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**Economia della Regolamentazione e della Concorrenza**  
(Economia e Politica Industriale)

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## **LEZIONE 11**

### **II MODELLO DEI NETWORK E I PROCESSI DI APPRENDIMENTO INTERATTIVO**

## **The changing sectoral structure of the European economy**

The specific contribution of each sector to the GDP growth may be attributed to the respective increase of employment and of productivity, which represent the strategic aims of a modern European industrial strategy, as indicated in table 1. In the case of overall Euro area, the growth rate of GDP (9,40%) in the 2008-2019 period, has been determined almost in the same measure by an employment (4,18%) and a productivity (4,98%) increase.

In particular, during the most recent years employment in the euro area has been growing in service much more than in industrial activities and the sectors where employment has most increased are: professional services, public administration and retail and whole sale trade. These are sectors where a high education and the pull effect by internal demand are most important.

The numbers indicated in yellow are those indicating the most important contribution to the aggregate growth rate and the characteristics of the restructuring process of the economy. Manufacturing has had a negative impact due to the employment decrease compensated by a large productivity increase. Construction has also had a large employment decrease. Trade and related activities have had a positive productivity and employment effect. Financial activities have had a negative employment effect compensated by a positive productivity increase. Information and communication has been characterized by a positive productivity effect and also positive employment effect. Professional activities have had a very important employment increase while the slow growth of productivity has had a negative effect. Similarly, in the case of public administration the employment effect has been very positive while the increase of productivity has been small. Finally, also in the arts and related activities the employment effect has been positive and the productivity effect negative.

The structural changes are similar in the case of Italy. However, they have occurred in the framework of a negative macroeconomic evolution, which was mainly due to the decrease of investment and public expenditure and an increase of the external trade balance, due to the well known austerity policies. Moreover, the negative impact on aggregated growth by the decline of productivity has been partially compensated by an increase of employment. Important difference with respect to the Euro area is the large increase of employment in agriculture. Manufacturing as in the euro area is characterized by high productivity growth and negative employment growth. Trade and related activities, professional and arts and also public administration and related activities have had a positive employment effect similarly to what has occurred in the euro area, while being characterized by a negative productivity growth. Also the positive productivity effect in financial services is similar to those in the euro area, but it has occurred at the cost of a employment decline. Finally construction has been penalized by both negative employment and productivity growth.

Therefore, the long term trends both in the euro area and in Italy indicate that the reconversion of employment is characterized by a decrease in manufacturing and construction, compensated by an increase of employment in professional activities, public administration, retail and also arts and related activities. These mainly service activities may become the focus of the future European industrial strategy, in order to compensate the negative impact on employment levels of the macroeconomic crisis and of technological automation especially in manufacturing and construction and financial activities. Clearly, to achieve a greater employment growth and to support to the creation of new firms in these non-manufacturing sectors, higher material and immaterial investments are needed in these sectors.

The needs and priorities of citizens have changed profoundly, at least in Europe, and that requires a different response by the public institutions and also by the private companies, due to the greater sensitivity of citizens to the environmental problems on a global and local scale as also to new issues, such as the availability and use of free time and leisure opportunities and also the quality of work and the increasing social disparities. On the other hand, the new needs by the citizens create opportunities for the growth of new activities and can create new jobs.

Table 1 – Sectoral diversification and the employment vs the productivity effects in the recent European GDP growth (2008-2019)			
	A	b	c
<b>EURO AREA</b>	Productivity	Employment	Total
	Effect	effect	effect
Total - all NACE activities	4,984%	4,385%	9,368%
Agriculture, forestry and fishing	0,244%	-0,198%	0,046%
Industry (except construction and manufacturing)	-0,203%	0,192%	-0,012%
Manufacturing	3,112%	-1,559%	1,553%
Construction	0,188%	-1,072%	-0,884%
Wholesale and retail trade, transport, accommodation and food service activities	0,856%	0,999%	1,855%
Information and communication	0,980%	0,767%	1,747%
Financial and insurance activities	0,543%	-0,539%	0,004%
Real estate activities	1,290%	0,145%	1,436%
Professional, scientific and technical activities; administrative and support service activities	-0,417%	2,186%	1,769%
Public administration, defence, education, human health and social work activities	-0,316%	1,993%	1,676%
Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organizations and bodies	-0,127%	0,215%	0,088%

	a	b	c
<b>ITALY</b>	Productivity	Employment	Total
	effect	effect	effect
Total - all NACE activities	-2,798%	0,547%	-2,251%
Agriculture, forestry and fishing	0,028%	-0,048%	-0,020%
Industry (except construction and manufacturing)	-0,759%	0,157%	-0,602%
Manufacturing	1,619%	-2,480%	-0,861%
Construction	-1,042%	-1,198%	-2,239%
Wholesale and retail trade, transport, accommodation and food service activities	0,065%	1,179%	1,244%
Information and communication	0,023%	0,201%	0,224%
Financial and insurance activities	0,819%	-0,747%	0,072%
Real estate activities	-0,600%	1,293%	0,693%
Professional, scientific and technical activities; administrative and support service activities	-1,676%	1,548%	-0,128%
Public administration, defence, education, human health and social work activities	-1,077%	0,206%	-0,871%
Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organizations and bodies	-0,285%	0,395%	0,109%
Source: Eurostat national accounts data base.			
Note: column (a) indicates the impact of productivity taken employment constant: $(Y1/N1 - Y0/N0) * N0 / Y0^*$ ; column (b) indicates the impact of employment taken productivity constant: $(N1 - N0) * Y1/N1 / Y0^*$ ; column (c) indicates the total product change: $(Y1 - Y0) / Y0^*$ . Values refer to the different sectors: Y indicates value added, N employment, 0 the initial year, 1 the final year. Y0* indicates total GDP in the initial year			

ISTAT: <http://www.istat.it/it/archivio/145089>

## Il sistema di tavole input-output

Disponibile il quadro intersettoriale di Contabilità nazionale secondo il Sec 2010: tavole delle risorse e degli impieghi (anni 2010 e 2011) e tavole simmetriche (anno 2010)

L'Istat rende disponibili le tavole delle risorse e degli impieghi (o tavole *supply and use*) ai prezzi correnti e ai prezzi dell'anno precedente per gli anni 2010 e 2011, coerenti con gli aggregati di Contabilità nazionale secondo il Sec 2010, diffusi il 22 settembre 2014.

Completano il quadro intersettoriale le tavole simmetriche ai prezzi base

, basate sulla tecnologia di branca, relative all'anno 2010, che vengono aggiornate ogni cinque anni.

La classificazione utilizzata per le attività economiche è la Nace Rev. 2 mentre quella per i prodotti è la Cpa 2008. Le due classificazioni sono tra loro perfettamente allineate in modo che, a ciascun livello di aggregazione, la Cpa mostri i principali raggruppamenti di prodotti delle corrispondenti branche della classificazione Nace.

Le tavole risorse impieghi sono fornite per due diversi livelli di dettaglio: 1) a 63 branche di attività economica e 63 raggruppamenti di prodotti; 2) a 20 branche di attività economica e a 20 raggruppamenti di prodotti. Le due classificazioni escludono l'attività delle organizzazioni e degli organismi extraterritoriali.

Le tavole simmetriche sono fornite a 63 branche di attività economica o a 63 raggruppamenti di prodotti, con l'esclusione dell'attività delle organizzazioni e degli organismi extraterritoriali

Per maggiori dettagli consultare la nota informativa.

The image displays a screenshot of the ISTAT input-output tables for the year 2010. The table is a large, complex grid with multiple columns and rows. The columns represent different economic sectors and products, while the rows represent the flows between these sectors. The data is presented in a structured format, with various headers and sub-headers indicating the specific categories and units of measurement. The table is divided into several sections, each corresponding to a different type of input-output relationship. The overall layout is dense and detailed, reflecting the comprehensive nature of the data provided by ISTAT.

Tavola simmetrica branca per branca, al prezzi base (a)

Valori in milioni di euro

Valori a prezzi correnti

BRANCHE (NACE '03)	INPUT DELLE BRANCHE INTERMEDIE (NACE)										INPUT DELLE BRANCHE INTERMEDIE (NACE)										INPUT DELLE BRANCHE INTERMEDIE (NACE)															
	V01	V02	V03	V04	V10-15	V15-15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	V31-32	V33	V34	V35	V36	V37-39	V40	V41	V42	V43	V44	V45	V46	V47	V48
V01 Produzione vegetale e animale, caccia e servizi connessi	5.790	0	1	2	24.498	522	37	20	9	6	44	34	290	12	19	42	9	19	35	14	13	26	8	99	4	34	92	30	1.700	968	24					
V02 Silvicultura e utilizzo di aree forestali	0	10	1	0	144	0	0	211	62	3	0	19	1	21	9	9	4	0	0	1	2	9	1	1	0	1	7	4	21	7	1					
V03 Pesca e acquicoltura	0	0	16	0	77	0	0	0	0	0	41	0	0	0	0	0	0	0	0	0	0	3	1	0	0	5	0	5	5	5	5	5	5	5	5	
V05 Attività estrattive	23	0	0	238	465	238	21	277	44	30.296	478	57	115	2.233	2.120	282	28	74	151	90	28	54	18	6.972	238	89	832	52	2.395	104	227					
V06 Industria alimentare, dalla bevanda e dal tabacco	3.978	0	67	19	31.009	717	15	61	15	113	1.381	232	103	37	34	47	21	34	69	38	21	55	11	46	5	49	131	117	2.169	859	68					
V10-15 Industria tessile, confezione di articoli di abbigliamento e di articoli in pelle e simili	197	1	50	16	162	28.911	113	343	124	105	454	104	520	75	134	264	54	74	212	619	138	785	35	41	179	322	78	960	417	111						
V16 Industria del legno e dei prodotti in legno e sughero	9	0	6	7	390	115	5.283	34	46	16	45	11	114	83	81	522	11	96	283	152	230	3.751	61	21	3	44	2.605	29	440	39	85					
V17 Fabbricazione di carta e di prodotti di carta	18	0	7	12	919	149	71	5.778	2.209	15	236	47	200	111	295	238	24	295	278	167	45	120	59	78	13	247	301	150	946	103	164					
V18 Stampa e riproduzione su supporti registrati	19	0	1	6	169	119	8	965	1.362	87	546	82	100	28	63	184	21	94	188	98	40	125	34	16	10	48	274	255	184	30	187					
V19 Fabbricazione di coke e prodotti derivanti dalla lavorazione del petrolio	1.401	15	111	190	175	110	149	51	30	6.951	5.347	60	255	951	1.314	130	41	65	719	136	39	221	138	320	481	564	2.222	126	932	342	4.847					
V20 Fabbricazione di prodotti chimici	1.328	4	14	461	1.138	1.805	450	774	904	2.008	16.503	2.113	8.022	807	710	1.102	610	1.226	847	707	573	1.226	236	78	56	262	761	357	1.118	217	130					
V21 Fabbricazione di prodotti farmaceutici di base	123	0	1	26	288	114	26	40	45	141	1.786	5.451	26	50	42	71	57	72	76	72	45	123	18	27	5	45	68	26	751	91	39					
V22 Fabbricazione di articoli in gomma e materie plastiche	275	7	14	30	604	2.010	174	480	217	173	1.031	242	484	198	494	1.246	226	1.040	2.550	1.995	337	826	228	109	17	157	2.647	520	541	134	935					
V23 Fabbricazione di altri prodotti della lavorazione del metallo, esclusi i prodotti di base e di macchinari e attrezzature	321	0	11	229	1.341	123	176	61	22	110	1.108	173	286	6.691	1.297	890	128	583	421	734	192	277	112	79	41	119	10.990	49	1.596	60						
V24 Attività metallurgiche	75	1	5	55	111	84	32	57	68	246	470	45	526	563	18.115	12.000	817	5.521	5.115	2.707	925	1.762	1.283	278	54	132	2.669	159	1.047	136	222					
V25 Fabbricazione di prodotti in metallo, esclusi i prodotti di base e di macchinari e attrezzature	231	13	42	35	330	219	158	116	141	76	214	59	497	445	2.453	15.687	374	1.771	16.821	5.787	1.458	1.058	1.201	295	69	177	7.615	265	1.093	190	291					
V26 Fabbricazione di computer e prodotti di elettronica	52	0	7	17	79	84	10	20	56	68	151	83	136	132	88	430	4.265	1.498	940	570	529	299	401	681	10	60	3.570	81	402	90	197					
V27 Fabbricazione di apparecchiature elettroniche	124	1	21	35	123	123	24	40	57	60	174	43	174	40	290	1.225	980	1.650	2.080	1.786	414	236	536	348	39	111	3.100	302	433	143	210					
V28 Fabbricazione di macchinari e apparecchiature	179	2	8	118	480	209	56	214	85	295	315	119	292	229	1.029	2.266	518	946	15.801	2.994	747	266	475	267	86	239	3.410	560	716	241	685					
V29 Fabbricazione di autoveicoli, rimorchi e semiorchioni	20	0	3	83	220	190	24	55	44	152	50	57	243	171	171	742	200	504	3.074	6.232	433	115	196	191	49	209	1.349	301	572	209	1.013					
V30 Fabbricazione di altri mezzi di trasporto	22	0	63	45	63	76	12	12	21	47	16	33	60	57	67	187	61	72	362	367	1.935	90	747	57	21	53	322	61	200	129	688					
V31-32 Fabbricazione di mobili, altro trattamento dei rifiuti, occupato dai rifiuti, attività di risanamento	49	0	11	0	178	252	445	34	67	60	120	156	164	100	244	484	237	125	526	382	179	5.895	95	52	13	31	1.378	86	471	100	113					
V33 Riparazione e installazione di macchine e apparecchiature	356	2	11	38	119	84	41	31	38	78	27	19	55	117	90	431	194	222	574	200	233	74	132	91	28	134	1.651	103	248	83	164					
V34 Fornitura di energia elettrica, gas, vapore e aria condizionata	907	3	63	211	2.216	965	387	1.515	269	2.716	1.835	257	1.104	1.478	3.102	792	332	2.655	1.396	551	69	561	546	27	638	718	450	967	372	766	2.600	1.155				
V35 Raccolta, trattamento e fornitura di acqua	215	0	0	47	158	85	8	31	3	28	46	26	15	42	92	19	7	9	14	16	89	6	3	304	215	307	165	3	21	53	108					
V36 Gestione delle reti fognarie, attività di raccolta	205	0	1	208	390	322	350	883	27	193	208	107	1.704	426	6.254	192	25	52	130	96	374	132	25	1.460	362	8.151	877	128	272	366	392					
V37-39 Costruzioni	526	1	3	60	609	557	134	36	69	374	230	241	256	409	344	583	230	290	707	388	349	236	162	545	67	401	74.024	307	1.364	861	1.247					
V40 Commercio all'ingrosso e al dettaglio e riparazione	452	1	1	41	311	393	40	55	38	82	44	44	177	201	99	345	121	198	1.210	1.918	270	132	137	100	33	131	891	1.292	1.951	245	278					
V41 Commercio all'ingrosso, escluso quello di autoveicoli	1.280	4	45	224	6.744	3.863	791	883	339	3.405	2.635	1.207	1.524	1.834	2.918	2.813	944	1.692	4.111	1.884	699	2.162	529	2.883	224	1.385	4.573	1.101	8.962	1.688	1.854					
V42 Commercio al dettaglio, escluso quello di autoveicoli	2.791	1	12	20	3.058	1.343	123	162	81	115	512	623	176	184	137	539	327	938	1.152	384	181	675	115	170	29	85	873	352	1.750	705	355					
V43 Trasporti terrestri a motore e trasporto marittimo e aereo	806	11	26	260	5.096	1.745	741	720	171	1.491	1.083	286	1.100	1.328	1.339	1.334	296	735	1.427	830	342	965	172	2.621	43	567	2.621	43	567	2.621	43	567				
V44 Trasporti marittimi e per vie d'acqua	42	0	3	13	248	81	41	32	10	64	67	19	59	13	46	93	74	17	44	79	50	30	40	12	16	4	25	224	61	430	113	450				
V45 Trasporto aereo	7	0	2	35	213	86	9	32	15	39	32	30	38	47	191	72	21	41	84	65	55	39	9	864	11	50	204	52	398	156	1.178					
V46 Magazzinaggio e attività di supporto ai trasporti	88	1	3	77	2.071	791	138	279	62	399	239	141	401	397	401	489	84	280	513	513	405	285	84	445	8	120	1.887	1.150	6.524	1.780	8.593					
V47 Servizi postali e attività di corriere	25	1	1	13	228	77	30	41	45	72	48	16	50	83	62	71	16	37	69	44	34	45	12	274	19	237	538	123	365	296	270					
V48 Servizi di alloggio, attività di servizi di ristorazione	44	0	3	37	430	240	113	65	27	93	58	74	222	264	219	515	210	381	529	298	277	126	148	642	11	28	2.914	643	1.798	773	553					
V49 Attività editoriali	2	0	0	6	212	91	15	104	66	13	22	37	43	43	40	94	24	48	6																	



