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Wage Analysis: A Conceptual Framework

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Wage Analysis: A Conceptual Framework

Ben Stanwix, Tim Köhler and Chris Rooney

Development Policy Research Unit

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1. Key Concepts

This section introduces and provides definitions/explanations of key terms and concepts that will be used in the Report.

Employment: Individuals of working age are considered by Statistics South Africa (Stats SA, 2008, pp. 8–9) to be employed if, for at least one hour during a survey’s reference week, they worked for a cash or in-kind payment; ran a business, irrespective of size, alone or with partners; helped without pay in a business operated by a household member; or were temporarily absent from a job or business. The employed population therefore include employees, the self-employed, employers, and unpaid family workers. It is also referred to as ‘the workforce’.

Skills: In a skills planning context, skills are “all types and facets of competencies required by workers to perform their jobs” (OECD, 2017). The term may, though, be used in different contexts to refer to competencies, educational attainment or qualifications, or occupations. In some contexts, skills refer to job competencies, such as communication, literacy or numeracy. Competencies that are required in the workforce, but which may not be adequately represented in the current skills profile of the workforce, are also labelled in the South African discourse as ‘critical skills’, ‘top up skills’ or ‘skills gaps’. Skills may be thought of in terms of educational attainment, such as grade 12 or a degree, or qualification, such as a National Senior Certificate, a MSc degree, or a diploma in nursing. Finally, skills may be conceptualised in terms of occupations—for example, electrician, nurse, or civil engineer—when considering high- or low-skilled occupations, or occupations in high demand. In this document, the term ‘skills’ is primarily used to refer to qualifications or education attainment. Where appropriate however, it will also be used to refer to job competencies or occupations.

Skills Demand: Skills demand refers to the human resources (in this instance, people) and competencies that employers require, at prevailing wage rates, to meet their operational needs at a given point in time. In this sense, the demand for skills derives from the demand for the goods and services produced by employers. Skills demand therefore reflects the skills that public and private sector employers need in order to meet their objectives. Skills demand can also be thought of as skills needs.

Skills Mismatch: A skills mismatch may occur where the skills supplied by an individual do not match demand exactly, but are sufficiently close for employers to hire the worker. Skills mismatches refer either to the inadequacy of a worker’s skills relative to the requirements of the job he/she is currently in (e.g. having a lower level of qualification than required for the job, or being trained in a field of study other than the one generally required for the job); or to the opposite phenomenon whereby a worker’s skills exceed those required by the job (e.g. having a higher level of qualification than required for the job). A skills mismatch can include a qualification mismatch or a field-of-study mismatch.

Labour Force: The labour force consists of all working-age individuals who are either employed or unemployed. Since there are two definitions of unemployment, there are two definitions of the labour force. The narrow labour force consists of the employed and the narrowly defined unemployed; the expanded labour force consists of the employed and the broadly defined unemployed.

Wages: The earnings from an employee’s main job.

Wage Pressure: Rising wages as a result of either increased demand for workers of a particular type, or a lack of supply of such workers.

Hourly mean wage growth: Growth of hourly wages at the mean of the wage distribution.

Hourly median wage growth: Growth of hourly wages at the median of the wage distribution.

Conditional hourly mean wage growth: Growth of hourly wages at the mean of the wage distribution, controlling for additional characteristics of the measured population.

Unemployed: In this report the unemployed are those classified as unemployed under the “**narrow unemployment**” definition, which refers to people who are **unemployed** and actively seeking work. As per the definition used by Statistics South Africa in their survey work – someone is considered to be unemployed if they are capable of working but are not employed. In addition, they need to have actively looked for work or tried to start a business at some point in the four weeks preceding the survey.

