Online appendix to "Fire sales and house prices" by Steffen Andersen and Kasper Meisner Nielsen

Appendix A. Definition of sudden deaths

This appendix shows the ICD-8 and ICD-10 codes corresponding to our definition of sudden deaths. We follow Andersen and Nielsen (2011, 2012), who identify relevant ICD-10 codes from related medical literature combined with a thorough inspection of WHO's detailed classification system. The ICD-10 classification system was introduced in 1994. Thus, for 1992 and 1993 we rely on the ICD-8 classification system. Among natural deaths, we consider acute myocardial infarction (ICD-8: 4101-9; ICD-10: I21-I22), cardiac arrest (ICD-8: 4272; ICD-10: I46), congestive heart failure (ICD-8: 4270-1, 4273; ICD-10: I50), stroke (ICD-8: 430-8; ICD-10: I60-I69), and sudden deaths by unknown causes (ICD-8: 795-6; ICD-10: R95-R98) as sudden deaths. Among unnatural deaths, we classify traffic accidents (ICD-8: 800-827; ICD-10: V00-V89) and other accidents and violence (ICD-8: 830-839, 870-929; ICD-10: V90-V99, X00-X59, and X86-X90) unanticipated by the relatives as sudden deaths.

	ICD-8	**ICD-10**
Acute myocardial infarction (a)	4101-4109	I22-I23
Cardiac arrest (b)	4272	I46
Congestive heart failure (c)	4270-4271	I50
	4273	
Stroke (d)	430-438	I60-I69
Sudden death by unknown cause (e)	795-796	R95-R97
Traffic accidents (f)	800-827	V00-V89
Other accidents and violence (g)	830-839	V90-V99
	870-929	X00-X59
		X86-X90

Appendix B. Determinants of transfers within the family

In this appendix we address concerns related to the potential selection bias arising from transfer of houses within the family. Column 1 shows the propensity to transfer the house within the family. We use a logit model where the dependent variable is an indicator for transfer within family among our sample of estates. We notice that the propensity to transfers is unrelated to market conditions and house characteristics. The main exceptions are lot size and bathrooms, but these effects are relatively small: A one standard deviation increase in the lot size or number of bathrooms increases the probability by 1.5% and 1.4%, respectively. More importantly we note that there is no systematic relationship between the house price growth and the likelihood of transfer within the family. Thus, family transfers are unrelated to market conditions.

In columns 2 and 3 we examine whether the quality of the transferred houses are different from other houses. We use the tax authorities' assessment of house value and regress it on house characteristics and an indicator for transfers within the family. In column 2 we find no significant difference in the assessed house value of forced sales (at arm's length) versus transfers within the family. In Column 3 we included all houses and find similar results. There appears to be no systematic relationship between the assessed house value and transfers within the family.

Dependent variable	**Transfer within family**	**Log. assessed house value**	**Log. assessed house value**
Model	**Logit**	**OLS**	**OLS**
	(1)	**(2)**	**(3)**
Interior size	0.0001	0.0049***	0.0047***
	(0.0011)	(0.0001)	(0.0000)
Lot size	0.0003***	0.0000**	0.0000***
	(0.0001)	(0.0000)	(0.0000)
Basement	-0.0397	0.1270***	0.1020***
	(0.0942)	(0.0092)	(0.0006)
Basement size	-0.0002	-0.0004***	-0.0004***
	(0.0004)	(0.0000)	(0.0000)
Bathrooms	0.3549***	0.0612***	0.0478***
	(0.0842)	(0.0094)	(0.0005)
House age	0.0013	-0.0059***	-0.0070***
	(0.0032)	(0.0004)	(0.0000)
House age squared	0.0000	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)
House price growth	-0.8357		
	(0.5620)		
Transfer within family		-0.0220	-0.0144
		(0.0140)	(0.0098)
Forced sale			-0.0114***
			(0.0029)
Location-year effects	No	Yes, fixed	Yes, fixed
N	7,022	7,022	878,552

Appendix C. Geographic and seasonal distribution of house sales

This appendix shows the geographic (Panel A) and seasonal distribution (Panel B) of house sales, respectively. Although forced sales appear to be geographically and seasonally diverse, and close to the distribution of non-forced sales, the distributions are statistically different. These differences are explained by the fact that forced sales reflect the distribution of the population, while non-forced sales reflect the activeness of the property market. The house market is more active in the Capital Region and during spring, as a result, forced sales are slightly underrepresented here. In the empirical analysis location-year fixed effects are based on municipalities. From 1992 to 2002, Denmark was subdivided into 275 municipalities. In 2003, the five municipalities on the island Bornholm merged, which reduced the number of municipalities to 271. In 2006, two municipalities on the island Ærø merged, which reduced the number of municipalities to 270. In 2007, a municipality reform reduced the number of municipalities to 98.

