

# Finding statistical evidence of a crisis in the European car industry using STAMP 8.20

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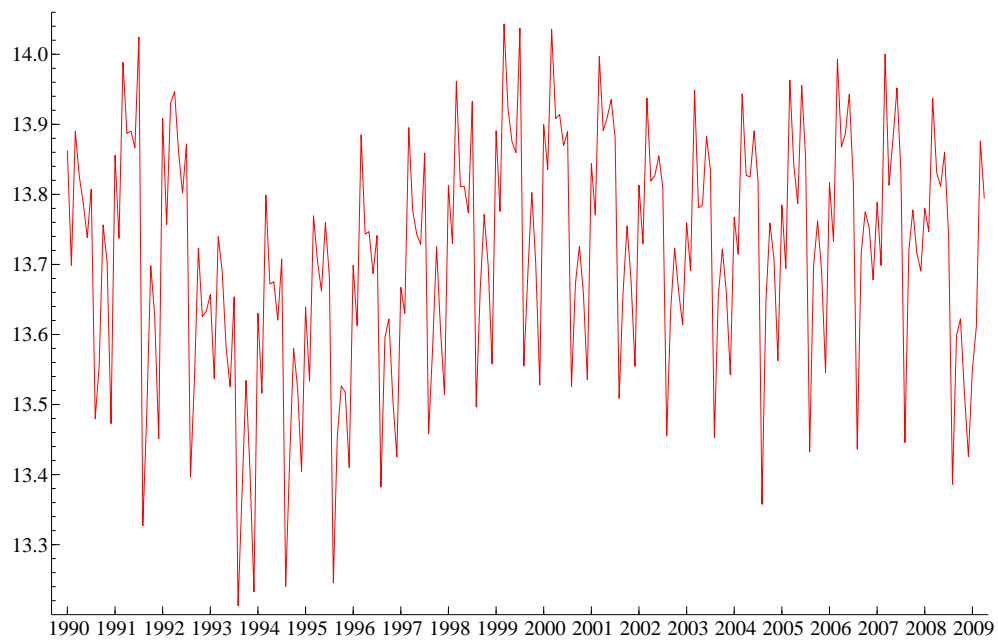
## 1 Introduction

Time series analysis is an exciting field of research. Economic and financial crises, as the ones we are experiencing today, are not phenomenae that we welcome but they do deliver interesting time series. The time series with non-standard features allow us to reflect on methodological issues. It also may lead to interesting challenges for econometricians and time series analysts generally. It further provides us with possible new ideas in the way we carry out our analyses in practice. A basic illustration of such challenges may be given below.

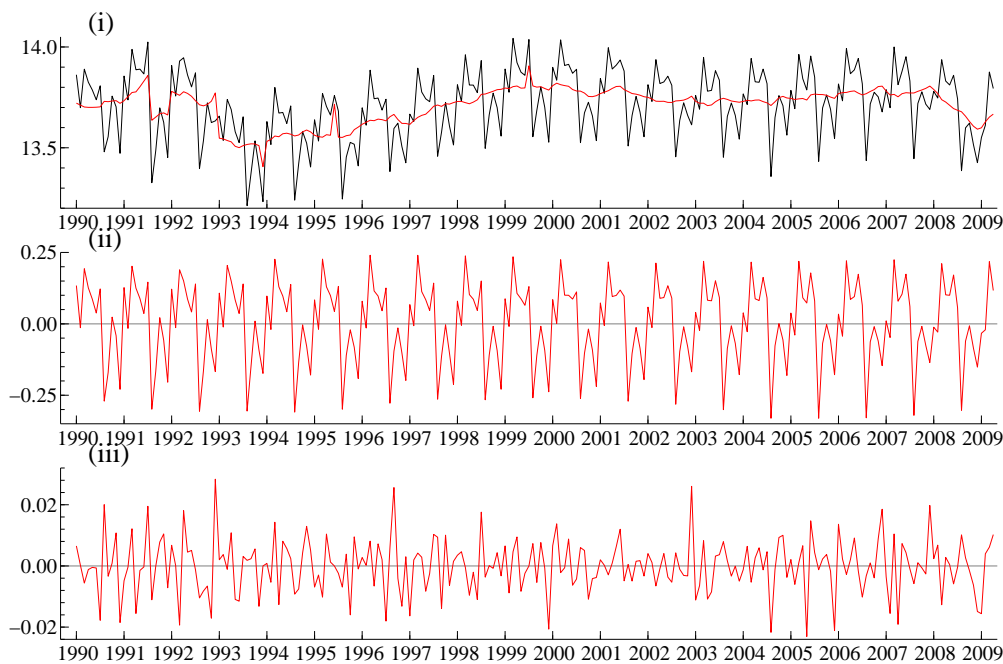
The financial crisis of the last and current years has been felt severely by many industries of importance including the car industry. An illustration of the problems in the car industry can be found in the time series of new passenger car registrations for the Eurozone countries (source: European Central Bank). The series is adjusted for trading days and is transformed into logs. The monthly observations from January 1990 towards April 2009 are presented in Figure 1.

