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Krugman's Economics: An Introduction

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Next week, Paul Krugman will receive the 2008 Nobel Prize for Economics. His work on New Trade Theory and New Economic Geography, for which Krugman has been awarded the Nobel, is explained and discussed in this article.

This article will attempt to provide an accessible exposition and evaluation of the work of Paul Krugman, winner of the 2008 Nobel Prize in Economics.¹ I shall focus on his theoretical writings in the two fields explicitly recognised by the Prize citation, "his analysis of trade patterns and location of economic activity".² To economists, these are known as the "New Trade Theory" (NTT) and the "New Economic Geography" (NEG), respectively. In order to set the stage, I begin with a brief introduction to "old" trade theory (OTT), and to facilitate a clear exposition of both old and new theories, criticism is deferred to a later section. I shall also briefly discuss Krugman's popular writings.

Background: Old Trade Theory

For nearly two centuries, economists studying international trade have sought answers to two basic questions: what determines the pattern of trade between countries, and what effect does trade have on countries and different groups of the population within countries? They have approached the first question by looking for differences between countries, either in terms of their technologies (the Ricardian model), or the relative proportions in which they are endowed with factors of production such as land, labour and capital (the Heckscher-Ohlin-Samuelson, or HOS, model). These differences result in an inter-country divergence in the relative costs of goods whose production requires the use of different technologies or factor proportions. Each country would therefore be expected to export goods that are very different from those it imports. (I have repeatedly used the words "different" or "differences" in this paragraph to reinforce a point whose importance will become apparent below.)

As for the second question, trade was seen as mutually beneficial because it

allows countries to take advantage of their differences, importing goods more cheaply than they can produce at home, and exporting goods that they can produce relatively more efficiently. However, the resulting changes in a country's production structure require reallocation of factors between sectors. In the HOS model, because sectors use factors in different proportions, this alters the overall demand and supply of factors, which brings about changes in their prices (rents, wages, and profits). Changes in trade policy, therefore, cause changes in income distribution within countries; this "Stolper-Samuelson effect" accounts for the political sensitivity of free trade despite its benefits at the national level. But the outcome seems agreeable, even progressive, for labour-abundant developing countries. The HOS model shows that such countries would export labour-intensive goods, stimulating demand for labour and pulling up wages even as the reverse process occurs in capital-rich but labour-scarce developed countries.

Until around 1980, then, standard economic doctrine predicted that the bulk of world trade should take place between countries that were very different from each other, each exporting goods that were very different from those it imported ("North-South" trade), and trade would tend to equalise factor incomes between countries, with unambiguous benefits to workers in the South. But casual observation showed that the volume of trade was actually far greater between countries that were similar in their technologies and factor proportions (between the larger countries of western Europe, for example, or between Europe and the United States). Much of this trade involved goods produced with similar technologies and factor proportions (countries exporting and importing cars to each other, for example), a phenomenon known as intra-industry trade. Consequently, the abolition of trade barriers between countries (as in the creation of the European Common Market) did not result in the kind of wrenching shifts in income distribution that OTT predicted. On the other hand, relative income levels as between developed and

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most developing countries, far from converging, were clearly diverging. These anomalies had been noticeable for decades, and yet OTT held the field.

Apart from the predictions of OTT being increasingly remote from the real world, there was some dissatisfaction with two of its basic assumptions: all goods are produced under constant returns to scale, and perfect competition prevails in all sectors of the economy. As anyone who has studied even elementary economics quickly realises, unrealistic assumptions are par for the course, but these two foundational ones were becoming an embarrassment even for some economists.

New Trade Theory

Although other economists had proposed piecemeal theoretical modifications to deal with these uncomfortable discrepancies, Krugman (1979) provided a framework that, with subsequent extensions, accounted for all of them. Like OTT, he started by assuming two countries, but made them identical in technology, using labour as the only factor of production. Both the Ricardian and HOS models would predict that there was no basis for trade between two such countries. Krugman's innovation was to allow for increasing returns to scale (IRS) in the form of fixed costs unrelated to the volume of output. But this also required a departure from the assumption of perfect competition, because a bigger firm can spread its fixed costs over a larger volume of output, reducing its average costs, and thereby charge lower prices which will displace its competitors.

