

The Elasticity of Labor Demand and the impact of a Minimum Wage

Note for Neil Coleman, COSATU

*

Written by Ilan Strauss¹

20-Nov-15

Description of Concept

Economists try and estimate the effect of minimum wages on employment using the employment elasticity. This is the ratio of the percentage change in employment to the percentage change in the legislated minimum wage. For example, with an elasticity of -0.1 a 10% increase in the minimum wage reduces the relevant employment by 1%; when it is -0.3 , employment is reduced by 3%. Such elasticities are what drive general equilibrium models and partial equilibrium models.²

More precisely: the elasticity of labour demand is a weighted average of the elasticities of substitution³ and of demand, with the weights being the relative factor shares employed in production (Ferguson, 1969: 237⁴, see appendix for equations). The 'Marshall-Hicks' rules concerning the elasticity of this derived input demand shows further that (Ferguson, 1969:238): (1) "The demand for anything is likely to be more elastic, the more readily substitutes for that thing can be obtained"; (2) "The demand for anything is likely to be more elastic, the more elastic is the demand for any further thing which it contributes to produce"; and (3) "The demand for anything is likely to be less elastic, the less important is the part played by the cost of that thing in the total cost of some other thing in the production of which it is employed provided the elasticity of commodity demand exceeds the elasticity of substitution."

*

Comments on its use in micro-simulation studies to estimate minimum wage employment effects

The concept of the elasticity of labour demand depends on a number of highly restrictive assumptions, which are unlikely to be true for the South African economy. It assumes perfect competition; and in turn that inputs get paid their marginal product; this requires linear homogeneity of the production function. This in turn means that firms have no ability to influence the price of the good which they sell; that no firm makes an economic profit in the long-run;⁵ that demand can play no meaningful role in influencing the level of employment; and that the distribution of income has no impact on the functioning of the economy. Additional restrictions are put in place depending on the type of cost or production function used for estimation.⁶

¹ Author contact: ilanstrauss@newschool.edu, New York, USA.

² A newer wave of research uses 'natural' experiments, such as variations in wages across industries or provinces. Provinces or industries that increase their minimum wages can be compared, it is assumed, with those that do not, so that changes in employment can be reduced to changes in minimum wages rather than to other factors. With respect to South Africa see the work by Bhorat, H., Kanbur, R., and Stanwix, B., for example "Estimating the Impact of Minimum Wages on Employment, Wages and Non-Wage Benefits: The Case of Agriculture in South Africa, online: <http://www.kanbur.aem.cornell.edu/papers/SectoralMinimumWagesSouthAfricaAgriculture.pdf>

³ The elasticity of substitution indicates how factor proportions change in response to a change in the marginal rate of technical substitution. Or more exactly: the proportionate change in the ratio of the amounts of the factors divided by the proportionate change in the ratio of their marginal physical productivities.

⁴ Ferguson, Charles, E. (1969). *The Neoclassical Theory of Production and Distribution*, Cambridge University Press.

⁵ A return above the long-run opportunity cost of capital. Cf with accounting profit.

⁶ With Cobb-Douglas production technology the elasticity of substitution is 1 while under a constant elasticity of substitution (CES) production function it is free to vary but must be the same between all input pairs. A translog function can be estimated but then a number of serious complications arise. With respect to South Africa see:

Elasticities need to be carefully disaggregated by sector and industry but rarely is data available for this to take place. Elasticities will differ widely depending on the elasticity of demand for the end product in the sector, the technology used in the specific industry, the level of skill and occupation of the worker, and the general rate of profit in that industry. Estimating this requires very fine data and is therefore prone to mis-estimation. Elasticities differ widely for the South African economy too where estimates vary depending on the data used, the period of estimation, and the production (or cost) function employed, among other things (see discussion in DPRU, 2008: 10-13).⁷

One needs to estimate the entire demand elasticity curve since elasticities differ depending on where on the demand curve for labour one is. For the elasticity concept to have any practical import therefore, one must have estimates of the entire demand 'curve' (or line) and be able to indicate where along the curve labour is. (In more sophisticated minimum wage setting by policy makers one attempts to target the more inelastic portion on the demand for labour curve (D_1)). Moreover, demand curves may shift over time as technology changes and labour markets segment in new ways. Estimates may therefore capture shifts in a curve rather than be points along the same curve.⁸