## 2 A STAMP analysis

The time series is clearly subject to seasonal effects. The smallest numbers of new registrations occur in August and December as these are months associated with the Summer and Christmas holidays. Most registrations take place in the period March–June. The times series is further subject to the cyclical behaviour of economic activity but the series is somewhat too short to identify trend and cycle dynamics separately. Therefore, we consider the basic structural model for a time series decomposition. It is the default model in STAMP and consists of a level component (its associated slope component is not necessary), a seasonal compo-



**Figure 1:** New passenger car registrations in the Eurozone: Monthly time series in logs, 1990M1–2009M4. Source: ECB



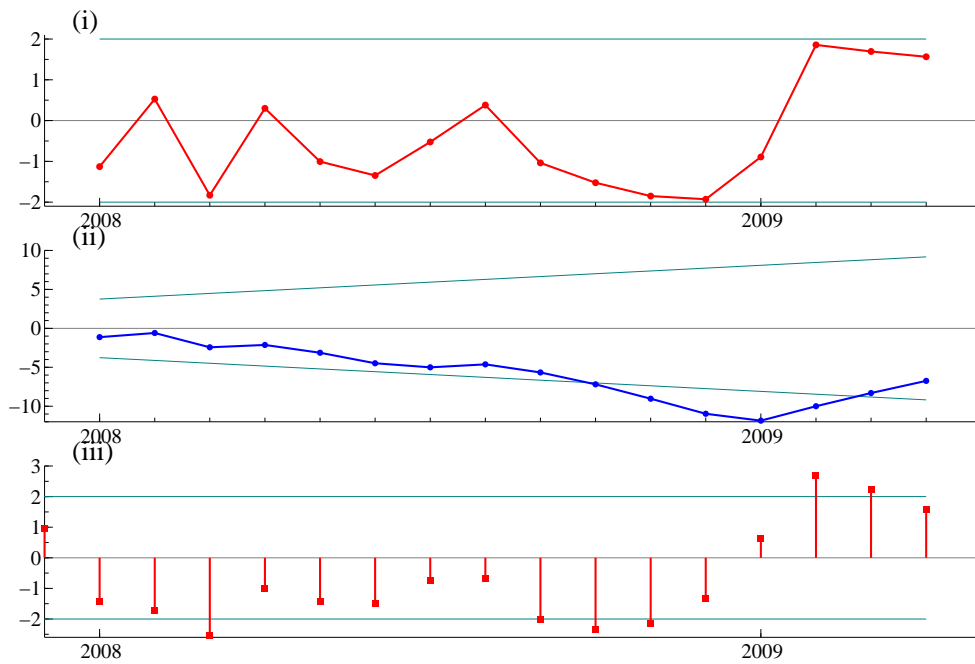
**Figure 2:** Decomposition of the new passenger car registrations in the Eurozone into (i) trend, incl. breaks and outliers, (ii) seasonal and (iii) irregular.

nent and the irregular. The graphical representation of the STAMP decomposition is presented in Figure 2.

The residual diagnostic statistics for normality, heteroskedasticity and serial correlation are satisfactory once STAMP has selected some outliers and breaks using the "automatic" option. The three level breaks occur in the year of 1992 or are close to it. These breaks indicate the intricacies of interpreting this part of the time series in a period when the Eurozone did not exist as an official entity and Germany experienced its post-reunification boom in car sales.

