Gender Differences and Extreme Events

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Christine Lagarde:

"As I have said many times, if it had been Lehman Sisters rather than Lehman Brothers, the world might well look a lot different today"

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"..., having more female leaders would lead to more prudence, and less of the reckless decision-making that had provoked the crisis.
Christine Lagarde:
"The male domination of the (financial) industry made the collapse of Lehman Brothers more likely"

– I expect female decision making to affect extreme event risk through two channels:

-First, most gender studies support the view that women are more risk averse and less optimistic than men. Female decision makers are less likely to invest in risky projects. Also, since female executives are less overconfident compared with their male counterparts, they are more likely to terminate money-losing projects at an early stage.

-Second, since female decision makers are more likely to comply with financial market regulations and financial reporting, female decision makers are less likely to withhold bad news intentionally when bad news actually arrives (no hoarding).

– The impact of top executive gender on asset prices:

-Negative association between female CFOs and future stock price crash risk.
-The negative relation between female CFOs and future stock price crash risk is more pronounced among firms with weaker corporate governance, less market competition, lower analyst coverage and higher financial leverage.
-Collectively, the evidence highlights the importance of CFO gender for firm financial decision making and stock return tail risk.

(e.g. Li and Zeng (2019, JCF))

In this paper ...

-I rely on an equilibrium asset-pricing model in an economy under jump diffusion

-I decompose the moments of the returns of European stock market indices into a diffusive risk and an extreme event risk part

-Collectively, I conjecture a negative empirical relation between female decision making and extreme event risk (Lehman sisters effect)

-I find that stock markets in countries with more female decision makers are characterized by higher risk aversion, lower volatility (extreme event risk) and more positive return assymmetry, also driven by the lower frequency of negative jumps (robust results)

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-89% of country leaders remain men

-less than one in five of the EU's political parties is led by a woman

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... in the private sector:

-In corporate boards: 75% are men

-Gender gap in lifetime earnings: 40%

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... in academia:

-men dominate decision-making positions

-women's research is under-valued and under-funded

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European Institute of Gender Equality:

"Gender equality is a founding value of the EU and improving it could lead to an increase in GDP of up to €3.15 trillion by 2050"

