

Structural change in Brazil and in Minas Gerais between 2008 and 2019: an input-output analysis

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Financial support: Fundação de Amparo à Pesquisa do Estado de Minas Gerais (FAPEMIG).

1 Introduction

- The goal of this research is to analyse the driving forces behind the deindustrialization in Brazil and Minas Gerais from 2008 to 2019.
- Brazilian and Minas Gerais economies:
 - Intermediate stage of development;
 - Exports concentrated in natural resources;
 - Deindustrialization began in 1980 in Brazil and deepened from 2009 on.
- Methodology: structural decomposition of the value added; dataset from IBGE and FJP.

2 Literature review

- Structural change and economic growth.
- Driving forces underlying structural change:
 - Supply-side: innovation.
 - Demand-side: consumption preferences.
- Deindustrialization (Palma, 2019):
 - Growing use of services by manufacturing;
 - New international division of labor, including outsourcing;
 - Rapid growth of productivity in the sector;
 - **Shift in the ideological paradigm.**

2 Literature review

- Why the manufacturing sector? Due to dynamic increasing returns to scale, technological externalities, and linkage effects.
- Factors that can lead structural change to the right direction (Rodrik et al., 2016).
 - Exports not concentrated in natural resources;
 - A competitive real exchange rate;
 - Flexible labour markets;
 - **Industrial policy.**
- Premature deindustrialization in Brazil
 - More pronounced in the Southeast.

3 The Economy of Minas Gerais and Brazil: 2008-2019

Main differences:

- Coffee (MG) vs. soybeans (BRA);
- Mining (MG) vs. mining and oil and gas extraction (BRA);
- Iron and steel mills (MG) vs. coke and petroleum refining, and the production of chemicals (BRA);
- Financial and insurance services have a larger share in Brazil.

Table 1: Value Added Percentage by Economic Activity - Minas Gerais and Brazil - 2008/2019 and Percentage Change 2019/2008 (%) – constant prices¹

Value Added	Minas Gerais		Brazil		Minas Gerais	Brazil
	2008	2019	2008	2019	Percentage change ² 2019/2008 (p.p.)	
Agriculture, forestry, farming and fishing	7,3	4,6	4,1	4,9	-2,7	0,8
Agriculture and forestry	4,6	3,3	2,7	3,5	-1,4	0,8
Farming and fishing	2,7	1,4	1,3	1,4	-1,3	0,0
Industry	33,6	27,1	26,6	21,8	-6,5	-4,8
Mining and quarrying	7,1	4,5	3,0	2,9	-2,6	-0,2
Manufacturing	18,0	14,4	17,1	12,0	-3,5	-5,1
Electricity, gas and water supply; sewerage, waste management and remediation activities	4,2	3,3	2,8	3,0	-0,9	0,2
Construction	4,2	4,8	3,6	3,9	0,6	0,3
Services	59,1	68,3	69,3	73,3	9,1	4,0
Wholesale and retail trade; repair of motor vehicles and motorcycles	12,6	12,3	13,9	12,9	-0,3	-0,9
Transportation and storage services	5,4	4,6	4,2	4,5	-0,8	0,3
Accommodation and food services	1,9	2,2	2,4	2,5	0,4	0,1
Information and communication services	1,3	2,2	2,0	3,4	0,9	1,4
Financial and insurance services	4,3	4,6	6,3	7,2	0,3	1,0
Real state services	7,8	10,2	8,1	9,7	2,4	1,6
Services provided to companies	3,7	7,8	5,9	6,7	4,1	0,8
Public administration, public education and health services, defense and compulsory social security services	14,8	16,9	17,9	17,4	2,1	-0,5
Private education and healthy services	3,3	2,0	3,0	3,2	-1,4	0,2
Arts, entertainment and recreation; other services	2,8	4,2	4,5	4,5	1,4	0,0
Domestic services	1,3	1,4	1,2	1,2	0,1	0,0
Total	100,0	100,0	100,0	100,0		

Source: FJP and IBGE.

