Managing moral hazard in last resort lending
Credit limits as 'contingent rules' at the Austro-Hungarian Bank

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- Definitions
  - **LLR**: elastic supply of central bank liquidity for the benefit all CB counterparties under circumstances of aggregate liquidity shock
  - **Moral hazard**: Insurance provided by LLR reduces incentives for eligible counterparties for proper liquidity management, thereby increasing the probability that LLR will be needed.

- Moral hazard is costly because
  - sorting out illiquid from insolvent institutions requires time and thus sufficient liquidity buffers.

Literature and contribution

- Last resort lending (LLR) $\rightarrow \infty$
- Fighting moral hazard by increasing (expected) costs ex post:
  1. High or **penalty** rates (Crockett 1996)
  2. **Constructive ambiguity** (Freixas 1999)

Literature and contribution

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- This paper
  1. **Focus on liquidity**, not credit risk
  2. Suggest **new mechanism** building on Flandreau, Ugolini (2013, 2014) and Carlson et al. (2015): Combination of monitoring/incentives + free lending in case of exogenous liquidity crisis
  3. Do so within historic context when **Bagehot-type free lending became standard** during the second half of 19^{th} century
  4. Exploit **unique evidence** on credit limits

Argument

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- Central element: **credit limits** for individual bank access to CB refinancing
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  1. Limits attributed as a function of good liquidity (& capital) risk management
  2. Ceteris paribus, counterparties prefer higher limits
- Consistent with "free lending": credit limits as **contingent rule**
  1. Enforced in normal times
  2. Lifted during liquidity crises perceived as exogenous
  3. Central bank returns to enforcing limits as soon as possible

Plan for the rest of the presentation

1. Brief overview on Austro-Hungarian Bank and its lending framework
2. Data and qualitative evidence
3. Operationalize the argument on credit limits and empirical testing
4. Conclusion

