

## MODELLING THE DYNAMIC IMPACT OF A NAFTA

Timothy J. Kehoe,<sup>1</sup> University of Minnesota and  
Federal Reserve Bank of Minneapolis

### I. INTRODUCTION

The current tool of choice for analyzing the impact of a potential North American Free Trade Agreement on the economies of Canada, Mexico, and the United States is the static general equilibrium model. Examples of such analyses include Brown, Deardorff, and Stern (1991), Cox and Harris (1991), Hinojasa-Ojeda and Robinson (1991), KPMG Peat-Marwick (1991), Sobarzo (1991), and Yúnez-Naude (1991). They all tend to find small, but favourable impacts of such an agreement, with Sobarzo's estimation of a potential welfare gain to Mexico of 2.4% of base period GDP being the largest impact found.

Static applied general-equilibrium (GE) models do a good job in analyzing, and even in predicting, the impact of trade liberalization or tax reform on relative prices and resource allocation over a short time horizon. Kehoe, Polo and Sancho (1991), for example, assess the performance of a static GE model of the Spanish economy that had been constructed to analyze the impact of the tax reform that accompanied Spain's 1986 entry into the European Community. They find that the model was able to account for more than two thirds of the variation in relative prices that occurred between 1985 and 1987.<sup>2</sup>

Typically, however, this sort of model predicts small changes in economic welfare (see Shoven and Whalley, 1984 and Whalley, 1989). One reason is that it does not attempt

---

<sup>1</sup>The views expressed herein are those of the author and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

<sup>2</sup>It would be interesting to do similar *ex post* performance evaluations of the analyses of the NAFTA.

to capture the impact of policy on growth rates. For this we need a dynamic model. Anything that can affect the growth rate of a variable like income per capita or output per worker, if only slightly, can have a tremendous impact over time.

At present, there is no model that analyzes the impact of a NAFTA on growth rates. This paper outlines some of the issues that confront a researcher interested in building a dynamic applied GE model to assess the potential economic impact of a NAFTA, including the impact on growth rates. A dynamic model can capture the effect of government policy on capital flows, and these are likely to be very important. Yet, as we argue in the next section, a low capital-labour ratio cannot be the only, or even the most important, factor in explaining the low level of output per worker in Mexico compared to that in a country like the U.S. We must look elsewhere for explanations for the differences in levels of output per worker. It is here that the new, endogenous growth literature, which follows Romer (1987) and Lucas (1988) and focusses on endogenous technical change, may be able to provide answers.

The channels through which increased openness can alter the growth rate are clear: economic growth is spurred by the development of new products. New product development is the result of direct research and development and of learning by doing, where experience in one product line makes it easier to develop the next product in the line. On the final product side, increased openness allows a country to specialize more, achieving a larger scale of operations in those industries in which it has a comparative advantage. On the input side, increased openness allows a country to import technologically-specialized inputs to the production process without needing to develop them itself.

## II. CAPITAL FLOWS

A major impact of NAFTA would be on capital flows. One would expect capital to flow from relatively capital-rich Canada and the U.S. to relatively capital-poor Mexico. Indeed, it is by exogenously imposing a substantial capital flow of this sort that the KPMG Peat-Marwick (1991) model is able to show a significant welfare gain to Mexico. It is worth stressing two points about capital flows, however: first, differences in capital-labour ratios between Mexico and its northern neighbours cannot explain the large differences in output per worker between these countries.<sup>3</sup> As a result, simply equalizing capital-labour ratios cannot eliminate income differences. Second, when modelling the savings and investment decisions that determine capital flows, we need to take into account the significant differences in age profiles of the Mexican and neighbouring populations.

---

<sup>3</sup>See Lucas (1990) for a discussion and calculations similar to those below.