Totale (1)	Spesa per consumi finali delle famiglie	Spesa per consumi finali delle istituzioni sociali senza scopo di luoro al servizio delle famiglie (ISP)	Spesa per consumi finali delle AA, PP.	Spesa per consumi finali	Investimenti fissi lordi	Oggetti di valore	Variazione delle scorte	Variazione delle scorte e oggetti di valore	Investimenti lordi	Esportazioni	Totale impieghi finali (2)	Totale impieghi (1) + (2)
V												
37 145	16 036	7	22	16 065	416	1	225	226	642	4 882	21 589	58 734
659	466	0	464	930	0	0	- 6	- 6	- 6	94	1 018	1 677
657	2 179	0	0	2 179	42	0	0	4	46	181	2 406	3 063
49 693	10 539	1	5	10 546	243	0	43	43	286	908	11 739	61 433
58 495	65 775	5	101	65 880	458	6	1 956	1 961	2 419	21 229	89 529	148 024
37 347	31 096	4	90	31 190	1 102	25	1 245	1 270	2 372	33 982	67 543	104 890
15 612	2 411	11	44	2 466	1 140	6	- 69	- 63	1 077	2 202	5 745	21 357
18 936	2 626	0	6	2 632	82	2	377	380	462	5 017	8 111	27 047
12 987	716	0	2	718	72	5	2	7	78	723	1 519	14 506
36 996	16 496	0	122	16 507	105	2	89	91	196	11 908	28 611	65 507
51 262	6 231	11	12	6 365	1 425	4	251	255	1 680	19 480	27 525	78 786
16 988	3 713	9	5 638	9 360	1 054	4	193	196	1 250	13 279	23 888	40 877
28 450	5 455	2	14	5 471	800	29	228	257	1 057	11 811	18 339	46 789
30 238	2 465	1	27	2 493	534	14	- 599	- 585	- 50	8 600	11 043	41 280
58 286	1 621	1	8	1 629	593	176	733	910	1 503	21 351	24 483	82 769
63 000	3 571	3	22	3 596	8 683	41	380	421	9 104	17 949	30 649	93 649
20 738	6 851	11	58	6 920	9 829	72	399	471	10 299	9 722	26 942	47 680
26 358	5 761	4	10	5 775	5 352	10	1 193	1 203	6 556	18 674	31 005	57 363
39 621	3 284	10	25	3 319	26 258	17	910	927	27 185	56 202	86 705	126 326
24 675	20 385	13	13	20 410	10 221	0	- 136	- 136	10 085	24 263	54 758	79 433
8 890	2 867	8	10	2 886	7 576	4	- 712	- 708	6 868	11 327	21 081	29 971
16 235	11 348	2	19	11 369	4 401	888	351	1 239	5 640	15 494	32 504	48 739
8 440	686	1	7	694	8 820	1	1	2	8 822	1 831	11 346	19 787
67 708	17 529	0	107	17 636	1 429	10	6	17	1 446	697	19 779	87 487
2 774	4 032	19	197	4 248	159	0	0	0	159	14	4 421	7 194
28 433	6 679	4	157	6 841	123	1	0	1	124	1 038	8 002	36 435
100 088	10 743	1	1 339	12 083	141 496	5	- 3	2	141 498	894	154 476	254 564
13 766	23 361	0	21	23 382	3 173	0	- 1	- 1	3 172	1 094	27 648	41 414
88 187	57 123	3	1 416	58 543	12 355	179	62	241	12 596	9 703	80 842	169 029
20 245	84 479	40	3 002	87 521	7 266	337	44	381	7 647	5 216	100 383	120 628
57 805	26 349	1	1 189	27 539	1 622	30	- 1	29	1 651	4 289	33 480	91 285
3 803	4 968	43	109	5 120	80	2	0	2	82	3 040	8 242	12 046
7 205	5 386	0	155	5 542	33	0	0	0	33	1 540	7 114	14 319
45 863	7 271	2	4 485	11 758	456	4	- 1	2	458	5 272	17 488	63 351
6 918	1 075	0	16	1 091	64	1	- 1	0	64	359	1 513	8 431
21 579	77 536	1 213	815	79 563	99	3	0	3	102	45	79 709	101 288
6 004	4 806	3	11	4 820	1 778	0	0	0	1 778	1 144	7 741	13 745
11 004	4 854	4	6	4 863	1 180	1	- 2	- 1	1 178	1 104	7 145	18 149
29 392	20 147	7	32	20 185	2 443	2	62	65	2 508	5 292	27 985	57 377
34 688	2 399	6	659	3 064	14 152	3	12	14	14 166	1 932	19 163	53 851
71 303	16 730	3	25	16 758	789	0	0	0	789	1 725	19 272	90 575
5 782	13 817	0	6	13 823	50	0	0	0	50	1 282	15 155	20 937
25 470	1 571	0	7	1 578	154	0	0	0	154	1 408	3 140	28 610
52 758	153 598	3	1 384	154 985	10 338	0	0	0	10 338	1 507	166 830	219 588
70 698	3 597	401	300	4 297	2 848	0	2	2	2 850	1 781	8 928	79 626
30 783	890	2	167	1 059	1 433	0	0	0	1 433	1 161	3 653	34 436
3 188	64	84	192	340	9 259	0	3	3	9 261	1 002	10 604	13 791
18 813	69	0	23	92	45	0	0	0	46	1 107	1 245	20 057
19 941	2 814	7	629	3 450	214	3	0	3	217	1 768	5 435	25 376
15 406	899	0	10	910	101	1	1	2	103	1 662	2 675	18 081
5 682	496	0	95	591	38	0	0	0	38	865	1 495	7 177
7 284	5 453	0	303	5 756	5	0	0	0	5	1 275	7 036	14 320
52 154	4 167	2	1 553	5 722	180	2	2	4	184	3 518	9 424	61 578
3 534	1 660	1	130 984	132 644	365	0	0	0	365	99	133 109	136 643
4 610	11 413	568	57 902	69 883	114	0	1	1	116	63	70 062	74 672
10 524	17 430	348	90 495	108 274	922	95	37	132	1 054	932	110 259	120 784
3 095	3 466	835	15 629	19 931	10	0	0	0	10	1	19 942	23 037
9 343	10 852	1 111	4 165	16 128	382	79	0	79	461	303	16 892	26 234
8 316	5 478	1 150	1 237	7 865	65	2	1	3	68	234	8 167	16 483
4 156	2 691	2 717	1 320	6 728	67	0	0	0	67	50	6 844	11 000
1 775	1 442	0	9	1 450	340	1	4	6	346	217	2 014	3 788
2 067	21 799	95	123	22 017	36	0	2	3	39	114	22 169	24 236
0	18 006	0	0	18 006	0	0	0	0	0	0	18 006	18 006
1 633 751	879 714	8 779	326 990	1 215 483	304 867	2 070	7 288	9 357	314 224	375 855	1 905 563	3 539 314
39 805	104 509	0	658	105 167	15 135	171	0	171	15 306	990	121 463	161 268
1 673 556	984 224	8 779	327 648	1 320 650	320 002	2 241	7 288	9 529	329 530	376 845	2 027 026	3 700 582





Ministero dell'Economia e delle Finanze

Dipartimento del Tesoro

*Analisi e Programmazione*  
**Economico Finanziaria**

Note Tematiche

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## ANALISI INPUT-OUTPUT: PRESUPPOSTI TEORICI E POSSIBILI APPLICAZIONI

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## I. Modello I/O nazionale

Con riferimento alla sezione delle branche produttive, per un generico *input* della branca *j* proveniente dalla branca *i* indichiamo con:

- $pX_{ij}$  il flusso di produzione interna,
- $x_{ij}$  il flusso di importazione,
- $x_{ij}$  il flusso totale.

Con riferimento alla sezione delle risorse primarie, relativamente ai fattori primari della branca della branca *j*, indichiamo con:

- $W_j$  i salari,
- $S_j$  gli oneri sociali,
- $K_j$  gli altri redditi,
- $D_j$  gli ammortamenti,
- $T_j$  le imposte indirette al netto dei contributi correnti alla produzione.

### Notazioni

Tavola Input-Output con 4 settori

		Impieghi Intermedi					Impieghi Finali					
Origine	Destinazione	Agricoltura	Industria	Trasporti	Servizi	Tot. Impieghi Intermedi	Consumi privati	Consumi pubblici	Investimenti	Variazioni scorte	Esportazioni	Tot. Impieghi
Agricoltura		$X_{11}$	$X_{12}$	$X_{13}$	$X_{14}$	$\sum_j X_{1j}$	$C_1$	$G_1$	$I_1$	$VS_1$	$E_1$	$R_1$
Industria		$X_{21}$	$X_{22}$	$X_{23}$	$X_{24}$	$\sum_j X_{2j}$	$C_2$	$G_2$	$I_2$	$VS_2$	$E_2$	$R_2$
Trasporti		$X_{31}$	$X_{32}$	$X_{33}$	$X_{34}$	$\sum_j X_{3j}$	$C_3$	$G_3$	$I_3$	$VS_3$	$E_3$	$R_3$
Servizi		$X_{41}$	$X_{42}$	$X_{43}$	$X_{44}$	$\sum_j X_{4j}$	$C_4$	$G_4$	$I_4$	$VS_4$	$E_4$	$R_4$
<b>Totale costi intermedi</b>		$\sum_i X_{i1}$	$\sum_i X_{i2}$	$\sum_i X_{i3}$	$\sum_i X_{i4}$	$\sum_{ij} X_{ij}$	$\sum_i C_i$	$\sum_i G_i$	$\sum_i I_i$	$\sum_i VS_i$	$\sum_i E_i$	$\sum_i R_i$
<b>Conti Produzione e Distribuzione Valore Aggiunto</b>												
Totale costi intermedi		$\sum_i X_{i1}$	$\sum_i X_{i2}$	$\sum_i X_{i3}$	$\sum_i X_{i4}$	$\sum_{ij} X_{ij}$						
Redditi lavoro dipendente		$W_1$	$W_2$	$W_3$	$W_4$	$\sum_j W_j$						
Altri redditi		$K_1$	$K_2$	$K_3$	$K_4$	$\sum_j K_j$						
Valore aggiunto		$V_1$	$V_2$	$V_3$	$V_4$	$\sum_j V_j$						
<b>Produzione al costo dei fattori</b>		$X_1$	$X_2$	$X_3$	$X_4$	$\sum_j X_j$						
<b>Risorse Disponibili</b>												
Produzione al costo dei fattori		$X_1$	$X_2$	$X_3$	$X_4$	$\sum_j X_j$						
Importazioni		$M_1$	$M_2$	$M_3$	$M_4$	$\sum_j M_j$						
Imposte indirette nette		$Im_1$	$Im_2$	$Im_3$	$Im_4$	$\sum_j Im_j$						
<b>Totale risorse</b>		$R_1$	$R_2$	$R_3$	$R_4$	$\sum_j R_j$						

**Tav. II.1 – Matrice I/O**

<b>Siot 2000</b>	Agricoltura ed industria estrattiva	Industria e costruzioni	Servizi	Totale	Totale impieghi finali	Totale impieghi ai prezzi
Agricoltura ed industria estrattiva	6 025	62 835	8 763	77 623	15 650	93 273
Industria e costruzioni	8 922	403 241	154 751	566 915	636 799	1 203 714
Servizi	5 441	202 823	364 334	572 598	745 438	1 318 036
<b>Totale</b>	<b>20 388</b>	<b>668 898</b>	<b>527 849</b>	<b>1 217 135</b>	<b>1 397 887</b>	<b>2 615 022</b>
Imposte meno contributi ai prod	440	11 124	21 752	33 316	93 704	127 020
<b>Totale consumi intermedi/Im</b>	<b>20 828</b>	<b>680 022</b>	<b>549 600</b>	<b>1 250 451</b>	<b>1 491 591</b>	<b>2 742 042</b>
Redditi da lavoro dipendente	<b>8 731</b>	<b>147 846</b>	<b>310 816</b>	<b>467 393</b>		
Altre imposte nette sulla produz	<b>808</b>	<b>14 603</b>	<b>18 840</b>	<b>34 251</b>		
Ammortamenti	<b>8 883</b>	<b>50 052</b>	<b>93 421</b>	<b>152 355</b>		
Risultato netto di gestione	15 133	90 349	304 555	410 037		
Risultato lordo di gestione	24 016	140 400	397 976	562 393		
Valore aggiunto ai prezzi base	33 555	302 850	727 631	1 064 036		
<b>Produzione ai prezzi base</b>	<b>54 383</b>	<b>982 872</b>	<b>1 277 232</b>	<b>2 314 487</b>		
Importazioni	38 889	220 842	40 804	<b>300 535</b>		
<b>Totale Risorse</b>	<b>93 273</b>	<b>1 203 714</b>	<b>1 318 036</b>	<b>2 615 022</b>		

**Tav. II.2- Matrice dei coefficienti diretti**

<b>Dom 2000</b>	Agricoltura ed industria estrattiva	Industria e costruzioni	Servizi	Totale
Agricoltura ed industria estrattiva	0,1011	0,0293	0,0059	0,0181
Industria e costruzioni	0,1550	0,2863	0,1070	0,1843
Servizi	0,0951	0,1906	0,2678	0,2310
Totale	0,3512	0,5062	0,3808	0,4333
Totale costi di prodotti importati cif	0,0237	0,1744	0,0325	0,0926
Imposte meno contributi ai prodotti	0,0081	0,0113	0,0170	0,0144
<b>Totale consumi intermedi/Impieghi finali ai prezzi di acquisto</b>	<b>0,3830</b>	<b>0,6919</b>	<b>0,4303</b>	<b>0,5403</b>
<i>ULA dipendenti (1000 ULA)</i>	<i>0,0093</i>	<i>0,0053</i>	<i>0,0083</i>	<i>0,0070</i>
<i>ULA totali (1000 ULA)</i>	<i>0,0277</i>	<i>0,0070</i>	<i>0,0118</i>	<i>0,0101</i>
Redditi da lavoro dipendente	0,1605	0,1504	0,2434	0,2019
Altre imposte nette sulla produzione	0,0149	0,0149	0,0148	0,0148
<i>Capitale netto totale (mln di euro 2000)</i>	<i>2,6476</i>	<i>0,7240</i>	<i>2,1399</i>	<i>1,5506</i>
Ammortamenti	0,1633	0,0509	0,0731	0,0658
Risultato netto di gestione	0,2783	0,0919	0,2384	0,1772
Risultato lordo di gestione	0,4416	0,1428	0,3116	0,2430
<b>Valore aggiunto ai prezzi base</b>	<b>0,6170</b>	<b>0,3081</b>	<b>0,5697</b>	<b>0,4597</b>
<b>Produzione ai prezzi base</b>	<b>1,0000</b>	<b>1,0000</b>	<b>1,0000</b>	<b>1,0000</b>

# Le tavole input-output nella contabilità nazionale

Da Wikipedia, l'enciclopedia libera.

