Ec 181
Seminar in Economic Development
**Week 7 Problem Set: Inward-looking industrialization**

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**Introduction.** This week and next we contrast two leading approaches to the role of trade policy in the industrialization process: import substitution and outward orientation. These approaches have a lot in common. Starting from a largely resource-based export pattern, they both seek to achieve a rapid increase in productivity (or *absolute advantage*) through the achievement of production experience and scale across a range of manufacturing industries. Both strategies feature an *easy import substitution* phase in which a graduated structure of protection (problem 3) encourages the emergence of a labor-intensive, low-technology import-competing consumer goods industry. Where the strategies diverge in practice is in (a) the size and diversity of effective protection coefficients across manufacturing, (b) the degree and rapidity with which protection is extended to second-stage industries with higher skill and capital requirements, (c) the degree of discrimination against traditional exports, and (d) the degree of emphasis on achieving exporter status in protected industries. Outward-oriented regimes also tend to keep important economy-wide prices closer to scarcity values, for example by avoiding severe overpricing of labor or underpricing of foreign exchange. These differences, in turn, tend to produce a considerably faster growth in manufacturing exports (and, more recently, business-services exports) as a share of GDP in the outward-oriented cases.

At the extremes, the policy differences between import-substituting and outward-oriented regimes appear to reflect fundamentally divergent attitudes towards the dynamic benefits and costs of integrating with international markets. Both types of regime employ trade protection and other instruments of industrial policy; free trade is almost never observed in practice (maybe Hong Kong among contemporary countries, or Britain in the second half of the 19$^{th}$ century). But outward oriented regimes protect selectively (even if aggressively) and temporarily; their key feature is that they embrace and even pursue dynamic comparative advantage without strongly repudiating static comparative advantage. Import-substituting strategies, in contrast, pay less attention to static comparative advantage and in extreme cases reveal a suspicion not just of international markets but of market prices and competition more generally. Protection can be highly persistent, even effectively permanent.

Government capability may be a key determinant of success in implementing outward-oriented industrial policies. We consider two dimensions of capability: the ability to terminate protection when an infant industry is failing to achieve international productivity standards, and the ability to avoid over-pricing of labor in the modern sector. Problem 2 addresses the first of these and argues that permanent protection may be the only time-consistent outcome if the government faces high political costs of terminating protection. An optional problem looks at labor costs and shows how a high minimum wage can undermine the attractiveness of an outward-oriented strategy by undermining employment creation in the modern sector, particularly when capital is internationally mobile.

Since inward-looking attitudes are more likely to emerge where trade opportunities are less immediately favorable, we should be careful in prescribing for Nigeria (large and resource-rich) or Bolivia (landlocked) based on Korea (small, coastal and resource-poor). But strongly inward-looking

and market-unfriendly policies have been broadly discredited by experience, even controlling for trade opportunities.[1] At bottom, these policies appear to get the balance between market failure and government failure wrong. The ongoing challenge for a resource-rich or landlocked country is how to strike this balance when labor-intensive manufacturing and services are not easily within reach.

The economic difficulties confronted by aggressive ISI regimes during the 1970s and 1980s, together with the success of outward-oriented economies in East and Southeast Asia and the emergence of economically conservative governments in the industrial countries, created a sea change in global attitudes towards trade policy starting in the early 1980s. The result was a shift towards outward orientation and a substantial liberalization of import controls by developing countries, a process spurred on by regional trade agreements both within the South (e.g., Mercosur) and between North and South (e.g, NAFTA). For internal reasons, China adopted an outward orientation in the late 1980s and flooded the world with low-cost manufactured goods over the next quarter-century, particularly following its accession to the WTO in December of 2001. The global financial crisis, however, generated a sharp decline in the growth of global trade and a slowdown if not a reversal in the global trend towards trade liberalization and outward orientation.

Debate persists over what constitutes appropriate trade policy for developing countries. The guidance from economic theory and evidence is important but ultimately limited. The only really non-controvertible findings are that quantitative restrictions are sharply inferior to price-based interventions (e.g., tariffs) as instruments of trade policy, and that chaotic and quasi-permanent structures of protection are inconsistent with sustained progress in productivity and industrialization. This leaves a lot on the table. As Buffie (2001) puts it, "What is still unclear is exactly where trade policy should head: toward moderate protection, balanced incentives for import-substitution and export production, or completely free trade." (p. 33)

**Problem set.**

1. **The infant industry argument again.** In week 3 (problem 1) we looked briefly at the infant industry argument, using an example in which productivity spillovers were external to the firm, but internal to the industry. Here we consider an alternative case, in which there is learning-by-doing internal to the firm. In Figure 1.1, therefore, we consider a single domestic textile firm that can pay a set-up cost of *F* (e.g., factory construction) and then incur marginal costs given by the schedule *MC*. The country is small in the world textile market, which means that under free trade the firm is a price taker even though it has no domestic rivals.

