from the *conditional distribution* of u_{ft} given ψ_{ft}, which incorporates whatever information ψ_{ft} contains concerning u_{ft}.

The conditional density function of u_{ft} given $\Psi_{ft} = \psi_{ft}$ is given by[83]

$$f_{U|\Psi=\psi}(u) = \frac{f_{\Psi,U}(\psi,u)}{f_{\Psi}(\psi)}, \qquad [A.17]$$

thus, using equations [A.6B] and [A.9b],

$$f_{U|\Psi=\psi}(u) = \frac{\exp -\frac{1}{2}\{(u-\mu_*)^2/\sigma_*^2\}}{\sqrt{2\pi}\sigma_*\Phi[\mu_*/\sigma_*]}. \qquad [A.18]$$

The overall cost *efficiency* of the f^{th} firm at the t^{th} observation, CE_{ft}, may be expressed as the ratio of stochastic frontier minimum cost (with $u_{ft} = 0$) to observed cost, which is equal to[84]

$$CE_{ft} = \frac{1}{\exp\{u_{ft}\}} = \exp\{-u_{ft}\}. \qquad [A.19]$$

This measure is bounded between zero ($u_{ft} \to \infty$) and one ($u_{ft} = 0$), and can be predicted in a similar way to that described for technical efficiency in the stochastic production frontier case analyzed by Battese and Coelli (1993). Using the conditional distribution of u_{ft} given ψ_{ft} defined by equation [A.17], the authors derive an expression for the conditional expectation of the technical efficiency for the f^{th} firm at the t^{th} observation, conditional upon the observed value of $\psi_{ft} = (v_{ft} - u_{ft})$. This expression, $E(\exp\{-u_f\}|\Psi_{ft} = \psi_{ft})$, is a generalization of the results presented in Jondrow et al. (1982) and Battese and Coelli (1988).

The prediction of the individual cost efficiencies relative to a stochastic cost frontier, i.e. expression [A.19], can be obtained by minor sign alterations of the technical efficiency point estimator in Battese and Coelli (1993). It is derived using the conditional density function of u_{ft} given $\Psi_{ft} = \psi_{ft}$ specified in equation [A.18] and is given by

$$\hat{CE}_{ft} = (\exp\{-u_{ft}\} \mid \Psi_{ft} = \psi_{ft}) = \left\{\frac{\Phi[(\mu^*_{ft}/\sigma_*) - \sigma_*]}{\Phi[\mu^*_{ft}/\sigma_*]}\right\} \exp\left\{-\mu^*_{ft} + \frac{1}{2}\sigma_*^2\right\} \qquad [A.20]$$

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[83] Again the subscripts, *f* and *t*, are omitted in the following expressions for convenience in the presentation.

[84] Expression [A.19] is appropriate for CE_{ft} only if the general specification of the stochastic frontier cost model is given by equations [1]-[2] in the text.