Just Transition and the Labour Market in South Africa

Measuring Individual and Household Coal Economy Dependence

Presidential Climate Commission and DPRU Webinar

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Outline

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- Characteristics of Coal Industry Jobs: Profiling Coal Industry Workers
- Households Linked to Coal Industry: Exploring Dependency
- Concluding Remarks and Discussion on Just Transition Numbers

Introduction

Background: The Environmental and Economic Imperatives to Transition (Justly)

- Climatic stabilisation imperative from Paris Agreement: Necessitates transition from fossil fuel based economic production and processes.
- NEED to shift away from coal: South Africa has a larger dependence on coal for energy and a larger CO_2 emitter than the global average.
  - 86% (36%) of primary energy supply and 85% o(40.3%) f CO2 emissions (Richer, Roser & Rosado, 2022).
- Important to note: South African economy at early (natural) stages of transition away from coal.
- However, not without socio-economic costs as coal has direct and indirect economic footprint:
  - Relatively cheap energy
  - Export revenue (USD 3.8b and 3.97% of total merchandise exports)
  - Source of employment and livelihood
- *Note*: potentially costly to hinder or delay transition (e.g. trade protocols demanding EVs or green steel).

Motivation and Research Objective

- Discussions about JT: Based on rigorous and robust empirical estimates of size and shape of the coal labour market.
- Understanding labour market implications associated with transition is key factor shaping policy choices.
  For example:
  - Age distribution of coal mine workforce
  - Occupational distribution
  - Relative quality of jobs
  - Spatial dimension of jobs
  - Household dependency and vulnerability

- Provide a robust quantitative estimate of jobs associated with coal sector in South Africa.
- Profile characteristics of individuals and households linked to coal sector.
- As such, we address the following research questions:
  - How many individuals are employed in coal industry?
  - How many households are dependent on incomes derived from jobs in coal sector?
  - What is the spatial allocation of these jobs?
  - What are the socio-economic characteristics of the individuals and households associated with coal sector jobs?

- Note: focus on coal sector and not coal value chain

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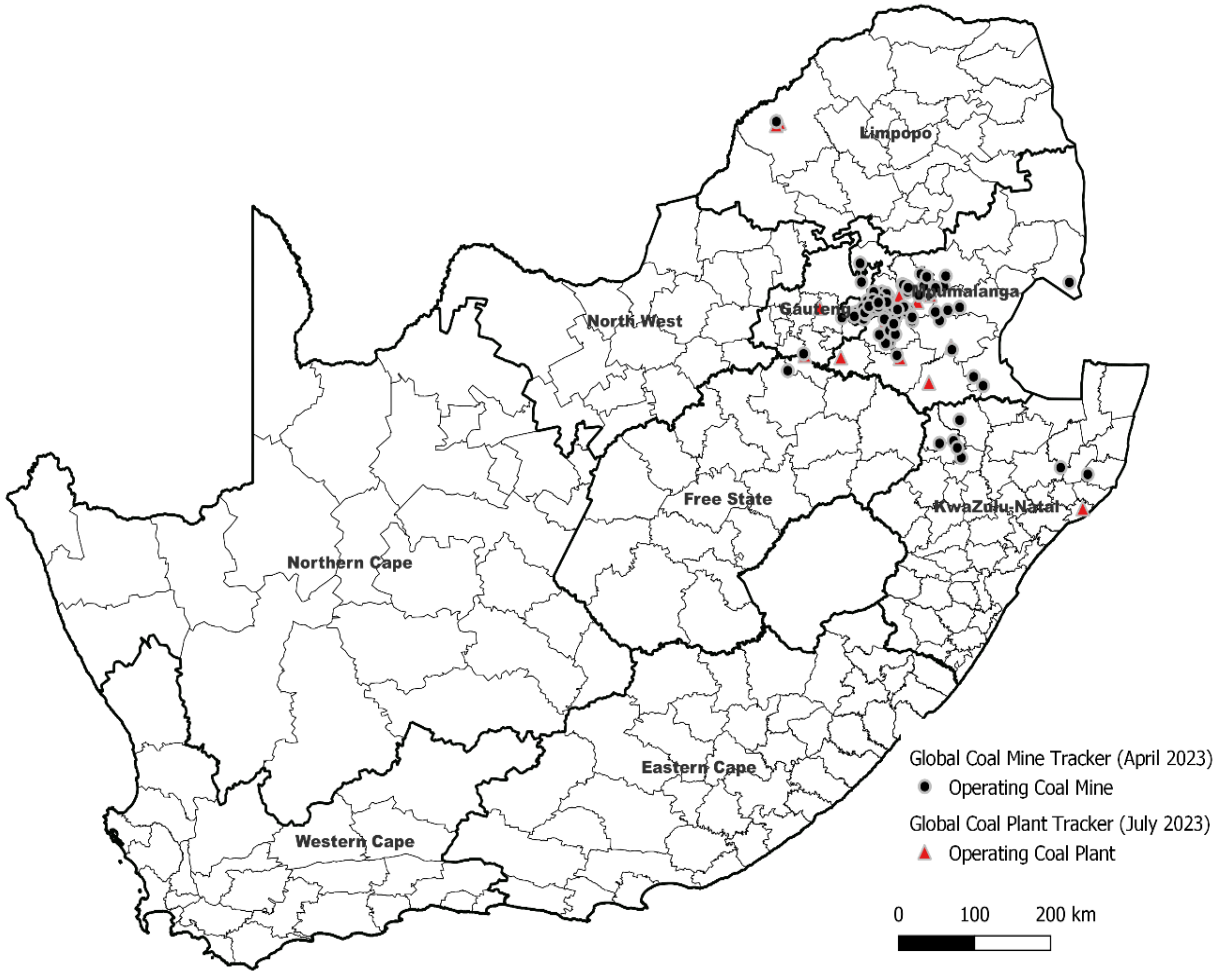
South African Coal Mining Landscape

Spatial Location and Economic Contribution

Spatial Distribution of Coal Mining and Coal-Fired Electricity Production

Spatial Location Of Coal Mines And Coal-fired Power Plants In South Africa



Coal labour market is **concentrated regionally.**

- 78 operating coal mines in South Africa, 65 (or 83%) located in Mpumalanga, account for 80% percent of total coal production.
  - One coal mine in Limpopo, accounts for about 10% of total production.
- Coal Industry concentrated within 5 mining companies – Seriti, Sasol, Exxaro, Thungela and Glencore – together account for 77% of all coal production.
- 11 of 14 coal-fired power plants operated by national utility located in Mpumalanga (70% of operating capacity).

Source: Global Energy Monitor (2023a; 2023b)

Spatial Distribution of Coal Mines

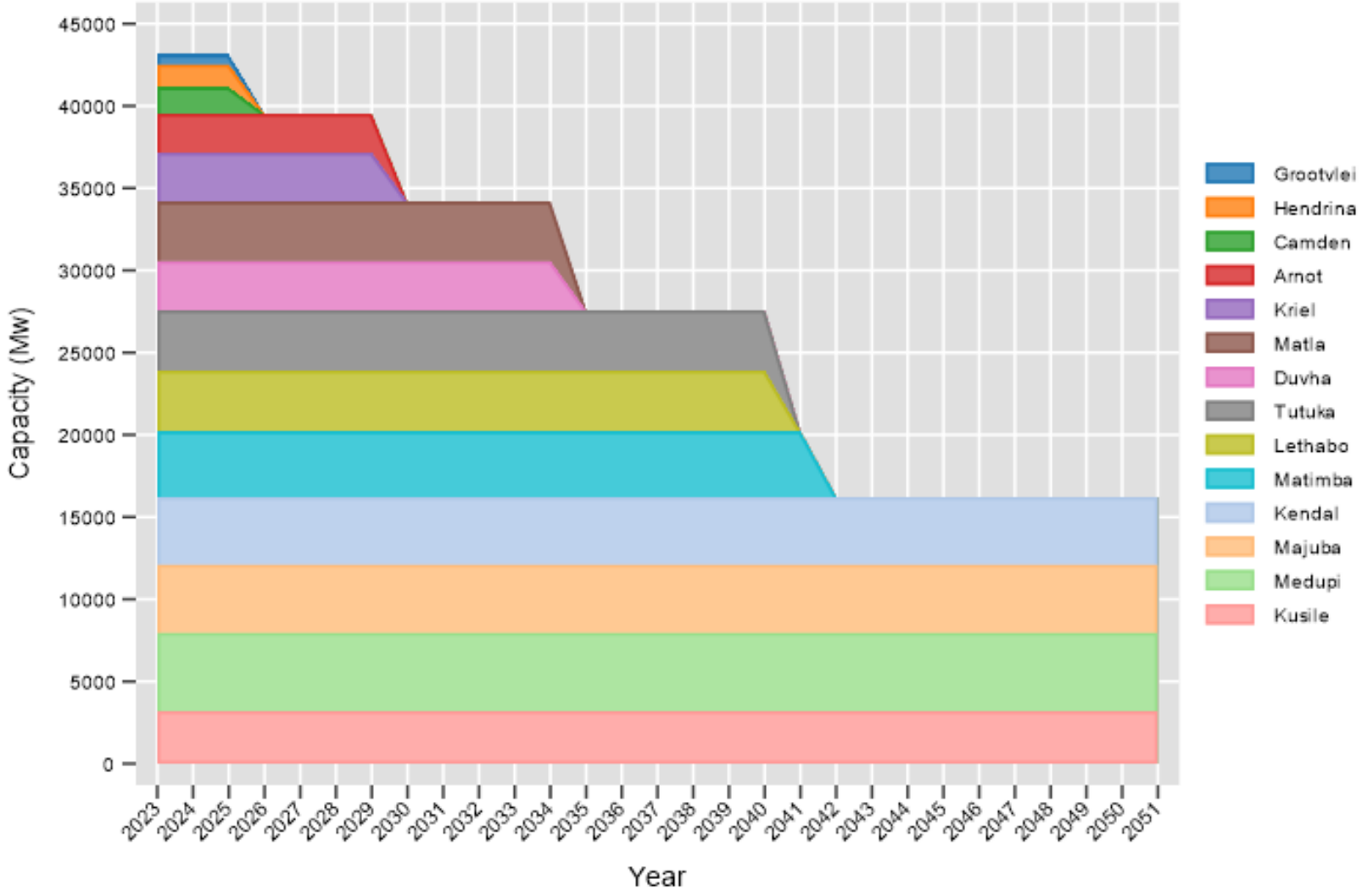
Province or Municipality	No. of mines	No. of companies	Total annual production (Mt)	Share of total SA production (%)	Life of mine (Years)		
					Mean	Median	Max
Free State	2	2	19.7	7.3	19	19	19*
Gauteng	2	1	2.8*	1.0	10	10	14
KwaZulu-Natal	8	7	4.1	1.5	17	16	25
Limpopo	1	1	26.9	9.9	20	20	20
Mpumalanga	65	33*	217.4	80.3	11	14	50
Emalahleni	18	13	84.8	31.3	13	11	30
Govan Mbeki	6	3	31.9	11.8	20	25	30
Msukaligwa	3	3	2.4*	1.1	..	..	..
Steve Tshwete	13	10	41.7	15.4	9	7	23
Victor Khanye	11	8	32.0	11.8	15	8	50
Other	14	16	24.7	9.1	17	20	25
Total	78	44*	270.9	100.0	15	13	50