Austria-Hungary 1908

Background: OeUB lending framework

- OeUB (1878-1918)
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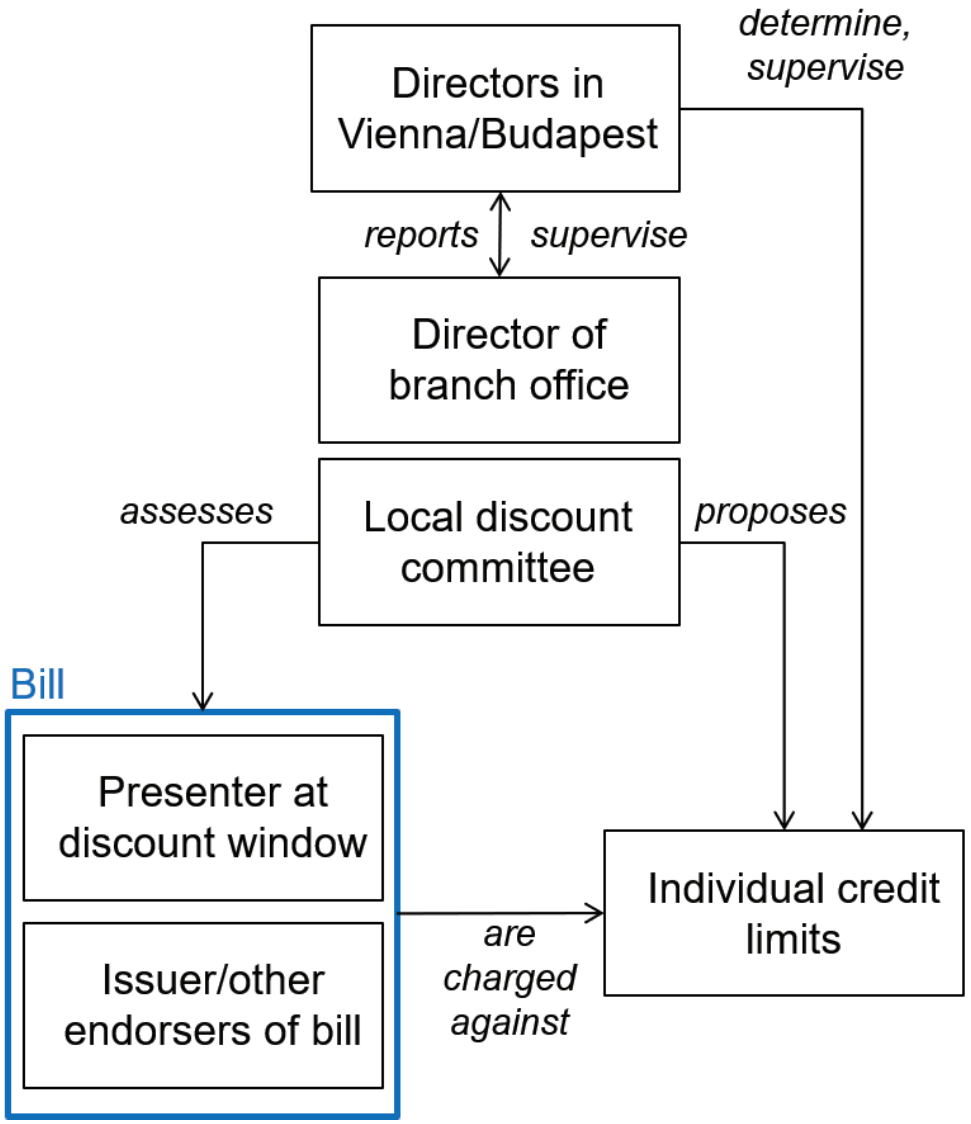
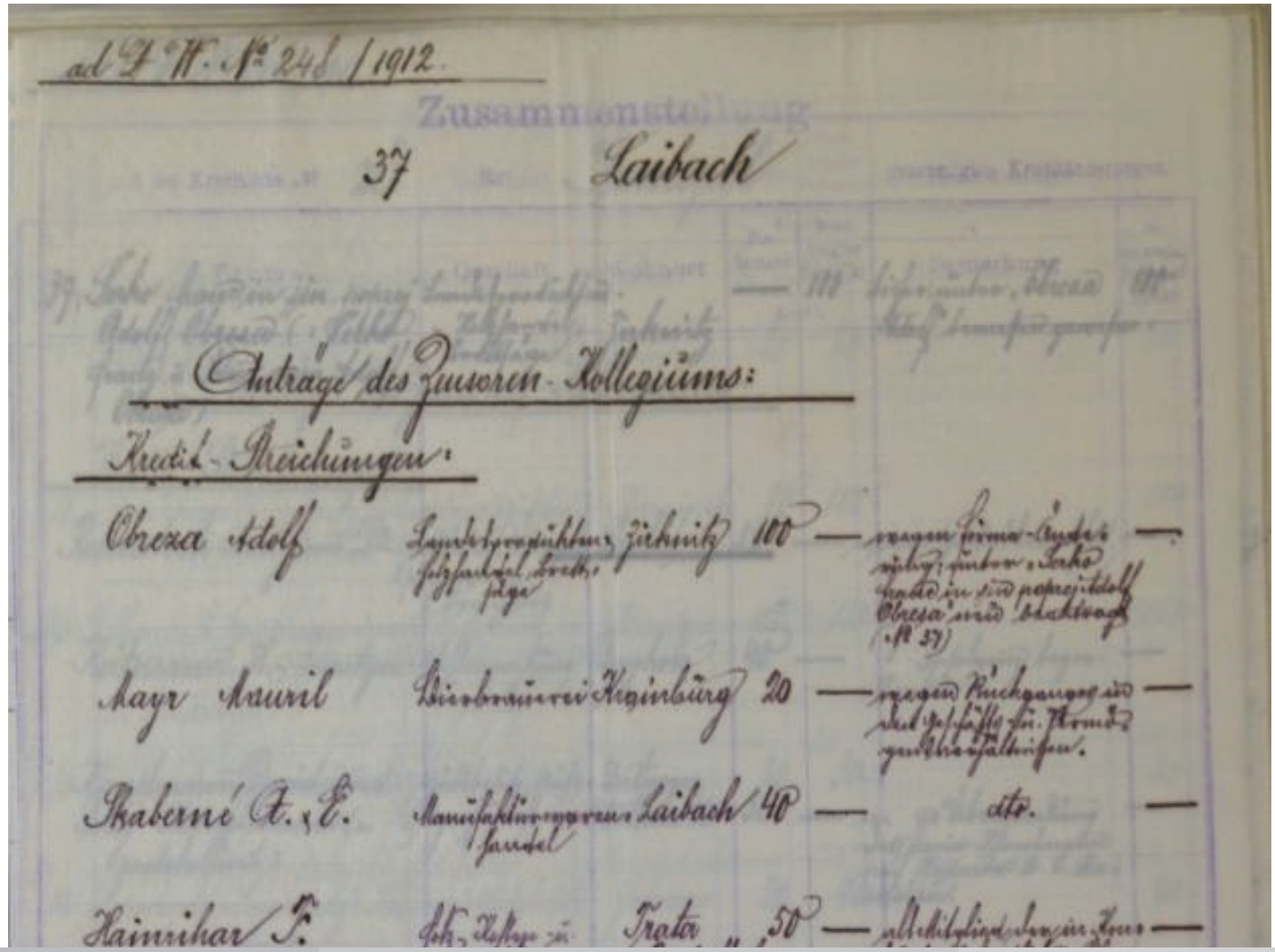
- Most important liquidity providing operation: **Discount of bills** (*Wechseldiskont*)
  1. Outright purchase of short-term paper at discount
  2. OeUB carries credit risk, requires risk management
  3. Three good signatures (mutual liability) + quality of bill assessed by local discount committees
  4. Total exposure to CPs monitored through credit ledgers ('Kreditkonten')
  5. Credit limit defines maximum exposure for each CP

