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Stellenbosch Economic Working Papers: 14/15

KEYWORDS: MACROECONOMIC MODELLING, POTENTIAL OUTPUT, MULTIVARIATE FILTER, COBB-DOUGLAS
JEL: C51, E31, E52

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A WORKING PAPER OF THE DEPARTMENT OF ECONOMICS AND THE
BUREAU FOR ECONOMIC RESEARCH AT THE UNIVERSITY OF STELLENBOSCH

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ABSTRACT

Estimates of potential output growth in SA have declined from over 3% prior to the Global Financial Crisis (GFC) to just over 2% currently (Ehlers et al, 2013; Anvari et al, 2014; IMF, 2014; SARB MPC statement, March 2015; Kemp, 2015). A similar slowdown has been experienced in several other countries, including most members of the G20 (IMF, 2015). The purpose of this paper is to (i) estimate SA's level of potential output growth both before and after the GFC using a multi-variate filter technique based on Blagrave et al (2015) and (ii) attempt to explain the apparent decline in the growth potential by investigating the underlying drivers of potential GDP growth using a Cobb-Douglas-type production function (similar to IMF, 2015). It is found that potential growth has declined to around 2.2% post-GFC. It is also determined that the biggest driver of the post-crisis decline in potential growth has been lower productivity growth.

Keywords: Macroeconomic modelling, Potential output, Multivariate filter, Cobb-Douglas
JEL codes: C51, E31, E52

1. Introduction

Measuring potential output accurately is important. Judgements about the stance of the economy, medium term growth prospects and policy analysis depend on it. Over the medium term, the growth rate in potential output provides a guide for the assessment of sustainable non-inflationary growth in output and employment. The deviation of actual from potential output – the so-called output gap – provides a measure of aggregate demand pressure relative to potential in an economy at a particular time. The output gap therefore contains useful short-term information for the formulation of economic policy, specifically stabilisation policy.

But potential output is hard to measure. Firstly, potential output is unobservable. Numerous concepts have been defined in the literature, but no consensus has been reached on the precise definition of potential output. Secondly, given the difficulty in pinning down a precise definition of potential output, a wide variety of methods are used in estimation exercises. Estimation results are often quite sensitive to the specific method employed and are in general not robust across methodologies.

We employ a simple multivariate filter (MVF) based on Blagrave et al (2015) to estimate potential output and the output gap for South Africa. The technique satisfies several criteria critical to the discussion surrounding potential output and the output gap. Firstly, the estimates of the output gap are economically plausible (periods of excess demand and supply correspond with the authors' priors as well as other estimates found in the literature). Secondly, the filter incorporates economic theory, as opposed to the atheoretical nature of most simple univariate filters. The structure relates the output gap to inflation, (manufacturing) capacity utilisation and slack in the labour market. Thirdly, the estimates of potential and the output gap are more robust in real time relative to estimates from an HP filter, although some real-time uncertainty is unavoidable. However, as mentioned in Blagrave et al (2015), the filter is designed to be 'least bad' among the set of estimation techniques.

Importantly, recent evidence, both domestically and internationally, has shown that potential growth rates the world over have fallen substantially in the wake of the 2008-2009 global financial crisis (Ehlers et al, 2013; IMF, 2014; Anvari et al, 2014; IMF, 2015; Kemp, 2015). From a policy perspective, it is important to get some idea as to the drivers of this slowdown. To that effect, the second part of the paper focuses on decomposing potential growth into its main drivers using a growth accounting framework. In accordance with results for other emerging markets, it is found that the dramatic slowdown in potential growth was mainly driven by a substantial decline in post-crisis productivity growth.

The rest of the paper is structured as follows. Section 2 provides a brief overview of the concept of potential output and the different techniques used in its estimation. Section 3 details the MVF methodology applied in this paper and discussed the estimation results, while Section 4 decomposes potential growth into its main drivers. Section 5 concludes.

2. Potential Output: A Brief Overview

2.1. Definition

A precise definition of potential output has been hard to pin down. Taken literally, potential output refers to the maximum possible output of an economy if all resources were fully utilised. Alternatively, the term could refer to some "normal" level of production given average or trend utilisation of the factors of production, including capital and labour.

However, the definition most commonly used in recent studies identifies potential output as the maximum level of output attainable without generating an increase in inflation (Okun, 1962). Estimating potential output and the output gap accurately is particularly important for the conduct of monetary policy, since the output gap – the difference between actual output of the economy and its potential – is a key indicator of inflation pressures in the economy. When demand is strong, actual output can move above potential, pushing against the economy's capacity to produce and putting upward pressure on inflation. Therefore, the Okun definition is attractive to monetary policy makers as it allows them to communicate their monetary policy decisions with reference to the short-run trade-off between output and inflation (Blagrave et al, 2015).

However, thinking of potential output only as non-inflationary output is too restrictive. Recent history has shown that other imbalances, notably in the financial sector and in asset markets, can emerge while inflation remains low and stable. As such, recent work has focused on expanding the definition of potential output to include consideration of macroeconomic imbalances more broadly rather than focusing on inflation alone as the main symptom of unsustainability. However, given the difficulty in identifying the drivers of, for example, credit expansions, it is unwise to counsel policy makers to treat all such expansions as bad, requiring a policy response to ensure long-term sustainability. As such, the broader definition of potential output should be seen as a complement to, rather than a substitute for, the Okun concept (Blagrave et al, 2015).

Whatever the definition used, potential output is generally determined by structural factors such as demographic developments (i.e. age of population), education, productivity and investment in the (productive) stock of capital. As such, lifting the potential growth rate of any economy requires structural interventions in product and labour markets in order to strengthen underlying fundamentals.

2.2. Estimating Potential Output

Potential output is hard to measure. Firstly, it is unobservable and as such needs to be estimated. Secondly, given the difficulty in pinning down a precise definition of potential output, a wide variety of methods are used in estimation exercises. Unfortunately, estimation results are often quite sensitive to the specific method employed and are in general not robust across methodologies.

