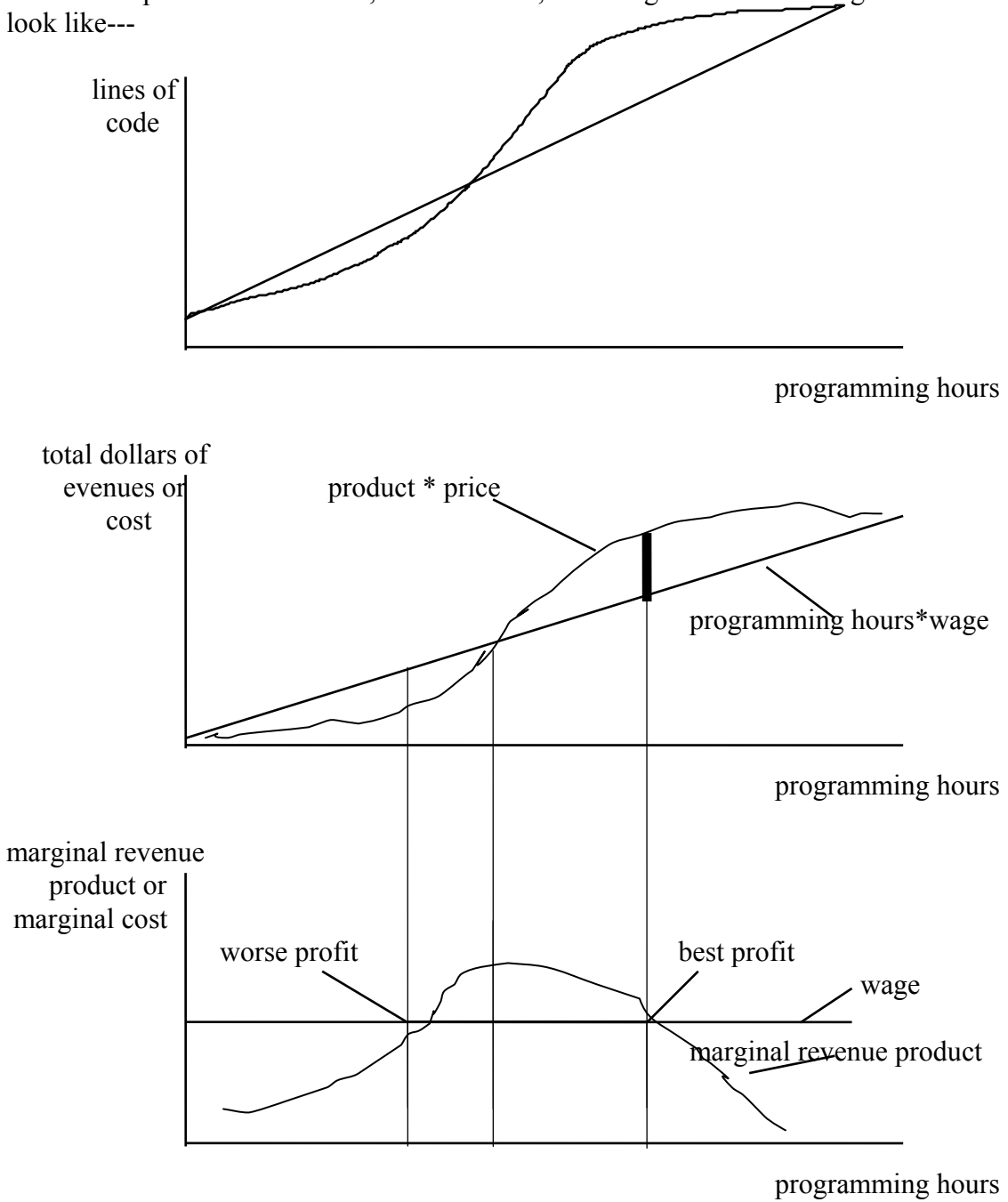


Labor Demand With Just One Input: MP, Scale and Division of the Output

I. Maximizing Profits with Just One Input: the Computer Software Case

Hold buildings, computer hardware, and pizza consumption constant and see how output varies with just the number of programming hours.

The production function, revenue costs, and marginal revenue/marginal costs are look like---



where marginal revenue product = Marginal Product of Labor \* product price

profit maximization rule:

Marginal Product of Labor \* product price = wage (marginal cost of Labor)

Numerical example of the maximization problem, assuming that each programmer is paid \$20/hour and each million lines of code sells for \$100/period