Credit limits system: operational framework

Figure: Assessments of credit limits and individual bills



- Handcollected 4,000 credit limit assessments for both NFIs and FIs
- Matched with handcollected balance sheet data for FIs
- Output: **cross-sectional and panel data sets** for 1908-1913



Credit limits to address moral hazard: operationalizing the argument

- **Credit limits serve as 2nd layer of CP risk framework ...**
  - Rationale: utilization of limit indicator of credit quality
  - **Hypothesis: wealth (equity) important determinant of credit limit**

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  - LLR lowers incentives for proper liquidity management
  - **Hypothesis: Credit limit = f(proper liquidity management)**
  - Liquidity shocks & transformation: moral hazard mostly problem of FIs
  - **Hypothesis: liquidity supervision more relevant for FIs than NFIs**

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- **... while being compatible with last-resort lending**
  - **Hypothesis: limits lifted during liquidity crises perceived as exogenous**

Testing our hypotheses: What determines limits according to OeUB directors?

- Classify verbal reasons into categories
- Results:
  - Equity matters more for non-financial firms
  - Leverage and liquidity (asset side, refinancing) matters more for banks

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- Run cross-sectional regressions for subset of financial firms with balance sheets

$$C_i = \alpha + \beta SIZE_i + \gamma AGE_i + \delta LEV_i + \phi LIQ_i \ (+\boldsymbol{\Lambda}'\mathbf{X}_i) + \varepsilon_i \qquad (1)$$

- Robustness checks: split samples, additional controls, Panel FE regressions for levels and changes in limits