Generally speaking, potential output can be derived from either a purely statistical approach or from full econometric analysis. The former attempts to separate a time series (such as real GDP) into trend and cyclical components using mechanistic statistical techniques devoid of any economic theory considerations, while the latter utilises insights from economic theory in constructing structural economic models in order to obtain an estimate of the potential growth rate of an economy.

One of the more popular techniques to estimate potential is the use of single-variable (or univariate) statistical filters in order to smooth out fluctuations in output. The benefit of this approach is that it is simple and transparent, and can be used in any country where GDP data exists. However, partly because of its simplicity, the technique has several drawbacks. The main drawback is that estimates are better thought of as trend (rather than potential) growth as these filters do not include any economic structure and are therefore inconsistent with the economic concept of potential. Additionally, univariate filters suffer from a severe "end-of-sample" problem, with estimates toward the end of the sample subjected to significant revisions as new data becomes available and the sample is extended (Blagrave et al, 2015).

Recently, a good deal of work has focused on the use of multivariate filters (MVF) in estimating potential output.[1] This approach augments the simple single-variable filters by conditioning on basic theoretical relationships in order to incorporate some economic structure, bringing estimates closer to the Okun concept of potential (Blagrave et al, 2015). In its simplest form, this technique is relatively easy to perform and can be augmented where data availability allows. However, these MVF techniques suffer from the same end-of-sample problem as the single-variable filters discussed above, although to a lesser extent.

[1] See Laxton and Tetlow (1992), Benes et al (2010) and Blagrave et al (2015), among others.

Finally, structural econometric techniques for estimating potential output attempt to isolate the trend and cycle components of output using economic theory. Techniques include the popular production function technique, the so-called structural vector autoregressive technique, and, more recently, the estimation of trend output utilising estimates obtained from dynamic stochastic general equilibrium (DSGE) models. The main drawback of these techniques are that they are often much more difficult to implement, while results are highly dependent on the underlying structure imposed on the model.

In this paper, we will apply a simple MVF in estimating the potential growth rate of the South African economy. Section 3 gives a detailed breakdown of the methodology and key results.

3. A Simple Multivariate Filter for Estimating Potential Output Growth

The MVF approach applied in this paper is based on work by Benes et al (2010), Blagrave et al (2015) and Alichi (2015). It is relatively simple, requiring data on just four observables: real GDP growth, CPI inflation, the unemployment rate and capacity utilisation. Additionally, as discussed below, data on growth and inflation expectations are used, in part to help identify shocks, but mostly to improve the accuracy of estimates at the end of the sample period.

3.1. Methodology

As in Blagrave et al (2015), the output gap is defined as the deviation of real GDP (in log terms), Y, from its potential level, $\bar{Y}$:

(1) $$y_t = Y_t - \bar{Y}_t$$

The stochastic process for output (real GDP) comprises three equations and is subject to three kinds of shocks:

(2) $$\bar{Y}_t = \bar{Y}_{t-1} + G_t + \varepsilon_t^{\bar{Y}}$$

(3) $$G_t = \theta G^{ss} + (1-\theta)G_{t-1} + \varepsilon_t^G$$

(4) $$y_t = \varphi y_{t-1} + \varepsilon_t^y$$

The level of potential output ($\bar{Y}_t$) evolves according to potential growth (G_t) and a level-shock term ($\varepsilon_t^{\bar{Y}}$). Potential growth is also subject to persistent shocks (ε_t^G), with their impact fading gradually according to the parameter θ. Finally, the output gap is also subject to demand shocks (ε_t^y).

In order to help identify the three shocks mentioned above, a Phillips Curve equation for inflation is added, which links the evolution of the output gap to observable data on inflation in accordance with the Okun definition of potential output. The Phillips Curve is given by equation (5):

(5) $$\pi_t = \lambda\pi_{t+1} + (1-\lambda)\pi_{t-1} + \beta y_t + \varepsilon_t^\pi$$

Equations describing the evolution of unemployment is included to provide further identifying information for the estimation of the output gap:

(6) $$u_t = \bar{U}_t - U_t$$

(7) $$\bar{U}_t = \tau_4\bar{U}^{ss} + (1-\tau_4)\bar{U}_{t-1} + g\bar{U}_t + \varepsilon_t^{\bar{U}}$$

(8) $$g\bar{U}_t = (1-\tau_3)g\bar{U}_{t-1} + \varepsilon_t^{g\bar{U}}$$

(9) $$u_t = \tau_1 u_{t-1} + \tau_2 y_t + \varepsilon_t^u$$

Here, $\bar{U}_t$ is the equilibrium value of the unemployment rate (the non-accelerating inflation rate of unemployment, or NAIRU), which is time varying and subject to shocks ($\varepsilon_t^{\bar{U}}$) and also variation in trend ($g\bar{U}_t$) which is itself subject to shocks ($\varepsilon_t^{g\bar{U}}$). This specification allows for persistent deviation of the NAIRU from its steady state value. Equation (9) specifies an Okun's law relationship wherein the gap between actual unemployment and its equilibrium value (given by u_t) is a function of the amount of slack in the economy (y_t).

Finally, following Benes et al (2010) and Alichi (2015) and extending Blagrave et al (2015), we add equations describing the evolution of capacity utilisation to provide even further identifying information:

(10) $$c_t = C_t - \bar{C}_t$$

(11) $$\bar{C}_t = \bar{C}_{t-1} + g\bar{C}_t + \varepsilon_t^{\bar{C}}$$

(12) $$g\bar{C}_t = (1-\delta)g\bar{C}_{t-1} + \varepsilon_t^{g\bar{C}}$$

(13) $$c_t = \kappa_1 c_{t-1} + \kappa_2(1-\delta)y_t + \varepsilon_t^{c}$$

The capacity utilisation gap (c_t) is the difference between actual capacity utilisation (C_t) and its equilibrium level ($\bar{C}_t$). The stochastic process for equilibrium capacity utilisation includes level shocks ($\varepsilon_t^{\bar{C}}$) as well as more persistent shocks to trend ($\varepsilon_t^{g\bar{C}}$). Due to data restrictions, manufacturing capacity utilisation is used as a proxy for total capacity utilisation.

