



Total Factor Productivity and Transformations of Brazilian Agriculture

Analisis of Agricultural Census Data

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Ministry of
Agriculture, Livestock
and Food Supply



Methodology

1. **Total Factor Productivity Index** (Tornqvist Index), Jorgenson (1996).
2. **Structural Change Index**, Ramos (1991).
3. **Diversification Index**, Hoffmann et alli (1984).
4. **Source of Data**, IBGE and others.
5. **Covering**: 367 products and 11 inputs
6. **Period 1970 to 2006**



Brazil - Comparison of the main Agricultural Census Data

Description	Censos				
	1920	1940	1970	1995	2006
Number of Farms (thousand)	648	1,905	4,924	4,860	5,175
Average Area of farms (hectares)	270	104	60	73	64
% of crops land in comparison to total land area	3,8	9.5	11.6	14.2	18.1
Average of Labor per farm	9,7	5.3	3.6	3.7	3.2
Average of crops area per tractor (ha/ per tractor)	3,893.4	5,572.6	204.9	62.7	72.9
Relationship between land for pasture and total number of bovines	-	2.56	1.96	1.16	0.93
Average yield (kg/ha) Grape	-	-	8,370	11,589	13,057
Average yield (kg/ha) Corn	2,040		1,197	2,442	3,606
Average yield (kg/ha) Beans	1,078		372	507	718
Average yield (kg/ha) Soybean			862	2,334	2,602
Average yield (kg/ha) Sugar - cane	33,736		39,970	62,086	68,876

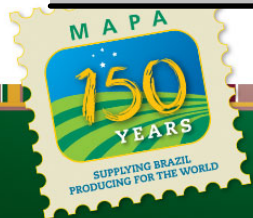
Source: IBGE



Productivity Indexes

BRAZIL	1970	1975	1980	1985	1995	2006
Output index	100	139	173	211	244	343
Input index	100	122	142	149	137	153
TFP	100	114	122	142	178	224
Land productivity	100	135	162	196	230	324
Labor productivity	100	129	158	185	241	348

