How far can we get with the full-employment framework? A contrarian view.

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To try to be helpful I will frame my submission in the context of the typology of regulations Ann Wolverton mentioned:

Category #1: Single Sector Emission Rate Limits - MATS Example
Category #2: Regional or State-Implemented Emission Targets - Ozone NAAQS Example
Category #3: Multi-Sector Boiler or Engine-Level Emission Rate Limits - Boiler MACT Example
Category #4: Federal Product Standards - VOC Emissions Standard for Consumer Products Example

General overarching points:

The operative word in this charge section is credibility. Sergey Paltsev pointed to this. To amplify, one can interpret this in several ways. In order of stringency, (1) the first and loosest definition might be the laugh test—"consistency of model's emergent behavior with what we understand to be textbook economic theory". A second (2) might be ability to reproduce more nuanced responses that are at the cutting edge of theoretical and empirical economic research, such as search frictions or behavioral responses. A third and very stringent might be (3) can CGE models capture these responses <u>better</u> than other alternative modeling approaches. Finally (4) the ability to represent observed real-world labor market consequences of historical regulatory shocks of various kinds.

Not being a labor economist, I am unaware of studies that have specifically performed a head-to-head comparisons in terms of (2) to (4). There have been a couple ex-post evaluations of whether CGE models have got large policy shocks right (e.g., NAFTA), but not with a specific focus on labor.

All of the categories of regulation above can be modeled as substitution of labor and capital for pollution. The details can certainly be worked out by detailed PE engineering models, but the envelope of these bottom-up abatement responses can be used to represent the increase in labor and capital specific to regulated industries that is warranted by a particular regulation. Call this the abatement production function

$$A = h(L^a, K^a)$$

where L^a and K^a are policy parameters that will be specified by the analyst. The action in the rest of the economy comes from the opportunity costs of these, now-sector specific factors. The amounts of labor and capital $\bar{L}$ and $\bar{K}$ required for the target industry to maintain its level of output. Thus, in the baseline

$$\bar{Q} = f(\bar{L}, \bar{K})$$

with emissions given by say $\bar{E} = \varepsilon \cdot Q$, then in the counterfactual regulation scenario to maintain the level of output, we have

$$\bar{Q} = f(\bar{L} + L^a, \bar{K} + K^a)$$

thus turning f from a constant returns production function to a diminishing returns function, but reducing emissions to a level $E = \bar{E} - A$. The fact that L^a and K^a actually contribute to the production

of output addresses Adam Rose's comments earlier. Of course the devil is in the details. Nevertheless, this kind of thing can be very simply implemented via a counterfactual recalibration in MPSGE.

With full employment, the policy parameters L^a and K^a are given, and therefore withdrawn from the residual endowment available to the rest of the economy. The target sector's output price (quantity) rises (shrinks), and its demand for inputs (labor) will fall, releasing labor to other sectors, and inducing a decline in the wage to clear the market.

This is the textbook effect, (1), which CGE models capture very well. Note that the changes in sectoral labor demands should properly be interpreted in terms of hours, not jobs or their equivalents. As Don Fullerton stressed, this is likely unrealistic, in that economy-wide labor supply will likely change for a whole host of reasons that I will defer to other more knowledgeable colleagues to discuss.

Intersectoral labor reallocation frictions

Now imagine that we stick with the economywide framework but abandon the idea of homogeneous labor traded at a single market wage to introduce frictions. The easiest way to differentiate amongst different kinds of labor is along the lines of the sectors represented in the model. We can model sectoral labor supplies as being a constant elasticity of transformation (CET) disaggregation of the aggregate labor endowment. Smaller values of the elasticity of transformation render intersectoral labor reallocation more difficult, promote the divergence of wages and marginal labor products, and increase the aggregate costs of the policy. The key question is, how valid is such a highly stylized representation of factor market frictions in terms of theoretical consistency with the latest labor economics research, and, if so, what values of the elasticity of transformation should be used that can match the envelope of responses recovered by empirical tests of these theoretical frameworks. And what time-frames should these elasticity parameters target? On one hand, it's not clear we have answers to these questions. But on the other such a formulation is sufficiently simple that it is particularly amenable to sensitivity analysis.

Interregional labor reallocation frictions

One can also think of a similar structure, but now implemented inter-regionally, e.g., to represent migration among states, and, in IMPLAN-like settings, get rid of the fiction that state labor endowments are fixed.

Distributional implications

Now for distributional analysis, most IMPLAN-based models will combine homogeneous labor with a vector of representative agents denominated over income classes, each of which has her own factor endowment. To move toward the kind of criteria that policy makers are asking for as indicators of impacts, we would need to disaggregate labor in each class into non-homogeneous factors with various degrees of sector-specificity. Again, one might think about doing this in a simple, back of the envelope way using the CET approach. The key question to my mind is the data basis for this disaggregation. Some investment in generating these data will definitely be useful for EPA, as what that can potentially buy us is an understanding of which income groups will be disproportionately affected by policies of what stringency, applied to what sectors of the economy.

Moving beyond full employment

I have flogged this dead horse for the reason that the full-employment modeling approaches that I have described (but not advocated) are likely to provide a simple and transparent characterization of the pure economy-wide reallocative effects that attend mandated sector-specific allocation of labor and capital

to pollution control activity. Moreover, I think they provide an excellent way to characterize the additional impact of changes in labor supply, via labor-leisure choice, the inclusion of search frictions a la Hafstead and Williams, or, further, third-order complementarity/substitutability of amenities with these factor supply changes.