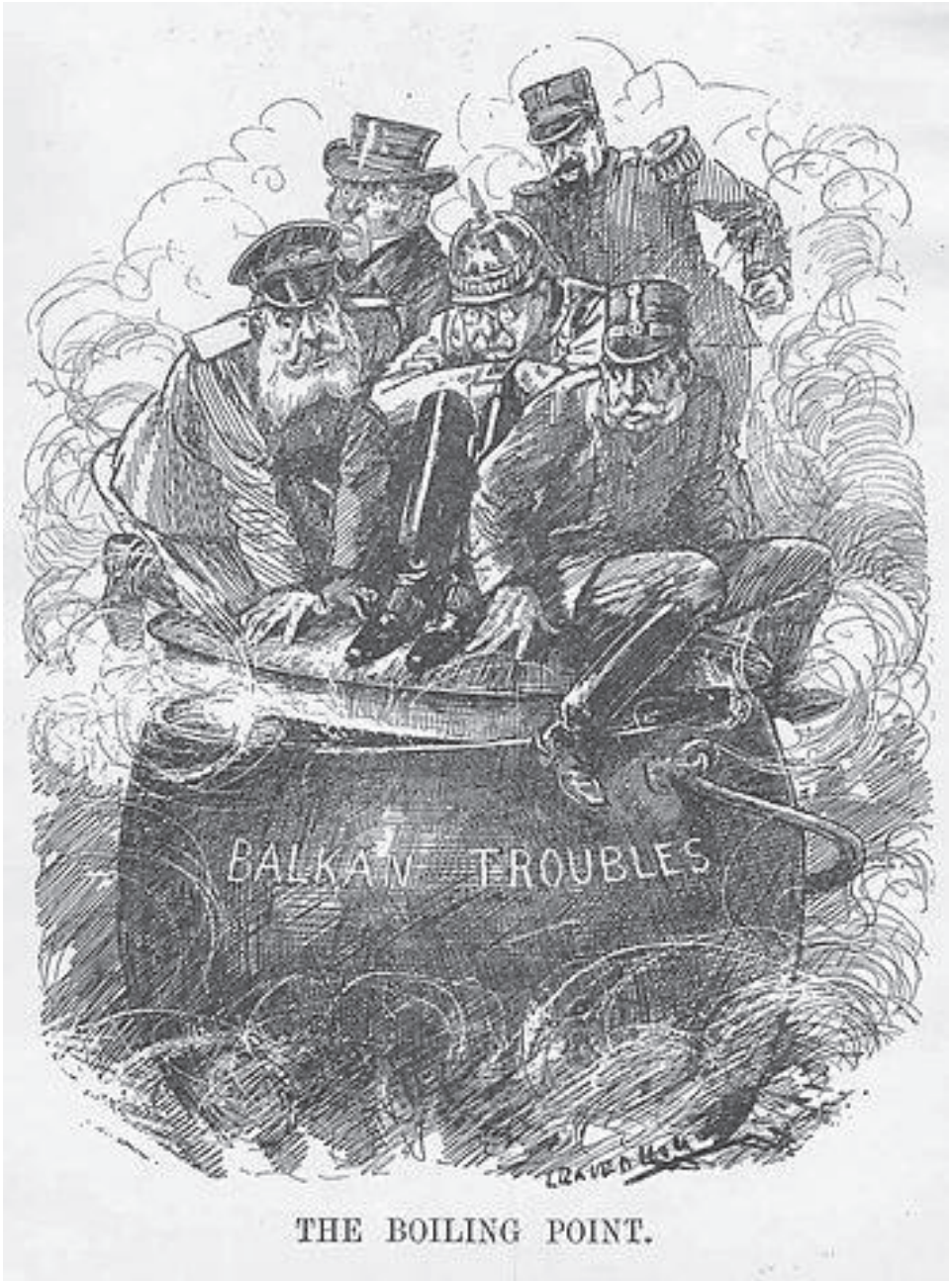
Table: Cross-sectional regressions: explaining levels of credit limits (baseline)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Size	1.08***	1.09***	1.13***	1.19***	1.18***	1.17***	1.20***	0.98***	0.94***	0.92***	0.95***
	(0.04)	(0.04)	(0.04)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Age		-0.03	-0.05	0.01	0.05	0.05	0.02	0.22***	0.24***	0.22***	0.19***
		(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)
Leverage ratio			-0.15	-0.12	-0.11	-0.11	-0.10	-0.06	-0.06	-0.07	-0.08
			(0.10)	(0.09)	(0.09)	(0.09)	(0.09)	(0.07)	(0.07)	(0.07)	(0.08)
Liquidity 1				0.10**				0.21***			
				(0.05)				(0.05)			
Liquidity 2					0.15***				0.12***		
					(0.04)				(0.03)		
Liquidity 3						0.16***				0.11***	
						(0.04)				(0.03)	
Illiquidity							-0.18***				-0.20***
							(0.05)				(0.05)
Bank dummy								1.63***	1.50***	1.50***	1.39***
								(0.15)	(0.15)	(0.15)	(0.16)
Savings bank dummy								0.45***	0.30***	0.31***	0.48***
								(0.10)	(0.09)	(0.09)	(0.09)
Constant	4.81***	4.81***	4.82***	4.83***	4.83***	4.81***	4.84***	4.52***	4.58***	4.57***	4.56***
	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.06)	(0.05)	(0.05)
Observations	489	471	440	400	394	423	435	400	394	423	435
R-squared	0.57	0.57	0.59	0.60	0.61	0.60	0.60	0.68	0.68	0.67	0.67
Robust SE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses; coefficients on continuous variables represent effect of 1 std.dev. increase in regressor.
*** p<0.01, ** p<0.05, * p<0.1

