

UNEMPLOYMENT AND TRADE LIBERALISATION

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Abstract

In contrast to the focus of the public debate over trade liberalisation on job losses there is a widespread view among economists that employment and trade issues should be considered separately. Such a view is found in recent Productivity Commission reports and simulation exercises. This view cannot be justified theoretically as standard general equilibrium trade models with wage floors generate unemployment, complicating the effects of trade liberalisation on employment, income distribution and national welfare. Given persistent unemployment, freer trade can lead to either gains or losses depending on the production technology, severity of the factor market distortion, factor intensities of the industries, and conditions in trading partners. Opening up trade with countries with lower wage floors is more likely to lead to losses. Tariffs on goods which use the labour subject to the wage floor can be welfare improving, although they are not the optimal policy, which would be removing the labour market distortion. Trade liberalisation would be better advanced by including endogenous employment in trade policy simulation exercises and by discussing employment effects rather than brushing them aside as temporary adjustment problems or regional difficulties.

1. Introduction

Pick up any newspaper or magazine, and if trade liberalisation is discussed the main issue will inevitably be jobs losses. Employment issues dominate the public debate over trade policy. By contrast, there is a widespread view among economists that unemployment and trade policy should be debated separately.

This view is expressed forcefully by Paul Krugman in a paper presented at the American Economic Association entitled "What Undergraduates Should Know about Trade". Krugman (1993 p25) writes "The level of employment is a macroeconomic issue, depending in the short run on aggregate demand and depending in the long run on the natural rate of unemployment, with microeconomic policies like tariffs having little net effect. Trade policy should be debated in terms of its impact on efficiency, not in terms of phony numbers about jobs created or lost". Similar comments have been made by other prominent economists.

In Australia one of the few discussions of the links between trade policy and jobs is Corden (1977), which was stimulated by a dinner party debate about the issue. The question he considers is the economic mechanism to replace jobs lost as a result of tariff cuts, and argues that the additional jobs will come from wherever the additional income is spent, either in the hands of domestic or overseas consumers. However, the verbal model seems to be one where aggregate employment depends solely on demand management and exchange rate policy, with no pathway for resource reallocation effects of a tariff to influence employment.

Turning to the recent Australian policy debates, the view that trade policy and employment are separate issues runs through the recent Productivity Commission reports and associated modeling exercises. In the Automobile Industry Report (Industry Commission 1997a) the Commission stresses that "models need to capture the essential elements of the issue under consideration while abstracting from issues of secondary importance (appendix O p24)" but the impact of trade on employment is in the second category. The treatment of employment is similar in many of the Commission's recent reports and worth quoting in full "In its analysis of the effects of reducing the automobile tariff the Commission believes that in the long run, the aggregate supply of labour is determined by factors unaffected by tariff policy changes. This assumption ... is consistent with the macroeconomic concept of the non-accelerating-inflation rate of unemployment (NAIRU)" (appendix O p19). They add "Imposing a NAIRU results in wages becoming more flexible over time as agents become

accustomed to the disturbance. Initially when the response of real wages is assumed to be sluggish, disturbances in the labour market are accommodated mainly by adjustments in aggregate employment. Concomitant with the gradual increase in flexibility of real wages is a gradual erosion of the initial employment gains or losses. Eventually the adjustment in real wages will be sufficient to eliminate all employment gains or losses" (appendix O p19). In contrast with the usual careful specification of mechanisms in the models the Commission uses there is no discussion of the mechanisms by which the job gains or losses from tariff changes adjust to zero in the long run. A great deal of faith is being placed in the existence of an invariant long run NAIRU¹.

The other recent report of the Commission (1997b) on tariffs levels for the Textile, Clothing and Footwear(TCF) industries treats employment in a similar way. Although it is not the focus of the present paper, there is an excellent extended discussion of prospects and assistance for displaced workers. A new labour market disruption index prepared in conjunction with the main modeling done for the report (see Dixon and Rimmer 1998) is also an important contribution to the debate over these adjustment issues. However, because the main modeling is always done with a fixed NAIRU, employment effects of trade policy changes can only be transitory.

¹ The possibility of the real wage being fixed is mentioned in the report (see appendix P p6-7) but discarded because the magnitudes of the gains from trade liberalisation with a fixed real wage in simulations conducted for the earlier draft report were too large to be reasonable to the Commission. This approach of fixing the real wage is not the only way of introducing employment effects. It is more plausible that the wage of the low paid unskilled workers is fixed at a floor level while the wages of higher paid skilled can vary, and this will be the approach adopted in the present paper.

The basic problem with the view of Krugman, the Productivity Commission and others is that the long run rate or natural rate or NAIRU is not constant but varies depending on many things, including trade policy². Models of linkages between trade and the long run unemployment may be found in the general equilibrium trade literature - for instance Haberler (1950), Brecher (1974a,1974b), Neary (1985) and Kemp Long and Shimomura (1991). A new but similar model will be developed in the present paper. Standard trade theory and policy texts do not discuss these models apart from remarks about temporary adjustment problems. e.g. Kemp (1969), Woodland (1982), Vousden (1990), Corden (1997), Krugman and Obstfeld (1997), Ethier (1995) or Markusen Melvin Kaempfer and Maskus (1995). To my knowledge there have been no attempts to link these general equilibrium models of trade and unemployment to the Australian policy issues.

To summarise, this paper argues that the separation of trade and employment issues cannot be justified theoretically and is detrimental to the credibility of the case for trade liberalisation. The next section of the paper reviews the argument for free trade in the benchmark case of a competitive fully employed small open economy. Following this, a model of a similar economy with unemployment due to a wage floor will be developed. Trade liberalisation may lead to either gains or losses depending on the production technology, severity of the factor market distortion, factor intensities of the industries, and conditions in the country's trading partners. The present paper goes further than the existing literature by considering two particular instances of policy interest where we can say more. Firstly, it is shown that losses from opening up trade are only possible if the trading partner has a lower minimum wage, and secondly that cutting tariffs on industries which use minimum wage factors relatively intensively is likely to lead to losses. In the final section of the paper further implications for the Australian trade liberalisation debates are considered. It will be argued that the cause of trade liberalisation would be better advanced by endogenising long run employment in policy simulation exercises and discussing the employment effects rather than brushing them aside as temporary adjustment problems or regional difficulties.

