Skills, Technology and Capital Intensity: Employment & Wage Shifts in post-*apartheid* South Africa

Haroon Bhorat

ILO Symposium for Employers on the Future of Work

5 – 6 December 2013

Outline

- Introduction
- Data
- Changing Employment Landscape
  - Sectoral and Skills-biased trends
- Skills-Biased Technological Change
  - Katz & Murphy Decomposition
- Task-Based Wage Analysis
  - Quantile Regression Approach
- Conclusions

Introduction

- South Africa as a middle-income country:
  - Population 51 million
  - Resource rich, well-developed financial sector
  - GDP per capita US$7,507 (World Bank, 2012)
  - High unemployment (25%)
  - High poverty & inequality levels
- Two key historical trends in South Africa:
  - An inter-sectoral shift away from primary sectors
  - An intra-sectoral shift away from low-skilled jobs
- In post-*apartheid* period, continued skills-biased labour demand contributes to inequality & high unemployment rates

Structure of Presentation

- Paper looks at employment trends, sectoral shifts and occupational returns for the 2001 to 2011/2 period
- Three parts
  - Descriptive overview of employment changes (sectoral and occupational employment trends)
  - Decomposition of skills demand into between and within-sector forces
  - Returns to occupational tasks: examine how technological change and capital intensity has impacted on wage premia for different kinds of work