2. Purpose of the report

The South African labour market is characterised by a severe mismatch between the skills required by firms and those available in the labour force. At the industry level, data show that the tertiary sector is growing while the primary sector, which employs the majority of low-skilled labour, continues to shrink. This is exacerbated by the continued skills-biased demand trajectory in the economy where within particular industries and occupations, highly skilled workers are in short supply and experience rising incomes, while there is a growing pool of low-skilled workers with limited formal education or training who are unable to find work. This skills mismatch contributes to the high levels of unemployment in the country and is a major driver of rising wage inequality.

A central mechanism in the relationship between demand and supply in the labour market is the wage level. More specifically, how wages change over time, and how they differ in relation to various sectoral, demographic and occupational characteristics can reveal insights about the labour market more broadly. Tracking relative wage growth in a particular segment of the labour market, among forensic auditors, or community carers for example, can serve as a marker of specific skillsets that are in high demand. However, because multiple factors can affect an individual’s wage, and occupational changes and wages do not always correlate at the aggregate level, careful empirical study is required to disentangle these factors and try to identify where wages are a good indicator of changing demand or supply in the labour market.

The purpose of this report is to provide a comprehensive analysis of wages in South Africa, with a focus on issues of skills mismatch and the relationship between supply and demand in the labour market for particular sub-sectors, skill levels and occupations, and at different points in the wage distribution. In this way, the work forms part of a labour market intelligence project that feeds back into policy questions around sectoral and occupational needs, education and skills constraints, possible future skills demands, and the changing nature of work in the country.

3. Rationale for the report

As explained above in the South Africa context of rising wage inequality and unemployment, it is imperative to have a clear understanding of the relationship between skills demand and supply, and how this interacts with employment and wages. From a policy perspective this report will add value in several respects. Firstly, together with a number of other papers in the broader project, it aims to provide a deeper understanding of the relationship between skills demand and supply in the economy, and how this has changed over the last decade. Secondly, it offers a comprehensive overview of wages and wage trends alongside detailed employment information. Taken together the insights that emerge

from this work will help to inform policymakers about skills shortages and more broadly contribute to policy dealing with wage setting and employment issues. **Thirdly, this report serves as an important feeder to the development of the three important lists (LMI project 1.6), namely, the List of Occupations in High Demand, the Critical Skills list and the List of Priority occupations. These three lists continue to be the key deliverable of the entire LMI research programme.** Fourthly, the analytical approach, which we discuss in more detail below extends and updates existing work in this area and in this way adds to the labour market literature in South Africa.

4. Key research questions to be answered through the study

To clarify the research focus within the frame introduced above, there are a number of research questions that the analysis aims to deal with in this study:

- Firstly, there is the basic question of why the study aims to measure wages in relation to skills needs. The study contends that wages can provide important insight into the skills needs of an economy – where relative wage changes are suggestive of changes in supply and demand for skills in the labour market. In this sense, wages function as the price of different skill profiles. As such, the study intends to start with a descriptive approach that examines what has happened to the wage distribution over the last decade, across a range of relevant categories. This should answer questions around the nature of the ‘problem’.
- Secondly, building on this, the study is interested in the various factors affecting wages. As already known from existing work, such factors include the influence of industry and occupation-specific effects, influence of union membership and demographic variables such as age, gender, population group, education and work experience. The study intends to measure how each of these factors affect wages and what this may suggest about demand and supply.
- Thirdly, and building on the point above, it is important to examine how the contributions of these factors have changed over time. This is a critical component of this report as it provides information on how the labour market is shifting, what may be driving this, and what it means from an occupation and skills perspective. Here we will take into account the effects of institutional changes such as the National Minimum Wage, details specific to certain occupations or occupational sub-groups such as workers in independent contracting arrangements, as well as more macro comparisons across the formal and informal sectors, for example.
- Fourthly, looking at wages, the study will use the necessary econometric modelling techniques to isolate the influence of individual characteristics from economy-wide shifts in order to estimate the extent to which each reflects changes in demand.
- Finally, the study intends to use the findings on wages to connect to the relevant reports in the LMI research project, particularly the three lists, and conclude with a set of basic recommendations that emerge from the work.
- This report will feed into other research being undertaken through the LMIP 2 research programme where applicable.