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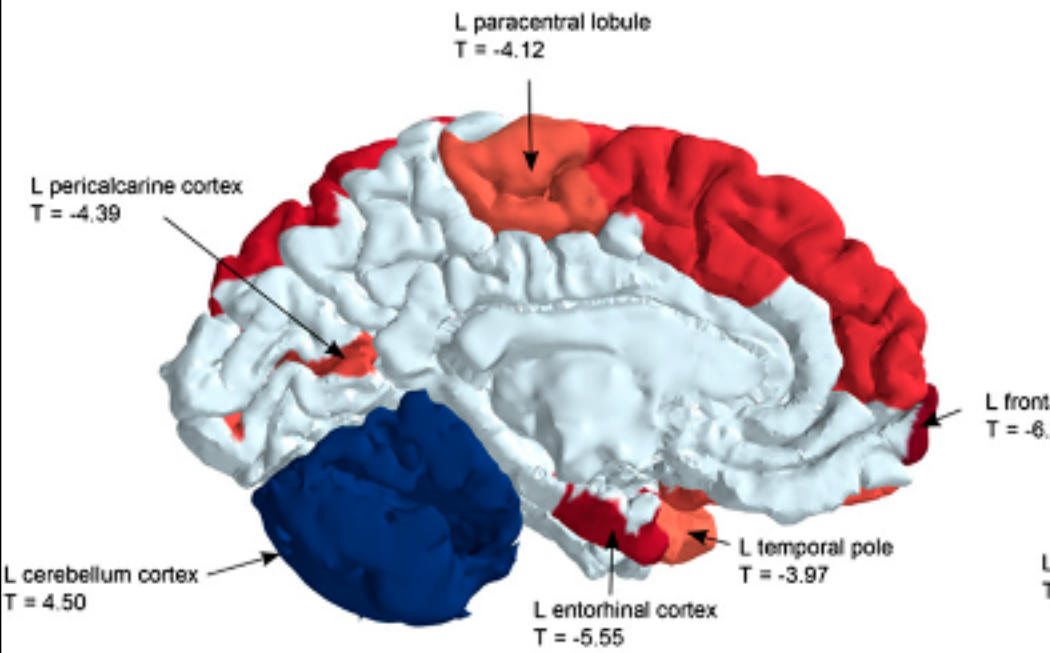
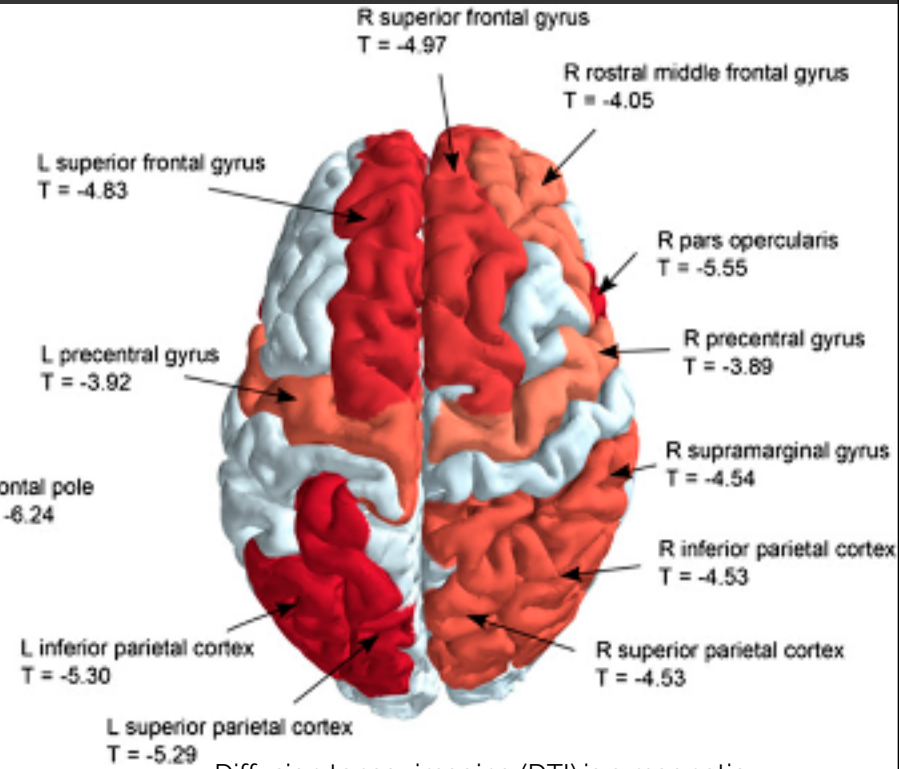
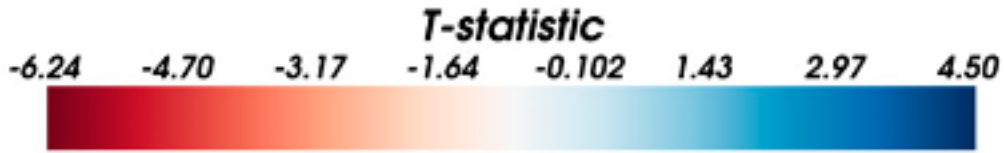
Complex interactions among brain regions (Participation Coefficients)