Equations (1) – (13) comprise the core model for the estimation of potential output. In addition, information on growth and inflation expectations are added to help with the identification of the abovementioned shocks, but mostly to alleviate the end-of-sample bias:

(14) $$\pi_{t+j}^{BER} = \pi_{t+j} + \varepsilon_{t+j}^{\pi^{BER}} \quad , j = 0,1$$

(15) $$GROWTH_{t+j}^{BER} = GROWTH_{t+j} + \varepsilon_{t+j}^{GROWTH^{BER}} \quad , j = 0,1,\dots,5$$

For real GDP growth ($GROWTH_t$) the model is augmented with the forecasts from the BER for the five years following the end of the sample period. Equations (14) and (15) relate the model-consistent forward expectation for growth and inflation ($GROWTH_{t+j}$ and π_{t+j}) to observable data on how the BER expected these variables to evolve over the different horizons (one to five years ahead), given by $GROWTH_{t+j}^{BER}$ and π_{t+j}^{BER}. The strength of the relationship between the BER's forecasts and the model's forward expectation is given by the standard deviation of the error terms ($\varepsilon_{t+j}^{\pi^{BER}}$ and $\varepsilon_{t+j}^{GROWTH^{BER}}$). As discussed in Blagrave et al (2015), the estimated variance of these terms allows the BER's forecast to influence, but not completely override, the model's expectations, particularly at the end of the sample.

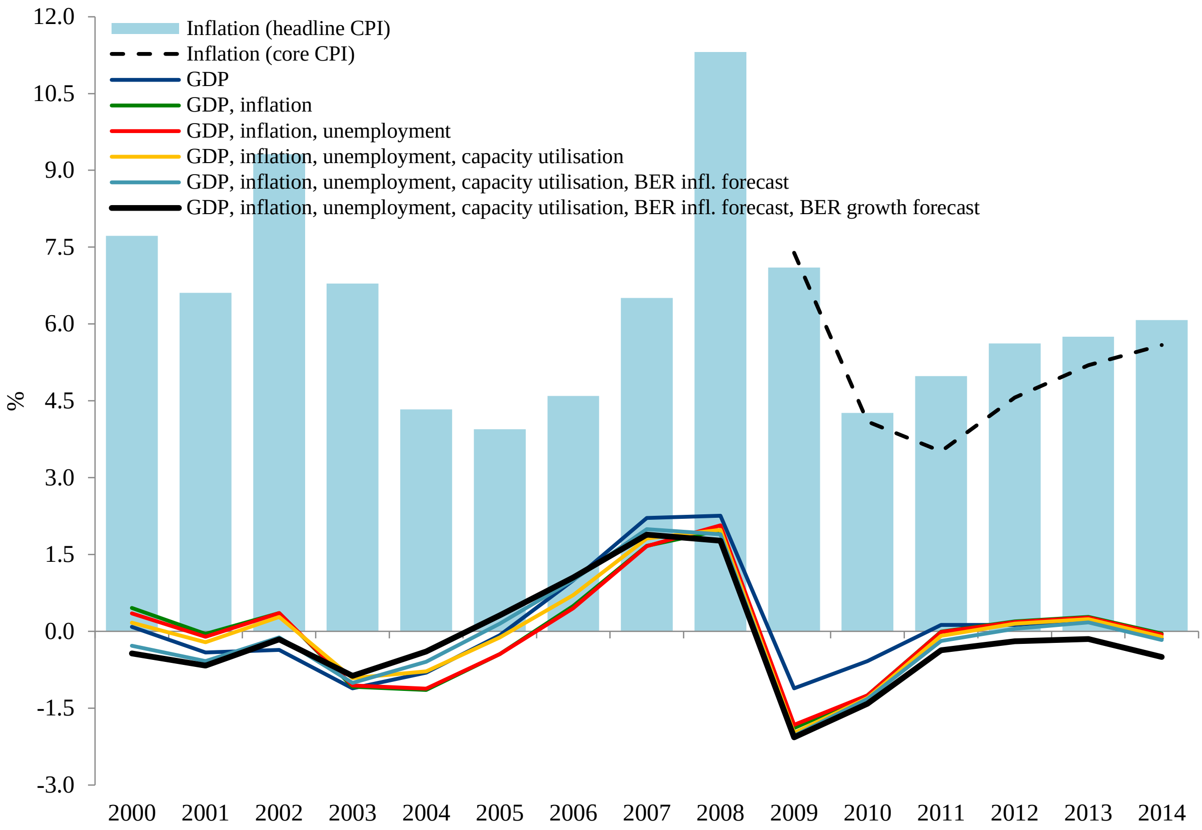
3.2. Baseline Estimation Results

Parameters are estimated using Bayesian estimation techniques. More specifically, we use regularized maximum likelihood (see Ljung, 1999). This allows for the definition of prior distributions that prevent parameters from wandering into nonsensical regions, which is a sensible consideration in this context as the data are uninformative about several parameters. Due to data restrictions, the sample is restricted to the period 1990 to 2014. Table 1 in the Appendix gives details on the data sources, while Table 2 displays priors regarding the steady-state values of output growth and the unemployment rate, as well as prior distributions and estimated posterior distributions of the model parameters.

Similar to Blagrave et al (2015), each marginal step in the construction of the estimates is presented in order to shed light on the role of the different components of the model. In what follows, it is shown that this relatively simple model has several advantages, namely, the theoretical coherence of output-gap estimates and inflation, the transparency of the estimates and the robustness of real-time estimates of potential growth. However, as mentioned in Blagrave et al (2015), it is far from perfect and should not be used to mechanically obtain estimates of potential growth or the output gap.

