Modeling the Dynamic Effects of Trade and Foreign Investment Liberalization

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ABSTRACT

Policies governing trade and foreign investment can have important effects that are not captured by static applied general equilibrium (GE) models. Most importantly, such policies can affect changes in efficiency, measured as total factor productivity (TFP). Numerical experiments using a simple dynamic applied GE model indicate that fluctuations in TFP are the primary determinants of macroeconomic fluctuations in Mexico over the period 1980-2002. Furthermore, trade and foreign investment liberalization can change incentives for both domestic savings and foreign investment, thereby changing the rate of capital accumulation. Each of these two sets of effects can alter both the rate of economic growth in an economy and relative prices and can dwarf the effects analyzed by static applied GE models.

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1. INTRODUCTION

Trade and foreign investment policies can have large impacts that are not captured by static applied general equilibrium (GE) models. Most importantly, these policies can affect the rate of growth of productivity. Furthermore, they can affect incentives for domestic savings and foreign investment, thereby changing the rate of capital accumulation. Each of these two sets of effects can alter the rate of growth in an economy and dwarf the effects analyzed by static applied GE models. Kehoe (1994) stresses this point in analyzing the impact of the North American Free Trade Agreement (NAFTA) on the Mexican economy. Static applied GE models capture the efficiency gains from the reallocation of resources across sectors in response to changes in relative prices. Even here, however, there are potentially large impacts of policy changes that are not captured by static models. The large capital inflows that often accompany liberalization produce an initial appreciation of the real exchange rate followed by a later depreciation. These exchange rate movements are changes in relative prices generated by the initial reallocation of resources from the traded goods sector to the nontraded goods sector and the later reallocation back to the traded goods sector.

2. BIG QUESTION: WHAT DRIVES CHANGES IN PRODUCTIVITY?

The key to modeling not just economic growth but large economic fluctuations like depressions is modeling changes in productivity. Bergoeing, Kehoe, Kehoe, and Soto (2002) study the depressions that began in Chile and Mexico in the early 1980s and the different paths that these two economies followed afterward, with Chile growing rapidly and Mexico mired in crisis or stagnation until 1995. Bergoeing et al. conclude that the differences in the recovery paths of Chile and Mexico were due to differences in the paths of total factor productivity (TFP) rather than to differences in the inputs of labor or capital. They argue that these differences in productivity were due to Chile’s earlier reforms in banking and bankruptcy procedures, which generated a distribution of firms with higher productivity than that of the distribution of firms in Mexico. In both countries, fiscal reforms in the mid to late 1980s led to increases in investment, but this increased both recovery paths rather than causing the two paths to differ.

We focus the relevance of the research of Bergoeing et al. for applied GE analysis very tightly as a challenge to modelers of NAFTA. Using a simple dynamic applied GE model, we argue that, by exogenously incorporating the evolution of TFP, we capture the determinants of
most of the macroeconomic fluctuations that occurred in Mexico over the period 1980-2002. The changes in trade flows and foreign investment associated with NAFTA are relevant to the extent that they determine productivity, not aggregate employment or investment. To make the point bluntly, and perhaps a little crudely: if NAFTA was not important for TFP in Mexico, then it was not important in determining macroeconomic fluctuations there.

It is worth noting that Trefler (2001) finds that the major impact of the Canada-U.S. FTA on Canada was in changing the distribution of firms in terms of size and productivity. Trefler argues that the change in the distribution of firms that occurred in Canada did not match the predictions of applied GE models of NAFTA that relied on the Dixit-Stiglitz (1977) theory of industrial organization.