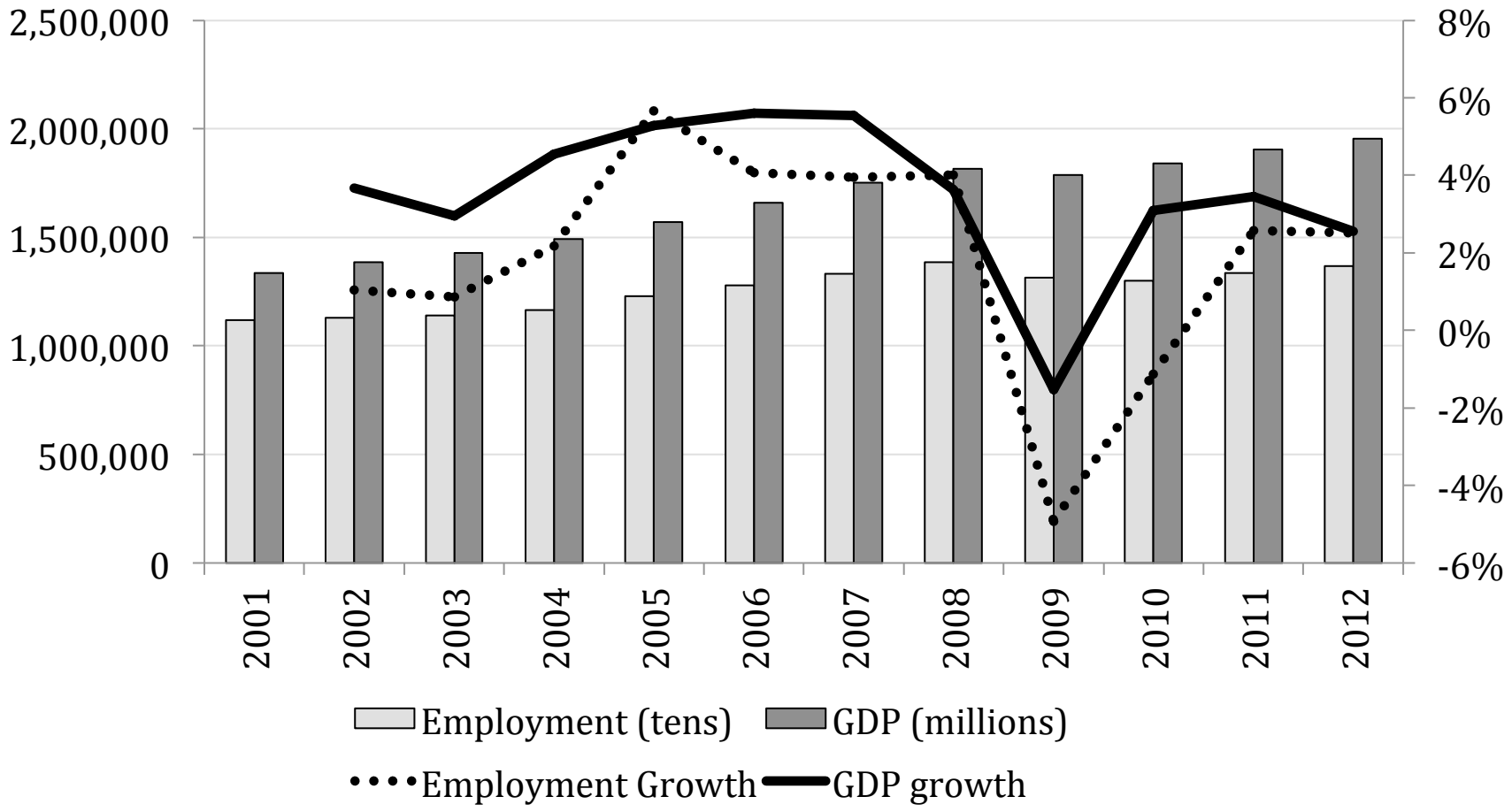
Key Questions

- How has economic structure changed in recent 10-year period?
- Are employment shifts still ‘skills-biased’?
- Do within- or between-sector shifts explain changes in employment?
- What has happened to returns and how does this link to technological and capital-intensive change?
- What are the lessons for ‘inclusive growth’?

Data

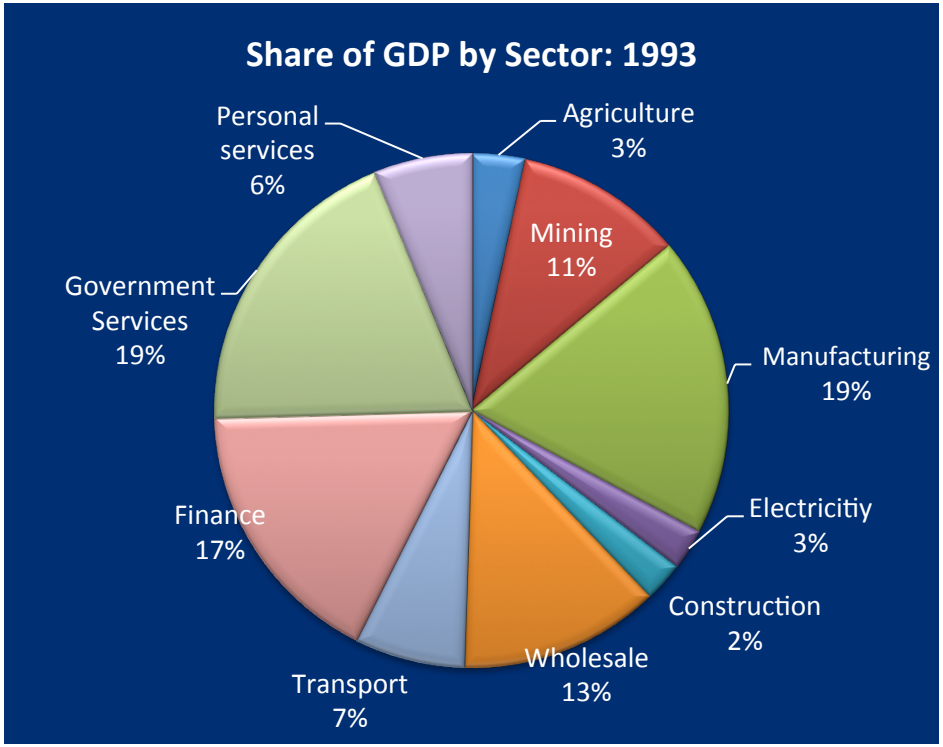
- Labour Force Surveys (2001-2007)
  - Bi-annual
- Quarterly Labour Force Survey (2008-2011)
  - Quarterly
- Household surveys
- Sample ~ 30 000 dwellings in each wave
- Contain occupational and industry codes
- Data on earnings
  - Consistent quarterly in LFS
  - Annual, 2010/11, in QLFS