We start with the simplest filtration of GDP (using only equations (1) to (4) in the model above). This is depicted by the dark blue line in Figure 1, which shows the estimates which arise solely from the chosen calibration of the incidence of demand/supply shocks over the business cycle.[2] The green line shows the role of adding structure on inflation (i.e. equation (5)) to the filter. Though largely obscured by the red line, this additional economic structure suggests less excess demand in the pre-crisis period as a result of lower inflationary pressure in 2003-06. The effect of adding information on unemployment is given by the red line, which is almost identical to the green line suggesting that data on labour-market conditions do not add much identifying information. From here, information on capacity utilisation and information on the expectation for one-year ahead inflation is added (orange and teal lines). Adding these pieces of information result in slightly less slack in the pre-crisis period as capacity utilisation rates were picking up between 2000 and 2007, while inflation was expected to pick up from 2005 suggesting a smaller negative (more positive) output gap. Finally, the solid black line shows the effect of adding expectations data for growth. The impact at the end of the sample is significant: with actual growth underperforming expectations from 2010 to 2014, the filter interprets

Figure 1: Output Gap Decomposition



Source: Statistics South Africa, Authors' calculations

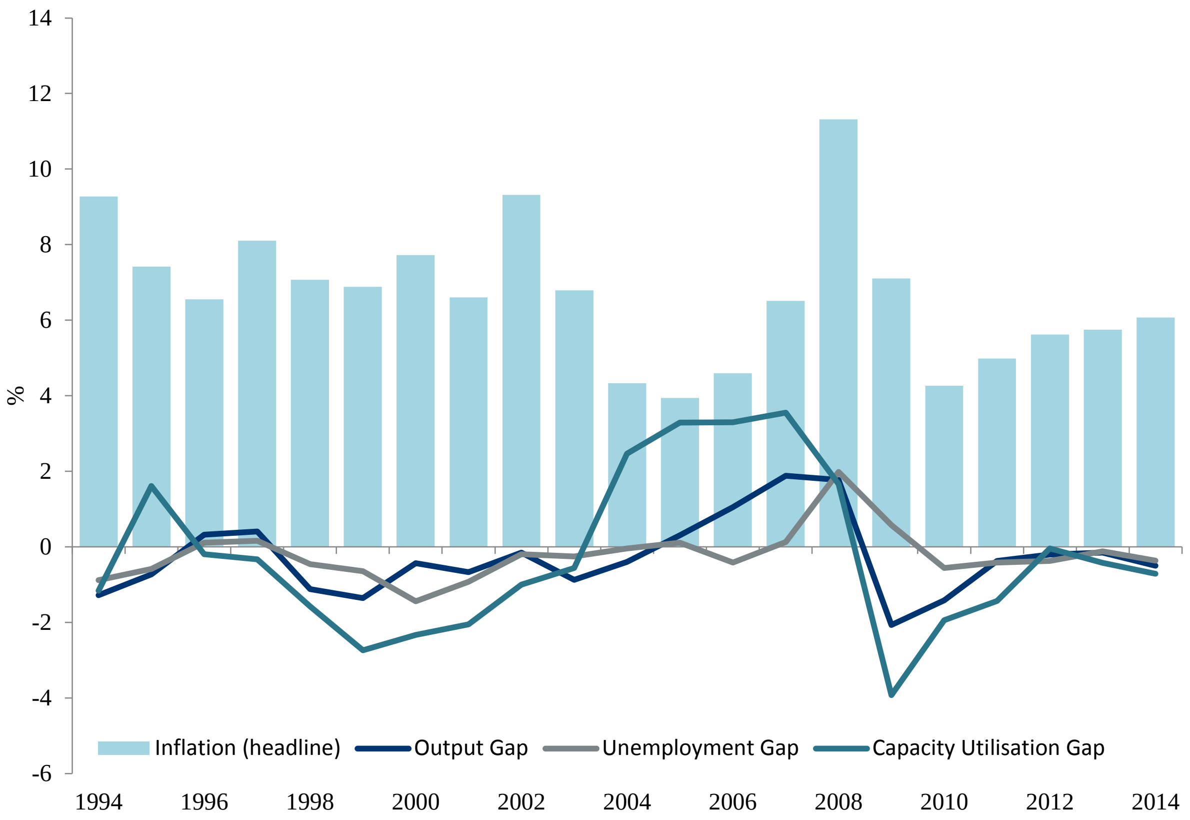
[2] The prior is that for advanced economies, shocks to output over the cycle is predominantly associated with fluctuations around the trend, i.e. shocks to output are driven mainly by demand/gap shocks. A common rule-of-thumb is that shocks to output will be approximately 1/3 supply/potential and 2/3 demand/gap. While the prior is that there is a more important role for shocks to trend (potential) in explaining the business cycle in emerging economies, the abovementioned calibration is used as a baseline, but the data is allowed to influence the prior through the estimation procedure.

this weak growth as temporary (i.e. related to demand shocks rather than shocks to potential), resulting in more economic slack and a more negative output gap.

The estimates can also be considered together with the other measures used to help identify the output gap. In Figure 2, the estimated output gap is shown alongside inflation and estimates for the unemployment and capacity utilisation gaps. The main takeaway is the broad coherence between the different pieces of information. Also of note is the general decline in headline inflation post-2000. In fact, if has been shown that the South African Reserve Bank has succeeded in anchoring inflation expectations at just under 6% since the introduction of explicit inflation targeting (see Rangasamy, 2009, and Burger, 2014, among others).

In all, estimates suggest that potential growth has slowed notably since the crisis, from 3.2% between 1994 and 2007 to 2.2% between 2011 and 2014. This corresponds well to estimates in the existing literature (see Ehlers et al (2013), Anvari et al (2014) and Kemp (2015), among others). According to the estimates, the output gap measured -0.5% of potential GDP in 2014. While somewhat smaller than other estimates in the literature, this mainly reflects the relatively sharp slowdown in estimated potential growth immediately following the crisis.

