Long-term forecasts for the Dutch economy*

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Abstract

A strong link exists between Randstad's temporary staffing services and Dutch GDP. The two annual series share a stochastic trend and two long-swing deterministic cycles. Causality appears to run from temporary staffing to GDP and not vice versa. These features are taken aboard in a simple forecasting model for Dutch GDP growth for the period 2005-2015. The forecasts suggest growth rates around 2 per cent, with a dip to be expected around 2012-2013.

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1 Introduction

Empirical experience reported in De Groot and Franses (2005) suggests that quarterly data on Randstad's temporary staffing services and on real GDP in the Netherlands are strongly correlated. This correlation concerns the long run, as a cointegration relationship is found and the shorter run, where contemporaneous and lagged correlations exist between growth rates. De Groot and Franses exploit these correlations to forecast the most recent quarter of real GDP growth, 6 weeks before the Central Bureau of Statistics makes available their first flash value. In order to do that, the authors rely on a model for quarterly data on staffing services that fits and predicts rather well.

An interesting feature of the quarterly data, and also for the annual data, of both series of interest is that the data experience cycles. These cycles are the main issue of the present paper. The reason for this is that most studies on real GDP adopt autoregressive models for the growth rates, where the order of these models typically is 2 or more. It is well known that when the solutions of the characteristic polynomial of such an autoregression are complex valued, the model implies that the data experience cycles. However, when these cycles are stable, then, due to very nature of autoregressive models, long-term forecasts will show cycles with ever decreasing amplitude, see Section 2 below. In order to make the cyclical patterns to continue in a similar fashion in the forecasting sample, one can rely on harmonic regressors, and this is what we will do in the present paper.

In Section 2, we will discuss the data (which are displayed in Table 1). It should be stressed here that the real GDP data concern those data that were available in June 2005. After that month, the Netherlands Central Bureau of Statistics started a revision process, which was announced to be finished no earlier than by the end of 2006. As the main focus is to deliver forecasts for annual real GDP growth rates, we could expect that these revisions will not change the forecasts. However, Nijmijer and Hijman (2004) show that on average on may expect 0.35 percent increases in growth rates. Indeed, the growth rates for 2003 and 2004 for the old data (the data we use in the present paper) are -0.4 and 1.4, while for the new data (for which at this moment only 2001-2005 is available) these annual growth rates are -0.1 and 1.7. So, both increased with 0.3. In sum, we will add 0.35 to all of our long-term forecasts, thereby incorporating upward tendencies in the next few years.

For each of the series, we first fit univariate time series models, allowing for cycles. It is shown that suitable models for both series are AR(1) models with two harmonic regressors, implying cycles of around 5 and 11 years.

Section 3 takes a next step by examining the possible presence of a common stochastic trend in the log-level series, while we allow for deterministic cycles. As expected, given the results in De Groot and Franses (2005), there is such a common trend. However, when the cointegration variable and current and lagged growth rates of GDP are added to the univariate model for Randstad, these terms appear statistically irrelevant. Hence, we proceed with a single equation error-correction model for real GDP. This model includes lags of both growth rates as well. Diagnostic tests indicate the adequacy of this model, and also that there is no need to add any harmonic regressor.

Section 4 takes all together and uses these to generate forecasts for 2005-2015 for both the Randstad data and the real GDP series. An important conclusion is that the Dutch economy will grow with around 1.5 percent per year, while a future dip may be expected around 2012-2013.

Section 5 concludes. One of the main novelties of this paper, which is quite in contrast with much recent research on business cycle forecasting, is that the forecasts are based on very simple single-equation models where only a single predictor variable is used.

2 Univariate models

This section first discusses the annual data of interest, and then turns to univariate models for the Randstad series and for real GDP in The Netherlands.

The two series

The original Randstad data concern weekly data on the number of staffing employees (in all industries and sectors) employed through Randstad the Netherlands for the years 1967 to 2004. In univariate analysis we will use the full sample. For multivariate analysis we consider the sample starting from 1977, as from then onwards also reliable GDP data are available, published by the Netherlands Central Bureau of Statistics (CBS). In our analysis we use annual staffing data, where we have constructed the data by averaging over all 52 weeks.