¹ The deflation method used was the double deflation method, as presented in the following section.

² The differences between the percentage change and the actual numbers are due to rounding.

4 Methodology

- Structural decomposition analysis:

$$\Delta v = \left(\frac{1}{2}\right) (\Delta \widehat{v\bar{a}})(L^1 f^1 + L^0 f^0) + \left(\frac{1}{2}\right) (\widehat{v\bar{a}}^0 \Delta L f^1 + \widehat{v\bar{a}}^1 \Delta L f^0) \\ + \left(\frac{1}{2}\right) (\widehat{v\bar{a}}^0 L^0 + \widehat{v\bar{a}}^1 L^1)(\Delta f)$$

- The first term on the right side of equation represents the variation in the value-added coefficient.
- The second term indicates the change in value added due to technological changes.
- The third term reflects the effect of changes in final demand on value added.

5 Results and Discussion

Resource based industries:

Brazil

- Change in value added: positive.
- Main driver: international exports.

Minas Gerais

- Change in value added :negative.
- Main drivers: efficiency losses (supply shocks).

5 Results and Discussion

Manufacturing sector: the value added decreased between 2008 and 2019 in both Brazil and Minas Gerais.

- The changes attributed to efficiency and technology were negative.
- The main positive influence came from household consumption.

Brazil

Change in value added negative:

- Food and Beverage: efficiency loss.
- Machinery and equipment: investments decline.
- Computer and electronic: efficiency gains.
- Iron and steel: efficiency loss.

Change in value added positive:

- Biofuels: efficiency gains.
- Pharmaceutical products: interlinkages rise and household consumption rise, but efficiency loss.

Minas Gerais

Change in value added negative:

- Food and Beverage: efficiency loss.
- Iron and steel: inter-regional exports decline, but efficiency gains.
- Computer and electronic: efficiency loss.

Change in value added positive:

- Machinery and equipment: interlinkages rise.
- Biofuels: inter-regional exports rise and efficiency gains.
- Pharmaceutical products: efficiency gains and inter-regional exports rise.

5 Results and Discussion

Utilities services and construction:

Brazil

Utilities services

- Change in value added positive.
- Main driver: household consumption.

Construction

- Change in value added positive.
- Main driver: efficiency gains.

Minas Gerais

Utilities services

- Change in value added negative.
- Main driver: efficiency loss.

Construction

- Change in value added positive.
- Main driver: investments.

5 Results and Discussion

Services: the value added increased driven mainly by changes attributed to household consumption.

Only in Minas Gerais two industries experienced a negative value-added change (supply shock and household income decline)

6 Concluding remarks

From 2008 to 2019, the deindustrialization process in Brazil and Minas Gerais intensified due to:

- Efficiency loss;
- Weakened sectoral linkages.

Growth share of the service sector due to:

- household consumption.

Overall, results for Minas Gerais and Brazil were very similar.

Results

Table 4: Change in the value added of primary and resource-based industries due to technological changes and changes in components of final demand - Brazil and Minas Gerais - 2008-2019 - (%).

Industry	Changes in value-added (R\$ milhões)	Change attributed to (%):						Total
		Value-added coefficient (efficiency)	Technological effects	Final demand effects				
				Household consumption	Internacional exports	Interregional exports	Other demands	
Brazil								
Agriculture and forestry	68.765	9,5	5,0	23,2	73,3	-	-11,1	100
Farming and fishing	12.434	2,4	20,5	82,0	15,5	-	-20,3	100
Mining and quarrying	11.883	-233,3	-30,1	87,5	294,0	-	-18,1	100
Total	93.083	-22,4	2,6	39,3	93,8	-	-13,2	100
Minas Gerais								
Agriculture and forestry	-6.287	131,7	63,1	2,2	-86,8	-61,6	51,4	100
Farming and fishing	-6.575	88,4	-13,1	-0,5	-2,9	17,5	10,7	100
Mining and quarrying	-12.326	69,6	8,0	-1,3	22,8	5,4	-4,6	100
Total	-25.188	90	16	-0,2	-11,3	-8,2	13,4	100

Source: Own elaboration.