5. Target group for the report

The final report has a varied target audience that includes policymakers, at Department of Higher Education and Training and other government institutions concerned with labour market issues such as the Department of Employment and Labour; the National Planning Commission, The Dept of Trade,

Industry and DTIC), The Department of Home Affairs; academics and researchers; and organisations in the private sector involved with skills planning.

6. Scope of report

The study's analytical timeframe is partly determined by the data available, but it focuses primarily on the 2000-2019 period. The study deems that a 20-year time period is sufficient to pick up trends and explore the questions listed above. For this analysis, the study intends to make use of the labour force survey data available from Statistics South Africa. Specifically, the plan is to use Labour Force Surveys (LFS, 2000-2007) and Quarterly Labour Force Surveys (QLFS, 2008-2019). These datasets contain information on earnings¹, relatively detailed occupational and industry information (to the 4-digit level), as well as a range of relevant demographic data for each individual. The descriptive analysis will cover the full period in order to track broad trends in wages for different groups, while the econometric analysis will focus on the 2011-2019 period. The analysis is limited here by a break in the collection of wage data for the QLFS between 2009-2011.

7. Methodology and approach

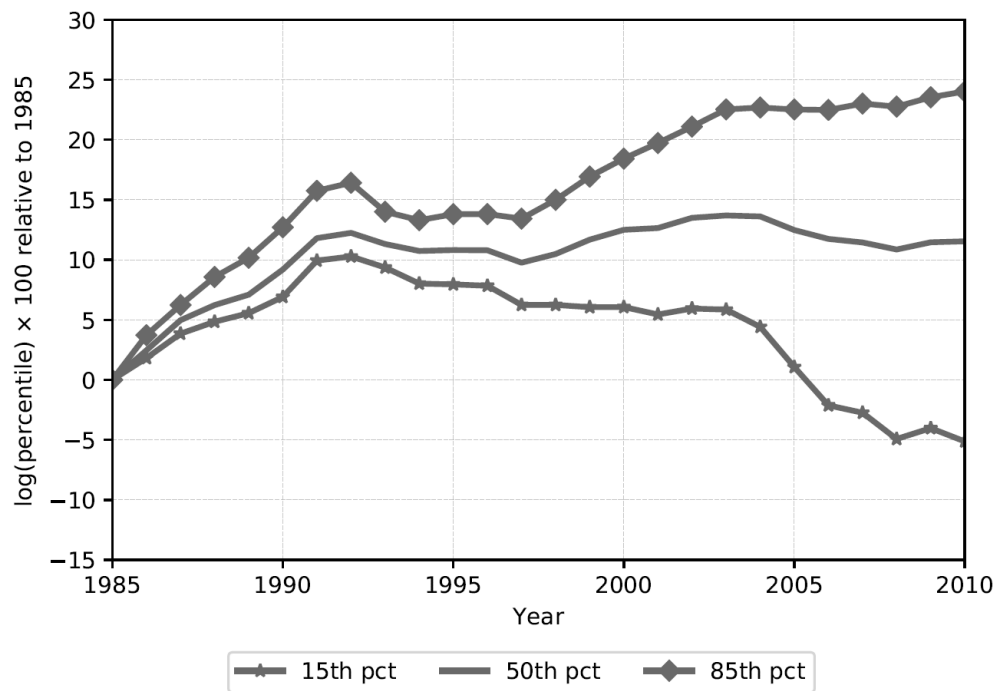
Tinbergen (1975) developed an early economic understanding of the relationship between skills and wages in the labour market. In this work, changes in the wage structure of high and low-skilled workers over time were explained in terms of returns to education, where education in turn was influenced by the relative demand and supply of skills. Increased education levels produced higher wages, and if wages began to rise more rapidly in a certain occupation - signalling a shortage – it would incentivise individuals to move into that field. There have been substantive additions to this basic formulation² and this report does not discuss these in detail here but an increasingly important addition in this relationship is technology. Technology is generally understood to have 'skills-biased' impacts and raises the level of wage inequality in the labour market. Looking at the South African case, the impacts of technology on wages and employment have been partially documented (see Bhorat et al., 2014) while there is clear evidence of substantial growth in the returns to education at the top end of the wage distribution (Branson et al., 2013). Together, both of these trends help to explain the high levels of wage inequality in the country. However, there are other factors that are important to understand in the relationship between education, skills, and demand and supply in the South African labour market and in large part the questions listed above remain open.