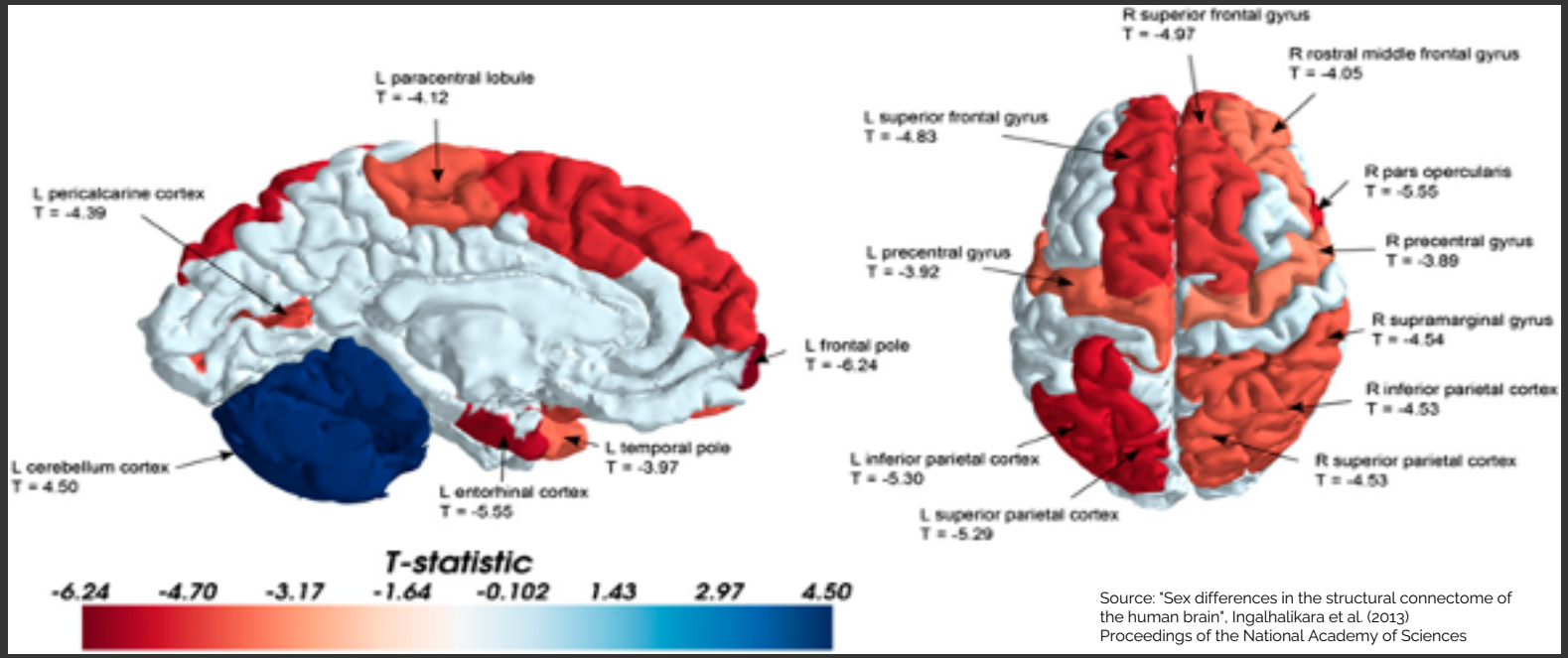




Diffusion tensor imaging (DTI) is a magnetic resonance imaging technique that produces neural tract images. Source: "Sex differences in the structural connectome of the human brain", Ingalhalikara et al. (2013)

Male brains are structured to facilitate connectivity between perception and coordinated action

Female brains are designed to facilitate communication between analytical and intuitive processing modes



Source: "Sex differences in the structural connectome of the human brain", Ingalhalikara et al. (2013) Proceedings of the National Academy of Sciences

Jump-Diffusion Model (Zhang et al. (2012))

Risk-averse investor allocates part of his wealth to a risky and risk-free asset. Price process of the risky asset (stock market portfolio):

$$\frac{dS_t}{S_t} = (r_f + \phi)dt + \sigma dB_t + (e^x - 1)(dN_t - \lambda dt)$$

He maximizes expected utility of consumption, subject to a wealth constraint

$$max_{(c_t,w)} E_t \int_t^T \beta(t) U(c_t)\, dt$$

$$\frac{dW_t}{W_t} = \left[r_f + w\phi - w\lambda(e^x - 1) - \frac{c_t}{W_t}\right] dt + w\sigma dB_t + w(e^x - 1)dN_t$$

… which results in an equity premium:

$$\phi_\sigma = \gamma\sigma^2$$
$$\phi_J = \lambda E[(1 - e^{-\gamma x})(e^x - 1)]$$
$$\phi \equiv \mu - r_f \equiv \phi_\sigma + \phi_J$$