   In part 1 of the problem we assume that there is no learning-by-doing, so that the future looks exactly like the present except for the set-up cost *F*. We set up a situation in which the firm is not a profitable venture, either privately or socially. We then set up a situation in which learning-by-doing takes place in the short run. In this case a firm that would not be viable at all in the absence of learning effects may indeed be a profitable venture as long as it can withstand producing at a loss in the short run. These losses are directly analogous to the set-up investment *F*, and as long as financial markets are willing to finance these costs at a low enough

[1] This is probably least true, for the period since WWII, of landlocked countries in low-income neighborhoods (e.g., landlocked African countries, particularly those outside the Southern African Customs Union). But technological changes (cheaper air transport and the information revolution) have opened up new export possibilities for these countries in all sectors, including services.

interest rate, there is no market failure and no infant industry problem. Imperfect credit markets, however, can create a market failure: the firm may be unwilling to enter even though entry is socially desirable. We look at subsidized loans, a temporary production subsidy, and a temporary tariff as alternative ways of generating entry and producing a net social gain.

The main points in this problem can be established intuitively, using the supply/demand diagram and the familiar concepts of consumer and producer surplus. But the analysis is inherently dynamic, so to capture this feature we divide time into an initial period and a set of identical future periods. Because future periods are all assumed to be identical to each other, any annual net future cash flow *x* has a present discounted value of exactly $x/r$ from the perspective of period 1, where *r* is the interest rate or 'discount rate' used in the calculation. In the end, therefore, the dynamic analysis comes down to comparing 'present' costs with 'future' benefits, as in any private or social investment decision.

**1.1. A non-viable industry.** Using Figure 1 (no calculation is necessary), explain why in the absence of learning-by-doing or some other dynamic benefits from operating in the short run, a firm facing the marginal cost curve *MC* will not enter the market under free trade even if *F* = 0. Explain why this firm is neither privately nor socially profitable. (Hint: By 'socially profitable' we mean that entry would create a potential Pareto improvement, i.e., more benefits than costs on an economy-wide basis.)

**1.2. Learning-by-doing may justify entry.** Suppose now that the firm can expect to benefit from learning-by-doing. We'll give the learning effect a very simple form: once the firm has produced at least $Q_{min}$ for one period, the marginal cost curve will shift down permanently to $MC'$ and the scope for learning will be exhausted (production below $Q_{min}$ generates no learning). Will entry be profitable now? To answer this note that if the firm pays the start-up cost $F$ and produces the minimum level $Q_{min}$ in period 1, its discounted profits are

$$-F + \pi_1 + \frac{\pi_2}{1+r} + \frac{\pi_2}{(1+r)^2} + \cdots$$

where $\pi_1$ is the firm's producer's surplus in period 1 (which may be negative), $\pi_2$ is its producer's surplus in all subsequent period (recall that producer's surplus is defined as the difference between total revenue and total variable cost), and $r > 0$ is the rate at which the firm discounts future cash flows. Using the formula for a convergent geometric series, $1 + \alpha + \alpha^2 + \cdots = 1/(1-\alpha)$ for $0 < \alpha < 1$, show that the firm will enter if and only if $\pi_2/r > F - \pi_1$ or, equivalently in Figure 1.1, if and only if

$$\frac{g+h}{r} > F + b.$$

Interpret this expression.

**1.3. In the absence of distortions, the private entry decision is socially optimal.** Suppose that the discount rate appropriate for social cost-benefit analysis is $\delta > 0$. What then is the condition under which entry produces net *social* benefits? (Hint: Calculate the net social benefits in each period, discount them appropriately, and add them up. Make sure you

include $F$ among the costs in period 1.) Explain why the firm's entry decision is socially optimal if the firm's discount rate *r* is exactly the same as the social discount rate $\delta$.

**1.4. But credit market imperfections may inefficiently bar entry.** Due to enforcement and information problems in financial markets, the firm is very unlikely to be able to borrow at the social discount rate. Show that if this leads the firm to apply a higher discount rate to its investment decision ($r > \delta$), entry may be privately unprofitable even if it would produce net social benefits.

**1.5. A government loan can fix matters.** Show that if the government were willing to lend the firm $F + b$ in period 1 and receive a perpetual interest payment of $\delta(F + b)$ in return, (a) the government will exactly 'break even' on its loan (i.e., the loan itself it will have present value zero from the government's perspective), and (b) the firm will enter whenever entry is socially optimal. (Hint: The firm now has zero net cash flow in period 1, and in subsequent periods its cash flow – which should still be discounted using its own discount rate *r* – is reduced by the interest payment to the government. From the viewpoint of period 1, what is the present value of cash flows for the firm, and the condition for entry?)

