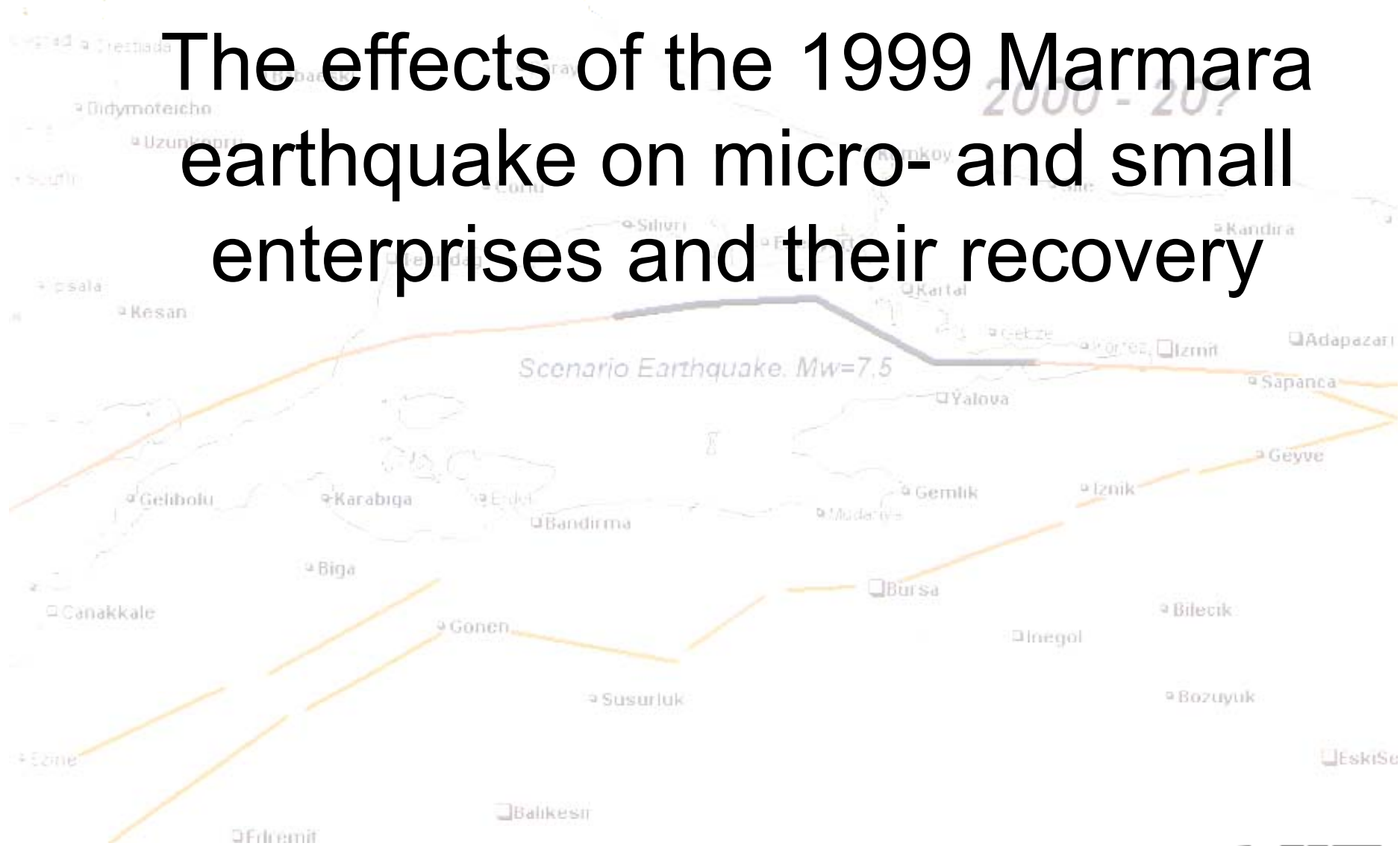


# The effects of the 1999 Marmara earthquake on micro- and small enterprises and their recovery



Claas Menny

Ute Werner

It is often claimed, that small enterprises are especially hard hit by disasters.

*“Smaller enterprises, employing up to 10 people, were the hardest hit by the earthquake, losing most of their working capital, facilities and workers“.*

...

*“about 20.000 small businesses have terminated their operations leaving behind about 140.000 jobless people.“*

*(Akgiray 2004 about Marmara earthquake)*

On the other hand the quick recovery of small businesses is mentioned.

*„The following general effects are common to all types of natural disasters:...*

*A tendency for small businesses and providers of personal services to be among the first to recover regardless of the amount of damage sustained“ (ECLAC 2003)*

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What is true?

Detailed studies about the effects of natural disasters on micro- and small enterprises (MSE) were mainly conducted in the US. The examined disasters had mostly moderate intensities.

Therefore a study about the impact and the aftermath of the Marmara earthquakes (Turkey) of 1999 was conducted in 2007 among micro- and small enterprises (MSE) .

