Persistence in innovation and innovative behavior in unstable environments

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Innovation Indicators

- The percentage of **small firms** increased over time
- Percentage of firms belonging to an **economic group** decreased
- High and mid high-tech sectors have the highest percentage of product innovation, even though, the highest percentage of firms in the CIS comes from “low tech sectors”
- The percentage of firms performing **intramural and extramural R&D** rose; the acquisition of external knowledge importantly fell, contrarily, training rose, along with launching new products.
- Firms more intensively use **innovation sources** inside their value chain rather than the external, the University along with the government labs are somehow neglected
- The **objective of the innovation** effort is mostly quality improvement, cost reduction and increase in turnover.
- A high percentage of firms report the existence of **barriers to innovation**. Economic factors very important.
- Few firms rely on **funds**, small firms even less than others.

Persistence Frameworks

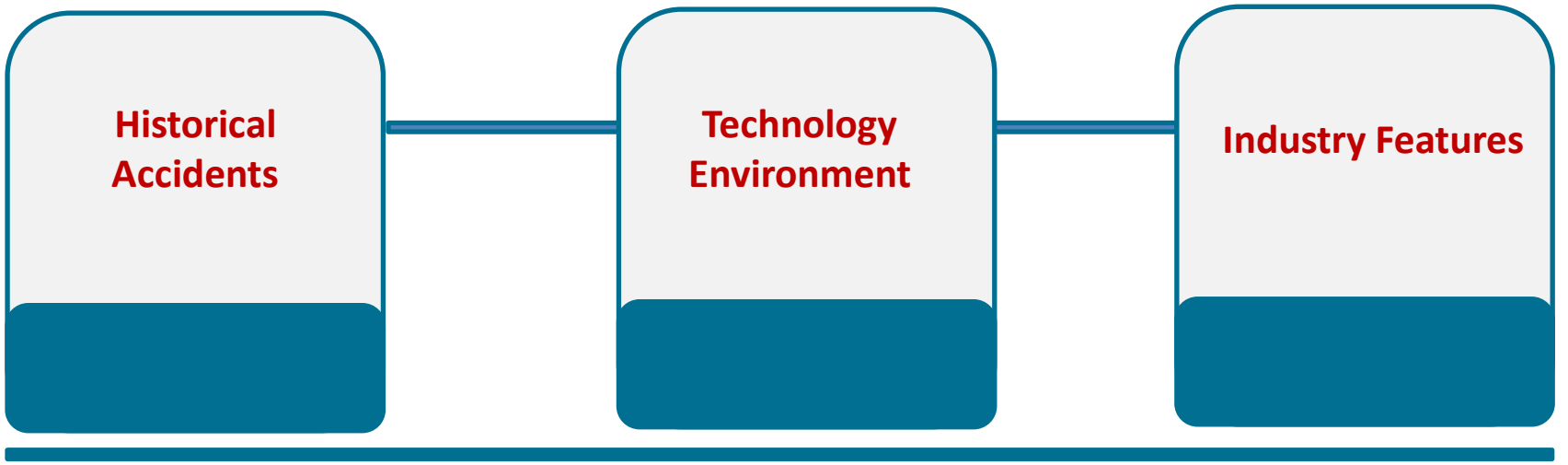
- **Knowledge Accumulation – Economics of knowledge**
- **Success-breeds-success – Economics of Organisation**
- **Sunk costs in R&D – Economics of Innovation**

Persistence Frameworks

- **Past dependence** claims that the determinants' of the innovative process and its results are fully determined by the initial conditions. Mansfield's (1961) **epidemic model of technological diffusion** describes this process relying on the number of innovation pioneers, the speed of diffusion foreseeing the contagion process. Persistence will be conditional to the first innovation, and the generation of long-lasting innovative skills.

- **Path dependence** explains that, in a localized context in which knowledge is planted, an **"historical accident"** occurs, followed by another in a random process. The success of innovation will depend on the ability of the firm to benefit from the "accident". Therefore innovation will be strongly tied to existing competences and networking. Persistence will be contingent to the exploitation of complementarities and interdependencies under the proper institutional environment (Collombelli and von Tunzelmann, 2011). The access to knowledge pools, reinforcement of networks, linkages among firms will therefore be strongly recommended.