To illustrate the point that differences in capital-labour ratios cannot explain the differences in output per worker, suppose that each economy has the production function

$$Y_j = \gamma N_j^{1-\alpha} K_j^\alpha$$

where  $Y_j$  is GDP,  $N_j$  is the size of the work force, and  $K_j$  is capital. In per capita terms, where  $y_j = Y_j/N_j$  and  $k_j = K_j/N_j$ , this becomes  $y_j = \gamma k_j^\alpha$ . The net return of capital is

$$r_j = \alpha \gamma k_j^{\alpha-1} - \delta$$

where  $\delta$  is the depreciation rate. In 1988, according to Summers and Heston (1991), real GDP per worker was \$14,581 in Mexico and \$37,608 in the U.S.<sup>4</sup> Suppose that  $\alpha = 0.3$ , which is roughly the capital share of income in the U.S. Then to explain this difference in output per worker, we need capital per worker to be larger than that in Mexico by a factor of 23.5,

$$\frac{k_{us}}{k_{mex}} = \left( \frac{y_{us}}{y_{mex}} \right)^{1/\alpha} = \left( \frac{37,608}{14,581} \right)^{1/0.3} = 23.5.$$

Suppose that  $\delta = 0.05$  and  $r_{us} = 0.10$ , which are roughly the numbers obtained from calibration. Then the net interest rate in Mexico should be 17.2 times that in the U.S.,

$$r_{mex} = (r_{us} + \delta) \left( \frac{k_{us}}{k_{mex}} \right)^{\alpha-1} - \delta = 0.10(23.5)^{0.7} - 0.05 = 0.86.$$

During the period 1988–90 the real return on bank equity in Mexico — and banks are the major source of private capital in Mexico — averaged 28.2%, as compared to 4.7% in the U.S. (see Garber and Weisbrod, 1991). Since 28% is far less than the 86% that we would expect if differences in capital-labour ratios were the principal determinant of the differences in output per worker between Mexico and its neighbours, we must look elsewhere for an explanation of the difference in productivity.

There are more dramatic ways of illustrating this point. According to Summers and Heston (1991), real GDP per worker in Haiti in 1988 was 4.9% that in the U.S. Calculations similar to those performed above suggest interest rates in Haiti should be over 11,000% per year if differences in the capital-labour ratio were the sole

---

<sup>4</sup>The Summers-Heston numbers are based on purchasing-power parity indices. Comparisons that convert Mexican GDP into dollar terms using exchange rates would show a much larger difference between these two numbers and would make the calculations even more compelling.

explanation of the difference in output per worker between the two countries. If workers in the U.S. worry about capital flowing to Mexico, they should worry even more about it flowing to Haiti.

Historical evidence does not indicate that Mexico has always been starved of funds for investment. In fact, the problem has often been that investments abroad, particularly in the U.S., have been more attractive. Between 1977 and 1982, for example, \$17.8 billion of private investment flowed into Mexico while \$18.7 billion flowed out (Garcia-Alba and Serra-Puche 1983:45).

Although capital inflows cannot provide all the answers to Mexico's problems, they are important. One of the crucial roles of a NAFTA would be to create a stable economic environment that would encourage private investment in Mexico. It is intended to do this in at least two ways. First, it would lock the Mexican government into the free-trade policies that it is currently pursuing unilaterally. Second, it would protect Mexican producers from protectionist tendencies in the U.S., which fluctuate with the business cycle and are sensitive to a variety of special interest groups.

A sensible analysis of capital flows must model consumer's savings decisions. In modelling savings decisions in North America, we must take into account demographic differences among the three countries. To illustrate the importance of demographic differences, note that half the population of Mexico is under the age of 17, while the populations of Canada and the U.S. are aging as the postwar baby boom generation reaches middle age. These differences would be very important in an overlapping generations context in which consumers dissave while they are young and building up human capital, save during middle age, and dissave again when they are old and retired.<sup>5</sup> Modelling demographic differences in an overlapping generations framework would be especially important in a model in which human capital, as well as physical capital, plays an important role.

### III. SPECIALIZATION IN FINAL PRODUCTS

The possibility that learning-by-doing could help account for economic growth has been recognized since the pioneering work of Arrow (1962). Recent research has tried to incorporate learning-by-doing into models of trade and growth (see Stokey, 1988 and Young, 1991).

Consider the following simple framework, as presented by Backus, Kehoe and Kehoe (1991): output in an industry in some country depends on inputs of labour and capital, country- and industry-specific factors, and an experience factor that depends, in turn, on the output of that industry in the previous period. Keeping constant the rates of

---

<sup>5</sup>An example of an applied GE model with overlapping generations is Auerbach and Kotlikoff (1987).

growth of inputs, the crucial factor in determining the rate of growth of output per worker is the rate of growth of the experience factor. Output per worker grows faster in industries in which this experience factor is higher. The rate of growth of output per worker nationwide is a weighted average of the rates of growth across industries. Thus one way increased openness promotes growth is that it allows a country to specialize in certain product lines and attain more experience in these industries.

