

Does Robert Barro's Model Forecast Growth?

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Abstract

Robert Barro produces forecasts of growth for a number of countries using a model he develops for showing which factors most strongly influenced past growth rates. I compare the accuracy of his predictions to a naive model where future growth rates are assumed to depend simply on previous growth rates. I find that the naive model performs better than Barro's model, even though it requires no work to implement. I explore the possible reasons for the disappointing accuracy of growth forecasting achieved by Barro's model.

Introduction

Predicting economic growth is a daunting task, but a crucial one for determining economic policy and the aid loans which organizations like the IMF and World Bank must distribute properly. In the book *Determinants of Economic Growth*, Robert Barro analyzes growth data across a broad range of countries and tries to isolate what factors are responsible for the observed differences in growth. He looks at such factors as initial GDP, education levels, life expectancy, fertility rate, government consumption, rule of law, democracy, terms of trade, and inflation. He analyses the levels of these various factors roughly five years prior to a per capita growth measurement. In this way he hopes to isolate causation of growth from correlation with growth. Most of the first section of the book is concerned with which factors have contributed most significantly to past

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growth, either positively or negatively. Near the end of the first section, Barro applies his findings to forecasting future per capita growth rates. His data end in 1995. Observed growth rates for the forecasted period, 1996-2000, are now available, and thus it is possible to judge the accuracy and value of Barro's predictive model. I find that though far from pinpointing future growth, Barro's predictions do have a relation to the observed values. In comparison however, Barro's forecasts do not outperform the naive assumption of growth rates over the next five years being a simple linear function of growth rates from the previous five years. Barro's model for past growth is therefore not remarkably useful for predicting future growth.

This does not necessarily imply faults with Barro's explanations of past growth. It may mean that predicting growth requires exploring how the relations between different factors determining growth change over time, as opposed to only measuring the importance of each factor in the past. The way growth was determined in the past is not necessarily the way it will be determined in the future. If this alternative explanation is the case, it would unfortunately still make Barro's analysis less valuable, as predicting future growth is more important than explaining past growth. So either explaining past growth is insufficient to forecast future growth, or else Barro's analysis of past growth is flawed. My analysis does not prove which case is true, but the rigorous and thoughtful nature of Barro's study points to the former case as more likely. Certainly understanding past growth is the best starting point for forecasting future growth. Perhaps what is needed is a predictive model combining the importance of factors in the past with forecasts of the changing interaction of these same factors in the future. This might involve studying the changing dynamics of these factors in the past.

Analysis

In analyzing Barro's numbers, I regressed observed growth (real per capita growth) on his predicted growth rates for the 52 countries mentioned in the book, where the observed growth rates are annualized geometric averages. I took the observed growth data from the world development indicators database of the World Bank. My regression analysis yields the following equation:

$$(1) \text{ Observed} = 0.365(\text{Predicted}) + 1.15.$$

(2.73) (2.67)

The p-value was 0.00871 and the R squared was 0.130. The low p-value shows the relation is not random and that the estimated coefficient is significantly different from zero at the 0.871 percent level. Though a coefficient of 1 and an intercept of 0 are ideal, Barro's coefficient is positive and significant at the 1% level. This performance is impressive when one considers the unpredictable political and financial shocks affecting these growth rates.

As a comparison, I took the annualized geometric average growth rates for the previous five years, 1991-1995, and used them as my predictor of the next five years' growth. In performing the regression analysis, I generated the following equation:

$$(2) \text{ Observed} = 0.296(\text{Predicted}) + 1.62.$$

(3.63) (5.39)

The p-value was 0.000669 and the R squared was 0.208. Though the coefficient and intercept are worse, the p-value and R squared demonstrate a stronger relation between the naively predicted values and the observed values of growth than between Barro's predictions and these same observed values.

Interestingly, when one looks at the average squared difference between observed and predicted values (rather than fitting a regression line), Barro fares better than simply extrapolating the growth over the previous five years, with values of 2.54 percent per year and 3.23 percent per year respectively. In other words, on a country by country basis, Barro's predictions tend to be closer to the future growth rates than the extrapolated previous growth rates are to the future rates. Both Barro and my naive prediction method tend to over estimate the variation of future growth rates.

Conclusion

The lesson may be that just because you can explain past growth, doesn't necessarily mean you can predict future growth better than by extrapolation. Shocks to a country's economy, such as financial collapses or wars, make any predictions of growth difficult, and in this vein, a future study might test how Barro's predictions fare when countries with large shocks over the forecasted period are removed from the analysis. This is difficult though, as all countries experience some degree of shocks.

As mentioned previously, it is also possible that Barro's analysis of the past is flawed in some ways. One possible problem affecting Barro's methods may be that a five year lag is not enough to completely separate causation from correlation. More specifically, individuals' expectations of future growth may alter the factors Barro studies, even if the expectations turn out to be way off the mark. For example, expectations of future growth may lead to higher educational attainment, even though education does not lead to growth. Remedying this issue might improve Barro's predictions, but it seems likely that there is another mechanism in play.

More fundamental is that factors which influenced growth in the past may have different impacts in the future. For instance, education may have become more significant with the introduction of more advanced technologies, even over just a five year period. Thus what seemed an adequate level of education in 1995 might not have been sufficient to capitalize on technical revolutions in the coming few years. A single factor might also be changing in quality though not in quantity, which would not be accounted for in the forecasting of growth. For example, the way a government consumes resources may become more efficient, though it consumes the same amount as five years before. Barro's model would then predict the same contribution to growth as before, even though the real consequences of the government consumption would be much different. In general, factors may interact differently with each other than they did in the past or be qualitatively different themselves and thus vary in potency in the future. The exhaustiveness of Barro's analysis of past growth makes it disheartening that he did not do a better job predicting future growth. There is still a relation between his predictions and observed growth, meaning explaining past growth does provide some guide for forecasting future growth. The inability of Barro's model to unambiguously surpass my naive model in forecasting future growth means it is not useful by itself to anyone needing the most accurate growth predictions possible. Instead it should be considered as a starting point for future researchers' attempts to build models which incorporate the dynamic nature of factors with even better explanations of past growth.

References

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