Persistence Frameworks



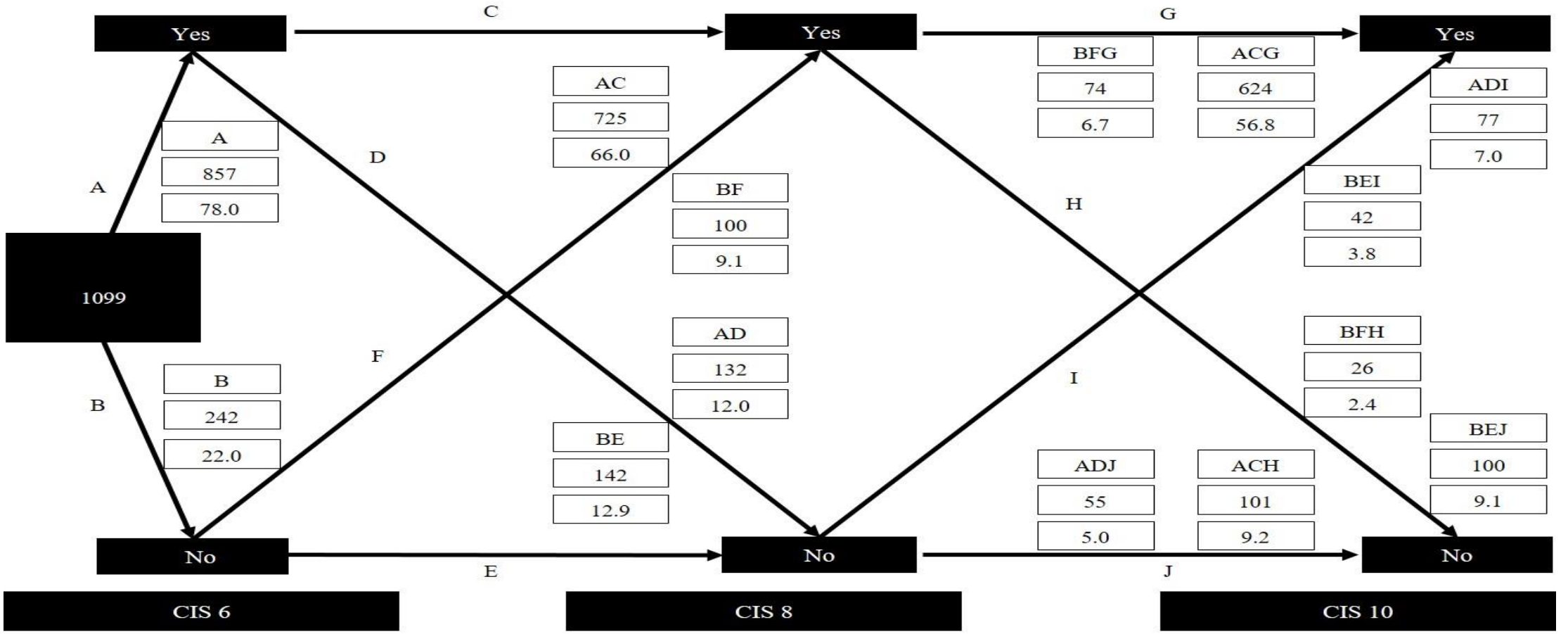
Estimation Results

	Innovation $_{t-1}$		Persistent_gen_lag 1		Sporadic_gen_lag1		New_gen_lag1		R&D_intensity		Mid_tech		High_tech	
	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE
Model E1	**0.125*** **	-0.041							0.002	-0.002	-0.03	-0.03	**-0.109*** **	-0.03
Model E2			**-0.037** **	-0.017	**-0.163*** **	-0.02	**0.161*** **	-0.019	0.001	-0.001	-0.013	-0.019	**-0.062*** **	-0.018