Modelling dynamic increasing returns as the result of learning-by-doing is a reduced-form specification for a very complex microeconomic process. It captures the effects of the learning curve documented by industrial engineers. To some extent, it also captures the adoption of more efficient production techniques both from abroad and from other domestic industry. The learning that takes place is not solely related to physical production techniques, but also to the development of complex financial and economic arrangements between producers of primary and intermediate goods and producers of final goods. A country's ability to benefit from learning-by-doing depends on the educational level of its work force. It also depends on whether a country is at the frontier of development of new products and production techniques or can import these from abroad: it is easier to play catch-up than to be the technological leader.

Backus *et al.* use data on the determinants of growth rates of a large number of countries from 1970-85 to investigate the ability of the learning-by-doing theory to explain differences in growth rates. Using a formal version of the above framework, they derive a relationship of the form

$$g_t^j = \alpha + \beta \log Y_t^j + \beta \log \sum_{i=1}^I (Y_{it}^j/Y_t^j)^2.$$

This relationship says that yearly growth rate of output per worker in country *j* in year *t*,  $g_t^j$ , depends on output in country *j*,  $Y_t^j$ , and a specialization index,  $\sum_{i=1}^I (Y_{it}^j/Y_t^j)^2$ , where  $Y_{it}^j$  is output of product category *i*.<sup>6</sup> We refer to the summation in the above expression, a number between zero and one, as a "specialization index". Its product with aggregate output operates as a scale effect on growth. This measure is meant to capture the dispersion of production across industries that the theory suggests is important.

#### IV. IMPORTS OF SPECIALIZED INPUTS

Increased openness allows a country to import more specialized inputs to the production process. Stokey (1988) and Young (1991) have proposed models in which new product

---

<sup>6</sup>Backus *et al.* concentrate on manufacturing output since it is in manufacturing, rather than agriculture or services, that previous empirical work suggest the effects of learning by doing are most evident.

development is still the result of learning by doing, but where the primary impact of learning by doing is in the development of new, more specialized inputs. Trade allows a country to import these inputs without developing them itself. Aghion and Howitt (1989), Grossman and Helpman (1989), Rivera-Batiz and Romer (1989), and others have proposed similar models where it is research and development that leads to the development of new products.<sup>7</sup>

The most interesting aspect of this theory is the perspective it gives us on trade and growth. In the previous section the natural interpretation is that technology is embodied in people and is not tradeable. Trade may influence the pattern of production, including both the scale of production and the pattern of specialization, and in this way affect growth. In this section's model, technology is embodied in product variety, and there is a more subtle interaction between trade and growth. Recall that increases in the number of varieties of intermediate goods raise output. If these varieties are freely traded, a country can either produce them itself or purchase them from other countries. By importing these products a small country can grow as quickly as a large one. When there is less than perfectly free trade in differentiated products, we might expect to find that both scale and trade in differentiated products are positively related to growth.

A commonly used measure of the extent to which a country engages in trade of highly specialized products in the Grubel-Lloyd (1975) index. The Grubel-Lloyd index for country  $j$  is

$$GL^j = \frac{\sum_{i=1}^j (X_i^j + M_i^j - |X_i^j - M_i^j|)}{X^j + M^j}$$

Here  $X_i^j$  is exports of industry  $i$ ;  $M_i^j$  is imports of industry  $i$ ;  $X^j$  is total exports; and  $M^j$  is total imports. Backus, Kehoe and Kehoe (1991) find a strong positive relation between the Grubel-Lloyd index for all products at the three-digit S.I.T.C. level and growth in GDP per capita for a large sample of countries. They also find a strong positive relationship between the Grubel-Lloyd index for manufactured products and growth in manufacturing output per worker. Trade in category 711, nonelectrical machinery, might consist of imports of steam engines (7113) and exports of domestically produced jet engines (7114). Simultaneous import and export of these goods provides the country with both, and leads to more efficient production.

---

<sup>7</sup>Here, of course, the relationship between trade and growth is more complicated if one country can reap the benefits of technological progress in another country by importing the technology itself without importing the products that embody it.

