Lecture Note 6

Ricardo and the Ricardian period

1. The Ricardian labour theory of value

While several authors propose a theory of prices based on labour *and* land, reducing labour to land using the basket of goods feeding a worker raised on a certain amount of land had already been proposed by Cantillon. Ricardo's method of reducing everything to labour involves the idea that the soil is available in different qualities, and that the labour value of land should be found on the land of poorest quality.

While introducing several types of land the argumentation does not explicitly introduce that there are also more than one commodity. Following Samuelson (1966), we discuss the Ricardian labour value in a model with *two* commodities. It is instructive to begin with a very simple world, where labour is available in a fixed amount L. If commodity 1 needs a_1 unit of labour and commodity 2 needs a_2, then society can achieve all combinations (q_1, q_2) on the (labour) budget line

$$a_1q_1 + a_2q_2 = L,$$

and relative prices are fully determined by the slope $\frac{a_2}{a_1}$ of this line, independent of demand, and we have a clear-cut labour theory of value. Alternatively, if land is given as S we would have a budget line $b_1q_1 + b_2q_2 = S$ and a land theory of value. However, if both are fixed so that we have two constraints, then the relative prices are not uniquely defined without reference to demand.

Ricardo's world is one where labour is not fixed but can be reproduced. In this case we would have prices determined as

$$p_1 = wa_1 + rb_1,\ p_2 = wa_2 + rb_2,$$

where a_i, b_i are labour and land content of the prices of commodity i, for $i = 1, 2$. Assuming that to reproduce labour we need c_1 and c_2 of the two commodities, so that

$$w = c_1p_1 + c_2p_2,$$

we get that

$$w = c_1(wa_1 + rb_1) + c_2(wa_2 + rb_2) = (c_1a_1 + c_2a_2)w + (c_1b_1 + c_2b_2)r$$

or

$$\frac{w}{r} = \frac{c_1b_1 + c_2b_2}{1 - (c_1a_1 + c_2a_2)}.$$

From this we get that

$$\frac{p_1}{r} = \frac{c_1b_1 + c_2b_2}{1 - (c_1a_1 + c_2a_2)}a_1 + b_1,\ \frac{p_2}{r} = \frac{c_1b_1 + c_2b_2}{1 - (c_1a_1 + c_2a_2)}a_2 + b_1,$$

and we have expressed the prices using r, the price of land, as numéraire.

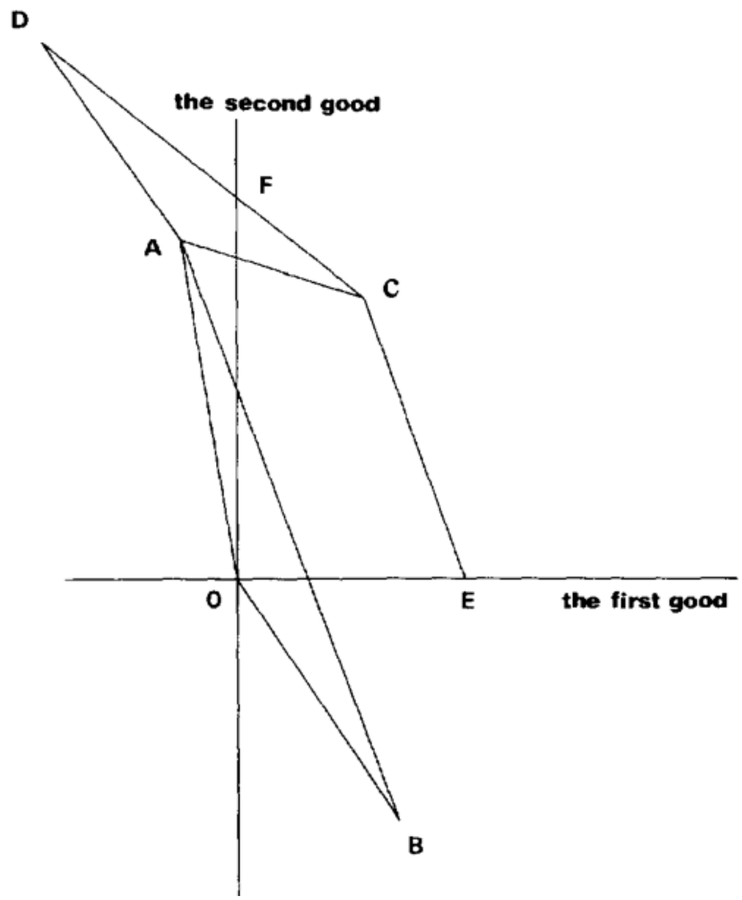
This situation, where land is fixed but labour is not, also gives uniquely determined relative prices, given as the slope of the budget line