Both series are transformed by taking natural logarithms. We denote by y_t the log-level of real GDP and by x_t the log-level Randstad data. For the growth rates we use the notation $\Delta_1 y_t$ and $\Delta_1 x_t$, where Δ_1 denotes the usual first-differencing filter.

Figure 1 gives the two series. It is clear that they both have an upward trend[1], and also that they display cycles. These cycles show some correspondence, as their peaks and troughs roughly coincide, where the peaks in the Randstad data seem to occur a little earlier than those in the GDP data. Next, and not unexpectedly, we see that the amplitude of the Randstad data is much larger than that of GDP.

Figure 2 gives the growth rates of the two series. Comparing the axes on the both sides, we see again that the amplitude of the Randstad data is much higher than that of GDP. We also see, now more clearly than for Figure 1, that the cyclical patterns in the two growth rates are broadly similar. Dips in the series seem to occur each 10 years. Indeed, peaks and troughs in both series seem to occur roughly in the same years, where perhaps the peaks and troughs in the Randstad series sometimes seem to lead with one year

[1]We do not formally test for unit roots in these data, as we believe that the alternative hypothesis, that is, trend-stationarity, suggests an implausible model. Such a model would imply overly confident long-term forecasts. So, we assume that both series have a unit root.

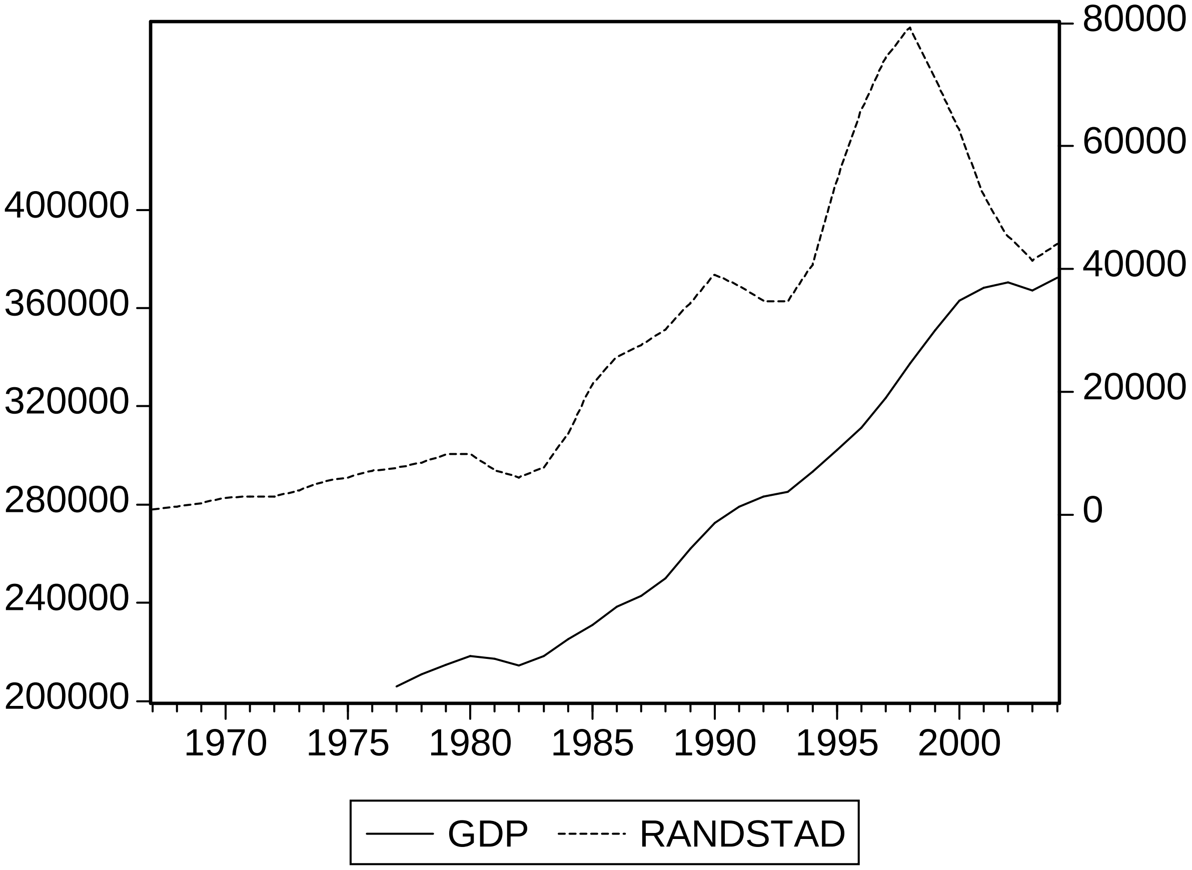

Figure 1: Gross Domestic Output in millions of euros(left axis) and Staffing in number of employees (right axis), observed per year