## V. SOME EMPIRICAL ESTIMATES AND ILLUSTRATIVE CALCULATIONS

Using cross-country data from a large number of countries over the period 1970-85, Backus, Kehoe and Kehoe (1991) analyze the determinants of growth. Using their methodology, we can estimate relationships implied by the theory sketched out in the previous two sections. Details concerning the data sources and methodology can be found in Backus *et al.*

Consider a relationship of the form

$$g^j = \alpha + \beta_1 \log Y^j + \beta_2 \log \sum_{i=1}^I (X_i^j/X^j)^2 + \beta_3 \log GL^j + \beta_4 \log y^j + \beta_5 \text{PRIM}^j + \epsilon^j.$$

Here  $g^j$  is average yearly growth of manufacturing output per worker in per cent from 1970-85;  $Y^j$  is 1970 manufacturing output;  $\sum_{i=1}^I (X_i^j/X^j)^2$  is a specialization index for exports at the three digit S.I.T.C. level;  $y^j$  is 1970 per capita income; and  $\text{PRIM}^j$  is 1970 primary school enrollment rate.  $GL^j$  is the Grubel-Lloyd index of intra-industry trade. Both the specialization index and the Grubel-Lloyd index are computed for manufacturing industries only.

We include total GDP and the specialization index to account for the impact of specialization in production of final goods. One motivation for using export data is that specialization is most important in the export sector. Another motivation is purely practical: the trade data permits a more detailed breakdown of commodities, and the export specialization index can be thought of as a proxy for the total production specialization index. The Grubel-Lloyd index is included, as we have explained, because it captures, in a loose way, the ability of a country to trade in finely-differentiated products, which our theory implies is important for growth. We include per capita income and the primary enrollment rate partly because they are widely used by other researchers in this area (for instance, Barro, 1991) and partly because they are relevant to our theory: the inclusion of per capita income allows for less developed countries, which are playing catch-up, to face different technological constraints. The inclusion of the enrollment rate allows for differences in countries' ability to profit from learning by doing because of differences in levels of basic education.

A regression of the above relationship yields

$$g(y^j) = \frac{3.151}{(5.761)} + \frac{0.629}{(0.236)} \log Y^j + \frac{0.775}{(0.491)} \log \sum_{i=1}^I (X_i^j/X^j)^2 \\ + \frac{1.498}{(0.570)} \log GL^j - \frac{0.166}{(0.822)} \log y^j + \frac{1.832}{(2.353)} \text{PRIM}^j$$

NOBS = 49

$R^2 = 0.413.$

(The numbers in parentheses are heteroskedasticity-consistent standard errors.) Notice that in this regression the coefficients all have the expected signs. Similar results can be obtained in a regression of growth of per capita GDP on base-period GDP and specialization and Grubel-Lloyd indices for all commodities. The results of this latter regression are very sensitive, however, both to other variables included in the regression and to the sample of countries. The results reported above are fairly robust to such factors.

To illustrate the dramatic impact of trade liberalization possible in a dynamic model that contains the endogenous growth features discussed in the previous two sections, let us suppose that NAFTA allowed Mexico to increase its level of specialization in production of final manufactured goods. In 1970 Mexico's specialization index for exports of manufactured goods was 0.037. Let us suppose this number increases to 0.100. The comparable index is 0.135 for Canada and 0.050 for the U.S. Let us further suppose that free trade would lead to an increase of trade in specialized goods, increasing Mexico's Grubel-Lloyd index of intra-industry trade. In 1970 this index stood at 0.277% for manufactured goods. Suppose this number increases to 0.500. (The index is 0.626 for Canada and 0.567 for the U.S.) Using the results of the second regression, we would estimate the increase in the yearly growth rate of manufacturing output per worker to be 1.656% per year:

$$\begin{aligned} 1.656 &= 0.775 \log(0.100/0.037) + 1.498 \log(0.500/0.277) \\ &= 0.771 + 0.885. \end{aligned}$$

It is clear that much is at stake in the issues discussed here. Suppose Mexico really were able to increase its growth rate of output per worker by an additional 1.656% per year by taking advantage of both specialization and increased imports of specialized intermediate and capital goods. After 25 years, its level of output per worker would be almost 51% higher than it would have been otherwise. By way of comparison, if Mexico's output per worker had been 51% higher in 1988, it would have been slightly higher than Spain's.<sup>8</sup> Although the empirical work is still preliminary, it suggests there is a significant impact of increased openness on growth through dynamic increasing returns, an impact that dwarfs the static benefits found by more conventional applied general equilibrium models.