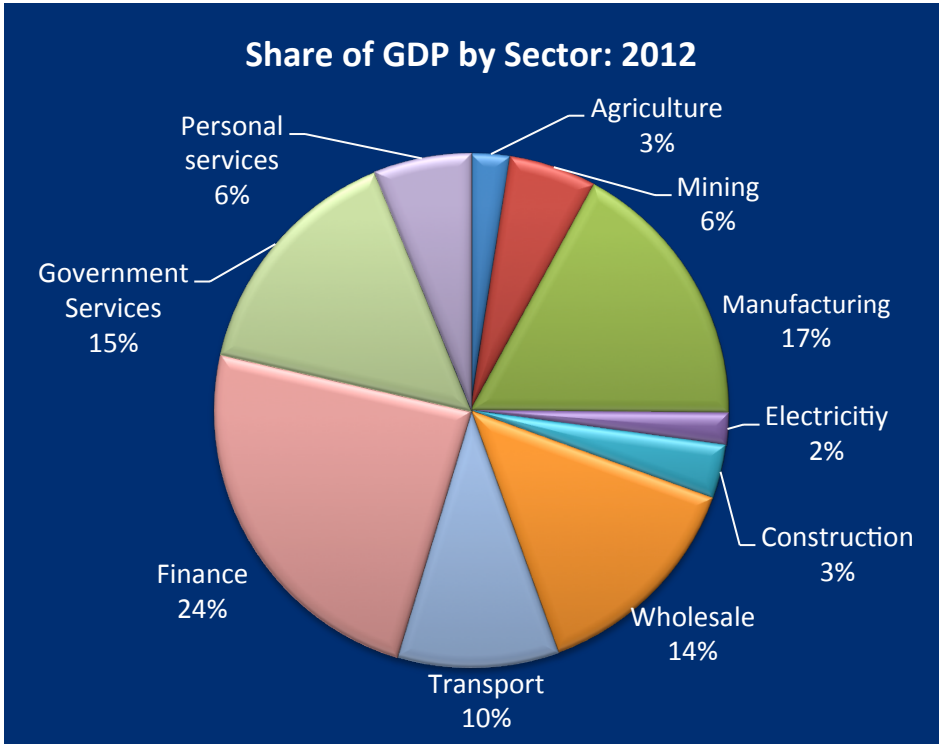
GDP & Employment



DEVELOPMENT POLICY RESEARCH UNIT

Shares of GDP

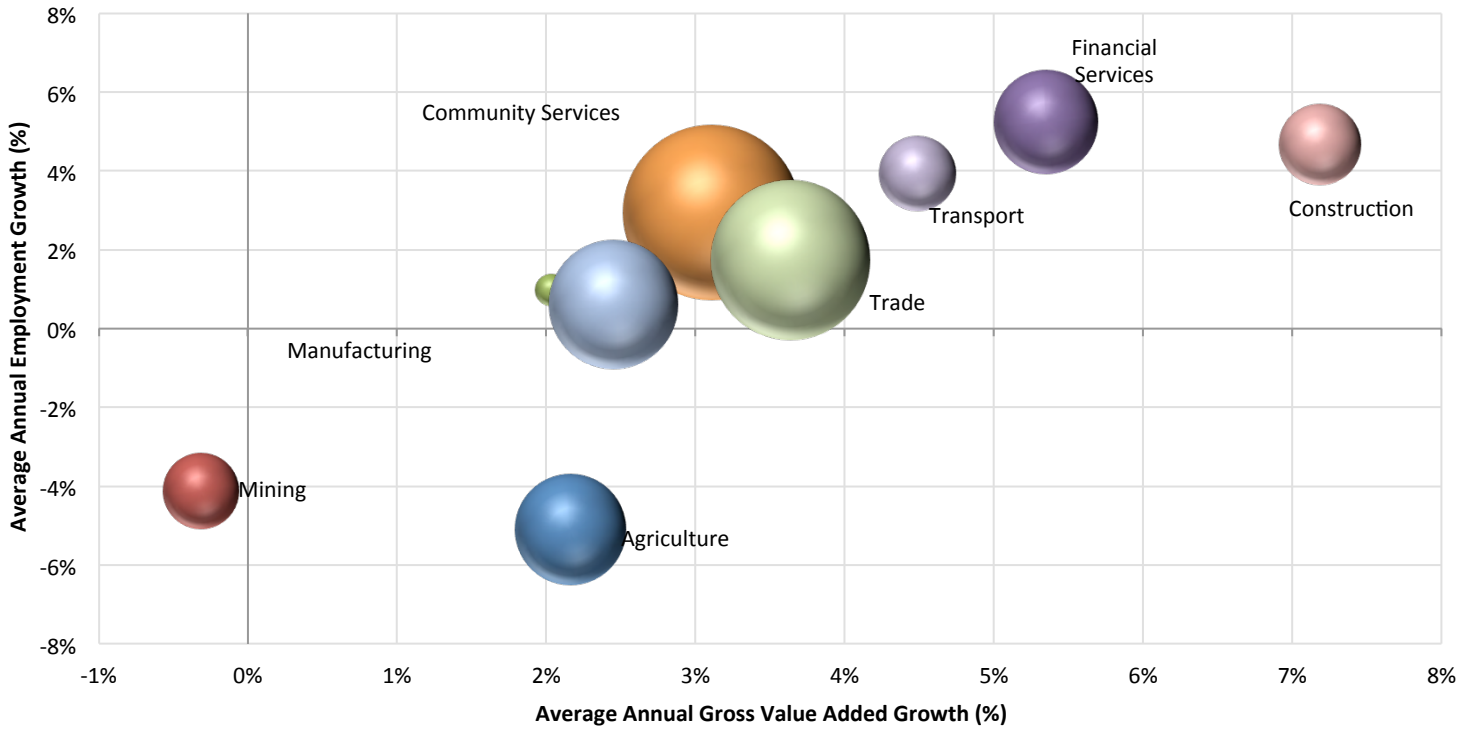




DEVELOPMENT POLICY RESEARCH UNIT

Changing Employment Landscape

Figure 1: Gross Value Added and Employment Growth, by Sector: 2001-2012



DEVELOPMENT POLICY RESEARCH UNIT

Changes in Sectoral Employment

	Growth (2001-2012)		*Employment Shares*		Share of Change
	Absolute	**Relative**	***2001***	***2012***	**(2001-2012)**
Primary	***-719,232****	***-2.6***	***15.5%***	***7.4%***	***-28.8%***
Agriculture	-514,468*	-2.7	*10.5%*	*4.8%*	-20.6%
Mining	-204,764*	-2.2	*5.0%*	*2.6%*	-8.2%
Secondary	***537,376****	***1.0***	***21.0%***	***21.1%***	***21.5%***
Manufacturing	112,149	0.3	*14.5%*	*12.7%*	4.5%
Utilities	10,774	0.5	*0.8%*	*0.8%*	0.4%
Construction	414,453*	2.5	*5.7%*	*7.7%*	16.6%
Tertiary	***2,720,821****	***1.6***	***63.1%***	***71.5%***	***108.9%***
Trade	513,572*	0.9	*21.9%*	*21.7%*	20.6%
Transport	288,364*	2.1	*4.9%*	*6.1%*	11.5%
Financial	782,108*	2.8	*9.3%*	*13.3%*	31.3%