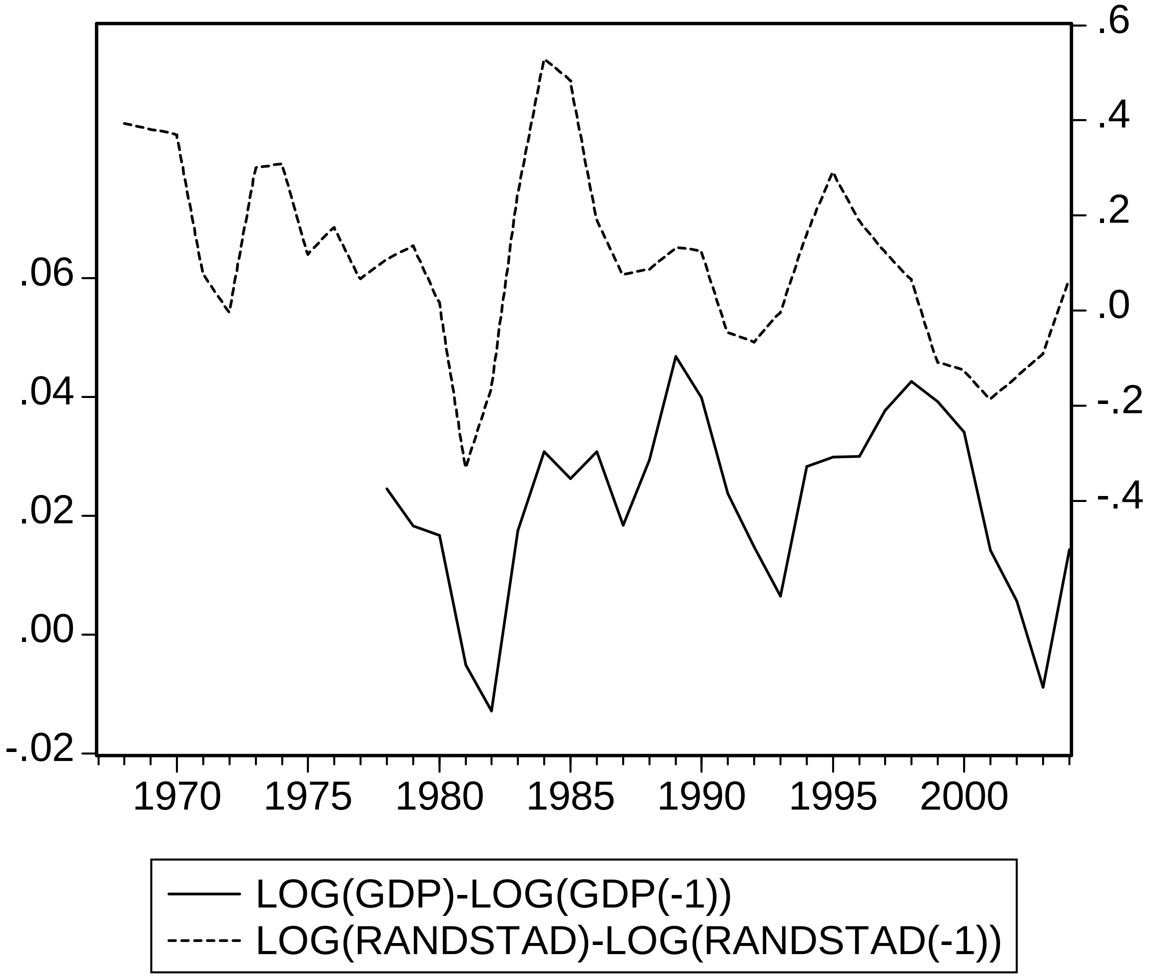

Figure 2: Growth rates of Gross Domestic Output (left axis) and Staffing (right axis), observed per year

A model for Randstad

We first start with a univariate model for the Randstad data, for which we fit an AR(2) model for the growth rates. The estimation results are

$$\Delta_1 x_t = \underset{(0.025)}{0.055} + \underset{(0.148)}{0.963}\ \Delta_1 x_{t-1} \underset{(0.146)}{-0.532}\ \Delta_1 x_{t-2}, \tag{1}$$

where the estimated standard errors are in the parentheses.

As the solution of the characteristic equation for this estimated AR(2) polynomial has complex components, we can compute the implied cycle length from this AR(2) model, see Franses (1998, page 42). It turns out to be around 7 years. This seems odd, as the graph in Figure 1 seems to suggest a cycle of length 10 to 11 years

It is possible that the value of 7 amounts to the mean length of two or more cycles. Indeed, an AR(2) model only allows for a single cycle, and perhaps an AR(3) or AR(4) model would have been better. However, adding more lags to the AR(2) model leads to insignificant parameter estimates.

Another possibility, which, as it appears to us, is not very often used in practice, is that the cycles are not stochastic (and caused by sequences of observation) but that they are deterministic. That is, perhaps the model fit would benefit from including harmonic regressors, which means terms like

$$\alpha_1 \cos(\frac{2\pi t}{C} - \alpha_2) \tag{2}$$

where t runs from 1 to T, and α_1, α_2 and C are unknown parameters.