**1.6. So can a temporary production subsidy.** Suppose that $\alpha > F$ (just to keep things simple). Recall from problem set 3 that when the marginal cost curve is $MC$ the net social cost of a production subsidy at rate $s = t$ is $b$.[2] Explain that as long as entry passes the *social* cost-benefit test you laid out in part 3 of this problem, a *temporary production subsidy* at rate $s = t$ (a) will be sufficient to provoke entry; and (b) the subsidy program will pass a social cost-benefit test. By a 'temporary' subsidy I mean one that is available in period 1 and only lasts 1 period.[3]

**1.7. A tariff may well produce a net gain too.** Explain (calculation not required) that a temporary tariff may well also produce a net gain, although not as big a gain as a loan subsidy or production subsidy. Explain this ranking of alternative interventions using the principle of policy targeting. Could fiscal constraints produce a situation in which the tariff is actually better than these alternatives? Explain.

**2. Protection and the credibility problem.** A key feature of the previous example is that learning effects are an *automatic* by-product of production experience. What if they're not automatic? What if firms have to undertake costly activities to acquire technological capability, even after paying the setup cost $F$? We show here that this may undermine the success of infant-industry protection, because it introduces the possibility that firms may choose to remain infants rather than investing in learning. What is crucial for this outcome to emerge in equilibrium is that

[2] Recall from the week 3 problem set that the net social cost of a tariff at rate *t* (by contrast with a production subsidy) is the familiar deadweight loss $b + f$.

[3] Note that in this particular case (in contrast to problem 1 of problem set 3) there is no learning-by-doing externality. So it's not obvious that a production subsidy should be as good as a subsidized loan; after all, in the present case the distortion is in the credit market, and the principle of policy targeting says that an intervention in that market is probably best. But in this case a production subsidy really is the equivalent of a subsidized loan, except for distributional issues. The government is paying out a subsidy in period 1 and financing it, implicitly, out of future net social gains.

firms' beliefs are consistent with rational behavior by the government. In particular, firms must believe that continued infant status will be rewarded with continued protection – and when they act on this belief, the government must indeed find it optimal not to penalize them.

To establish these points we need to analyze a simple strategic game, in which the behavior of firms depends on how they expect the government to set trade policy in the future.

**2.1. Suppose learning requires purposive activity.** Return to Figure 1.1 and suppose that learning effects do not occur unless the firm produces an output of at least $Q_{min}$ *and* undertakes additional activities costing an amount $I$ in period 1 to acquire technological capability. Explain why in this case we get a market failure – entry is socially beneficial but will not occur – if the condition $(g+h)/r < F + b + I < (g+h)/\delta$ holds.

**2.2. A credibly temporary tariff will work.** Drawing on your answer to question 1 above, explain that a 'credibly temporary tariff' – meaning a tariff that everyone knows will last exactly 1 period – may be able to solve the market failure in part 1 of this problem.

**2.3. And some governments may indeed be credible.** Now let's look at the technological effort decision more closely, and how it may depend on the firm's expectations regarding government policy in period 2. Once entry has occurred and production is taking place in period 1, the firm has two alternatives: it can spend $I$ in order to move to $MC'$, or it can choose not to spend $I$, which means it retains $MC$. In your answer to part 2 of this question, you assumed that the government would liberalize trade in period 2 regardless of whether the firm actually put in the technological effort or not in period 1, and under this assumption you showed that the firm would indeed spend $I$. Why is it in fact reasonable to assume that a highly capable government would announce its intentions in this way, and then would actually manage to carry these intentions out, i.e., to liberalize trade regardless of the firm's choice? [Hint: Use Figure 2, which shows how payoffs starting in period 2 depend on whether the firm made the investment in period 1, and on the government's choice of whether to retain or eliminate the tariff.]

**2.4. But not all.** But now suppose the government has a reputation for being 'soft'. The firm therefore understands that if it has not acquired global competitiveness by period 2, the government will be reluctant to remove the tariff, for fear of the short-run political costs of layoffs or of admitting failure. To capture this perception on the part of firms, adjust the government's payoff in the lower-right corner of Figure 2 to include this political cost. Explain that the firm, in period 1, may now understand that it is really comparing the following two alternatives:

- Alternative 1 (spend $I$ now, and move to $MC'$ and free trade in future periods)
- Alternative 2 (don't spend $I$, and retain $MC$ and the tariff in future periods, because the government caves in and does not liberalize trade.

Notice that this soft government is not completely incapable; first of all, it is quite good at identifying promising infant industries. Second, as long as learning actually does take place, the soft government ends up looking tough (according to alternative 1, everyone

understands that if the firm reaches global competitiveness the government will liberalize trade even though the firm would prefer continued protection). So: is it plausible that a soft government would indeed manage to liberalize trade if the firm had achieved competitiveness, but would fail to do so if the firm had remained an infant? Explain that under these conditions a soft government that introduces an infant-industry tariff in period 1 may be stuck with permanent protection, regardless of how firmly it announces that protection will be temporary.

**2.5. Overcoming credibility problems.** The government in part 4 of this question faces what Kydland and Prescott called a *time consistency* problem.[4] What institutional approaches to trade policy might be useful for a government that faces such a problem? [Open discussion. Hint: how might a government tie its hands? What other approaches might work?]