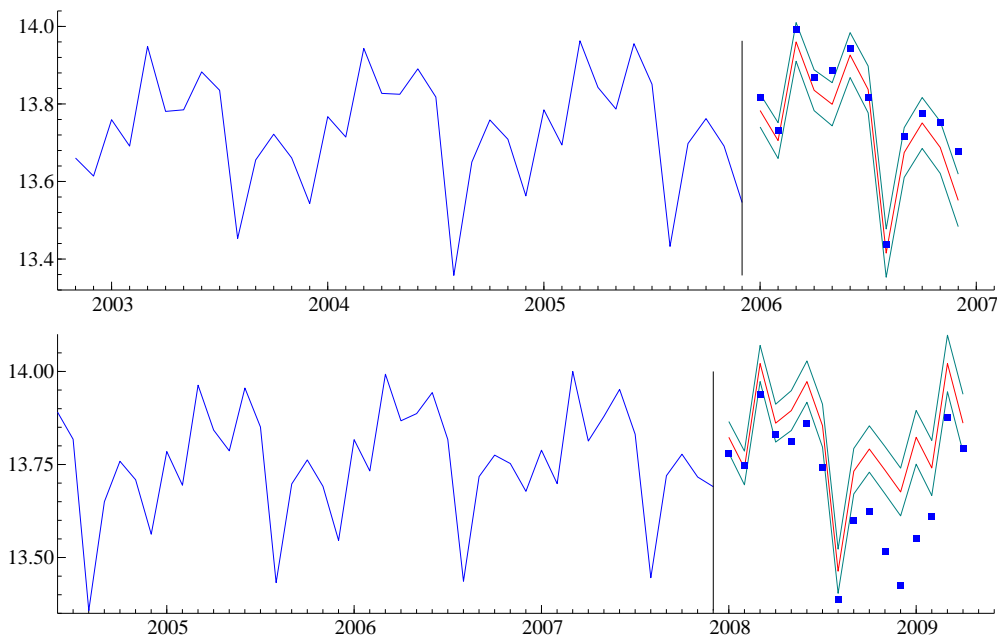
The seasonal component is somewhat changing over the years but is at least in the more recent years quite stable. The most interesting feature of the STAMP decomposition is the decline of the level component after the final months of 2007. The decline is severe but we should also point out that the estimated level in the last months has not gone beyond the low levels during the recession period in the first years of the 1990s.

We would like to investigate the recent decline in more detail and we question whether some statistical evidence can be given of the decline. The standard diagnostics are somewhat or partly helpful in this respect. In Figure 3 we present the standardized one-step ahead prediction errors (observation minus its fore-



**Figure 3:** Some diagnostic plots for our analysis of the new passenger car registrations in the Eurozone for the last 16 observations (2008M1–2009M4): (i) standardized one-step ahead prediction errors; (ii) the cumulative sum of residuals; (iii) t-test statistic for a level break at each particular time point.

cast based on past observations only). The standardized residuals remain strictly within their 95% confidence interval and are therefore not significantly different from zero. However, 9 out of 12 forecast errors are negative. The negative bias of this set of residuals is more clearly observed from the cumulative sum of the residuals in the second panel of Figure 3, with a 95% confidence interval. We may conclude that at the end of 2008 the yearly level has significantly been subject to a structural break. We verify this by presenting the last 16 auxiliary residuals for the level innovation in the last panel of Figure 3. They can be interpreted as the t-test statistic for a level break at its corresponding time-point. It is confirmed that all potential level breaks in 2008 are negative but that a specific month cannot be associated with a clear significant level break. It is therefore not evident whether a level break in 2008 should be introduced and, if yes, nevertheless, at what time point the break should start to take effect.



**Figure 4:** Forecasts the new passenger car registrations in the Eurozone for 2006 (upper panel) and for the period 2008M1 – 2009M4 (lower panel).

### 3 Forecasting

From a forecasting point of view, the impact of the financial crisis can be presented in a clear and transparent way. The new car registrations in the period 2000–2007 is a rather stable time series. To illustrate this, we have estimated the parameters of the basic model using the observations upto December 2005. We then forecast the 12 monthly observations in 2006. The realizations together with their forecasts are presented in the upper panel of Figure 4. The 68% confidence band for the multi-step forecasts is sufficient to keep almost all realizations within their forecasts certainty levels. When we repeat this for other windows, a similar picture is obtained. However, a very different picture emerges when we repeat this exercise by estimating the parameters using the observations upto December 2007 and then forecast the remaining 16 observations in the period 2008M1 – 2009M4. The forecasts and the realizations in the lower panel of Figure 4 clearly illustrate the depth of the crisis for the car industry and its challenges for the months ahead.