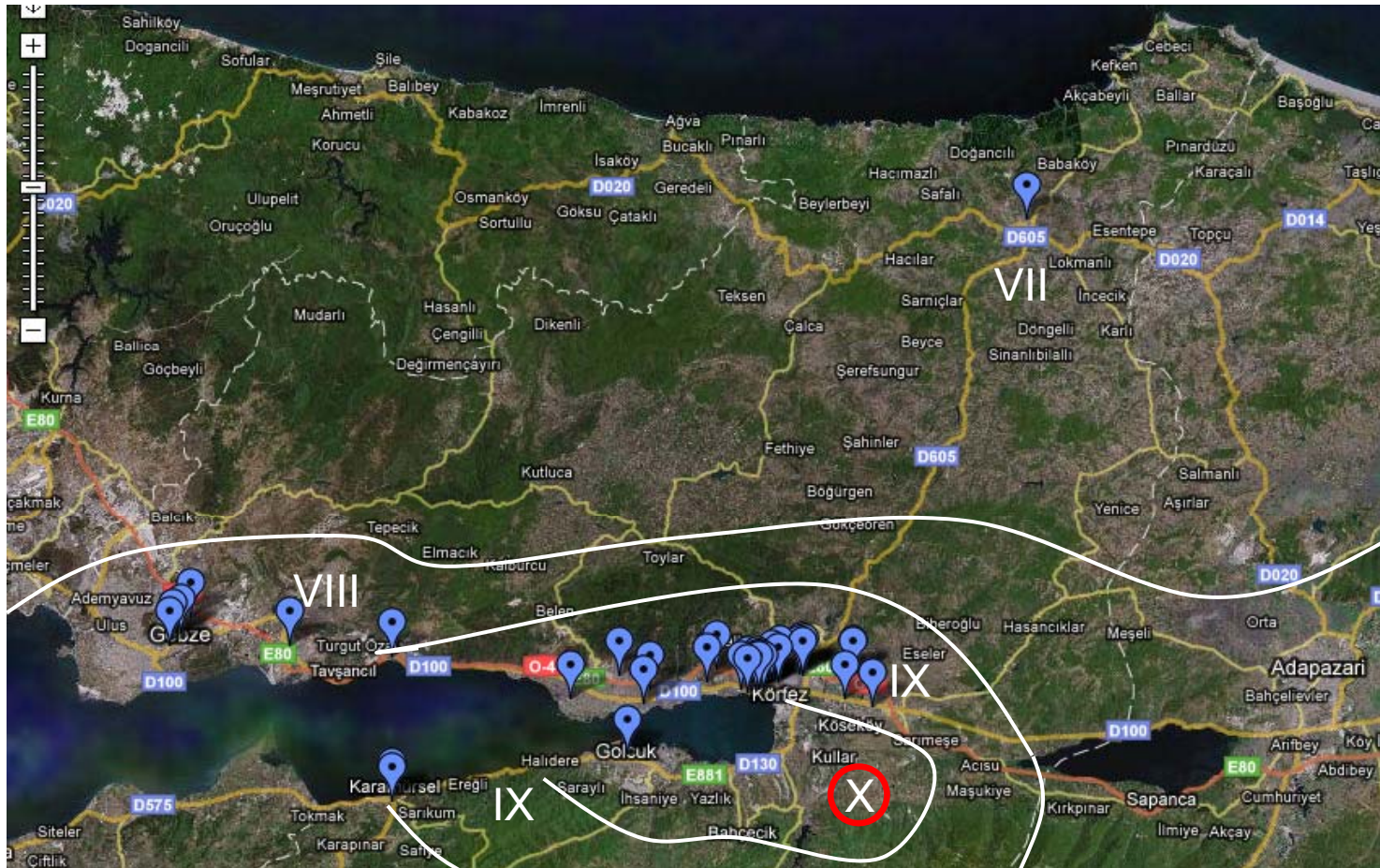
- Which damages occurred?
  - Which reasons influence business disruptions and losses?
  - Which reasons lead to recovery?
  - How were business-growth and -development affected in the long run?
  - How was the surrounding community affected by the disaster?
- Which measures are appropriate to support business recovery and growth?

- 203 entrepreneurs were interviewed
- Quota-sample with 3 strata (sector, size of business, location)
- Sectors:
  - Trade, 48%
  - Manufacturing, 21%
  - Construction, 10%
  - Service, 20%
- Size:
  - 24% were sole proprietors
  - 58% had 2-9 employees ( $\bar{\sigma}=3,5$ ),
  - 18% had more than 9 employees ( $\bar{\sigma}=16,7$ )

Micro

Small

# Survey design



Source: Miksat, Wenzel, Sokolov 2005; Google maps

- It was planned to interview at least 20 entrepreneurs in each district center
- That was impossible
- From Gölcük only 1 enterprise answered!