## Le tavole simmetriche

Si tratta di tavole che hanno la stessa struttura della tavola degli impieghi a prezzi base, ma a differenza di questa, che è una matrice prodotto  $\times$  branca, hanno uguali intestazioni per le righe e le colonne. Vi sono:

- una *tavola branca per branca*, che indica le relazioni interindustriali, ovvero quanto della produzione di ciascuna branca è impiegato nell'attività produttiva delle altre;
- una *tavola prodotto per prodotto*, che indica le relazioni tecnologiche, ovvero i prodotti necessari per la produzione di ciascun prodotto, indipendentemente dalla branca di provenienza.

Le tavole sono due, mentre la [matrice di Leontief](#) è unica, in quanto nel metodo di Leontief branca e prodotto coincidono (ad esempio, l'output del settore agricolo è costituito solo da prodotti agricoli), mentre nel metodo rettangolare si considerano anche le produzioni secondarie.

Si cerca comunque di riallocare le produzioni secondarie lungo le righe o lungo le colonne, secondo il tipo di tavola, utilizzando due metodi, a loro volta basati su due ipotesi:

- *tecnologia di prodotto*: si assume che ciascun bene sia prodotto sempre con la stessa tecnologia;
- *tecnologia di branca*: si assume che ciascuna branca utilizzi la stessa tecnologia per tutte le sue produzioni, anche per le secondarie.

Ne segue che entrambe le tavole vengono in realtà costruite ciascuna in due versioni, una secondo la prima ipotesi e una secondo l'altra.

## Uso delle tavole per analisi e previsione

---

La struttura di una tavola simmetrica può essere rappresentata simbolicamente come nello schema seguente (nel quale si prescinde, per semplicità, dagli scambi con l'estero):

$$\begin{bmatrix} x_{11} & x_{12} & x_{13} \\ x_{21} & x_{22} & x_{23} \\ x_{31} & x_{32} & x_{33} \end{bmatrix} \begin{bmatrix} X_{1.} \\ X_{2.} \\ X_{3.} \end{bmatrix} \begin{bmatrix} c_1 & i_1 \\ c_2 & i_2 \\ c_3 & i_3 \end{bmatrix} \begin{bmatrix} Z_1 \\ Z_2 \\ Z_3 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix}$$
$$\begin{bmatrix} X_{.1} & X_{.2} & X_{.3} \end{bmatrix} \begin{bmatrix} X_{..} \end{bmatrix} \begin{bmatrix} C & I \end{bmatrix} \begin{bmatrix} Z \end{bmatrix} \begin{bmatrix} X \end{bmatrix}$$
$$\begin{bmatrix} Y_1 & Y_2 & Y_3 \end{bmatrix} \begin{bmatrix} Y \end{bmatrix}$$
$$\begin{bmatrix} X_1 & X_2 & X_3 \end{bmatrix} \begin{bmatrix} X \end{bmatrix}$$

## Metodi di calcolo del PIL

### Utilizzo della matrice

---

La matrice  $(x_{ij})$  in alto a sinistra, detta *matrice intermedia*, è la vera e propria parte simmetrica (prodotto × prodotto oppure branca × branca), contenente gli impieghi intermedi. Procedendo verso destra si hanno:

- le somme per riga (prodotto o branca fornitrice) degli impieghi intermedi,  $X_{i.}$ ;
- gli impieghi finali di riga, costituiti dai consumi  $c_i$ , dagli investimenti  $i_i$  e dalle loro somme  $Z_i$ ;
- gli impieghi totali di riga,  $X_i$ .

Procedendo verso il basso:

- le somme per colonna (prodotto o branca utilizzatrice) degli impieghi intermedi,  $X_{.j}$ , seguite dalle somme degli impieghi intermedi, finali (consumi e investimenti) e totali;
- i valori aggiunti per prodotto o per branca a prezzo di mercato,  $Y_j$ , ed il loro totale, il prodotto interno lordo  $Y$  (v. il Conto della produzione);



- i costi totali per prodotto o branca e la loro somma, la produzione totale  $X$ .

Considerando le  $n$  righe e colonne della matrice intermedia, per ciascuna riga si ha:

$$X_i = X_{i.} + Z_i = \sum_{j=1}^n x_{ij} + Z_i$$

e per ciascuna colonna:

$$X_j = X_{.j} + Y_j = \sum_{i=1}^n x_{ij} + Y_j$$

Sommando poi su tutte le righe e colonne:

$$\sum_{i=1}^n X_i = \sum_{i=1}^n \sum_{j=1}^n x_{ij} + \sum_{i=1}^n Z_i = X_{..} + Z = X$$

ed anche:

$$\sum_{j=1}^n X_j = \sum_{j=1}^n \sum_{i=1}^n x_{ij} + \sum_{j=1}^n Y_j = X_{..} + Y = X$$

Ne segue  $Y=Z$ ; essendo  $Z=C+I$ , si ha l'identità macroeconomica:

$$Y = C + I$$

Lo schema costituisce il presupposto delle attività di analisi e di previsione, di cui sono esempi l'analisi strutturale e l'analisi di impatto.

## Analisi strutturale

Una tavola prodotto  $\times$  prodotto o branca  $\times$  branca consente di analizzare le interrelazioni del sistema economico.

Ad esempio, i *coefficienti di spesa* ricavabili da una tavola prodotto  $\times$  prodotto:

$$a_{ij} = \frac{x_{ij}}{X_j}$$

consentono di determinare le unità monetarie del prodotto  $i$  necessarie per produrre un'unità momentaria del prodotto  $j$ .

Dalla tavola branca × branca, invece, si possono ricavare *coefficienti di mercato*:

$$s_{ij} = \frac{x_{ij}}{X_i}$$

che dicono quanto della produzione della branca  $i$  è utilizzato nell'attività produttiva dalla branca  $j$ .

## Analisi di impatto

Poiché, in linea di massima, ciascun prodotto viene realizzato usando altri prodotti e ciascuna branca usa i prodotti di altre branche, qualsiasi variazione nel livello della produzione di un prodotto o da parte di una branca ha effetti su tutti gli altri.

Per valutare tali effetti, si osserva che:

$$x_{ij} = a_{ij} X_j$$

quindi:

$$X_i = AX_i$$

dove  $X_i$  è il vettore dei flussi intermedi,  **$A$  è la matrice dei coefficienti di spesa** e  $X$  è il vettore della produzione.

Ne segue:

$$X = AX + Z, \quad X - AX = Z, \quad (I - A)X = Z, \quad X = (I - A)^{-1}Z$$

**Gli elementi della matrice  $(I-A)^{-1}$ , detta «inversa di [Leontief](#)», indicano quante unità del prodotto della  $i$ -esima riga sono globalmente necessarie per soddisfare una domanda finale unitaria del prodotto  $j$ .**

Se cambia la domanda finale di un prodotto, la somma degli elementi della  $i$ -esima riga della matrice esprime gli effetti *ricevuti* dal prodotto  $i$ ; la somma degli elementi della  $j$ -esima colonna esprime gli effetti *distribuiti* dal prodotto  $j$ .

## UN APPROCCIO CROSS-SETTORIALE ALLA CRESCITA

**La crescita dipende dalla creazione di nuovi comparti produttivi e di nuove imprese**, dalle innovazioni di prodotto e di processo e organizzative interne alle imprese e da **una forte integrazione delle singole imprese** sia nelle filiere produttive globali che nel sistema produttivo territoriale.

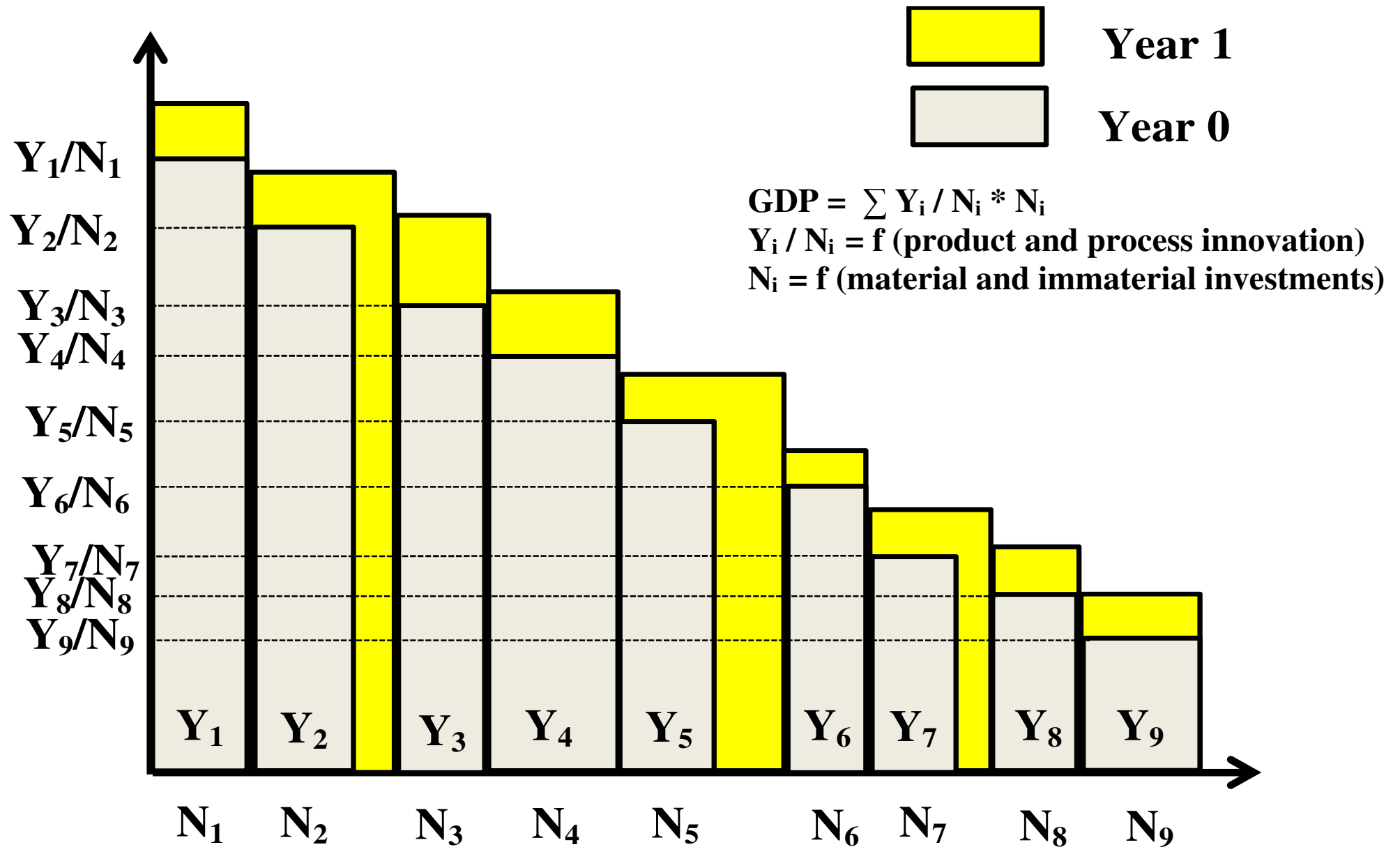
La crescita economica dipende da **un processo dinamico in cui interagiscono sia la domanda che l'offerta delle nuove produzioni** (Cappellin 2014a, 2014b).

Da un lato, **lo sviluppo di nuove capacità produttive** nei beni e servizi innovativi da parte delle imprese più innovative stimola la domanda finale da parte dei consumatori e la domanda intermedia delle imprese a sperimentare tali nuovi beni e servizi.

D'altro lato, **l'emergere di nuovi bisogni da parte delle comunità di utilizzatori innovativi (“lead users”)** e delle imprese, che hanno bisogno di nuovi prodotti intermedi traina la domanda di mercato e induce i produttori a modificare le produzioni di beni e servizi tradizionali.

**I veri driver della crescita in una “nuova politica industriale” sono la conoscenza, gli investimenti, le nuove preferenze dei consumatori e la *governance* dei cambiamenti e delle relazioni tra gli attori economici.**

# Innovation and investments increase the GDP



The **creation of new productions** depends on a change/innovation by the consumers/users and by the producers. Schumpeterian creative destruction - smart productions - disruptive innovations are those new productions which **are different** and competitive with respect to the existing traditional productions either because are produced at **lower costs (process innovation)** or because they have a **superior quality and higher prices (product innovation)** than the traditional productions.

Therefore, innovation by the users and innovation by producers are both a crucial factor in pulling the investment decision (*demand led innovation*).

The crisis of investment is determined to too low innovation as the main driver of investments is innovation, both on the supply side and on the demand side of new productions.

On the other hand, innovation requires investments, since innovation requires adequate investment in R&D, in the labour competence, in the technical/economic/financial design and also in the creation of technological and economic and financial collaborations with the other actors of the regional and national system of innovation (NIS).

Investment imply both the demand of funds by the firms and by the households and the supply of funds by financial institutions (banks and no bank intermediaries)

**The selection of the new productions should respond to the identification of the basic needs of the European citizens.**

New productions should respond to the need of the citizens:

- good nutrition,
- good cities,
- good free time, culture and entertainment,
- good mobility,
- good health and training,
- good environmental quality and fewer natural disasters.

The restructuring of demand and the patterns of consumption are tightly linked and even pull the parallel restructuring of the supply side of the economy towards new innovative productions, leading to an increase of the aggregate productivity.

Therefore, changes in the demand patterns, in the national and regional sectoral production structures and also in the environment and in the territorial structure are closely linked between themselves, as they could be described as a “circular” development model.

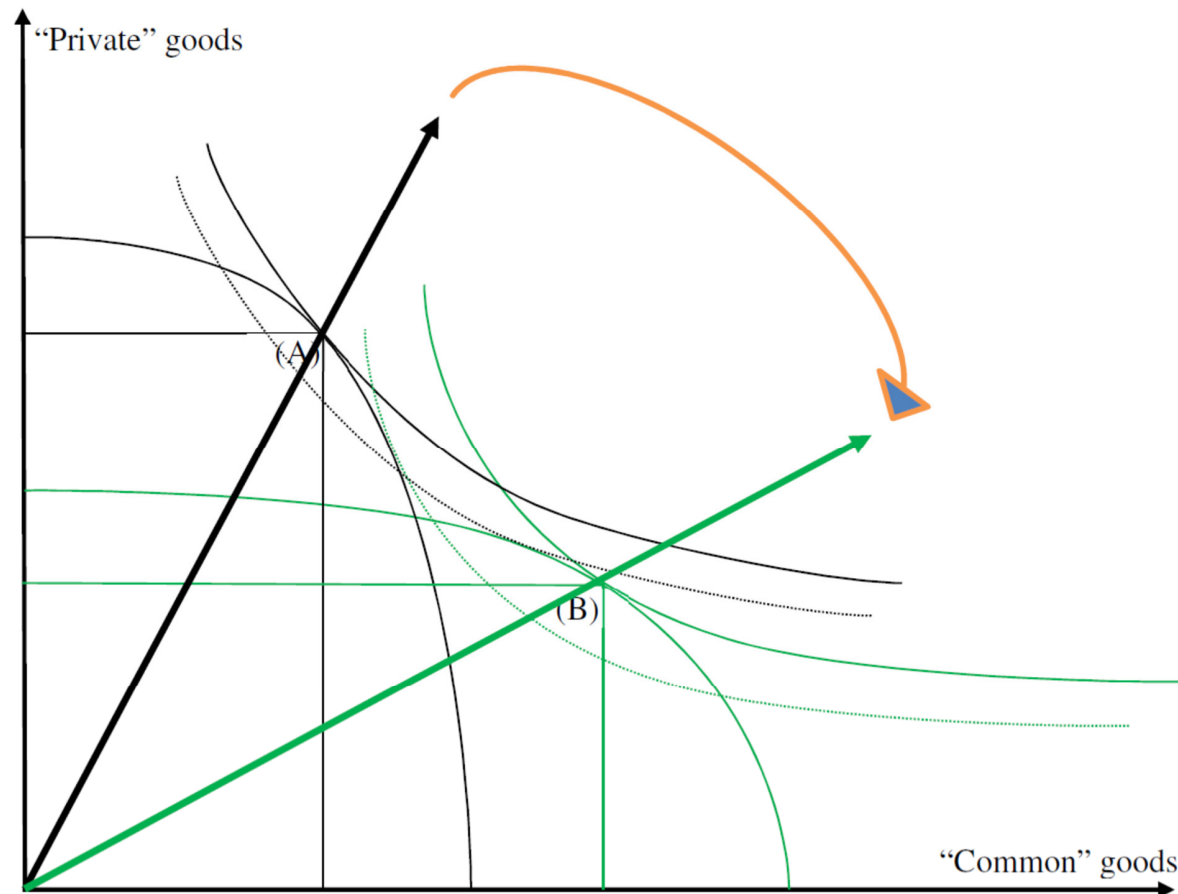


**The European Recovery Plan should mainly promote the following productions or "lead markets":**

- 1) agro-food,
- 2) housing and quality of cities,
- 3) sustainable mobility and urban and regional logistics,
- 4) health,
- 5 ) training,
- 6) leisure, culture, tourism,
- 7) environment and energy.