**3. Effective protection.** From a normative perspective, the primary role of trade policy is as an instrument of industrial policy. But what is the impact of trade policy on the structure of industrial production? The question turns out to be complicated for two main reasons. The first is that most industrial activities end up using the outputs of previous stages of processing as intermediate inputs. For example, the production of bicycle parts requires steel. Trade policy can affect the incentives facing any given stage of processing not just from the output side (tariffs on imported bicycle components help the domestic bicycle parts industry) but also from the input side (quotas on imported steel hurt the domestic bicycle parts industry). The second is that protection can also affect the relative profitability of activities through general equilibrium effects on the prices of factors of production and nontraded inputs.

In general, one can only determine the impact of trade policy by solving for the full general equilibrium of the economy with and without protection. But a useful partial equilibrium approach is provided by the *effective rate of protection*, defined for any individual stage of processing as the percentage difference between the value added per unit of output at domestic prices and the value added per unit of output at world prices:

$$ERP = (VAD - VAW)/VAW$$

[4] The government's announcement of a temporary tariff would generate welfare gains if it were credible. But in order for the announcement to be credible (*time consistent*), the government must be prepared to carry it through even if the private sector acts as if it does not believe the policy (by refusing to innovate). If it is known that the government will cave in under pressure, the original claim that the tariff is temporary is not credible. The reason time consistency is important in practice is that any scope for fooling the public with non-credible promises ("we will not bail you out if you re-build in this flood-prone area") is likely to evaporate over time as the private sector observes the government's actual behavior. This reduces the set of sustainable policies to the time-consistent ones. A weak government, in section 4 of this problem, may have only one time consistent form of protection: permanent protection! This greatly undermines the welfare gains from protection and may well mean that protection produces a net welfare loss.

The analysis of time consistency as a public policy problem was introduced by Finn Kydland and Swarthmore graduate Ed Prescott (Kydland and Prescott 1977), who received a joint Nobel prize for this contribution and for their contributions to real business cycle theory. The time consistency problems of individuals (in carrying out their own good intentions, like quitting smoking or exercising enough) are at the heart of a lot of recent research in behavioral economics, where they can justify paternalistic *nudges* as welfare-improving policy interventions. The problem of rational self-restraint is beautifully analyzed by Elster (1979), and has recently produced some very clever online initiatives to help individuals overcome their own time-consistency problems (e.g., http://www.stickk.com/).

Recall that value added is the sum of payments to primary factors of production (land, labor and capital). For given market prices of these inputs, *the $ERP$ provides an indicator of the influence of trade policy on promoting an expansion of value added in a given sector*: sectors with high *ERP*s will tend to pull primary factors of production out of sectors with low or negative *ERP*s.

If there are no intermediate goods in production, then value added per unit is simply the gross sales price. In this case the $ERP$ is the same as the nominal protection rate (the tariff rate or the tariff-equivalent of binding quota protection). For an import-competing good protected by a tariff $t_M$, for example, the $ERP$ in the absence of any intermediate goods is

$$\frac{[(1+t_M)\cdot E\cdot P^* - E\cdot P^*]}{E\cdot P^*} = t_M$$

You are familiar with the protective effect of a tariff: in the absence of intermediate goods, a 50 percent nominal tariff allows domestic firms to 'meet the competition' while incurring value-added costs per unit of output that are 50 percent higher than those achieved by foreign firms.[5] *The $ERP$ simply generalizes this logic to the case where production requires traded inputs.*

$ERP$s can differ very sharply from nominal protection rates, and when they do they are hugely superior for assessing the incentive effects of trade policy. Interpreting them nonetheless requires some care. One reason is that the incentive effects of policy are *always relative*: one sector or stage of processing is favored relative to another. Gauging the direction of incentives therefore requires comparing relative $ERP$s (for example, the $ERP$ to an export sector that has no export tax and uses no imported intermediates is zero; but that sector will shrink when an import-competing sector receives a high $ERP$. You have to compare the two *ERP*s to get a bead on the incentive effect on exports). Another is that some inputs are nontraded (electricity, transport services), and handling these requires making a judgment about the impact of protection on the prices of nontraded goods. There is no 'law of one price' to help here, and this can introduce an element of arbitrariness into calculated $ERP$s (at the very least an assumption has to be made about how the structure of protection affects the real exchange rate). A final issue has to do with the direct or indirect impact of trade policy on factor prices. Higher tariffs on imported capital goods, for example, increase the price of the services of capital relative to labor, thereby exerting a discouraging effect on capital-intensive sectors or stages of production; but this would not be captured in relative $ERP$s.