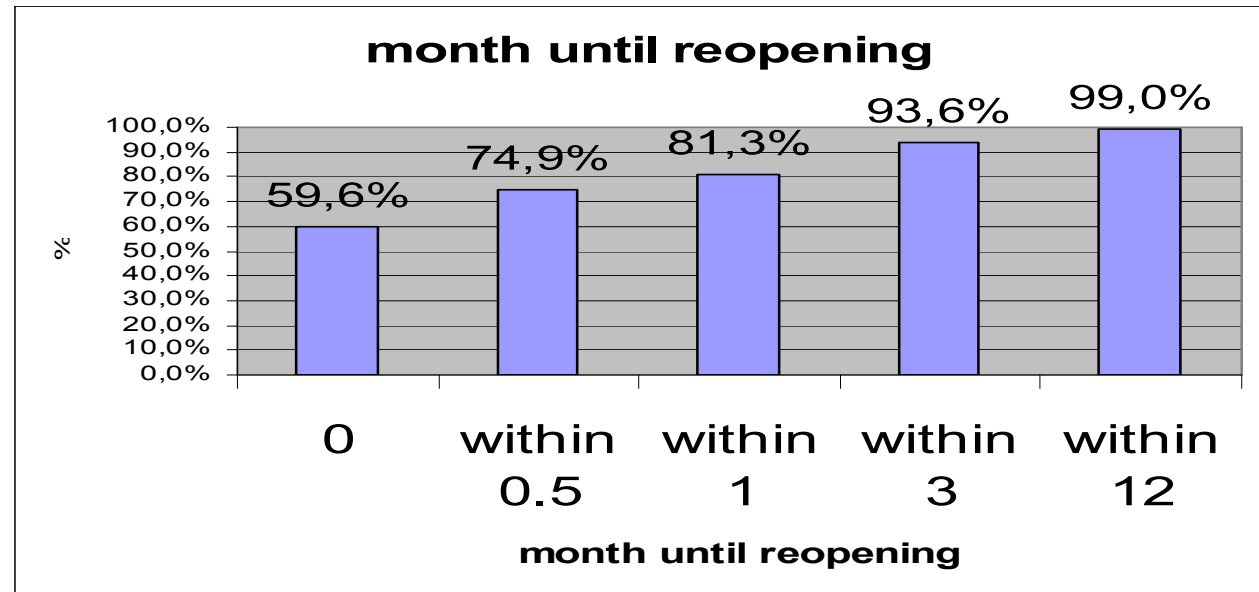
- MSE sustained more and heavier damages than bigger ones.

Size of enterprises and damages			
	Micro and Small enterprises	Medium sized enterprises	Large enterprises
Damage	68,5%	32%	25,5%
Devastation	3,40%	1,70%	0,50%
sources: own data, Kocaeli chamber of industry (KOSANO)			

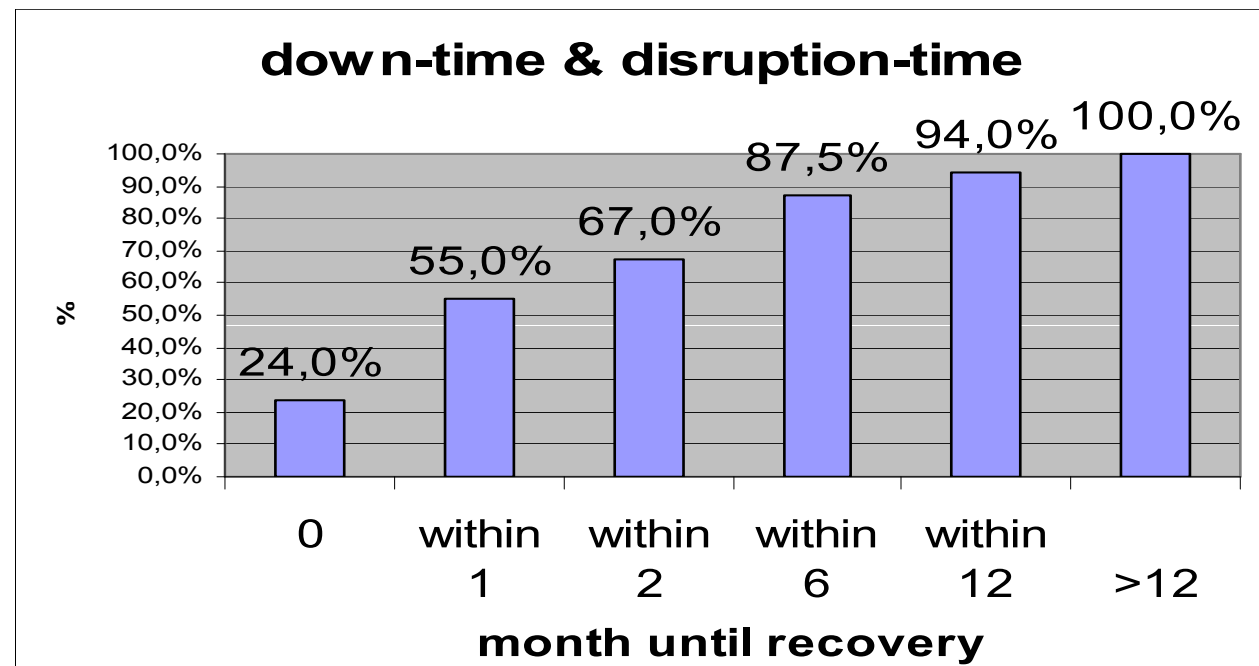
- Among MSE, businesses with 1-5 employees sustained more and heavier damages than those with more than 5 employees.
- One explaining variable: **building type** – many very small businesses worked in residential buildings, which were especially hard hit.