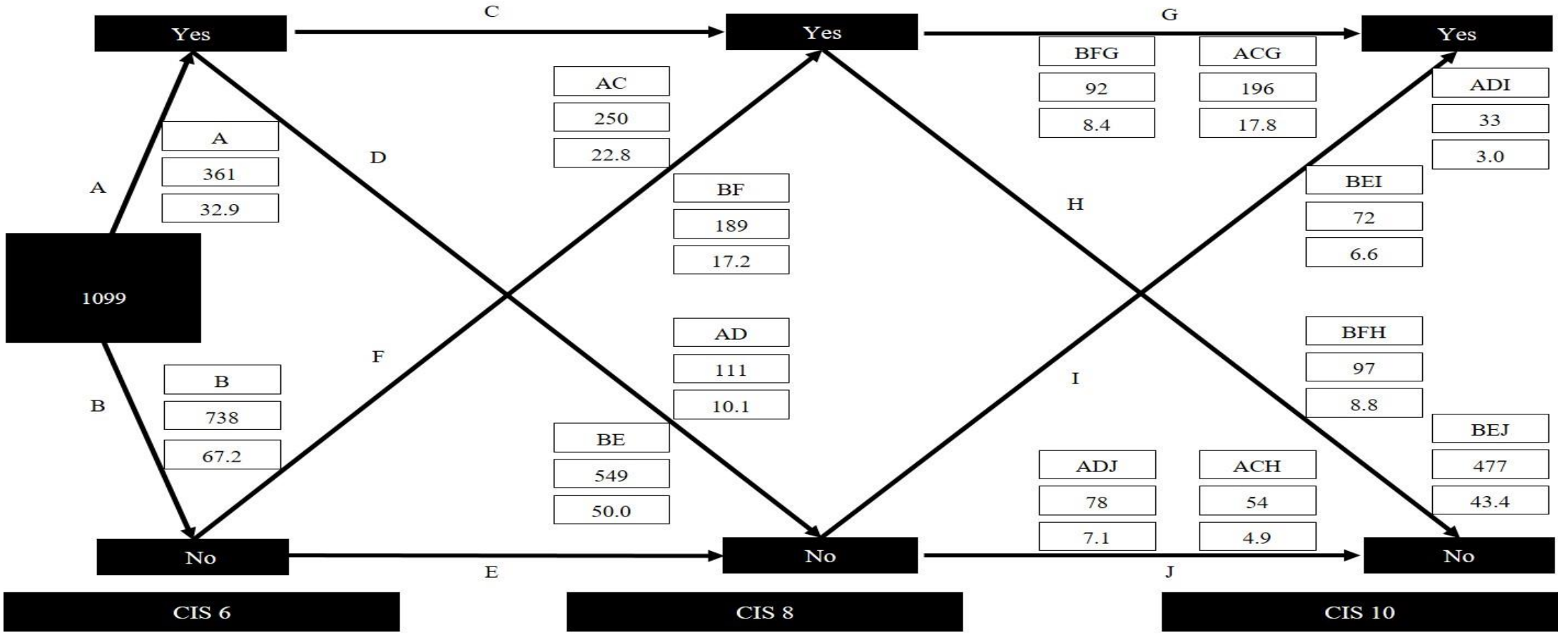
	Balance		Education_intensity		Openness		Funds		Medium_size		Large_size		Group	
	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE
Model E1	**0.130*** **	-0.027	-0.007	-0.016	**0.034*** **	-0.004	0.022	-0.026	**-0.067*** **	-0.024	-0.045	-0.03	**-0.038** *	-0.022
Model E2	**0.090*** **	-0.018	-0.007	-0.011	**0.025*** **	-0.003	0.019	-0.018	**-0.044*** **	-0.015	-0.028	-0.019	**-0.034** **	-0.014

	Inno$_0$		mean_rd_intensity		mean_educ_intensity		mean_openness		Industry		Services		OBS / Groups	Wald test
	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE		
Model E1	**0.157*** **	-0.038	**-0.005** *	-0.003	0.025	-0.018	0.005	-0.006	-0.043	-0.067	0.079	-0.069	2198 / 1099	386.67
Model E2	**0.408*** **	-0.009	**-0.003** *	-0.002	0.021	-0.013	-0.001	-0.003	-0.035	-0.042	0.037	-0.043	3296 / 1098	1231.88