* The grey shaded lines indicate that the value-added change was negative; thus, a negative change attributed to any factor means that it mitigated the negative value-added change.

Table 5: Change in the value added of manufacturing activities due to technological changes and changes in components of final demand – Selected industries – Brazil - 2008-2019 - (%)

Industry	Technological Intensity	Brazil						
		Changes in value-added (R\$ milhões)	Change attributed to (%):					Total
			Value-added effects (efficiency)	Technological effects	Final demand effects			
Household consumption	Internacional exports	Other demands						
Food and beverages	medium-low	-69.178	104,2	3,0	-12,4	2,1	3,1	100
Leather and related products	medium-low	-925	-729,1	234,4	457,3	230,0	-92,6	100
Coke and refined petroleum	medium-low	-25.010	129,0	14,3	-46,5	-3,8	6,9	100
Biofuels	medium-low	8.897	52,3	27,1	28,7	-1,7	-6,5	100
Chemical and chemical products	medium-high	-10.190	119,8	39,9	-33,6	-55,0	28,8	100
Basic pharmaceutical products and pharmaceutical preparations	high	6.294	-9,1	30,8	82,3	8,8	-12,8	100
Iron and steel mills and manufactured from purchased steel	medium	-11.442	40,8	65,4	-3,5	-15,8	13,0	100
Fabricated metals products, except machinery and equipment	medium-low/medium-high	-3.539	-6,7	80,8	-28,2	-9,3	63,4	100
Computer, electronic and optical products; electrical equipment	medium-high/high	-2.280	-60,5	167,5	-248,4	108,7	132,7	100
Machinery and equipment; Repair and installation services of machinery and equipment	medium/medium-high	-10.801	9,5	49,2	-22,6	-0,7	64,6	100
Motor vehicles, trailers and semi-trailers	medium-high	-14.193	59,2	2,4	14,3	5,8	18,3	100
Wood and products of wood; furniture; and other manufactured goods	medium-low/medium/	-6.179	39,7	72,0	-52,5	2,4	38,3	100
Total (all industries)		-201.242	72,7	27,2	-18,6	-2,6	21,3	100

Source: Own elaboration.

* The grey shaded lines indicate that the value-added change was negative; thus, a negative change attributed to any factor means that it mitigated the negative value-added change.

Table 6: Change in the value added of manufacturing activities due to technological changes and changes in components of final demand – Selected industries – Minas Gerais - 2008-2019 - (%)

Industry	Technological Intensity	Minas Gerais								
		Changes in value-added (R\$ milhões)	Change attributed to (%):							Total
			Value-added effects (efficiency)	Technological effects	Final demand effects					
					Household consumption	Internacional exports	Interregional exports	Other demands		
Food and beverages	medium-low	-7.787	141,1	25,4	-12,5	-7,9	-47,5	1,4	100	
Leather and related products	medium-low	1.292	90,4	-15,2	-57,9	-3,2	86,9	-1	100	
Coke and refined petroleum	medium-low	-379	825,1	-455,6	-408,9	-11,1	157,6	-7,2	100	
Biofuels	medium-low	901	22,3	13,1	21,2	3,2	41,3	-1,1	100	
Chemical and chemical products	medium-high	-1.217	131,9	86,5	-5,4	-23,4	-102,4	12,8	100	
Basic pharmaceutical products and pharmaceutical preparations	high	1.492	46,4	1,6	-5,7	10,1	47,3	0,3	100	
Iron and steel mills and manufactured from purchased steel	medium	-1.862	-102,2	2,7	-14,2	4,8	188,6	20,3	100	
Fabricated metals products, except machinery and equipment	medium-low/medium-high	1.827	59,3	25	13	1,1	12,2	-10,5	100	
Computer, electronic and optical products; electrical equipment	medium-high/high	-4.355	14,6	27,3	-2,6	8	37,4	15,2	100	
Machinery and equipment; Repair and installation services of machinery and equipment	medium/medium-high	3.753	6,3	72,1	6,4	4,5	36	-25,3	100	
Motor vehicles, trailers and semi-trailers	medium-high	-831	-193,6	3,9	23,5	37,1	189,5	39,6	100	
Wood and products of wood; furniture; and other manufactured goods	medium-low/medium/	954	81,4	-16,6	11,3	15,3	5,9	2,8	100	
Total (all industries)		-14.342	78,8	12,0	-15,8	-6,8	10,9	20,8	100	

Source: Own elaboration.