Source: Global Energy Monitor (2023a)

Notes: Other refers to mines located in the other local municipalities within the Mpumalanga province. Number of companies in Mpumalanga local municipalities exceeds that of province due to mining companies operating multiple mines. Asterisks indicate missing data when compiling the aggregate or an approximation based on existing data.

- Spatial distribution of mines within Mpumalanga province is further concentrated within several local municipalities located in western parts of the province.
  - Emalahleni (18)
  - Govan Mbeki (6)
  - Msukaligwa (3)
  - Steve Tshwete (13)
  - Victor Khanye (14)
- 70% of national coal production in these 5 municipalities.
- Mean life of mine is 15 years (natural transition).

Planned Retiring of Coal-Fired Power Plants
Natural (Endogenous) Transition

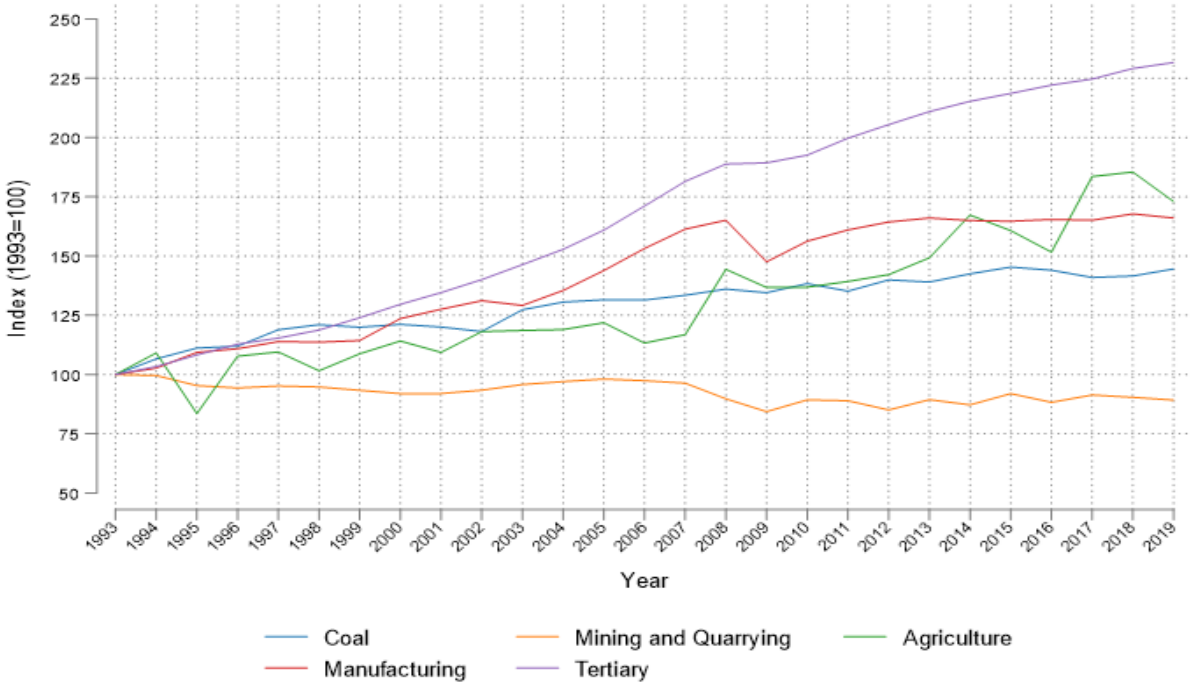


Source: Global Energy Monitor (2023b) and adapted from Cole et al. (2023)

- Grootvlei, Hendrina, Camden, Arnot and Kriel set for retirement by 2030.
  - 21.5% of current coal-fired power production.
- Matla and Duvha power stations are set to retire by 2034
  - Thus, over a third (36.6%) of the national utilities coal -fired power production will be retired in just over a decade (12 years).
- By 2040, Tutuka, Lethabo and Matimba set to retire
  - Approximately half (53.5%) of the coal fleet is set to be retired in just over 15 years' time.

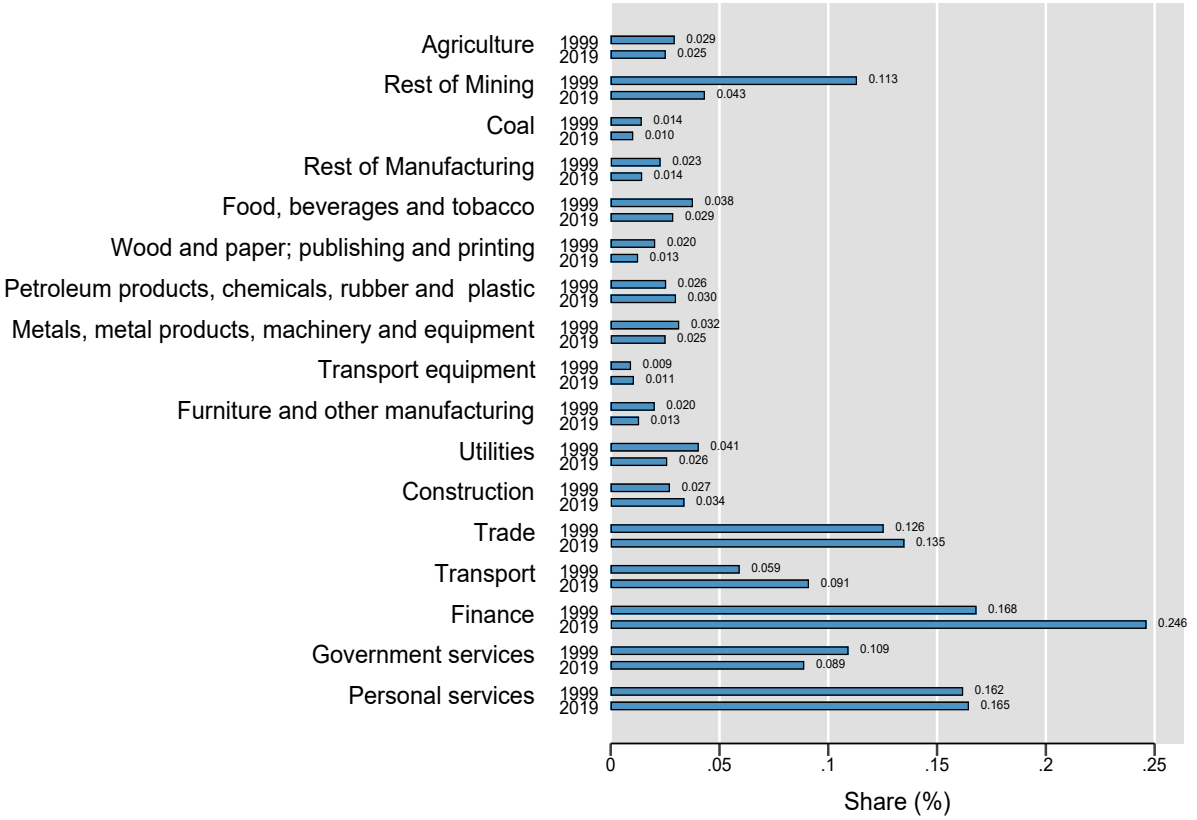
Economic Footprint of Coal Mining Industry

Growth and Share of Value-Added by Sector/Industry, 1993-2019



- But, contribution to national GVA is relatively small (1% of GVA in 2019).
- And has declined slightly (1993: 1.4% → 2019: 1.0%).
- Small in relation to several manufacturing industries, which present pathways to (re)industrialisation.

- The coal industry is a core component of SA mining sector
  - Approx. 20% of mining sector GVA in 2019.
- And its relative contribution to the sector has grown since 1993
  - 1993: 13% → 2019: 20%.