**3.1. Calculating the $ERP$.** To calculate effective protection rates we first choose units so that all traded goods have international prices of 1. We then need the whole set of input/output coefficients describing how much of each traded input is needed to produce each unit of traded output. For example, suppose that domestic textile firms can produce an amount of textiles valued at $1 in the world market using *a* units of cotton (at a unit price of $1 on world markets) plus capital and labor (there are no other intermediate

[5] For an export, the $ERP$ in the absence of intermediate goods is $[(1-t_X)EP^* - EP^*]/EP^* = -t_X$, where $t_X$ is the ad-valorem export tax (negative if the export is being subsidized); a 10 percent export tax means that domestic exporters must pay10 percent less to primary factors than foreign competitors do, per unit of output, to remain competitive.

inputs). And suppose that the tariffs (or tariff-equivalents) on cotton and textiles are $t_C$ and $t_T$. Using equation (3), show that the $ERP$ for textiles is given by

$$ERP_T = \frac{t_T - at_C}{1 - a}$$

**3.2. Uniform tariffs.** Show that if there is a uniform tariff structure ($t_T = t_C$), then the $ERP$ for textiles is just the nominal protection rate $t_T$.

**3.3. Graduated tariffs.** The hallmark of import-substituting regimes is a *graduated tariff structure*, which is one in which tariff rates on final goods are higher than on intermediate inputs (and these in turn are at least as high as those on imported capital goods). If $a = 0.5$ and $t_C = 0$, what is $ERP_T$ as a function of the nominal protection rate? For given values of $t_T > t_C$, how does $ERP_T$ vary with increases in $a$? What is the value of $ERP_T$ if $a = 0.90$, $t_T = 100$ and $t_C = 0$? This case looks extreme; what kind of manufacturing activity (not necessarily textiles) does it suggest?

**3.4. Taxing traditional exports.** In a cotton-exporting country, a government intent on promoting textile industry might be tempted to put an export tax on cotton, or ban cotton exports altogether. Interpret this from the perspective of effective protection.

**3.5. Protecting exporters from import protection.** Suppose that the producers of traditional exports purchase inputs from domestic firms, and that these domestic firms are protected from import competition at the nominal rate $t_I$. What is the effective rate of protection of the traditional export sector?

**4. Tariffication and openness.** The "tariffication" of quotas is their replacement with tariffs at rates equal to the gap between the quota-induced domestic price and the world price. This is often the first step in trade liberalization, and despite the celebrated equivalence of tariffs and quotas it is considered a liberalization in its own right. For purposes of this question, assume that the importing question is small in world markets.

**4.1.** Draw a supply-and-demand equilibrium for some good in a competitive global market, and use the resulting world price to characterize the equilibrium in a competitive domestic industry that is being protected from import competition [Hint: draw the world and domestic diagrams directly next to each other; assume an exchange rate of 1 so that you can translate world prices directly into domestic-currency units]. Show that the same equilibrium can be achieved either through a quota or through the equivalent tariff. Note that it follows from this that tariffication of a quota does not change the effective rate of protection.

**4.2.** Now suppose that foreign producers achieve productivity gains. Show the impact of this on the world price of the good, and explain why this impact is independent of the country's trade policy. [Hint: what happens to the world supply curve?]

**4.3.** Now consider the impact of foreign productivity growth on the *domestic* price level. Show that this depends on whether a given initial rate of effective protection is achieved through fixed tariff rates or fixed quota amounts. In what sense is a country's trade policy genuinely more *open* after tariffication than before?

**4.4.** Consider the impact of *domestic* productivity growth on the price level. What type of industry benefits more from its own productivity growth, an industry protected by fixed tariff rates, or one protected by fixed quotas? Is this likely to make any difference for actual effort to achieve productivity improvements?

**4.5.** Would your answer to part 4 change if tariff rates, rather than being fixed over time, were determined on a discretionary basis by public officials capable of being influenced by protectionist lobbies?

**5. Trade policy and market power.** There is a single domestic producer of detergent who can operate at a scale comparable to the entire domestic market. This producer has an upward-sloping marginal cost ($MC$) curve. In a diagram, identify the equilibrium price and quantity in the domestic market under the following three conditions:

**5.1.** Imports are prohibited completely and the firm acts as an Ec 1 monopolist (call the equilibrium price $P_M$).

**5.2.** Imports are available in unlimited quantities at the tariff-inclusive price $P_T = (1+t)P^* < P_M$, where $P^*$ is the world price and $t$ is the *ad valorem* tariff rate (the exchange rate = 1). Call the amount imported in this case $M$. [Hint: Draw the foreign supply curve, which is horizontal at $P^*$, and the foreign supply facing consumers, which is horizontal at $P_T$. Make sure that $P_T$ is below the intersection of the $MC$ curve and the market demand curve, so that imports would be positive if the domestic market were perfectly competitive. Now ask yourself how the tariff modifies the monopolist's marginal revenue ($MR$) curve. Show that the $MR$ curve becomes flat for a while and then jumps down to the old $MR$ curve. Set $MR = MC$ to find the equilibrium price and quantity.]