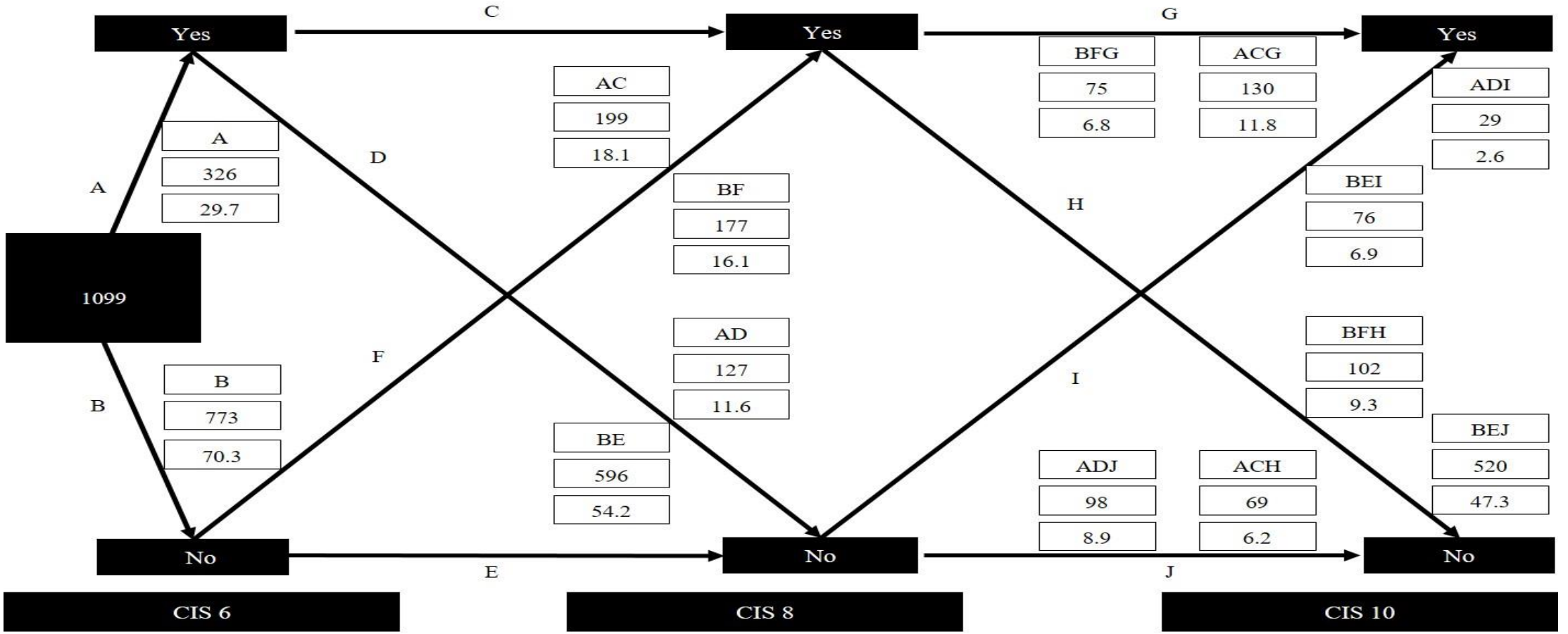
Transition frequencies: overall innovation