Source: Gasques, Bastos, Bacchi e Valdes, 2010

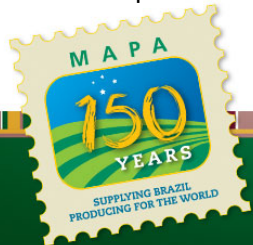


TFP by Regions

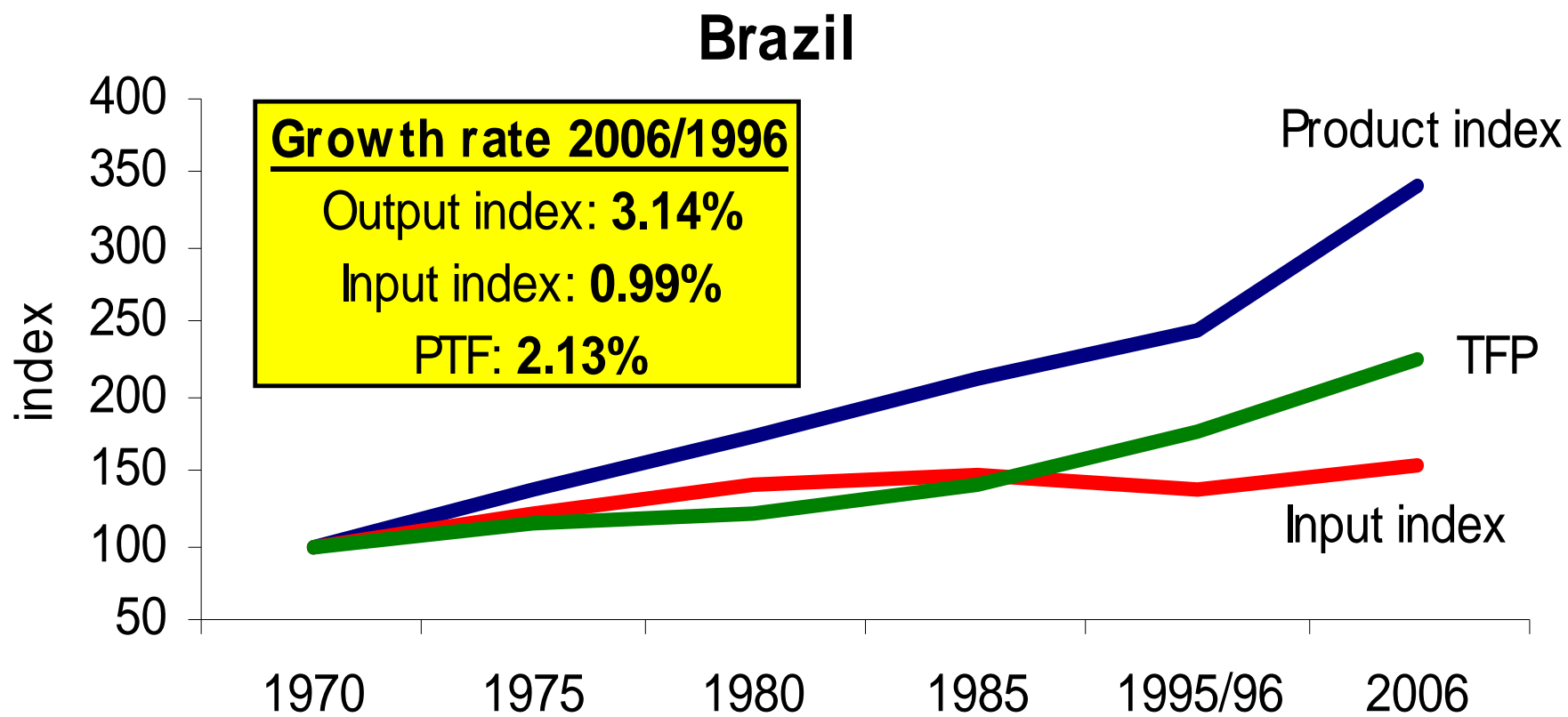
REGIONS	TFP * (100)					
	1970	1975	1980	1985	1995	2006
Brasil	100	114	122	142	178	224
<u>Northeast Region</u>						
Alagoas	100	121	115	146	174	336
Bahia	100	99	92	86	99	180
Ceará	100	166	135	168	238	391
Maranhão	100	94	102	101	123	243
Paraíba	100	123	123	149	207	241
Pernambuco	100	130	139	172	193	308
Piauí	100	123	93	119	174	249
Rio Grande do Norte	100	139	122	156	247	310
Sergipe	100	100	121	120	145	217
<u>Center-west Region</u>						
Distrito Federal	100	130	146	209	260	292
Goiás	100	119	127	204	258	287
Mato Grosso	100	85	117	198	341	518
Mato Grosso do Sul	-	100	130	180	304	315

REGIONS	TFP * (100)					
	1970	1975	1980	1985	1995	2006
<u>North Region</u>						
Acre	100	87	86	72	82	128
Amapá	100	108	137	71	92	228
Amazônas	100	75	75	67	58	72
Pará	100	95	104	95	109	135
Rondônia	100	76	52	78	91	150
Roraima	100	84	119	171	171	320
Tocantins	-	-	-	100	151	101
<u>Southeastern Region</u>						
Espírito Santo	100	99	83	94	109	296
Minas Gerais	100	89	79	105	137	185
Rio de Janeiro	100	127	127	135	156	180
São Paulo	100	117	120	160	164	184
<u>South Region</u>						
Paraná	100	160	192	234	284	343
Rio Grande do Sul	100	98	97	123	149	167
Santa Catarina	100	119	153	189	253	349