$$\frac{p_1}{r}v_1 + \frac{p_2}{r}v_2 = S, \tag{1}$$

where S is available land and v_i is the net output (when the amount needed to reproduce labour is deducted) of commodity $i = 1, 2$. The situation is illustrated in the figure on the next page (taken from Negishi (1989),p.112), where A represents the (hypothetical) case where all land is used to produce commodity 2 (and some amount of commodity 1 must be used from outside to feed labour), and similarly B is the case where all land is used for commodity 1 (for the moment, forget about all other points). The budget line (1) is the segment of AB which falls in the first quadrant.

So far we have basically reduced labour to land, so that what comes out is more Cantillon than it is Ricardo. But we have not yet used the fundamentally new aspect introduced by Ricardo, namely that of diminishing returns of land: As more land is used, the productivity of the newly cultivated soil will be inferior to those already used. Since the price paid for using land is the same, it allows for a surplus to owners of productive soil, which is *rent*. For the poorest land there is no such gain, so the price of commodities raised on this land reflects only labour, and since competition assures that commodity prices are the same no matter where the commodity was produced, we finally get a full labour theory of value.

This is a remarkable way of reasoning, but it has its limitations. There is an implicit assumption about the way in which the soil becomes less productive, namely that production of all commodities should be affected in the same way. If this is not the case, then relative prices will depend on other things than just technology (namely, demand). This is where the remaining part of the figure comes in: Let OAB be all the



output combinations possible on the first (and best) piece of land. Now we add a second, inferior, piece of land, which isolated would have given another triangle with top in O, but since we already have the first one, we can produce all combinations arising as a sum of a production in the two triangles. Geometrically this means that we move the last triangle to have its top in A and the slide it down along AB the whole way to B. The outcome is a transformation curve FCE which has a kink in C, so its slope is not constant, in other words, relative prices cannot be determined by embodied labour alone.

2. The rate of profit and the rent on superior soil

Ricardo's reasoning about the rate of profit, which plays a role in his theory about the eventual static state of the economy, uses a somewhat simpler model of the economy that the one above, in particular he assumes that

1. Say's law works, so that there is no lack of demand or overproduction,

2. No fixed capital, only circulating capital in the form of wages advanced to workers,
3. Wages are at subsistence level,
4. Workers consume only agricultural products ("corn")

In the agricultural sector producing corn, the working capital has the size wL_c where w is the wage rate, which can be measured directly in corn, and L_0 is the number of workers employed in agriculture, giving a profit rate

$$\pi_0 = \frac{q_0 - wL_0}{wL_0} = \frac{1 - wa_0}{wa_0},$$

where $a_0 = \dfrac{L_0}{q_0}$ is the labour embodied in one unit of corn. Turning now to some other sector of the economy, such as the production of cloth, we similarly get a profit rate of the form

$$\pi_1 = \frac{p_1 q_1 - wL_1}{wL_1} = \frac{p_1 - wa_1}{wa_1},$$

with a_1 the labour coefficient of this sector. Now Ricardo applies a principle taken from Adam Smith, taking into account also the distinction between natural and market prices, namely that profit rates in different sectors must be equal due to the forces of the market. Thus, p_1 can be found from

$$\frac{p_1 - wa_1}{wa_1} = \frac{1 - wa_0}{wa_0},$$

which gives the well-known expression $p_1 = \dfrac{a_1}{a_0}$ for the price determined by labor coefficients.

The same approach could in the case of different qualities of soil, considering them as different sectors with $a_0' > a_0$ but here the price of the output, corn, is the same, so equality of profit rates can only by adding a new variable r with

$$\frac{1 - wa_0 - r}{wa_0} = \frac{1 - wa_0'}{wa_0'},$$

interpreted as the rent (here measured per unit of output) to be paid by the capitalist to the landowner.

It is seen that the size of the profit rate is determined by the less productive sector. Adding here the assumption, also a standard one with the classics, that investment, here in the form of extension of the working capital, is an increasing function of the profits earned, we get that economic growth becomes slower as a consequence of the lower productivity of the land, eventually sending the profits to zero.

3. Some subsequent contributors to the classical economic theory

In the period from Malthus and Ricardo and to the introduction of the marginalist approach several authors contributed to the development of economic theory without acquiring the status of fundamental importance, in some cases definitely undeserved. In this lecture we give a brief treatment of some of the more interesting of these. While V&G concentrate upon English authors, we add some of the contributors from the continent.

