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**ECONOMIC EFFECTS OF NAFTA: EMPLOYMENT AND MIGRATION MODELLING  
RESULTS<sup>1</sup>**

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**1. Introduction**

Computable general equilibrium (CGE) models are used to highlight the complex interactions among economic variables. A CGE model can capture the upstream and downstream effects of a change in production levels or prices. For instance, a change in trade policy that makes the production of light manufactures in Mexico more profitable (raising the price Mexican producers receive on shipments to the United States, for instance, by cutting tariffs) will generate demand for goods used intensively as intermediates in such production. Conversely, as the price of light manufactures rises in response to the higher US demand, producers in Mexico that use light manufactures as inputs into further production will face higher costs.

CGE models can also capture changes in the demand and returns to factors of production. As Mexican production of light manufactures expands, labour demand rises. The increase in demand causes a rise in wages, and as more labour (particularly unskilled labour) relative to capital is bid away from other sectors, the return to capital may fall. The change in the allocation of income between labour and capital may have further ripple effects through the economy if the structure of demand is different for the different groups. Thus a CGE model presents a comprehensive and consistent answer to the question: What happens to the economy or economies in question if a certain policy change is implemented?

The CALNAFTA model places an emphasis on the trade links and concomitant flows of labour (in the form of migration) between Mexico and the United States, with California treated as a separate region. Simulations are used to demonstrate: *i*) the effects of free-trade and its relative importance compared with migration; *ii*) the implications of restrictive immigration policy, such as California's Proposition 187<sup>2</sup> and *iii*) the effects of increased foreign investment in Mexico and the effect of adopting greater equalisation of labour rights for immigrants.

## 2. Model description

The CALNAFTA model is a revised version of the model used in Hinojosa-Ojeda *et al.*, 1992 (see Appendix for a complete description). There are four regions: California, Mexico, rest of United States, and rest of world. Production is accomplished with capital, land, unskilled labour, and skilled labour, and allocated to one of eleven productive sectors. Unskilled labour is further segmented into rural unskilled (used in the production of corn and feed grains, other program crops, fruits and vegetables, and other agricultural products), and urban unskilled (used in producing output in the other seven sectors of each economy: oil, services, food processing, other light manufacturing, intermediate goods, consumer durables, and capital goods). Skilled labour is subdivided into unionised and non-union labour. Land represents agricultural land, and is used only in the production of agricultural output. Capital is used in production in all sectors.

As in most CGE models, factors flow freely within countries in response to any differential in rates of return, such that in equilibrium the rates of return are equal. Clearly, migration (whether domestic or international) is not a costless process. We thus build equilibrium differentials into the model, and migration only takes place when the benefits of migration, in terms of higher wages, exceed the costs. In an equilibrium without migration, the US urban unskilled wage would exceed the US rural unskilled wage, which would in turn dwarf the Mexican urban unskilled wage, which itself exceeds the Mexican rural unskilled wage. Thus the original source of all migration can be thought of as rural Mexico.

In that case, one might ask why all migrants do not head for the US urban unskilled labour market? In fact, given that wages in California are generally higher than in the United States as a whole, why don't all migrants go to California? The lure of the greater wage differential between Mexico and the United States is partially offset by the greater cost of cross-border migration and/or of the perceived social costs to having to live as an undocumented migrant. These relative benefit and cost functions are used in the model to test various assumptions of how immigrants might behave towards different policy approaches, such as Proposition 187 in California and increased wage growth in Mexico. In short, the model is parameterised on the initial data, with the initial levels of immigration and initial wage differentials taken to represent an equilibrium. This equilibrium differential may represent a number of different variables, including the cost (in both money and income foregone) of migration, the preference of Mexicans for Mexico (in other words working in the United States must confer a substantial wage premium over Mexico to induce migration) and discrimination based on undocumented status.<sup>3</sup>

Another unique feature of this model is the detailed and explicit treatment of not just tariffs and other trade barriers but the myriad of complex farm support programs in each country. Mexico, for example, used direct price supports for corn and program crops, in addition to credit subsidies, input (fertiliser, etc.) subsidies, and consumption subsidies, often with significant variation across crops. The United States has various export subsidies, initial deficit payments, and numerous other price, quantity, or land use controls. The cost and impact of each are calculated and incorporated into the model structure, and each is maintained as a separate policy variable.

Trade is motivated by the Almost Ideal Demand System (AIDS), a more robust functional form than traditional formulations. Along with the level of tariff protection, other direct and indirect tax rates are given as policy variables.

### *Scenarios and results*

The CGE modelling framework outlined above is designed to analyse the impacts of alternative scenarios of trade, migration and capital flows between Mexico, California and the rest of the United States. The scenarios which were generated for this paper are summarised in Table 1, and the impacts on real GDP, net migration, and factor returns of each scenario compared with various baseline scenarios are shown in Tables 2, 3 and 4. Below, a brief outline of the scenarios is provided and is followed by discussion of the results.