## VI. AGGREGATION ISSUES

One problem that confronts a researcher interested in constructing a dynamic general equilibrium model to analyze the impact of NAFTA is what level of aggregation to use. There is evidence that some disaggregation is necessary: Echevarria (1991), for example, finds that while there has been only negligible change in total factor

---

<sup>8</sup>Again, this comparison uses Summers and Heston's 1991 data.



productivity in agriculture in the OECD in recent decades, there has been a significant increase in services, although a smaller increase than in manufacturing. Moreover, simple regressions of growth in income per capita on the initial composition of output, that is, on percentages of output in industry, agriculture, and services account for more than 77% of the variation in national growth rates.

Obviously, much depends on the level of disaggregation of goods in the model. The costs of computing an intertemporal equilibrium, for example, go up very quickly with the number of sectors, at least if adding new sectors adds new state variables. The more sectors we add, however, the more we are able to capture gains from trade.

A further problem in applied modelling of trade and growth at a disaggregate level is that the objects in theoretical models that stress the development of new products do not have obvious empirical counterparts in the data.<sup>9</sup> Various approaches have been used to reinterpret trade data disaggregated using the S.I.T.C. in terms of these sorts of themes, for example, Feenstra (1990), Havrylyshyn and Civan (1985), and this paper. This is obviously an area that needs more research, particularly research with a high imagination component.

## REFERENCES

- Aghion, P. and P. Howitt (1989), "A Model of Growth Through Creative Destruction" (Unpublished manuscript, Massachusetts Institute of Technology).
- Arrow, K.J. (1962), "The Economic Implications of Learning by Doing", *Review of Economic Studies* 24, 155-73.
- Auerbach, A.J. and L.J. Kotlikoff (1987), *Dynamic Fiscal Policy* (Cambridge: Cambridge University Press).
- Backus, D.K., P.J. Kehoe and T.J. Kehoe (1991), "In Search of Scale Effects in Trade and Growth", Research Department Working Paper 451, Federal Reserve Bank of Minneapolis.
- Baldwin, R. (1989), "On the Growth Effect of 1992", Working Paper 3119, National Bureau of Economic Research.
- Barro, R.J. (1991), "Economic Growth in a Cross Section of Countries", *Quarterly Journal of Economics* 106, 407-44.
- Brown, D.K. (1987), "Tariffs, the Terms of Trade, and National Product Differentiation", *Journal of Policy Modeling* 9, 503-26.
- Brown, D.K., A.V. Deardorff and R.H. Stern (1991), "A North American Free Trade Agreement: Analytical Issues and a Computational Assessment" (Unpublished manuscript, University of Michigan).

---

<sup>9</sup>Note that work such as Brown (1987) and Watson (1991) indicates that the disaggregation of goods typically used in static trade models has problems in terms of capturing the degree of substitutability between imports and domestically produced goods.