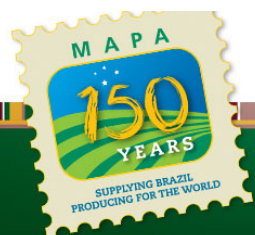
Source: Gasques e Bastos, 2010



Output index, input index and TFP

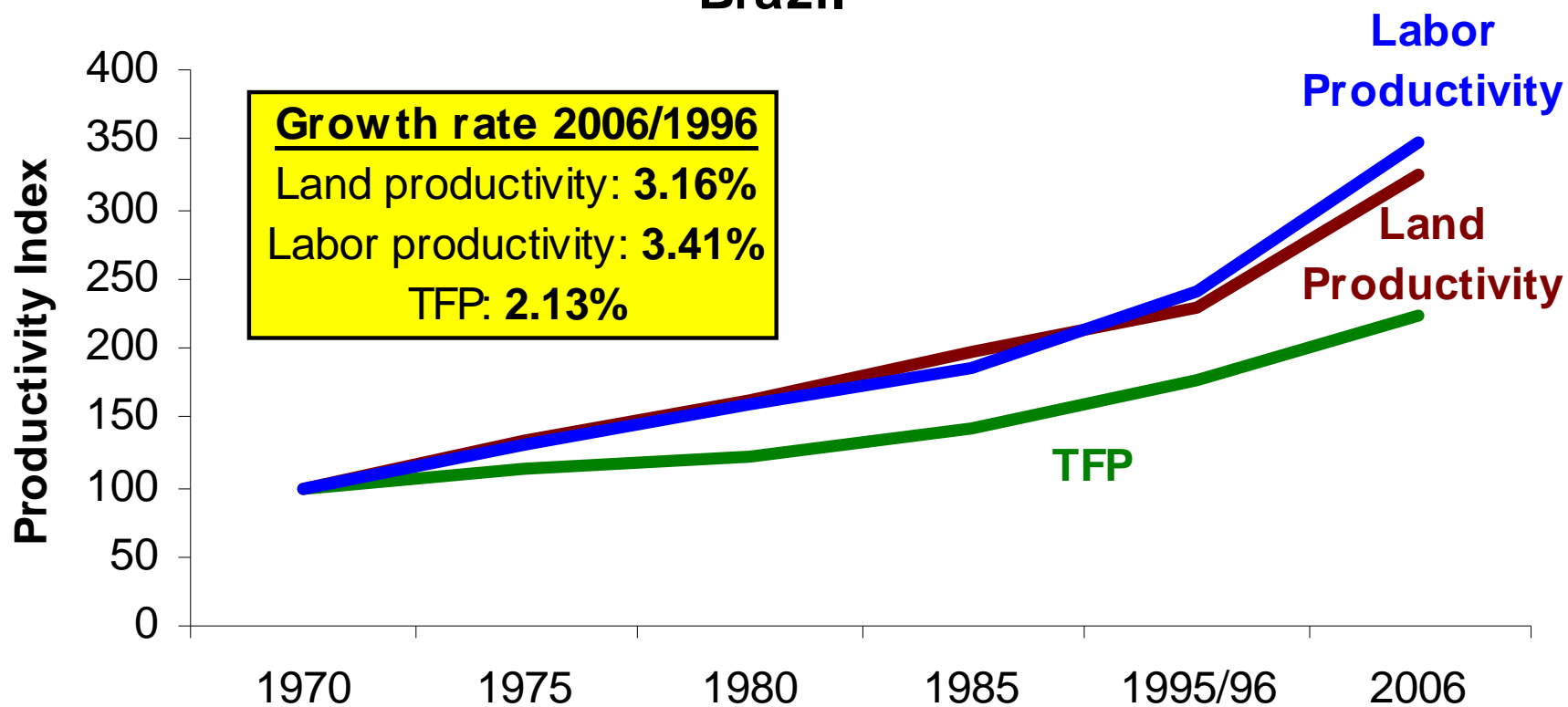


Source: Gasques, Bastos, Bacchi e Valdes, 2010

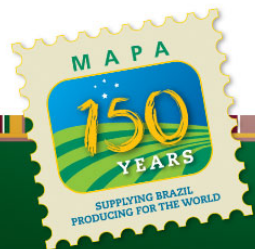


Labor productivity, Land productivity and TFP

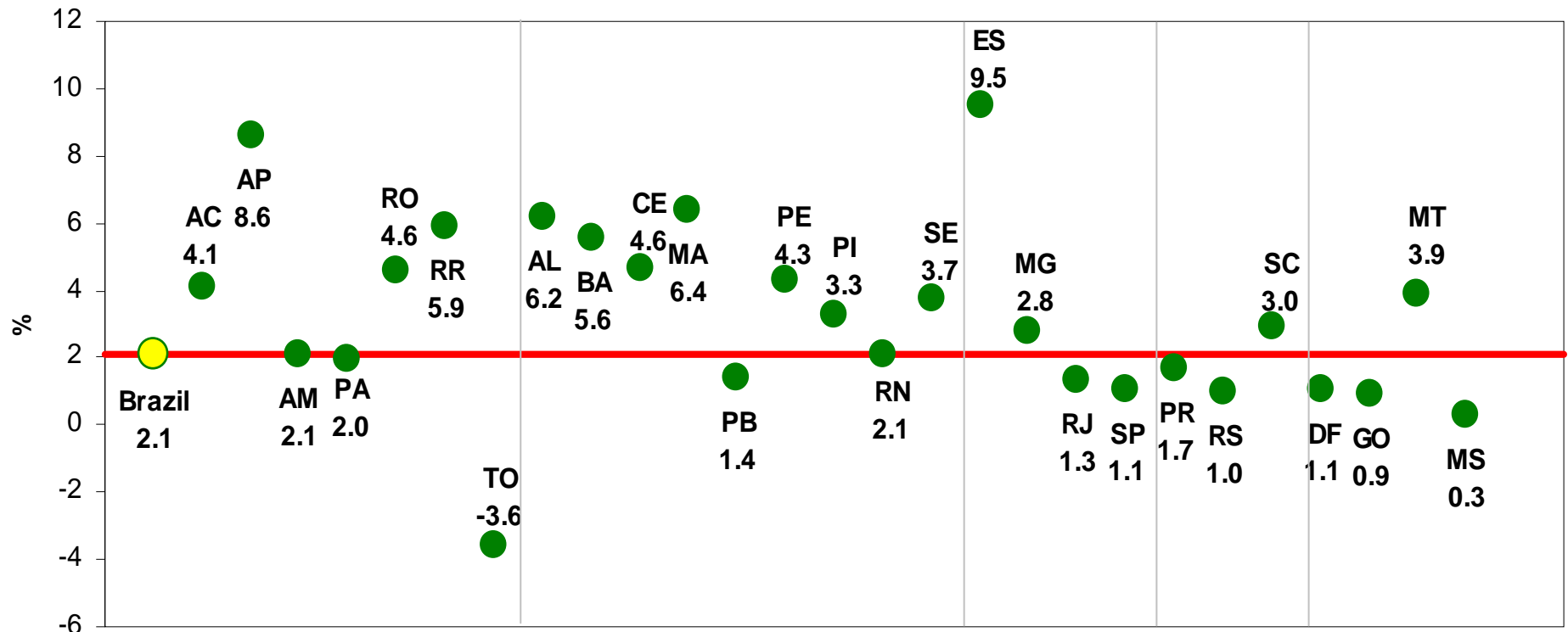
Brazil



Source: Gasques, Bastos, Bacchi e Valdes, 2010



Brazil- Growth rates of TFP by states 1995/96 to 2006



Source: Gasques, Bastos, Bacchi e Valdes, 2010

Legend: AC – Acre, AP – Amapá, AM – Amazonas, PA, Pará, RO – Rondônia, RO – Roraima, TO – Tocantins, AL – Alagoas, BA – Bahia, CE – Ceará, MA – Maranhão, PB – Paraíba, PE – Pernambuco, PI – Piauí, RN - Rio Grande do Norte, SE – Sergipe, ES - Espírito Santo, MG - Minas Gerais, RJ - Rio de Janeiro, SP - São Paulo, PR – Paraná, RS - Rio Grande do Sul, SC - Santa Catarina, DF - Distrito Federal, GO – Goiás, MT - Mato Grosso, MS - Mato Grosso do Sul.