Scenario 1 sets all tariffs and subsidies on trade to zero and is compared to a baseline scenario which assumes the system of tariffs and quotas existing in the late 1980s and net migration based on current flows. The scenario therefore represents the hypothetical scenario of free-trade and can therefore be seen as approximating the impact of NAFTA and Mexican liberalisation policies.

- Scenario 1a calculates the impact of NAFTA and liberalisation whilst maintaining current migration levels, while scenario 1b calculates the same effect allowing net migration to change from current levels in response to the imposition of free-trade. In a sense, scenario 1b can be regarded as the current status quo and is used as the baseline in subsequent scenarios.

Scenario 2 simulates alternative assumptions about the full implementation of anti-immigration legislation (e.g., Proposition 187) and is compared to a baseline scenario of NAFTA, liberalisation and migration (*i.e.* scenario 1b).

- Scenario 2a) calculates the impact of the departure of all undocumented workers from California.
- Scenario 2b calculates the impact of the departure of all undocumented workers from the entire United States.
- Scenario 2c reports the possible impact if anti-immigration legislation does not result in the departure of undocumented immigrants but rather in a worsening of their employment conditions.

Scenarios 3 and 4 report impacts of increased investment and increases in the reservation wage of immigrant workers. As in scenario 2, the results in Tables 2, 3 and 4 are reported as changes in relation to scenario 1b.

- Scenarios 3a, 3b and 3c present the impacts of NAFTA combined with increases in rest-of-world investments in Mexico of 5 per cent, 10 per cent and 15 per cent respectively.
- Scenarios 4a, 4b and 4c are the same as scenarios 3a, 3b and 3c except that migrants reservation wage has been increased. The motivation for this is discussed below.

Scenario 1 illustrates that, compared with trade, migration is empirically more important in the economic link between the United States and Mexico. Scenario 1a shows the hypothetical effect of NAFTA in a world without immigration. By contrasting these results with those of scenario 1b, NAFTA with migration, one can clearly see the differential impact of the flow of labour in comparison with the flow of goods. Table 2 shows the impact on real GDP in the rest of the United States is more than two hundred times greater and nearly one hundred times greater for California.<sup>4</sup>

The quantity of additional migration occurring in this scenario is fairly large, with nearly 400 thousand migrants moving from rural Mexico to the rest of the United States, nearly 150 thousand coming to California, and more than 300 thousand migrating from rural to urban Mexico (Table 3). In both cases of international migration, migrants enter the rural and urban unskilled sectors in roughly the same proportions as the initial labour force, meaning that the vast majority enter the urban labour market.

Without migration, changes in factor returns in California due to free-trade are relatively minor. The main benefits accrue to agriculture in the rest of the United States, with a rise of nearly 1 per cent in the returns to rural labour (*i.e.* agricultural unskilled wages) and of nearly 0.5 per cent in the return to land (*i.e.* farmers incomes). Mexico, by contrast, would experience a sharp contraction in returns to these same two categories of about 5 per cent, combined with a modest increase in the return to capital of 0.5 per cent. With the migration option, wages of rural labour in Mexico rise slightly instead of declining by nearly 5 per cent, which would occur without migration. The inflow of workers depresses wages of unskilled workers in California and the rest of the United States.

Scenarios 2a and 2b simulate effective migration restrictions in California and the entire United States respectively, on top of the impact of NAFTA in scenario 1b. One way to interpret scenario 2a is to assume that the proponents of Proposition 187 get what they say they want and all undocumented migrants go back to Mexico and no more come to California. Thus not only does NAFTA not generate the additional 150 000 migrants we posit in scenario 1b, but the entire stock of undocumented migrants currently in California, estimated at 200 000 rural and 550 000 urban workers, return to Mexico. This turns out to hurt the economy of California, the tax base, and thus the fiscal health of the state. CGE models of course assume instantaneous and costless adjustments, with unskilled wages rapidly rising (43 per cent increase in returns for rural labour and a more modest 6 per cent for the unskilled in urban areas) to induce natives to take some of the vacated immigrant jobs. Even without adjustment costs, the wages required by US residents would still mean large price rises and a collapse in State GDP of 2.5 per cent (about \$25 billion). This economic crisis would hardly improve the fiscal status of the state, swelling deficits and/or reducing services to natives. Given the distribution of wealth, the fall in returns to capital of nearly 2 per cent would most likely affect the incomes of the more highly skilled and farmers would see falls in the return to land of 11.5 per cent.

The shocks are more muted for the rest of the United States, which keeps its migrants but loses some labour to California in response to the higher wages there. Perfect capital mobility between California and the rest of the United States ensures that capital income falls by the same 1.8 per cent across the nation. Strongly linked and highly elastic rural labour causes a similar increase in factor returns to rural labour. However less integrated urban unskilled labour markets see a much smaller wage rise of just over 2 per cent. Mexico experiences significant adjustments as well, with wages of urban elites (skilled workers and capital owners) all rising by about 2.5 per cent, and both rural and urban unskilled wages falling by more than 4 per cent.