Figure 2: Output gap, employment gap, capacity gap and inflation

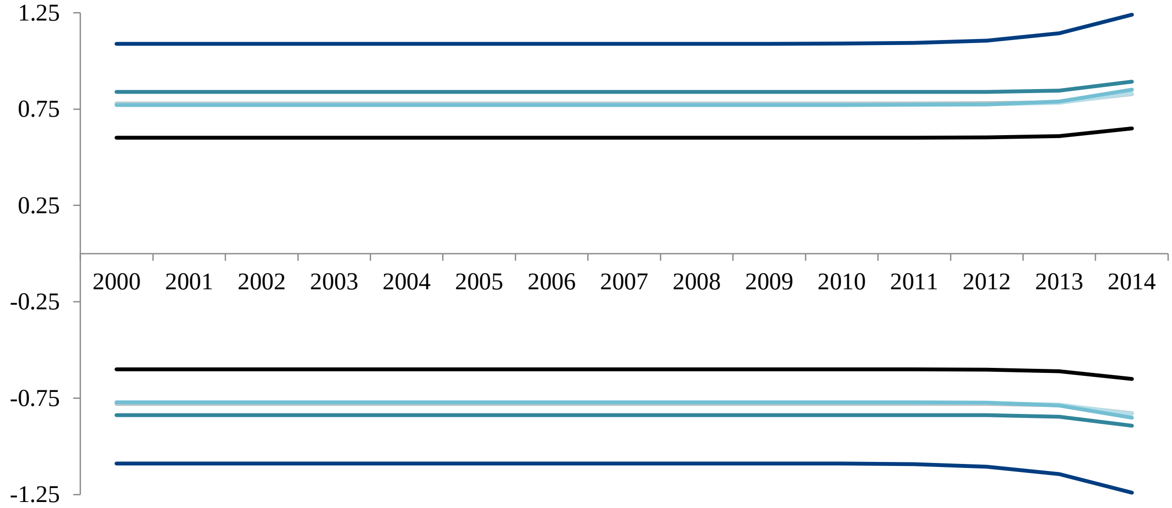


Source: Statistics South Africa, Authors' calculations

3.3. Evaluation

Importantly, both potential output and the output gap are unobservable and can only be estimated. These estimates are subject to varying degrees of uncertainty, depending on the technique used. Confidence bands for the MVF are constructed in order to gauge the degree of uncertainty associated with the model estimates.[3] Similar to results in Blagrave et al (2015), the estimates of potential growth become more robust as more information is added in the form of additional structure. Figure 3 plots confidence bands for the estimates of potential growth as more structure is added to the model in the form of additional identifying information. Relative to the simplest formulation of the MVF (the dark blue line), the addition of model structure in the form of the Phillips Curve improves the performance of the model materially. From there, adding structure on unemployment, capacity utilisation and inflation expectations yield only marginal improvements. However, adding information on growth expectations significantly improves the performance (black line).