To examine these questions, the study begins with a basic descriptive approach that looks at wages and employment across key covariates and over time. For example, the analysis looks at how wages have changed over time at different points in the distribution (see Figure 1 below) and this is done both at the aggregate level and then for specific covariates of interest, including sectoral/occupational groups, as well as demographic groups. While Figure 1 below is based on European data, it represents a global trend that provides useful context against which to compare the South African case of wage polarisation, where wages at the top and bottom of the distribution grow but the middle is stagnant (see Figure 3, below).

Figure 1. Wage percentiles over time

¹ Since 2015 wage data has been released in an annualised version of the QLFS called the Labour Market Dynamics South Africa (LMDSA) and we make use of this in addition to the QLFS data.

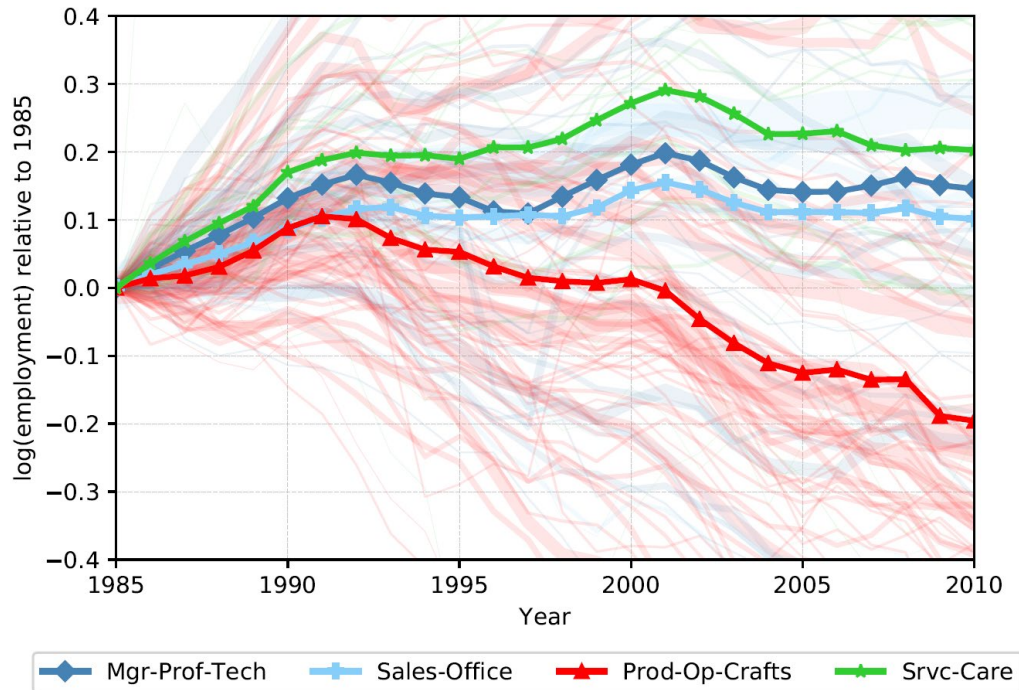
² See Autor and Acemoglu (2011) for an overview of the major developments.