To make this idea precise, Krugman employed a modern reformulation by Dixit and Stiglitz (1977) of the old idea of monopolistic competition. In this framework, each firm employs the same technology to produce a differentiated product. Consumers with identical Dixit-Stiglitz utility functions regard the variety produced by each firm as an imperfect substitute for all others, consuming some of each and becoming better off by spreading their incomes over more varieties as they become available. Firms can freely enter the market, each producing a new variety. Thus, despite each firm being a monopolist for its own variety, free entry ensures that prices fall to the level of average costs, as with perfect

competition. However, given a country's endowment of labour, fixed costs required for the production of each variety imply that it can produce only some of the large number of possible varieties.

Allowing trade between two such hypothetical countries would allow each to specialise in producing a smaller range of varieties, with the labour released from those no longer produced becoming available for each surviving variety to be produced on a larger scale and therefore at a lower cost per unit. Because of IRS, each variety continues to be produced by one firm, which now serves consumers in both countries. So each country exports some varieties and imports others: intra-industry trade.³ With homogeneous labour as the only factor of production, trade-induced restructuring of the manufacturing sectors of both countries involves no changes in income distribution. But all workers are better off with trade, first because they can now buy all the varieties produced by both countries, and second because even those that they were consuming earlier are now available at lower prices thanks to IRS.

Krugman (1980) presented a simpler version of this model, in which trade leaves the scale of output of each firm unchanged, so the entire benefit accrues through greater variety. He also extended the model to allow for international transport costs, with two important consequences. First, we have already seen that IRS results in each variety being produced by only one firm which supplies both countries, but now firms also have an incentive to locate themselves in the larger market in order to minimise transport costs. This "home market effect" means that a country will produce and export varieties for which it has greater demand. This result is quite contrary to the HOS model, where domestic demand reduces a country's exports and possibly turns it into an importer of that good. The second consequence of allowing transport costs is that the price of each variety is now systematically higher in the export market than the home market, so workers have higher real wages in the bigger country because it produces a larger number of varieties.

In another influential model by Brander and Krugman (1983), the market for a

homogeneous good in each of two identical countries is initially served by local monopolists with identical costs. Opening of trade creates duopolistic competition in each market, with firms facing higher demand elasticity in their export markets because of transport costs. This results in "reciprocal dumping", with firms exporting at a lower price than what they charge in their home markets, and intra-industry trade in *identical* products between identical countries. The enhancement of competition in each country can make both better off, despite the waste involved in hauling the same good in both directions.

The culmination of Krugman's NTT research was Helpman and Krugman (1985), which developed the models outlined above more systematically, with extensions and alternative approaches to IRS based on the older idea of Marshallian economies "external to the firm but internal to the industry". A significant advance was the integration of old and new trade theory, with the monopolistically-competitive industrial sector described above now assumed to coexist with an agricultural sector producing a homogeneous good under constant returns to scale. The sectors use capital and labour in different proportions, reintroducing the comparative advantage and income distribution issues of the HOS model. The new model showed that trade between countries with similar but not identical capital/labour endowment ratios would involve export of manufactures by the relatively capital-abundant nation and of the agricultural product by the more labour-abundant one, as in HOS. But unlike HOS, the latter would also export some manufactured varieties. Only for very divergent factor endowments would such intra-industry trade cease altogether. Finally, as long as factor endowments are not too diverse, and in the absence of transport costs, everyone benefits from trade as access to increased variety outweighs any adverse Stolper-Samuelson effect on factor prices. This remains true even if a country's industrial sector shrinks in the face of foreign competition, as imports provide domestic residents with all the varieties they no longer produce, plus those they did not produce in autarky. All the anomalies of

OTT, except the issue of international divergence, were thus resolved.

While remedying the perceived deficiencies of OTT in predicting the pattern and consequences of trade, these models shared its generally benign view of free trade in most circumstances. A rather different message seemed to be emerging from a different strand of NTT, which Krugman helped to popularise: the theory of strategic trade policy (Helpman and Krugman 1989). This involved models of international oligopoly rather than monopolistic competition, and individual industries (partial equilibrium) rather than entire economies (general equilibrium). In this framework, firms can earn oligopoly profits (unlike monopolistic competition, in which profits are competed away by free entry) and a government can use import tariffs and export subsidies to tilt the competitive struggle between home and foreign firms in favour of the former, so that a larger share of profits accrues to home nationals. If, in addition, technology is characterised by IRS, then protection enables the home firm to expand output in the home market and thereby reduce costs, while the foreign firm's exports shrink and its costs rise, giving the home firm a competitive advantage in the foreign market as well. Protection from imports can thus promote exports, contrary to a standard result in OTT (Krugman 1984). These ideas were seized upon by opponents of free trade to justify protection of "national champions". In a dramatic disavowal, Krugman (1987a) pointed out that the prescriptions of the strategic trade policy models were very sensitive to the underlying assumptions, requiring governments to have detailed knowledge of industry conditions, which would be manipulated by firms in order to get a better deal for themselves. Estimated gains from getting the trade policy right were small, and the costs of getting it wrong were large. Free trade, therefore, remained a good rule of thumb to follow.