Figure 3: Confidence bands for potential growth



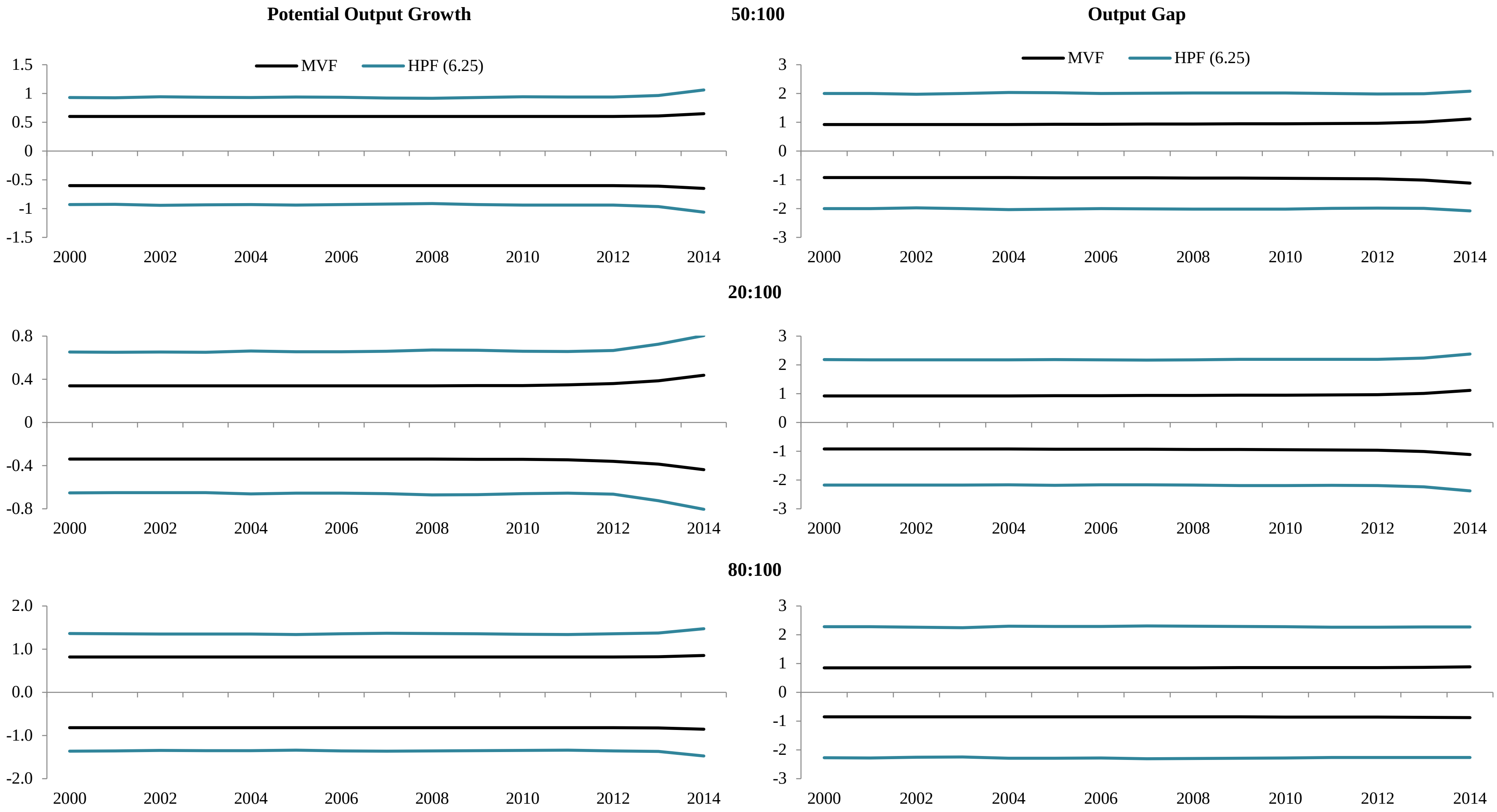
Source: Authors' calculations

In Figure 4, confidence bands for the MVF are compared to the confidence bands for a simple HP filtration of GDP.[4] Each panel of Figure 4 show the confidence bands for different calibrations of the ratio of supply to demand shocks (50:100, 20:100 and 80:100). The different calibrations serve as a robustness check to ensure the improved fir of the MVF relative to the HP filter is not as a result of the chosen calibration of supply/demand shocks. The ratio 50:100 is the baseline calibration (corresponding to 1/3 supply shocks and 2/3 demand shocks). Similar to the results documented in Blagrave et al (2015) for Canada, the estimates of potential output growth and the output gap obtained from the MVF is subject to less uncertainty than are those from the HP filter, irrespective of the calibrated ratio of supply/demand shocks. Additionally, the end-of-sample problem is clearly illustrated with the confidence bands widening at the end of the sample for both techniques.

[3] Following Blagrave et al (2015), the confidence bands are plotted in deviations from the model's point estimates.

[4] For the construction of the HP-based confidence bands, a Monte Carlo procedure was followed where 5000 draws of GDP were obtained from simulating historical shocks, which were assumed to follow mean-zero Gaussian processes. An HP filter with $\lambda = 6.25$ is applied to each sample and +/- 1.96 RMSEs from the assumed true path of the trend growth and cycle components is plotted. Conventional wisdom has become to fix the value of the smoothing parameter, λ, at 1600 (100) for quarterly (annual) frequency data following Hodrick and Prescott's (1997) view. Ravn and Ulhig (2002), while still proposing a fixed lambda, suggest that the HP filter should adjust to the frequency of data. They suggested a value of 6.25 for annual and 1600 for quarterly data. In fact, setting $\lambda = 6.25$ for annual data results in trend and cycle series that more closely resemble those obtained when setting $\lambda = 1600$ for the same series at a quarterly frequency.

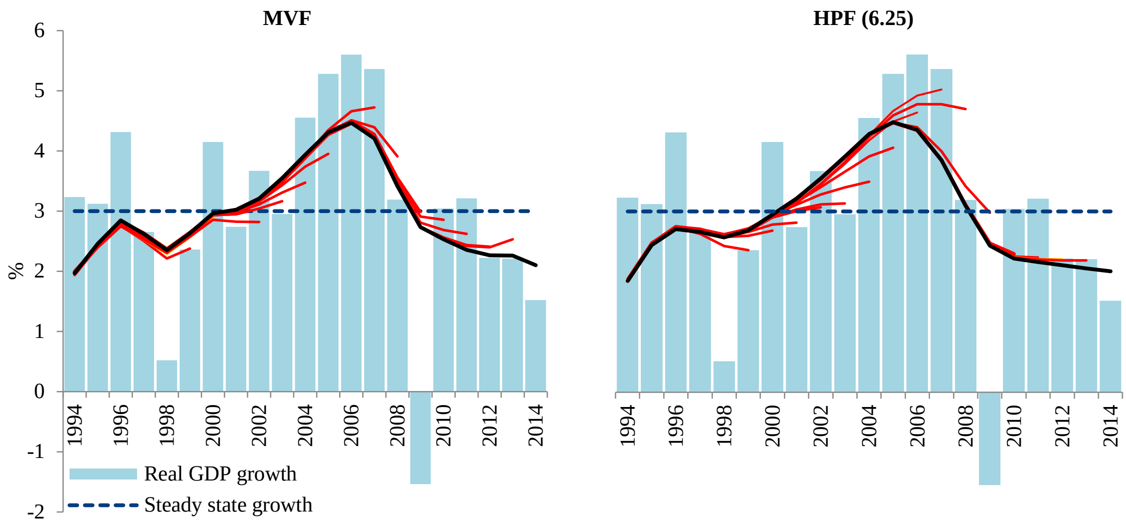
Figure 4: Confidence bands for estimates of potential growth and the output gap



Source: Authors' calculations

Apart from a lower degree of uncertainty associated with the MVF estimates, real-time estimates coming from the MVF are also less prone to revision than those from the HP filter. Figure 5 plots quasi-real-time estimates of potential growth over the past 20 years. These estimates are quasi-real-time in the senses that actual vintage data are not use for this exercise – we use only currently available data, which have been revised over time.