Comm Serv	1,041,524*	2.1	*17.8%*	*22.2%*	41.7%
Priv Hholds	95,253	0.4	*9.2%*	*8.3%*	3.8%
Total	**2,497,763***	**1.0**	***100.0%***	***100.0%***	**100.0%**

DEVELOPMENT POLICY RESEARCH UNIT

Changes in Sector Skills

Table 1: Changes in Skills Shares, by Sector: 2001-2012

		Proportions		*Change in Prop*	*Change in No*
		2001	**2012**	**2001-2012**	
Primary	**High-Skilled**	2.9%	7.6%	*4.8 percentage points*	*27,602*
	Med-Skilled	54.5%	36.8%	*-17.7 percentage points*	*-571,229**
	Unskilled	42.6%	55.5%	*12.9 percentage points*	*-175,392**
	Total	**100%**	**100%**	***-719,232****	
Secondary	**High-Skilled**	14.2%	18.1%	*3.9 percentage points*	*188,518**
	Med-Skilled	69.8%	61.5%	*-8.3 percentage points*	*136,140*
	Unskilled	16.0%	20.4%	*4.4 percentage points*	*214,002**
	Total	**100%**	**100%**	***537,376****	
Tertiary	**High-Skilled**	27.4%	29.3%	*1.9 percentage points*	*931,498**
	Med-Skilled	41.8%	42.6%	*0.8 percentage points*	*1,214,349**
	Unskilled	30.8%	28.1%	*-2.7 percentage points*	*576,288**
	Total	**100%**	**100%**	***2,720,821****	