New Economic Geography

NEG was a natural outgrowth of NTT, and Krugman later wondered why it had taken him a decade to develop it. The NTT models had, like OTT, taken countries' labour endowments as given. But NTT

had also recognised in passing that higher wages would attract migrants, and shown that in the presence of transport costs, larger countries have higher wages, and more firms want to be located there due to the home market effect. These forces set up a process with far-reaching consequences, which was analysed in Krugman (1991).

Faithful to trade theorists' convention that factors can move more easily between sectors and regions of a country than between countries, Krugman modelled two regions, identical in technology, tastes, and labour endowments, with constant returns in agriculture and IRS and monopolistic competition in industry. He assumed that inter-regional trade in manufactured goods involves transport costs, and that industrial workers, but not farmers, can move from one region to another. He then considered the effects of migration of some industrial workers from one region (call it the South) to the other (the North). First, the relocation of their expenditure expands the Northern market and contracts the Southern market, inducing firms to move northwards. This is the home market effect, also referred to as a backward linkage. Second, recalling that each firm produces a different variety, more Southern workers can now save on the transport cost of a wider range of goods by migrating north. This is the "cost of living effect", or forward linkage. These two effects clearly reinforce each other: more firms in the North attract more workers, and more workers in the North attract more firms. But more firms in the North also increase local competition, which (together with the demand of the immobile Southern farmers) acts as a dispersion force, discouraging regional concentration (agglomeration) of industry. All three effects occur in reverse in the South.

The results of the model hinge on mathematically comparing the strengths of these forces. At high levels of transport costs the dispersion force is stronger, maintaining a symmetric distribution of manufacturing activity in both regions as the only locally stable equilibrium, with workers having no incentive to migrate. At lower transport costs, outcomes with all industry in either the North or the South

also become stable equilibria, coexisting with the symmetric one. At still lower transport costs, agglomeration forces win out, so the symmetric equilibrium becomes unstable. Then the smallest migration triggers a process of cumulative causation, which ends only when all manufacturing activity shifts to one region, say the North. Real wages end up higher there, partly because firms in the larger market pay higher wages, and partly because workers do not have to pay transport costs on the manufactured goods they consume. The immobile farmers left behind in the deindustrialised South are worse off because they do not benefit from higher labour demand and also pay higher prices for manufactured goods which are now entirely imported. However, agglomeration could equally well occur in the South, since the two regions were identical to begin with; which one ends up with the entire manufacturing sector depends on which way the workers moved initially. By extension, agglomeration takes place in a region which has a slightly larger industrial sector to begin with.

This became known as the core-periphery model, which describes the process of regional polarisation within a country with inter-regionally mobile labour. International polarisation was analysed in an extension by Krugman and Venables (1995) which has similar outcomes but a different agglomeration mechanism. They treated labour as immobile between countries, but mobile between agriculture and manufacturing within countries. The new assumption (also taken from an extension of NTT) was that manufactured varieties are also used as intermediate inputs in their own production, with productivity increasing in the number of varieties. (This is the production function analogue of the Dixit-Stiglitz utility function.) Firms now have an incentive to relocate to the larger country, because it can support production of a wider range of intermediate goods. This further increases the supply and demand for intermediates in that country, attracting more firms and setting up another process of cumulative causation. Once again, at a crucial level of transport costs, a symmetric diversified equilibrium becomes unstable, and the slightest perturbation

induces industry to relocate entirely, say to the North, deindustrialising the South and resulting in a wage gap for reasons similar to the earlier model. Thus the remaining anomaly of OTT is resolved: trade can lead to income divergence, even between countries that start out identical in all respects.