In France, the proposals for reform were much more radical and far-reaching than in England. It can be traced back to **Francois-Noël ("Gracchus") Babeuf** (1760 – 1797) who not only wrote but also went into political action for a radically egalitarian society, for which he was executed by the reactionary government taking power in 1797.

The French left-wing thinkers were more directly inspired by **Henri de Saint-Simon** (1760 – 1825) who had a background in impoverished nobility and looked with deep mustrust to the new class of rich industrial capitalists. He pointed to the unbalances in a society with few rich and many poor people, but he did not propose any radical means of changing society.

Charles Fourier (1772 – 1837) stated that in a capitalist society on 2/3 of the population has useful employment while the rest are useless parasites, and he was sceptical towards property and in favour also of sexual liberalization. His proposals for a more just society was centered on collectivist production ins the so-called phanlanstères, where the inhabitants both worked and lived and had other activities such as education. Only few of these were ever tried out, among these one in what is now Romania (1835 – 36), but it was closed down after one year by the authorities who were suspicious against the activities and considered the establishment as a camouflaged brothel.

Pierre Joseph Proudhon (1809 – 1865) is famous for the statement "property is theft" in his writings about property rights, which he considers as being the mother of tyranny – in the sense that property owners can prevent other citizens from using the result of previous labour and are protected by the law, which means that violence can be used if necessary. Proudhon can be considered the founder of the anarchist movement (the word 'anarchist' was introduced by Proudhon).

Having mentioned the French socialist thinkers of the period, we need also to comment on another (apart from J.-B.Say) economist of the conservative school:

Frederic Bastiat (1801 – 1850), whose main work "Economic Harmonies" indicates the political observation, was a strong believer in laissez-faire capitalism and justified the existing society as the best possible. He considered the authority of science, as represented by Say and Senior, as decisive against left-wing writers such as Proudhon.

Bastiat's point of departure is a version of *utilitarianism:* In an exchange, both parties are better off since otherwise they would not engage in the exchange. Given that all human interactions are exchanges, it may then be concluded that what emerges is better for all. So, according to Bastiat, political economy, which deals with exchanges, shows that society achieves social harmony.

In the value theory, Bastiat considers also nature to contribute to value, but apart from this, it comes from production, where also capital, which he considers as the result of foresight, intelligence and thrift, plays a role. Not surprisingly, he was opposed to any interference with or taxation of inheritance.

4. First steps towards a modern price theory

Johann Heinrich von Thünen (1783 – 1850) is one of the outstanding economists of the nineteenth century, standing somewhat apart from the main contributors and therefore often neglected.

The isolated state: Localization and land use. Here is a modernized version, due to Beckman (1972) of the most important of von Thünen's contributions. We begin with the case of only one agricultural commodity. At distance r, employment x yields a profit (all per unit of land)

$$g(p,r,x) = (p - tr)a\phi(x) - wx,$$

where p is price, t transportation cost, ϕ the production function, a a proportionality factor for the particular commodity, and w the wage rate. Profit maximization gives first order conditions

$$\frac{\partial g}{\partial x} = a(p - tr)\phi'(x) - w = 0$$

so that

$$x = (\phi')^{-1}\left(\frac{w}{a(p - tr)}\right).$$

If we simplify to have $\phi(x) = x^\alpha$ for $0 < \alpha < 1$ (per capital version of a Cobb-Douglas), then

$$x = \left(\alpha a \frac{p - tr}{w}\right)^{1/(1-\alpha)}.$$

This means that employment per unit of area unit falls with increasing distance and becomes 0 when distance is $r_0 = \dfrac{p}{t}$. Output and profit per unit of area also decreases and become zero beyond r_0.

Now we assume that there are two commodities with proportionality factors a_k, prices p_k and transportation cost t_k. Profit per unit of area is

$$g(p_1, p_2, r, x_1, x_2) = \sum_{k=1}^{2} (p_k - t_k r) a_k \phi(x_k) - w \sum_{k=1}^{2} x_k,$$

and first order conditions for maximization are

$$(p_k - t_k) a_k \phi'(x_k) - w = 0 \text{ if } x_k > 0, k = 1, 2.$$

In the simple case this gives us

$$x_k = \left(\alpha a_k \frac{p_k - t_k r}{w}\right)^{1/(1-\alpha)}$$

with a profit

$$g_k(r) = (1 - \alpha) \left(\frac{\alpha}{w}\right)^{\alpha/(1-\alpha)} (a_k(p_k - t_k r))^{1/(1-\alpha)}$$

for $k = 1, 2$ (insert x_k and replace w using the first order ondition). Since at any location $g_1(r)$ will typically differ from $g_2(r)$, only one of the crops will be grown at this place. Also, the profit functions intersect only at one particular value $\overline{r}$ of r, where

$$a_1(p_1 - t_1 \overline{r}) = a_2(p_2 - t_2 \overline{r}).$$

Assume that commodity 1 is grown closest to the center. To find what determines the boundary, we notice that the (numerical) slope of the profit function g_1 must be higher than that of g_2 at the intersection point where g_1 is equal to g_2, and this amounts to the condition

$$a_2 t_2 < a_1 t_1,$$

saying that output per area unit using one worker is larger for commodity 1 than for commodity 2.