We modify the closed economy model of Bergoeing, Kehoe, Kehoe, and Soto (2002) to include fluctuations in the trade balance. The feasibility constraint in this economy is

\[ C_t + K_{t+1} - (1 - \delta)K_t + X_t = Y_t = A_t K_t^\alpha L_t^{1-\alpha}. \]

Here \( C_t \) is aggregate consumption, both private and public; \( K_t \) is capital; \( K_{t+1} - (1 - \delta)K_t \) is gross investment; \( \delta K_t \) is depreciation; \( X_t \) is the trade balance; \( Y_t \) is GDP; and \( L_t \) is the labor input measured in hours worked per year. Following Bergoeing et al., we set \( \delta = 0.050 \) and cumulate investment to calculate the capital stock,

\[ K_{t+1} = I_t + (1 - \delta)K_t, \]

and then set \( \alpha = 0.300 \) to calculate TFP,

\[ A_t = \frac{Y_t}{K_t^\alpha L_t^{1-\alpha}}. \]

We model fluctuations in \( A_t \) as exogenous. The point is not that we as applied GE modelers should want to take changes in productivity as exogenous, but precisely the opposite: if a model with changes in TFP treated as exogenous accounts for most macroeconomic fluctuations, then we know that it is changes in TFP that we need to explain!

The stand-in consumer chooses sequences of consumption, capital, and hours worked to maximize the utility function

\[ \sum_{t=1986}^{\infty} \beta^t \left[ \gamma \log C_t + (1 - \gamma) \log (\ln Y_t - L_t) \right]. \]
subject to the budget constraint in each period,

$$C_t + K_{t+1} - K_t = w_tL_t + (1 - \tau_t)(r_t - \delta)K_t + T_t - X_t$$

and an initial condition on capital, $K_{1980}$. Here $\bar{h}$ is the number of hours available, assumed to be 100 hours per week, 52 weeks per year for working age (15-64) persons; $N_t$ is the working age population; $(\bar{h}N_t - L_t)$ is leisure; $r_t$ and $w_t$ are the marginal products of production function $A_tK_t^\alpha L_t^{1-\alpha}$ with respect to $K_t$ and $L_t$; $\tau_t$ is the tax rate on capital income; and $T_t$ is a lump-sum transfer that, in equilibrium, equals tax revenue $\tau_t(r_t - \delta)K_t$.

Using the first-order conditions for the labor-leisure decision from the consumer’s problem, we follow Bergoeing et al. in using 1960-1980 data — that is, data are not from the period that we study — to estimate $\gamma = 0.304$. Setting $\beta = 0.985$, we use the first-order condition for the consumption-investment decision to estimate a constant tax distortion $\tau_t = 0.455$.

Figure 1 presents the results of four numerical experiments in which the sequences of $N_t$, $A_t$, and $X_t$ are treated as exogenous. In each, $N_t$ and $A_t$ grow at their trend growth rates 1980-2002 after 2002, $X_t$ shrinks to 0 at a constant rate after 2002, and the equilibrium is assumed to converge to its balanced growth path by 2030. In the base case, we set the trade balance and TFP equal to their values in the data over 1980-2002, and we impose a tax reform that unexpectedly lowers the tax rate to $\tau_t = 0.133$ in 1988.

The base case experiment does well in tracking the performance of the Mexican economy 1980-2002 because captures well the endogenous responses of the economy to the exogenous fluctuations that we have imposed in the trade balance, the tax rate, and TFP. The three other experiments examine the relative importance of incorporating each of these three exogenous sources of fluctuations by eliminating each one separately, one at a time.

In the experiment “constant trade balance,” we maintain the trade balance constant at its average value over 1980-2002. Contrasting the results of this experiment with those of the base case, we observe that incorporating the evolution of the trade balance in the model — even its violent fluctuations in 1981-1984 and 1994-1996 — has relatively little impact on the evolution of GDP. That fluctuations in the trade balance have little impact on the equilibrium of our one-
sector model does not imply that the corresponding fluctuations in foreign investment played no role in determining economic fluctuations in Mexico over 1980-2002. Fluctuations in foreign investment can have large effects on relative prices and the allocation of resources across traded and nontraded goods sectors. It is just that whatever impact these fluctuations have at a macroeconomic level works primarily through fluctuations in productivity rather than through fluctuations in aggregate employment or investment.