The story, however, has a happy ending in this model. Further reduction of transport costs allows firms to retain access to the North's bigger market and wider range of intermediate goods even if they relocate to the South to take advantage of its lower wages. This enables the South partially to reindustrialise and its wages to rise. Referring to the decline in transport costs over the centuries, and the observed pattern of international divergence followed by industrialisation and wage increases in at least some developing countries, Krugman and Venables described their model as providing a "History of the World, Part I". If transport costs fall to zero, we get international factor price equalisation as in OTT and NTT, because consumers everywhere can buy manufactures at the same price, regardless of where they are produced.

In later extensions, Krugman and various co-authors extended the framework to more than two regions, and to determinants of agglomeration within and between countries simultaneously. His work converged with Masahisa Fujita's research on the size and location of cities, resulting in Fujita et al (1999). Other authors have subsequently tried out different assumptions on demand, transport costs, and factor mobility, with similar results, and have integrated NEG with models of endogenous growth (Baldwin et al 2003). In the last decade, many of the predictions of NEG have been empirically tested; for an innovative application to India, see Chakravorty and Lall (2007).

Critical Assessment

Many readers might still be wondering why Krugman's work deserved a Nobel Prize. Those familiar with traditional development economics would have noticed, in the course of my description of NEG, ideas and terminology that seem familiar from the work of authors of the 1950s such as Rosenstein-Rodan, Fleming, Myrdal,

Hirschman and Scitovsky. Krugman (1995a) actually discussed their work in detail, and acknowledged that they had the right insights,⁴ but could not present their ideas in formal economic models – not because they were technically incompetent, but because techniques for handling IRS in a general equilibrium setting were not developed until the 1980s. His models do represent a considerable technical feat, which my ruthless over-simplification has concealed. It is not a trivial exercise to derive these seemingly obvious results from optimising behaviour by firms and consumers, given endowments, tastes and technology, with all markets clearing and consistency between incomes generated and spent. In mainstream economic theory,⁵ this does represent a major achievement, especially because it contradicts so many long-established propositions.

And yet, like adolescent siblings rebelling against their parents while unable to escape their genetic inheritance, NTT and NEG are constrained by the methodology of OTT. Static equilibrium theory has many uses, but surely the structural transformation of an economy from having its labour force equally distributed between agriculture and industry to being entirely industrial cannot be represented as a transition from one equilibrium to another, without any change in endowments, tastes or technology. To call this a "History of the World" is sheer hyperbole. It also involves a further absurdity: if multiple stable equilibria exist at a given level of transport costs, as in most NEG models, then industrial agglomerations can be moved back and forth between regions by escalating government subsidies, for example. Missing entirely from this framework are sunk costs, capital accumulation, learning by doing and local knowledge spillovers which make the consequences of locational changes hard to reverse.⁶

The static perspective also makes both NTT and NEG inherit OTT's predisposition towards free trade, reinforced by the assumption of Dixit-Stiglitz preferences, according to which all consumers, regardless of income level, consume all manufactured varieties and benefit from more and cheaper varieties. Unemployment is of course ruled out by the OTT assumption that factor markets always clear. In one

respect, NEG did seem to endorse protection, but other authors were quick to debunk this interpretation. Tariffs, like transport costs, create a home market effect which can become a cumulative process, rapidly leading to import substituting industrialisation (ISI). However, tariffs also raise the price of varieties that continue to be imported. Trade liberalisation avoids this distortion and, by allowing for cheaper intermediate inputs, enables a different kind of ISI which yields a higher level of economic welfare as conventionally measured (Puga and Venables 1999; Baldwin et al 2003, ch 12). This is an entirely static argument, with ISI of both kinds being achieved by capturing industries from the other country rather than inducing investment and technological change. It is true that cases of successful ISI have been rare in recent years, but a model that claims historical applicability cannot ignore the fact that it was the basis of industrialisation in almost all developed countries and a few developing ones (Chang 2002).

Krugman himself refrained from deriving policy implications from NEG, fearing that like the theory of strategic trade policy, it might be misused by protectionist interests. He remains a committed free trader on the basis of OTT-style arguments,⁷ but adds his own ahistorical twist with his repeated claims that NEG shows how initially identical economies give rise to a core-periphery structure via "spontaneous self-organisation"; which country becomes the core and which the periphery is determined by historical accident. Erased from this picture is the fact that some countries industrialised by protecting their own markets while imposing free trade on others through colonial rule or unequal treaties.