Scenario 2b is similar to 2a, except that not only are all migrants expelled from California, a similar quantity (another three-quarters of a million workers) are deported from the rest of the United States as well. In this scenario we would expect large contractions in output and wage adjustments in all three regions. That is precisely what we see. Rural wages rise even more, up about 85 per cent over the base. Urban unskilled wages rise by an additional 6 per cent in California and 2 per cent in the rest of the United States over scenario 2a, for total increases of 11.6 per cent and 4 per cent over the

base. With the return to agricultural land tumbling by over 23 per cent, land values in rural California would collapse, with serious implications for the tax base and state and local government revenues.

It goes without saying that Mexico would face an enormous adjustment problem if an additional 1.5 million workers suddenly returned to the cities and the *campo*. Over 80 per cent of these workers (1.2 million) end up in the cities, to the delight of capitalists (earnings up 4.5 per cent), union labour (up 4.5 per cent) and profession labour (up 4.7 per cent). Wages for unskilled urban workers are driven down drastically (5.5 per cent), even more than rural wages (down 5.1 per cent).

Thus, if Proposition 187 is potentially as effective as some believe, California would be locked into a permanently lower path of output and income growth, especially if one considers the additional influence of declining population growth rate in the United States. Mexican real wages for unskilled workers, in both the poor rural sectors and politically important cities, would suffer a significant decline and acutely exacerbate social and political tensions in Mexico.

Scenario 2c simulates the possibility that Proposition 187 would not deter undocumented immigration and that the undocumented population in California would become increasingly marginalised. There is general agreement among researchers that this will be the more likely scenario since immigrants are not drawn to the United States due to a presumed availability of social services (Alarcón, 1995; Hinojosa and Schey, 1996). The employers of undocumented workers, traditionally strong supporters of Governor Pete Wilson, must also believe this to be the outcome or else they would have vocally opposed Proposition 187 in the same way they have opposed efforts to limit their access to undocumented labour in the past.

Scenario 2c simulates that a possible impact of anti-immigrant legislation like Proposition 187 would be that wages for undocumented immigrants would continue to fall, as they did after the passage of a weak employer sanctions law in 1986 (IRCA). The results in Table 2 show that this scenario would have a positive impact on California GDP. Table 4 shows that scenario 2c would also benefit the rate of profit of employers as well as the consumers of low wage goods. The ironic result is that since wages for undocumented workers fall, the demand for them will rise, resulting in even greater dependence on low wage labour by California employers. In fact, as Table 3 shows, immigration would rise in this scenario in contradiction to the aims of Proposition 187.

While this may seem a positive short term scenario for some sections of Californian society, there are some negative implications of Proposition 187 which are not captured by the CGE model. First, implementation of Proposition 187 may lead to increased, rather than reduced health-care costs in the long-run. Under Proposition 187 pregnant women will be denied prenatal care and children who have been abused or neglected will not receive social services. Immigrant adults and children with serious illnesses will be denied needed health care. Others, fearing deportation, will be deterred from seeking care when they need it. Illnesses susceptible to early treatment will deteriorate into life-threatening emergencies and communicable diseases will spread, endangering everyone's health. Medical experts point out that the cost of health care may skyrocket as health workers are mandated to provide expensive emergency services that could have been avoided by far less costly early intervention. However, Proposition 187 would in effect deny treatment when it is least costly and most effective. As a result, the Chief of Staff of the Los Angeles County Medical Center, the largest public hospital in California, has stated that while implementing Proposition 187 may save the state about \$9 million annually, the medical costs in emergency care and treatment of US citizens with communicable diseases will rise by \$47 million, leaving net costs of over \$38 million.

Second, Proposition 187 could lead to lower levels of human capital and additional public expenditure in the longer-term. One section of Proposition 187 bars undocumented children from attending public schools. Testimonials from teachers and educators throughout the country speak to the irreparable harm caused to children banned from attending school. As most undocumented children eventually become lawful permanent residents, and later US citizens, the long-term costs of implementing Proposition 187 on California are enormous. They will be largely unemployable, rely extensively on public support programs, and be far more likely to tax the criminal justice system. People who could have produced goods and services in California, adding to the production of wealth, will instead have fewer skills and contributions to offer.

Finally, there are implications for discrimination. If fully implemented, Proposition 187 mandates a vast state network of immigration informants comprising employees of public schools, medical clinics, social service agencies, and state and local law enforcement agencies, all of whom will be required to identify suspected deportable aliens and report them not only to the INS, but to high state officials as well. Those required to make decisions of "suspected" undocumented immigration status have no training to make such determinations. There can be no doubt but that race and national origin will often play a role in the classification of persons suspected of not possessing lawful immigration status, resulting in greater discrimination and higher social tension between those who "look like immigrants" and those who "look like they belong here."

### **3. Scenarios for alternative policies approaches**

It thus appears that full implementation of Proposition 187 may in fact lead to increased migration, and although short-run effects may be beneficial for some, there are negative implications in the longer-run. Given this somewhat contradictory outcome, it is essential to present an alternative vision for a more economically sound and humane immigration policy capable of mobilising broad political support on both sides of the border. The same bi-national framework which exposes the contradictions of Proposition 187 can be a guide for constructing a policy approach that can improve wages, working conditions, human rights, and economic growth in both the United States and Mexico.

