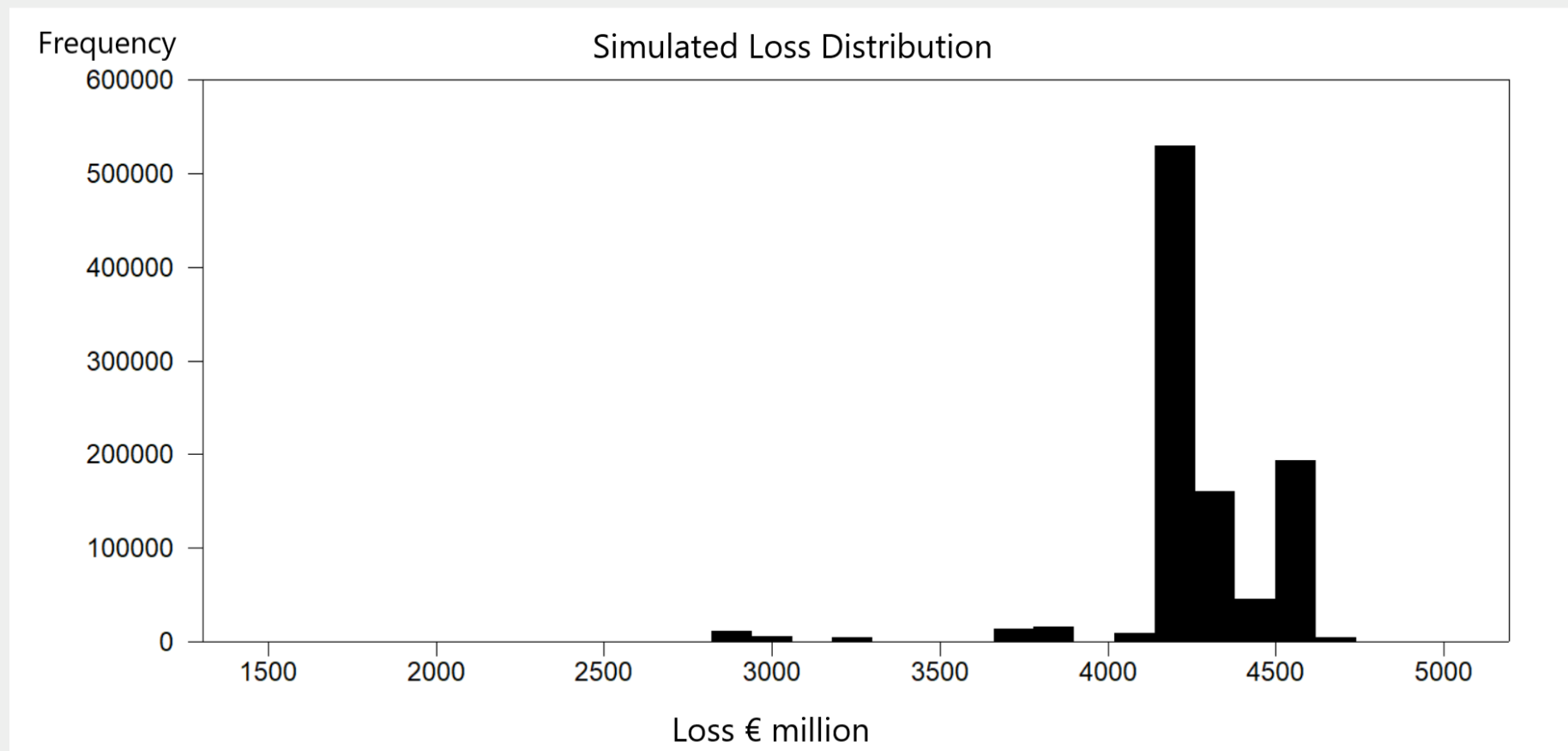
Basel approach and the world real
GDP growth as the only factors (as of
macro factor during 2008-2009 crash), meur

Prob.	VaR	CVaR	VaR	CVaR
0.05	4569.13	4586.76	1241.97	1589.25
0.01	4593.07	4629.35	1773.13	2046.05
0.005	4618.74	4653.34	1955.03	2239.29

Loss distribution based on the multifactor model under current prevailing economic conditions



Loss distribution in the crash scenario based on the multifactor model





Discussion: Finnvera

- Conditional on the prevailing state of the global economy the Finnvera credit risk portfolio *offers diversification gains reducing risk to a rather low level*
- The Finnvera portfolio is concentrated on US and European risk factors, which have a large impact on the risk profile
- **Under the Global Financial Crisis scenario risk level increases by a factor of about 32 (in e.g. the multifactor model for a 5% CVaR value).**
- **The same macro risk factor dependencies that create stability under normal economic conditions are the key risk drivers under the crash scenario**



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Results for the Housing Guarantee Portfolio

- VaR and CVaR analysis is applied to the valuation of housing (relying on the biggest seven cities' housing market price indexes), based on the distribution of the housing market guarantee portfolio
- In the single factor model the macro risk factor is the *real GDP growth of Helsinki* and in the multi-factor model the *real GDP growth rates of all the guaranteed seven biggest cities individually, and of other areas together, that have obtained the guarantees*
- No actual information about the individual clients (firms), so used the Sato PLC credit rating, and implied default probability

Results for the Housing Guarantee Portfolio

- Risk measures under current economic conditions are rather low, but increase significantly in the 10% real GDP drop case outside Helsinki scenario
- Risk is very much 'Helsinki-concentrated', only a small real GDP drop in Helsinki has an economically significant impact on the risk measures

	Current Economic Conditions		1.5% Decline in Helsinki		10% Decline in all cities other than Helsinki	
Probability	VaR	CVaR	VaR	CVaR	VaR	CVaR
0.05	2.22	125.90	2.22	160.40	2.22	364.33
0.01	2.22	125.90	2.22	160.40	667.92	1351.24
0.005	470.52	712.21	470.52	1058.85	667.92	1351.24

Hedging possibilities?



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- Set well-defined but absolute (to be obeyed) limits to the exposures
 - / Firm/Industry/Country level for export guarantees?
 - / Regional level (Helsinki against others) for housing guarantees?
- CDS/Insurance (probably already in use in Finnvera)
- Role of buffers
 - / Current (at the end of 2018) amount of Finnvera guarantee buffers 1.4 bill eur (1.8 including own capital) → covers over 30% of losses in the extreme case
- Role of government owned companies in hedging
 - / Even though might not be included explicitly to the Finnvera guarantee portfolio, the indirect effects through the industry risks eminent
 - / NOTE: Systemic risks affect strongly all government owned firms, too
- Increasing the government positions in safe haven assets
 - / Gold (BoF holdings, actual or in futures markets)? (has been proved to work very well in all crisis situations internationally)
 - / Other precious metals

THANK YOU!



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