# Down-time and disruption-time

- 60% of enterprises had no downtime at all
- Overall 81% were back to business within 1 month



- 24% had no disruptions
- Overall 87% of enterprises were fully recovered within 6 months
- 6% needed up to 24 months until business failures & disruptions were overcome.



# Monetary losses (in YTL)

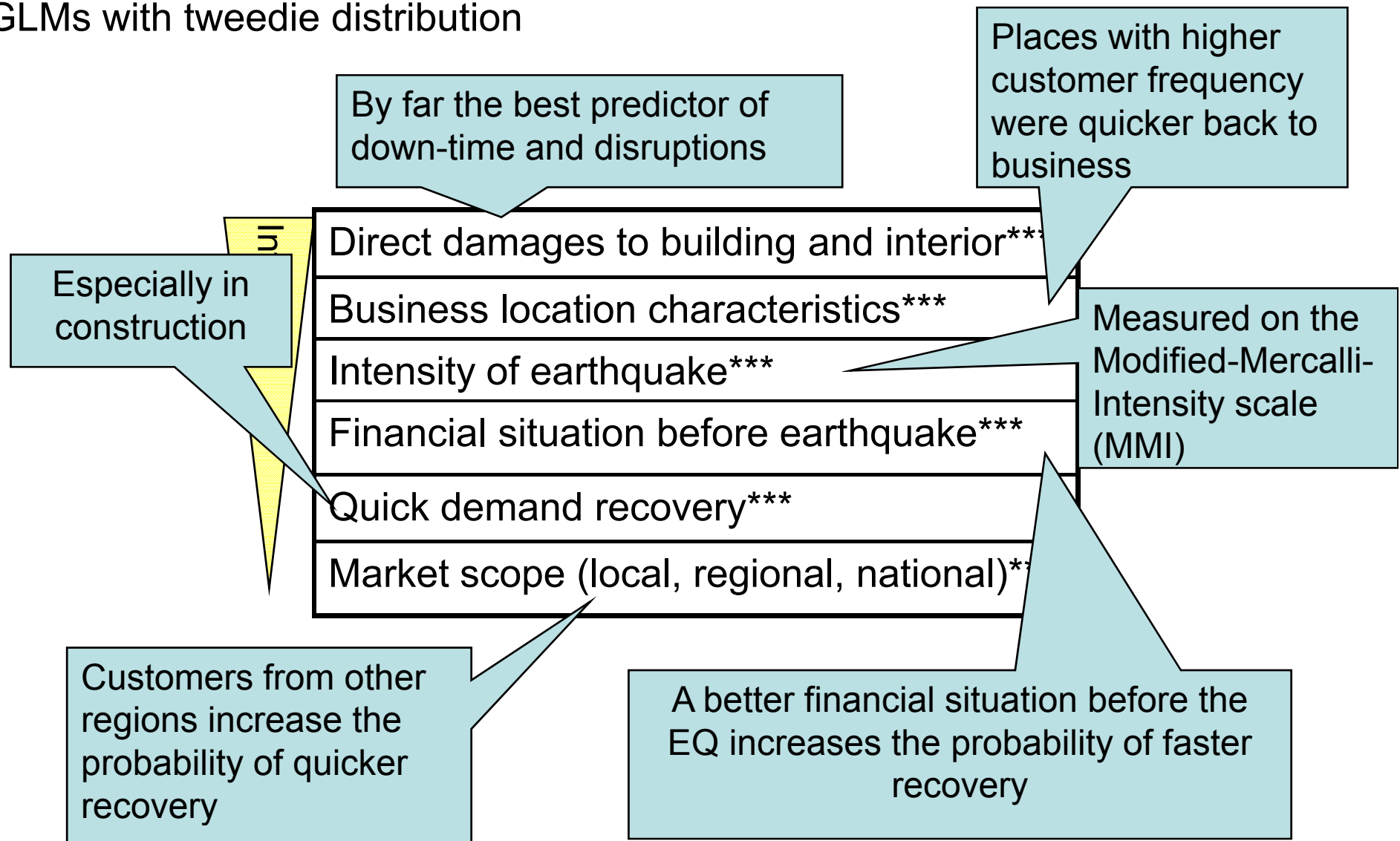
- Losses from interior damages (furniture, machines, stocks) were often as high, as losses from building damages
- Disruption losses clearly exceeded the losses from damages to building structures and interior