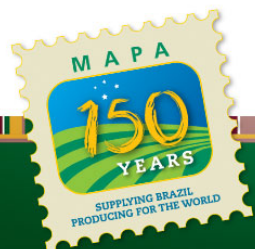


Share in Production Value of 10 principal products - Brazil

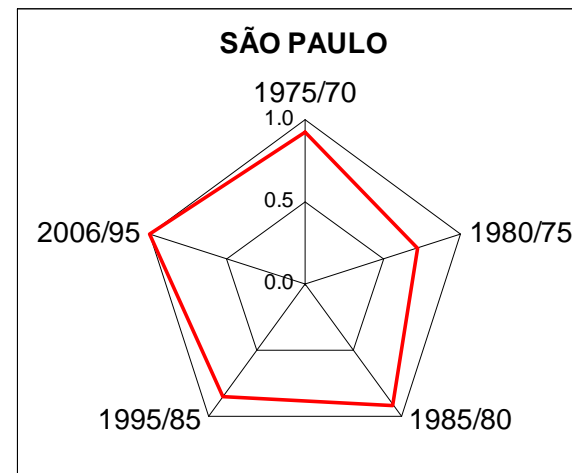
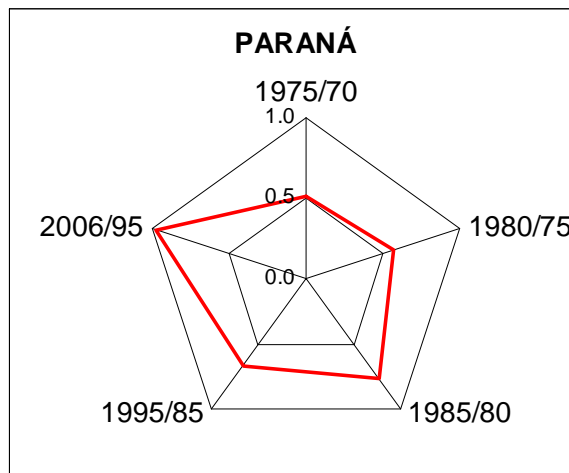
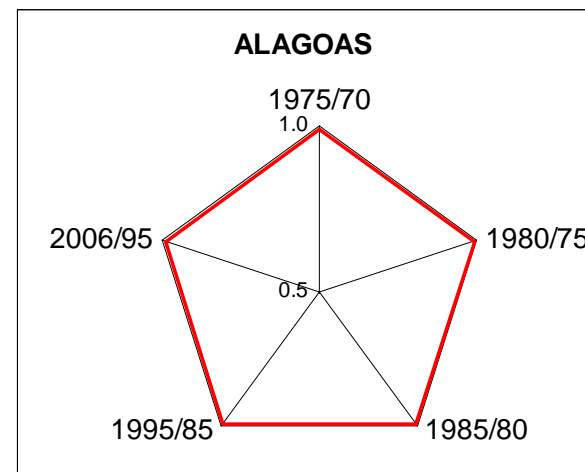
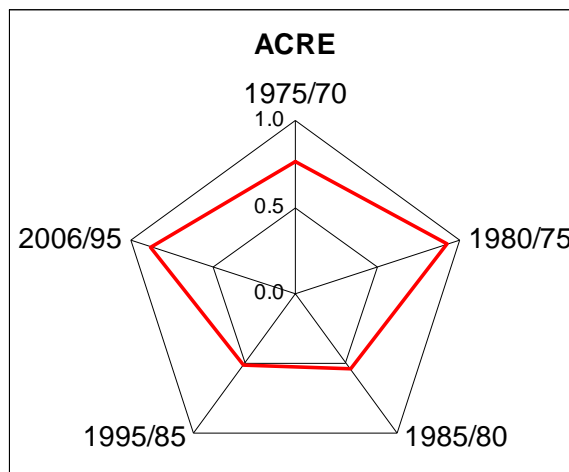
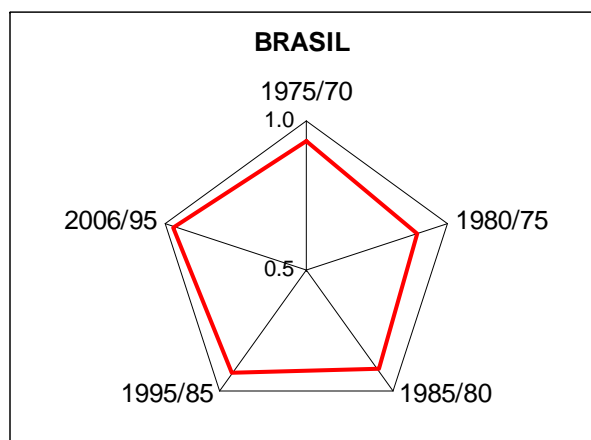
1970		%
1	Bovines	13.7
2	Corn	8.5
3	Milk	7.5
4	Rice	6.8
5	Sugar - cane	6.1
6	Pigs	4.7
7	Coffee	4.6
8	Beans	4.5
9	Manioc	4.5
10	Cotton	3.7

