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An analysis of food safety private investments drivers in the Italian meat sector

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Electronic supplementary material (ESM)

Table S1. Bivariate probit – change decision equation coefficients (number of respondents – 104)

	Hazard Analysis and Critical Control Points (HACCP)				Traceability (Trace)			Certification (Cert)			Geographical indications (Gi)			Private brand (Brand)		
	PR_HACCP	HR_HACCP	CO_HACCP	PR_HACCP	HR_Trace	CO_Trace	PR_Cert	HR_Cert	CO_Cert	PR_Gi	HR_Gi	CO_Gi	PR_Brand	HR_Brand	CO_Brand	
Law	0.301* (-2.50)	0.116 (-0.39)	0.232 (-0.77)	0.126 (-0.56)	0.247 (-1.00)	-0.12 (-0.40)	0.104 (-0.58)	0.266 (-0.75)	0.255 (-0.79)	0.00723 (-0.26)	0.169 (-0.42)	0.105 (-0.37)	0.275 (-0.82)	0.0542 (-0.18)	0.06 (-0.36)	
Custom	-0.0569 (-0.61)	-0.0921 (-0.68)	-0.306** (-2.89)	-0.116 (-0.91)	-0.266* (-2.35)	-0.331* (-2.35)	-0.329* (-2.17)	-0.296 (-1.75)	-0.177 (-1.32)	-0.0114 (-0.26)	-0.142 (-0.99)	-0.261 (-1.82)	-0.286 (-1.84)	-0.292 (-1.87)	-0.27 (-1.81)	
Price	0.117 (-1.32)	0.0422 (-0.40)	0.159 (-1.40)	0.258* (-2.57)	0.282* (-2.12)	0.185 (-1.33)	0.172* (-2.02)	0.183 (-1.07)	0.128 (-1.02)	0.00931 (-0.26)	0.094 (-0.75)	0.198 (-1.39)	0.201 (-1.46)	0.221 (-1.55)	0.142 (-1.02)	
Tech	0.712** (-2.59)	0.161 (-0.57)	0.0941 (-0.35)	0.586* (-2.12)	0.315 (-1.08)	0.172 (-0.53)	0.469 (-1.52)	0.411 (-1.14)	0.530* (-2.21)	0.0264 (-0.26)	0.164 (-0.51)	0.199 (-0.61)	0.18 (-0.59)	0.483 (-1.50)	0.523 (-1.55)	
pHoff	0.694* (-2.35)	1.119* (-1.98)	0.471 (-1.18)	0.758 (-1.29)	0.722 (-1.67)	0.771 (-1.52)	0.813 (-1.44)	0.921 (-1.54)	1.166* (-2.09)	0.021 (-0.26)	1.582*** (-3.69)	0.762 (-1.39)	0.972 (-1.67)	1.214 (-1.79)	0.984 (-1.60)	
PublAdv	-0.183 (-0.98)	0.346 (-1.84)	0.155 (-0.68)	0.011 (-0.05)	-0.146 (-0.65)	0.281 (-1.15)	0.057 (-0.26)	0.193 (-0.68)	-0.0794 (-0.40)	0.0314 (-0.26)	0.282 (-1.01)	0.298 (-1.16)	0.00918 (-0.04)	0.0895 (-0.34)	0.334 (-1.26)	
Enterpr	0.674** (-2.60)	0.123 (-0.35)	0.664* (-2.31)	0.359 (-1.25)	-0.123 (-0.43)	0.572 (-1.53)	0.898* (-2.44)	0.725 (-1.61)	0.45 (-1.59)	-0.0127 (-0.20)	0.837* (-2.20)	0.739 (-1.55)	0.750* (-2.31)	0.978* (-2.47)	0.765 (-1.78)	
Delta	-0.292 (-1.63)	0.256 (-1.18)	-0.226 (-1.00)	0.0027 (-0.01)	0.0367 (-0.18)	-0.141 (-0.53)	0.301 (-1.41)	-0.0277 (-0.09)	-0.305 (-1.19)	-0.0309 (-0.26)	0.176 (-0.77)	-0.00921 (-0.03)	0.0171 (-0.06)	0.00538 (-0.02)	0.0708 (-0.32)	