## Losses in YTL (New Turkish Lira)

		<i>direct</i>		<i>indirect</i>
		Building	Machines & Interior	Failure & Disruption
N	valid	124	104	155
	missing	79	99	48
<b>Mean</b>		<b>4581</b>	<b>3071</b>	<b>6671</b>
<b>Median</b>		<b>600</b>	<b>2250</b>	<b>3000</b>
Sum		568.050	319.400	1.034.000

# Factors influencing down-time and disruptions

GLMs with tweedie distribution



\*\*\* sig. level <0,01, \*\* sig.level <0,05

# Recovery times of the districts (Median of month)



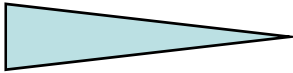
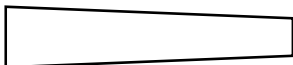
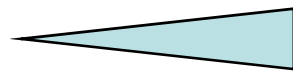
Source: Miksat, Wenzel, Sokolov 2005; Google maps; own data

„How long did it take until the business activity was on the same level as it was before the earthquake in your city district?”

- No significant relationship between the intensity of the earthquake (MMI) and long term economic recovery of the affected regions

- The entrepreneurs estimated that 20% of businesses never reopened in their neighborhood and that 18% closed within the following two years → these numbers are below the numbers usually mentioned by the business-continuity-industry.
- 59% of entrepreneurs named the financial crisis in 2001 as worst crisis for their enterprise, only 22% named the EQ
- The existence of business continuity plans and the cooperation with other enterprises had no measureable effect on the recovery time or the long term recovery outcome.

# Employment changes before and after the disaster

Businesses with employment-changes		
	From business establishment until 1999	From 1999 until 2007
Hired	12% 	7%
Stagnant	80% 	74%
Laid off	8% 	19%

- The strongest decrease in trade and construction!
- positive short term effects on demand could not be turned into long term growth
- **Before** the Earthquake 24% of the small enterprises (>9 employees) were growing, but only 10% of the micro-enterprises (1-9 employees)
- **After** the Earthquake 9% of the micro-enterprises were growing and **0** of the small enterprises!

„How is the business situation today (2007) in comparison to the situation just before the Earthquake in 1999?“

<b>Worse</b>	<b>(39%)</b>
<b>The same</b>	<b>(48%)</b>
<b>Better</b>	<b>(13%)</b>

# Long term recovery (Logistic regression)

Same or better (61%)

Worse (39%)

Quick demand recovery increases the probability for a good business situation (strongest predictor)

A **good** financial situation in 1999 indicates a **worse** situation of the business today. (regression to the mean?)

Smaller businesses are more likely to be worse off

Influence

Demand recovery\*\*\*

Financial situation before earthquake\*\*\*

Nr. of disturbances after earthquake\*\*\*

Size of business\*\*

Direct damage\*\*

Infrastructure failure, financial problems, failure of suppliers, transportation problems, absence of employees, data loss, personal problems

Businesses with heavy damages are more likely to be worse off

Nagelkerkes  $R^2 = 0,47$

\*\*\* sig. level <0,01, \*\* sig.level <0,05

- Smaller businesses were more affected by direct damages than larger ones.
  - Losses from business disruptions clearly exceed losses from physical destruction
- fostering business interruption insurance products could be a reasonable measure to strengthen MSE

- The rate of business closures was lower than expected, MSE seem to be rather resilient
  - Only micro-businesses were growing after the quake
- for highest efficiency in terms of employment, measures should be focused on Micro-businesses
- Measures should be linked to the intensity of the direct damages

Thank you!