DEVELOPMENT POLICY RESEARCH UNIT

Between & Within-Sector Shifts

- Labour demand patterns driven at the sectoral level by two forces:
  - *within-sector shifts* (driven, for example, by technological change)
  - *between-sector shifts (*driven, for example, by trade flows and evolving product demand)
- Estimate using standard Katz & Murphy (1992) decomposition technique:

$$\Delta X_k^d = \frac{\Delta D_k}{E_k} = \sum_j \left(\frac{E_{jk}}{E_k} \right) \left(\frac{\Delta E_j}{E_j} \right) = \frac{\sum_j \alpha_{jk} \Delta E_j}{E_k}$$

- Identifies *relative* demand shifts in net sectoral employment growth

DEVELOPMENT POLICY RESEARCH UNIT

Katz & Murphy Decomposition Results

Table 4: Industry-Based Relative Demand Shift Measures, by Occupation: 2001-2012

	Between	Within	Total	*Share of Within in Total*
High-Skilled				
Managers	0.92	12.63	**13.32**	*94.9%*
Professionals	3.03	15.04	**17.20**	*87.4%*
Medium-Skilled				
Clerks	1.59	12.88	**14.07**	*91.6%*
Service & Sales Workers	1.92	11.75	**13.23**	*88.9%*
Skilled agric and fishery	-0.55	-19.60	**-20.47**	*95.8%*
Craft & Trade Workers	1.35	7.88	**9.01**	*87.4%*
Operators & Assembler	0.19	1.63	**1.81**	*90.1%*
Unskilled				
Elementary Workers	0.28	1.10	**1.37**	*80.1%*
Domestic Workers	0.37	3.49	**3.83**	*91.1%*

DEVELOPMENT POLICY RESEARCH UNIT

Wage Trends

- Wage inequality in SA driven by education and skills
- How have wages changed for those involved in specific tasks?
- Autor, Levy & Murnane (2003), Goos & Manning (2007), Acemoglu & Autor (2011) identify 'occupational tasks' as a key channel for wages shifts
- Relevant in face of capital deepening and skills-biased technological change
- Jobs requiring cognitive skill, creative problem-solving or face-to-face interaction are unlikely to be automated or threatened by international competition or technological change, while routine tasks on an assembly line, for example, face high risks

5 Task Categories

- **Information and communication technology (ICT)**-related jobs: Jobs that have high information content and are likely to be affected by technological change through the adoption of new production technologies, or face competition from countries where the same thing can be done more efficiently. These jobs generally include activities such as getting information, analysing data, recording information, and often involve interaction with computers. In the SASCO codes this consists of occupations such as software engineers, computer programmers, typists, data entry, and so on.
- **Automation/routinisation**: Jobs that are routine in nature and have the potential to be automated, often involving repeated tasks, structured work environments, and where the pace of the job is often determined by mechanical or technical equipment. These jobs could also potentially be at risk through increased trade and import penetration. They include occupations such as textile weavers, engravers, machine operators, and assemblers.
- **Face-to-Face**: Work that relies on face-to-face contact, such as establishing and maintaining personal relationships, working directly with the public, managing people, caring for others, teaching, and work requiring face-to-face discussions. Generally these are jobs that cannot be easily automated or replaced by a competing international firm. Such jobs range from room service attendants, food vendors, labour supervisors, travel guides, to therapists and teachers.
- **On-Site**: Jobs that require the worker to be present at the particular place of work, and usually include tasks involving physical work, controlling machines/processes, operating vehicles or mechanical equipment, inspecting equipment, constructing physical objects. Again, these jobs are not easily offshorable and are generally made up of construction workers, machine operators, drivers, mechanics, and various kinds of manual labourers.
- **Decision-Making/Analytic**: Work that requires non-routine decision-making abilities, usually tasks that involve creative thought, problem-solving, developing strategies, taking responsibility for outcomes and results. Such jobs cannot easily be automated and are usually at lower risk of being displaced by international competition. Occupations include artists, all types of professionals, managers, and other jobs generally considered to be high-skilled jobs.