The focus here is on values of cycle length C. Adding more than one harmonic regressor can quickly lead to estimation problems and hence proper starting values are very helpful. We decide to run 15 auxiliary regressions where each time the AR(2) model in (1) is enlarged with a single such harmonic regressor, that is for $C = 1$, $C = 2$, through, $C = 15$. We compute the R^2 values of these auxiliary test regressions, and we observe that the fit is highest $C = 5$ and $C = 11$. Including these two harmonic terms at the same time makes the second order lagged regressor obsolete, so the final model includes only an AR(1) term. We take $C = 5$ and $C =$

11 as the starting values, and our final estimation result is

$$\begin{aligned}\Delta_1 x_t = \underset{(0.026)}{0.031} + \underset{(0.164)}{0.639}\ \Delta_1 x_{t-1} & \underset{(0.027)}{-0.115}\cos(((2\pi t/\underset{(0.101)}{5.144})-\underset{(0.630)}{0.268}) \\ & \underset{(0.028)}{-0.088}\cos(((2\pi t/\underset{(0.576)}{10.511})-\underset{(0.659)}{1.431}),\end{aligned} \quad (3)$$

where the estimated standard errors are in the parentheses.

The in-sample fit of this model is depicted in Figure 3. We observe a close fit, which is also reflected by the fact that the R^2 was 0.573 for the AR(2) model, while it has increased to 0.731 for this AR(1) model with harmonic regressors. The Jarque-Bera test for residual normality has a p-value of 0.894, the test for residual autocorrelation at lag 1 has a p-value of 0.553, and a test for first order ARCH gets a p-value of 0.831. In sum, the model seems very adequate.

The estimation results show that the Randstad growth rates display cycles of length 5.14 and 10.51 years, which also comes close to the visual impression obtained from Figure 2.