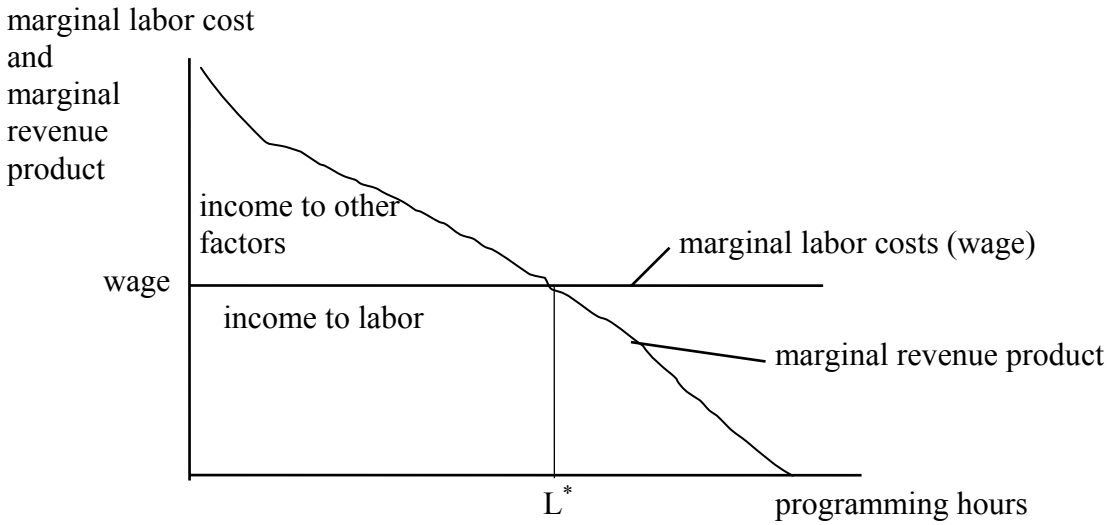
progr hrs (1000)	lines of code (m)	marginal product (MP)	MP*P=MRP	total revenues	total costs	profits
1	100	--	--	10,000	20,000	-10,000
2	115	15	1500	11,500	40,000	-28,500
3	131	16	1600	13,100	60,000	-46,900
4	148	17	1700	14,800	80,000	-65,200
5	166	18	1800	16,600	100,000	-83,400
6	185	19	1900	18,500	120,000	-101,500
7	206	21	2100	20,600	140,000	-119,400
8	231	25	2500	23,100	160,000	-136,900
9	311	80	8000	31,100	180,000	-148,900
<b>10</b>	<b>511</b>	<b>200</b>	<b>20000</b>	<b>51,100</b>	<b>200,000</b>	<b>-148,900</b>
11	1,371	860	86000	137,100	220,000	-82,900
12	2,571	1200	120000	257,100	240,000	17,100
13	3,071	500	50000	307,100	260,000	47,100
<b>14</b>	<b>3,271</b>	<b>200</b>	<b>20000</b>	<b>327,100</b>	<b>280,000</b>	<b>47,100</b>
15	3,301	30	3000	330,100	300,000	30,100
16	3,316	15	1500	331,600	320,000	11,600
17	3,328	12	1200	332,800	340,000	7,200
18	3,339	11	1100	333,900	360,000	-26,100
19	3,349	10	1000	334,900	380,000	-45,100

The marginal cost (MC) of another 1,000 hours of coding is \$20,000 [[going from 13,000 to 14,000 progr hrs, at programmer pay of \$20/hr=\$20,000]]. Note that the profits are maximized and minimized at the point where

MRP=MC, that is, at that level of output where \$20,000 in MRP equals \$20,000 in MC at

those levels of output highlighted. Also, note that to guarantee that the output leads to profit maximization, you need to choose that level of output where the MRP product is falling .

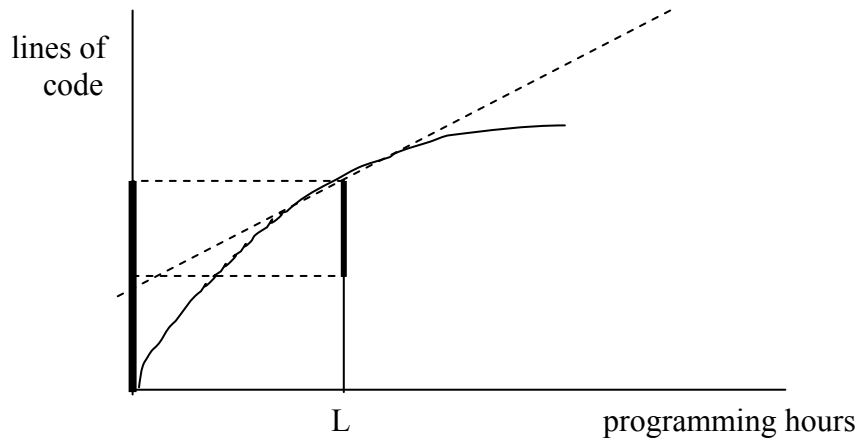
## II. Marginal Productivity and the Theory of Distribution



## III. Scale Economies and Exhaustion of the Product in Competitive Markets with IRS

Paying labor their marginal revenue product can be a problem in a competitive economy with increasing returns to scale (IRS).

Returns to scale: If doubling the inputs, results in doubling the output, then the production function is said to exhibit constant returns to scale (CRS). If doubling the inputs more than doubles the output, then it is increasing returns to scale (IRS). If doubling the inputs less than doubles the resulting output, then it is decreasing returns to scale (DRS). Though it sounds good, an IRS production function presents a problem for a competitive economy—paying the “very productive” inputs their marginal product more than exhausts the total amount of output available. We illustrate first with the DRS production function pictured below.



The big thick line on the vertical axis is the total amount of code produced. If we paid labor their marginal product, what fraction of that total output would they be entitled to if



small, 'local' sections of IRS, as our first production function had, but it is a problem with globally IRS as pictured immediately above).

Constant returns to scale (CRS) is the small-bowl of porridge case (neither too hot, nor too cold, but just right). With CRS, the production with one input would be a line from the origin, and labor would get paid all the output that they produce (as pictured below):