Figure 5: Quasi real-time estimates of potential growth



Source: Authors' calculations

4. Decomposing Potential Output Growth

Given the estimates of potential output and the NAIRU (given by $\bar{U}_t$) obtained above, we can investigate the drivers of potential growth using a growth accounting framework. This framework describes how potential output is determined by the basic factor inputs (capital and labour) and productivity (total factor productivity, or TFP). Similar to the procedure in IMF (2015), the framework follows a Cobb-Douglas production function approach:

(16) $$\bar{Y}_t = \bar{A}_t K_t^{\alpha} \bar{L}_t^{1-\alpha}$$

where $\bar{Y}$ is potential output, K is the stock of productive capital,[5] $\bar{L}$ is potential employment, $\bar{A}$ is potential factor productivity – which includes human capital – and is measured as a residual, and α is the share of capital in output. As mentioned in IMF (2015), the residual ($\bar{A}$) is likely to include utilisation of the inputs of production (such as hours worked, capacity utilisation, labour quality and possible measurement errors in the inputs of production). The capital share parameter, α, is set equal to 0.53 and broadly corresponds to estimates in the literature. Potential employment is then decomposed into the NAIRU ($\bar{U}$), working age population (W) and trend labour force participation rate ($\overline{LFPR}$):

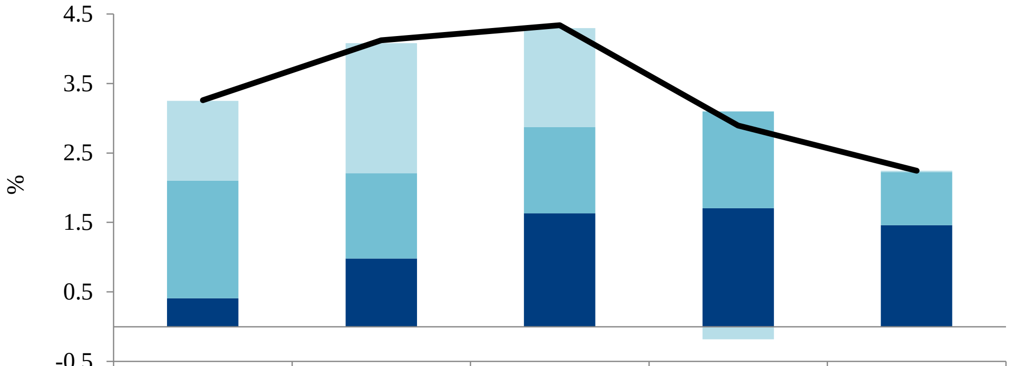
(17) $$\bar{L}_t = (1 - \bar{U}_t) W_t \overline{LFPR}_t$$

in which the NAIRU is estimated in the MVF filter above and the trend labour force participation rate is obtained by filtering the actual labour force participation rate using an HP filter.

[5] For the purposes of this paper, actual capital stock as published by the South African Reserve Bank is used. Alternative formulations, including removing housing stock from the capital variable or multiplying the capital stock by trend capacity utilisation does not materially alter the results.

Using this framework, potential output growth can be decomposed into the contributions from each of these factors. Figure 6 gives the decomposition for the period 2001-2014.

Figure 6: Determinants of potential growth in South Africa



	2001-2003	2004-2005	2006-2007	2008-2010	2011-2014
TFP	1.1	1.9	1.4	-0.2	0.0
Labour	1.7	1.2	1.2	1.4	0.8
Capital	0.4	1.0	1.6	1.7	1.5
Potential Growth	3.3	4.1	4.3	2.9	2.2