Economic Footprint of Coal Mining Industry

Coal Export Performance and Coal Value Chain

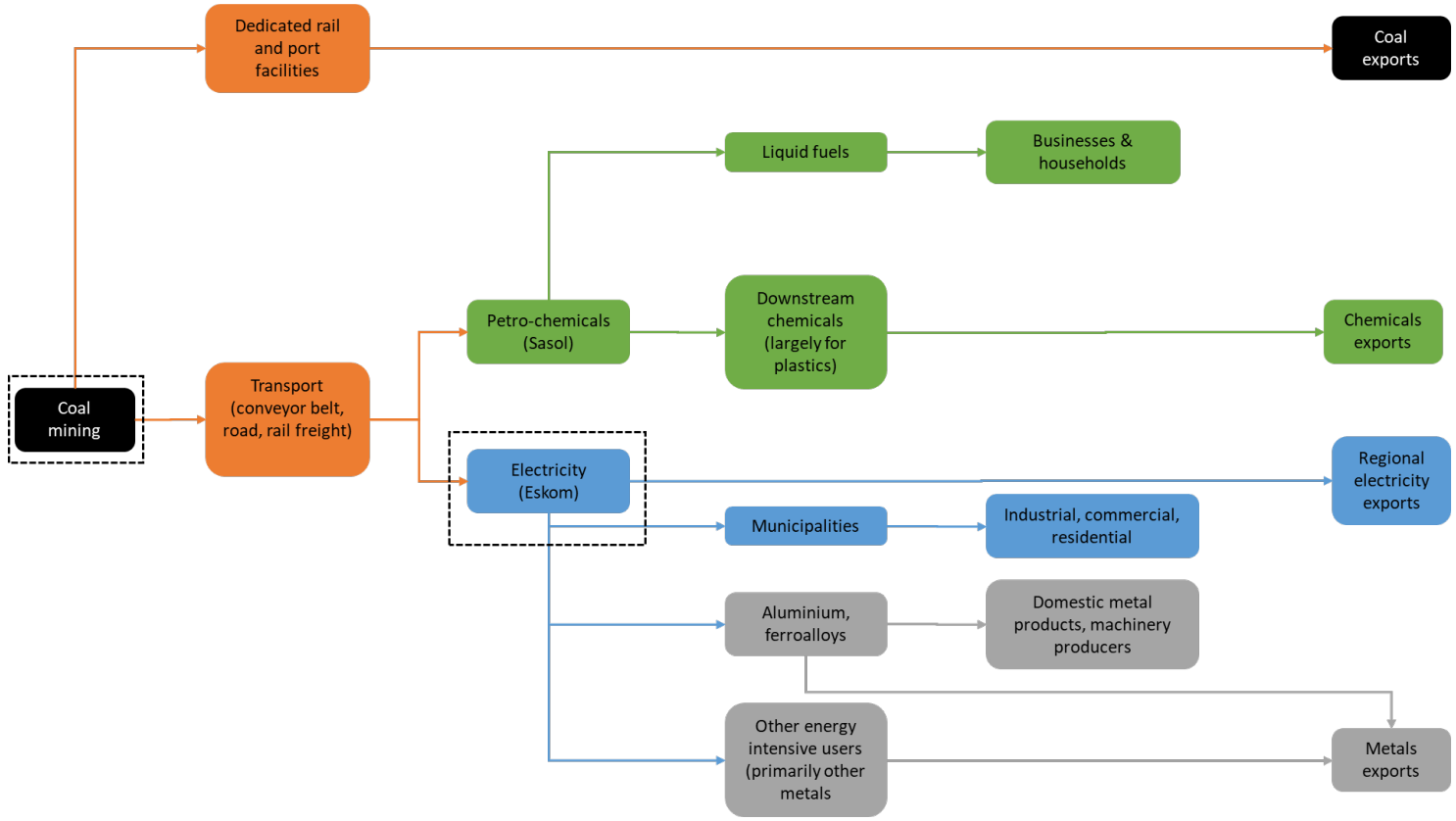
Product/sector	Levels (USDm)		Shares		Growth (%p.a.)
	1998	2019	1998	2019	1998-2019
Coal	**1 553**	**4 883**	**0,065**	**0,048**	**0,053**
Agriculture	2 737	9 995	0,115	0,098	0,061
Mining (less coal)	7 848	30 131	0,330	0,295	0,063
Commodity-based manufacturing	3 793	22 829	0,159	0,223	0,085
Non-commodity-based manufacturing	7 826	33 480	0,329	0,327	0,068
Total	23 807	102 247			0,068

Source: Growth Lab at Harvard University (2019)

Coal is an important source of export revenue.

- 5th largest export (4-digit level) – 4.8% of total merchandise exports in 2019.
- But, underperformed in terms of relative growth.

- Coal industry's economic contribution felt more acutely in its downstream linkages to other industries - i.e. the coal value chain.
  - Transport (rail and road), petrochemicals, metal products and machinery, electricity production (Makgetla et al., 2019).
- Critical and significant employer in a province with very few alternative economic opportunities.



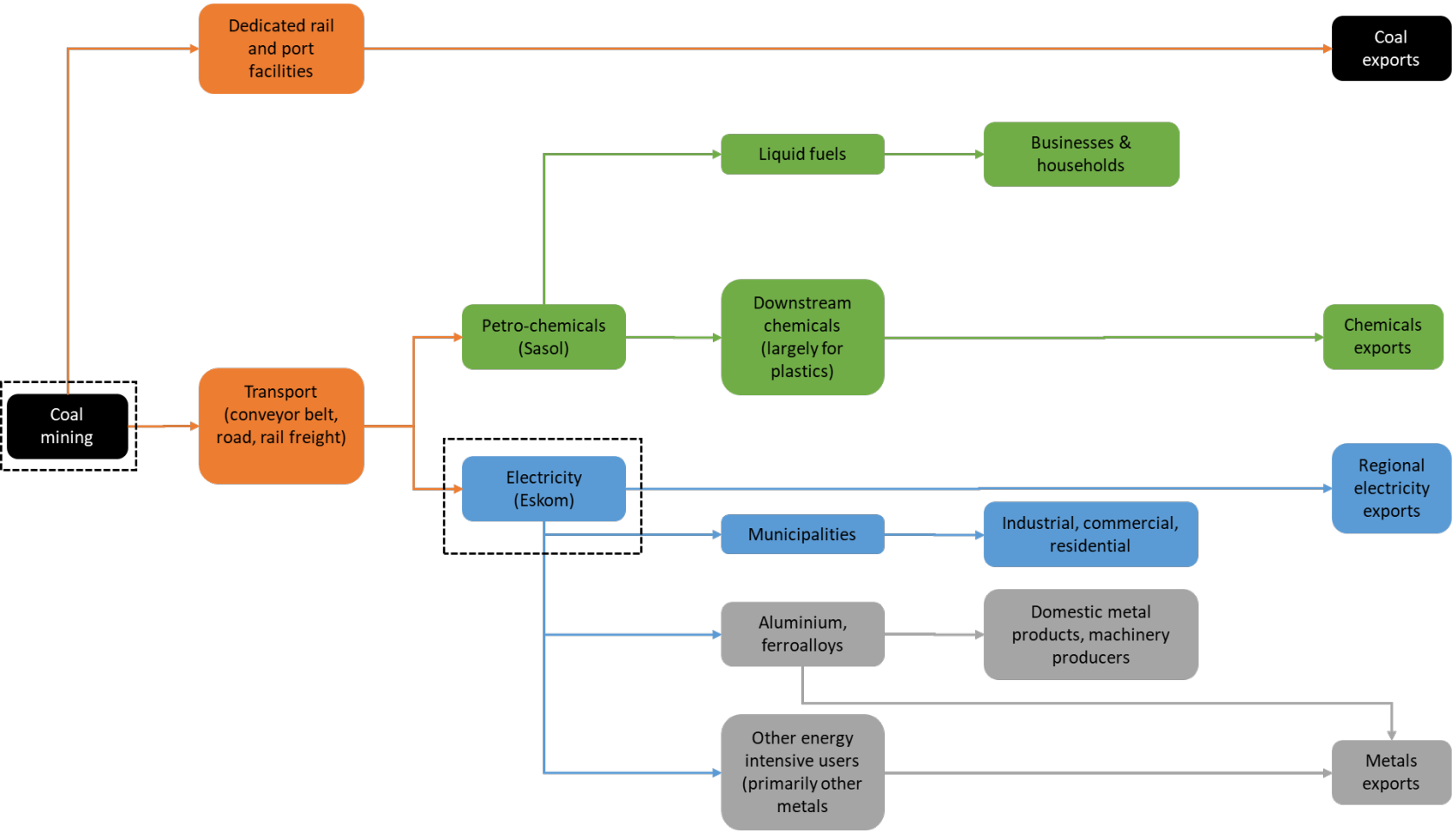
Source: Adapted from Makgetla and Patel (2021: 15)

Empirical Approach

Defining the Scope of Study

Empirical Approach: Defining the Scope

Coal Value Chain in South Africa



Source: Adapted from Makgetla and Patel (2021: 15)

Coal value chain

- Wide range of producers and consumers in the value chain – with significant and heterogenous impacts emanating from a decarbonization growth trajectory.
- Four types of activities that comprise coal value chain:
  - Power generation (53% of non-exported coal)
  - Petro-chemicals (33%)
  - Metals (12%)
  - Transport
- Measurement is analytically and empirically tricky principally due to data challenges. E.g.:
  - Downstream chemicals
  - Transport and level of aggregation

Empirical Approach: Defining the Scope

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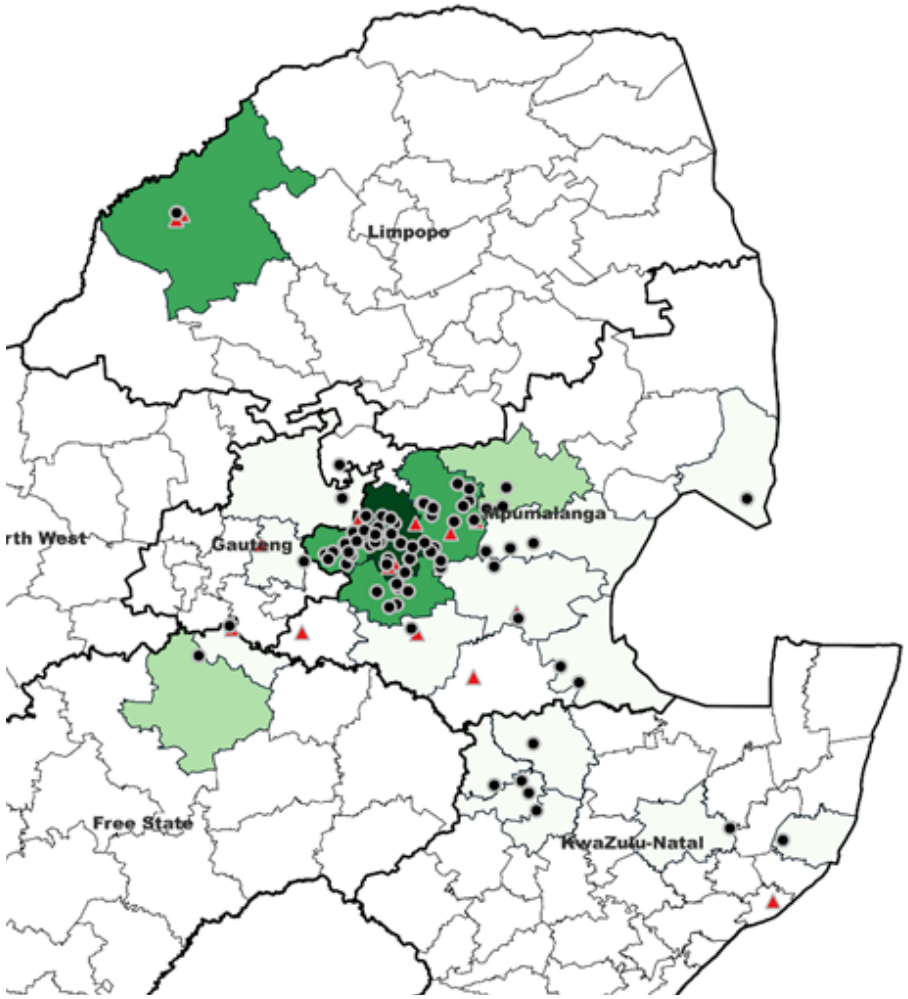
Industry dimension