Jump-Diffusion Model (Zhang et al. (2012))

Density of daily stock market returns (constant *jump size*):

$$p(r_\tau) = \frac{1}{2\pi}\int_{-\infty}^{+\infty} Re\left[e^{-ikr_\tau} f_{r_\tau}(k)\right]dk$$

$$ln\left(f_{r_\tau}(k)\right) = ik\mu\tau - \frac{1}{2}ik(1-ik)\sigma^2\tau + \lambda\tau\left(e^{ikx} - 1 - ik(e^x - 1)\right)$$

The second and third central moments are given by:

$$E(r_\tau - E(r_\tau))^2 = \tau(\sigma^2 + \lambda x^2)$$
$$E(r_\tau - E(r_\tau))^3 = \tau\lambda x^3$$

Parameters (μ, σ, λ, x) can be obtained by maximum likelihood.

Dependent Variables

Measure of total stock market risk (*Volatility*) :

$$V_{i,t} = \sqrt{\sigma_{i,t}^2 + \lambda_{i,t} x_{i,t}^2}$$

Diffusive Risk *Jump Risk*

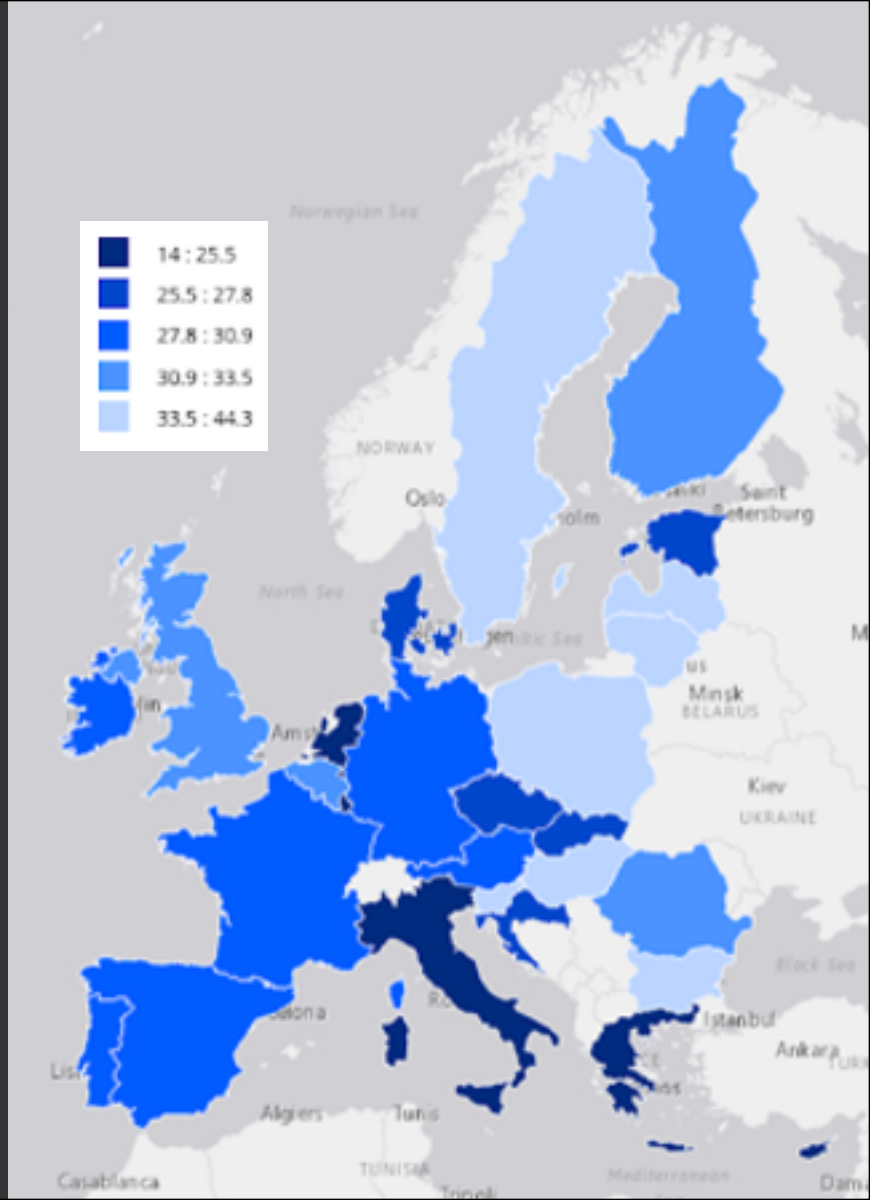
Measure of return asymmetry (non-normal. *Skewness*):