Scenarios 3 and 4 report the possible impacts of different elements of an alternative policy approach to integration and immigration that would combine NAFTA with increased capital investments flows to Mexico and the introduction of a more liberal immigration regime that would guarantee equal labour rights to Mexican immigrants in the United States.

Scenario 3 presents the possibility that, as a result of NAFTA in combination with other regional mechanisms to increase investment, Mexico could experience a boom in capital inflows. What impact might substantial capital inflows have on migration flows? Will the "immigration problems" go away as capital inflows fuel more rapid growth of employment and incomes in Mexico?

To some extent, that appears to be true. Even five per cent increase of total investment reverses the flow of new immigration due to NAFTA, from a net inflow of nearly 650 000 to a net outflow of almost 165 000, from the United States as a whole (Table 3). This modest outflow of migrants has a small impact on GDP, reversing the 0.1 per cent gains from NAFTA in scenario 1b to small losses. As the amount of investment is increased to 10 per cent of total investment in scenario 4b, the impacts on GDP and wages are more significant. GDP losses for California and the rest of the United States are about 0.25 per cent each. Although unskilled wages in the United States rise by nearly 2 per cent,

wages for the two categories of skilled labour fall slightly. The large flows of returning migrants cause the same problems for Mexico as in scenarios 2a and 2b, but in greater magnitudes.<sup>5</sup>

Scenario 4 extends this scenario to include changes in the regime of labour rights of Mexican immigrants in the United States. The scenario we are attempting to simulate here is one where all immigrants in the United States, regardless of their immigration status, would be allowed the same ability to claim the full basic labour rights accorded to US citizens, including the right to organise and strike, protected legal standing to complain about working conditions, minimum wage, etc. One possible mechanism for this equalisation of immigrant/non-immigrant labour market status could be a special North American Work Visa.

We assume that under such a new regime of transnationally protected worker rights, Mexican immigrants would be in a position to demand better compensation from their employment or seek new employment, thereby closing the "10-15 per cent" difference in wages in the same way that recently legalised immigrants were able to achieve after the Immigration Reform and Control Act (IRCA). In scenario 4, we simulate this new immigrant rights regime by increasing the "reservation wage" that immigrants would use to compare their wages in Mexico with a wage in the United States in order to determine whether to migrate or not. The effect is to require the clearing of the US labour market for immigrants at a higher wage level in order to induce migration, an effect which would not only increase wages in the United States but reduce the demand for Mexican immigrants.

The results of scenario 4 suggest some interesting dynamics which point to a viable argument as to why such a regime of more liberal, yet labour-rights-based migration could be politically acceptable in the United States. First, Mexican migration would actually fall in the rights-based scenario compared to the status quo, even without any capital transfers to Mexico. Migrants would become more expensive and less of them would be used by capital. Second, if this new immigration regime were accompanied by an increase of capital transfers to Mexico as in scenario 3, reductions in migration would actually be less expensive to achieve. Less investment capital would be required to raise Mexican wages to a level where potential migrants would decide to remain in Mexico. Third, income inequality would improve in both the United States and, to a lesser degree, Mexico under this scenario compared to all others. Finally, scenario 4 could generate much greater reduction in levels of migration compared to the Proposition 187 approach without dramatic reduction in US economic activity and without a deterioration of a regime of rights in the United States, rather than their significant improvement.

#### 4. Conclusion

The results of these CGE simulations suggest a number of stylised facts. First, migration appears to be empirically far more important compared with trade in the economic link between the United States and Mexico, suggesting that the implications of immigration policy carry far more weight than policies directed at trade. Second, the simulations suggest that free-trade by itself is not sufficient to generate the type of development needed to close the income inequality gaps in North America and that more significant impacts are to be found in increased foreign investment. This suggests a degree of impotence in the effects of trade-liberalisation and the need for it to be combined with greater depth in agreements which create greater freedom of capital movement. Finally, the results of the CGE model and consideration of longer-term effects suggests that policy measures of the type included in Proposition 187 have the potential of being counterproductive both in terms of reducing undocumented migration and in terms of achieving economic growth.

Further simulations have shown that more successful outcomes are generated by a policy option centred on furthering long-term agreements on trade, capital, and labour migration relations, as well as creating a shared North American agreement on labour and human rights, all crafted with the clear goal of sustainable and equitable development. As the results of this CGE model suggest, if moderately high growth in Mexican investment has a positive impact on labour market outcomes for workers, the trend towards North American wage convergence would be powerful enough that potential migrants would begin to choose to stay in Mexico, even if US wages for immigrants also rise. Sustained growth in Mexico would also generate a large net increase in high wage US export jobs, as well as help close the gap between high and low wage labour in the United States.