- Direct employment
  - Mining of coal and lignite (SIC210)
- Indirect employment
  - Employment linked to production of electricity
  - Production, collection and distribution of electricity (SIC411)
- Existing estimates of employment in coal value chain, these industries constitute the bulk share – 68%.

Spatial dimension

- Coal mining and coal power generation is regionally concentrated in the Mpumalanga (MP) province, and in particular, four local municipalities:
  - eMalahleni (Witbank); Steve Tshwete (Middelburg); Govan Mbeki; Msukaligwa (Ermelo) – four dark green municipal areas.



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Data

Sources, Limitations and Approach

JT Labour Market: Data Sources

Publication	Source	Type of survey	Unit of analysis	Measurement objective
Post-Apartheid Labour Market Series (PALMS)	Developed by DataFirst (UCT). Harmonisation of existing household surveys conducted by Statistics South Africa.	Household	Individual	• Employment estimate
Labour Market Dynamics (LMD) (2008-2019)	Statistics South Africa	Household	Individual	• Individual characteristics • Job characteristics
Census 10% sample (1996; 2001; 2011)	Statistics South Africa	Household	Individual + Household	• Individual characteristics • Household characteristics
Mining industry Report (N0201-01-02 (2009; 2012; 2015; 2019)	Statistics South Africa	Firm Census	Mine (plant)	• Employment estimate
Bulletin B1/2020 Minerals Statistical tables 1998-2019	Department of Mineral Resources and Energy (DMRE), Mineral Economics	..	..	• Employment estimate

- Data on the Coal LM drawn from a variety of sources for verification, cross-confirmation and to maximise variable list.
- Individual-level data include the PALMS, LMD surveys and the Census.
- Coal Employment [both the coal mining industry (SCI210) and coal-fired electricity production (SIC411)], for 1994-2019.
- Must though also include firm-level data and this would come in the form of SSA Mining Census data (4 discrete years) and DMRE data.
- *Note:* Last two only really used for population estimates of coal workers – no indiv. charac. data.

JT Labour Market: Data Limitations

Data Source	Period	Geographic locality	No. workers in coal mining		No. of Households linked to coal workers
			Unweighted	Weighted (000s)	Unweighted
Quarterly Labour Force Survey	2019:Q3	National	84	83.3	75
		Mpumalanga	72	72.8	64
Labour Market Dynamics	2019	National	315	76.4	153
		Mpumalanga	272	66.3	129
Census	2011	National	5503	68.9	5036
		Mpumalanga	4361	55.0	3960
		eMalahleni	*2061*	*25.8*	*1858*
		Steve Tshwete	*931*	*11.8*	*840*
		Govan Mbeki	*269*	*3.5*	*254*
		Msukaligwa	*498*	*6.4*	*443*

Source: Quarterly Labour Force Survey 2019:4 (Statistics South Africa, 2020); Census 2011 10% Sample (Statistics South Africa, 2015a)
Notes: Individuals employed in coal mines defined as those working in industry SIC code 210 'Mining of coal and lignite'

- Challenge of Statistical Representativity: QLFS industry data (at 3-digit level-coal mining, SIC210), only representative at national level, not provincial (i.e. Mpumalanga), or lower (i.e. municipal).
- Disaggregating: Risk of small sample bias → Statistically noisy results.
- Combat small sample bias: Pool quarterly QLFS data – LMDS.
- Also: Use Census (10% sample) data. Disadvantage: Only available for 1996, 2001 and 2011.
- Also use firm-level data: Mining Census and DMRE data.
- Profile individual charac. of coal mining industry workers: LMD data and cross-check the corresponding estimates with the larger sample size Census data.
- Profile job charac. of coal mining sector workers: LMD data.
- Profile household charac. of coal mining sector workers: Census data.

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Employment in Coal Industry

Moving Towards a Robust Quantitative Estimate of Jobs in Coal Industry

Differences in JT Labour Market Estimates

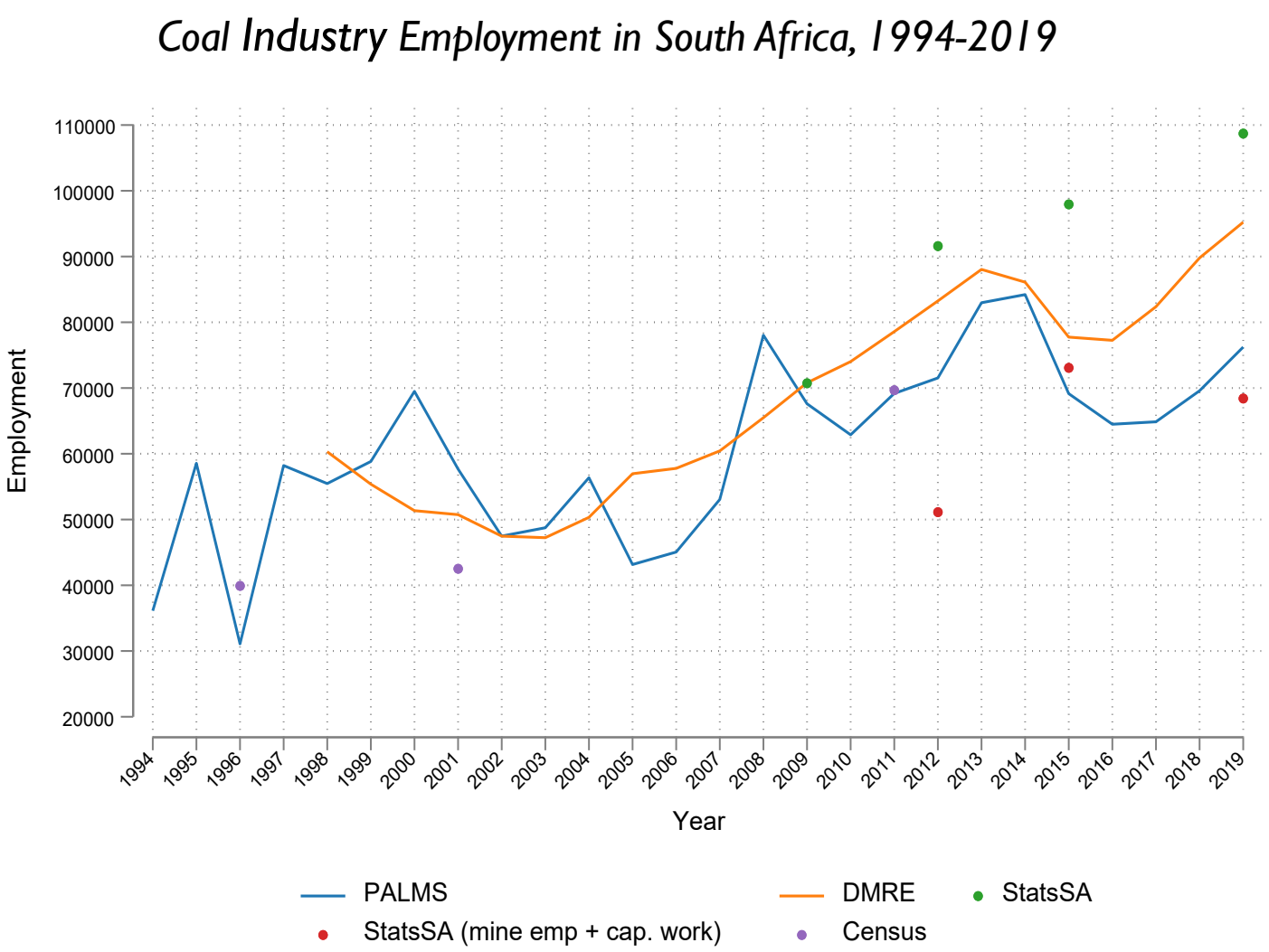
Differences in Coal Employment Figures Between Data Sources, 1996-2019

Year	Household surveys		Firm Surveys		Employ-ment Range	Share of		
	PALMS	Census	Mining Census	DMRE		Total	Formal Emp.	Mining Emp.
1996	31 085	39 918	..		31-40k	0.30%	..	11.2%
2001	57 676	42 524	..	50 740	42-57k	0.48%	0.71%	10.81%
2011	69 173	69 684	..	78 579	68-78k	0.49%	0.65%	20.11%
2012	71 530	..	91 605	83 244	71-92k	0.51%	0.65%	19.43%
2019	76 230	..	108 717	95 221	76-108k	0.46%	0.62%	19.05%

Source: Authors' calculations using PALMS (Kerr, Lam & Wittenberg, 2019); South Africa Census (Statistics South Africa, 1998; 2003; 2015a); Mining Census (Statistics South Africa, 2011; 2014; 2017; 2021a); Department of Mineral Energy (2020).
Note: Share of total employment estimated using PALMS estimates

- Key table in that we reconcile the different data sources around coal industry employment.
- PALMS/QLFS is fairly reliable when cross-checked against Census data.
- General trend of increasing employment.
- Key first-order estimate of the direct number of jobs in the coal industry – carefully constructed.