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Continuation Table S1

	Hazard Analysis and Critical Control Points (HACCP)			Traceability (Trace)			Certification (Cert)			Geographical indications (Gi)			Private brand (Brand)		
	PR_HACCP	HR_HACCP	CO_HACCP	PR_Trace	HR_Trace	CO_Trace	PR_Cert	HR_Cert	CO_Cert	PR_Gi	HR_Gi	CO_Gi	PR_Brand	HR_Brand	CO_Brand
Ndir	-0.00101 (-0.39)	-0.00513 (-1.06)	-0.00061 (-0.16)	0.00255 (-0.44)	0.000346 (-0.14)	-0.00743 (-1.46)	-0.00239 (-0.47)	-0.00352 (-0.58)	-0.00466 (-0.86)	-0.0000931 (-0.26)	0.00318 (-0.71)	-0.00032 (-0.05)	-0.00213 (-0.39)	-0.00015 (-0.03)	-0.00118 (-0.26)
Exper	0.0158* (-2.32)	-0.00098 (-0.19)	0.00686 (-0.98)	0.00837 (-1.38)	0.00131 (-0.23)	0.00977 (-1.19)	0.00296 (-0.45)	0.00786 (-0.78)	0.00998 (-1.25)	0.00114 (-0.26)	0.00764 (-0.94)	0.0107 (-1.16)	0.00895 (-1.05)	0.0088 (-1.09)	0.00201 (-0.24)
Sales	1.02E-06 (-0.39)	-2.2E-06 (-0.56)	5.29E-07 (-0.14)	2.86E-06 (-0.62)	4.44E-06 (-0.98)	-3.1E-06 (-0.58)	-2.7E-06 (-0.75)	2.71E-06 (-0.45)	-0.00000324 (-0.61)	-0.000000995 (-0.26)	-3.4E-06 (-0.58)	1.56E-07 (-0.03)	1.76E-06 (-0.31)	-3E-06 (-0.53)	6.71E-07 (-0.13)
Constant	-2.931*** (-5.27)	-1.786* (-2.19)	-1.568 (-1.91)	-2.314** (-2.61)	-1.628* (-2.10)	-1.164 (-1.10)	-1.892** (-3.08)	-2.277* (-2.17)	-2.533* (-2.55)	-0.0807 (-0.26)	-3.040** (-2.82)	-2.005* (-2.51)	-2.308* (-2.25)	-2.489* (-2.42)	-1.936 (-1.87)
Wald χ^2	61.24 (0.00)	72.26 (0.00)	97.95 (0.00)	63.61 (0.00)	24.64 (0.05)	83.04 (0.00)	75.49 (0.00)	777.64 (0.00)	55.07 (0.00)	42.99 (0.00)	44.89 (0.00)	42.86 (0.00)	81.03 (0.00)	35.44 (0.00)	41.18 (0.00)
ρ	-1.00	-0.100	-1.00	1.00	-0.26	-1.00	1.00	1.00	-0.84	1.00	1.00	1.00	-1.00	-0.86	1.00

*** denote $p < 0.1$, 0.05, 0.01, respectively; Wald χ^2 – Wald test was used to test the joint significance of the variables in the model; ρ – correlation coefficient between the residuals of the two equations; for the variable *Sales* we use the E-notation, where letter E represents “times ten raised to the power of” and is followed by the value of the exponent; variables are defined combining the symbols for the type of investment (*PR* – physical resources; *HR* – human resources; *CO* – additional costs) with the type of food safety system (e.g. HACCP); for further explanation of variables see chapter Variables and Table 1

Source: the authors

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Table S2. Bivariate probit – investment decision equation coefficients