The static nature of this CGE model inevitably leaves some issues unexplored. In particular, demographic trends raise important issues. Since the Mexican birth rate declined precipitously over the last 25 years, the number of new entrants into the labour force will also fall over the next decade. This suggests an increased importance for closing the poverty gap in the migrant sending regions of Mexico, thus preventing further loss of growth in the stock of human capital. Meanwhile, the US population is ageing and perhaps prompting the need for new immigrants to sustain growth and care for an older population, particularly in California (David Hayes-Bautista, 1992).

In conclusion, the top priority is thus not stopping US immigration but rather to improve the human capital and social conditions of those people who will have to carry California and the rest of the United States into the next century, exactly the opposite of what measures such as Proposition 187 will do. Economic and demographic realities between the United States and Mexico suggest that North America has the opportunity to adopt a new form of economic integration which could, if managed properly, produce a pattern of upward growth and convergence in productivity and income levels across North America.



## Appendix

### THE CALNAFTA CGE MODEL

The CALNAFTA CGE model is an 11-sector, four-country, computable general equilibrium (CGE) model composed of three single-country CGE models (of Mexico, California, and the rest of the United States), linked through trade and migration flows, plus a set of export-demand and import-supply equations to represent the rest of the world. The model is an extension of an earlier CGE model of the United States developed at the Department of Agriculture (USDA). A three-country (United States, Mexico, and rest of world) extension of the USDA model was initially developed by Hinojosa and Robinson (1991), who also introduced the use of domestic and international migration functions. That model was extended by Robinson *et al.* (1991) to include an explicit modelling of domestic farm programs in both the United States and Mexico. The CALNAFTA model is very close in structure to the model by Robinson *et al.*, but adds an additional 'country', California.

The core model follows the standard theoretical specification of trade-focused CGE models. Each sector (four of which cover agricultural products) produces a composite commodity that can be transformed according to a constant elasticity of transformation (CET) function into a commodity sold on the domestic market or into an export. Output is produced according to a CES production function in primary factors, and fixed input-output coefficients for intermediate inputs. The model simulates a market economy, with prices and quantities assumed to adjust to clear markets.

Supply in the market for each sector is generated by six primary factors of production: four types of labour, capital, and agricultural land. The aggregate quantity of each is determined exogenously. The four labour types are rural, urban unskilled, urban skilled, and professional. In factor markets, full employment for all labour categories is assumed. The model can incorporate different assumptions about factor mobility, and various labour markets are linked by migration flows. The results should be seen as reflecting adjustment in the long-run, with capital able to switch between sectors.

Domestic demand is comprised of consumption, intermediate demand, government expenditure, and investment. Consumer demand is based on Cobb-Douglas utility functions, implying fixed expenditure shares. Households pay income taxes to the government and save a fixed proportion of their income. Intermediate demand is given by fixed input-output coefficients. Real government demand and real investment are fixed exogenously.

Imports and exports are incorporated through the use of sectoral export supply and import demand functions for each country, and solves for a set of world prices that achieves equilibrium in world commodity markets. At the sectoral level, in each country, demanders differentiate goods by country of origin and exporters differentiate goods by country of destination. In the commodity markets, California is treated as a separate country, with relative prices that may differ from the rest of the United States.

Three key macro balances are maintained in each country model: the government deficit, aggregate investment and savings, and the balance of trade. Government saving is the difference between revenue and spending, with real spending fixed exogenously but revenue depending on a variety of tax instruments. The government deficit is therefore determined endogenously. Real investment is set exogenously, and aggregate private savings is determined residually to achieve the nominal savings-investment balance.<sup>6</sup> The balance of trade for each country (and hence foreign savings) is set exogenously, valued in world prices. In the case of California, the balance of

trade for California and the rest of the United States together is assumed fixed, but it is not fixed for each separately.

In determining equilibrium prices and quantities, each country model solves for relative domestic prices and factor returns which clear the factor and product markets, and for an equilibrium real exchange rate given the exogenous aggregate balance of trade in each country. The model determines two equilibrium real exchange rates, one each for the United States and Mexico, which are measured with respect to the rest of the world. The cross rate (United States to Mexico) is implicitly determined by an arbitrage condition. Of course, the United States-California exchange rate is fixed at one, so the California-Mexico exchange rate is the same as the United States-Mexico rate. The GDP deflator defines the numeraire in each country model, and the currency of the rest of the world defines the international numeraire.

Four types of elasticity parameters are used in the model. The production specification requires sectoral elasticities of substitution among primary factors. The CET export supply functions require elasticities of transformation between goods sold on the home and export markets. The Almost Ideal Demand System import demand functions require sectoral income elasticities and substitution elasticities for home goods and for goods from each import source. We have drawn on estimates and guesstimates from various studies, including Hinojosa and Robinson (1991). In lieu of econometric estimation, sensitivity analysis was carried out to check for the robustness of the model results using alternative elasticity parameters.

The fully parameterised model is applied to data relating to the late 1980s. The base year for Mexico is mostly 1988.<sup>7</sup> The United States and California use a 1987 base year because of the severe contraction of agricultural output following the 1988 drought. All bilateral trade flows are from 1988. Tariffs and tariff equivalents of quotas are 1988 trade-weighted rates. Therefore where simulations incorporate tariffs and quotas, they are essentially describing a pre-NAFTA scenario.