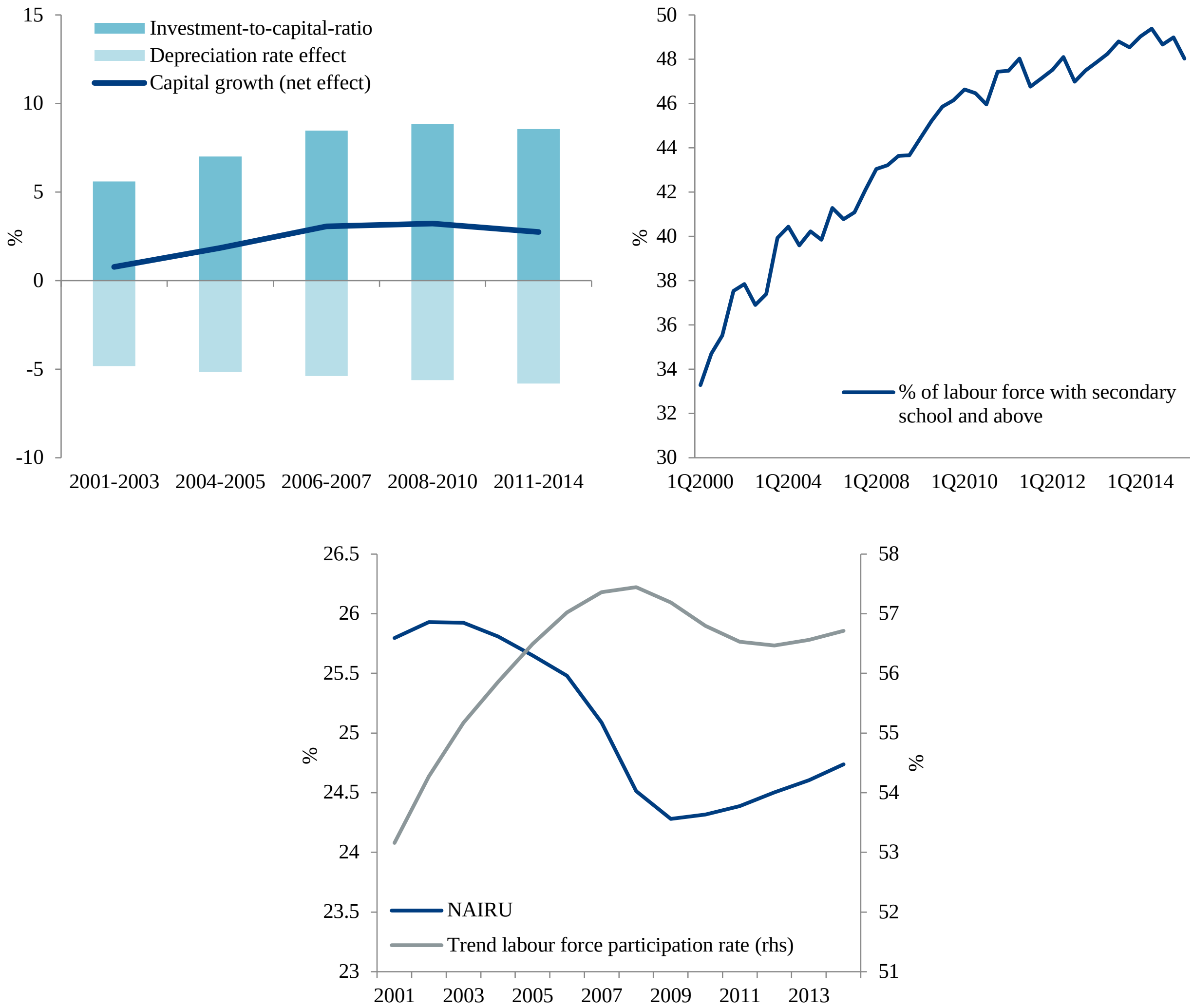
Source: Authors' calculations

In all, potential growth picked up from 3% in 2001 to reach a peak of almost 4.5% in 2006 before slowing significantly in the wake of the GFC to reach 2.1% in 2014. Much of the acceleration in potential growth prior to the crisis was driven by an acceleration in capital growth (see Figure 6). Capital growth increased from around 0.6% in 2001 to 4.1% in 2008, contributing over 1 percentage point to the increase in potential growth. The acceleration in capital accumulation was driven by a strong increase in the investment-to-capital ratio during the period – from 5.3% in 2001 to 9.7% in 2008 (see the first panel of Figure 7). The ratio was boosted by a strong infrastructure investment drive, strong growth in the terms of trade and more favourable financing conditions, including lower global interest rates.[6] Additionally, total factor productivity growth accelerated from 0.6% in 2001 to around 2% in 2006. Over the period, human capital growth (as proxied by the percentage of the labour force with at least a secondary school education) picked up notably (see the second panel of Figure 7). The contribution of potential employment growth remained relatively stable throughout the period – a decrease in the NAIRU as a result of diminishing inflationary pressure and an increase in the trend labour force participation rate (see the third panel in Figure 7) resulted in potential employment growth remaining steady at around 3% per annum over the period.

In contrast, potential growth declined from about 4.3% in the pre-crisis period (2006-07) to around 2.2% during 2011-14. Most of the moderation in potential growth was the result of a sharp decline in total factor productivity growth (see Figure 6). In contrast, capital growth was little affected by the crisis (see Figure 7), while potential employment growth registered only a marginal decline. The fact that most of the decline in post-crisis potential growth results from a decline in total factor productivity growth corresponds to evidence for emerging markets as a whole. According to the IMF (2015), the slowdown in total factor productivity growth in emerging markets in the post-GFC period could be the result of a gradual slowdown in convergence to the technological frontier after rapid catch-up in the decade preceding the crisis, reduced growth in input utilisation and lower human capital growth. In South Africa, human capital accumulation slowed after the crisis, while the capacity utilisation rate and the labour force participation rate also declined (see Figure 7).

[6] See Cubeddo et al (2014) for a discussion of this phenomenon for emerging markets in general.

Figure 7: Capital growth, human capital accumulation, NAIRU and trend labour force participation



Source: Statistics South Africa, South African Reserve Bank, Authors' calculations

5. Conclusion

A relatively simple MVF was used to estimate potential output and the output gap for South Africa. The technique produced estimates that were more precise and more robust in real time than estimates obtained from the standard HP filter.

Results show that potential output growth declined sharply in the wake of the financial crisis. A growth accounting exercise determined that most of the decline in potential growth can be attributed to a sharp fall in total factor productivity growth post-GFC. The fall in productivity growth can, in turn, be attributed to reduced growth in input utilisation and lower levels of human capital accumulation.

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Appendix

Table 1: Data sources

Indicator	Source
Indicators used in the estimation of potential output	
Gross domestic prices (constant prices)	South African Reserve Bank, Quarterly Bulletin
Inflation	Statistics South Africa
Unemployment	Statistics South Africa, OHS (1995-1999), LFS (2000-2007), QLFS (2008-2014)
Capacity utilisation (manufacturing)	South African Reserve Bank, Quarterly Bulletin
Inflation expectations	BER, Economic Outlook (1990-2014)
Growth expectations	BER, Economic Outlook (1990-2014)
Indicators used in the decomposition of potential output growth	
Potential output growth	Author's estimates using MVF
Capital	South African Reserve Bank, Quarterly Bulletin
NAIRU	Author's estimates using MVF
Working age population	Statistics South Africa, OHS (1995-1999), LFS (2000-2007), QLFS (2008-2014)
Labour force participation rate	Statistics South Africa, OHS (1995-1999), LFS (2000-2007), QLFS (2008-2014)

Table 2: Regularised maximum likelihood estimation results

Estimated parameters				
	Mode		Dispersion	
	Prior	Posterior	Prior	Posterior
θ	0.10	0.19	0.10	0.06
φ	0.60	0.61	0.10	0.07
λ	0.25	0.45	0.10	0.03
β	0.25	0.28	0.10	0.07
τ_1	0.30	0.33	0.10	0.08
τ_2	0.30	0.39	0.10	0.10
τ_3	0.10	0.10	0.01	0.01
τ_4	0.10	0.10	0.01	0.01
κ_1	0.40	0.40	0.10	0.08
κ_2	0.80	0.80	0.10	0.10
δ	0.20	0.21	0.10	0.12
$\sigma^{\varepsilon^{Y}}$	1.00	1.02	0.10	0.08
$\sigma^{\varepsilon^{\bar{Y}}}$	0.50	0.50	0.10	0.10
$\sigma^{\varepsilon^{G}}$	0.50	0.59	0.10	0.13
Calibrated parameters				
	G^{ss}	3.00		
	$\bar{U}^{ss}$	25.0		