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The impact of the 2014 platinum mining strike in South Africa: An economy-wide analysis☆

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ABSTRACT

In this paper we measure the economy-wide impact of the 2014 labour strike in South Africa's platinum industry. The strike lasted 5 months, ending in June 2014 when producers reached an agreement with the main labour unions. The immediate impacts on local mining towns were particularly severe, but our research shows that the strike could also have long lasting negative impacts on the South African economy as a whole. We find that it is not the higher nominal wages itself that caused the most damage, but the possible reaction by investors in the mining industry towards South Africa. Investor confidence is likely to be, at least, temporarily harmed, in which case it would take many years for the effects of the strike to disappear. We conduct our analysis using a dynamic CGE model of South Africa.

1. Introduction

The labour strike in South Africa's platinum sector that started on 23 January 2014 became the country's largest and most expensive in history. The dispute regarding wages and conditions of service between the Association of Mineworkers and Construction Union (AMCU) and the main platinum producers lasted 5 months, with an agreement eventually reached on 24 June 2014. The mines directly affected included Anglo American Platinum Limited, Impala Platinum Holding Limited and Lonmin Plc. (2014), the three largest platinum producers in South Africa and the world. According to a joint statement from the platinum producers, the strike reportedly affected half of the global platinum supply in which employers forfeited revenue of approximately R23 billion and employees lost earnings of some R10.7 billion. Whilst these direct effects are relatively easy to estimate, it is harder to predict the total economy-wide impact of the shock over an extended period of time.

For this study we use a dynamic computable general equilibrium (CGE) model to estimate the economy-wide impact of the platinum sector strike in South Africa over the period 2014 to 2020. Four different simulations are run, ranging from the most optimistic scenario to the most damaging with regard to the expected future impact of the strike.

The structure of the paper is as follows. Section 2 briefly describes our methodology, including a description of the model and database. Section 3 describes the baseline and four strike simulations, and interprets the subsequent results. Section 4 concludes the paper with an overview of the findings.

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2. Methodology

We use the University of Pretoria General Equilibrium Model (UPGEM) to conduct our analysis of the platinum sector strike on the South African economy. CGE models such as UPGEM provide industry-level disaggregation in a quantitative description of the whole economy and postulate neo-classical production functions and price-responsive demand functions, linked around a supply-use matrix in a general equilibrium model that endogenously determines prices and quantities.

Four basic tasks distinguish CGE based analysis (Adams, 2005). First is the theoretical derivation and description of the model. UPGEM is based on the well-documented MONASH model described in Dixon and Rimmer (2002) and Dixon et al. (2013). Following the MONASH-style of implementing a CGE model, the general equilibrium core of UPGEM is made up of a linearised system of equations describing the theory underlying the behaviour of participants in the economy. It contains equations describing, amongst others: the nature of markets; intermediate demands for inputs to be used in the production of commodities; final demands for goods and services by households; demands for inputs to capital creation and the determination of investment; government demands for commodities; and foreign demand for exported goods. The model is implemented and solved using RunDynam in the GEMPACK suite of programs described in Harrison and Pearson (1996). GEMPACK eliminates linearisation errors by implementing shocks in a series of small steps and updating the database between steps.

The specifications in UPGEM recognise each industry as producing one or more commodities, using as inputs combinations of domestic and imported commodities, different types of labour, capital and land. The multi-input, multi-output production specification is kept manageable by a series of separability assumptions, illustrated in Fig. A1 of the Appendix. This nested production structure reduces the number of estimated parameters required by the model. Optimising equations determining the commodity composition of industry output are derived subject to a CET function, whilst functions determining industry inputs are determined by a series of CES nests. At the top level of this nesting structure intermediate commodity composites and a primary-factor composite are combined using a Leontief or fixed-proportions production function. Consequently, they are all demanded in direct proportion to industry output or activity. Each commodity composite is a CES function of a domestic good and its imported equivalent. This incorporates Armington's assumption of imperfect substitutability for goods by place of production (Armington, 1969). The primary-factor composite is a CES aggregate of composite labour, capital and, in the case of primary sector industries, land. Composite labour demand is itself a CES aggregate of the different types of labour distinguished in the model's database. In UPGEM, all industries share this common production structure, but input proportions and behavioural parameters vary between industries based on base year data and available econometric estimates, respectively.

The demand and supply equations in UPGEM are derived from the solutions to the optimisation problems which are assumed to underlie the behaviour of private sector agents in conventional neo-classical microeconomics. Each industry minimises cost subject to given input prices and a constant returns to scale production function. Zero pure profits are assumed for all industries. Households maximise a Klein-Rubin utility function subject to their budget constraint. Units of new industry-specific capital are constructed as cost-minimising combinations of domestic and imported commodities. The export demand for any locally produced commodity is inversely related to its foreign-currency price. Government consumption, typically set exogenously in the baseline or linked to changes in household consumption in policy simulations, and the details of direct and indirect taxation are also recognised in the model.