## 1. Import demand equations

The standard approach in trade-focused CGE models is to assume that domestic and imported goods are imperfect substitutes and to specify a constant elasticity of substitution (CES) import aggregation function.<sup>8</sup> In the case of a multi-country model, the function aggregates imports from all countries of origin. In the simplest case, the CES function is extended to include goods from many countries, with the substitution elasticity assumed to be the same for all pairwise comparisons of goods by country of origin.<sup>9</sup> The first-order conditions define import demand as a function of relative prices and the elasticity parameter.

The use of CES functions in multi-country Armington trade models has led to empirical problems due to the restrictive nature of the CES functions. Instead of the CES import aggregation function, we use import demand equations based on the Almost Ideal Demand System (or AIDS). The AIDS function is a flexible functional form in that it can generate arbitrary values of substitution elasticities at a given set of prices, and also allows expenditure elasticities different from one. Various restrictions on the parameters of the model are required to have the system satisfy standard properties of expenditure functions such as symmetry, homogeneity, adding up, and local concavity. We calibrated the parameters for the CALNAFTA model by starting from a set of expenditure elasticities and substitution elasticities for each sector in each country. Higher substitution elasticities for goods traded between the United States and California are specified, and lower elasticities are specified for trade with Mexico and the rest of the world.<sup>10</sup> Because each sector in the model consists of composite goods aggregate prices need to be used. These were generated by a translog index.<sup>11</sup>

## 2. Migration

The CALNAFTA model specifies a number of labour migration flows: rural Mexico to rural United States and rural California; urban unskilled Mexico to urban unskilled United States and California; internal migration

within Mexico from rural to unskilled urban labour markets; and migration between rural and urban unskilled between the United States and California. Migration is assumed to be a function of wage differentials between the linked labour markets. In equilibrium, migration levels are determined which maintain a specified ratio of real wages for each labour category in the countries, measured in a common currency, and a specified ratio of real wages between the rural and unskilled urban markets in Mexico.

An implication of this specification of Mexican-US-California migration flows is that real wages measured in a common currency are equated, but they can grow at different rates measured in the domestic currency. It is therefore possible to observe migrants between Mexico and the United States/California moving from a labour market where real wages are rising to one in which they are falling in domestic currency terms. The issue is in the specification of what motivates migrants. For example, if they are motivated by the desire to accumulate savings which they intend to repatriate, then migration will be sensitive to the exchange rate. On the other hand, if they are motivated by observations on relative changes within the two economies then migration could be expected to be insensitive to the exchange rate. The model probably overstates the sensitivity of migration to the exchange rate, generating a backward flow of migrants into Mexico when the Mexican peso appreciates.

Migration flows generated by the CALNAFTA model refer to changes in migration from a base of zero. They should be seen as additional migration flows due to the policy change, adding to current flows. Note also that these additional flows are those generated by economic incentive (*i.e.* workers or heads of households) and therefore do not include associated flows of dependants.

### 3. Agricultural programs

Five of the sectors in the model are agricultural, four are groups of primary products, and there is one intermediate food-processing sector. Particular attention has been given to the complex set of trade policies and domestic agricultural programs, as these policies distort production, consumption and trade, and require significant fiscal expenditures in both Mexico and the United States. Mexican agricultural program expenditure in 1988, totalling \$1.6 billion, represented over one-half of total national subsidy expenditure, and equalled almost one per cent of GDP.<sup>12</sup> In the United States, deficiency payments and expenditures on the export enhancement program (EEP) in 1987 totalled \$11.5 billion, or one per cent of government spending and 10 per cent of the fiscal deficit. Note that the policies described in the model relate to those existing at the end of the 1980s.

The agricultural policies are modelled either as price wedges, which affect output decisions, or lump-sum income transfers. The wedges and transfers are either specified exogenously or determined endogenously, based on the institutional characteristics of the program being modelled.<sup>13</sup> California is assumed to have the same agricultural policies as the rest of the United States. Note that because the model assumes there is imperfect substitution between domestic and foreign goods, the link between trade and domestic prices is weaker than a model where all goods are perfect substitutes.

Six Mexican policies are modelled. In the four agricultural sectors, these are input subsidies, tariffs, and quotas. In the food processing sector, we model direct subsidies and price subsidies, in addition to tariffs and quotas. The sixth Mexican policy is the low income, or tortilla, subsidy. Note that one of the main motivations for the systems of tariffs and quotas is the maintenance of targets for domestic farm prices and controlled retail prices for almost all basic foods.

Two US farm programs are included in the model, the 'deficiency payments program' and the Export Enhancing Program (EEP). The deficiency payments program provides payments to farmers who participate in feed grain, wheat, rice, or cotton programs. The EEP program is intended to counter competitors' subsidies and other unfair trade practices in targeted US agricultural export markets, and to develop, expand, or maintain foreign markets.