	Hazard Analysis and Critical Control Points (HACCP)			Traceability (Trace)			Certification (Cert)			Geographical indications (Gi)			Private brand (Brand)		
	PR_Haccp	HR_Haccp	CO_Haccp	PR_Trace	HR_Trace	CO_Trace	PR_Cert	HR_Cert	CR_Cert	PR_Gi	HR_Gi	CO_Gi	PR_Brand	HR_Brand	CO_Brand
Reg	0.855*** (-3.57)	0.409* (-2.02)	0.281 (-0.97)	-	-	-	-	-	-	-	-	-	-	-	-
Autonom	0.618** (-2.69)	0.091 (-0.39)	-0.269 (-0.96)	-	-	-	-	-	-	-	-	-	-	-	-
Partnerdir	0.414 (-0.62)	-0.363 (-0.53)	7.090 (0.00)	-	-	-	-	-	-	-	-	-	-	-	-
Reg	-	-	-	0.434 (-1.59)	0.267 (-1.86)	0.098 (-0.37)	-	-	-	-	-	-	-	-	-
Autonom	-	-	-	0.730** (-2.95)	0.103 (-0.60)	0.032 (-0.13)	-	-	-	-	-	-	-	-	-
Partnerdir	-	-	-	0.808 (-1.13)	-5.606 (-0.00)	0.447 (-0.78)	-	-	-	-	-	-	-	-	-
Reg	-	-	-	-	-	-	1.233** (-2.96)	0.776* (-2.07)	0.982*** (-3.35)	-	-	-	-	-	-
Autonom	-	-	-	-	-	-	1.574*** (-4.29)	0.877** (-3.03)	1.030*** (-4.38)	-	-	-	-	-	-
Partnerdir	-	-	-	-	-	-	0.443 (-0.65)	0.818 (-1.19)	1.177*** (-3.60)	-	-	-	-	-	-
Reg	-	-	-	-	-	-	-	-	-	0.725 (-1.95)	0.785* (-2.03)	1.803** (-3.21)	-	-	-
Autonom	-	-	-	-	-	-	-	-	-	0.756* (-2.52)	0.727* (-2.04)	1.198** (-2.75)	-	-	-
Partnerdir	-	-	-	-	-	-	-	-	-	-6.867 (-0.00)	1.364 (-1.64)	-6.683 (-0.00)	-	-	-
Reg	-	-	-	-	-	-	-	-	-	-	-	-	1.448** (-3.27)	-5.220 (-0.00)	0.665 (-1.71)
Autonom	-	-	-	-	-	-	-	-	-	-	-	-	1.070** (-3.16)	0.710* (-2.32)	1.024** (-2.80)

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Continuation Table S2

	Hazard Analysis and Critical Control Points (HACCP)				Traceability (Trace)			Certification (Cert)			Geographical indications (Gi)			Private brand (Brand)		
	PR_Haccp	HR_Haccp	CO_Haccp		PR_Trace	HR_Trace	CO_Trace	PR_Cert	HR_Cert		PR_Gi	HR_Gi	CO_Gi	PR_Brand	HR_Brand	CO_Brand
Partnerdir	-	-	-	-	-	-	-	-	-	-	-	-	-	-8.520	0.781	-5.506
Change	1.296***	1.192***	1.691***		1.598***	-1.685***	1.561***	-1.040***	0.343	1.568***	-1.903***	-1.540***	-0.79	1.714***	-0.990**	-1.517***
	(-6.93)	(-7.17)	(-9.16)		(-8.06)	(-8.13)	(-4.66)	(-5.48)	(-0.30)	(-7.43)	(-6.33)	(-4.94)	(-1.89)	(-5.47)	(-2.72)	(-4.34)
Constant	-1.045***	-0.969***	-1.076***		-0.879**		-0.926**	-1.088**	-1.117**	-1.813***		-0.593**	-1.320***	-2.054***	-0.865*	-1.021**
	(-3.93)	(-4.02)	(-3.29)		(-2.94)		(-3.27)	(-2.85)	(-3.02)	(-6.65)	-	(-2.66)	(-3.34)	(-6.61)	(-2.56)	(-2.94)

***, **, * denote $p < 0.1$, 0.05, 0.01, respectively; for further explanation of variables see chapter Variables and Table 1–2

Source: the authors

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Table S3. Bivariate probit – marginal effects