These new productions can activate new industrial and tertiary production chains. In particular, (“upstream”) they can stimulate product and process innovations in the supplier sectors and (downstream), an increase in aggregate productivity in the user sectors which may be facilitated in their reconversion towards higher added value productions

**Figure 1 – The changes of the social preferences and the patterns of internal demand and the reconversion or the internal production capacity from traditional “private goods” (A) to modern “common goods” (B)**



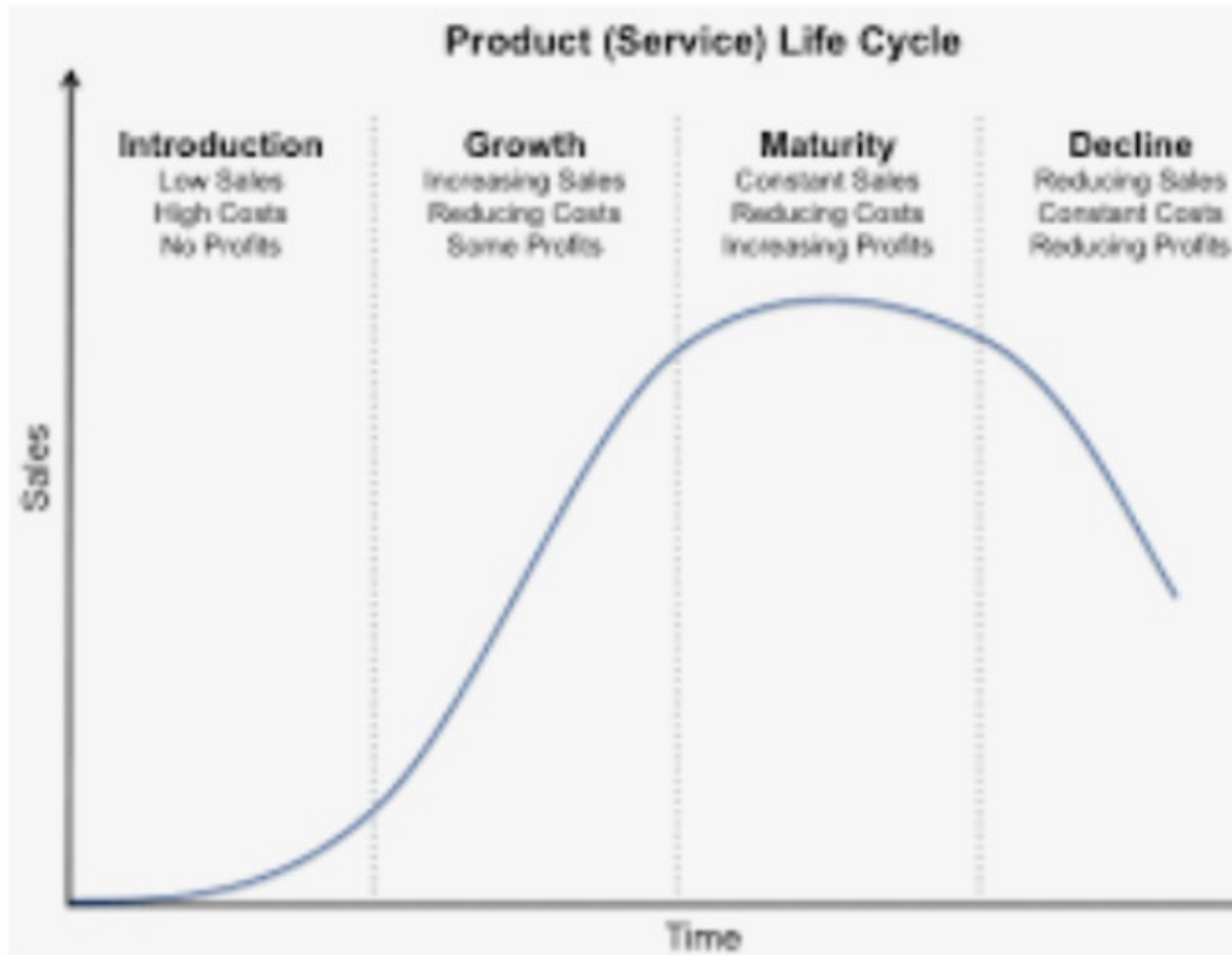
## THE PROCESS OF SECTORAL RECONVERSION AND THE AGGREGATE GROWTH OF THE ECONOMY

The growth process of the overall economy depends on the **structural change** and the reallocation of resources between the various sectors.

In fact, the relative importance of the various sectors in the economy is determined by structural change and that explains the crucial role of **the transfer of resources from lower productivity to higher productivity sectors**, as that leads to an increase of the per capita income.

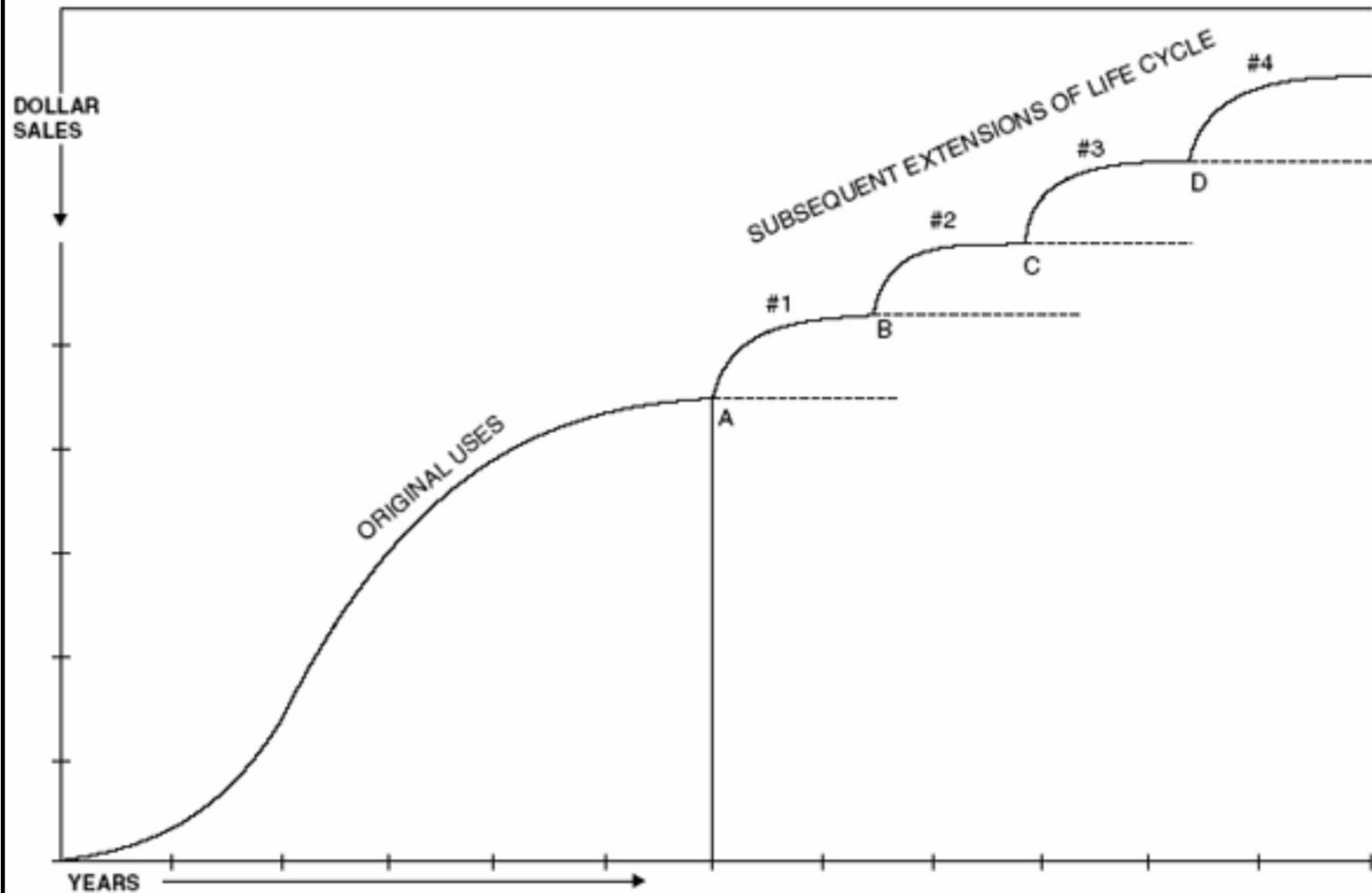
The sequence of **many different innovation waves**, according to the product life cycle model, determines the creation of new industries and the continuous increase of labour productivity, of wages and incomes and also of the internal demand, which drives the GDP growth.

In particular, the development of the new productions **requires both major investments** by new firms and by existing firms (**demand of funds**) and various **financial instruments** (**supply of funds**): public subsidies and venture capital (early stage) and private equity and bank credit (development phase).



# EXHIBIT IV

## Hypothetical Life Cycle—Nylon



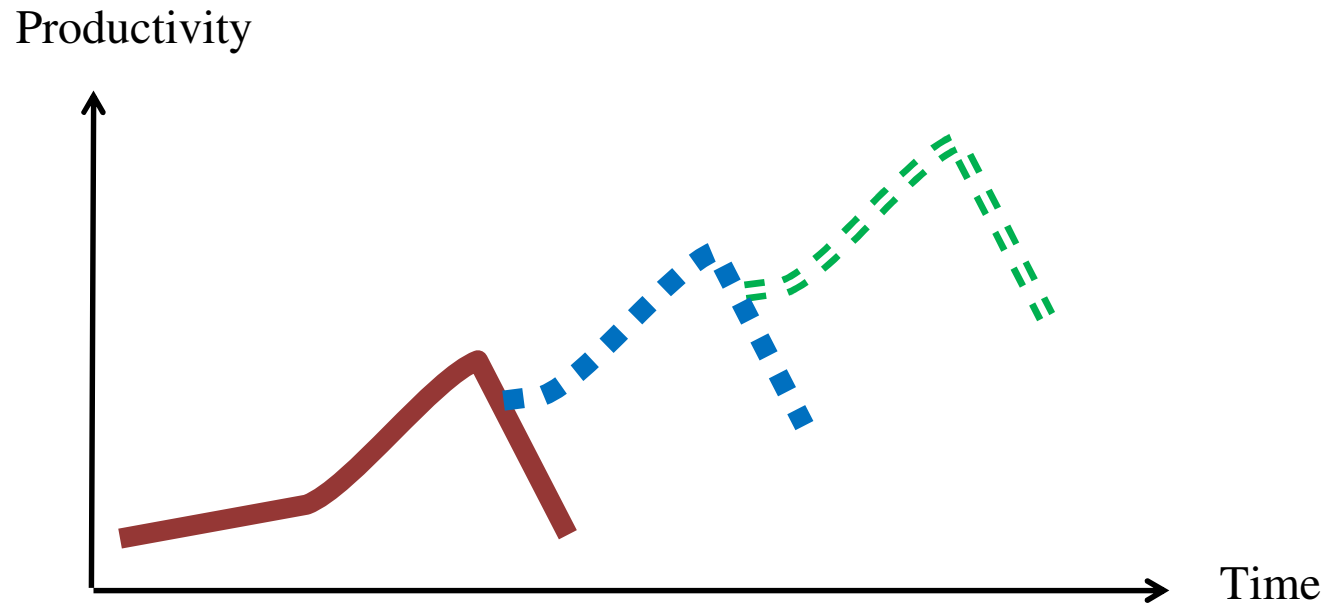


Figure 1 – The evolution of production diversification and the growth of productivity



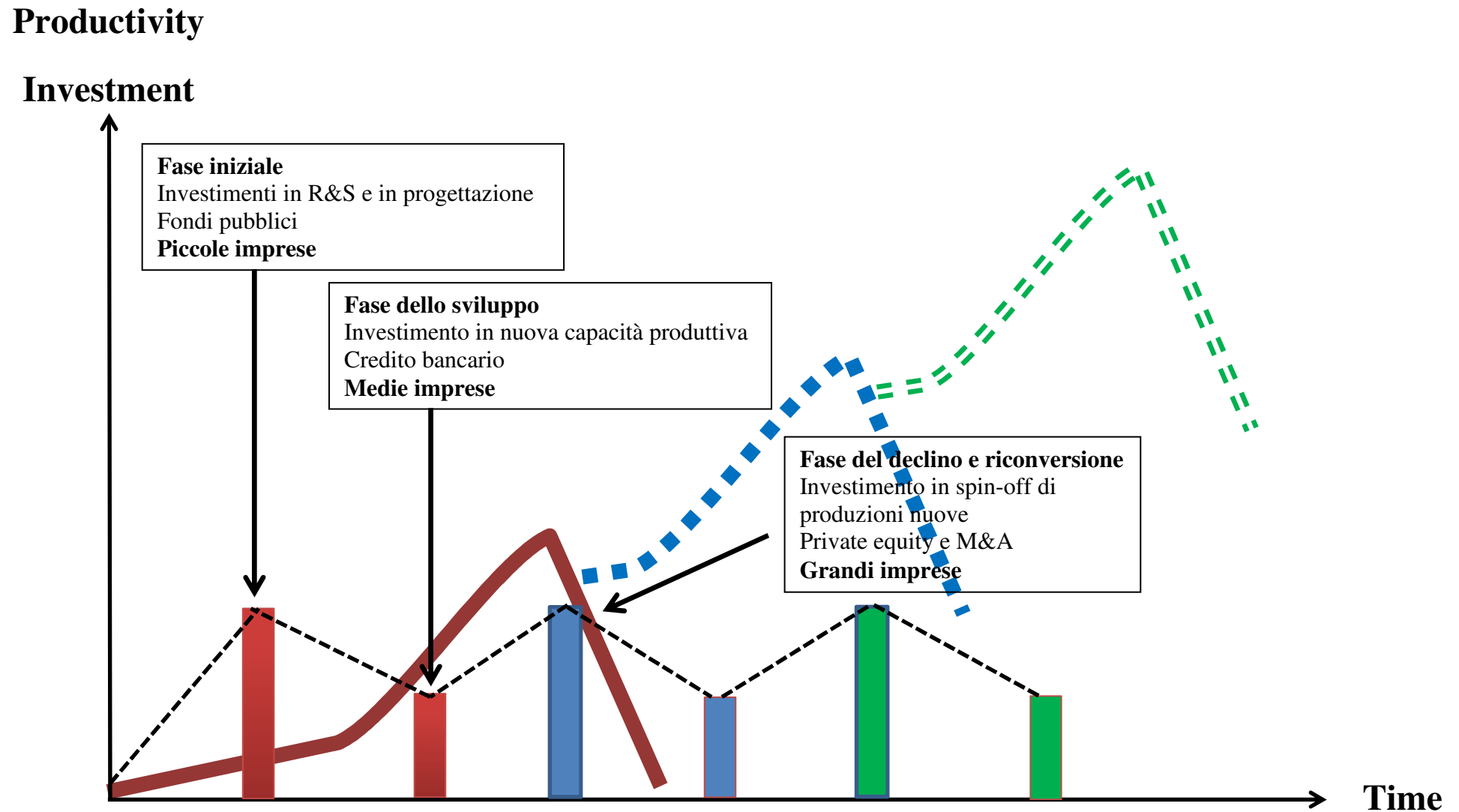


Figure 1 – The evolution of production diversification, the growth of productivity and the investment cycle

<b>Consumption items less developed in Italy with respect to Germany</b> Actual rentals for housing Medical products, appliances and equipment Hospital services Purchase of vehicles Transport services Postal services Telephone and telefax services Audio-visual, photographic and information processing equipment Other recreational items and equipment, gardens and pets Recreational and cultural services Newspapers, books and stationery Social protection Insurance Financial services n.e.c.	<b>Consumption items less developed in Italy with respect to UK</b> Alcoholic beverages, tobacco and narcotics Actual rentals for housing Imputed rentals for housing Purchase of vehicles Transport services Audio-visual, photographic and information processing equipment Other major durables for recreation and culture Other recreational items and equipment, gardens and pets Recreational and cultural services Newspapers, books and stationery Education Catering services Personal care Social protection Insurance Financial services n.e.c.	<b>Consumption items with increasing share in Italy</b> Actual rentals for housing Imputed rentals for housing Electricity, gas and other fuels Hospital services Transport services Postal services Recreational and cultural services Education Catering services Accommodation services Social protection Insurance
Source: Eurostat, data on 2000-2013 period		

Dal punto di vista industriale e territoriale, appare indispensabile **individuare gli ambiti di nuove “specializzazioni intelligenti”**, che tengano conto non solo della domanda internazionale ma anche delle esistenti specializzazioni produttive nazionali e regionali e soprattutto della domanda potenziale, delle carenze evidenti e dei bisogni crescenti dei cittadini nel territorio.