**5.3.** Imports are restricted by a quota, to exactly the amount $M$ obtained in part (2) of this question. Call the equilibrium price in this case $P_Q$ and identify the total amount of the good sold in the domestic market. [Hint: If an amount $M$ is imported, then the domestic firm faces a residual demand curve that is shifted to the left by $M$ units. Draw this demand curve, together with its $MR$ curve. Now set $MR = MC$ again, to find the firm's price and quantity.]

**5.4.** Explain why $P_Q > P_T$ and why consumers get less detergent under what seemed like an equivalent quota. Is the country as a whole better or worse off? Intuitively, what's causing the tariff/quota equivalence that would prevail under competition to break down here?

**6. Discussion of Westphal (1990)** *Effective incentive rates* generalize the effective rate of protection concept to include a wide range of policies governments may use to favor particular

industries (not just tariffs or quotas but also preferential interest rates, income tax reductions, privileged access to import licenses, and other policies). In what sense do the calculations reported in Table 1 reveal a regime that was interventionist but decidedly export-oriented? Looking at the bottom row: what do these figures for the entire manufacturing sector imply about effective incentive rates in agriculture?

7. **Discussion of Rodrik, Chapters 8 (The global governance of trade as if development really mattered) and 9 (Globalization for whom?)** Successful integration into global markets has been a hallmark of country-level growth success since the early 1960s. Did the global institutions that govern trade actively foster this success in important ways, or essentially just let it happen? Does the global economy and its governing institutions hold out export-led pathways for LICs today?

8. **[Optional problem] Minimum wages and investment in a dual economy.** What role did labor market policies play in the East Asian miracle – and is it possible that high minimum wages, or other policy-driven sources of high labor costs in the modern sector, are important in explaining weak modern-sector growth in some other emerging markets, including South Africa?

   To investigate these questions, Figure 3 shows a 2-sector general-equilibrium diagram in which the supply price of labor comes from all "other" (i.e., non-manufacturing) activities and we focus on the demand for labor in the modern (manufacturing) sector. We assume throughout this problem that both goods are traded internationally, so their relative price is fixed (this means that the supply price of labor is not shifting around due to relative price changes). Elsewhere in the seminar we have focused on different specifications for the supply price schedule (e.g., in a labor-surplus model, or a neoclassical model), and you are free to draw that as you like.

   Suppose that the aggregate production function in the manufacturing sector is $Y = AK^{\alpha}L^{\beta}$ with $\alpha + \beta < 1$ (there is some third factor of production that is fixed in the background, leading to diminishing returns to capital and labor combined). The marginal products of capital and labor in the manufacturing sector are then given by $MPK = \alpha AK^{\alpha-1}L^{\beta} = \alpha \cdot (Y/K)$ and $MPL = \beta AK^{\alpha}L^{\beta-1} = \beta \cdot (Y/L)$, from which we can see that $MPK \cdot K = \alpha Y$ and $MPL \cdot L = \beta Y$.

   Let's first consider the demand for labor in the manufacturing sector as a function of the real product wage in manufacturing, $\omega$ (this is the ratio of the nominal wage to the price of manufactured goods). Assume that firms are competitive, which implies that they hire labor up to the point at which the real product wage equals the marginal product of labor. Suppose also that capital is perfectly mobile internationally, so that the domestic capital stock is determined *in the long run* by the condition that the marginal product of capital is equal to the global user cost of capital, which is the sum of the world real interest rate $r^*$ and the rate of depreciation.

   8.1. In the short run, the capital stock is fixed. Use the labor demand condition $MPL = \omega$ to derive the following short-run demand curve for labor:

$$L_{SR}^{D}(\omega) = \left(\frac{\beta A}{\omega}\right)^{1/1-\beta} K^{\alpha/1-\beta}.$$

8.2. Now combine the long-run condition $MPK = r^* + \delta$ with $MPL = \omega$ to derive the equation below, which governs the capital-to-labor ratio in manufacturing *in the long run*. Does this condition make economic sense?

$$\frac{K}{L} = \frac{\alpha}{\beta} \cdot \frac{\omega}{r^* + \delta}.$$

8.3. Use this LR equilibrium condition to plug in for the capital stock in your labor-demand curve, and then solve for $L$ to derive the LR demand curve for labor in the manufacturing sector. This shows the demand for labor after the capital stock has adjusted to equate the return to capital to the global user cost:

$$L_{LR}^{D}(\omega) = A^{1/\gamma} \left(\frac{\beta}{\omega}\right)^{1-\alpha/\gamma} \left[\frac{\alpha}{r^* + \delta}\right]^{\alpha/\gamma}.$$

8.4. The elasticity of demand for labor is defined as $\epsilon^D \equiv d \ln L^D / d \ln \omega$. Taking logs in the SR and LR demand-for-labor expressions, calculate the short-run elasticity $\epsilon^D(SR)$ – the one that prevails holding the capital stock fixed – and the long-run elasticity $\epsilon^D(LR)$ – the one that prevails after the capital stock has adjusted. Why is the long-run elasticity larger in absolute value than the short-run elasticity?