	Hazard Analysis and Critical Control Points (<i>HACCP</i>)				Traceability (<i>Trace</i>)			Certification (<i>Cert</i>)			Geographical indications (<i>Gi</i>)			Private brand (<i>Brand</i>)		
	PR_HACCP	HR_HACCP	CO_HACCP	PR_Trace	HR_Trace	CO_Trace	PR_Cert	HR_Cert	CO_Cert	PR_Gi	HR_Gi	CO_Gi	PR_Brand	HR_Brand	CO_Brand	
<i>Law</i>	0.0721046**	0.0313967	0.0234211	0.0359133	0.0139755*	0.007689	0.0996075***	0.0824726**	0.0634625**	0.0359101	0.0723655**	0.2245347***	0.0850008**	-0.132024***	0.0720677	
<i>Autonom</i>	0.060518**	0.008261	-0.0219955	0.0494901*	0.0054485	0.0025223	0.1712986***	0.086967***	0.0662804***	0.0342932**	0.0664663**	0.1613198***	0.0556423**	0.0854665**	0.1055468***	
<i>Partnerdir</i>	0.0431109	-0.023375	0.2543636	0.082625	-0.2348904	0.0364415	0.0401156	0.0902408	0.0877754***	-0.3467108	0.1121311	-0.1047906	-0.0217719	0.0909926	-0.1319736	
<i>Change</i>	0.185205**	0.0719303***	0.1145516**	0.2323057***	-0.2562617***	0.1525763***	-0.0985095***	0.0330026	0.0769905***	-0.4423422***	-0.2300877***	-0.0812888**	0.0478805	-0.125376***	-0.1697839***	
<i>Law</i>	0.0385531**	0.0111069	0.0256309	0.0172036	0.0472498	-0.0124635	0.0130263	0.0247225	0.0169075	0.0012582	0.0124175	0.004732	0.0110882	0.0035469	0	
<i>Custom</i>	-0.0072633	-0.0087813	-0.0332477***	-0.0158558	-0.0506771***	-0.0339515**	-0.0408654**	-0.0274416*	-0.0116945	-0.0019653	-0.0102674	-0.0116361*	-0.011515	-0.0189582**	-0.0176091***	
<i>Price</i>	0.0149313	0.0039991	0.0178985	0.0355151***	0.0534889***	0.019141	0.0214637**	0.0170681	0.0084323	0.0016125	0.0064976	0.0088202*	0.0081648	0.0144119*	0.0091327	
<i>Delta</i>	-0.030416*	0.0290369	-0.0228812	0.0003766	0.0069663	-0.0138028	0.0355861	-0.0025665	-0.0163936	-0.0065611	0.0099431	-0.000434	0.0007364	0.0003513	0.0041205	
<i>Tech</i>	0.1306367***	0.017753	0.0111433	0.1045376	0.0575644	0.0189365	0.0554627*	0.0424068	0.0464128*	0.0034596	0.0092743	0.0087088	0.0077992	0.0274708***	0.0272376**	
<i>PHoff</i>	0.1266755**	0.1536466*	0.0582324	0.1421704	0.1126049***	0.097595	0.0922409**	0.1006296*	0.1192308*	0.0028492	0.0544312***	0.0233416**	0.0631036	0.052473***	0.040974***	
<i>Publadv</i>	-0.0199558	0.0400821	0.0185253	0.0015317	-0.0291299	0.0320319	0.0068413	0.0189553	-0.0047915	0.0039695	0.0152171	0.0126003	0.0003943	0.0057292	0.0185043	
<i>Enterpr</i>	0.1219721***	0.0133007	0.0836058**	0.0581726	-0.0246604	0.0700774	0.0996819***	0.0781212	0.0381523	-0.0025652	0.0350167**	0.0231809**	4.31E-02	0.0464066***	0.0361742**	
<i>Ndir</i>	-0.0001297	-0.0004825	-0.0000695	0.0003469	0.0000673	-0.0007716	-0.000302	-0.0003287	-0.0003076	-0.0000162	0.0002042	-0.0000147	-0.0000879	-9.69E-06	-0.0000761	
<i>Exper</i>	0.0020167**	-0.0000925	0.0007785	0.0011381	0.000254	0.0010136	0.0003742	0.0007345	0.0006569	0.0001973	0.0005234	0.0004841	0.0003674	0.0005753	1.29E-04	
<i>Sales</i>	1.29E-07	-2.06E-07	6.14E-08	3.89E-07	8.63E-07	-3.16E-07	3.37E-07	-2.53E-07	-2.14E-07	-1.73E-07	2.18E-07	-7.16E-09	7.43E-08	1.97E-07	-4.31E-08	

***, **, * denote $p < 0.1, 0.05, 0.01$, respectively; for further explanation of variables see chapter Variables and Table 1–2

Source: the authors