## NOTES

1. Limitations of space dictate that this paper be presented here in its shorter form..
2. Proposition 187 is a piece of Californian legislation comprising a series of measures aimed at illegal aliens. The Proposition was approved by public vote in November 1986 and consists of five major sections, each of which can be implemented separately:
  - barring of illegal aliens from public education systems and requires public education institutions to verify the legal status of both students and their parents;
  - providers of all publicly-paid, non-emergency health-care services must verify the legal status of persons seeking services in order to be reimbursed by the state of California. In this regard, the implication that prenatal care may be denied to illegal alien women has been particularly controversial;
  - requires that all persons seeking cash assistance and other benefits must verify their status before receiving benefits;
  - all service providers must report suspected illegal aliens to California's Attorney General and to the Immigration and Naturalisation Service (INS) and police must determine the legal status of persons arrested;
  - the making and use of false documents is a state felony.

In fact, the core provisions of Proposition 187 have not been implemented as a result of a series of successful court challenges. The latest of these was in March 1998 when US District Judge, Mariana Pfaelzer, declared the core provisions of the Proposition as unconstitutional on the grounds that the US constitution gives the federal government exclusive power to regulate immigration.
3. For a full description of these effects in a slightly different modelling context, see Hinojosa and McCleery (1992).
4. Note that these are GDP numbers, not welfare gains. In particular, the higher US GDP due to NAFTA and immigration may lead to a lower GDP/capita figure, given the relatively low skill level of the immigrants. Is the United States really better off? A side calculation indicates that prior US residents clearly are better off. If one takes the increase in US GDP of nearly \$5 billion (0.1272 per cent of 3 875.3 billion) and subtracts net wages paid to new immigrants (approximately 400 000 new immigrants at \$10 000 each), there is a welfare gain of a billion dollars. This dwarfs the gain of \$20 million (an increase of 0.0005 per cent over the base rest of US GDP of \$3875.3 billion) from trade alone.
5. At the higher levels of investment, the impact on migration, and thus on wages in both countries, appears to be exaggerated. We need to carefully analyse and perhaps revise the implicit migration elasticities in the model.
6. Enterprise savings rates are assumed to adjust to achieve the necessary level of aggregate savings in each country. In the CGE literature, this treatment is known as Johansen macro closure, after Lief Johansen, who used it in the earliest single-country CGE model.

7. Some of the Mexican agricultural support data refer to 1989.
8. The properties of single-country CGE models incorporating CES import aggregation functions have been extensively studied.
9. Other generalisations of the CES function could allow different, but fixed, elasticities of substitution between goods from different countries. It is also common to use nested CES functions, with a two-good CES function specifying substitution between domestically produced goods and a composite of imports, which is itself a CES function of goods from various countries of origin.
10. We drew on work at the International Trade Commission for estimates of the various elasticities.
11. The geometric price index is usually called a Stone index.
12. This total represents agricultural expenditures for 1989 and subsidies to food processing for 1988.
13. The policies are modelled as in the US-Mexico model Robinson *et al.* (1991), where the policies are described in detail.

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Table 1. Scenario description

| Scenario | Description   |
|----------|---|
| 1a       | NAFTA - All tariffs and subsidies set to Zero. No migration |
| 1b       | 1a plus migration   |
| 2a       | Migrants expelled from California                           |
| 2b       | Migrants expelled from the United States and California     |
| 2c       | Migrants allowed to stay in California but wages reduced    |
| 3a       | Mexican total investment increased by 5 per cent            |
| 3b       | Mexican total investment increased by 10 per cent           |
| 3c       | Mexican total investment increased by 15 per cent           |
| 4a       | 3a plus increase in migrants' reservation wage              |
| 4b       | 3b plus increase in migrants' reservation wage              |
| 4c       | 3c plus increase in migrants' reservation wage              |

Table 2. Real GDP  
(Percentage change from base)

|               | 1a     | 1b     | 2a      | 2b      | 2c     | 3a      | 3b      | 3c      | 4a      | 4b      | 4c      |
|---------------|--------|--------|---------|---------|--------|---------|---------|---------|---------|---------|---------|
| United States | 0.0005 | 0.1272 | -0.3878 | -0.7755 | 0.4080 | -0.0393 | -0.2580 | -0.4461 | -0.2642 | -0.4386 | -0.6191 |
| California    | 0.0014 | 0.1104 | -1.2056 | -2.4926 | 0.3518 | 0.0339  | -0.2222 | -0.3845 | -0.2270 | -0.3759 | -0.5325 |
| Mexico        | 0.2284 | 0.0648 | 0.5385  | 0.7786  | 0.2635 | 0.1097  | 0.1239  | 0.1205  | 0.3979  | 0.4090  | 0.3714  |

Source: NAID CalNAFTA CGE Model.