8.5. In the Figure below, point 1 is a LR equilibrium in the manufacturing sector with a minimum wage at $\bar{\omega}$. Why do the short- and long-run labor demand curves have the configuration shown in the diagram? [Hint use the elasticities but remember the axes are flipped.] What is the real wage in the rest of the economy? Is this equilibrium macroeconomically efficient?

8.6. Explain why the SR equilibrium shifts to point 2 if the government gets rid of the minimum wage. At point 2, has the wage bill in the manufacturing sector, $\omega \cdot L$, risen or fallen by comparison with point 1? [Hint: Use the fact that $MPL \cdot L = \beta \cdot Y$ at both points; then look at the production function and figure out whether $Y_2 > Y_1$ or not.]

8.7. At point 1, $MPK = r^* + \delta$. What is the relationship between the $MPK$ and the global user cost of capital at point 2? What happens to the capital stock over time? Explain why the new LR equilibrium is at point 3, with the economy evolving along the $L^S$ curve as the capital stock rises. What do we know about the wage bill in manufacturing at point 3 by comparison with point 2?

8.8. The path of manufacturing wages following elimination of the minimum wage is a fall, then a rise, with the new LR equilibrium wage below the original minimum wage. But your analysis also says $L_3 > L_2 > L_1$ and $\omega_3 L_3 > \omega_2 L_2 > \omega_1 L_1$: employment and the wage bill in the manufacturing sector both increase monotonically over time after the minimum wage is eliminated. What happens to the real wage in the rest of the economy as the manufacturing sector is going from point 1 to point 2 to point 3? What happens to the overall earnings of labor in the economy?

8.9. Suppose that the economy is in a long-run equilibrium at point 3 and the government decides to re-impose the original minimum wage. What happens in the short run? What is the new LR equilibrium, and how does the economy get there? Is this a good idea for labor?

**Figure 1** *Infant-industry protection with learning-by-doing internal to the firm*

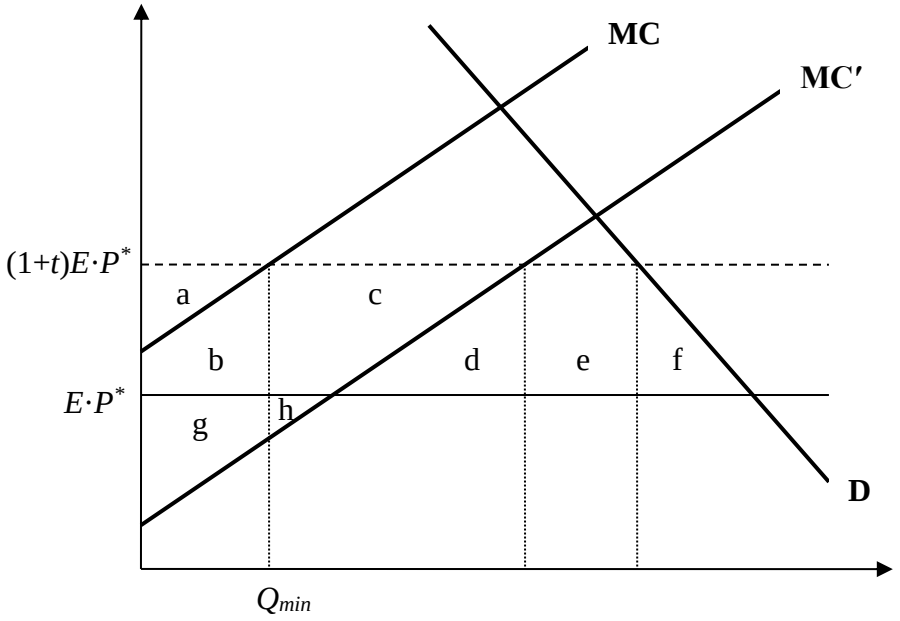


**Figure 2** Timing: [1] The government grants protection in period 0; [2] The firm then chooses in period 1 to invest or not to reduce its costs; [3] The government chooses whether or not to renew protection in period 2. *Fill in the two blanks, using Figure 1.*

The final 2 columns show non-discounted payoffs received in every period starting in period 2, based on Figure 1. The government's payoff is calculated as the sum of producer surplus and consumer surplus and tariff revenues, minus any political cost. Under discretion, the government's choice of whether to continue protecting or not in period 2 depends only on its payoffs starting in period 2. In the final column, *UT* refers to the 'upper triangle' of consumers' surplus above the tariff-inclusive world price.