The reasoning holds also with general functional forms for ϕ.

The natural wage. The square-root formula for the natural wage has been debated in the literature, usually in a highly critical way. Von Thünen has a very modern approach, deriving the formula from maximization of zy, where z is the rate of interest and y the annual surplus of a working family, which is considered as converted into capital. Let a be subsistence consumption (price of the consumption good seet to 1), then average wage is $a + y$. If one unit of labour is necessary to produce one unit of capital, then

$$z = \frac{p - (a + y)}{q(a + y)},$$

where p is annual production of consumer goods for a worker using q units of capital. If p, q and a are taken as constants, then maximization of zy gives first order conditions

$$(a + y)^2 = ap, \text{ or } a + y = \sqrt{ap},$$

so that the natural wage is the geometric mean of necessary subsistence a and average product of the worker. It has been argued by Samuelson (1983) that q and p cannot be taken as constants. If the wage rate is higher, then q abd consequently p must be larger. If production of consumer goods is described by a (per capita) production function f with standard properties, so that $p = f(q)$, then

$$a + y = f(q) - qf'(q)$$

(the remuneration to labour equals the product minus remuneration to capital), and inserting in the expression for z we get

$$z = \frac{f'(q)}{a + y}$$

and

$$zy = \frac{f'(q) - af'(q)}{f(q) - qf'(q)}.$$

This expression should then be maximized in q, and again the first order condition is $(y + a)^2 = ap$, giving the same square root formula as that derived by von Thünen. What was wrong according to the critics was the choice of maximand zy. But the idea of considering zy as a social welfare function and the expression $\sqrt{ap}$ as an optimal wage is a much later construction, it might not have been what von Thünen was looking for. According to Negishi (1990), what von Thünen had in mind was rather a kind of equilibrium wage determined by equality of demand and supply when workers have adjusted their supply fully, and it should perhaps be considered in the context of a steady state growth model.

Nicolas-François Canard (1750 – 1833) can be considered as a forerunner of Cournot, who however was extremely critical in his judgement of Canard's work. Although Canard supported a labor theory of value, he considered the labor employed as insufficient for determining the price. For this, one has to fall back on the market, gathering buyers and sellers. Buyers determine a maximal price, beyond which they will not buy, and sellers similarly have a minimum price. The lower limit is the price of the necessary labour which has been used in producing the commodity. For the maximum price, the are several cases to consider:

(a) If the good is a not necessity, the seller cannot force the price beyond the point where what he gains from an increase in price is lost by the reduction of sales. This point is the limit of what the seller can obtain, and we have here an anticipation of the demand function used by Cournot.

(b) If the good is a necessity, the price will be limited by the natural wages of the buyer. If higher, the wages would have to increase wages or the workers would revolt or die from hunger.

(c) If the buyer intends to transform the good and resell it, the price cannot be higher than what will leave to the seller his natural wage.

From this, Canard goes on the consider what is the outcome in the market given that the two parties have opposite interests. If L denotes the latitude of the price (distance between maximum and minimum) and x is the part added by sellers to the minimum price, then the proportion

$$\frac{x}{L-x}$$

can be seen as the relation between force of sellers and force of buyers. The force of the buyers is expressed as $\frac{1}{BN}$, where B is the need and the competition among buyers, possibly measured as the number of other buyers, and similarly, the force of sellers is $\frac{1}{bn}$ with b the need of sellers and n their competition. From

$$\frac{x}{L-x} = \frac{\frac{1}{bn}}{\frac{1}{BN}}$$

we get that

$$x = \frac{BN}{BN+bn}L,$$

and letting S be the natural price for producing the good, which is the minimum price, we finally get the expression

$$p = S + \frac{BN}{BN + bn} L.$$

As it can be seen, Canard had a price theory which included all forms of imperfect competition, and in some ways looks very modern. He was among the first to use a mathematical expression of the argumentation, for which he was severely criticized by contemporary and later economists, with only few exceptions as e.g. Sismondi.

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