² Recall Friedman's (1968) original words "The natural rate of unemployment is the level which would be ground out by the Walrasian system of general equilibrium equations, provided there is embedded within them the actual structure of labour and commodity markets, including market imperfections". General equilibrium trade models are examples of these Walrasian models, and some include market imperfections of the type Friedman discusses.

2. The Benchmark Model With Full Employment

To introduce the model and notation, the argument for free trade for the benchmark case of with full employment will be reviewed³. In order to focus on the employment issue the underlying model will be kept as simple as possible. The assumptions will be those of the standard neoclassical trade model:

- Profit maximising firms operating in competitive markets, earning zero profits.
- Given factor endowments, with ownership evenly distributed across individuals.
- Given technology represented by production functions which are nondecreasing, concave and constant returns to scale.
- Utility maximising individuals with given utility functions which are nondecreasing, concave, homothetic and identical for all individuals.
- No uncertainty, externalities, adjustment costs or distortions in production consumption or trade, apart from the wage floors which will be specified.
- Free trade in goods, no trade in factors of production.
- Small open economy taking goods prices as given.

The production side of the full employment economy can be represented by the concave production possibility frontier shown in figure 1. There are two goods but the number of factors of production will be left open for the moment. With given world goods prices P^f (expressed as a ratio of the price of good 1 to the price of good 2) the economy produces at Y^f and consumes at Z^f . Throughout the paper upper case variables will be used for the full employment economy, and lower case for the economy with unemployment.

Under the assumption that endowments are evenly distributed across individuals and preferences are identical homothetic, the indifference curves shown in figure 1 represent utility of the representative individual in the economy. This will be the welfare measure used in the paper⁴. For comparison, autarky goods prices P^a and autarky production and consumption points Y^a and Z^a are shown. Opening up trade reduces the relative price of good 1, shrinks industry 1 and expands industry 2. The free trade consumption point Z^f will always be on a higher indifference curve, and thus dominate the autarky consumption point. An autarkic economy thus gains from moving to free trade. These gains

³ A more formal and detailed account can be found in texts such as Dixit and Norman (1980) or Woodland (1982).

⁴ The standard proofs of the gains from trade use the Pareto criteria plus an assumption that some form of lump sum transfers between individuals are possible. The alternative approach focusing on utilities of individuals is used in this paper because lump sum transfers do not seem realistic.

come from production, as resources move into industries in which they are more productive, and from consumption as opportunities expand under free trade.

This simple standard model ignores any costs of moving resources between industries, and any adjustment costs may offset, at least in the short term, the other gains from trade. This point is well recognised in the literature and addressed in the context of the Australian policy debate by Dixon and Rimmer (1998). Another important point to bear in mind is that it has only been shown that there are gains for the representative individual. Goods prices and factor prices change as a result of the opening up of trade, and if endowments are not evenly distributed across individuals, then individuals who own a proportionately more of the factors whose price rises will gain more than would a representative individual, and other individuals may lose from the opening up of trade. This is well understood and there have been some attempts through labour market and regional assistance to deal with it in Australia. Both these points - about adjustment costs and income distribution - are important and apply equally to trade with unemployment, which will now be considered.

3. A Model with Unemployment

Unemployment in the model will come from a binding wage floor which applies in all industries⁵, but which only binds for the type of labour with the lowest marginal product (e.g unskilled labour).

The floor could represent:

- A legislated minimum wage or minimum award wage.
- Unemployment or other government benefits, assumed for simplicity to be financed through lump sum taxes.
- An underlying efficiency wage, implicit contract, union bargaining or other effect which is not clearly enough understood to be modeled explicitly. Some models with an endogenous wage floor exist in the literature, but rely on very specific forms of the efficiency wage or union bargaining effect. For instance the best developed trade model with union bargained wages (Kemp Long and Shimomura 1991) relies on the contentious monopoly union bargaining structure. Until there is

⁵ It is not necessary to claim that all unemployment is due to wage floors. For instance, some may be due to effective demand failures linked to money and uncertainty as suggested by Keynes, but these other sources of unemployment will be treated as exogenous as we focus on the part of unemployment due to wage floors.

more consensus about the specifics of the efficiency wage and union bargaining mechanisms that explain the above market clearing wage, it seems wiser for policy analysis not to try to endogenise the level of the floor..

Any of these interpretations of the wage floor is consistent with the results of this paper.

There are various ways of specifying the wage floor. In the literature it is sometimes a real floor, defined in relation to the price of another factor, or price of a particular good or some index of prices (see Brecher 1974a,1974b and references therein). The choice of the price or index is somewhat arbitrary and results in the literature depend on which definition is used. Another problem with using a real floor it that it is difficult to point to mechanisms in the present Australian economy that fully adjust the minimum wage to maintain its real value defined in any of these ways. To avoid these problems the wage floor in this paper will not be assumed to adjust to maintain its real value as other wages and prices change.

Now consider the number of factors of production. It is possible to work in a very general setting with arbitrary numbers of goods and factors (as in Neary 1985) but few results are obtainable. The best known neoclassical trade model of unemployment (Brecher 1974a,1974b) introduced a minimum wage into a model with two goods and two factors of production. Under these conditions the industry which uses the factor subject to the minimum wage relatively intensively ceases production, leaving the economy completely specialised in the production of the other good. The reason is that the minimum wage increases costs, but increases them unevenly across different industries. The price of the flexible factor will fall to the extent that the industry which uses the minimum wage factor least intensively makes just zero profits, but at this price of the flexible factor the industry which uses the minimum wage factor intensively will make less than zero profits and thus close down.

To avoid this complete specialisation outcome the minimum wage will be introduced into a model with two goods and three factors. This model has been neglected in the literature⁶. As with the full employment version in Jones (1971), it will be assumed that industry 1 uses factor 1 which is specific to it plus mobile factor 3, while industry 2 uses factor 2 which is specific to it plus the mobile factor 3⁷. The minimum wage will apply to factor 2. The specialisation outcome is avoided because while

⁶ A formal analysis of the model with unemployment is carried out in Oslington (1998). Other discussions of similar models in the literature are Kemp Long and Shimomura (1991) who develop a specific factors model as part of laying the groundwork for their union bargaining model, and an unpublished working paper version of Neary (1985). Neither model derives the results of the present paper.