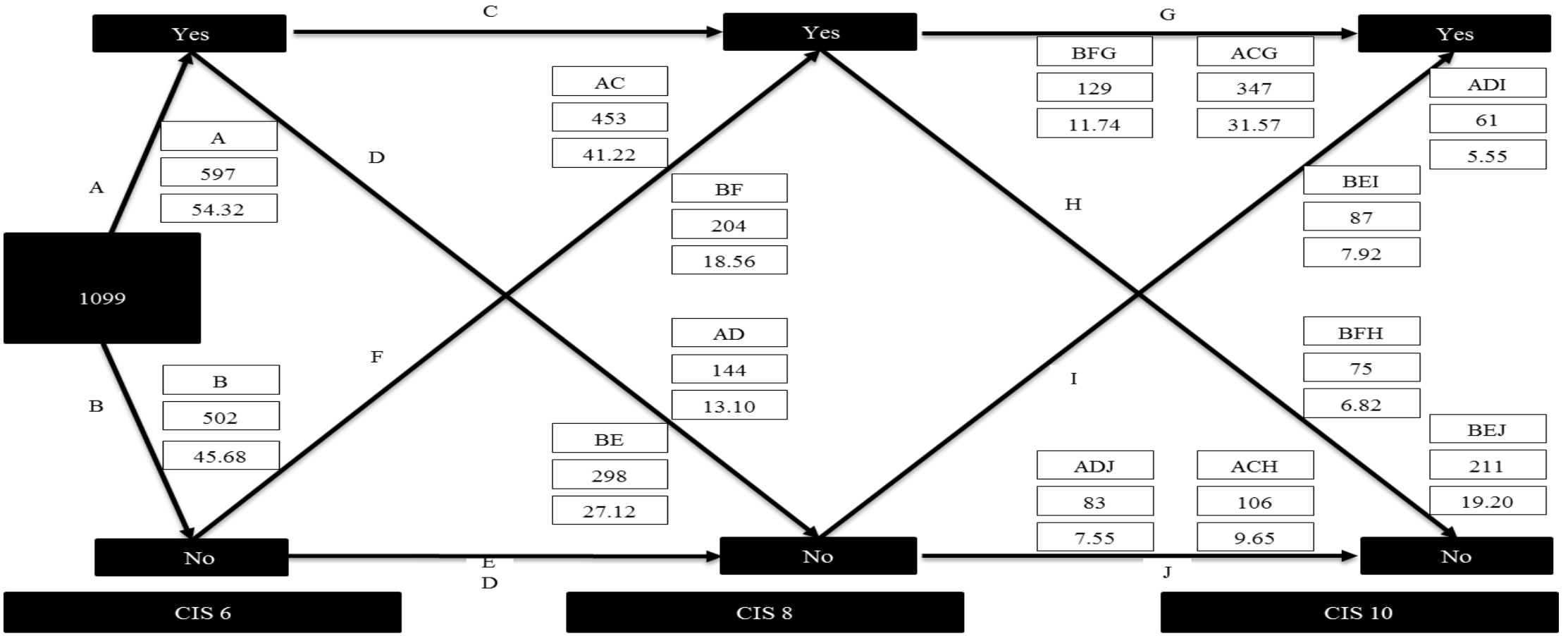
Transition frequencies: product innovation