- Cox, D. and R.G. Harris (1991), "North American Free Trade and its Implications for Canada: Results from a C.G.E. Model of North American Trade" (Unpublished manuscript, University of Waterloo).
- Echevarria, E.C. (1991), "Changing Sectorial Composition and Economic Growth" (Unpublished manuscript, University of Minnesota).
- Garber, P.M. and S.R. Weisbrod (1991), "Opening the Financial Services Market in Mexico" (Unpublished manuscript, Brown University).
- Garcia-Alba, P. and J. Serra-Puche (1985), "Financial Aspects of Macroeconomic Management in Mexico" (Unpublished manuscript, El Colegio de Mexico).
- Grossman, G.M. and E. Helpman (1989), "Product Development and International Trade", *Journal of Political Economy* 97, 1261-83.
- Grubel, H. and P.J. Lloyd (1975), *Intra-Industry Trade* (London: Macmillan).
- Havrylyshyn, O. and E. Civan (1985), "Intra-industry Trade Among Developing Countries", *Journal of Development Economics* 18, 253-71.
- Hinojosa-Ojeda, R. and S. Robinson (1991), "Alternative Scenarios of U.S.-Mexico Integration: A Computable General Equilibrium Approach", Discussion Paper 609, University of California-Berkeley.
- Kehoe, T.J., C. Polo and F. Sanchez (1991), "An Evaluation of the Performance of an Applied General Equilibrium Model of the Spanish Economy", Research Department Working Paper 480, Federal Reserve Bank of Minneapolis.
- KPMG Peat Marwick/Policy Economics Group (1991), "Analysis of Economic Effects of a Free Trade Area between the United States and Mexico: Executive Summary" (Washington, DC: U.S. Council of the Mexico-U.S. Business Committee).
- Lucas, R.E. (1988), "On the Mechanics of Economic Development", *Journal of Monetary Economics* 22, 3-42.
- \_\_\_\_\_ (1990), "Why Doesn't Capital Flow from Rich to Poor Countries?", *American Economic Review, Paper and Proceedings* 80, 92-96.
- Rivera-Batiz, L. and P.M. Romer (1989), "International Trade with Endogenous Technological Change" (Unpublished manuscript, University of Chicago).
- Romer, P.M. (1987), "Growth Based on Increasing Returns Due to Specialization", *American Economic Review, Papers and Proceedings* 77, 56-62.
- \_\_\_\_\_ (1990), "Endogenous Technological Change", *Journal of Political Economy* 98, S71-102.
- Shoven, J.B. and J. Whalley (1984), "Applied General Equilibrium Models of Taxation and International Trade", *Journal of Economic Literature* 22, 1007-51.
- Sobarzo, H.E. (1991), "A General Equilibrium Analysis of Gains from Trade for the Mexican Economy of a North American Free Trade Agreement" (Unpublished manuscript, El Colegio de Mexico).
- Stokey, N.L. (1988), "Learning by Doing and the Introduction of New Goods", *Journal of Political Economy* 96, 701-17.
- Summers, R. and A. Heston (1991), "The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-1988", *Quarterly Journal of Economics* 106, 327-68.

- Watson, W.G. (1991), "Canada's Trade With and Against Mexico" (Unpublished manuscript, McGill University).
- Whalley, J. (1989), "General Equilibrium Trade Modelling over the Last Five Years" (Unpublished manuscript, University of Western Ontario).
- Young, A. (1991), "Learning by Doing and the Dynamic Effects of International Trade", *Quarterly Journal of Economics* 106, 369-406.
- Yúnez-Naude, A. (1991), "Hacia un Tratado de Libre Comercio Norteamericano: Efectos en los Sectores Agropecuarios y Alimenticios de Mexico" (Unpublished manuscript, El Colegio de Mexico).

## Edited Discussion

**Steve Kaliski:** I was very impressed and disturbed by Rick's paper, but I have a nagging question about it which must have occurred to Rick himself. Why is the hypothetical or real assembly plant still in Illinois?

**Rick Harris:** The *maquiladora* experience has been gaining momentum slowly. You had a lot of fixed investment [in Canada and the U.S.] and it takes a long time to wind down these plants. No one's going to move the auto parts plants out of Ontario tomorrow, even if the NAFTA were to be signed.

**Steve Kaliski:** But some assembly plants have moved.

**Rick Harris:** Yes, some assembly plants are moving. Zenith just moved a plant. They virtually picked up a big plant and just moved it to the *maquiladora*. Obviously, there are lots of factors that take time. A big factor is infrastructure. One reason the *maquiladora* is so successful is that the U.S. interstate system goes right up to the Mexican border. In fact, exactly the same kind of plants exist on the U.S. side and they use the same labour. Either you live in Texas or you just walk across the border to go to work. Exactly the same kind of economic activity is occurring on both sides of the border, so to a large degree this economic integration is going to happen anyway.

**Doug Purvis:** I have trouble with the orders of magnitude involved in looking at this economy. Within the context of Rick's framework, I see a difference in the capital-labour ratio of roughly 25 in Canada and the U.S. and roughly 1.5 in Mexico. I was surprised you were so willing so quickly to reject the human capital argument on the basis of the *maquiladora* episode. If my orders of magnitude are roughly correct, if you were to run your hypothetical experiment of getting the capital-labour ratio in Mexico up to what it is in Canada and the U.S. and then have to explain the remaining one-third productivity gap, you would be talking about a manufacturing sector in Mexico that must be 50 times as big as what's involved in the *maquiladora*. I would be surprised, if you did do that experiment, that you wouldn't run into a human capital constraint somewhere along the line. You can't infer from the *maquiladora* experience with labour that that wouldn't happen, if you ran that scale of experiment.