Le produzioni italiane si trovano quasi tutte **in una fase di maturità o di declino del ciclo di vita del prodotto, nella quale non sono necessari grandi investimenti** per l’espansione delle capacità produttive, ma solo investimenti labour-saving e si rendono persino inevitabili disinvestimenti delle imprese o dismissioni di impianti produttivi, chiusure di imprese in crisi e riduzioni delle capacità produttive.

In questo modello di crescita, **le città e il territorio sono l’ambito** (come indicato da una “nuvola”) **nel quale le conoscenze diverse interagiscono e si combinano tra loro**, dando origine a nuovi progetti di investimento e a imprese attive in nuove produzioni.

Il confronto internazionale con altri grandi paesi europei dimostra il **minore sviluppo** e quindi la probabile sotto dotazione in Italia **di diversi consumi di carattere moderno**, come quelli collegati alla **abitazione, salute, trasporti collettivi, comunicazioni, tempo libero, cultura, informazione, servizi sociali, finanziari e assicurativi**. Peraltro, il **peso di questi beni e servizi sui consumi complessivi è crescente anche in Italia**.



**Figura 2 – Lo sviluppo di nuovi mercati-guida per la diversificazione dell'economia italiana**

**Questi mercati-guida sono tra loro collegati, in quanto complementari nell'uso e anche nei processi di produzione. Pertanto, è importante lo sviluppo di processi di integrazione orizzontale e verticale tra le diverse imprese.**

## **The network model and the explanation of aggregate growth**

In this **model of multilayer networks**, the output of a firm may be determined both by the demand of its products and by the supply of the intermediate inputs as also of the various production factors, indicated by the various flows represented in the four networks of figure 3.

In particular, **the output of the economy will depends not only on the aggregate endowment of production factors, but also on the very different forms of organization of the material and immaterial flows between firms, institutions and others actors involved in the economic system.**

The network model may be used as a growth model of the economy. In fact, the relationships between the network of Input Output flows (Y), the network of labor flows (L), the network of capital flows (K) and the network of technological relations (T) in **the determination of the overall growth of the economy** considered may be formally described with the following relationships:

- 1) *Output* =  $n_1(\text{output flows, final local demand, export})$
- 2) *Final local demand* =  $n_2(\text{output})$
- 3) *Export* =  $n_3(\text{output/production capacity, external demand})$
- 4)  *$p(\text{Output}) = p(\text{Production capacity})$*
- 5) *Production capacity* = *Resources* \* *Productivity*
- 6) *Resources* =  $n_4(\text{input flows}_t \dots\dots\dots, \text{input flows}_{t-n})$
- 7) *Productivity* =  $n_5(\text{knowledge flows}_t, \dots\dots\dots \text{knowledge flows}_{t-n})$
- 8) *knowledge flows<sub>t</sub>* =  $n_6(\text{output flows, input flows, knowledge flows})_{t-1}$
- 9) *input flows<sub>t</sub>* =  $n_7(\text{output flows, input flows, knowledge flows})_{t-1}$
- 10) *output flows<sub>t</sub>* =  $n_8(\text{output flows, input flows, knowledge flows})_{t-1}$

Source:

Cappellin, R. (2003), Networks and Technological Change in Regional Clusters in Bröcker, J., Dohse, D. and Soltwedel, R. (eds.), Innovation Clusters and Interregional Competition, Springer Verlag, Heidelberg (ISBN 3-540-00999-X): 52-78

[Link to Cappellin \(2003\)](#)

Where:

Relationship 1) indicates that the production of an economy is equal to the flows of products ( $x_{ij}$ ) which are sold by the different firms to other firms and to the final internal and external demand.

Relationship 2) indicates the levels of the final demand (consumption, investment, public expenditure) as a function of the income

Relationship 3) indicates the level of exports as a function of the output capacity and of the external demand

Relationship 4) indicates that the price which determines the actual final demand (demand side) should be equal to the costs which are determined by the existing production capacity (supply side).

Relationship 5) indicates that the production capacity of the individual firms is determined by the availability of resources (as labor and capital) times the respective productivity.

Relationship 6) indicates that the availability of resources depends on the flows of these resources in the same and in the previous period. The role of internal resources is underlined by the resource based theory of the firm.

Relationship 7) indicates that the productivity of resources is a function of the actual and previous flows of knowledge. The level of production is a function not only of the internal resources but also of the skills or capabilities to use these latter.

Relationships [8, 9 and 10] indicate that the structure of a network is linked to the structure of the same network and of that of other complementary networks in the previous periods.

Moreover, the relations [8, 9 and 10] indicate that **the evolution of the various networks is interdependent**, due to the existence links assuring their interconnectivity. **In fact, the form of the real flows of inputs and outputs affect the form of the knowledge flows**, while these latter determine the productivity of production factors and hence the overall output growth of the economy.

The flows within the various networks are affected by accessibility and receptivity or by the various forms of distance (geographical, organizational and institutional distance) and by the different characteristics of the nodes (cognitive distance). Distance is affected by the endowment and investments in soft and hard infrastructures. These investments indicated a link to the equation (1) as they are related to the use or demand of actual production.

**The system may be solved in the eight types of unknown:** the levels of input, productivity, production capacity and production of the various firms, subject to the constraint indicated by the inequality (2). Moreover, it may also determine the flows of material inputs (capital, labour), of knowledge and of output between the various firms.



**Table 1**  
**A CROS-SECTORAL MODEL OF ECONOMIC GROWTH**  
 (Cappellin, 2019)

- 1)  $X = (I-A)^{-1} (C + I^* + G + EX - IM)$
- 2)  $C_i = f(Y_d, p_i, \text{Productivity}_i^*, X_i^*)$
- 3)  $(EX_i - IM_i) = n_3(p_i, Y_d, X_i^*, \text{external demand, governance})$
- 4)  $p_i = u_i + w_i N_i / X_i^* + \sum_j p_j a_{ji}$
- 5)  $u_i = f(X_i / X_i^*)$
- 6)  $w_i = f(p_i, u_i, X_i^* / N_i, N)$
- 7)  $Y_d = \sum_i w_i N_i + \sum_i u_i X_i$
- 8)  $N_i = f(X_i, X_i^*)$
- 9)  $X_i^* = \text{Resources}_i^* \text{Productivity}_i^*$
- 10)  $\text{Resources stock}_{it}^* = n_4(\text{input flows}_{it}, \dots, \text{input flows}_{it-n})$
- 11)  $\text{Productivity}_{it}^* = n_5(\text{knowledge flows}_t, \dots, \text{knowledge flows}_{t-n})$
- 12)  $\text{Knowledge flows}_t = n_6(\text{output flows}, \text{input flows}, \text{knowledge flows}, \text{governance})_{t-1}$
- 13)  $\text{Input flows}_t = n_7(\text{output flows}, \text{input flows}, \text{knowledge flows}, \text{governance})_{t-1}$

### A cross-sectoral model indicates the working of a new industrial strategy

The equilibrium between the aggregate demand and the supply can also be represented through the equations of the model indicated in table 1.

In fact, the following equations:

$$4) p_i = u_i + w_i N_i / X_i^*$$

$$5) u_i = f(X_i / X_i^*)$$

$$6) w_i = f(p_i, u_i, X_i^* / N_i, N)$$

indicate that the price of the supply or the cost of the product/services in a particular sector is determined by “normal” productivity ( $X_i^* / N_i$ ), the mark-up ( $u_i$ ) and by the wages ( $w_i$ ) determined in the labour market.

On the other hand, the following equations:

$$1) X = (I - A)^{-1} (C + I^* + G + EX - IM)$$

$$2) C_i = f(Y_d, p_i, \text{Productivity } i^*, X_i^*)$$

$$3) (EX_i - IM_i) = n_3(p_i, Y_d, X_i^*, \text{external demand, governance})$$

determine the price of the demand for each sector ( $p_i$ ).

**Table 1**  
**A CROSS-SECTORAL MODEL OF ECONOMIC GROWTH**

$$1) X = (I - A)^{-1} (C + I^* + G + EX - IM)$$

$$2) C_i = f(Y_d, p_i, \text{Productivity } i^*, X_i^*)$$

$$3) (EX_i - IM_i) = n_3(p_i, Y_d, X_i^*, \text{external demand, governance})$$

$$4) p_i = u_i + w_i N_i / X_i^*$$

$$5) u_i = f(X_i / X_i^*)$$

$$6) w_i = f(p_i, u_i, X_i^* / N_i, N)$$

$$7) Y_d = \sum_i w_i N_i + \sum_i u_i X_i$$

$$8) N_i = f(X_i, X_i^*)$$

$$9) X_i^* = \text{Resources } i^* \text{ Productivity } i^*$$

$$10) \text{Resources stock } i_t^* = n_4(\text{input flows } i_t, \dots, \text{input flows } i_{t-n})$$

$$11) \text{Productivity } i_t^* = n_5(\text{knowledge flows}_t, \dots, \text{knowledge flows}_{t-n})$$

- 12) Knowledge flows  $_t = n_6$  (output flows, input flows, knowledge flows, governance) $_{t-1}$   
 13) Input flows  $_t = n_7$  (output flows, input flows, knowledge flows, governance) $_{t-1}$

By rearranging the above equations, it is possible to obtain the negative schedule of the demand and the positive schedule of the supply, between price and quantity of the various sectoral productions.

$$p_i = f(N_i, X_i, X_i^*, (I-A)^{-1}(C + I + G + EX - IM), I^*, Y_d, \text{productivity}_i^*, \text{external demand})$$

$$p_i = f(X_i/X_i^*) + g(X_i^*/N_i, N)$$

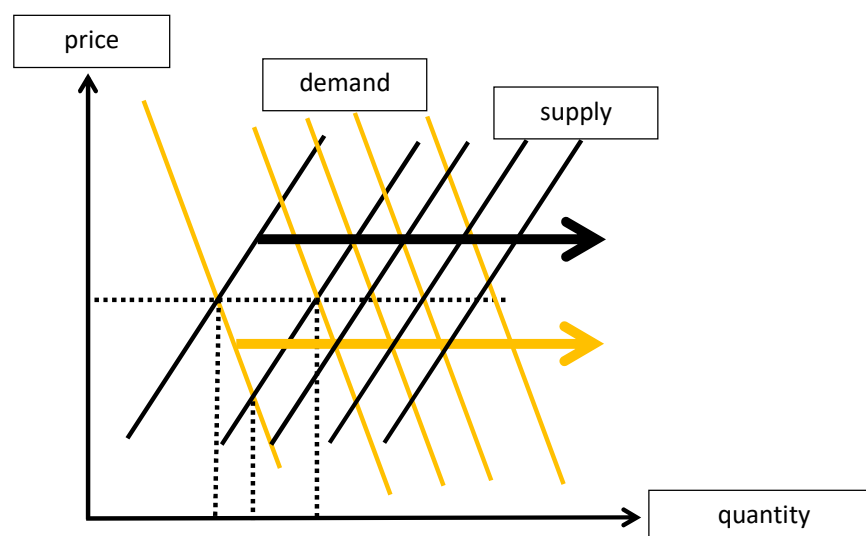


Figure 2: The growth of investment determines a shift of the sectoral demand and supply

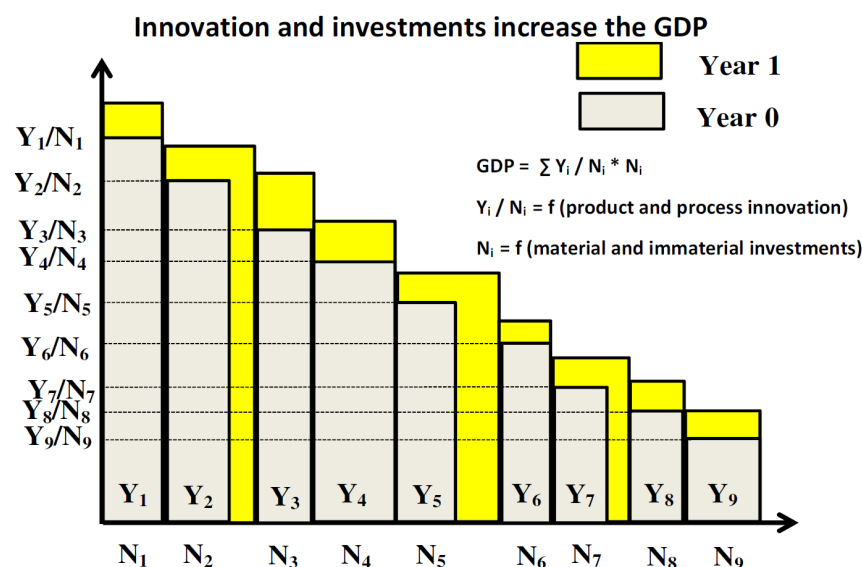
Therefore, the specific level of production in each sector is the result of the equilibrium between the demand and the supply in that sector. That can be illustrated in figure 2, which is similar to the aggregate demand and aggregate supply schedules in figure 1 and it indicates the interdependence of the demand and the supply for each specific sector.

In particular, the aggregate GDP can be represented as in figure 3 as the summation of the value added of the products of the various sectors, indicated in descending order of the respective productivity. The value added of each sector is equal to the area, determined by the multiplication of the employment and productivity levels of that sector. Therefore, GDP growth is determined by an increase of the productivity and/or of employment in the various sectors.

In fact, the process of economic development, according to the Schumpeterian perspective of “creative destruction”, implies the shrinking of traditional productions and the creation of new productions. Therefore, the decrease of employment in the companies and sectors in crisis should be compensated by the creation of new employment through a diversification process into new productions, which may be result of the expansion of existing companies or the creation of new companies and sectors.

Therefore, investments have positive effect, on the one hand, on the increase of the average physical productivity of labour and of the market value (i.e. the price) of the various existing productions (through process and product innovation) and, on the other hand, investments lead to an increase of the capital stock, which allows to create employment in new productions.