Source: von Gaudecker (2019)

At the same time, the study wants to observe what has happened to employment over a similar period by looking at occupational categories to find out whether similar polarisation has taken place by job type. In this case, the analysis intends to use the existing occupational categories and the 4-digit level but also create aggregate groups that collate occupations by job type in order to capture the impacts of technological change and skills bias. Figure 2, below, presents a figure of this nature using the same European data and again shows what has been identified in many countries around the world and to some extent for South Africa, at the industry level. Low-skilled occupations are shrinking in employment terms, while higher skilled jobs in the services, professional and technical occupations are growing. Again, the study intends to apply this lens to the South African data to present a comparative overview.

Figure 2. Employment by occupation



Source: von Gaudecker (2019)

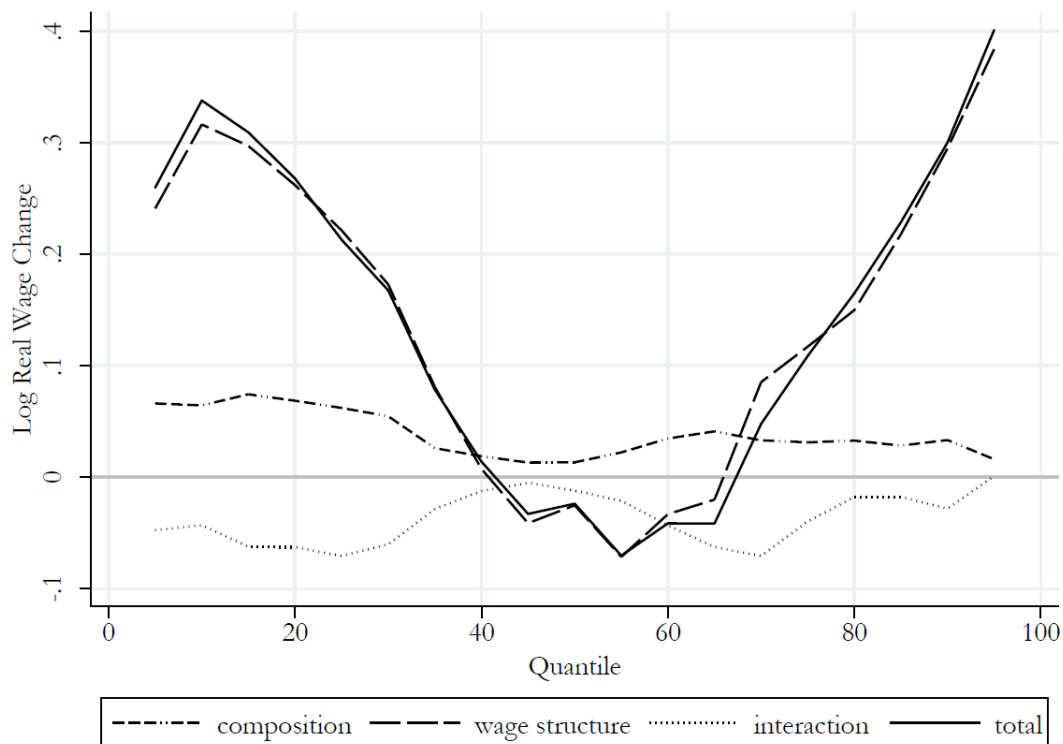
In addition to a rigorous descriptive overview of wage and employment trends, the study adopts a relatively novel but widely used econometric technique to examine the various factors driving some of the observed changes. To do this, one must ‘decompose’ individual wages into categories that allow one to examine how individual characteristics such as age, gender, education influence earnings versus structural factors such as changing demand for specific occupations. Several decomposition procedures are available that work to disentangle the sources of change or the differences in wage distributions. The most well-known is the Oaxaca-Blinder (OB) decomposition method, which in simple terms provides a way of decomposing changes or differences in mean wages into individual and structural components. However, this approach does have limitations for purposes of this study here given that the analysis intends to look not only at these two components, but also how much each of these components matter at different points in the wage distribution. Put differently, the analysis wants to be able to capture the effect of education on wage growth for those earning at different points in the wage distribution. For example, it would be useful to examine those at upper levels of the earnings distribution, say the 85th percentile, and see whether this differs from the effects for those at the lower levels of the distribution, say 15th percentile. Discussions about various limitations of the OB method are relatively technical but the main point is that it does not allow one to do this – changes can only be examined at the mean, not at different points in the wage distribution. Essentially, the analysis would like to generalize the Oaxaca-Blinder decomposition of the mean to any quantile of the distribution. In order to do this, the analysis will make use of the recentered influence function (RIF) regression technique developed by Firpo et al. (2009).