Credit limits during a crisis: A case study on the panic of 1912

- Classical bank runs Oct-Dec 1912
- Context: Balkan wars
- Trigger: Fear of war with Russia
- Runs concentrated at Russian border
- Central bank perceives shock as exogenous: independent of ex ante liquidity management
- Limits increased quickly by up to 100 percent and more
- 3 Dec 1912: All limits are suspended given that addition good collateral is provided
- Market interest rates stay below/at central bank discount rate: no rationing, clear case of free lending



THE BOILING POINT.

Table: Firth logit estimates: explaining tolerations of transgressions during the crisis of 1912

VARIABLES	(1)	(2)	(3)	(4)	(5)
Distance to Russian border (linear)		-1.92***			
		(0.53)			
Distance to Russian border (natural log)			-0.81***		
			(0.20)		
Distance to Russian border (inverse)				0.36***	
				(0.12)	
Exposure to war threat dummy					3.05***
					(0.82)
Size	0.93***	1.26***	1.14***	1.07***	0.71**
	(0.30)	(0.35)	(0.32)	(0.31)	(0.31)
Age	-0.78***	-0.66**	-0.78***	-0.79***	-0.49
	(0.28)	(0.29)	(0.29)	(0.30)	(0.35)
Leverage ratio	0.10*	0.12**	0.12**	0.12**	0.14**
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Liquidity 3	0.23	-0.11	0.03	0.19	-0.01
	(0.18)	(0.20)	(0.19)	(0.18)	(0.20)
Refinancing	-0.02	-0.33	-0.24	-0.39	-0.82
	(0.35)	(0.39)	(0.37)	(0.59)	(0.93)
Profitability	-0.85	-1.82*	-1.38	-1.13	-1.41
	(1.15)	(1.06)	(0.98)	(1.09)	(0.96)
Observations	714	714	714	714	714
Log-likelihood	-36.75	-26.42	-28.82	-31.58	-29.13
Chi-squared statistic	24.29	23.87	31.23	31.02	33.82
Number of tolerations	10	10	10	10	10

Standard errors in parentheses

Coefficients on continuous variables represent marginal effect of 1 std.dev. increase in regressor.

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

Suspension is temporary and low liquidity sanctioned both ex ante and ex post

OeUB directorate dealings with Ústřední banka českých spořitelen

Before crisis (Sep 1912): **Request for higher limit rejected:** "The bank had **immobilized itself** in a way, so that previously granted credit lines did not appear appropriate anymore and **restrictive measures** had to be taken." (Minutes Vienna directorate)

In the midst of the crisis (Nov 1912): "[...] we **cannot restrict credit too rapidly**, otherwise we would cause a catastrophe." Still: "[W]e have **limited our exposure [to the bank] by strict screening of bills** so that we can hope to soon apply normal stricter standards without putting its customers at risk."

After the crisis abated (Feb 1913): "The **management of the bank is being changed** at the moment and the new board aims at achieving a business reorganization. [...] Our future stance will have to be made **contingent on the alterations which are triggered by this change**."

- **Our contributions**
  1. New explanation how moral hazard was tackled by 19C LLRs
  2. Wealth of qualitative evidence and unique micro-data set on credit limits (supply side of central bank lending)

- **Caveat:**
  1. We do not claim that contingent rules were effective!
  2. BUT: Credit limits operationalized in a way consistent with interpretation as micro-prudential tool to check moral hazard

- **Main take-aways and suggestions for future research**
  1. 19C central banks very concerned about liquidity, i.e. long before introduction of explicit liquidity regulation à la Basel III
  2. Constructive ambiguity and penalty rates have theoretical appeal but might be less important empirically
  3. Key role of information for central bank policy (see other contributions to panel today)
  4. To understand lending of last resort have to look at what central banks do during normal times as well