**Figure 3**



Looking at the demand side, the increase of the supply by each sector should be matched or it should rather be anticipated by a corresponding increase of the respective demand, as the price that the consumers are willing to pay should be at least greater than the unit cost of the product and the quantity demanded should be greater or equal to the quantity supplied. Therefore, the recovery of the European economy must start, first of all, from identifying the new needs of citizens in an economy, where services and new knowledge play the crucial role, and from identifying new productions, aimed at responding to these emerging needs.

In conclusion, the aggregate growth depends on the structural change of both the aggregate demand and the aggregate supply. In particular, the process of restructuring of the economy is the result of the sequence of different innovation waves which affect the structure both of the supply side but also of the demand side, according to the product life cycle model, as indicated in figure 4. That determines not only the creation of new industries and the continuous increase of the labour productivity, wages and incomes but also the increase of the internal aggregate demand and a structural change of the pattern of consumption, and that drives the growth of GDP and of the demand of the individual productions.

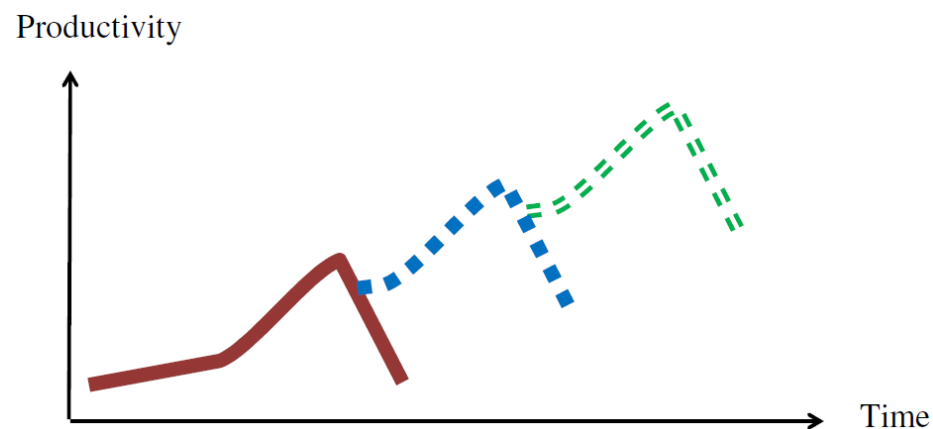
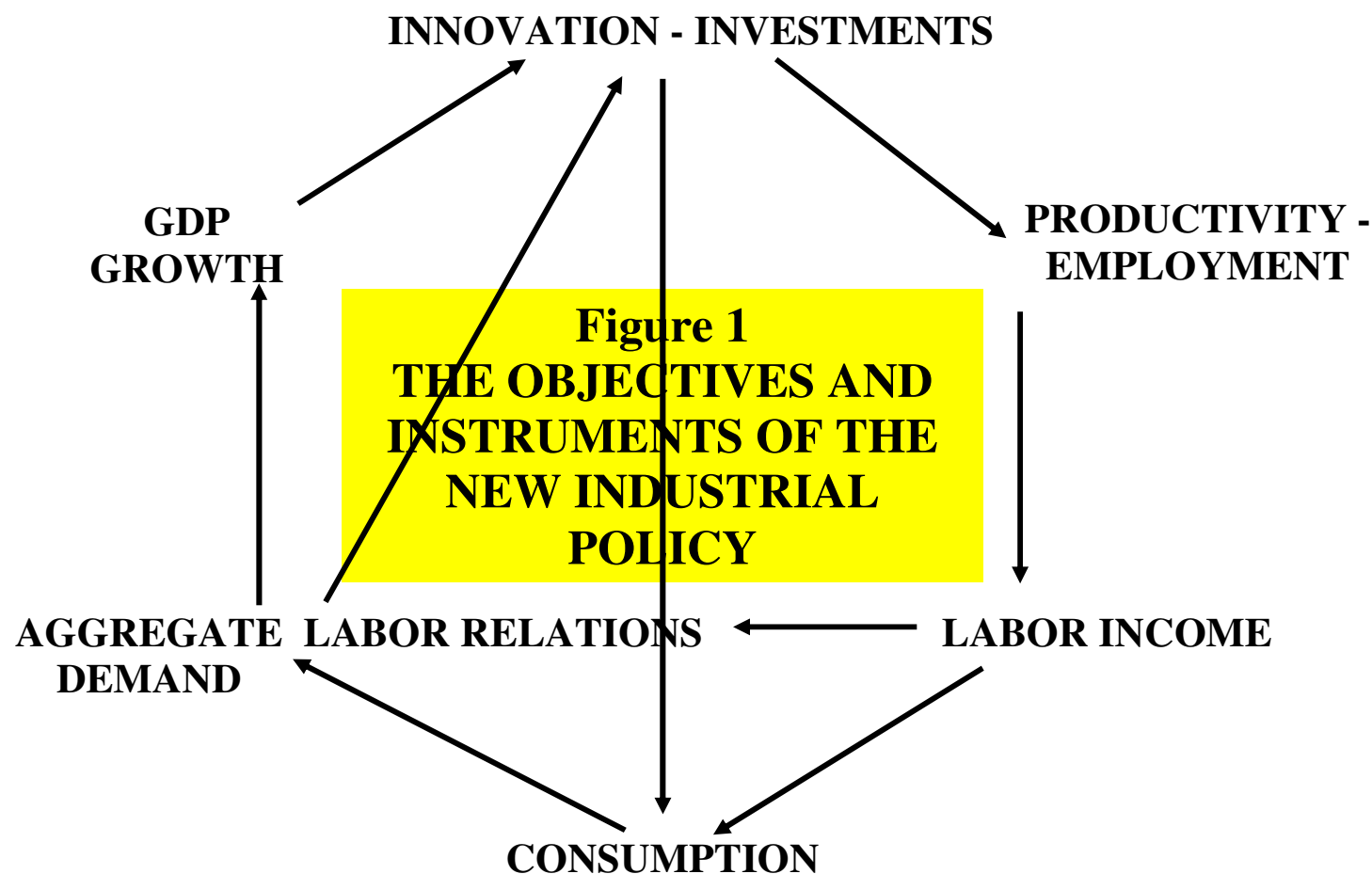


Figure 4: the evolution of productivity and the productions cycles

In conclusions, industrial policies may affect the level of employment by working both on the demand and on the supply side of the various sectors and in particular by stimulating the investment which increases the demand side and also enhances the production capacity on the supply side.

## Innovation and investments are the strategic policy instruments



Cappellin, R. and Wink, R. (2009), **International Knowledge and Innovation Networks: Knowledge Creation and Innovation in Medium Technology Clusters**. Cheltenham: Edward Elgar Publishing.

[http://books.google.it/books?id=1BpcJGekx18C&printsec=frontcover&source=gbs\\_navlinks\\_s#v=onepage&q=&f=false](http://books.google.it/books?id=1BpcJGekx18C&printsec=frontcover&source=gbs_navlinks_s#v=onepage&q=&f=false)

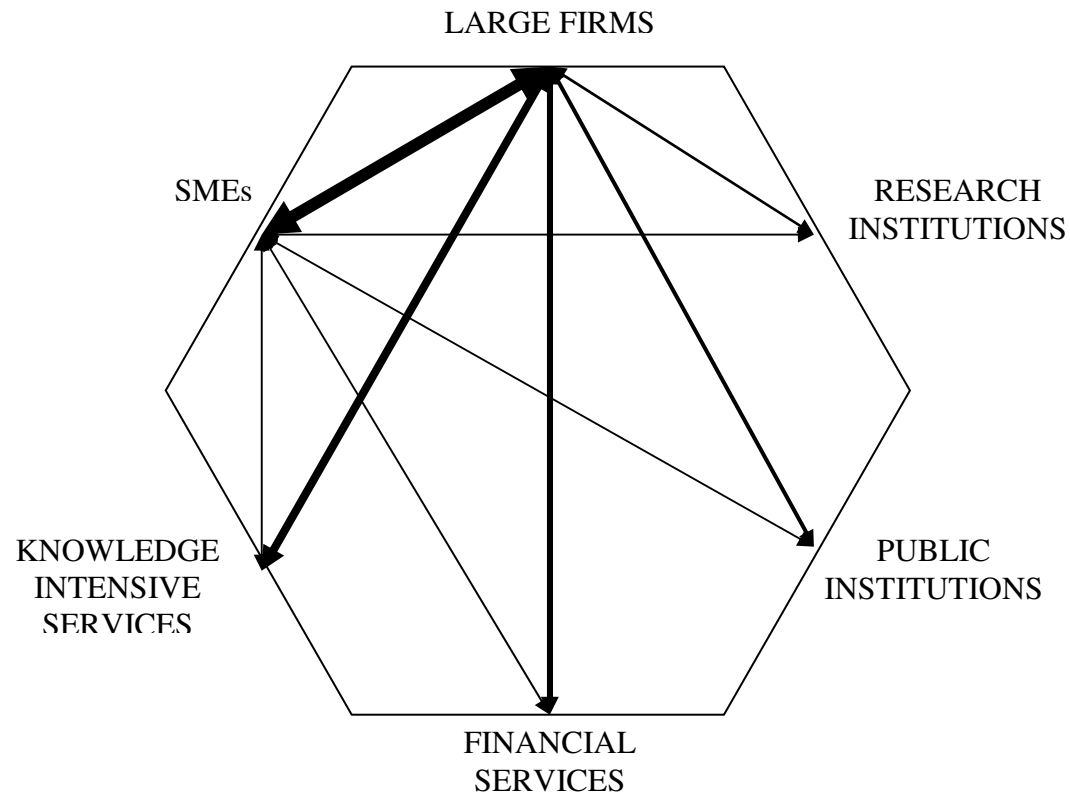
**Cap. 4.9, pp. 116-119**

## **9. The model of knowledge and innovation networks**

The relationships between the firms become **more complex, risky** and require to be redesigned in a long-term perspective.

The role of **interactive learning process** for knowledge creation and the access to **tacit knowledge** underline the importance of the concept of **knowledge and innovation networks**

In fact, **networks are an appropriate form of organization** facilitating the interaction and the flows of information and knowledge. Knowledge circulates within networks through formal and informal institutions. Explicit or codified knowledge may be exchanged on technology markets.



**Figure 4: Information and knowledge links in a regional innovation system**

The structure of a network can be illustrated by the relationships between various actors, which can be classified in six groups: large industrial firms, industrial SMEs, business services, financial services, research institutions and public institutions, as indicated in figure 4.



In particular, the structure of a network is characterized by:

- **nodes**, which may be firms and other private and public actors,
- **links**, which connect directly or indirectly the various nodes,
- **flows**, which may be material or immaterial, such as product, services, financial, labour, power, information and knowledge flows,
- **distances**, which may be geographical but also technological, organizational, cultural, institutional and determines obstacles or transaction costs in the circulation of the flows,
- **infrastructures**, which may be material or immaterial, such as norms, institutions and social capital, and reduce the transaction costs, thus facilitating the circulation of the flows between the nodes.

Network relations present **five characteristics**.

First of all, the **relationship** between two nodes is characterized by **a precise direction and a hierarchical character**.

Secondly, each **node** has a **specific function**.

Thirdly, the various **networks** are **interconnected between themselves**.

Fourth, **networks** have a **different geographical reach**.

Fifth, the relations existing within a specific network **in a particular time** are normally related to the relations existing in **the previous periods**.

In fact, networks can be analysed **in a dynamic perspective** and are characterized by their flexibility. **Their evolution** (figure 5) is related to:

- the change in the **nodes** and in the **capabilities** of the various nodes,
- the change in the **intensity of the various flows**,
- the **creation and disappearance of some links**,
- the **change in the alternative paths** linking directly or indirectly the same nodes,
- the **creation of hard or soft infrastructures** between particular nodes,
- the path of evolution of the **overall structure of the network**.

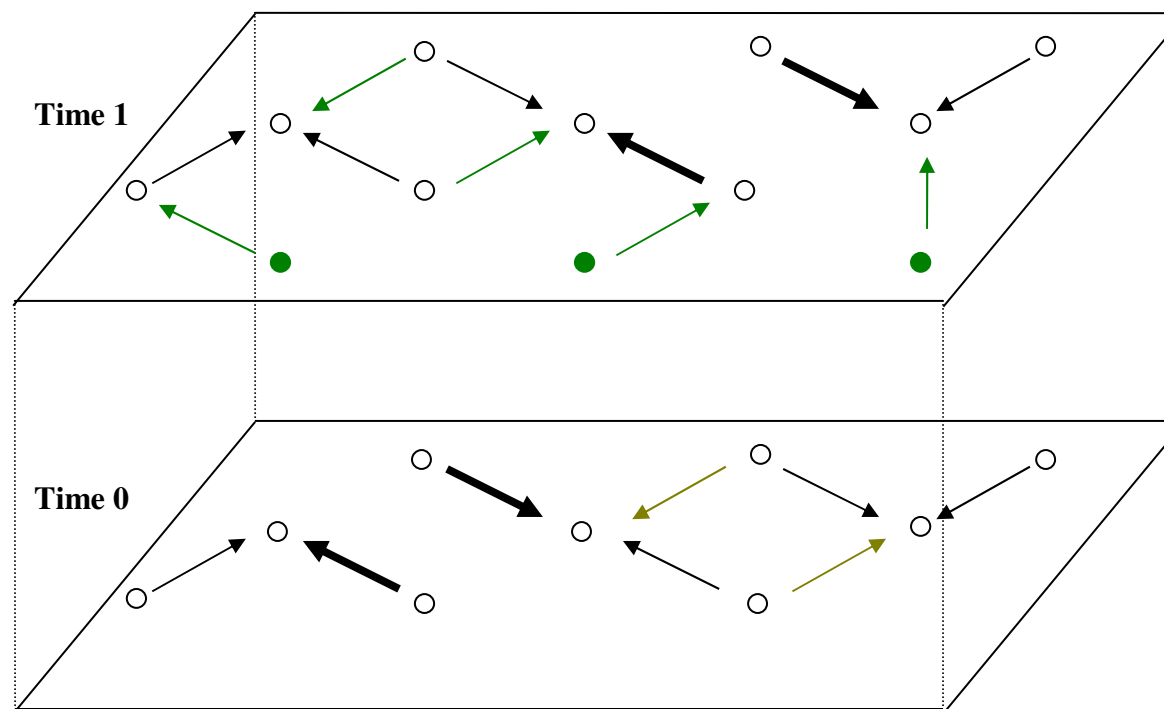


Figure 5: The evolution of the network form

The network approach is very **different from the neoclassical approach**

In the model of the networks the **firms are all different** and **integrated between them** through different types of relations.

The network paradigm **underlines the vertical dimension** of the relations of **production integration** between the firms.

The **crucial characteristic of a network of firms** is indicated by the **concepts of integration, sequential interaction, circulation, diffusion, feedback, recursive processes, symbiosis and co-evolution**.