2006		%
1	Bovines	14.1
2	Sugar - cane	12.7
3	Soybean	11.0
4	Corn	7.3
5	Milk	5.7
6	Coffee	5.5
7	Chickens	4.0
8	Banana	3.3
9	Pigs	3.0
10	Orange	2.7

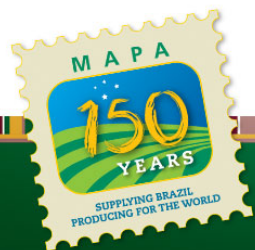
Source: Gasques, Bastos, Bacchi e Valdes, 2010



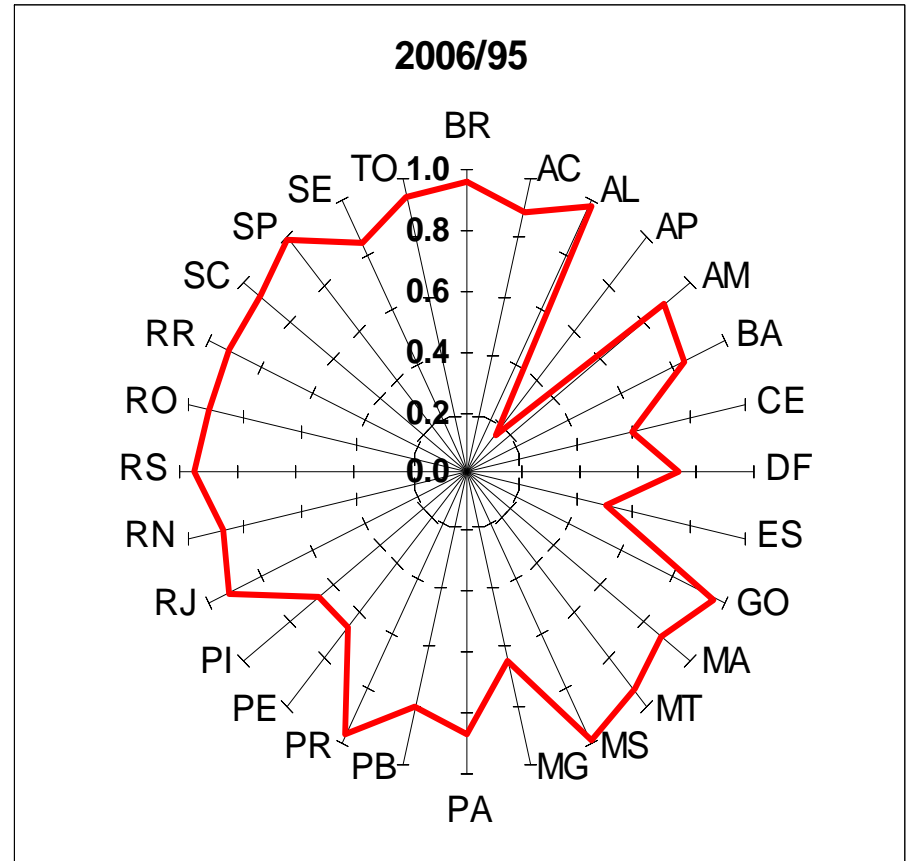
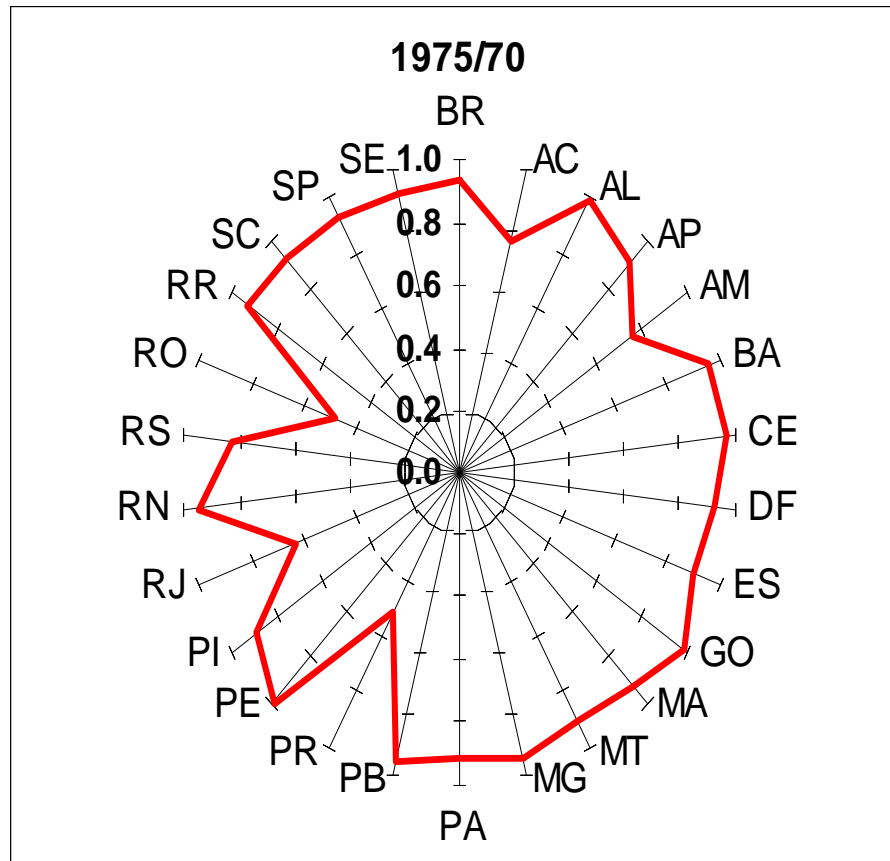
Structural change index