In the experiment “no tax reform,” we do not lower the tax rate in 1988. Contrasting the results of this experiment with those of the base case, we see that incorporating the fiscal reforms of 1987 and 1989 in the model has a relatively large impact on the equilibrium. We follow Bergoeing et al. in modeling these reforms as a fall in the tax rate in 1988, using the first-order conditions for the consumption-investment decision and 1988-2002 data to estimate a new value for $\tau_r$. Observe that, if liberalization of foreign investment had an impact on incentives to accumulate capital, it may have been responsible for some of the estimated fall in the effective tax on capital income.

In the experiment “constant TFP growth,” we model TFP as growing at its 1960-1980 trend. Notice that, if we do not incorporate the TFP path in the data, we lose almost all ability to account for fluctuations even though we have incorporated changes in the trade balance and in taxes. The message is clear: if changes in trade flows and capital flows into Mexico had important effects on macro aggregates, then these effects had to operate through productivity and not just by loosening the feasibility constraint or altering aggregate employment or investment.

3. WHERE DO WE GO FROM HERE?

Trade flows and capital flows affect productivity by reallocating resources across sectors and by reallocating resources across firms within a sector.

Fernández de Córdoba and Kehoe (2000) use a model with a traded goods sector and a nontraded goods sector to analyze Spain’s 1986 entry into what was then the European Community. Similar models have been used by Bajona and Chu (2003) to analyze China’s accession to the World Trade Organization and by Bems and Jönsson (2002) to analyze trade and foreign investment liberalization in the Baltic countries. In response to liberalization, capital flows into the country, and resources flow from the traded goods sector to the nontraded goods sector, causing the relative price of the nontraded good to rise — a real exchange rate
appreciation. Later, as the economy starts to run trade surpluses to repay the rest of the world for its earlier trade deficits, resources flow from the nontraded goods sector to the traded goods sector, causing the relative price of nontraded goods to fall — a real exchange rate depreciation. Fernández de Córdoba and Kehoe argue that a calibrated model needs to include frictions on the movements of factors from the one sector to another to produce the sorts of changes in relative prices observed in the data. Combining these frictions with sudden changes in the trade balance, like that in Mexico in 1995 — which force resources to move rapidly from one sector to another — has the potential to explain sudden drops in aggregate productivity.

An even more promising, but more difficult, approach to modeling the impact of changes in trade and foreign investment policies on productivity would incorporate heterogeneity among firms within different sectors, following Lucas (1978) and Hopenhayn (1992). Policy changes that induce resources to flow from inefficient firms to efficient firms increase TFP. Some first steps in constructing trade models with heterogeneous firms have been taken by Bernard, Eaton, Jensen, and Kortum (2003) and Melitz (2003). A crucial ingredient in this sort of model is the decision by firms whether or not to export. Rolleigh (2003) finds that a model with firms with heterogeneity in productivity and in the fixed costs of exporting can do better than static applied GE models in accounting for the increase in trade after the implementation of NAFTA and the distribution of this increase across sectors. Ruhl (2003) uses a dynamic stochastic model with heterogeneous firms that solve dynamic programming problems in which the crucial decision is whether or not to pay the fixed costs of exporting. He finds that firms respond differently to business cycle shocks that cause fluctuations in the real exchange rate than they do to policy changes that permanently change the costs of trading. This finding potentially explains why static models with Armington elasticities estimated using fluctuations in relative prices at the business cycle frequency failed miserably in predicting the huge increase in trade volume that accompanied the policy changes in NAFTA.

Reflecting on the poor performance of the static applied GE models used to study the impact of NAFTA, Kehoe (2003) conjectures that the biggest effect of liberalization of trade and foreign investment is on productivity — through changing the distribution of firms and encouraging technology adoption — rather than the effects analyzed by static applied GE models. A lot more research is needed.
REFERENCES


Figure 1
Real GDP per Working Age Person in Mexico

- Base case
- Constant TFP growth
- Constant trade balance
- No tax reform

Index (1980=100)