Overview

Table 5: Occupation Categories and Occupational Tasks (2001)

LFS September 2001	ICT		Automated		Face-to-Face		On-site		Analytic		Total	LFS Totals
	No.	***Share***	**No.**	***Share***	**No.**	***Share***	**No.**	***Share***	**No.**	***Share***		
Managers	0	*0.00*	0	*0.00*	663 227	*0.19*	8 681	*0.00*	663 227	*0.35*	1 335 135	**663 945**
Professionals	77 922	*0.12*	2 986	*0.00*	249 490	*0.07*	31 776	*0.00*	381 861	*0.20*	744 036	**485 829**
Technicians	178 638	*0.29*	205 165	*0.05*	531 864	*0.15*	134 110	*0.02*	671 219	*0.36*	1 720 996	**1 176 031**
Clerks	368 923	*0.59*	1 029 770	*0.26*	356 139	*0.10*	100 998	*0.02*	51 481	*0.03*	1 907 311	**1 090 772**
Service	0	*0.00*	0	*0.00*	1 034 643	*0.29*	740 526	*0.12*	32 993	*0.02*	1 808 162	**1 429 021**
Skilled Agriculture Workers	0	*0.00*	283 450	*0.07*	0	*0.00*	292 128	*0.05*	43 464	*0.02*	619 042	**520 699**
Craft Workers	0	*0.00*	724 015	*0.18*	0	*0.00*	1 297 763	*0.20*	30 134	*0.02*	2 051 912	**1 529 375**
Operators and Assemblers	0	*0.00*	475 869	*0.12*	0	*0.00*	878 239	*0.14*	0	*0.00*	1 354 108	**1 127 155**
Elementary Workers	0	*0.00*	1 311 656	*0.33*	673 791	*0.19*	2 055 714	*0.32*	0	*0.00*	4 041 162	**2 252 554**
Domestic Workers	0	*0.00*	0	*0.00*	0	*0.00*	881 411	*0.14*	0	*0.00*	881 411	**881 411**
Total	**625 483**	***1***	**4 032 912**	***1***	**3 509 154**	***1***	**6 421 344**	***1***	**1 874 380**	***1***	**16 463 277**	**11 156 792**

DEVELOPMENT POLICY RESEARCH UNIT

Sectors and Task Categories (2001)

	ICT		AUTO		FACE		ONSITE		ANALYTIC	
Sector	*No.*	*Share*	*No.*	*Share*	*No.*	*Share*	*No.*	*Share*	*No.*	*Share*
Primary										
Agriculture	6 252	0.01	1 054 458	0.26	23 619	0.01	1 195 143	0.18	53 543	0.03
Mining	19 338	0.03	415 210	0.10	26 215	0.01	453 409	0.07	23 024	0.01
Secondary										
Manufacturing	104 652	0.17	1 028 247	0.25	197 030	0.05	968 729	0.15	237 079	0.12
Utilities	7 170	0.01	40 058	0.01	19 569	0.01	68 856	0.01	15 792	0.01
Construction	7 244	0.01	223 553	0.05	38 761	0.01	586 422	0.09	36 106	0.02
Tertiary										
Trade	85 840	0.14	505 761	0.12	1 566 343	0.44	1 265 933	0.19	298 041	0.16
Transport	38 665	0.06	162 219	0.04	175 122	0.05	230 025	0.04	109 699	0.06
Financial Services	240 845	0.38	302 898	0.07	491 164	0.14	338 458	0.05	343 788	0.18
Community Services	114 706	0.18	378 878	0.09	1 032 946	0.29	544 978	0.08	794 582	0.41
Private HHs	0	0	0	0	6 502	0	898 622	0.14	235	0
Total	624 712	1	4 123 115	1	3 582 898	1	6 553 495	1	1 917 247	1