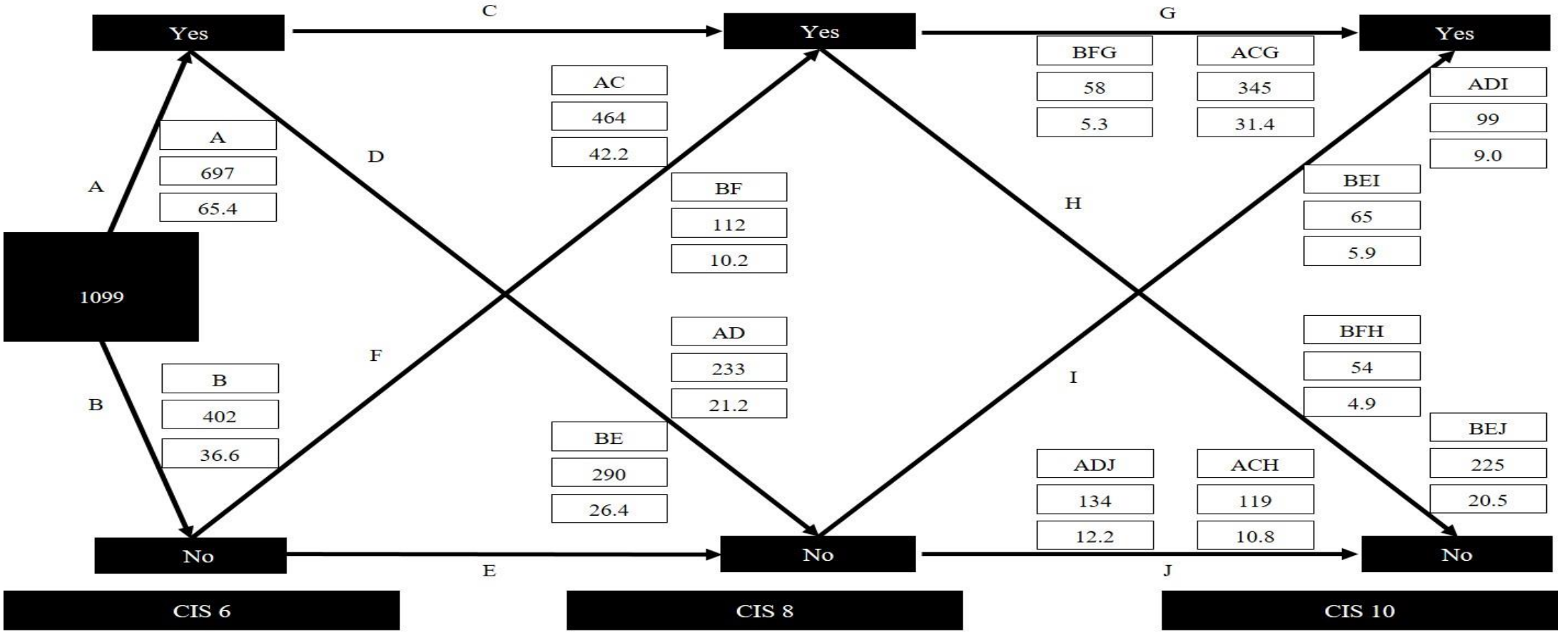
Transition frequencies: service innovation



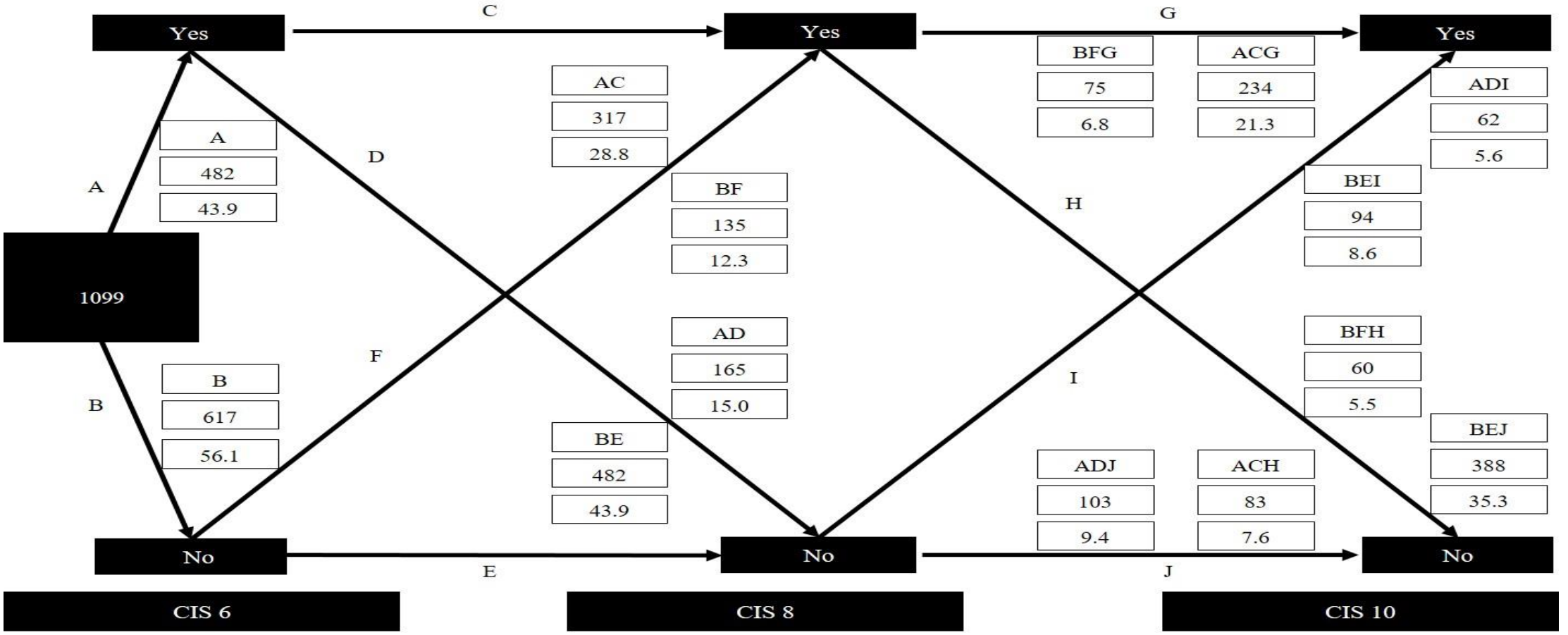
Transition frequencies: process innovation