**Rick Harris:** Even if you get to only one-third, by international comparisons among industrialized countries that's a very big number left to explain. As far as manufacturing is concerned, it appears there are large supplies of labour in Mexico with skill levels necessary to function in traditional American manufacturing plants, at existing wage rates. So human capital is not, in the short or even medium run, a constraint on potential expansion of Mexican manufacturing, though obviously it would show up in the longer run in explaining income differences. Virtually 50% of the Mexican labour force is either in subsistence agriculture or in the unemployed urban labour force. Twenty-five per cent of the Mexican labour force is officially listed as self-employed: [in reality] they stand on corners. There are serious difficulties about

how much human capital is in that 50%. There is a big debate about just what the quality of the labour force is.

**Tim Kehoe:** Could I say something about that? In 1982 per worker output was roughly what it is now. Between 1982 and now Mexico missed out on a decade of growth. But per capita output is roughly the same. In 1982 in Mexico there was no labour surplus. There were some people standing on corners. But there was no labour surplus. Skilled labour markets in Mexico were very, very tight: there was quite a bit of wage inflation. Factory owners found it difficult to get literate workers. I think Rick is right: because of macroeconomic conditions there certainly is a surplus of labour in Mexico right now. But I don't think that can be the answer. Why wasn't it the answer in 1982? It would be hard to argue that for some reason per capita output has stayed roughly constant but now all of a sudden there is a flood of labour. The labour force is bigger than it was in 1982. But I don't think that's the answer.

**Frank Flatters:** I'd just like to point out, based on an observation in Southeast Asia, that there isn't a homogeneous "unskilled labour". What's being experienced now in Thailand, Malaysia and Indonesia is that, although there are lots of literate, public-school trained people, the shortages are of people with technical training. People with those sorts of skills are getting wages which are enormous, even by our standards.

**Pierre-Paul Proulx:** I'm going to exaggerate in order to make a point, trying to underscore what Rick Harris mentioned in passing, that exports from the *maquiladora* are 45% of total Mexican exports. My point is the following: technological change, the infrastructures for transportation of goods, services, and information, and the mobility of factors of production now make for a situation in which what we have to understand is, not inter-country competition, but international, interregional competition. I quite understand that people would be concerned about the competition coming from the *maquiladoras*. What you have there are players who are maximizing on a world scale and are competing with other regions in the U.S., in Southeast Asia, and in Europe. To try to get at this through national models muddles things up. If you get down to interregional, international competition, you've got basically the same list of determinants of competitiveness as Rick's but there are other new ones, as well. It enriches our analysis and points to much more relevant examination of export-import problems, because you get into quality of human resources, the mobility of factors, entrepreneurship, where the infrastructure is, and firm-strategic planning, which is changing significantly. Many of these forces do not work on an international level, they work at interregional, international level. So the emphasis on *maquiladoras*, done from a total-Mexico level, confuses the issue. There are elements in what Tim Kehoe mentioned that are relevant to that, because you have these growth and decline patterns being emphasized, but they can only be examined in a relevant way at the sub-national interregional level.

**Bob Wolfe:** What I think I have understood is that government policy isn't really the issue in explaining existing differences in relative productivity or income or trade flows. Yet there is tremendous potential for change in the Mexican situation. Is it correct,

therefore, to assume the real potential political issue is whether barriers go up as a result of NAFTA as opposed to whether they might come down? Is that's what's driving U.S. labour, that more protection is needed because there is so much potential competition from Mexico — because the models don't seem to indicate there is a great deal of change to be got from simply changing American or Canadian policy?

**Rick Harris:** It's not true government policy is not important. What Mexico has done has been absolutely remarkable. That economy has opened up. They took tariffs from 75% down to the 10% range in a matter of two or three years. They had import licensing covering virtually the entire import-competing sector less than 7 years ago. For all intents and purposes, they were practising autarky. The problem with our models is that our data reflects the fact that we are picking up an economy that is in dramatic transition. The question is, what is the NAFTA going to do with respect to future trade flows? If Mexico becomes the Hong Kong of tomorrow, how will American trade policy respond? Under NAFTA there will be one type of response; without NAFTA there will be another type of response.