Table 3. Net change in migration  
(Thousands)

|   | 1a   | 1b     | 2a      | 2b        | 2c     | 3a      | 3b      | 3c        | 4a      | 4b        | 4c        |
|---|------|--------|---------|-----------|--------|---------|---------|-----------|---------|-----------|-----------|
| USMIGAG<br>Migrants to US rural sector  | 0.00 | 18.40  | -200.22 | -400.00   | -57.75 | 6.16    | -15.16  | -30.25    | -24.38  | -35.10    | -45.91    |
| USMIGURB<br>Migrants to US urban sector | 0.00 | 370.03 | -550.00 | -1 100.00 | 183.61 | -125.63 | -773.30 | -1 330.23 | -785.26 | -1 303.61 | -1 841.61 |
| CAMIGAG<br>Migrants to CA rural sector  | 0.00 | 7.25   | -200.00 | -200.00   | 64.60  | 4.05    | -2.99   | -7.39     | -6.19   | -9.24     | -12.28    |
| CAMIGURB<br>Migrants to CA urban sector | 0.00 | 140.90 | -550.00 | -550.00   | 977.72 | -49.01  | -293.44 | -504.36   | -298.18 | -494.94   | -698.55   |
| MXMIG<br>Migrants in MX urban sector    | 0.00 | 305.90 | -9.62   | -273.29   | 267.81 | 176.58  | -74.78  | -245.59   | -256.27 | -420.61   |           |

Source: NAID CaNAFTA CGE Model.

Table 4. Return to factors  
(Percentage change from base)

|                        | 1a     | 1b     | 2a      | 2b      | 2c     | 3a      | 3b      | 3c      | 4a      | 4b      | 4c      |
|------------------------|--------|--------|---------|---------|--------|---------|---------|---------|---------|---------|---------|
| <b>United States</b>   |        |        |         |         |        |         |         |         |         |         |         |
| Capital                | -0.040 | 0.057  | -1.790  | -3.602  | 0.181  | -0.045  | -0.119  | -0.193  | -0.130  | -0.215  | -0.277  |
| Rural labour           | 0.860  | -0.917 | 42.993  | 85.566  | -2.877 | 0.277   | 1.907   | 3.292   | 2.715   | 3.644   | 4.607   |
| Urban unskilled labour | -0.050 | -0.917 | 2.041   | 4.040   | -2.877 | 0.277   | 1.907   | 3.291   | 1.919   | 3.210   | 4.555   |
| Union labour           | -0.041 | 0.054  | -0.526  | -1.097  | 0.198  | -0.050  | -0.122  | -0.202  | -0.142  | -0.218  | -0.286  |
| Professional           | -0.044 | 0.048  | -0.482  | -1.011  | 0.181  | -0.050  | -0.113  | -0.187  | -0.135  | -0.202  | -0.266  |
| Land                   | 0.425  | 0.585  | 6.805   | 13.477  | 0.744  | 0.585   | 0.346   | 0.266   | 0.239   | 0.133   | 0.053   |
| <b>California</b>      |        |        |         |         |        |         |         |         |         |         |         |
| Capital                | -0.030 | 0.053  | -1.789  | -3.601  | 0.189  | -0.047  | -0.124  | -0.201  | -0.136  | -0.218  | -0.283  |
| Rural labour           | 0.006  | -0.917 | 43.013  | 85.606  | -2.877 | 0.277   | 1.907   | 3.291   | 2.715   | 3.644   | 4.607   |
| Urban unskilled labour | -0.020 | -0.917 | 5.699   | 11.566  | -2.877 | 0.277   | 1.907   | 3.291   | 1.919   | 3.210   | 4.554   |
| Union labour           | -0.014 | 0.054  | -0.535  | -1.113  | 0.198  | -0.022  | -0.122  | -0.202  | -0.142  | -0.218  | -0.286  |
| Professional           | -0.012 | 0.048  | 0.143   | 0.375   | 0.181  | -0.012  | -0.113  | -0.187  | -0.134  | -0.202  | -0.266  |
| Land                   | 0.013  | 0.188  | -11.527 | -23.283 | 0.705  | -0.235  | -0.651  | -1.054  | -0.678  | -1.034  | -1.390  |
| <b>Mexico</b>          |        |        |         |         |        |         |         |         |         |         |         |
| Capital                | 0.515  | 0.315  | 2.307   | 4.538   | 0.444  | -0.642  | -1.757  | -2.843  | -0.397  | -1.460  | -2.555  |
| Rural labour           | -4.611 | 0.981  | -4.264  | -5.146  | -0.922 | -4.347  | -10.645 | -16.510 | -11.465 | -16.925 | -22.680 |
| Urban unskilled labour | 0.284  | 0.982  | -4.423  | -5.466  | -0.923 | -4.347  | -10.645 | -16.510 | -7.391  | -12.850 | -18.606 |
| Union labour           | 0.463  | 0.298  | 2.398   | 4.475   | 0.397  | -0.752  | -2.003  | -3.164  | -0.585  | -1.745  | -2.912  |
| Professional           | 0.435  | 0.264  | 2.522   | 4.752   | 0.364  | -0.704  | -1.851  | -2.917  | -0.516  | -1.585  | -2.657  |
| Land                   | -5.724 | -6.761 | -2.617  | 5.467   | -6.271 | -10.501 | -12.822 | -16.324 | -8.431  | -11.719 | -15.463 |

Source: NAID CalNAFTA CGE Model.