National Coal Industry Employment, 1994-2019



Source: Authors' calculations using PALMS (Kerr, Lam & Wittenberg, 2019); South Africa Census (Statistics South Africa, 1998; 2003; 2015a); Mining Census (Statistics South Africa, 2011; 2014; 2017; 2021a); Department of Mineral Resources and Energy (2020).
Notes: StatsSA Mining Census estimates comprise mining employees, employees of labour brokers, employees of sub-contractors and capital employees. StatSA (inc brokers) estimates comprise only mining employees.

- Employment in coal mining industry relatively stable in the 1990s.
- From the mid-2000s until the mid-2010s employment experiences a strong upward trend, falls in 2015 and 2016, and then proceeds upward from 2017 onward.
- Upward trend coincides with growth in coal demand along both the domestic and export channels.
- 2019: Employment in coal mining within range of 76 000 -108 000 workers, representing about 0.5% of total employment and 19.05 percent of mining employment in 2019.
- Mpumalanga follows national trend.

Spatial Distribution of Employment in Mpumalanga

Employment Break Down by Municipalities Using Census Estimates

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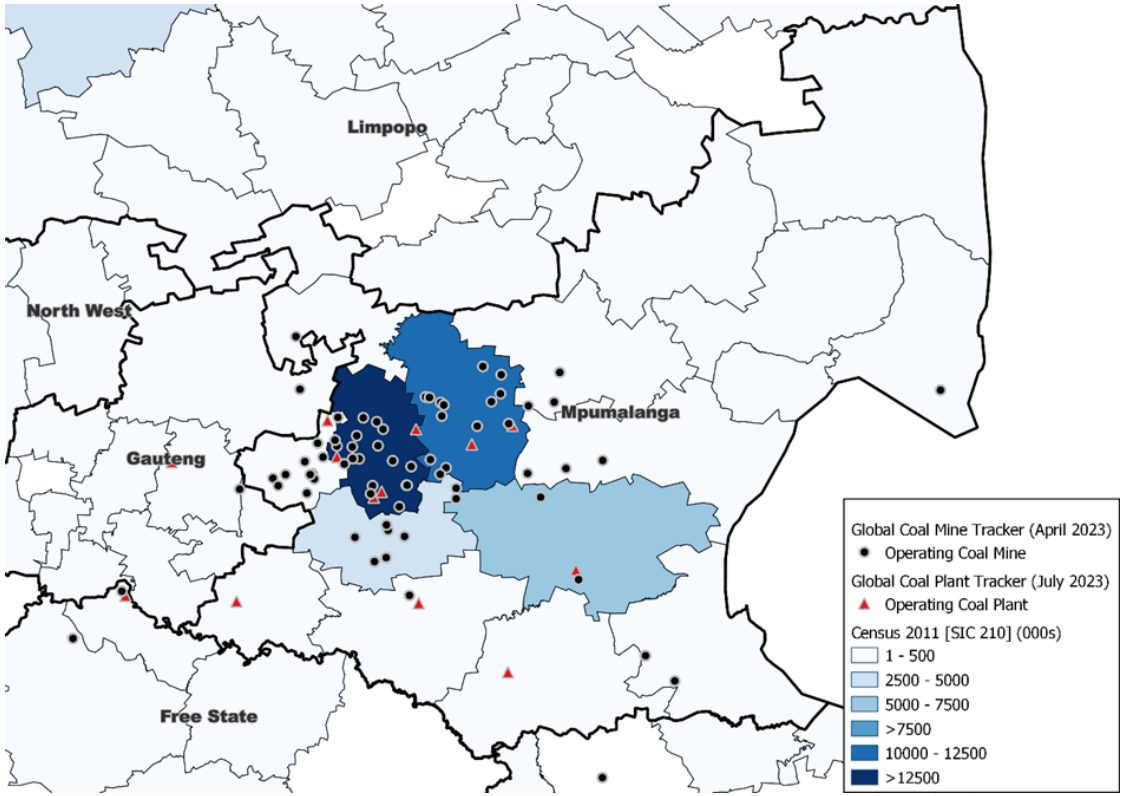
Municipality/Province	Level (000s)			Shares of total coal employment (%)		
	1996	2001	2011	1996	2001	2011
eMalahleni (Witbank)	8 774	18 069	25 935	22.0	42.5	37.2
Steve Tshwete (Middelburg)	4 439	5 318	11 964	11.1	12.5	17.2
Govan Mbeki (Highveld East)	4 491	5 687	3 473	11.3	13.4	5.0
Msukaligwa (Ermelo)	1 442	1 586	6 590	3.6	3.7	9.5
Mkhondo	276	594	2 937	0.7	1.4	4.2
Victor Khanye	529	614	1 555	1.3	1.4	2.2
Albert Luthuli	369	494	1 483	0.9	1.2	2.1
Total Mpumalanga	**25 923**	**34 192**	**55 619**	**64.9**	**80.4**	**79.8**
KwaZulu Natal	8 926	2 553	3 036	22.4	6.0	4.4
Limpopo	1 935	2 818	5 408	4.8	6.6	7.8
Gauteng	1 206	1 206	3 018	3.0	2.8	4.3
Free State	898	1 286	1 214	2.2	3.0	1.7
Total other provinces	**13 995**	**8 332**	**14 065**	**35.1**	**19.6**	**20.2**
TOTAL	**39 918**	**42 524**	**69 684**	**100**	**100**	**100**

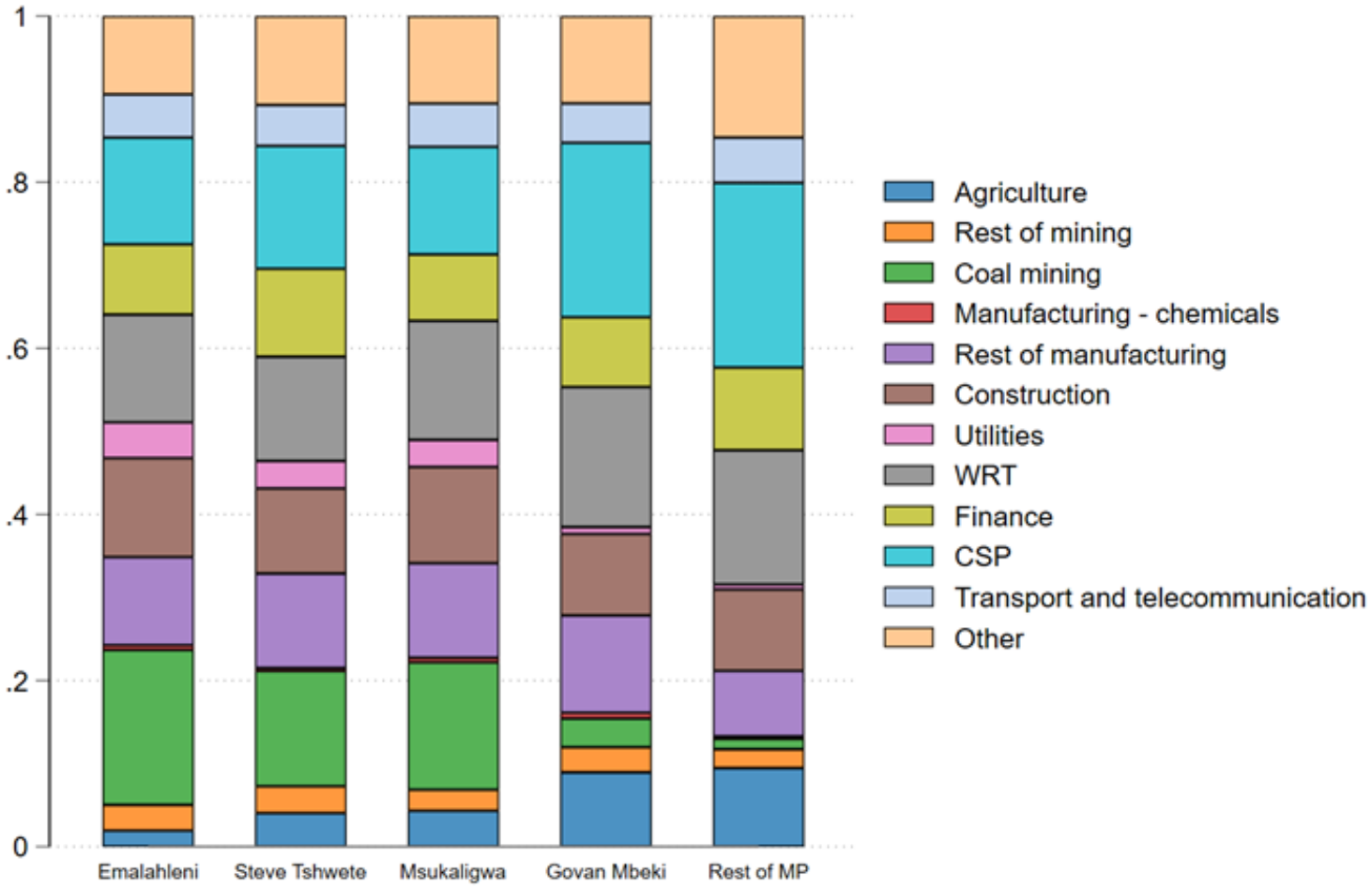
Source: Authors' calculations using South Africa Census (Statistics South Africa, 1998; 2003; 2015a)
Notes: Sum of local municipalities in Mpumalanga province does not add up to total for Mpumalanga because of small number of coal industry jobs in other parts of the province. Sum of coal industry jobs in KwaZulu-Natal, Limpopo, Gauteng and Free State does not add up to total for other provinces because of small number of coal industry jobs in remaining other four provinces.