It is not that Krugman is innocent of history, capital accumulation, or irreversible economic changes. In an early North-South model (Krugman 1981), he assumed that due to Marshallian externalities, productivity in each manufacturing firm is positively related to a country's overall stock of industrial capital, which can be enhanced by saving and investment out of profits. This engenders a process of cumulative causation in which a country that starts out with a slightly larger capital stock emerges as the core while the other

is deindustrialised. Krugman cited colonial India as an example, and ascribed the initial conditions that give one country a head start to "primitive accumulation", the slave trade or the Protestant ethic. Repeatedly citing Lenin's *Imperialism*, and using his terminology, Krugman's model showed that after accumulation exhausts its reserve army of labour, the North would witness a fall in its profit rate, emergence of a labour aristocracy, and export of capital to the South. In another interesting paper (Krugman 1987b), he allowed for irreversible dynamic increasing returns in the form of accumulated experience, and showed how temporary influences on the level of industrial output (protection, currency appreciation, or contractionary monetary policy) can permanently change the pattern of comparative advantage. Despite their thematic affinity, neither of these two papers was cited in Krugman's later writings on NEG.

Whatever one's reservations, there is no doubt that Krugman's academic papers are exemplary in their brevity, ability to derive far-reaching conclusions from minimal assumptions, illuminating diagrams, and exceptionally clear verbal explanations. His felicitous prose style has been put to use in far more widely read publications: several popular books on contemporary economic problems, undergraduate textbooks (an established one on international economics, and a newer one on the principles of economics), and his syndicated newspaper column.⁸ Long before the current crisis, he had been warning Americans about their growing indebtedness, effectively financed by China, and the unsustainable bubbles in their housing and stock markets. For many years, he has excoriated the Bush administration for glorifying the private sector and undermining the role of government, resulting in a level of inequality last seen in the 1920s. It was therefore a surprise earlier this year to read this unapologetic liberal's repeated attacks on Barack Obama during the Democratic primary campaign. Like his favourite Hillary Clinton, Krugman ridiculed Obama's rhetoric about hope and change, but like Clinton he ultimately supported her rival. He sees the recent election results as a clear mandate for government intervention and a major Keynesian

fiscal stimulus, particularly in the areas of education, healthcare, and unemployment benefits. His continuing advocacy of free trade, however, will pit him against the tide of public opinion as the United States enters its worst economic crisis since the 1930s.⁹

NOTES

- 1 Strictly speaking, the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel.
- 2 See http://nobelprize.org/nobel_prizes/economics/laureates/2008/, which also provides a much briefer and simpler introduction to Krugman's contribution to these two areas of economics. His work on exchange rate instability and currency crises was unaccountably ignored in the citation; Dixit (1993) provides a nice introduction to that and other contributions which I have not covered here.
- 3 There is, however, an unavoidable element of indeterminacy in this model: although it can predict the number of varieties that each country will produce in a free-trade equilibrium, given their labour endowments, it cannot predict which varieties will be produced where.
- 4 He should have included Nicholas Kaldor, whose work was much closer to NEG in many respects.
- 5 While this methodology would usually be referred to as "neoclassical", many contributors to NTT and NEG use that term to describe OTT models with constant returns and perfect competition. Hence my use of the word "mainstream".
- 6 Some of the more recent models which marry NEG to endogenous growth do allow for knowledge creation and spillovers.
- 7 In a rare comment on India a decade ago, he recommended further liberalisation, deregulation, and privatisation, but maintaining restrictions on capital inflows and currency convertibility. He also recommended forcing weak banks to close down – a statement that is ironic in view of recent developments in the United States. See <http://www.pkarchive.org/crises/interv.html>. (Although no date is given, the events referred to in this interview with the *Business Standard* suggest that it took place soon after the 1997 Asian crisis.)
- 8 See <http://krugmanonline.com> for a list of Krugman's popular books, biographical information, links to his blog, his *New York Times* column (also carried by some Indian newspapers), and to another web site which archives his older columns and other writings.
- 9 Apart from his contributions to economic theory, Krugman has done substantive empirical research on issues of policy significance. Of especial relevance for developing countries is his work on the impact of trade on wages in the United States, which earlier showed (Krugman 1995b) that imports from low-wage developing countries were too small to explain growing wage inequality. Like several other scholars, he blamed the stagnation of low-skilled workers' wages on biased technological change. Recently, however, he has shown that if imports are broken down into their skilled and unskilled labour components, imports from low-wage producers have actually grown quite rapidly and are hurting the majority of American workers (Krugman 2008). To his credit, he still opposes protectionism and calls instead for better social insurance and education.

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