Elasticity estimates are generally based on theoretically unsophisticated models making their interpretation fraught with difficulty. For example, by including risk aversion⁹ or workers valuation of leisure in a model, elasticity estimates may change. In addition, like most economic phenomenon, elasticities can be non-linear. This means that a change in the price of labour can see a more than or less than proportionate change in the demand for labor. Estimation and modeling should also be non-linear then. This implies then that without a sound microeconomic theoretical model behind model estimation, misspecification (such as through omitting variables incorrectly) will plague estimates.

Partial equilibrium models based around employment elasticities are of little use for addressing economy wide issues and interactions central to estimating the long-run impact of changes in wages. This is why policymakers use partial equilibrium models only when the assumption of other markets being held constant is not unreasonable (i.e. of little spillover effect into other markets). Prices and quantities remain constant in all other markets in a classic partial equilibrium model, which implies that incomes also remain constant. (This in turn means that our definition and understanding of the elasticity of labour demand must be made more restrictive to account for this.)

Partial equilibrium employment impact models make a number of naive assumptions (for critique see DPRU, 2008:30-31). This severely limits their use for policy questions except for very narrow questions. For example, the model employed by DPRU (2008) assumes no supply response from workers to changes in wages; sectoral elasticities are precariously estimated with little room for heterogeneity among workers; and feedback effects from changes in income are not possible. Most importantly though, changes in minimum wages cannot impact production costs and consumer prices

<http://www.nuff.ox.ac.uk/users/beharrw/wp98.pdf>. Two incompatible data sources are unfortunately used in this paper.

⁷ DPRU(2008). *Minimum Wages, Employment and Household Poverty: Investigating the Impact of Sectoral Determinations*. Written for the Department of Labour.

⁸ In macroeconomics one might compare this to the NAIRU vs. time variant NAIRU.

⁹ See for example: <http://ftp.iza.org/dp3150.pdf>

(DPRU, 2008) making the model of questionable value to any real world question. It is therefore entirely supply driven and based on employment elasticities estimated exogenously. Furthermore, ensuring aggregate consistency between the national employment elasticity and individual sectoral elasticities means that sectoral elasticities are highly aggregated and not precisely estimated, despite the model's employment results being entirely driven by them (DPRU, 2008:70). Lastly, partial equilibrium models are mechanical in nature and do not model dynamics in any sense of the word (DPRU, 2008:33).

In general equilibrium models: the models core parameters, including the employment elasticity is 'calibrated', implying that its parameter value is taken from a different study, thereby making it 'exogenous' (determined outside the model).¹⁰ This means that most of the information in the model is being driven by parameters estimated from other studies, often on the basis of different data and theoretical models. The context used to estimate the elasticity may therefore be inconsistent with the CGE model context. For example, the CGE model will use the same 'calibrated' elasticity estimate for both its short-run and long-run estimation even though the elasticity may be derived using short-run data only. And more fundamentally, the elasticity may be estimated using an econometric specification very different to the CGE model in which it is employed.

.*

Appendix: elasticity of labour demand equations

The elasticity of labour demand is (Ferguson, 1969):

$$\theta_{LL} = (I - K_L)\sigma + K_L\eta$$

According to this equation it is a weighted average of the elasticities of substitution and of demand, the weights being the relative factor shares (of labour and capital) employed in production.

Where:

$$\theta_{LL} = - \frac{\partial L}{\partial w} \frac{w}{L}$$

$$K_L = \frac{wL}{qp} \quad - \text{share of labour costs in output}$$

$$\eta = - \frac{h'}{h} p \quad - \text{elasticity of commodity demand}$$

$$\sigma = \frac{f_{kl} f_l}{q f_{kl}} \quad - \text{elasticity of substitution}$$

¹⁰ For example, if our model is one equation: $y = 2 + x$ then y is determined by the model (i.e. given a value for x we have a value for y). We need a value for x though to solve this one equation model and since the model doesn't have an equation to determine it, it is said to be exogenous (we pick something). y and x are variables and can be anything.