⁷ Nothing hinges on the specific factors restriction. Any three factor model will have a specific factors like structure.

the minimum wage on factor 2 must drive down the price of factor 3 to maintain zero profits in industry 2, the price of factor 1 can adjust to maintain zero profits in industry 1. The important feature for avoiding specialisation is that there are now more factors of production than goods, or equal numbers of factors and goods if the factor with the floor is not counted.

To make it a little more concrete, think of industry 1 as something like software development which uses industry specific technical labour and generalist managerial labour, and industry 2 as something like clothing manufacture which uses the same managerial labour and unskilled labour for which the minimum wage binds⁸.

Ruffin (1981) shows that there will always be a middle factor that corresponds to the mobile factor, and two extreme factors that correspond to the specific factors.

⁸ None of the factors is interpreted as capital because a given endowment of capital does not make sense in a world of capital mobility. Capital is viewed as available at given price to all domestic industries, and can be ignored for our purposes. This follows the treatment of capital in the Heckscher-Ohlin model by Wood (1994), and a number of other recent applications.

Now consider what happens to resource allocation, employment and welfare with the minimum wage. In figure 2 the unemployment brought by the minimum wage means that the economy does not produce on its production possibility frontier ab , and instead produces inside it along the locus ac . The point marked $Y^a=Z^a=Y^f=Z^f$ is the full employment autarky production and consumption point, and will also be the free trade production and consumption point. The assumption that it is also the free trade point is made to give a basis of comparison for the unemployment equilibrium, and amounts to assuming that the rest of the world is identical apart from any wage floor which might exist. All other sources of comparative advantage and trade gains are being neutralised so as to focus on the effect of the wage floor. Now introduce the minimum wage on factor 2. This causes unemployment of factor 2, output of good 2 falls and output of good 1 rises, so that the production equilibrium is a point like y^f in figure 2. Goods prices remain unchanged at p^f . The distortionary effect of the minimum wage means the slope of the production locus will not be equal to world prices at the production equilibrium. Since goods prices are p^f at $Y^a=Z^a=Y^f=Z^f$ and at y^f , and since preferences are identical and homothetic, the ratio in which the goods are consumed must be the same, so the consumption point with unemployment will be z^f on the ray Od .

Thus, with a minimum wage on factor 2, the country exports good 1 and imports good 2, i.e. the good which uses its minimum wage factor relatively intensively. Recall there was no trade under full employment. This gives;

Proposition 1: A minimum wage affects the pattern of trade, giving the country a comparative disadvantage in the good which uses its minimum wage factor relatively intensively.

So far we have considered the effect of the minimum wage on an initially fully employed trading economy. The comparison of interest for trade liberalisation though, is between autarky with unemployment and free trade with unemployment. To carry out the comparison the autarky point with unemployment needs to be identified. Now we have seen that imposing the minimum wage on good 2 with given goods prices reduces output of good 2 and increases output of good 1. If goods prices are allowed to change, as in the autarkic economy, the relative price of good 1 will be forced down. Thus the autarky production point y^a must be to the left of y^f along the production locus ac . At a lower relative price of good 1 consumers will want relatively more of it, so the autarky consumption point z^a must be on the locus ac to the right of the ray Od . An example of a point which satisfies these requirements is marked $y^a=z^a$ in figure 2.

Exactly where the autarky consumption point z^a is in relation to the free trade consumption point z^f

depends on the particular configuration of technology, endowments, preferences and the minimum wage. Figures 3 and 4 illustrate the possibilities. The autarky point could be on a higher indifference curve, as in figure 3, in which case the representative individual would lose from trade liberalisation. However, the autarky point could also be on a lower indifference curve, as in figure 4, so that the representative individual gains.

The possibility of losses when moving from autarky to free trade illustrated in figure 3 gives;

Proposition 2: Trade liberalisation may not be gainful when there is a minimum wage.

Under full employment trade liberalisation is always pushing resources out of low productivity industries into more productive ones – but when there is unemployment it may push resources out of employment, so that they have zero productivity.

The way figures 2,3 and 4 have been drawn employment will always fall when trade is opened up.

This flows from the earlier assumption that the only source of comparative advantage was the minimum wage, and any trade caused by a minimum wage will always be associated with lower employment in the country which imposes it. In cases like figure 4 the employment fall was insufficient to outweigh usual gains, but in figure 3 the employment losses dominated. It is important to recognise that in a model where there are endowments and technology differences as well as different minimum wages, the employment effects can work in either direction.

Proposition 3: Employment effects, while they preclude us saying there are always gains from trade under conditions of unemployment, may enhance the gains from trade rather than reverse them.

There is a further distributional issue to consider when assessing trade liberalisation with unemployment. When discussing the benchmark full employment case it was noted that if endowments are not evenly spread across individuals, some individuals gain and some lose as a result of trade liberalisation. The further distributional issue arises when there is unemployment even if endowments are evenly distributed, because unemployment typically is not evenly spread across owners of labour. Ten percent unemployment does not usually mean that all labour owners are ten percent unemployed but that ten per cent of individuals have their endowment unemployed. Employment comes in job sized lumps. If unemployment is unevenly spread across owners of labour then in a case like that shown in figure 4 we have;

Proposition 4: Trade liberalisation that increases unemployment, despite increasing the income of the representative individual, will hurt some individuals.

4. Trade with Low Wage Countries

In the theoretical literature results like propositions 1 and 2 have been derived before, but there is no guidance about particular circumstances when gains and losses will arise. One of the important questions in the Australian policy debate is whether losses are likely when trade with low wage countries is opened up.

Let us consider the effects of opening up trade with different types of countries. In the case illustrated in figure 2, the relative world price of good 1 was greater than relative autarky price of good 1, employment contracted when trade was opened and overall losses were possible if the employment losses outweighed the usual gains. If we had the reverse case to figure 2 and the relative world price of good 1 was less than relative autarky price of good 1, employment would expand and losses from trade would have been impossible regardless of the magnitudes of the various effects.