When we add $\Delta_1 y_t$ to this model, its t-value is 0.665. Also, adding levels of log(GDP) does not lead to significant parameters. In sum, we believe that we can use this model for out-of-sample forecasting, but we first need to see how a multivariate model looks like.

A model for real GDP

Along similar lines we arrive at an AR(1) model with two harmonic regressors for real GDP growth. The relevant estimation results are

$$\begin{aligned}\Delta_1 y_t = \underset{(0.005)}{0.013} + \underset{(0.214)}{0.439}\ \Delta_1 y_{t-1} & \underset{(0.002)}{-0.009}\cos(((2\pi t/\underset{(0.185)}{5.218})-\underset{(1.149)}{4.577}) \\ & \underset{(0.003)}{+0.010}\cos(((2\pi t/\underset{(0.730)}{10.667})+\underset{(0.961)}{1.078}).\end{aligned} \quad (4)$$

The R^2 of this model is 0.776, and diagnostic tests do not suggest serious misspecification. Intriguingly, the model for real GDP growth provides estimates for cycle lengths which are roughly the same as for the Randstad data in (3).

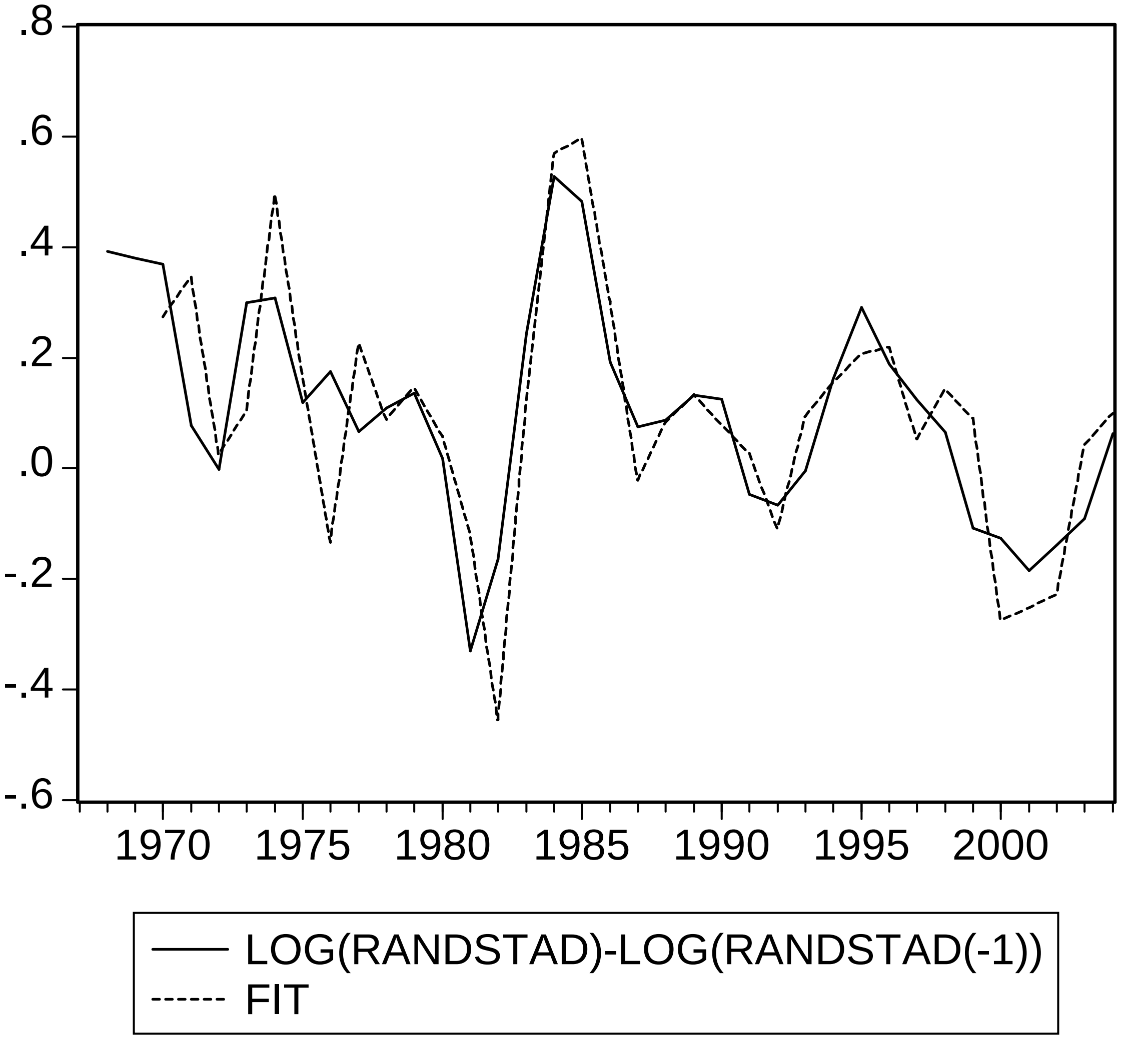

Figure 3: The fit of an AR(1) model with two harmonic regressors for the growth rates in the Randstad data

There is one major difference though, and this follows from adding the current variable $\Delta_1 x_t$ and the lagged variables x_{t-1} and y_{t-1} to (4). Each of these variables is significant, which is also reflected by the increase of the R^2 from 0.776 to 0.929.

In sum, it is now time to consider the two series jointly, as we will do in the next section.

3 Multivariate analysis

To construct a model for real GDP we wish to account for the possibility that the two series under scrutiny have a common stochastic trend. Indeed, even though our prime focus is on forecasting real GDP growth rates, we should allow for a common trend if there is one, see Lin and Tsay (1998) for simulation results that show that properly incorporating cointegration leads to better forecasts.