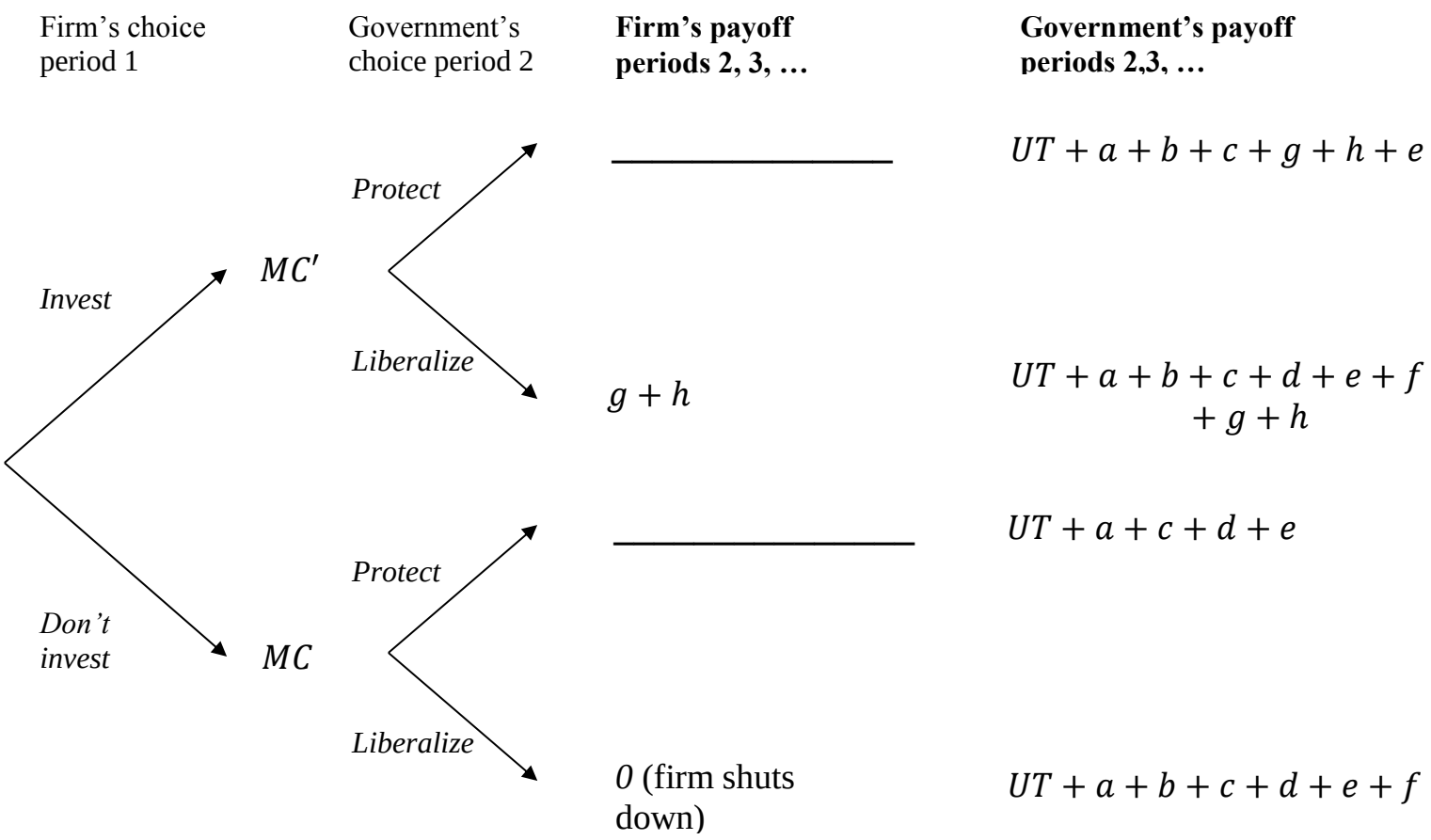
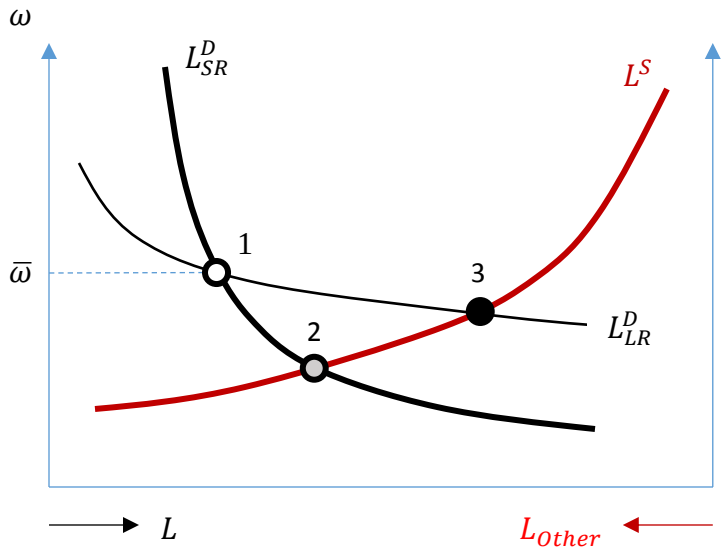


**Figure 3** *Short- and long-run equilibrium with a minimum wage in the modern sector*

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