	All	**Forced sales**		**Difference**
		Yes (1)	**No (2)**	**(1)-(2)**
	Panel A: Location			
Capital Region (%)	19.4	17.3	19.4	
Zealand (%)	18.7	18.9	18.7	
Southern Jutland and Funen (%)	25.6	25.6	25.6	
Central Jutland (%)	24.2	25.0	24.2	
Northern Jutland (%)	12.1	13.2	12.1	
χ^2-test				22.5***
	Panel B: Season			
January – March (%)	25.2	25.7	25.2	
April – June (%)	28.9	29.6	28.9	
July – September (%)	25.5	26.3	25.5	
October – December (%)	20.4	18.5	20.4	
χ^2-test				15.1***

Appendix D. Table 3 with reported coefficients on house characteristics
This internet appendix reports the coefficients on house characteristics in Table 3.

Dependent variable	**Log. house price**			
	(1)	**(2)**	**(3)**	**(4)**
Forced sale	-0.0681***	-0.0935***	-0.0508**	
	(0.0054)	(0.0049)	(0.0073)	
Forced sale * Months after death			-0.0067***	
			(0.0008)	
Forced sale after 0 to 90 days				-0.0338***
				(0.0092)
Forced sale after 91 to 180 days				-0.0847***
				(0.0086)
Forced sale after 181 to 270 days				-0.1356***
				(0.0117)
Forced sale after 271 days or more				-0.1510***
				(0.0106)
Assessed house value		0.0495***	0.0495***	0.0495***
		(0.0001)	(0.0001)	(0.0001)
Interior size	0.0051***	0.0050***	0.0050***	0.0050***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Lot size	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Basement	0.1087***	0.1055***	0.1055***	0.1055***
	(0.0011)	(0.0010)	(0.0010)	(0.0010)
Basement size	-0.0003***	-0.0003***	-0.0003***	-0.0003***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Bathrooms	0.0431***	0.0406***	0.0406***	0.0406***
	(0.0009)	(0.0008)	(0.0008)	(0.0008)
House age	-0.0081***	-0.0076***	-0.0076***	-0.0076***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
House age squared	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Calendar month effects	Yes	Yes	Yes	Yes
Location-year effects	Yes, fixed	Yes, fixed	Yes, fixed	Yes, fixed
N	877,559	877,559	877,559	877,559

Note: The dependent variable is the log of the house price. *Forced sale* is an indicator for forced sales due to sudden death. *Months after death* measures the difference between the time of death and the time of sales, and is measured in months. *Forced sale after 0 to 90 days* is an indicator for whether the forced sale occurred 0 to 90 days after the sudden death. *Forced sale after 91 to 180 days* is an indicator for whether the forced sale occurred 91 to 180 days after the sudden death. *Forced sale after 181 to 270 days* is an indicator for whether the forced sale occurred 181 to 270 days after the sudden death. *Forced sale after 271 days or more* is an indicator for whether the forced sale occurred 271 days or more after the sudden death. House characteristics are described in Table 2. Standard errors are reported in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Appendix E. Financial constraints and the forced sale discount