If losses are only possible when the world price of good 1 is greater than the autarky price of good 1, what does this imply about the structure of the rest of the world? If there are two countries in the world and they are identical apart from the levels of their wage floors, then the foreign country must then have a lower minimum wage. The reasoning is as follows. We know from the previous discussion that imposing or increasing a minimum wage on factor 2 will increase the relative price of good 2, or reduce the relative price of good 1. This implies that a country with a lower minimum wage on good 2 will have a higher relative autarky price of good 1. Since we are a small open economy, world prices are the other country's autarky prices and the result follows:

Proposition 5: Losses from trade are not possible when trade is opened up with an otherwise identical country with a higher minimum wage. Losses are only possible when trade opened up with an otherwise identical economy with a lower minimum wage.

This lends some support to the popular suspicion of opening up trade with low wage countries, but note that it does not say there will inevitably be losses, just that this is the only situation in which losses are possible. It perhaps also explains why freer trade with Europe is welcomed rather than feared, and there has been less resistance to CER with New Zealand than trade with lower wage Asian countries.

5. Tariffs and Employment

Now consider another of the important questions in the public debate - can a tariff increase employment and raise welfare?

In answering this question we can relax the simplifying assumption of the previous section that the rest of the world is identical apart from the level of the minimum wage. Consider figure 5, which shows the production locus with unemployment ac , a free trade production point y^f and a free trade consumption point z^f . The country exports good 2 and imports good 1, perhaps because of endowment technology or taste differences or because it has a lower minimum wage than its trading partners.

Now introduce a tariff on imports of good 1. This increases the price of good 1 for domestic producers and consumers to p^{f+t1} , but exchange with the rest of the world is still at world prices p^f . Production will be at y^{f+t1} and consumption at z^{f+t1} . Employment of factor 2 contracts. After the tariff we are on a lower indifference curve and so the tariff on good 1 has hurt the representative individual in the domestic economy. By contrast an export subsidy on good 2, or cutting tariffs on good 1, shifts production to y^{f+t2} and consumption at z^{f+t2} so that employment expands enough for the representative individual to be better off. The effect of the increase in employment need not dominate the other distortionary effects of the tariff, but does so in the situation illustrated.

Proposition 6: Liberalisation which cuts tariffs on industries which use unemployed factors relatively intensively could lead to losses, while cuts in tariffs on other industries will lead to gains.

This proposition is consistent with the theory of second best policy, as for instance in Corden (1996). The tariff can improve welfare by offsetting the labour market distortion, although of course a tariff will be inferior from a welfare point of view to directly addressing the labour market distortion, say through a wage subsidy for minimum wage workers.

Based on the above, an argument for a tariff on employment grounds can reasonably be mounted for TCF, especially the parts of TCF that employ low wage workers relatively intensively. The other industry that has been resisting tariff cuts, automobile manufacture, would seem to have no argument for a tariff based on the above results, as it does not use minimum wage workers particularly intensively. Considering employment effects would probably strengthen the case for liberalisation.

A limitation of the model is that it assumes given endowments of the various types of labour. A tariff on TCF imports will improve employment prospects for unskilled workers, reducing incentives for education, training, and skill upgrading and so inducing. These long run labour supply responses flowing from the tariff are difficult to quantify, but if strong would undermine the above argument for a TCF tariff.

6. Conclusions

The main conclusion of the paper is that trade and unemployment are related, and that simple models can shed light on the nature of the relationship. A variant of the existing general equilibrium models with unemployment was developed, which had the advantage of avoiding the unrealistic specialised equilibrium. It was shown that trade is not always gainful when there is unemployment, that opening up trade with otherwise identical countries with lower minimum wages is likely to lead to losses, and that when assessing the employment and welfare effects of a tariff the intensity with which the industry uses minimum wage labour is crucial. The relevance of these results to current Australian trade policy debates was discussed.

In view of the demonstrable effects of trade policy on the level of employment, consideration could be given to incorporating them in the models used by the Productivity Commission and others in simulating the effects of changes in trade policy. This would mean incorporating a wage floor that applies to some workers, which would require a model with more than one type of labour. Note that this is not the same as a fixed real wage that applies to all types of labour. A computable general equilibrium model including a wage floor would be able to tell us the impact on aggregate employment of a trade policy change, and specify exactly where jobs are created and lost. We do not know much about the magnitudes of employment effects at the moment, but a reasonable expectation would be that they will be many times larger than the resource reallocation effects identified in the full employment or fixed NAIRU simulations. When a job is lost or created the impact on national income is the entire wage, whereas the gains from resource reallocation are the difference between the marginal products of the labour in the industries. Results from such a model would strengthen the case for trade liberalisation where this is appropriate, as well as helping to identify the limited number of cases where liberalisation might be harmful. At the very least, incorporating long run employment issues would help the credibility of the economic models used in the trade policy debates.

If the links between trade and employment are well established in the general equilibrium trade theoretic literature, why have economists often kept them separate in the public debate? One explanation might be the division of labour between macroeconomics and microeconomics. Explaining unemployment is seen as the task of macroeconomists (whose single good single factor models cannot capture the type of employment effects considered in this paper) rather than microeconomists, including general equilibrium trade theorists. Another reason trade economists have tried to keep trade and unemployment issues separate might be fear of the employment argument being misused, in the same way as the infant industry and strategic trade policy arguments have been misused in the past. While the politics of trade liberalisation are complex, the damage done to the cause of trade liberalisation by ignoring long run employment effects seems very great, in the face of variations in employment that are obvious to the public and politicians.

References

Brecher R.A. (1974a) "Minimum Wage Rates and the Pure Theory of International Trade" *Quarterly Journal of Economics* 88 pp98-116.

Brecher R.A. (1974b) "Optimum Commercial Policy for a Minimum Wage Economy" *Journal of International Economics* 4 pp139-149.

Corden W.M. (1997) *Trade Policy and Economic Welfare* Second Edition Oxford:Clarendon.