DEVELOPMENT POLICY RESEARCH UNIT

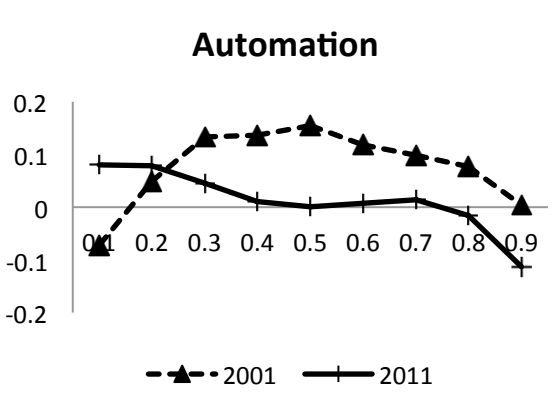
Methodology

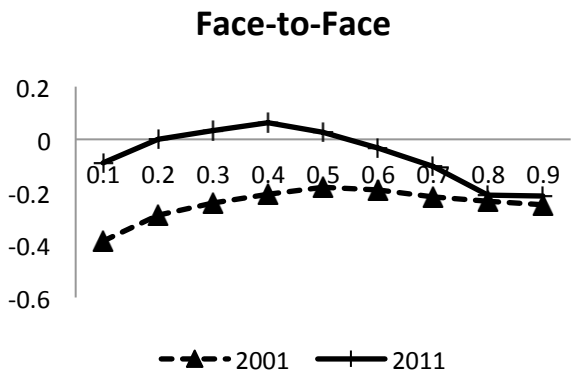
- Following Firpo, Fortin, & Lemieux (2011) we use 4-digit occupation codes and link every occupation with the 5 task categories
- Conditional quantile regression of the form:

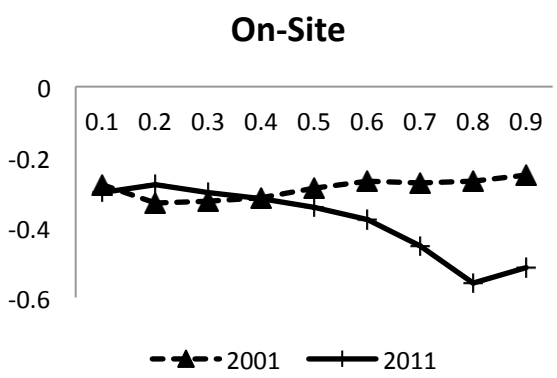
- where s the year, is a dummy for each of the five categories, and includes controls for age, race, and education
- Variable of interest is coefficient on , in each occupational category, for each decile of the income distribution, in a given year

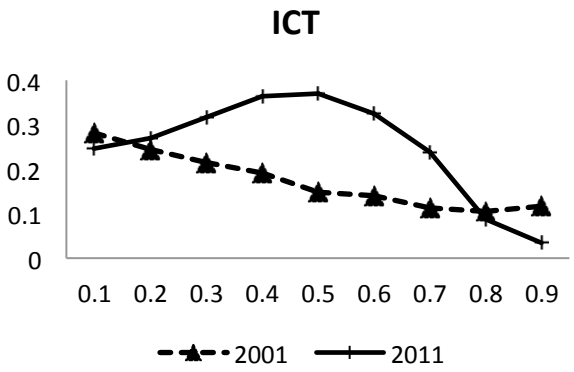
Results

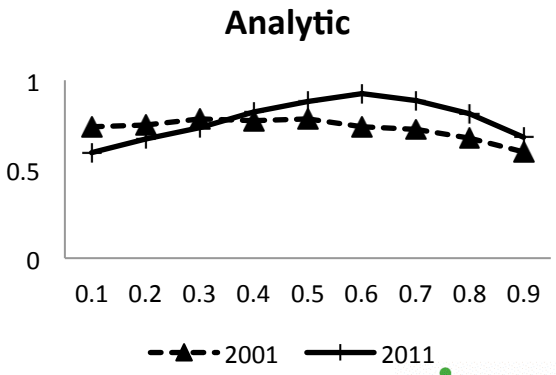
Figure 2: Task Wage Premia, plotted by Quantiles: 2001-2011











DEVELOPMENT POLICY RESEARCH UNIT

Conclusions: Key Trends 2001-2011 (Employment)

- Employment driven by 2001-2008 growth
- Primary sector employment collapse
  - Agriculture (Wm) and mining together losing over 700 000 jobs
    - Both employers of least-skilled workers
- No growth in Manufacturing
- Growth within tertiary sectors such as financial services and community services
  - Public sector as a growing source of employment
  - Financial Services & Labour Broking
- Employment gains in high- and medium-skilled occupations
- Employment shifts suggest technological change and increasing capital intensity

DEVELOPMENT POLICY RESEARCH UNIT

Conclusions: Key Trends 2001-2011 (Wages)

- Jobs that involve automated or routine tasks have experienced a drop in wage levels (agriculture, mining and manufacturing)
- Jobs involving face-to-face tasks and those with an ICT component have seen rising wages in general (largely community, trade and financial services)
- Onsite jobs saw falling returns at upper end of the distribution (domestic workers, manufacturing, agriculture)
- Analytic jobs posted high and relatively stable wages (community and financial services)
- At the bottom of the distribution wages remained relatively stable or rose in all task categories (impact of W_m?)

Thank you

Development Policy
Research Unit