We apply the Johansen cointegration test, where we need to include two lags of the first differenced series. As is well known, when the data can also have a deterministic trend, we need to include such a trend in a restricted way in the error correction term, while the model also includes intercepts, outside and inside the error correction term. For Eviews, this means we need to follow option 4. We also include as exogenous regressors two sets of harmonic terms, with fixed cycle lengths of 5 and 11 years[2]. The first eigenvalue is estimated to equal 0.521 and the second as 0.393, where only the first is significantly different from zero. Hence, there seems to be one cointegration relation.

The next step is to estimate a bivariate vector error correction model with one cointegration relation. The estimation results show that the cointegration variable only has an impact on real GDP growth. Also, lagged GDP growth rates do not have an effect on growth in Randsatd employees.

Taking all this together implies that we can proceed with a model for Randstad as in (3), while for real GDP growth we proceed with a single equation error correction

[2] We are aware of the fact that the inclusion of such harmonic regressors changes the asymptotic distribution theory. We are however unaware of such a theory, but we do expect that critical values must become larger

model. The final estimation results for this last model are

$$\begin{aligned}\Delta_1 y_t = &\underset{(0.273)}{0.560} - \underset{(0.027)}{0.060}\ (y_{t-1} - \underset{(0.059)}{0.335}\ x_{t-1}) \\ &+ \underset{(0.013)}{0.056}\ \Delta_1 x_t - \underset{(0.017)}{0.023}\ \Delta_1 x_{t-1} + \underset{(0.191)}{0.375}\ \Delta_1 y_{t-1}. \quad (5)\end{aligned}$$

This model shows strong similarity with the model used in De Groot and Franses (2005) for quarterly data. The long-run parameter is 0.335. The in-sample fit of this model is depicted in Figure 4, and it is important to see that turning points seem to be picked up by the model. As with the Randstad data, we observe a close fit, which is also reflected by the fact that the R^2 of this model is 0.764. The Jarque-Bera test for residual normality has a p-value of 0.528, the test for residual autocorrelation at lag 1 has a p-value of 0.995, and a test for first order ARCH gets a p-value of 0.217. In sum, the model seems very adequate.