Corden W.M. (1979) "Tell Us Where The Jobs Will Come From?" *Bank of New South Wales Review* 30 October. Reprinted in Corden W.M. *The Road to Reform: Essays on Australian Economic Policy* Melbourne: Addison Wesley Longman.

Dixit A.K. and Norman V. (1980) *The Theory of International Trade - A Dual General Equilibrium Approach* Cambridge:CUP.

Dixon P.B. and Parmenter B.R. (1994) "Computable General Equilibrium Modeling" Monash University Centre for Policy Studies and Impact Project Working Paper IP-65.

Dixon P.B. and Rimmer M.T (1998) "Computing Labour Market Adjustment Costs via Monash" Monash University Centre for Policy Studies Unpublished Paper .

Ethier W.J. (1995) *Modern International Economics* Third Edition New York: Norton

Friedman M. (1968) "The Role of Monetary Policy" *American Economic Review* 58 pp1-17.

Haberler G. (1950) "Some Problems in the Pure Theory of International Trade" *Economic Journal* 60 pp223-240.

- Industry Commission (1997a) *The Automotive Industry Report* No.58 Canberra:AGPS.
- Industry Commission (1997b) *The Textile, Clothing and Footwear Industries Report* No.59 Canberra:AGPS.
- Irwin D.A. (1995) *Against the Tide An Intellectual History of Free Trade* Princeton:PUP
- Jones R.W. (1971) "A Three Factor Model in Theory, Trade and History" in Bhagwati J. Jones R.W. Mundell R. and Vanek J. (eds) *Trade, Balance of Payments and Growth: Essays in honour of Charles P. Kindleberger* Amsterdam:North Holland.
- Kemp M.C. (1969) *The Pure Theory of International Trade and Investment* New Jersey: Prentice Hall.
- Kemp M.C. Long N.V. and Shimomura K. (1991) *Labour Unions and the Theory of International Trade* Amsterdam: North Holland.
- Krugman P. (1993) "What Do Undergrads Need to Know About Trade" *American Economic Review Papers and Proceedings* 83 May pp651-667.
- Krugman P and Obstfeld M. (1997) *International Economics* 4th edition New York: Addison Wesley.
- Markusen J.R., Melvin J.R, Kaempfer W.H. and Maskus K.E. (1995) *International Trade* New York: McGraw Hill
- Neary J.P. (1985) "International Factor Mobility, Minimum Wage Rates and Factor Price Equalisation: A Synthesis" *Quarterly Journal of Economics* 100/3 pp551-570.
- Oslington P. (1998) "Unemployment in An Open Economy" PhD Thesis, University of Sydney.
- Ruffin R.J. (1981) "Trade and Factor Movements with Three Factors and Two Goods" *Economics Letters* 7 pp177-182.
- Vousden N. (1990) *The Economics of Trade Protection* Cambridge: CUP.
- Wood A. (1994) *North-South Trade, Employment and Inequality* Oxford: Clarendon Press.
- Woodland A.D. (1982) *International Trade and Resource Allocation* Amsterdam: North Holland.

APPENDIX - EQUILIBRIUM CONDITIONS AND COMPARATIVE STATICS FOR THE MODEL

This appendix gives equilibrium conditions of the model in the paper and comparative static algebra supporting the results. Notation follows the main part of the paper with p for goods prices, y for outputs, w for factor prices, \tilde{w} for the minimum wage, and x for employment of the factor subject to the minimum wage, and v for endowments. $c(w)$ is the minimum cost function representation of production technology - the arguments of the function will sometimes be suppressed so that this is simply c . Superscripts indicate good and factor numbers, and subscripts derivatives with respect to the arguments of the functions. In signing the expressions we know that $c_i^j \geq 0$ because the technology is nondecreasing, that $c_{11}^j \neq 0$, $c_{22}^j \neq 0$, $c_{33}^j \neq 0$, $c_{12}^j = c_{21}^j \geq 0$, $c_{13}^j = c_{31}^j \geq 0$, $c_{23}^j = c_{32}^j \geq 0$ because of concavity and constant returns to scale.

For each of the goods, a zero profit condition:

$$(1) p^1 - c^1(w^1, w^3) = 0, y^1 > 0$$

$$(2) p^2 - c^2(\tilde{w}^2, w^3) = 0, y^2 > 0$$

For each of the factors, a full employment condition, with unemployment of factor 2.

$$(3) c_1^1(w^1, w^3)y^1 - v^1 = 0, w^1 > 0$$

$$(4) c_2^2(\tilde{w}^2, w^3)y^2 - v^2 < 0, w^2 = \tilde{w}^2$$

$$(5) c_3^1(w^1, w^3)y^1 + c_3^2(\tilde{w}^2, w^3)y^2 - v^3 = 0, w^3 > 0$$

From (2) using the implicit function theorem

$$Mw^3/M\tilde{w}^2 = -c_2^2/c_3^2 \neq 0$$

$$Mw^3/Mp^2 = 1/c_3^2 \geq 0$$

From (1) $p^1 - c^1(w^1, w^3(p^2, \tilde{w}^2)) = 0$ using the implicit function theorem

$$Mw^1/Mp^1 = 1/c_1^1 \geq 0$$

$$Mw^1/M\tilde{w}^2 = c_3^1/c_1^1 Mw^3/M\tilde{w}^2 = [c_3^1 c_2^2]/[c_1^1 c_3^2] \geq 0$$

$$Mw^1/Mp^2 = c_3^1/c_1^1 Mw^3/Mp^2 = -c_3^1/[c_1^1 c_3^2] \neq 0$$

From (3) $y^1 = v^1/c_1^1(w^1(p^1, \tilde{w}^2, p^2), w^3(p^2, \tilde{w}^2))$ explicitly, and using the quotient rule

$$My^1/Mv^1 = 1/c_1^1 \geq 0$$

$$My^1/Mp^1 = -v^1 c_{11}^1 Mw^1/Mp^1/[c_1^1]^2 = -v^1 c_{11}^1/[c_1^1]^3 \geq 0$$

$$My^1/M\tilde{w}^2 = -v^1 [c_{11}^1 Mw^1/M\tilde{w}^2 + c_{13}^1 Mw^3/M\tilde{w}^2]/[c_1^1]^2 = v^1 [-c_{11}^1 c_3^1 c_2^2 + c_{13}^1 c_1^1 c_3^2]/[[c_1^1]^3 c_3^2] \geq 0$$

$$My^1/Mp^2 = -v^1 [c_{11}^1 Mw^1/Mp^2 + c_{13}^1 Mw^3/Mp^2]/[c_1^1]^2 = -v^1 [-c_{11}^1 c_3^1 + c_{13}^1 c_1^1]/[[c_1^1]^3 c_3^2] \neq 0$$