Transition frequencies: organisational innovation



Transition frequencies: marketing innovation



Aggregation of the innovative strategies across the panel

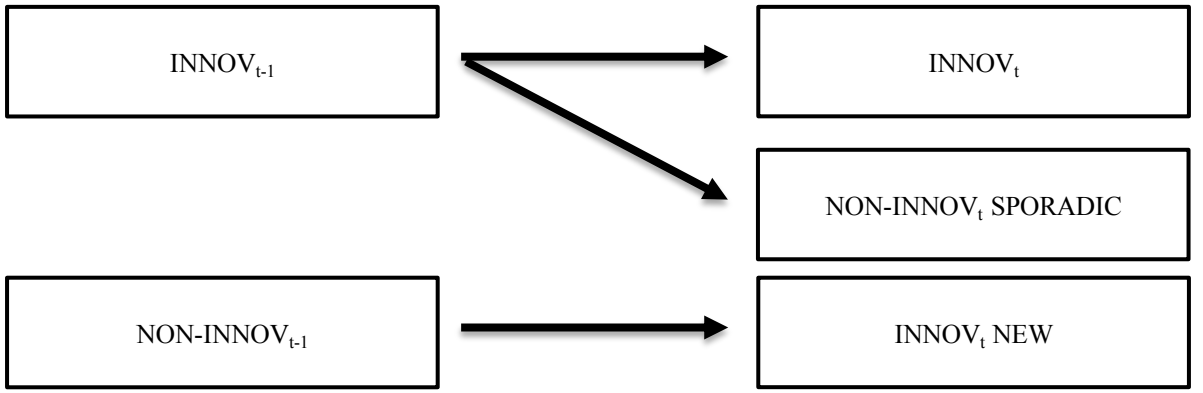
Innovative strategy		Type of innovation (nº of firms)					
		General	Product	Service	Process	Organisational	Marketing
ACG	Continuous	624	196	130	347	345	234
ACH	Continuous - Sporadic	101	54	69	106	119	83
ADI	Sporadic - New	77	33	29	61	99	62
ADJ	Sporadic - Non innovative	55	78	98	83	134	103
BFG	New - Continuous	74	92	75	129	58	75
BFH	New - Sporadic	26	97	102	75	54	60
BEI	Non - innovative - New	42	72	76	87	65	94
BEJ	Non - Innovative	100	477	520	211	225	388
	Total	**1099**	**1099**	**1099**	**1099**	**1099**	**1099**

Innovative strategies – conventional and unconventional

Conventional persistence hypothesis – Stable Environments

[H1]

(Un)conventional hypothesis – Unstable Environments/lack of persistence



[H2]

[H3]

[H4]

Econometric modelling

$$INNOV_{it} = \beta_1 + \beta_2\, INNOV_{it-1} + \boldsymbol{\beta} W_{it} + \boldsymbol{\delta} V_i + \alpha_i + \varepsilon_{it}$$

$$INNOV_{it} = \beta_1 + \beta_2 INNOV\_CONT_{it-1} + \beta_3 INNOV\_SPOR_{it-1} + \beta_4 INNOV\_NEW_{it-1} + \boldsymbol{\beta} W_{it} + \boldsymbol{\delta} V_i + \alpha_i + \varepsilon_{it}$$