$$S_{i,t} = \lambda_{i,t} x_{i,t}^3$$

Yearly measures, however, the model is estimated with daily data for each year separately!

Female Share!

"The proportion (%) of women who are employed in decision-making and management roles in government, large enterprises and institutions"



Source: The Sustainable Development Goals Database of the WorldBank.

Data

28 European countries' aggregate level data (2000-2018)

Explanatory Variables:

Governance indicators from the World Bank (Voice, Rule of Law, Regulation, Political Stability, Government Efficiency, Control of Corruption)

HDI, Human Development Index (United Nations)

lnGDPPC, logarithm of the GDP per capita in US dollar

lnTURNOVER, logarithm of the average daily stock market turnover

RETURN refers to the annualized average daily returns

FXVOL, annualized standard deviation of daily currency returns

... and many others.

Table 2. Two-Step System GMM Estimator, *DIFFUVOL*

Independent Variables		*VOICE*	*RULELAW*	*REGQUAL*	*POLSTAB*	*GOVEFF*	*CORRUP*
FEMSHARE	-0.71***	-0.67***	-0.72***	-0.69***	-0.71***	-0.59***	-0.75***
	(-3.64)	(-3.32)	(-3.80)	(-3.58)	(-3.69)	(-3.23)	(-3.75)
$TOTALVOL_{t-1}$	0.36***	0.33***	0.36***	0.36***	0.38***	0.40***	0.36***
	(8.48)	(8.82)	(9.03)	(8.46)	(8.11)	(8.56)	(8.25)
lnGDPPC	-0.08*	-0.03	-0.07	-0.07	-0.10**	-0.09**	-0.08
	(-1.77)	(-0.64)	(-1.47)	(-1.40)	(-2.17)	(-2.01)	(-1.58)
lnTURN	0.04***	0.03***	0.03****	0.03***	0.03***	0.04***	0.03***
	(4.11)	(3.91)	(-3.95)	(-3.85)	(-3.97)	(-4.01)	(-3.95)
RETURN	-0.15***	-0.14***	-0.15***	-0.15***	-0.16***	-0.15***	-0.15***
	(-12.45)	(-12.01)	(-12.53)	(-12.48)	(-12.98)	(-12.58)	(-12.50)
HDI	0.55	0.08	0.51	0.45	0.58	0.39	0.42
	(0.80)	(0.26)	(0.68)	(0.38)	(0.92)	(0.80)	(0.28)
GOVERNANCE		-0.17***	-0.08	-0.03	-0.06***	-0.10*	-0.03
INDICATOR		(-4.43)	(-1.01)	(-0.91)	(-2.89)	(-1.88)	(-1.20)
Other Controls	YES	YES	YES	YES	YES	YES	YES
AR(2)	0.55	0.46	0.52	0.49	0.47	0.51	0.48
Sargan	0.95	0.92	0.93	0.92	0.96	0.91	0.93
N	532	532	532	532	532	532	532