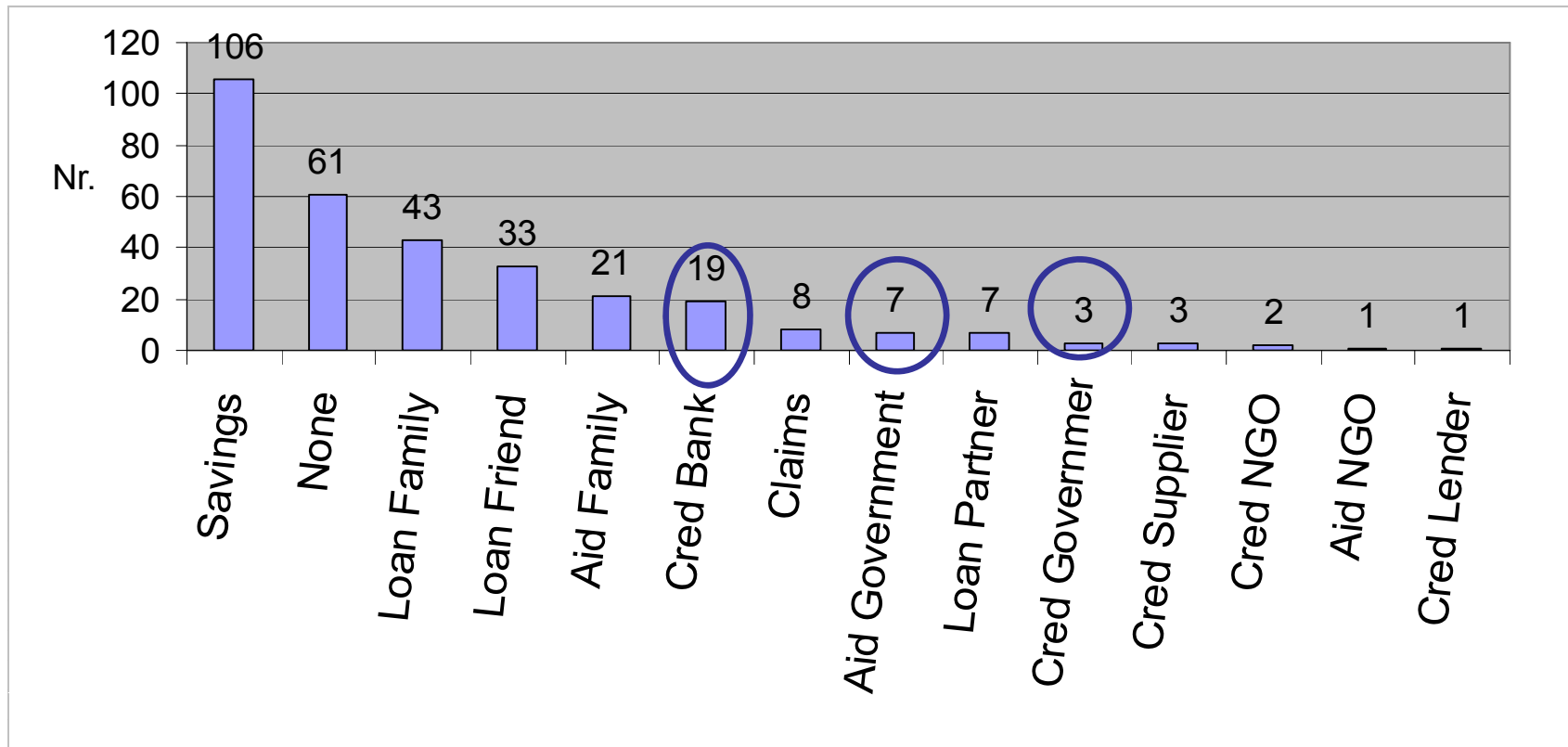


- Akgiray, A. et al. (2004): “The 1999 Marmara earthquakes in Turkey“, in: OECD - Large scale disasters, 2004, p.77-92.
- ECLAC (2003): Handbook for Estimating the Socio-economic and Environmental Effects of Disasters, vol. I.
- Miksat, J. et al. (2005): Low Free-Field Accelerations of the 1999 Kocaeli Earthquake, in: Pure and Applied Geophysics, vol. 162, p. 857-874,.