- Bulk share of coal mining industry employment in SA resides in Mpumalanga (approx. 80% in 2011).
- This has grown over time in relative terms.
- Employment concentrated within four local municipalities.



Spatial Distribution of Employment in Mpumalanga

Employment Break Down by Municipalities using Census Estimates, 2011



Source: Authors' calculations using South Africa Census (Statistics South Africa; 2015a)

Coal mining industry is a critical employer within the province and, more acutely, within these local municipal localities.

Coal industry accounts for approx. 5% of total employment in MP.

- Emalahleni – 19%
- Msukaligwa – 15.3%
- Steve Tshwete – 13.7%
- Govan Mbeki – 3.45%
- Mkhondo – 9.4%
- Albert Luthuli – 5%
- Victor Khanye – 7%

Presence of industries that may provide alternative employment avenues

- Matching problem
- Demand problem

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Characteristics of Coal Industry Jobs

Profiling Coal Industry Workers

Individual Characteristics of Coal Industry Workers in MP

	Coal mining industry employment			Ratio Coal:Formal
	Census 2011	LMD 2011	LMD 2019	2019
Total No. of employees (weighted)	55 619	55 423	66 252	
Gender				
Male	0.81	0.85	0.80	1.33
Race				
African/Black	0.80	0.73	0.81	0.92
White	0.17	0.27	0.19	1.90
Age Group				
15-24	0.13	0.06	0.08	1.14
25-34	0.35	0.43	0.43	1.26
35-44	0.25	0.25	0.22	0.71
45-54	0.19	0.20	0.22	1.05
55-64	0.08	0.06	0.06	0.75
Educational Attainment				
Primary or less	0.17	0.07	0.01	0.14
Secondary uncompleted	0.31	0.30	0.29	1.00
Secondary completed	0.38	0.37	0.43	1.19
Diploma	0.11	0.20	0.23	1.28
Degree	0.03	0.03	0.04	0.44

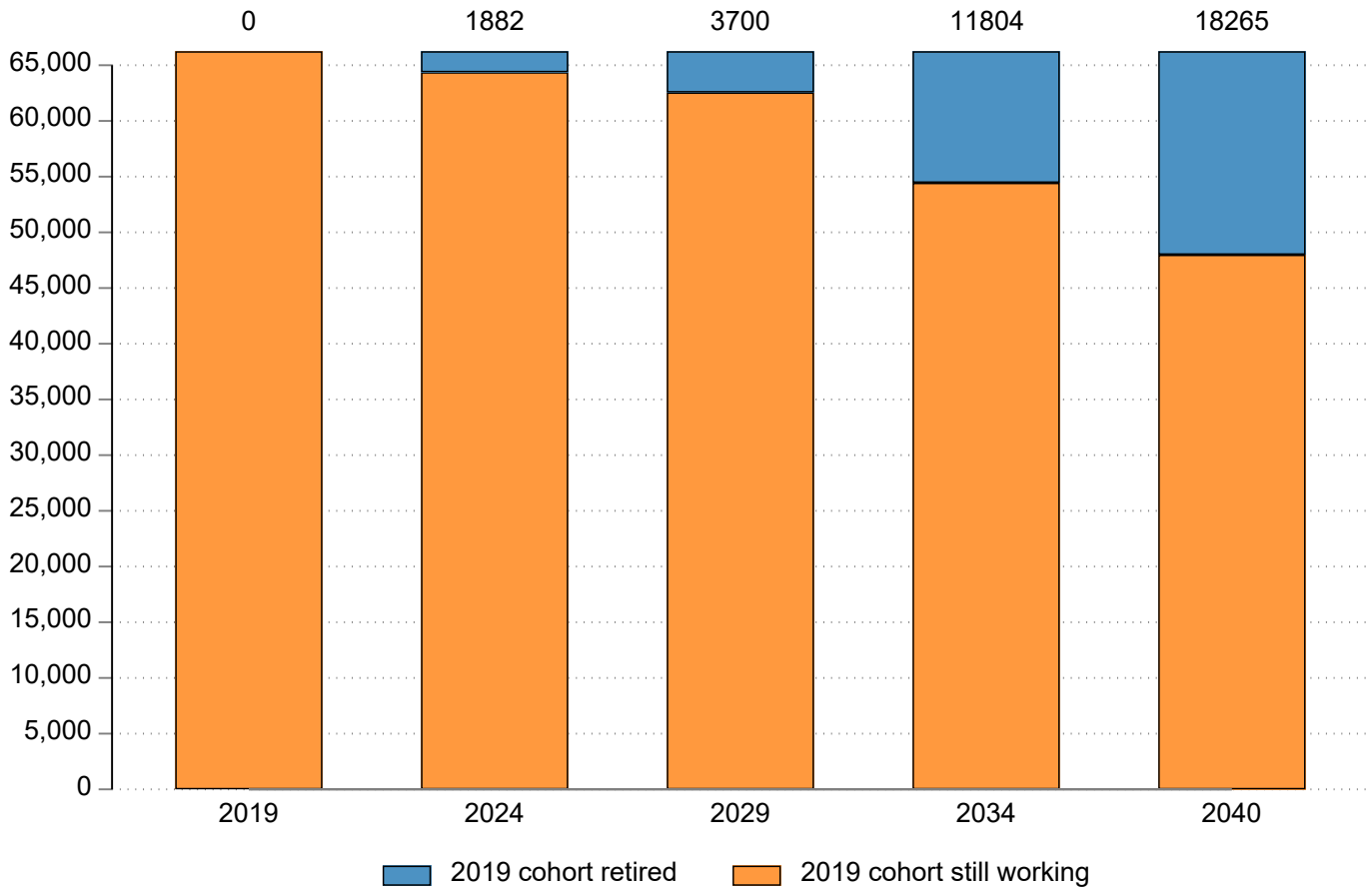
Source: Authors' calculations using South Africa Census (Statistics South Africa, 2015a) and Labour Market Dynamics (Statistics South Africa, 2011; 2021b)

Notes: Categories comprising negligible shares for race, age and education are omitted from the table. Shares represent the share of total coal employment by covariate.

- The average coal industry worker is an African male, aged between 25 and 44 years, and has at least a complete secondary education.
- Coal employees exhibit relatively high levels of educational attainment.
  - Between 60 and 71% of coal industry employees have at least a complete secondary education.
  - The entry level of education for the manufacturing sector is a complete secondary education (plus maths).
- The coal mining industry workforce is relatively youthful
  - 51% of employed fall within two youth age groups.
  - Thus, for a large portion of the employed in the industry, alternative employment opportunities will be needed (matching).

Individual Characteristics of Coal Industry Workers in MP

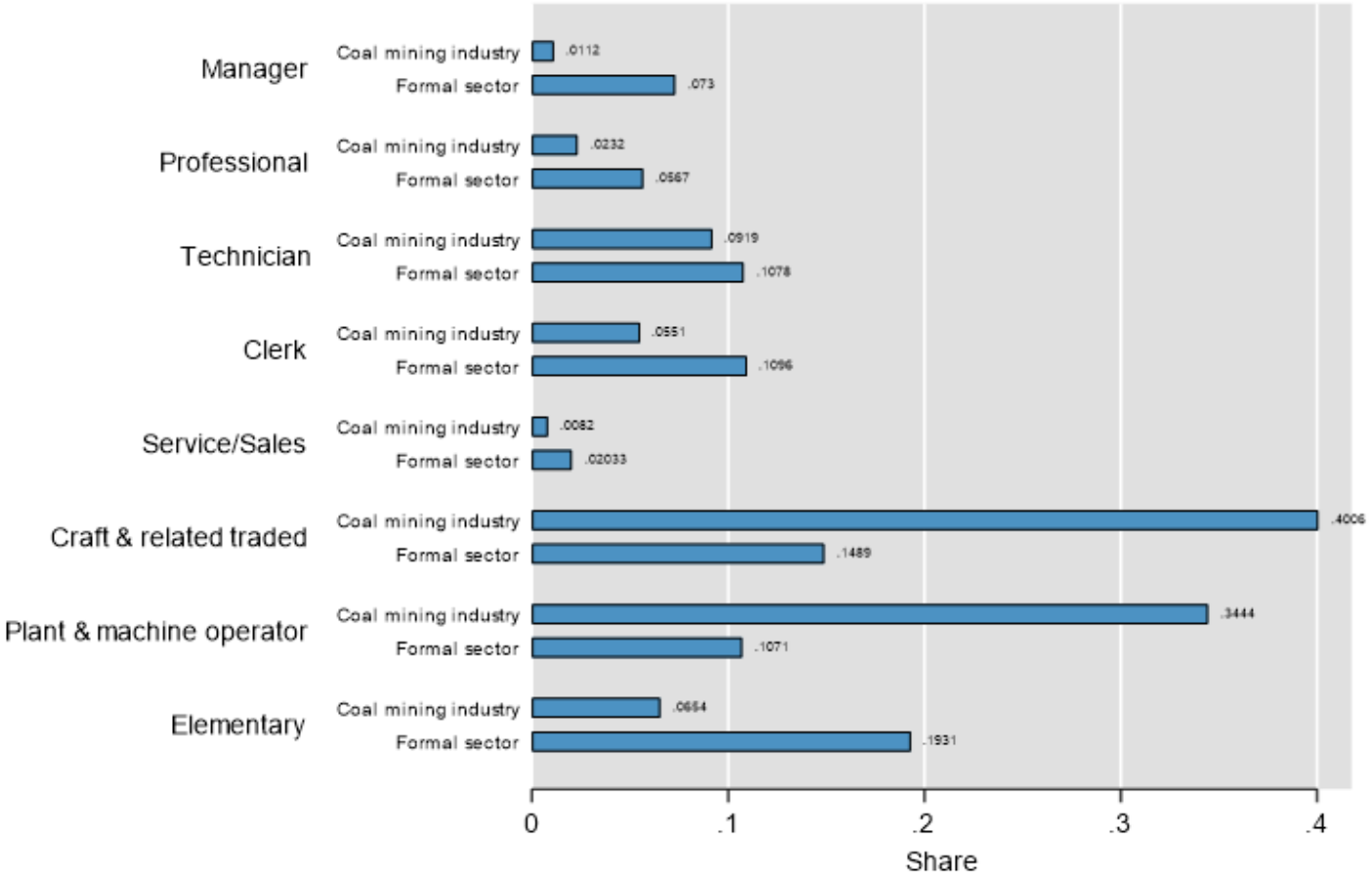
Phasing of Retirement for 2019 Cohort of MP Mining Industry Workers



Source: Authors' calculations using Labour Market Dynamics (Statistics South Africa, 2021b)

- By 2040 – 17 years time – only 3 of SAs 14 coal-fired power plants will be in commission:
  - Assuming retirement age of 65
  - By 2024: 2.8% of 2019 cohort retired
  - By 2029: 5.6% of 2019 cohort retired
  - By 2034: 17.8% of 2019 cohort retired
  - By 2040: 27.6% of 2019 cohort retired
- Point is not that workers won't get replaced, but that entrants will come in at lower wages. Further, JT cost possibly reduced should coal mines be closed down prematurely.
- Note: this is an underestimate since the standard retirement age for mine workers is 50-60 years for underground workers and 53 to 63 years for surface workers.