From (5) $y^2 = [v^3 - c_3^1(w^1(p^1, \tilde{w}^2, p^2), w^3(p^2, \tilde{w}^2))] y^1 (v^1, p^1, \tilde{w}^2, p^2)/c_3^2(\tilde{w}^2, w^3(p^2, \tilde{w}^2))$ explicitly, and using the quotient rule and the product rule

$$My^2/Mv^1 = -c_3^1 My^1/Mv^1/c_3^2 = -c_3^1/c_1^1 c_3^2 \neq 0$$

$$My^2/Mv^3 = 1/c_3^2 \geq 0$$

$$My^2/Mp^1 = -[c_{31}^1 y^1 Mw^1/Mp^1 + c_3^1 My^1/Mp^1]/c_3^2 = -[1/[c_1^1]^2 c_3^2][v^1/c_1^1][c_{31}^1 c_1^1 + c_{11}^1 c_3^1] \neq 0$$

$$\begin{aligned} My^2/M\tilde{w}^2 &= [c_3^2 y^1 c_{31}^1 Mw^1/M\tilde{w}^2 + c_3^2 y^1 c_{33}^1 Mw^3/M\tilde{w}^2 + c_3^2 c_3^1 My^1/M\tilde{w}^2 \\ &\quad + [v^3 - c_3^1 y^1] c_{32}^2 + [v^3 - c_3^1 y^1] c_{33}^2 Mw^3/M\tilde{w}^2]/-[c_3^2]^2 \\ &= -[1/c_1^1 [c_3^2]^2][v^1/c_1^1][c_{31}^1 c_3^1 c_2^2 - c_{33}^1 c_1^1 c_2^2 + c_{31}^1 c_1^1 c_3^2 - c_{11}^1 c_3^1 c_2^2] \\ &\quad - [1/[c_3^2]^3][v^3 - c_3^1 v^1/c_1^1][c_{32}^2 c_3^2 - c_{33}^2 c_2^2] \neq 0 \end{aligned}$$

$$\begin{aligned} My^2/Mp^2 &= -[[y^1][c_{31}^1 Mw^1/Mp^2 + c_{33}^1 Mw^3/Mp^2] + [c_3^1 My^1/Mp^2]]/c_3^2 - [v^3 - c_3^1 y^1][c_{33}^2 Mw^3/Mp^2] \\ &= [1/c_1^1 [c_3^2]^2][v^1/c_1^1][-c_{33}^1 c_1^1 c_1^1 + 2c_{31}^1 c_1^1 c_3^1 - c_{11}^1 c_3^1 c_3^1] \end{aligned}$$

$$- [v^3 - c_3^1 v^1 / c_1^1] [c_{33}^2 / c_3^2] \exists 0$$

Now using $x^2 = c_2^2(\tilde{w}^2, w^3(p^2, \tilde{w}^2))$ $y^2(p^1, \tilde{w}^2, v^1, v^3, p^2)$ from (4)

$$Mx^2/Mv^1 = c_2^2 My^2/Mv^1 = - [c_2^2 c_3^1] / [c_1^1 c_3^2] \neq 0$$

$$Mx^2/Mv^3 = c_2^2 My^2/Mv^3 = c_2^2 / c_3^2 \exists 0$$

$$Mx^2/Mp^1 = c_2^2 My^2/Mp^1 = - [c_2^2 / [c_1^1]^2 c_3^2] [v^1 / c_1^1] [c_{31}^1 c_1^1 + c_{11}^1 c_3^1] \neq 0$$

$$\begin{aligned} Mx^2/M\tilde{w}^2 &= c_2^2 My^2/M\tilde{w}^2 + [c_{22}^2 + c_{23}^2 Mw^3/M\tilde{w}^2] y^2 \\ &= c_2^2 My^2/M\tilde{w}^2 + [c_{22}^2 [c_3^2]^3 / c_2^2] [c_2^2 / [c_3^2]^3] [v^3 - c_3^1 v^1 / c_1^1] - [[c_3^2]^3] [c_2^2 / [c_3^2]^3] [v^3 - c_3^1 v^1 / c_1^1] \\ &= - [c_2^2 / c_1^1 [c_3^2]^2] [v^1 / c_1^1] [c_{31}^1 c_3^1 c_2^2 - c_{33}^1 c_1^1 c_2^2 + c_{31}^1 c_1^1 c_3^2 - c_{11}^1 c_3^1 c_2^2] \\ &\quad - [c_2^2 / [c_3^2]^3] [v^3 - c_3^1 v^1 / c_1^1] [c_{32}^2 c_3^2 - c_{33}^2 c_2^2 - c_{22}^2 [c_3^2]^3 / c_2^2 + [c_3^2]^3] \neq 0 \end{aligned}$$

$$\begin{aligned} Mx^2/Mp^2 &= c_2^2 My^2/Mp^2 + c_{23}^2 Mw^3/Mp^2 y^2 \\ &= [c_2^2 / c_1^1 [c_3^2]^2] [v^1 / c_1^1] [-c_{33}^1 c_1^1 c_1^1 + 2c_{31}^1 c_1^1 c_3^1 - c_{11}^1 c_3^1 c_3^1] \\ &\quad - [c_2^2] [v^3 - c_3^1 v^1 / c_1^1] [[c_2^2 c_{33}^2 - c_{23}^2] / [c_2^2 c_3^2]] \exists 0 \end{aligned}$$