Estimation Results

	Innovation $_{t-1}$		Persistent_gen_lag 1		Sporadic_gen_lag1		New_gen_lag1		R&D_intensity		Mid_tech		High_tech	
	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE
Model A1	0.025	-0.026							**0.013****	-0.006	0.014	-0.019	-0.025	-0.021
Model A2			0.001	-0.012	**-0.035***	-0.018	**0.102*****	-0.017	-6.94×10^{-5}	1.861×10^{-4}	0.014	-0.013	-0.006	-0.014

	Balance		Education_intensity		Openness		Funds		Medium_size		Large_size		Group	
	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE
Model A1	0.033	-0.059	0.012	-0.01	**0.056*****	-0.004	-0.036	-0.04	-0.013	-0.014	0.035	-0.022	0.003	-0.016
Model A2	0.049	-0.049	0.001	-0.008	**0.049*****	-0.004	-0.019	-0.032	-0.009	-0.01	**0.031****	-0.014	-0.008	-0.011

	$Inno_0$		mean_rd_intensity		mean_educ_intensity		mean_openness		Industry		Services		OBS / Groups	Wald test
	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE		
Model A1	**0.066*****	-0.021	0.001	-0.001	-0.008	-0.011	4.432×10^{-4}	-0.005	0.009	-0.036	0.025	-0.038	2198 / 1099	160.63
Model A2	**0.190*****	-0.01	2.446×10^{-4}	-0.001	0.003	-0.009	-0.003	-0.003	-0.001	-0.026	0.002	-0.027	3296 / 1098	750.14

Estimation Results

	Innovation $_{t-1}$		Persistent_gen_lag 1		Sporadic_gen_lag1		New_gen_lag1		R&D_intensity		Mid_tech		High_tech	
	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE
Model B1	0.025	-0.034							0.002	-0.001	**0.173*** **	-0.029	**0.070** **	-0.029
Model B2			**-0.050*** **	-0.017	**-0.172*** **	-0.019	**0.112*** **	-0.018	1.59×10^{-5}	3.9×10^{-5}	**0.108*** **	-0.017	**0.044** **	-0.017

	Balance		Education_intensity		Openness		Funds		Medium_size		Large_size		Group	
	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE
Model B1	**0.065*** **	-0.024	-0.007	-0.016	**0.043*** **	-0.003	0.036	-0.023	-0.004	-0.024	0.012	-0.03	-0.008	-0.023
Model B2	**0.029** *	-0.015	-0.002	-0.011	**0.037*** **	-0.002	**0.037** **	-0.016	-0.007	-0.014	-0.001	-0.018	-0.007	-0.014

	$Inno_0$		mean_rd_intensity		mean_educ_intensity		mean_openness		Industry		Services		OBS / Groups	Wald test
	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE	DY/DX	SE		
Model B1	**0.191*** **	-0.031	-2.73×10^{-4}	(0.001)	-0.004	-0.017	**0.011** *	-0.006	**0.117** **	-0.051	-0.002	-0.055	2198 / 1099	273.4
Model B2	**0.358*** **	-0.009	-8.47×10^{-5}	1.115×10^{-4}	-0.003	-0.012	-0.005	-0.003	**0.061** *	-0.032	-0.012	-0.034	3296 / 1098	1202.76

Conclusions

- **R&D intensity** appear as a persistence determinant
- **Openess** will influence the probability to continue innovation
- **Persistence** seems to be a matter of scale
- The use of **funds** is of scarce importance in defining persistence
- **Past innovative behaviours** are significant to shape the present innovative behaviour

Results

Hypothesis	Description	Results
[H1]	The probability of innovating at present positively depends on past innovation (ignoring the possibility of discontinuous innovation)	Partially Supported
[H2]	Being a continuous innovator in the past, considering the possibility of intermittence rises the probability of continuous innovation	Not Supported
[H3]	Sporadic innovators will have a reduced probability to pursuit innovators at present	Supported
[H4]	Among firms that are new to innovation, the probability of continuing innovative activities is higher	Supported

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