The recursive-dynamic behaviour in UPGEM is specified through equations describing: physical capital accumulation; lagged adjustment processes in the labour market; and changes in the current account and net foreign liability positions. Capital accumulation is specified separately for each industry and linked to industry-specific net investment in the preceding period. Investment in each industry is positively related to its expected rate of return on capital, reflecting the price of capital rentals relative to the price of capital creation. For the government's fiscal accounts, a similar mechanism for financial asset/liability accumulation is specified. Changes in the public sector debt are related to the public sector debt incurred during a particular year and the interest payable on previous debt. Adjustments to the national net foreign liability position are related to the annual investment/savings imbalance, revaluations of assets and liabilities and remittance flows during the year. In policy simulations, the labour market follows a lagged adjustment path where wage rates respond over time to gaps between demand and supply for labour across each of the different occupation groups.

The second task identified by Adams (2005) is calibration, which incorporates the construction of a balanced database and evaluation of coefficients and parameters. As required for MONASH-style models, the initial levels solution of the model is provided by the base year data. The database, in combination with the model's theoretical specification, describes the main real inter-linkages in the South African economy. The theory of the model is then, essentially, a set of equations that describe how the values in the model's database move through time and move in response to any given policy shock. The current version of UPGEM uses a 2011 reference year database that draws mainly from the 2011 supply-use tables published in StatsSA (2014a) and other data in SARB (2014). The standard database distinguishes 40 industries and commodities, and 11 occupation groups. However, in order to simplify the presentation of results in this study, we aggregate the database to 25 sectors and a single representative household. The source data was adapted for use in a CGE framework by the Department of Economics at the University of Pretoria.[1] A stylised representation of the model's core database, highlighting the amount of detail that can be accommodated, is shown in Fig. A2 of the Appendix. Dixon et al. (2013) describe a MONASH-style database in detail. We give a brief summary of their description in the Appendix.

The third task is solving the model using a suitable closure. Dynamic CGE models such as UPGEM are designed to quantify the effects of a policy change, or exogenous shock, to the economy, over a period of time. A good way to examine the impacts of an exogenous shock is to compute the differences between a scenario in which the shock has occurred – the policy simulation – and a counterfactual scenario in which the particular shock under examination did not occur – the baseline scenario (Cappuis and Walmsley, 2011). Results are then reported as percentage change deviations over time between the first 'baseline' simulation run and the second 'policy' simulation run. The model's closure settings, that is, the choice of exogenous versus endogenous variables, can be considerably different between the two runs. In the baseline we exogenise those variables for which reliable forecast information exists. Typically, these exogenously set variables in the baseline run include all the main macroeconomic variables, such as the components of GDP, population growth and various price indices forecast by various macroeconomic specialists. In the policy run, all the naturally endogenous variables are indeed set as endogenous, because we are interested in the impact of the policy change on them. This setting represents a more natural model closure where the variable for which the equation was written is typically set as endogenous. For this paper we use the standard baseline forecast and policy closures described in Dixon and Rimmer (2002: 262–274). The nominal exchange rate is set as the numeraire in the policy run for all scenarios.

The fourth and final task involves proper interpretation of simulation results, drawing only on values given in the database, the underlying theory and the model closure. Section 3 of the paper will focus on this task and aim to provide an intuitive understanding of the results. Since it is not practical to describe the entire CGE methodology or UPGEM model used in this study here, readers interested in the finer details are encouraged to consult the various references, in particular Dixon et al. (2013).

3. Simulations

As noted in the previous section, we run two separate simulations in order to isolate and measure the impact of any scenario. The first establishes a business-as-usual (BAU) baseline forecast of the economy in the absence of the shock under investigation. The second simulation imposes the exogenous shock on the economy, in this case, the strike in the platinum industry. Results quantifying the impact of the shock are then reported as percentage changes between the values in the baseline run and the policy run for each variable. The forecast and policy simulations are done with different closures to the model. In the forecast closure we exogenise variables that we have forecast information for, such as household consumption, and endogenise variables that are related to them, such as the average propensity to consume (APC). Shocking the model with the forecasted value of household consumption would give a resulting value for the APC. If we would then change the closure by making household consumption endogenous and the APC exogenous, we would get the same value for household consumption by shocking the value of the APC by the solution value found previously. In general, therefore, we do a baseline forecast of the economy, then change the closure of the model to the policy closure that will be used later in the policy simulation, and re-generate the baseline forecast with it.

We are now ready to apply any set of additional policy shocks to the exogenous variables. If we would run a policy simulation where no additional shocks are applied to the policy variables, the original baseline

[1] Documentation detailing the UPGEM database building process is available from the authors upon request.