Notably, LM-tests based on a regression of estimated residuals on harmonic regressor as in (2), for $C = 1$, $C = 2$, through $C = 15$, all turn out to obtain insignificant values. Hence, the error correction model does not need to be enlarged with harmonic regressors.

4 Forecasts for 2005 to 2015

We now use the above models to create forecasts for 2005 to 2015. First we give the forecasts for the Randstad series. For this, we use model (1). We create these forecasts in December 2005, so we have already available the figures for the quarters 1, 2 and 3 of 2005. These are 43108, 48143 and 50859, respectively. When we consider an autoregressive time series model to predict quarter 4, and combine this with expert opinions, we set the quarter 4 observation for 2005 at 53500. This makes the 2005 observation to become the average of these four numbers, that is 48903. We re-estimate model (1) now for the sample 1967-2005, and we create forecasts for 2006-2015.

The annual forecasts show that the years 2006 and 2007 will be prosperous, but the next years thereafter suggest a slowdown. The first signs of a dip appear in 2011, while recovery can be expected around 2014.

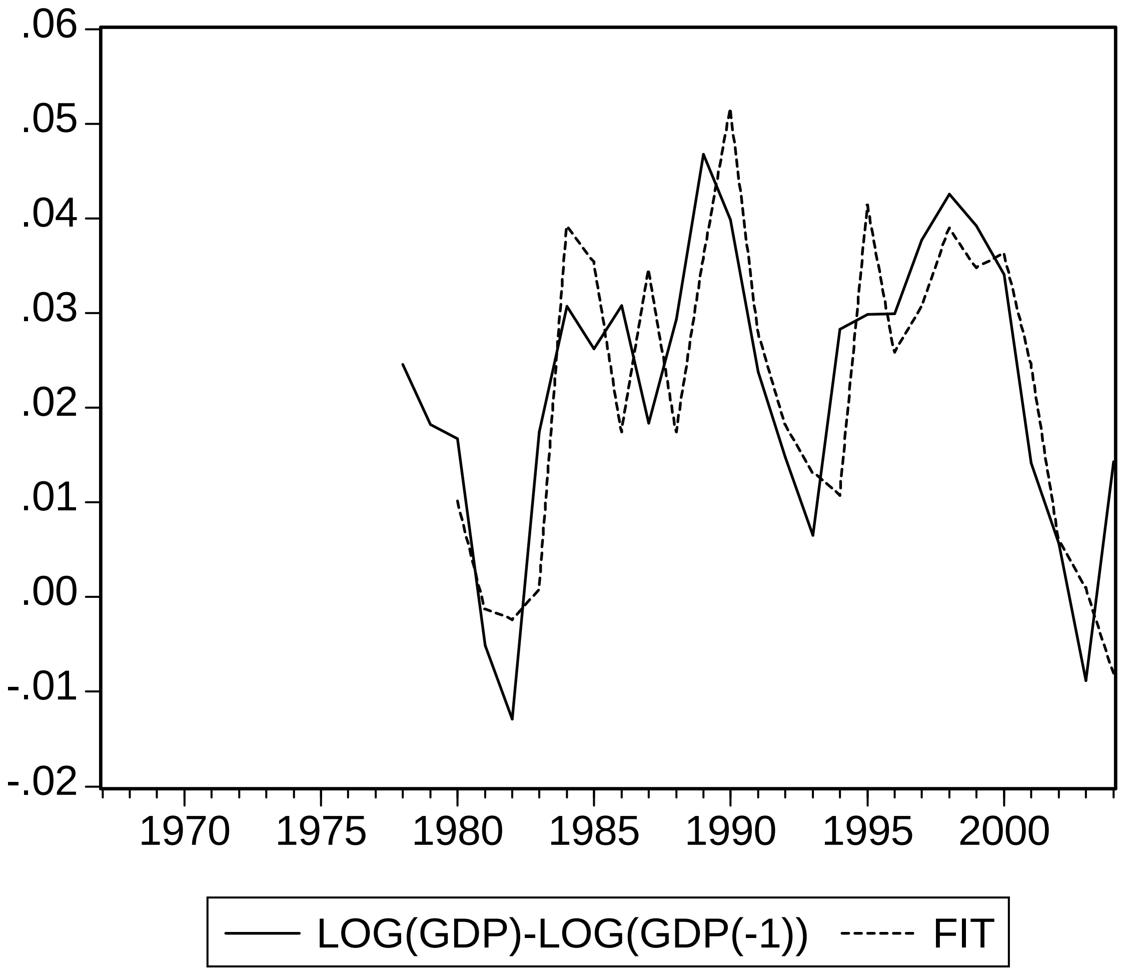

Figure 4: The fit of an error correction model for the growth rates of real GDP

The second column gives the forecasts for real GDP growth when the univariate model in (4) is used. We observe substantial fluctuations in these growth rates, with some values perhaps too large, like in 2010, and too low as in 2013. We believe that these forecasts have too large an amplitude.

The penultimate column gives the forecasts from an AR(2) model. As expected, these forecasts mark the disappearance of cyclical patterns, which we, in the first place, found less reliable. Indeed, we foresee that cycles will persist in the future, and hence our focus on the error correction model for GDP.

Finally, when we plug in the forecasts for Randstad in the error correction model, and we add 0.35 to each of these (as mentioned in the introduction) we obtain forecasts for real GDP growth as in the last column of Table 2. We see that these forecasts are more dampened and, to us, there are much more plausible. The dampening is caused by the link with the Randstad forecasts. On average, growth will be around 1.5 percent per year, with a slowdown to be expected in 2012 and 2013.