The technique allows us to estimate the impact of changing the distribution of explanatory variables (such as education) on the unconditional quantiles of the outcome variable – in our case wages. This is particularly useful when the effect of a given explanation variable on a specific quantile of the outcome variable differs over levels of other covariates (Borah & Basu, 2015). While a conditional quantile regression produces estimates that are conditioned on the mean value of all other covariates, the unconditional quantile regression estimates the effect of changing a covariate by one unit, keeping the

full distribution of all other covariates the same (*Ibid.*). The RIF approach also contains a re-weighting method that the analysis will adopt. This provides more interpretable and policy relevant results than under the standard conditional quantile regression assumptions. The estimated coefficients can be used to perform a detailed decomposition of the gap along the distribution into the compositional and structural components, as well as to determine the contribution of each of the explanatory variables to these components.³

While the technique is technically complex, it is now widely used and relatively straightforward to apply and interpret. To provide a basic example of this and our intended approach Figure 3, below, provides the results of an application of the RIF regression for South Africa. This decomposition presents the change in log real wages at each percentile into a compositional (endowment), wage structure (coefficient), and interaction effect.

Figure 3. Decomposition of Total Wage Change into Compositional, Structure and Interaction Effects: 2001-2015



Source: Bhorat et al. (2019)

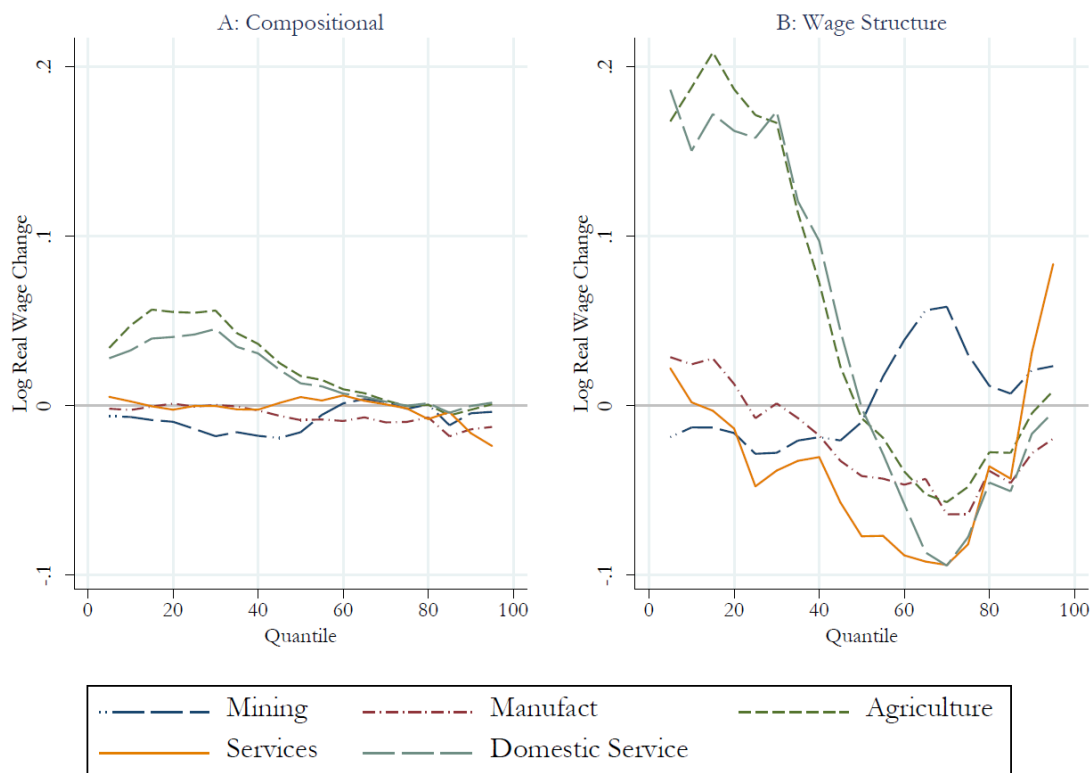
The compositional component in the figure is the proportion of the wage change that is explained by different characteristics of the employed over time, and the wage structure component is the proportion that is explained by changes in ‘market’ returns. Specifically, the compositional component plots the change in real wages in 2001 if the employed had x -characteristics (e.g. level of education, gender, or age) of the employed in 2015, holding the wage structure in 2001 (the reference year) constant. The wage structure component plots the change in real wages in 2001 if the employed had the β -returns of the employed in 2015, holding the worker characteristics in 2001 constant. Lastly, the interaction is the simultaneous effect of changes in coefficients and endowments. Put simply, the results suggest that compositional factors – such as changing shares of education attainment across