Occupational Profile of MP Coal Industry Workers, 2019



Source: Authors' calculations using Labour Market Dynamics (Statistics South Africa, 2021b)
Notes: Formal sector accounts for total employment in the formal sector labour market.

Coal industry is a semi-skilled intensive industry

- 40% of employees in Craft and Related trade occupations
  - Miners and quarry workers (38%)
  - Agricultural or industrial machinery mechanics and fitters (17%)
  - Motor vehicle mechanics and fitters (9.57%)
  - Shot-firers and blasters (9.57%)
  - Sheet-metal workers (8.7%)
- 35% of employees in Plant and Machine Operator occupations
  - Mining plant operators (25.81%)
  - Heavy truck and lorry drivers (24.19%)
  - Crane, hoist and related plant operator (24.19%)
  - Lifting-truck operators (9.68%)
  - Earth-moving and related plant operators (8.06%)

How transferrable are the skills (tasks) of these occupations across industries – matching?

Distribution of Coal Industry Workers in Mpumalanga by Occupation and Education Level, 2019

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	Primary	Incomplete secondary	Complete secondary	Diploma	Degree	Total
Manager			199 0.30%	223 0.34%	282 0.43%	704 1.06%
Professional		187 0.28%	117 0.18%	1 149 1.74%		1454 2.19%
Technician		888 1.34%	2 340 3.53%	1 654 2.50%	874 1.32%	5756 8.69%
Clerk			1 403 2.12%	2 050 3.10%		3453 5.21%
Sales/services			513 0.77%			513 0.77%
Craft & related traded	187 0.28%	6 948 10.49%	10 095 15.24%	8 105 12.23%	1 189 1.79%	26 522 40.03%
Plant & machine operator	596 0.90%	7 888 11.91%	12 781 19.29%	1 677 2.53%		23 097 34.86%
Elementary	144 0.22%	3 160 4.77%	1 229 1.86%	221 0.33%		4 754 7.18%
Total	927 1.40%	19 0714 28.79%	28 677 43.28%	15 080 22.76%	2 344 3.54%	66 252 100.00%

No JT issue

- Skilled and semi-skilled workers + high education
- High likelihood of finding alt. emp.
- Matching to alt. emp.
- 17 203 workers (25.97%)

Intermediate JT issue

- Skilled or Semi-skilled workers + low education
- Mixture of income support and matching to alt. emp.
- 44 142 workers (66.63%)

JT issue

- Low skilled workers
- Low likelihood of finding alt. emp – income support
- 4 754 workers (7.18%)

Distribution of Coal Industry Workers in Mpumalanga by Occupation and Age Group, 2019

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	15-24	25-34	35-44	45-54	55-65	Total
Manager		282 0.43%	199 0.30%	223 0.34%		704 1.06%
Professional	187 0.28%	450 0.68%	117 0.18%	699 1.06%		1 454 2.19%
Technician	642 0.97%	2 664 4.02%	1300 1.96%	460 0.69%	691 1.04%	5 756 8.69%
Clerk	623 0.94%	2 569 3.88%	260 0.39%			3 453 5.21%
Sales/services				513 0.77%		513 0.77%
Craft & related traded	2 068 3.12%	10 687 16.13%	4 835 7.30%	7 602 11.47%	1 331 2.01%	26 522 40.03%
Plant & machine operator	1 560 2.36%	9 155 13.82%	6 926 10.45%	3 776 5.70%	1 679 2.53%	23 097 34.86%
Elementary	204 0.31%	2 490 3.76%	768 1.16%	1 292 1.95%		4 754 7.18%
Total	5 284 7.98%	28 297 42.71%	14 407 21.74%	14 565 21.98%	3 700 5.59%	66 252 100.00%

Short-term retirees

- 3 700 (5.59%)

Medium- to long-term retirees

- 14 565 (21.98%)

No JT issue

- Skilled workers
- 5 841 (8.81%)

Intermediate JT issue

- Semi-Skilled workers
- 38 683 (58.39%)

JT issue

- Low skilled workers
- 3 462 (5.23%)

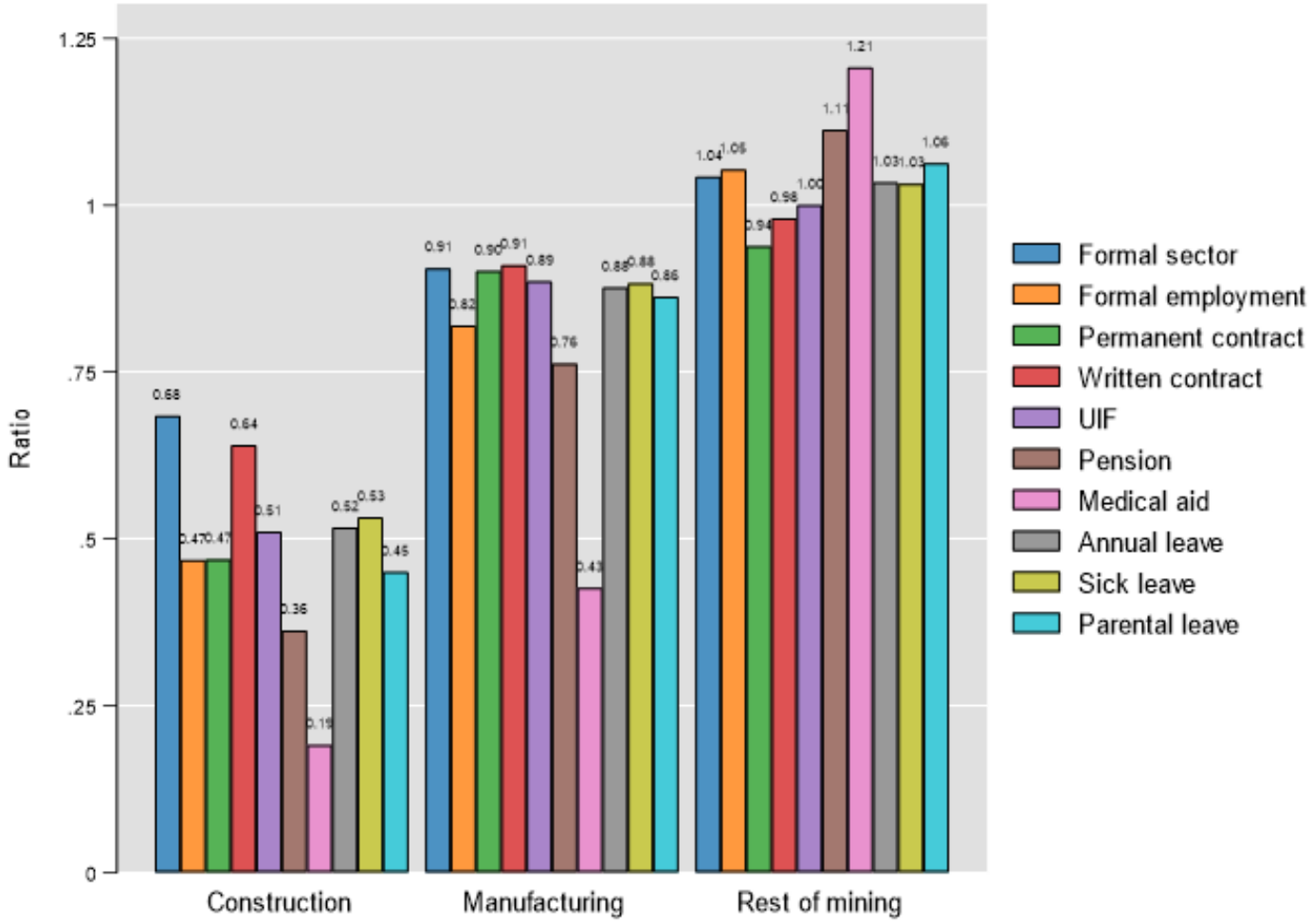
Job Characteristics for Coal Industry Workers in Mpumalanga, LMDS 2011 and 2019

Job characteristic	LMD 2011 Share (%)	LMD 2019 Share (%)	Change (%)	Ratio Coal:Formal 2019
Total No. of employees (weighted)	55 423	66 252	10 829	
Duration of contract				
Contract	0.04	0.06	0.02	0.50
Permanent	0.91	0.84	-0.07	1.20
Employment status				
Written	1.00	1.00	0.00	1.06
UIF				
No	0.00	0.01	0.01	0.03
Yes	1.00	0.99	-0.01	1.48
Medical aid				
No	0.21	0.28	0.07	0.46
Yes	0.79	0.72	-0.07	1.89
Pension				
No	0.07	0.17	0.10	0.45
Yes	0.93	0.83	-0.10	1.38
Annual leave				
No	0.02	0.07	0.05	0.32
Yes	0.98	0.93	-0.05	1.21
Sick leave				
No	0.01	0.05	0.04	0.28
Yes	0.99	0.95	-0.04	1.16
Parental leave				
No	0.09	0.16	0.07	0.42
Yes	0.91	0.84	-0.07	1.35
Union membership				
No	0.18	0.30	0.12	0.61
Yes	0.82	0.67	-0.15	1.43

Source: Authors' calculations using Labour Market Dynamics (Statistics South Africa, 2011; 2021b)
Notes: 1. Duration of contract does not sum to 100 percent due to unspecified responses.

