A Ricardian Model

Of Adam Smith Ricardo writes,

> The writer, in combating received opinions, has found it necessary to advert more particularly to those passages in the writings of Adam Smith from which he sees reason to differ; but he hopes it will not on that account be suspected that he does not, in common with all those who acknowledge the importance of the science of Political Economy, participate in the admiration which the profound work of this celebrated author so justly excites.

He agrees with Adam Smith in all but his theory of value and distribution, which is to say, in all but most of Smith's theoretical apparatus.

Ricardo's analysis of value goes something like this. There is one good, corn (which is a British term for grain, and not what they call maize). Corn is grown on land of varying quality, and requires both capital and labor. The community is composed of three classes: landowners, owners of capital, and labourers.

> The produce of the earth—all that is derived from its surface by the united application of labour, machinery, and capital, is divided among three classes of the community; namely, the proprietor of the land,, the owner of the stock or capital necessary for its cultivation, and the labourers by whose industry it is cultivated.

Ricardo wants to understand how the produce, or, the surplus beyond the real cost of production, is divided up into rent, interests, and the wage bill. He goes on to discuss taxes, and ways in which badly-designed tax schemes "prevent the national capital from being distributed in the way most beneficial to the community."

Ricardo's analysis rests in part on a subsistence wage, which he calls the "natural wage". He was very much in sympathy with Malthus, and thought of a long term population equilibrium in which wages above some baseline allowed the population to grow, while below the population would shrink.

> Labour, like other things which are purchased and sold, and which may be increased or diminished in quantity, has its natural and its market price. The natural price of labour is that price which is necessary to enable the labourers, one with another, to subsist and to perpetuate their race, without either increase or diminution.

Ricardo has an opportunity-cost theory of rent.

> Rent is that portion of the produce of the earth, which is paid in full to the landlord for the use of the original and indestructible powers of the soil.
>
> On the first settling of a country, in which there is an abundance of rich and fertile land, a very small proportion of which is required to be cultivated for the support of the actul population,..., there will be no rent; for no one would pay for the use of land, when there was an abundant quantity not yet appropriated, and therefore at the disposal....
>
> When, in the progress of society, land of the second degree of fertility is taken into cultivation, rent immediately commences on that of the first quality, and the amount of that rent will depend on the difference in the quality of these two portions of land.
>
> When land of the third quality is taken into cultivation, rent immediately commences on the second, and it is regulated as before, by the difference in their productive powers.

Ricardo's arguments are entirely intuitive. So it is interesting to see how they hold up under a formal analysis. The purpose of the problem set is not to do Ricardo in math; instead, we want to explore Ricardian ideas in a modern general-equilibrium setting.

1. Construct a model to describe a simple version of Ricardo's world without capital. You might imagine that there are discrete pieces of land of varying productivity can capacity, and that on each piece output is linear in labor input (think linear programs). What else will you need to assume? Interpret your variables. One hint is to measure rent as a land price per unit of output, so that the farmer who produces y units of corn on a piece of land will pay rental rate r per unit of output. The landlord will receive rent ry. This will be convenient for representing complementary slackness conditions. You might begin by making a list of the variables you will need. Another hint is to think of there being a finite number of discrete plots of land.

2. Now suppose there is capital. Ricardo cheats. He assumes that capital and labor come in fixed proportions — a farmer is born with a shovel in his hands. This neatly solves the problem of a second good. But we today are better than that. Let us suppose that capital Capital enhances the productivity of land. How, in a Ricardian model, is the distribution of output between land, labor, and capital determined?

3. Ricardo defined profits to be the return to capital. He claimed that when the real wage rate increased, profits fell. Is this true in your model? Ricardo wrote that when land is homogeneous, profits, which he measured as an average return, would be equal. He also recognized that this would no longer be true when all plots were not identically

productive, but without the benefit of marginal analysis he could not see farther than that. What do you see? Begin by thinking about why wages might rise.

4. Finally, Ricardo explored the idea that as the population grows and the demand for food increases, ever more marginal plots of land are brought into production. So suppose that there are a countably infinite number of land plots, that can be ordered by their quality. Extend your model to discuss what determines which land plots are used, and how wages are determined.