### **Reference:**

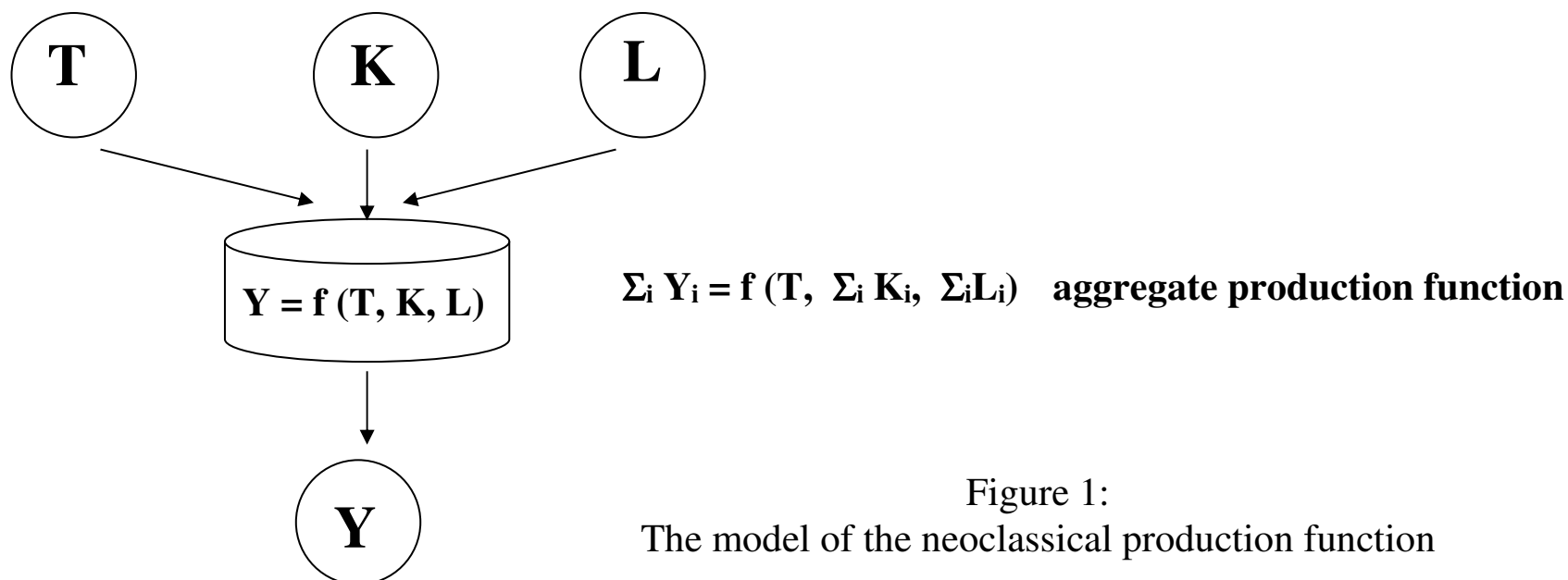
\* Cappellin, R. (2009), La *governance* dell'innovazione: libero mercato e concertazione nell'economia della conoscenza, *Rivista di Politica Economica*, 99, 4-6: 221-282.

<http://www.rivistapoliticaeconomica.it/2009/apr-giu/Cappellin.pdf>

Cappellin, R. (2003), Networks and Technological Change in Regional Clusters in Bröcker, J., Dohse, D. and Soltwedel, R. eds., **Innovation Clusters and Interregional Competition**, Springer Verlag, Heidelberg.

## The neoclassical model of the production function

In a neoclassical model, the growth of the production in a regional or national economy is determined through the tool of the aggregate production function, which indicates the effect on the production level of the use of various production factors, such as capital (K) and labor (L), given the characteristics of the technology (T), as this latter is supposed constant among all firms, as indicated in figure 1.



## The networks of firms in the local production systems

According to the approach of “territorial networks” the various forms of integration or the various networks, which may be identified in a local economy, may be described as in table 1 (Cappellin and Orsenigo 2000).

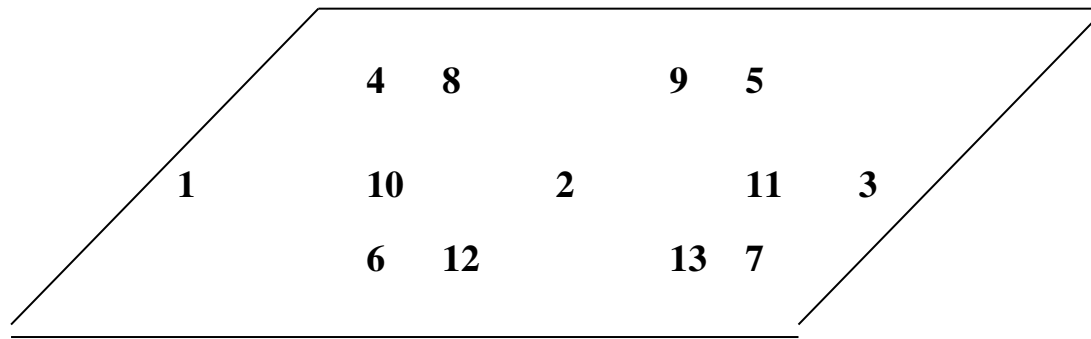
Table 1: Different networks in a local production system

<p><i>Technological integration,</i> pointed out by the development of the local production know how, the sharing of knowledge and values promoted by learning processes on the job, the continuous education of the workers, the vocational education of young workers, the joint investments in R&amp;D by local firms and the technological cooperation with external firms.</p>
<p><i>Integration of the local labor market,</i> related with the cooperation between the workers and the firms and the mobility of the workers between the firms of the same sector and also the capability to attract qualified workers from other regions and from other sectors.</p>
<p><i>Production integration between the firms,</i> through subcontracting relationships between the firms which play a crucial role in promoting the gradual diversification of the local productions.</p>
<p><i>Integration between the service sectors and the manufacturing firms,</i> related to the development of modern commercial distribution services, transport and logistic services and also qualified services in the certification of the quality of the productions and in the diffusion of modern technologies.</p>

<p><i>Financial integration of the firms,</i> as it is indicated by the creation of groups made by several firms belonging to the same entrepreneurial family and by pro-active bank-industry relationships, which promote the creation of spin-off and the capability to attract external investments or the investments of local firms in other countries and regions.</p>
<p><i>Territorial integration at the local level,</i> which requires an improvement in the infrastructure endowment and it is linked to an effective physical planning aiming to defend the quality of the territory.</p>
<p><i>Social and cultural integration,</i> which determines the existence of a local identity and the creation of the consensus within the local community on a shared developed strategy.</p>
<p><i>Relationships of institutional integration,</i> which are related to the development of local administrative capabilities and the capability of the local institution to interact with the regional and national institutions in the implementation of strategic development projects.</p>
<p><i>Territorial integration at the interregional and international level,</i> which leads to a greater openness in an interregional perspective, to the development of a local “foreign policy” or of a “territorial marketing” measures, which are crucial in attracting external investments and in promoting the internationalization of local firms.</p>

## An analytical representation of the model of territorial networks

The firms of a local production system may be represented as in the figure 2:



**Fig. 2 The firm in a local production system**

According to a network perspective, the working of a national or regional economy is explained by the integration between the various firms. These relationships may concern the same four variables, such as product (Y), labor (L), capital (K) and technology (T), which are traditionally considered in the neoclassical model of the production function. That allows to extend this model to the case of four interactive networks. Thus, an economic system may be described by four functional networks, as indicated in figure 3.





## A matrix representation of networks

The flows between the various firms indicated in the various networks of figure 2 may be also **represented in a matrix form**. In particular, the commercial flows of products and services (Y), the relationships of financial control (K) and the relationships of technological dependence or co-operation (T) between the various firms may be represented with the matrices along the diagonal of table 2.

	1	2	3		1	2	3		1	2	3		1	2	3	
1																
2		T				TK				TN				TY		
3																
1																
2		KT				K				KN				KY		
3																
1																
2		NT				NK				N				NY		
3																
1																
2		YT				YK				YN				Y		
3																

Table 2: The connectivity between flows of goods, labor, capital and technology

Clearly, the elements of these matrices indicate first of all the existence or the absence of those relations between the nodes, which were considered in the networks of figure 2. However, a matrix representation, allows also to illustrate in a clearer way some further crucial characteristics of a network and of the relationships between different networks.

In particular, these matrices may be used to represent **three crucial dimensions of the relations between the nodes of a network**, such as the **intensity of the flows** ( $x_{ij}$ ), the level of the reciprocal **distance** ( $d_{ij}$ ) and the existence of adequate **infrastructures** ( $f_{ij}$ ) in the connection between two nodes.

Thus, **the flows** ( $x_{ij}$ ) **from a node (i) to a node (j)** may consist of **flows of goods, financial flows, information, workers**, or other variables. The flows may be measured in monetary or physical term according to their respective nature.

These matrices may also be used in order to **represent the distance** ( $d_{ij}$ ) **between two nodes** or the obstacles, which hinder the relation between the actors (i) and (j). The distance may be measured not only in a geographical perspective (e.g. transport costs), but also in a “functional” perspective as organizational distance (e.g. “transaction costs”) and technological distance (e.g. “technology gap”). Thus, it may be expressed through different units of measurement, according to the nature of the relations represented in the specific network considered and the unit of measurement of the particular flow ( $x_{ij}$ ).

Thirdly, these matrices may be used to **represent the stocks of infrastructures** ( $f_{ij}$ ) allowing a tight integration between the various nodes and facilitating the flows between them. Clearly these infrastructures are important in order to reduce the distance between two particular nodes ( $d_{ij}$ ) and to increase the respective flows ( $x_{ij}$ ). In particular, the infrastructures of a network may be represented by:

- **material infrastructures**, such as the existence of transport, ICT and Internet connections,
- **immaterial infrastructures**, such as the existence of institutions, organizations and rules, which govern and coordinate the relations between the actors considered and, thus, decrease the transaction costs between them.

Two nodes, which are not directly linked, may be indirectly linked by the existence of the complex links **through various intermediate nodes**. In particular, within a particular network or matrix, the average unit flow ( $x_{ij}/x_j$ ) indicates the units of the production of firm (i) required in the production of one unit of the firm (j). This ratio, differently from the Input Output model, is not constant. Thus, **the total distance and the cost (transaction cost) in linking two nodes (i) e (j)**, which are not directly linked between themselves, may be measured as:

$$c_{ij} = \sum_s \sum_z A_{is} (x_{is}/x_s)(x_{sz}/x_z)(x_{zj}/x_j) + \sum_s \sum_z A_{sz} (x_{sz}/x_z)(x_{zj}/x_j) + \sum_z A_{zj} (x_{zj}/x_j)$$

when up to two consecutive intermediate nodes (s) and (z) are considered.

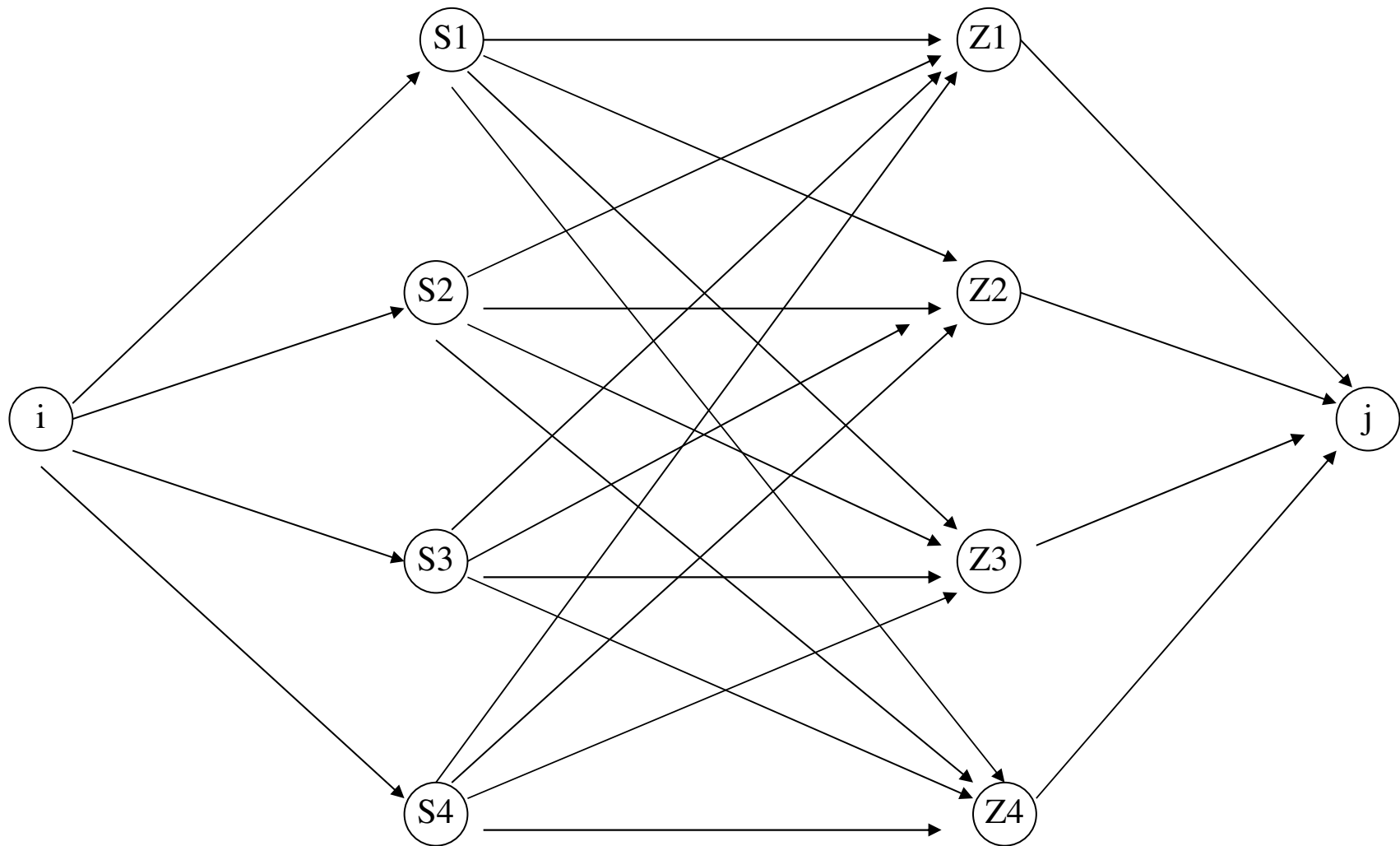


Fig. 5 – The indirect links between two nodes *i* and *j* through two intermediate nodes

## The interdependence between different networks

**The matrices, which are off the diagonal in table 2**, may be defined as “**transition**” or “**interconnection**” **matrices**. In particular, the matrices TK and TN may indicate the effect of the process of knowledge creation on the competencies or the capabilities respectively of the capital and labor inputs. Instead, the interconnection matrices KY and LY of table 2 may be used to formally indicate respectively the productivity of capital and labor inputs on the output of the various firms.

**An interconnection matrix** allows to relate between themselves different measures of distance appropriate for two different networks. That allows to define a mathematical expression which measures **the distance between two nodes, which do not belong to the same network**, but are indirectly connected by another node. This latter performs the role of a gateway or of a synapsis, as it belongs to both considered networks.

In fact, the **coefficient** ( $_{AB}d_{ij}$ ) **of an interconnection matrix AB** can indicate how to convert the cost of the distance between two specific nodes, as measured in the network A, according to the measurement unit of the distance in a different network B. For example, two small firms belonging to two different local subcontracting networks or located in different regions/countries may be both financially controlled by the same large firm. That will certainly facilitate the future establishment of a direct subcontracting relations between these two small firms. Thus, the proximity between the two firms in the financial network reduces the obstacles or distance, which hinder a direct contact in the Input Output network and increases the probability of the establishing a direct link in this latter network.

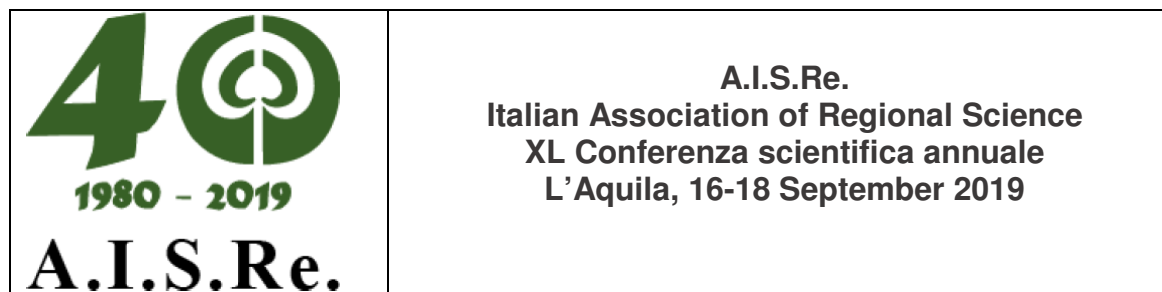
In general terms, given two nodes (j) and (z), which may respectively belong to the networks A and B and are indirectly connected through various intermediate nodes (s) belonging to both A and B networks, the unit cost of the relation between these two nodes may be measured as:

$$c_{iz} = \sum_s a_{is} d_{is} (AX_{is}/AX_s) + \sum_s b_{sz} d_{sz} (BX_{sz}/BX_z)$$

where the coefficient ( $a_{is}$ ) indicates the element of the interconnection or transition matrix between the network A and the network B and it **allows to transform the measure of the distance in the network A in the unit of measurement of the distance in the network B**, in order to compute the total transaction cost.