Source: Gasques, Bastos, Bacchi e Valdes, 2010

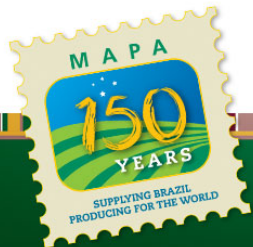


Structural change index

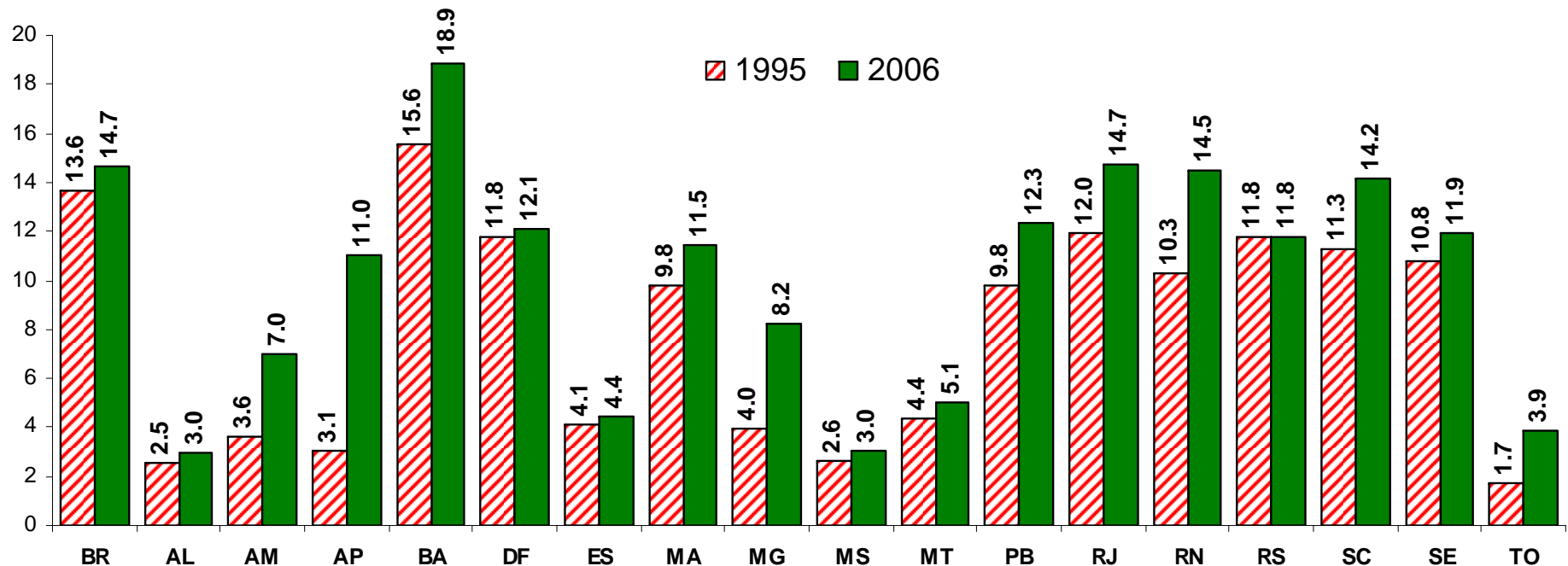


Source: Gasques, Bastos, Bacchi e Valdes, 2010

Note: index variation interval, $0 \leq \cos \theta \leq 1$.
The closer to the center, the greater the structural change



Diversification index



Source: Gasques, Bastos, Bacchi e Valdes, 2010

- Increased the diversification degree

- Tendency to specialization, Acre, Ceará, Goiás, Pará, Pernambuco, Piauí, Paraná, Rondônia, Roraima e São Paulo



Comparison of quantities between data of selected products : LSPA and 2006 Census

Products	2006 Census	LSPA (IBGE)	Absolute Difference	Difference %
Whole Cotton	2,350,132	2,898,721	548,589	18.93
Rice husk	9,447,257	11,526,685	2,079,428	18.04
Coffee beans	2,360,756	2,573,368	212,612	8.26
Sugar - cane	384,165,158	477,410,655	73,080,358	15.31
Manioc	16,093,942	26,639,013	10,545,071	39.59
Corn	42,281,800	42,661,677	379,877	0.89
Soybean	40,712,683	52,464,640	11,751,957	22.40
Wheat	2,257,598	2,484,848	227,250	9.15

Source: IBGE, LSPA and Agricultural Census 2006