- Coal industry jobs are formal (>95%).
- Coal industry employees enjoy relatively (rel. to other formal jobs) favourable job quality indicators
  - 81% have permanent employment conditions
  - 100% have a written contract
  - 96% pay UIF
  - 80% have a pension
  - 89% received annual leave
  - 68% have medical aid
- Notably, these indicators have become less favourable over the period
  - Unionisation seems to have declined as well.
- Part of fiscal support for JT can be clawed back from UIF.

Job Characteristic Ratio for Coal Mining Industry Relative to Substitute Industries



Source: Authors' calculations using Labour Market Dynamics (Statistics South Africa, 2011; 2021b)

- Ratio of the share of a job characteristic in the substitute industry relative to the corresponding share in the coal mining industry.
- Shift to alt. emp. Opportunity in construction or manufacturing industry would result in a decline job quality.
  - Construction industry much worse.
  - Receiving MA and a pension especially low for substitute industries relative to coal industry.
- Rest of mining more in line with coal mining
  - Better access to MA and pension.

Households Linked to Coal Industry

Exploring Dependency

Employment Composition of Coal Households

Coal Household Composition in Terms of Employment, Census 2011

		No. Coal Employees in Coal Households		
		1	>1	Total
No. Other Employed Individuals in Coal HHs	0	27.1 58.9%	2.4 5.2%	29.5 **64.1%**
	1	11.6 25.2%	0.8 1.7%	12.4 27.0%
	>1	3.6 7.8%	0.5 1.1%	4.1 8.9%
	Total	42.3 92.0%	3.7 8.0%	46.1 100%

Source: Authors' calculations using South Africa Census (Statistics South Africa; 2015)
Note: In each cell reporting numerical estimates, the first value reports the weighted number of households (in 000s), the second value reports the share of coal households. Due to rounding, the shares of coal households may not sum up to exactly 100 percent.

- For the majority (29,5k HHs or 58.9%) of coal households, the coal worker is the only employed person in the household.
  - A further 2,4k households (5.2%) have at least two coal industry employees.
  - These households (64.1%) completely reliant on coal industry employment and income – i.e. vulnerable.
- More than a third (16.5k or 35.9%) of coal households have at least one other employed individual from another industry and/or the coal industry in the household.
  - Worth noting that these other industries may be closely linked to the coal economy in the locality.

Prevalence of Unemployed Individuals in Coal Households

Coal Household Composition in Terms of Unemployed, Census 2011

		No. Coal Employees in Coal Households		
No. Unemployed Individuals in Coal HHs		1	>1	Total
	0	29.7 64.6%	2.8 6.1%	32.5 70.7%
	1	9.2 20.0%	0.6 1.3%	9.8 21.3%
	>1	3.4 7.4%	0.3 1.3%	3.7 8.0%
	Total	42.3 92.0%	3.7 8.0%	46.1 100%

Source: Authors' calculations using South Africa Census (Statistics South Africa; 2015)
Note: In each cell reporting numerical estimates, the first value reports the weighted number of households (in 000s), the second value reports the share of coal households. Due to rounding, the shares of coal households may not sum up to exactly 100 percent.

- Low dependency. Most coal households (70% or 32,5k HHs) do not have unemployed individuals in household.
  - Given mean coal household size of 3.6, this suggests that remainder of individuals in these households are not economically active.
- 29.3% (13.5k HHs) of coal households have at least one unemployed individual in the household.
  - The mean number of unemployed dependents in households with unemployed individuals present, is 1.8.
  - Households with unemployed individuals present also appear more likely to be single coal-worker households, rather than households with multiple coal workers.

Child Dependency of Coal Households

Coal Household Composition in Terms of Child Dependents, Census 2011

		No. Coal Employees in Coal Households		
No. Child Dependents in Coal HHs		1	>1	Total
	0	24.1 52.4%	2.1 4.6%	26.2 **57.0%**
	1	7.9 17.2%	0.6 1.3%	8.5 18.5%
	>1	10.3 22.4%	1.0 2.2%	11.3 24.6%
	Total	42.3 92.0%	3.7 8.0%	46.1 100%

Source: Authors' calculations using South Africa Census (Statistics South Africa; 2015)
Note: In each cell reporting numerical estimates, the first value reports the weighted number of households (in 000s), the second value reports the share of coal households. Due to rounding, the shares of coal households may not sum up to exactly 100 percent.

- Low dependency. More than half of coal households (26,2k HHs or 57%) do not have any child dependents.
- 18.5% (8.5k) have one child and 24.6% (11.3k) have at least two children.
  - The mean number of child dependents in coal households is 2.0.

Elderly Dependency of Coal Households

Coal Household Composition in Terms of Elderly Dependents, Census 2011

		No. Coal Employees in Coal Households		
No. Elderly Dependents in Coal HHs		1	>1	Total
	0	40.3 87.6%	3.6 7.8%	43.9 **95.4%**
	1	1.7 3.7%	0.1 0.2%	1.8 3.9%
	>1	0.3 0.6%	0.0 0.0%	0.3 0.6%
	Total	42.3 92.0%	3.7 8.0%	46.1 100%

Source: Authors' calculations using South Africa Census (Statistics South Africa; 2015)
Note: In each cell reporting numerical estimates, the first value reports the weighted number of households (in 000s), the second value reports the share of coal households. Due to rounding, the shares of coal households may not sum up to exactly 100 percent.

- Low dependency. Most coal industry worker households (43,9k HHs or 95.4%) do not have any elderly dependents.

Dependency of Coal Households

Overall Household Composition of Coal households, Census 2011

		No. Dependents (age-related, unemployed and not econ. active)				
		0	1	2	>2	TOTAL
No. Other Employed (incl. utils)	0	12.8 27.8%	4.7 10.3%	4.1 8.8%	7.9 17.2%	29.5 64.1%
	1	3.7 8.1%	2.3 5.0%	2.7 5.8%	3.7 8.1%	12.4 27.0%
	2	0.7 1.6%	0.4 0.8%	0.5 1.1%	1.1 2.3%	2.7 5.9%
	>2	0.3 0.7%	0.3 0.5%	0.2 0.4%	0.6 1.3%	1.4 3.0%
	TOTAL	17.6 38.3%	7.7 16.6%	7.4 16.1%	13.3 28.9%	46.1 100.0%

- Ideally, we would want to link indiv. Characteristics (e.g. occupations, age) to coal households – able to derive a proper rank-order of the JT needs.
  - But, not possible.
- Green and yellow households account for 38.3% of coal households (17,6k HHs) and can be considered less vulnerable, in terms of additional income streams, and less exposed, in terms of responsibilities to dependents.
- Orange and red households are the most exposed, because these households have additional dependents to consider when thinking of mine closures. These households account for 61.6% of households, meaning that the majority of coal households (28,4k households) fall within the higher vulnerability categories.

Concluding Remarks and Discussion on Just Transition Numbers

Just Transition Numbers: Workers

	Coal mining industry		Total
	Rest of SA	Mpumalanga	
Total Workers	10 154	66 252	76 406

Employment Levels

- 76 406 coal industry jobs in SA, 66 252 (87%) located within MP → 10 154 (13%) in rest of SA.

Average Characteristics of Workforce

- Majority of workers male (80%) and African (81%).
- Workforce is young, with half of those employed: 37 800 (33 581) workers or 49.48% (50,69%) of national (MP) coal workforce, falling within the two youth age group categories.

The JT Challenge

- *No JT Challenge:* National – 19 142 workers (25.1%); MP – 17 203 workers (26%).
- *Intermediate JT Challenge:* National – 51 549 workers (67.5%); MP – 44 142 workers (66.6%).
  - Workers mainly in plant and machine operator and craft and related trade occupations.
- *JT Challenge:* National – 5 716 workers (7.5%); MP – 4 754 workers (7.2%).

Just Transition Numbers: Households

	Coal Households
Total households	**46 100**
… with at least one dependents (Ue, elderly, child)	28 400 61.6%
…Child dependent	19 800 43.0%
…Elderly dependent	2 100 4.6%
…Unemployed dependent	13 500 29,3%

Source: Authors' calculations using South Africa Census (Statistics South Africa, 2015)

Total number of Coal Mining Households in Mpumalanga = **46 100.**

- 28 400 (61.6%) have at least one dependent (unemployed, elderly, child).
- 19 800 households (43.0%) have at least one child dependent.
- 2 100 households (4.6%) have at least one elderly dependent.
- 13 500 households (29.3%) have at least one unemployed dependent.

Conclusions

- Coal Mining Industry: At first glance represents relatively small proportion of economy.
- However economic footprint felt more acutely in its downstream linkages and also as a core export revenue generator.
  - Regionally concentrated in both output and employment terms in Mpumalanga.
  - A natural (endogenous) transition already underway given lifespan of coal-fired power plants. This is working in conjunction with the 'forced' exogenous regulated transition to renewables. In a decade and a half, 50% of coal-fired power capacity is retired.
- Contribution here was to very carefully derive a robust empirical estimate of the Coal labour market in South Africa – together with a measure of coal household dependency.
- An upper-bound national estimate of the jobs in coal suggest about 75 000 jobs in the industry, with 80% of these in Mpumalanga.
- In turn though, majority are semi-skilled jobs, employing predominantly young African males with Matric+ educational levels.
- In moving to an early LM assessment of the size and shape of the JT, clear that most extreme challenge lies with about 5000 workers in elementary occupations → possibly a core target for income support.
  - In addition, the rump of the coal workforce →some 50 000 workers in semi-skilled positions, require a much more complex creative set of solutions to derive a medium-term policy response ensuring continued employment and income support to these workers and their households.

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Thank You