## **APPENDICE**





**A model of economic growth  
based on the interregional networks approach and  
the foundation of a modern industrial strategy in Europe**

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This paper will illustrate a interregional growth model based on the network approach to innovation and productivity growth, where **goods/services, capital, labour and technology flows** within the region/nation and at the interregional/international scale and **determine both the supply and the demand to the various productions.**

Differently from traditional macroeconomic models, this model is sectorally disaggregated and the output of each production or sector in the economy is determined as the result of the **equilibrium between the demand and the supply** of the respective product or service.

From a theoretical perspective, according to this model, **the well-known network paradigm** is not only **a useful tool for just describing** the changing structure of economic and social relations in a region/country, while **it may be included within a quantitative model** capable to **estimate the economic impact** on the economic flows by the **various policy instruments** at the European, national or local level.

The paper will also illustrate that a new **European industrial strategy** should not promote, as in the past, **financial/fiscal transfers to the individual companies**, but rather **promote the diversification of** the overall European production system, especially in medium income countries, through the **increase of the demand of selective productions** ("smart specializations") and through **new modern material and immaterial investment and innovation** within the companies and especially within the networks of goods, services, knowledge, capital and people, facilitated by **public-private partnerships** and a **multilevel governance approach**.

A new European Industrial Strategy should **focus on the growth of the internal market** within the European economy and on the **changing needs and the well-being of the citizens**, rather than **only promote export, competitiveness and “value creation” for the individual firms**.

That leads to recognize the crucial role of the **territory and cities, as the most appropriate framework for an industrial strategy** and it allows to mobilize the active participation of local and regional community in innovation and projects of material and immaterial investments.

## The growth model and the internal demand and supply

- 1)  $X = (I-A)^{-1} (C + I^* + G + EX - IM)$
- 2)  $C_i = f(Y_d, p_i, \text{Productivity } i^*, X_i^*)$
- 3)  $(EX_i - IM_i) = n_3(p_i, Y_d, X_i^*, \text{external demand, governance})$
- 4)  $p_i = u_i + w_i N_i / X_i^*$
- 5)  $u_i = f(X_i / X_i^*)$
- 6)  $w_i = f(p_i, u_i, X_i^* / N_i, N)$
- 7)  $Y_d = \sum_i w_i N_i + \sum_i u_i X_i$
- 8)  $N_i = f(X_i, X_i^*)$
- 9)  $X_i^* = \text{Resources } i^* \text{ Productivity } i^*$
- 10)  $\text{Resources stock } i_t^* = n_4(\text{input flows } i_t, \dots, \text{input flows } i_{t-n})$
- 11)  $\text{Productivity } i_t^* = n_5(\text{knowledge flows}_t, \dots, \text{knowledge flows}_{t-n})$
- 12)  $\text{Knowledge flows}_t = n_6(\text{output flows, input flows, knowledge flows, governance})_{t-1}$
- 13)  $\text{Input flows}_t = n_7(\text{output flows, input flows, knowledge flows, governance})_{t-1}$

## Key forms of interdependence in the model

**The model determines the equilibrium output in each sector** of the economy as the result of the equilibrium between the demand and the supply in each sector. This can be illustrated also in a graphical form as the production level of each sector is determined by **the interdependence of the demand and the supply of each sector** as indicated in price equation (4).

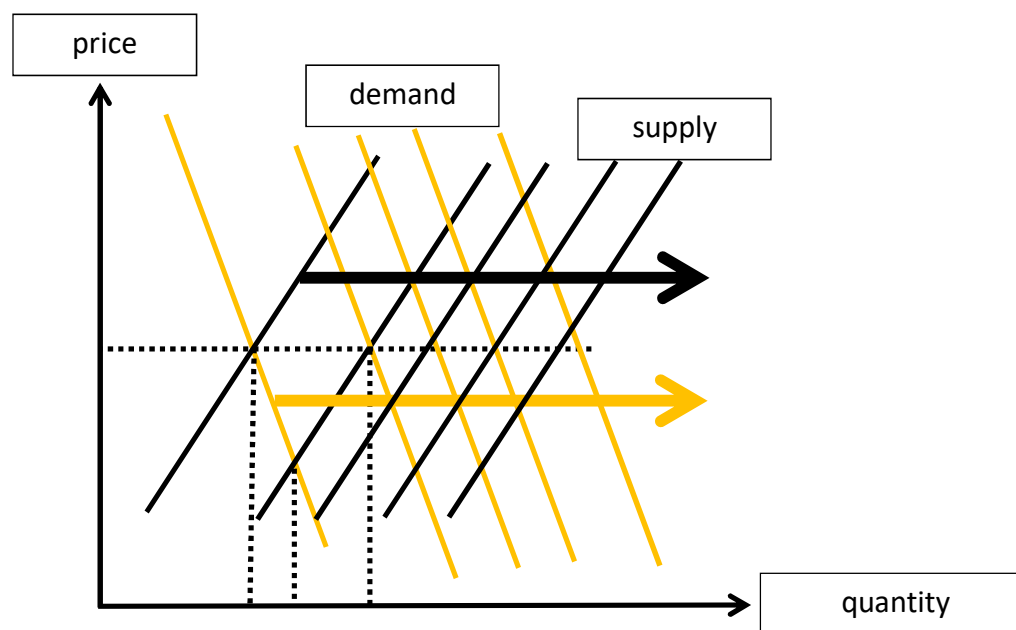


Figure 1: The growth of investment determines a shift of the sectoral demand and supply

In fact, according to this model, the equilibrium price of each sector (i) is determined by the price of the demand of the products/services of this sector (equations: 1, 2 and 3)

- 1)  $X = (I-A)^{-1} (C + I^* + G + EX - IM)$
- 2)  $C_i = f(Y_d, p_i, \text{Productivity}_i^*, X_i^*)$
- 3)  $(EX_i - IM_i) = n_3(p_i, Y_d, X_i^*, \text{external demand, governance})$

and the price of the supply or the cost of the product/services in the same sector (equations: 4, 5 and 6) determined by productivity, the mark-up and by the wages determined in the labour market.

- 4)  $p_i = u_i + w_i N_i / X_i^*$
- 5)  $u_i = f(X_i / X_i^*)$
- 6)  $w_i = f(p_i, u_i, X_i^* / N_i, N)$

Thus, there is a negative (demand side) relationship and a positive (supply side) relationship between price and sectoral production.

$$p_i = f(N_i, X_i, X_i^*, (I-A)^{-1} (C + I + G + EX - IM), I^*, Y_d, \text{productivity}_i^*, \text{external demand})$$

$$p_i = f(X_i / X_i^*) + g(X_i^* / N_i, N)$$

## The process of sectoral restructuring and the increase of GDP

The model indicated above considers the **existence of various sectors** and it is based on the microeconomic equilibrium between the demand and the supply in the market of each sector. **That allows to consider the process of structural change** and the **diversification of the overall economy and of the individual firms**, due to the decline of specific productions with lower productivity and **the creation and growth of new productions**, which have a higher productivity.

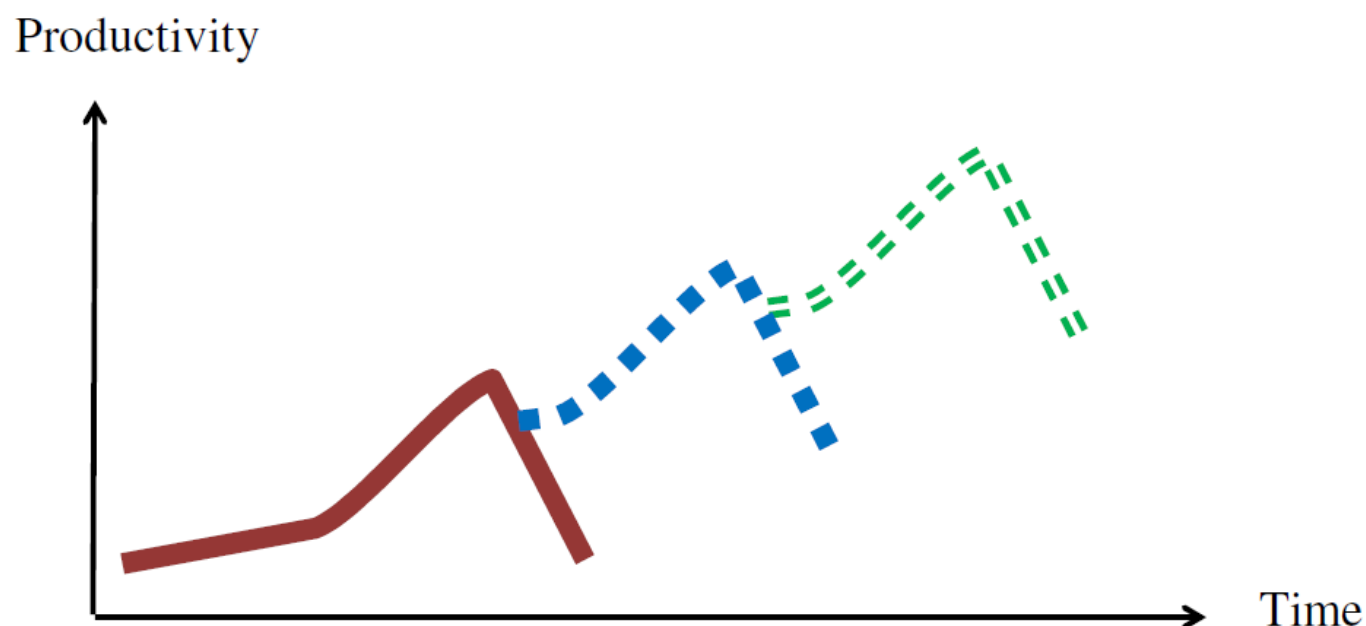


Figure 2: the evolution of productivity and the productions cycles

The **sequence of many different innovation waves**, according to the product life cycle model, determines the creation of new industries and the continuous increase of labour productivity, of wages and incomes and also of the internal demand, which drives the GDP growth.

In particular, **the development of the new productions requires major investments** by new firms and existing firms and various financial instruments: public subsidies and venture capital (early stage) and private equity and bank credit (development phase).

As **the average wage is determined by the weighted average of the wages** in the **various** sectors

$$\mathbf{w} = \sum \mathbf{N}_i / \mathbf{N}_T * \mathbf{w}_i$$

a shift of employment to the sectors with higher wages will increase the average wage and also the national income and then the consumption level and the GDP:

$$1) \quad X = (I-A)^{-1} (C + I^* + G + EX - IM)$$

$$2) \quad C_i = f(Y_d, p_i, \text{Productivity}_i^*, X_i^*)$$

$$6) \quad w_i = f(p_i, u_i, X_i^*/N_i, N)$$

$$7) \quad Y_d = \sum_i w_i N_i + \sum_i u_i X_i$$



## From an analytical model to a policy model for the recovery of the European economy

### The causes of the current crisis are:

- **the insufficiency of the domestic demand** (consumption and investments, private and public), and in the excessive surplus of the Euro area current balance,
- **the lack of a medium-term "Industrial Strategy" at the European scale**, which orients the investments of private companies, also through public investments, towards new strategic productions and societal needs.

The relaunch of growth in Europe requires, alongside the objective of stability of the financial system and the decrease of the public deficit and debt, also a new economic policy, which aims at **an expansion of domestic/internal demand in Europe, in order to pull (according to a “demand led” strategy) innovations and investments for a reconversion towards new productions**, capable of giving an answer to the new needs for a better quality of life for the European citizens.

At the aggregate level, there is **a well-known trade-off between investments inside the country and investment abroad** (either real investment or financial investment), as indicated by the identity between internal private (S) and public saving (T-G) and domestic investment (I) and external investment (X-M):

In fact, **a positive balance of trade indicates a flows of financial funds toward the rest of the world** in terms of direct or real investments or financial investments, such as acquisition of foreign companies, purchase real assets abroad or purchase of foreign stocks and foreign private and public bonds and other forms of lending to foreign actors through various forms of financial securities.

$X - M$  = accumulation of real and financial assets abroad

$$S + (T-G) - I = X - M$$

This identity can also be rewritten as follows and it indicates that internal investment can increase according to the size of internal private and public saving and it decrease when financial funds are transferred abroad or viceversa can increase in the case of inflows of financial funds.

$$I = S + (T-G) - (X - M)$$

**New investments can promote the development of new productions or "lead markets"**, which are linked to collective and not only individual needs and which are concentrated mainly in urban areas and in the European city networks.

In the model the investment directly contributes to the creation of new production capacity and then of new employment

8)  $N_i = f(X_i, X_i^*)$

9)  $X_i^* = \text{Resources}_i * \text{Productivity}_i^*$

**10) Resources stock  $_{it}^* = n_4 (\text{input flows}_{it} \dots, \text{input flows}_{it-n})$**

However, **industrial policy must not only expand the supply** capacity of companies by reducing costs and increasing productivity, **but it must also stimulate consumer demand** for new products that create new markets and can drive the investment effort of companies, diversifying the overall production system.

The role of the demand side is indicated in the model by the equations:

- 1)  $\mathbf{X} = (\mathbf{I} - \mathbf{A})^{-1} (\mathbf{C} + \mathbf{I}^* + \mathbf{G} + \mathbf{EX} - \mathbf{IM})$
- 2)  $C_i = f(Y_d, p_i, \text{Productivity}_i^*, X_i^*)$
- 3)  $(EX_i - IM_i) = n_3(p_i, Y_d, X_i^*, \text{external demand, governance})$

**A greater effort of private and public investment** on innovation and knowledge is necessary, to act on the one hand **on the productivity of companies** and on the other hand **on the orientation of the demand by the citizens towards new models of life and consumption.**

Only an increase of the aggregate demand will pull the increase of investments, which are linked to the increasing collective (“common goods”) and private needs by the citizens and also have a clear economic importance in terms of new employment and new productions, especially in the urban areas and the cities networks, **such the investments in the following new productions:**

- a) food;
- b) housing;
- c) mobility and logistics;
- d) culture, leisure and media;
- e) health, social assistance and education;
- f) environment, energy saving and spatial planning.

**The model does consider the role of the territorial networks** in the development process and in particular the role of knowledge networks. In fact as indicated by the equations:

9)  $X_i^* = \text{Resources}_i * \text{Productivity}_i^*$

10)  $\text{Resources stock}_{it}^* = n_4 (\text{input flows}_{it} \dots, \text{input flows}_{it-n})$

11)  $\text{Productivity}_{it}^* = n_5 (\text{knowledge flows}_t, \dots, \text{knowledge flows}_{t-n})$

12)  $\text{Knowledge flows}_t = n_6 (\text{output flows}, \text{input flows}, \text{knowledge flows}, \text{governance})_{t-1}$

13)  $\text{Input flows}_t = n_7 (\text{output flows}, \text{input flows}, \text{knowledge flows}, \text{governance})_{t-1}$

The material inputs and the immaterial knowledge flows affect the endowment of factors and their productivity and thus determine the production capacity of the various sectors.

**The territory, the urban areas and the cities networks** are the priority political and geographical framework for the new European industrial strategy since the quality of people's life depends on a well-preserved natural and urban environment. The new investments should promote modern productions and new qualified jobs. In fact, **citizens and their living conditions represent the fundamental European "common good" that promotes the strengthening of the European Community.**