**Tim Kehoe:** The U.S. does not have capital controls. What has happened in Mexico is that, in almost all industries, petrochemicals and petroleum being the big exception, they've lifted restrictions on foreign ownership and capital inflows. So actually the debate we're having here doesn't so much revolve around the NAFTA. There has not been much information coming out of the negotiations but it seems an agreement will principally deal with tariffs and non-tariff trade barriers. The stories you hear that link that to capital flows to Mexico have to do with locking the Mexican government into [a liberal] policy. There are certainly other political forces in Mexico that are achieving greater power, and rightfully so in a maturing democracy, that disagree with the government and would oppose these policies. So if NAFTA prevents backsliding of this sort, that will encourage investment. As I tried to suggest, if the differences in return on capital are so large, it can't be the current 10% tariff that's keeping the capital out now. As the earlier question went, why isn't all U.S. manufacturing in Mexico already? One answer is they haven't had time to move but I don't think that's the whole answer.

**Colleen Morton:** Just a couple of comments: from the point of view of my members in the Mexico-U.S. business community, the perception is that there is a severe shortage of skilled labour in Mexico in certain sectors. Whether this is true or not, the perception is very powerful in terms of strategic planning about whether to shift resources into Mexico in certain types of manufacturing, assembly and services operations. My second comment is that I have to agree that, with or without a NAFTA, Mexico is going to grow, and grow phenomenally, and attract a lot of capital from everywhere. But, politically, there is a body of opinion in the U.S. that sees NAFTA as an opportunity to impose origin-of-capital restrictions, to essentially address the Japanese issue through a NAFTA by imposing on Mexico restrictions on origin of capital, so as to limit the ability of Mexico to operate as an export platform into the U.S. So even if capital flows do not explain the differential in productivity, that almost is irrelevant to the political process in the U.S., which is focussing on NAFTA as a way to address Japanese investment issues. That is creating sympathy for a Fortress

North America type of approach, which seems to me the most dangerous trend I see in the thinking of certain parts of the corporate community and also of the people who have traditionally been opposed to the NAFTA, because it has a lot of resonance in Congress.

**Drusilla Brown:** I am used to Rick saying interesting, exciting and challenging things; also, he has played an important role in advancing the debate on these issues. I have a couple of comments in response to [his argument] and one in support.

First, in terms of magnitudes, it's hard for me to believe that the kind of story he's telling could work. The real issue has to be limitations by the Mexican government in terms of capital inflows and that's a domestic policy, not a subject of the FTA. The problem can't be a consequence of high U.S. tariffs keeping Mexican exports out of the U.S. because the U.S. tariffs are too low — and too low on a multilateral basis, not too low on a bilateral basis. What we really need to keep in context is that the U.S. isn't the only market for Mexican output. The whole world is. When you're talking about this large surplus of Mexican labour it needs to be taken in the context of 4 billion other people in the world, not just the 250 million in the U.S. On the question whether this story strikes sympathetic vibrations in terms of my gut feelings, what doesn't seem to fit is that, given that Mexico has large supplies of unemployed workers, the problem is not that there is too little capital but that there is something dysfunctional going on in the labour market. Industrialization and the development of markets haven't penetrated completely in Mexico.

The second point is that economic historians so often focus on the role of industrialization and its backward linkages with education. Many people in economic history are increasingly sympathetic with the development strategy of looking at the U.S. and England during the industrial revolution and the role of protection in order to stimulate education through industrialization. The third point is that the Mexican government is clearly worried about elementary education, much more than in the U.S. and Canada. Though primitive literacy rates may be high, it's hard to imagine that the kind of human capital formation that is necessary for industrialization is present. The fourth point is that if Rick is right and all it is is capital, why would the whole issue of economic development have been such a frustrating and difficult issue over the last 30 years? If all you had to do is liberalize and allow foreign investment to come in to get this huge industrialization, surely we would have tried that already.

In support of Rick, I think the models actually suggest a lot of the sorts of things he's describing. I didn't draw attention to them because I'm a little uneasy about them and don't particularly understand them, but one of the results that came out of our model is that when you put capital into Mexico its rate of return rises relative to the source where that capital is coming from, which is very supportive of what Rick is saying, which is that the capital flows in these models are very much smaller than will emerge in equilibrium. Now the reason I didn't actually push it to equilibrium is that this is a linear model so I don't really know what's going on in the marginal conditions that determine how much capital is going to flow in. But, clearly, something like Paul

Krugman's notion of economic geography is going on here. The capital flows could be huge. We don't know where they're coming from but there's a very strong suggestion Rick is on the right track. But the models tell us that.