³ We do not introduce the formal regression equation here for simplicity, but it is described in detail in Firpo et al. (2009).

the distribution – have had only marginal impact on mitigating wage inequality in the economy. Rather, it is changes in returns that are primarily contributing to the U-shaped pattern of wage growth in South Africa. Factors such as skills-biased technical change, structural shifts across sectors, the influence of technology, and the role of labour market institutions appear to have more meaningfully altered wages in post-apartheid South Africa.

The analysis can use this approach to examine more specifically how wage structure and composition effects vary across a wide variety of categories, such as education, gender, sector and so on. To provide one last example of this, this report shows the results for sectors in Figure 4. This analysis shows that there are important compositional and wage structure effects by sector, although the wage structure dominates. In Panel A, the analysis observes positive compositional effect in the domestic service and agricultural sectors at the bottom end of the distribution. Compositional effects in the mining sector, though, had the opposite effect over the same portion of the distribution; whilst compositional effects on wage growth in the manufacturing and services sector are little different from zero.

Figure 4. Detailed Decomposition of the Compositional and Wage Structure Effects for Selected Sectors: 2001-2015



Source: Borhat et al. (2019)

Although the analysis is looking at sectoral effects, it sees two very important institutional impacts in Panel B that intersect along sector lines: The introduction of minimum wages in the domestic services and agricultural sectors clearly inflated wage growth at the bottom end of the distribution. Although the mining sector itself is clearly in decline working in this sector was associated with positive wage change for the upper half of the distribution. Structural returns in both manufacturing and services display a quasi U-shape, although only services are able to sustain the upward curve beyond the 80th percentile. Interestingly, there remained a positive return to the manufacturing sector for the lower portion of the distribution, and these returns were higher than those in the services sector. Indeed, changes in wage structure in the services sector only explained growth in wages for those at the very

bottom and very top of the wage distribution. The services sector is one of the fastest-growing sectors in South Africa, both in terms of contribution to GDP and employment. This analysis suggests that this growth has not paid off in real wage terms for most people employed in this sector, and that many of these jobs appear to low-skilled and 'lousy'.

8. How will this report link to other reports or other components of the LMI project

In addition to the broad linkages across the entire project around skills supply and demand this paper connects closely to the work focusing on occupations in high demand and Critical Skills.

9. Referencing

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