* The grey shaded lines indicate that the value-added change was negative; thus, a negative change attributed to any factor means that it mitigated the negative value-added change.

Table 7: Change in the value added due to technological changes and changes in components of final demand – Brazil and Minas Gerais - 2008-2019 - (%)

Industry	Changes in value-added (R\$ milhões)	Change attributed to (%):						Total
		Value-added coefficient (efficiency)	Technological effects	Final demand effects				
				Household consumption	International exports	Interregional exports	Other demands	
Brazil								
Electricity, gas, water supply, sewerage and waste management	32.356	-32,6	42,2	80,1	10,7	-	-0,4	100
Construction and construction works	43.291	106,2	-3,8	4,5	2,4	-	-9,4	100
Total	75.648	46,9	15,9	36,8	6,0	-	-5,6	100
Minas Gerais								
Electricity, gas, water supply, sewerage and waste management	-3.914	140	11	-39,1	-5,2	-4,7	-2	100
Construction and construction works	4.670	-95,9	70,6	4,8	-0,1	-17,2	137,8	100
Total	756	-1.317	380	231,6	26,2	-82,0	861,8	100

Table 8: Change in the value added of service sector due to technological changes and changes in components of final demand - Brazil and Minas Gerais - 2008-2019 - (%)

Industry	Brazil							Minas Gerais							
	Changes in value-added (R\$ milhões)	Change attributed to (%):						Changes in value-added (R\$ milhões)	Change attributed to (%):						
		Value-added effects (efficiency)	Technological effects	Final demand effects			Total		Value-added effects (efficiency)	Technological effects	Final demand effects				Total
				Household consumption	Internacional exports	Other demands					Household consumption	Internacional exports	Interregional exports	Other demands	
Wholesale and retail trade; repair services of motor vehicles and motorcycles	40.367	-220,4	39,8	286,2	39,3	-45,0	100	2.341	-532,2	54,2	424,8	45,8	169,4	-62	100
Transportation and storage services	46.457	13,2	13,8	58,9	24,1	-10,0	100	-2.964	198,9	-351	-157,7	17,1	386,2	6,6	100
Accommodation and food services	24.004	-49,6	-17,3	160,3	1,7	4,9	100	2.792	-16,3	26	72,3	15,5	-2,3	4,8	100
Financial and insurance services	107.571	9,2	-8,4	94,1	2,6	2,5	100	3.156	-13,6	31,7	88,3	0,9	-16,7	9,4	100
Services provided to companies	95.216	2,3	38,5	40,5	17,6	1,0	100	24.528	12,8	52,5	8	-0,2	9,2	17,8	100
Public administration, public education and health services, defense and compulsory social security services	96.987	-28,6	-7,5	6,4	1,2	128,5	100	16.643	20,2	8,2	0,8	0,1	-0,1	70,8	100
Private education and health services	35.132	29,7	7,7	42,4	5,0	15,2	100	-6.632	52,2	-25,3	93,5	0,1	0,4	-20,9	100
Arts, entertainment and recreation; other services	34.147	-73,0	1,8	181,4	1,0	-11,2	100	9.011	13,6	-15,6	115,7	-0,8	-4,9	-8	100
Total (all industries)	754.795,7	6,9	-8,1	76,6	7,5	17,2	100	71.722,0	-19,5	37,6	64,9	1,4	-8,1	23,7	100,0

Source: Own elaboration.

* The grey shaded lines indicate that the value-added change was negative; thus, a negative change attributed to any factor means that it mitigated the negative value-added change.