5 Conclusion

This paper has put forward two simple models, one for annual staffing services of Randstad and one for real GDP growth in the Netherlands. The two models have been used to generate forecasts for the longer horizon, and it seems that the next slowdown in the Dutch economy may be expected around 2012 and 2013.

A key feature of this paper is that we have used just a single explanatory series to generate long run forecasts for the Dutch economy, which seems to be in contrast with many current studies where hundreds of variables (or combinations) are used. Given the in-sample fit of the two models, we are reasonably confident that these models can reliably be used to generate long term forecasts.

There is one major caveat to make. Our forecasts are based on models with data until and including 2004. At the moment, only revised GDP data are available from 2001 onwards. As revisions usually occur upwards, we added 0.35 to our forecasts from the error correction model. Of course, when revise data become available for more years, we will re-estimate the models and create new forecasts.

Table 1: The quarterly data on Randstad staffing services (number of individuals) and on real GDP (in millions of euros), as available in June 2005

Year	Randstad	real GDP
1967	856	
1968	1268	
1969	1855	
1970	2684	
1971	2899	
1972	2892	
1973	3902	
1974	5314	
1975	5982	
1976	7128	
1977	7619	205870
1978	8494	210985
1979	9737	214862
1980	9904	218478
1981	7116	217355
1982	6034	214566
1983	7700	218338
1984	13054	225149
1985	21152	231129
1986	25632	238352
1987	27631	242763
1988	30131	249998
1989	34395	261960
1990	38972	272607
1991	37174	279164
1992	34776	283322
1993	34622	285167
1994	40675	293336
1995	54417	302233
1996	65717	311419
1997	74347	323373
1998	79329	337435
1999	71172	350919
2000	62727	363081
2001	52096	368259
2002	45316	370355
2003	41376	367098
2004	44070	372382

Table 2: Forecasts

Year	real GDP growth without Randstad (harmonics)	real GDP growth without Randstad (AR(2))	real GDP growth with Randstad
2005	2.7	3.0	1.5
2006	3.0	3.3	1.4
2007	2.7	2.9	1.2
2008	2.9	2.4	1.5
2009	3.8	2.1	2.0
2010	4.2	2.1	1.8
2011	3.2	2.2	1.1
2012	1.2	2.3	0.4
2013	0.1	2.4	0.6
2014	0.7	2.3	1.4
2015	2.0	2.3	1.9

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