# Backup

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# Refinancing

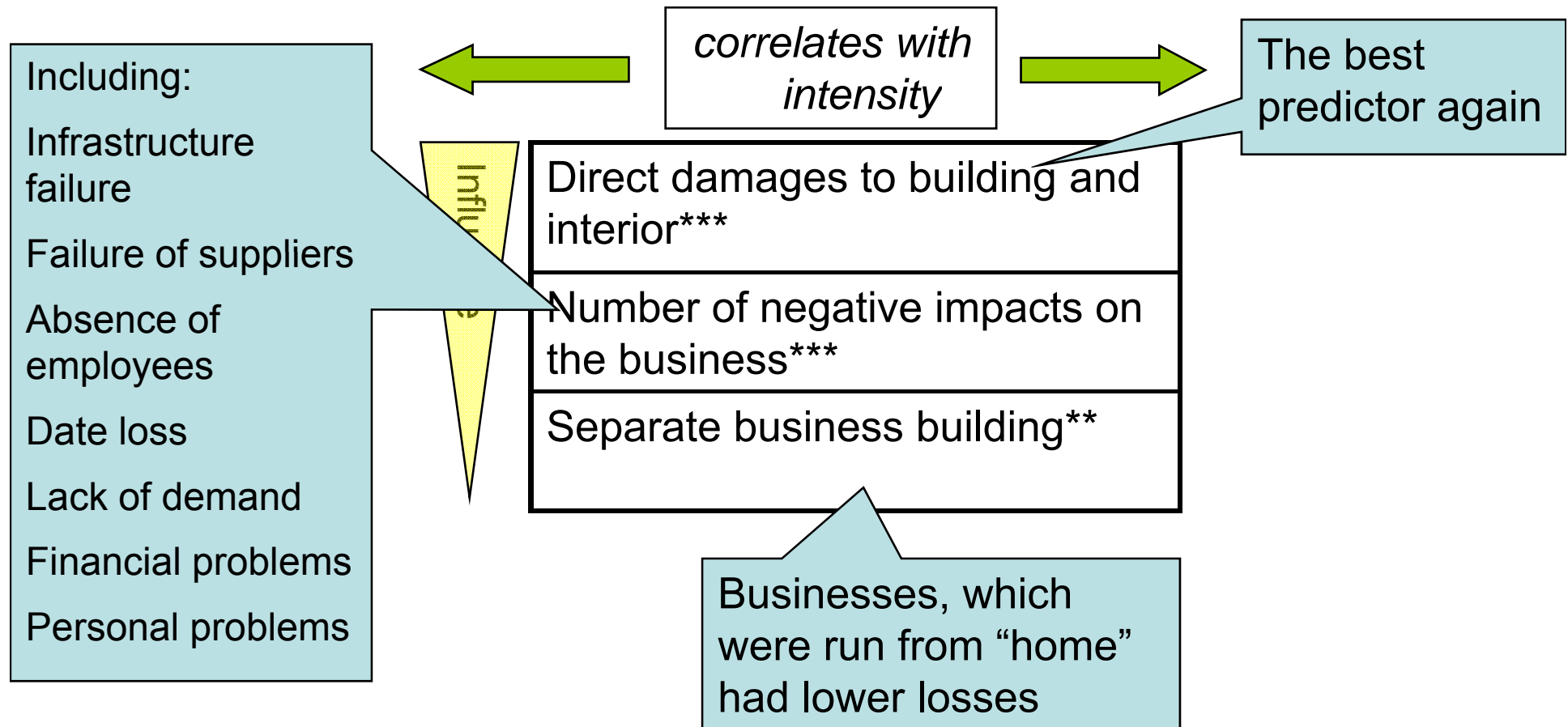


- Most entrepreneurs fell back on savings and on social contacts for refinancing (family, friends)
- The businesses which received government grants and credits (5%) were **not** those with the worst damages
- **None** of the micro and small businesses were insured, but 47% of the medium sized and large businesses were.

# Indirect losses

*Ordinal Regression*

Nagelkerke's  $R^2=56,2$



\*\*\* sig. level <0,01, \*\* sig.level <0,05

SXXXX11Kat3 \* Q33. How is the economic situation of the enterprise today in comparison to the situation before the earthquake in 1999? Kreuztabelle

			Q33. How is the economic situation of the enterprise today in comparison to the situation before the earthquake in 1999?			Gesamt
			Better	About the same	Worse	
SXXXX11Kat3 Einzel	Anzahl	4	21	23	48	
	% innerhalb von SXXXX11Kat3	8,3%	43,8%	47,9%	100,0%	
2-5	Anzahl	12	44	41	97	
	% innerhalb von SXXXX11Kat3	12,4%	45,4%	42,3%	100,0%	
6-48	Anzahl	10	32	16	58	
	% innerhalb von SXXXX11Kat3	17,2%	55,2%	27,6%	100,0%	
Gesamt	Anzahl	26	97	80	203	
	% innerhalb von SXXXX11Kat3	12,8%	47,8%	39,4%	100,0%	

Symmetrische Maße

	Wert	Asymptotischer Standardfehler $r^a$	Näherungsweise $T^b$	Näherungsweise Signifikanz $z$
Ordinal- bzgl. Ordinalmaß Kendall-Tau-b Anzahl der gültigen Fälle	-,147 203	,061	-2,387	,017

a. Die Null-Hyphothese wird nicht angenommen.

b. Unter Annahme der Null-Hyphothese wird der asymptotische Standardfehler verwendet.

# Modified Mercalli Intensity Scale (MMI)

<b>V. Rather Strong</b>	Felt by nearly everyone; many awakened. Some dishes and windows broken. Unstable objects overturned. <a href="#">Clocks</a> may stop.
<b>VI. Strong</b>	Felt by all; many frightened and run outdoors, walk unsteadily. Windows, dishes, glassware broken; books off shelves; some heavy furniture moved or overturned; a few instances of fallen plaster. Damage slight.
<b>VII. Very Strong</b>	Difficult to stand; <a href="#">furniture</a> broken; damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.
<b>VIII. Destructive</b>	Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture moved.
<b>IX. Ruinous</b>	General panic; damage considerable in specially designed structures, well designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
<b>X. Disastrous</b>	Some well built wooden structures destroyed; most masonry and frame structures destroyed with foundation. Rails bent.
<b>XI. Very Disastrous</b>	Few, if any masonry structures remain standing. Bridges destroyed. Rails bent greatly.
<b>XII. Catastrophic</b>	Total damage - Almost everything is destroyed. Lines of sight and level distorted. Objects thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move.