Now GDP = $p^1 y^1(v^1, p^1, \tilde{w}^2, p^2) + p^2 y^2(p^1, \tilde{w}^2, v^1, v^3, p^2)$

$$MGDP/Mv^1 = p^1 My^1/Mv^1 + p^2 My^2/Mv^1 = p^1 My^1/Mv^1 - p^2 c_3^1 My^2/Mv^1 / c_3^2 = [p^1 - p^2 c_3^1 / c_3^2] / c_1^1 = ?$$

$$MGDP/Mv^3 = p^2 My^2/Mv^3 = p^2 / c_3^2 \exists 0$$

$$MGDP/Mp^1 = p^1 My^1/Mp^1 + p^2 My^2/Mp^1 + y^1 = - v^1 [p^1 c_3^2 c_{11}^1 + p^2 [c_{31}^1 c_1^1 + c_{11}^1 c_3^1]] / [[c_1^1]^3 c_3^2] = ?$$

$$\begin{aligned} MGDP/M\tilde{w}^2 &= p^1 My^1/M\tilde{w}^2 + p^2 My^2/M\tilde{w}^2 \\ &= p^1 My^1/M\tilde{w}^2 - p^2 My^1/M\tilde{w}^2 y^1 c_3^1 / c_3^2 \\ &\quad - p^2 [c_3^2] [[y^1] [c_{31}^1 Mw^1/M\tilde{w}^2 + c_{33}^1 Mw^3/M\tilde{w}^2] - [v^3 - c_3^1 y^1] [c_{32}^2 + c_{33}^2 Mw^3/M\tilde{w}^2]] / [c_3^2]^2 \end{aligned}$$

= ?

$$MGDP/Mp^2 = p^1 My^1/Mp^2 + p^2 My^2/Mp^2 + y^2 = ?$$

To resolve the sign some of these ? results, consider the alternative definition of

$$GDP = w^1(p^1, \tilde{w}^2, p^2) v^1 + \tilde{w}^2 x^2(p^1, \tilde{w}^2, v^1, v^3, p^2) + w^3(\tilde{w}^2, p^2) v^3$$

$$MGDP/Mv^1 = \tilde{w}^2 Mx^2/Mv^1 + w^1 = - [c_2^2 c_3^1] / [c_1^1 c_3^2] + w^1 = ?$$

$$\begin{aligned} MGDP/Mp^1 &= Mw^1/Mp^1 v^1 + \tilde{w}^2 Mx^2/Mp^1 \\ &= [[c_1^1]^2 c_3^2 / \tilde{w}^2] [\tilde{w}^2 c_2^2 / [c_1^1]^2 c_3^2] [v^1 / c_1^1] + \tilde{w}^2 Mx^2/Mp^1 \\ &= - [\tilde{w}^2 c_2^2 / [c_1^1]^2 c_3^2] [v^1 / c_1^1] [c_{31}^1 c_1^1 + c_{11}^1 c_3^1 - [c_1^1]^2 c_3^2 / \tilde{w}^2] = ? \end{aligned}$$

$$\begin{aligned} MGDP/M\tilde{w}^2 &= Mw^1/M\tilde{w}^2 v^1 + x^2 + \tilde{w}^2 Mx^2/M\tilde{w}^2 + Mw^3/M\tilde{w}^2 v^3 \\ &= [c_3^1 c_1^1 c_3^2 / \tilde{w}^2 c_2^2] [\tilde{w}^2 c_2^2 / c_1^1 [c_3^2]^2] [v^1 / c_1^1] \\ &\quad + [[c_3^2]^3 / \tilde{w}^2] [\tilde{w}^2 c_2^2 / [c_3^2]^3] [v^3 - c_3^1 v^1 / c_1^1] + \tilde{w}^2 Mx^2/M\tilde{w}^2 - v^3 c_2^2 / c_3^2 \\ &= - [\tilde{w}^2 c_2^2 / c_1^1 [c_3^2]^2] [v^1 / c_1^1] [c_{31}^1 c_3^1 c_2^2 - c_{33}^1 c_1^1 c_2^2 + c_{31}^1 c_1^1 c_3^2 - c_{11}^1 c_3^1 c_2^2 + c_3^1 c_1^1 c_3^2 / \tilde{w}^2] \\ &\quad - [\tilde{w}^2 c_2^2 / [c_3^2]^3] [v^3 - c_3^1 v^1 / c_1^1] [c_{32}^2 c_3^2 - c_{33}^2 c_2^2 - c_{22}^2 [c_3^2]^3 / c_2^2 + [c_3^2]^3 + [c_3^2]^3 / \tilde{w}^2] - v^3 c_2^2 / c_3^2 \neq \end{aligned}$$

0

$$\begin{aligned} MGDP/Mp^2 &= Mw^1/Mp^2 v^1 + \tilde{w}^2 Mx^2/Mp^2 + Mw^3/Mp^2 v^3 \\ &= [\tilde{w}^2 c_2^2 / c_1^1 [c_3^2]^2] [v^1 / c_1^1] [-c_{33}^1 c_1^1 c_1^1 + 2c_{31}^1 c_1^1 c_3^1 - c_{11}^1 c_3^1 c_3^1 - c_3^1 c_1^1 c_1^1 c_3^2 / [\tilde{w}^2 c_2^2]] \\ &\quad - [\tilde{w}^2 c_2^2] [v^3 - c_3^1 v^1 / c_1^1] [[c_2^2 c_{33}^2 - c_{23}^2] / [c_2^2 c_3^2]] = ? \end{aligned}$$

Utility of the representative individual H = V(p^1, p^2, M) where M=GDP.