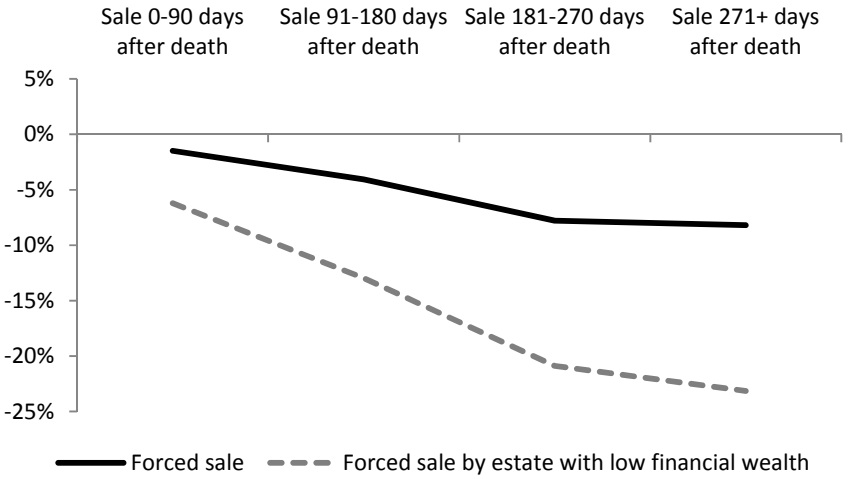
This appendix reports the results for our second measure of financial constraints, which captures estates with low financial wealth. We construct an indicator variable for estates holding less than DKK 50,000 of financial wealth (the sum of bank deposits, stock, and bonds). According to this measure, 1,993 of the 5,324 (37.4%) forced sales are likely to face a liquidity pressure to sell. In column 1 we show a large discount for estates with low financial wealth, as the incremental discount equals 9.8%. In Column 2, we similarly find larger discounts when all beneficiaries have low financial wealth. The incremental effect of the discount is 5.0%. In Column 3, we include both effects, and again we note that discounts are driven by the financial position of both the estate and the beneficiaries.

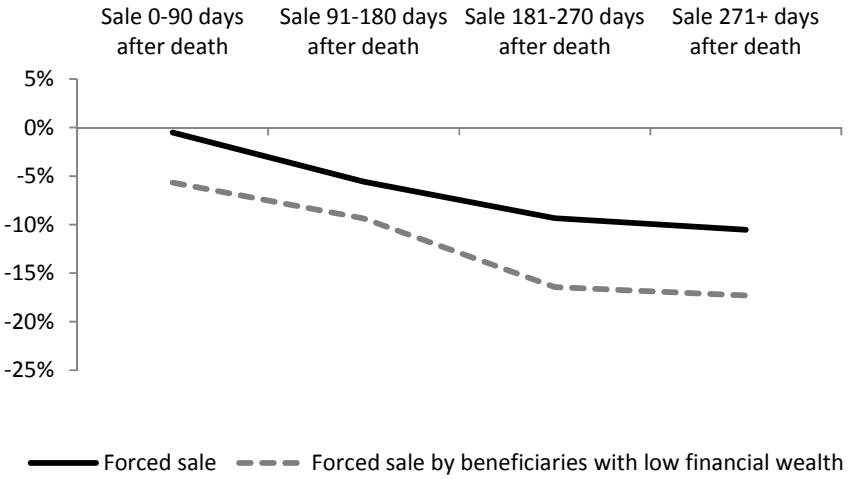
Dependent variable	**Log. house price**		
	(1)	**(2)**	**(3)**
Forced sale	-0.0515**	-0.0648***	-0.0367***
	(0.0071)	(0.0079)	(0.0085)
Forced sale by owner with low financial wealth	-0.1036***		-0.0973***
	(0.0114)		(0.0116)
Forced sale by beneficiaries with low financial wealth		-0.0508***	-0.0342***
		(0.0116)	(0.0112)
House characteristics	Yes	Yes	Yes
Calendar month effects	Yes	Yes	Yes
Location-year effects	Yes, fixed	Yes, fixed	Yes, fixed
N	687,216	687,216	687,216

Note: The dependent variable is the log. of the house price. The sample includes all house sales from 1996 to 2010. *Forced sale* is an indicator for forced sales due to sudden death. *Forced sales by estate with low financial wealth* is an indicator for whether the owner's financial wealth (estate in case of deceased persons) is lower than DKK 50,000. *Forced sale by beneficiaries with low financial wealth* is an indicator for whether all beneficiaries' financial wealth is lower than DKK 50,000. House characteristics are described in Table 2 and include; Log of assessed house value, Interior size, lot size, basement size, house age, bathroom and basement. Standard errors are in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Appendix F. Financial constraints and the time pattern of forced sale discount

This appendix reports the results for our second measure of financial constraints, which captures estates with low financial wealth.





Note: This figure reports the time pattern of forced sale discount using our hedonic pricing model. *Forced sale* is an indicator for forced sales due to sudden death. *Forced sales by estate with low financial wealth* is an indicator for whether the estate's financial wealth is lower than DKK 50,000. *Forced sale by beneficiaries with low financial wealth* is an indicator for whether all beneficiaries' financial wealth is lower than DKK 50,000.