Variance Estimation for Seasonally Adjusted Regional Unemployment Rates in Brazil

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Several time series regularly used as a source of information for planning and research are obtained from repeated sample surveys. However, although there has been widespread use of sample estimates from such surveys in time series analysis, it is not always the case that the precision of the time series estimates is available for assessment and publication. When the focus is on the estimation of unobservable components a time series, such as trend and seasonals, the need for seasonal adjustment procedures arises. One very well known method is the X-11 procedure (Shiskin, Young & Musgrave, 1967). However, when using the X-11 and its successors, the problem of how to estimate variances of the unobservable components and the seasonally adjusted series appears. Whereas many statistical offices regularly produce precision measurements for their survey estimates, they often do not do the same for seasonally adjusted estimates. The ability to evaluate the precision of these estimates is crucial for data analysis and interpretation. Moreover, when dealing with time series derived from repeated surveys, variance estimation procedures must take into account the sampling error. Therefore, the lack of variance estimates for seasonally adjusted series is still one of the problems encountered with series derived from continuing cross-sectional surveys. The relevance of this problem was acknowledged long ago, as shown by Wolter & Monsour (1981) in their citation:"*The commission reemphasizes the importance of standard errors for seasonally adjusted statistics and urges the Census Bureau to undertake research to develop them."(President's Committee to Appraise Employment and Unemployment Statistics-The Gordon Committee-1962)*.

The main objective of this work is to provide standard errors for trend and seasonally adjusted regional unemployment rate series in Brazil obtained by the X-12-ARIMA procedure (Findley, Monsell, Bell, Otto & Chen,1998). The standard errors, on the other hand, are estimated based on Pfeffermann (1994) and Pfeffermann & Scott (1998). Pfeffermann (1994) proposed a method that accounts for both, the sampling error of the survey estimates and the time series variation of the irregular component. The method provides variance estimates directly from the observed series. The properties of the combined error (sampling error plus irregular) are derived from the X-11 residuals in the middle of the series and hence the method does not require additional computation of sample covariances. Further developments to this method were presented in Pfeffermann & Scott (1998) that enable the use of survey error covariances (when they are available) to improve the variance estimation of the unobservable components.

The empirical work was carried out using data from the Brazilian Labour Force Survey (BLFS), for São Paulo metropolitan area covering the period from January 1991 to December 1997. The BLFS is a two-stage sample survey in which the primary sampling units (psu) are the census enumeration areas (EA) and the second-stage units (ssu) are the households. The primary sampling units are selected with probabilities proportional to their sizes and then a fixed number of households is selected from each sampled EA by systematic sampling. All household members within the selected households are enumerated. In addition, the BLFS is a rotating panel survey. For any given month the sample is composed of four rotation groups of mutually exclusive sets of primary sampling units. The rotation pattern applies to panels of second-stage units (households). Within each rotation group a panel of households stays in the sample for four successive months, is rotated out for the following 8 months and then is sampled again for another spell of four successive months. Each month one panel is rotated out of the sample. The substituting panel can be a new panel or one that has already been observed for the first four-month period. Note that the 4-8-4 rotation pattern induces a complex correlation structure for the sampling errors over time and that there is a 75% overlap between two successive months.

Using monthly micro data, the series of sample estimates and their estimated standard errors were computed using data of each specific survey round and standard estimators. For each month, two sets of estimates were obtained. The direct sample estimates (the observed time series) derived from the complete data collected at a given month and four elementary estimates, each based on data from a single rotation group. The panel estimates were used to estimate the sampling error autocorrelations as in Pfeffermann, Feder & Signorelli (1998). Figures 1 and 2 present the estimated 95% confidence limits obtained for the seasonally adjusted and trend series, respectively. The study also compared variance estimates obtained ignoring the sampling error. From this exercise, we concluded that in the presence of

sampling error, roughly two thirds of the standard error of the seasonally adjusted and trend estimates are due to sampling variation in the series considered. This reinforces the importance of incorporating the sampling error component when modeling time series from repeated surveys.

Figure 1 - Brazilian Labour Force Series for the São Paulo Metropolitan Area
Unemployment Rate Seasonally Adjusted Estimates (%) and Corresponding 95% Confidence Limits

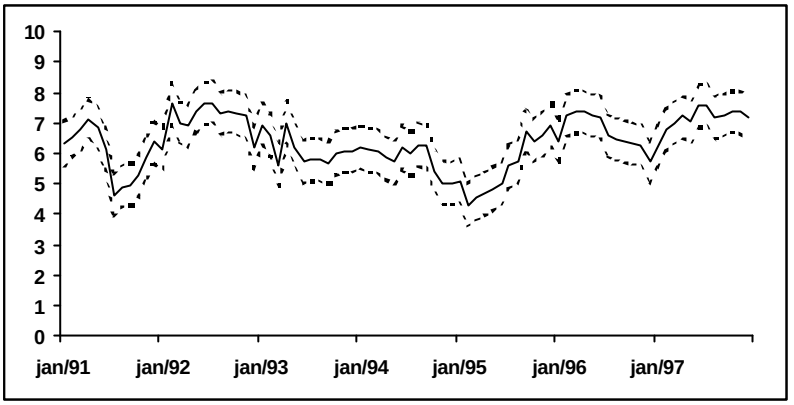
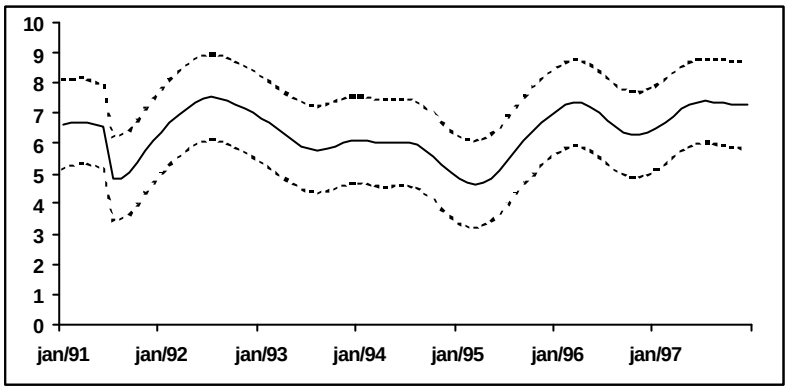


Figure 2 - Brazilian Labour Force Series for the São Paulo Metropolitan
Unemployment Rate Trend Estimates (%) and Corresponding 95% Confidence Limits



RÉSUMÉ

L'étude présente des estimatives de variance pour la série désaisonnalisée, et pour la composante de tendance, du taux de chômage produit pour la procédure d'ajustement saisonnier X-12-ARIMA Les estimatives de variance sont obtenues en utilisant la méthodologie proposée par Pfeffermann (1994) et Pfeffermann et Scott (1998). La méthodologie utilisée permet l'obtention d'estimatives de variance qui incorporent les effets du plan d'échantillonnage du sondage mensuel d'emploi au Brésil.

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