$$MH/Mv^1 = MV/MM \quad MGDP/Mv^1 = ?$$

$$MH/Mv^3 = MV/MM \quad MGDP/Mv^3 \exists 0$$

$$MH/Mp^1 = MV/Mp^1 + MV/MM \quad MGDP/Mp^1 = ?$$

$$MH/M\tilde{w}^2 = MV/MM \quad MGDP/M\tilde{w}^2 \neq 0$$

$$MH/Mp^2 = MV/Mp^2 + MV/MM \quad MGDP/Mp^2 = ?$$

Figure 1-Gains from Trade with Full Employment

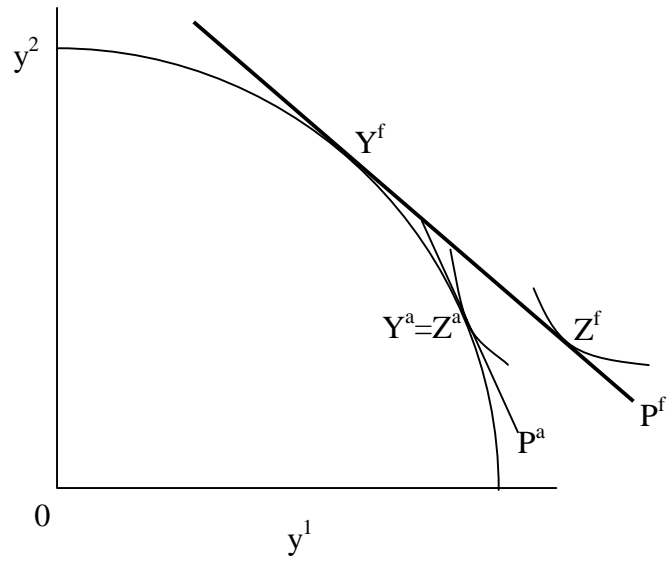


Figure 2-Effect of the Minimum Wage

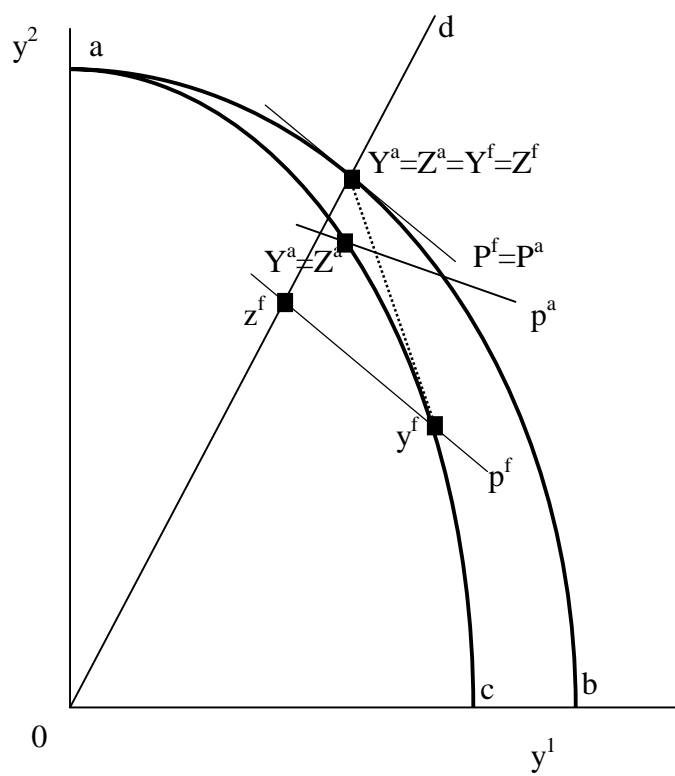


Figure 3-Losses from Trade with Unemployment

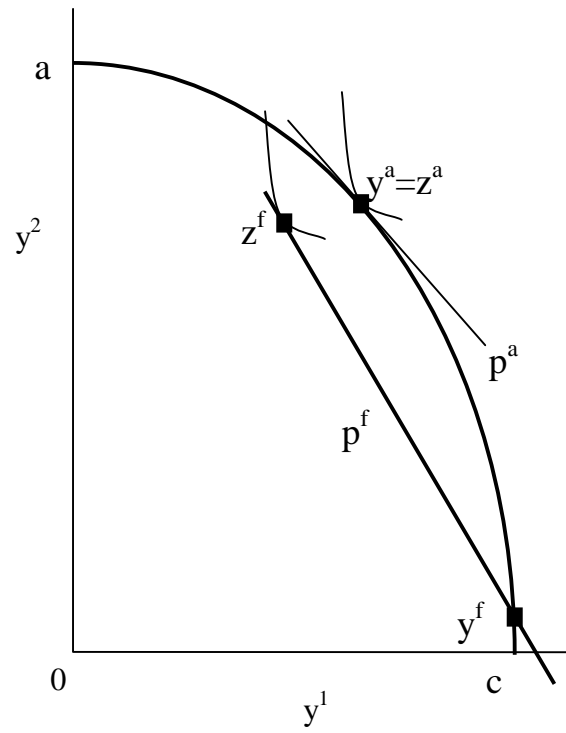


Figure 4-Gains from Trade with Unemployment

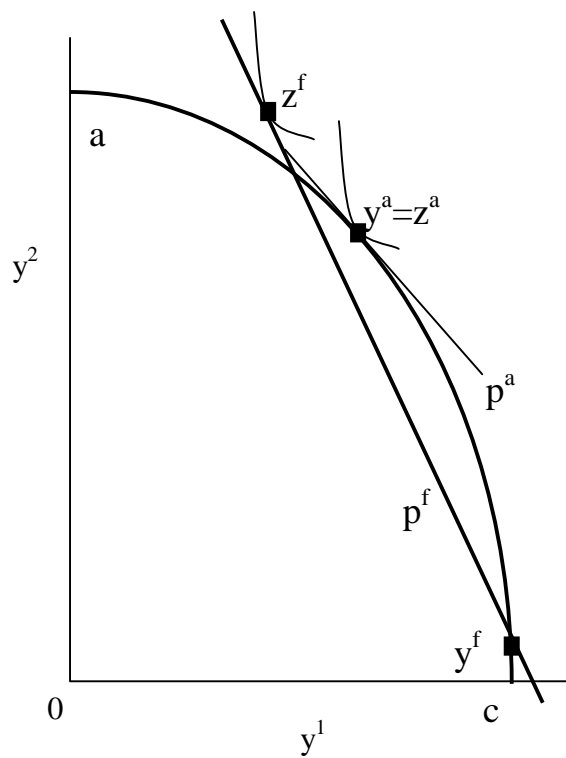


Figure 5-Tariffs with Unemployment