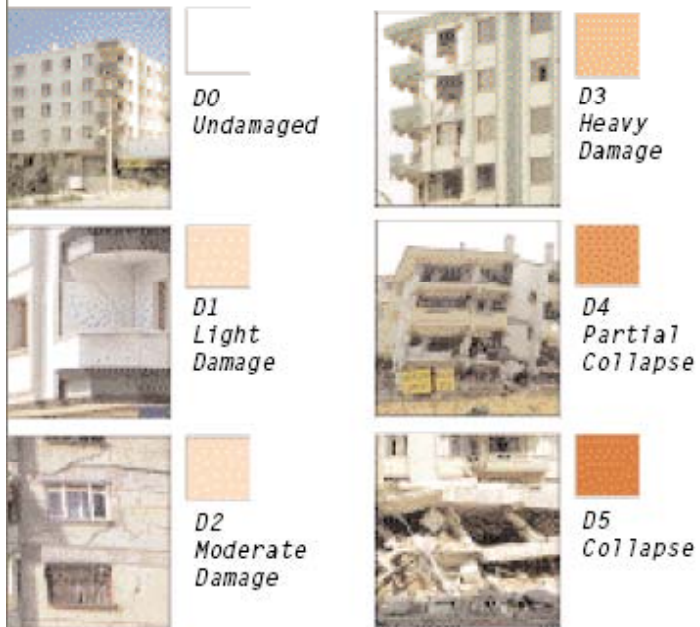
# Logistic regression (Nagelkerkes $R^2=0,474$ )

## Variablen in der Gleichung

		Regressionskoeffizient B	Standardfehler	Wald	df	Sig.	Exp(B)
Schritt 1 <sup>a</sup>	SX37_3			17,627	2	,000	
	SX37_3(1)	6,423	1,822	12,430	1	,000	615,994
	SX37_3(2)	5,347	1,825	8,582	1	,003	209,977
	SX32			28,645	2	,000	
	SX32(1)	-,461	,768	,360	1	,549	,631
	SX32(2)	-2,180	,410	28,240	1	,000	,113
	SX26b	,912	,313	8,485	1	,004	2,490
	Sx17_19kat3			8,002	2	,018	
	Sx17_19kat3(1)	-1,441	,781	3,410	1	,065	,237
	Sx17_19kat3(2)	-2,432	,887	7,517	1	,006	,088
	SXXXX11			8,386	2	,015	
	SXXXX11(1)	1,514	,533	8,070	1	,004	4,545
	SXXXX11(2)	1,025	,467	4,830	1	,028	2,788
	Konstante	-4,904	1,809	7,352	1	,007	,007

a. In Schritt 1 eingegebene Variablen: SX37\_3, SX32, SX26b, Sx17\_19kat3, SXXXX11.

Back



*MS'* rapid quantitative survey of the damage states of reinforced concrete apartment buildings showed the extent of losses to residential property and illustrated the spatial distribution of the earthquake's intensity.



RMS 2000

# GLM (Tweedie distribution, Var.Exp.1,4, log-link)

Parameterschätzer

Parameter	Regressionskoeffizient B	Standardfehler	95% Wald-Konfidenzintervall		Hypothesentest		
			Unterer Wert	Oberer Wert	Wald-Chi-Quadrat	df	Sig.
(Konstanter Term)	-2,950	,6409	-4,206	-1,694	21,185	1	,000
[SX100=2,00]	-1,479	,3519	-2,169	-,790	17,674	1	,000
[SX100=3,00]	0 <sup>a</sup>	.	.	.	.	.	.
[SXX8=1,00]	,958	,2005	,565	1,351	22,834	1	,000
[SXX8=2,00]	0 <sup>a</sup>	.	.	.	.	.	.
[SX32=1,00]	1,015	,2502	,524	1,505	16,455	1	,000
[SX32=2,00]	,148	,1526	-,151	,448	,946	1	,331
[SX32=3,00]	0 <sup>a</sup>	.	.	.	.	.	.
[SXX9=1,00]	1,086	,4478	,209	1,964	5,886	1	,015
[SXX9=2,00]	0 <sup>a</sup>	.	.	.	.	.	.
[SX17_19_Kat4=3,00]	2,665	,2344	2,205	3,124	129,286	1	,000
[SX17_19_Kat4=4,00]	1,415	,2336	,958	1,873	36,720	1	,000
[SX17_19_Kat4=5,00]	,960	,2027	,562	1,357	22,404	1	,000
[SX17_19_Kat4=6,00]	0 <sup>a</sup>	.	.	.	.	.	.
[SX37_3=1,00]	,811	,2321	,356	1,266	12,217	1	,000
[SX37_3=2,00]	,397	,2610	-,114	,909	2,317	1	,128
[SX37_3=3,00]	0 <sup>a</sup>	.	.	.	.	.	.
[Sx26_7_shrink=1,00]	,184	,3361	-,474	,843	,300	1	,584
[Sx26_7_shrink=2,00]	,915	,3965	,138	1,692	5,322	1	,021
[Sx26_7_shrink=3,00]	0 <sup>a</sup>	.	.	.	.	.	.
(Skala)	1,472 <sup>b</sup>	,1116	1,268	1,708			

Abhängige Variable: SX21\_22 Month out disturbed  
 Modell: (Konstanter Term), SX100, SXX8, SX32, SXX9, SX17\_19\_Kat4, SX37\_3, Sx26\_7\_shrink

a. Auf 0 gesetzt, da dieser Parameter redundant ist.

b. Maximum-Likelihood-Schätzer.

Back