More female decision makers -> lower diffusive risk

Table 3. Two-Step System GMM Estimator, *JUMPVOL*

Independent Variables		*VOICE*	*RULELAW*	*REGQUAL*	*POLSTAB*	*GOVEFF*	*CORRUP*
FEMSHARE	-0.46***	-0.44***	-0.45***	-0.44***	-0.45***	-0.32**	-0.48***
	(-2.93)	(-2.71)	(-3.05)	(-2.75)	(-2.93)	(-2.04)	(-3.02)
$TOTALVOL_{t-1}$	0.18***	0.14**	0.17***	0.18***	0.22***	0.19***	0.18***
	(3.15)	(2.21)	(2.93)	(2.80)	(3.53)	(3.19)	(2.91)
lnGDPPC	0.01	0.03	0.01	0.02	0.01	0.01	0.01
	(0.28)	(1.19)	(0.48)	(0.63)	(0.10)	(0.08)	(0.46)
lnTURN	0.02***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***
	(2.87)	(2.65)	(2.76)	(2.70)	(2.75)	(2.80)	(2.71)
RETURN	-0.10***	-0.09***	-0.10***	-0.10***	-0.10***	-0.10***	-0.10***
	(-14.55)	(-14.49)	(-14.59)	(-14.62)	(-14.65)	(-14.71)	(-14.60)
HDI	0.20	0.02	0.18	0.12	0.21	0.10	0.12
	(1.14)	(0.10)	(1.04)	(0.67)	(1.20)	(0.54)	(0.63)
GOVERNANCE		-0.13***	-0.12***	-0.08*	-0.06**	-0.09***	-0.04
INDICATOR		(-4.69)	(-2.68)	(-1.90)	(-2.06)	(-3.26)	(-0.93)
Other Controls	YES	YES	YES	YES	YES	YES	YES
AR(2)	0.78	0.71	0.77	0.72	0.76	0.73	0.74
Sargan	0.85	0.81	0.86	0.83	0.80	0.88	0.82
N	532	532	532	532	532	532	532

More female decision makers -> lower extreme event risk

Table 4. Two-Step System GMM Estimator, *RETASYM*

Independent Variables		*VOICE*	*RULELAW*	*REGQUAL*	*POLSTAB*	*GOVEFF*	*CORRUP*
FEMSHARE	0.83***	0.75**	0.93***	0.81**	0.83**	0.95***	0.85**
	(-2.79)	(-2.51)	(-2.91)	(-2.49)	(-2.63)	(-2.83)	(-2.45)
TOTALVOL$_{t-1}$	0.13**	0.13***	0.36***	0.36***	0.38***	0.40***	0.36***
	(2.51)	(2.49)	(9.03)	(8.46)	(8.11)	(8.56)	(8.25)
lnGDPPC	-0.44**	-0.34*	-0.45**	-0.40**	-0.48***	-0.45**	-0.43**
	(-2.54)	(-1.95)	(-2.50)	(-2.16)	(-2.76)	(-2.55)	(-2.40)
lnTURN	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	(0.25)	(0.35)	(0.24)	(0.15)	(0.19)	(0.23)	(0.26)
RETURN	-0.17***	-0.16***	-0.17***	-0.18***	-0.19***	-0.17***	-0.17***
	(-3.85)	(-3.64)	(-3.84)	(-3.90)	(-4.14)	(-3.85)	(-3.87)
HDI	2.22*	1.32	2.21*	1.88	2.28**	2.12*	1.90
	(1.95)	(1.10)	(1.94)	(1.56)	(2.01)	(1.79)	(1.57)
GOVERNANCE		0.32**	0.35	0.10	0.12*	0.11	0.07
INDICATOR		(2.19)	(1.54)	(0.83)	(1.72)	(1.15)	(0.97)
Other Controls	YES	YES	YES	YES	YES	YES	YES
AR(2)	0.44	0.41	0.40	0.47	0.48	0.43	0.45
Sargan	0.83	0.79	0.85	0.77	0.81	0.80	0.81
N	532	532	532	532	532	532	532

More female decision makers -> more positive return asymmetry due to extreme event risk

Summary

-I rely on an equilibrium asset-pricing model in an economy under jump diffusion

-I decompose the moments of the returns of European stock market indices into a diffusive risk and an extreme event risk part

-Collectively, I conjecture a negative empirical relation between female decision making and extreme event risk (Lehman sisters effect)

-I find that stock markets in countries with more female decision makers are characterized by higher risk aversion, lower volatility (extreme event risk) and more positive return assymmetry, also driven by the lower frequency of negative jumps (robust results)