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Morocco and the US Free Trade Agreement: A specific factors model with unemployment and energy imports

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ABSTRACT

This paper examines the impact in Morocco of its pending free trade agreement with the US in a specific factors model with unemployment and energy imports. Projected price scenarios across eight industries lead to adjustments in outputs, energy imports, rural wages, urban wages, and the unemployment rate. The model predicts substantial adjustments for reasonable price scenarios. Rural wages fall unless agriculture is subsidized. Unemployment, assumed inversely related to output, is sensitive to price changes. Factor substitution only affects the degree of output adjustments. Adjustments in capital returns lead to industrial investment and subsequent long run output adjustments.

The US Morocco Free Trade Agreement USMFTA promises to eliminate trade barriers between the two countries over a period of 25 years. Morocco will import more agricultural products, manufacturing, telecommunications, and financial services from the US. The net gains from trade, however, will come with economic adjustments. Brown, Kiyota, and Stern (2005) predict that USMFTA will have small employment effects in Morocco. The present specific factors model separates urban from rural labor, adds energy imports, and finds more substantial effects. Adjustments in energy imports and outputs across the eight industries are also substantial under various price scenarios.

The model includes unemployment in the urban sector based on Okun's (1962) law linking the unemployment rate to output. The present application is the first to include Okun's law in a general equilibrium model as developed by Thompson (1989). The model of production and trade developed is developed by Jones (1965), Jones and Scheinkman (1977), Chang (1979), Takayama (1982), and Thompson (1995).

The present specific factors model includes eight industrial capital inputs with urban labor, rural labor, and imported energy mobile between industries. There is ample motivation to include energy imports, critical to the economy of Morocco. Separate adjustments in the returns to industrial capital lead to long run investment and output adjustments. The paper includes sensitivity analysis for a number of assumptions including the degree of factor substitution and various price change scenarios.

The World Bank ranks Morocco as a middle income developing country. Morocco is similar to California in both land area and has a population of 34 million. About half the labor force is rural with very low wages. Labor intensive agriculture accounts for one fifth of GDP and one third of export revenue. Urban wages are much higher but unemployment is endemic. The economy is fairly diversified. Morocco has about two thirds of global phosphate reserves and is the third largest producer. Mining accounts for 6% of GDP and includes barite, cobalt, fluorspar, and lead. Tourism is the second source of foreign exchange following remittances. Table 1 lists the major merchandise trade categories. Leading imports from the US are aircraft, soybeans, corn, and wheat.

Morocco has been integrating into the global economy with privatization, more transparent business regulation, and open foreign investment (USITC, 2004). Economic and trade ties are mostly with the EU due to proximity and history. France, Portugal, and Spain account for almost all foreign direct investment. USMFTA is likely to increase investment from the US.

Table 2 summarizes tariff rates in Morocco and the US. Tariff rates in Morocco are quite high. Tariff rate quotas on agricultural imports reach over 300%. The average tariff rate on US imports is over 20% suggesting sizeable industrial price changes under USMFTA.

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Table 1
Merchandise trade in Morocco, 2005.

Exports	$mil	Imports	$mil
Apparel & footwear	2616	Computers	3576
Fish & shellfish	918	Yarn & fabric	1483
Electronics	883	Petroleum	1386
Inorganic chemicals	471	Machinery	906
Phosphates	364	Cereals	749
Fertilizer	332	Motor vehicles	582
Petroleum	286	Medicines	181
Exports to the US	446	Imports from the US	481
Total merchandise	11,190	Total merchandise	20,790

The first section below presents the model, followed by sections on the data and the comparative static elasticities. The fourth section discusses projected price scenarios followed by a section on the resulting economic adjustments in the specific factors model. A sixth section considers sensitivity analysis and long run adjustments due to industrial investment.

1. The specific factors model with unemployment and energy imports

The present model assumes neoclassical production with competitive markets for products and factors of production. Each of the eight industries has its own capital input K_j. Shared inputs are urban labor L_U, rural labor L_R, and imported energy E. Industrial prices p_j are projected to change in USMFTA leading to comparative static adjustments in the urban wage w_U, rural wage w_R, industry capital returns r_j, outputs x_j, national output Y, and the unemployment rate u. The model extends to the effects of long term industrial investment responding to adjusting capital returns in USMFTA.

Okun's (1962) law is the regular empirical relationship between the unemployment rate u and output Y. Prachowy (1993), Moosa (1997), Apel and Jansson (1999), Cuaresma (2003), Knotek (2007), and Malley and Molana (2008) find evidence of Okun's law across a wide range of countries and time periods. Okun's law is stated

$$du = -\beta Y', \tag{1}$$

where ′ represents percentage change.

The International Monetary Fund (2010) reports that the average β has increased during the recent decades, from 0.25 during the 1990s to 0.36 in the 2000s after some decline in the 1980s. Spain has the highest β at 0.8. Sweden and the UK have high β's reflecting labor market reforms. Norway and Denmark have the lowest β's. France, Germany, Italy, and the US have average β's with high volatility.

Output Y is exhausted by factor payments,

$$Y = w_U N + w_R L_R + eE + \Sigma_j r_j K_j, \tag{2}$$

where N is the number of employed urban workers, e is the international price of imported energy, and K_j is the capital input in industry j.

The endogenous unemployment rate u is linked to the endogenous number of employed urban workers N according to $N = (1 - u)L_U$ implying

$$N' = L_U{}' + (1–u)^{-1} du. \tag{3}$$

The first equation in the comparative static system (9) below is based on full employment of urban labor, $N = \Sigma_j a_{Uj} x_j$ where a_{Uj} is the cost minimizing amount of urban labor per unit of output in industry j. Differentiate to find $dN = \Sigma_j x_j da_{Uj} + \Sigma_j a_{Uj} dx_j$. Unit inputs are functions of input prices assuming homothetic production. Introducing elasticities leads to

$$N' = \sigma_{UU} w_U{}' + \sigma_{UR} w_R{}' + \sigma_{Ue} e' + \Sigma_j \sigma_{Uj} r_j{}' + \Sigma_j \lambda_{Uj} x_j{}', \tag{4}$$

where σ_{Ui} is the substitution elasticity of urban workers with respect to the price of input i and λ_{Uj} is the industry share of urban workers in industry j. The first equation in Eq. (9) combines Eqs. (3) and (4). The second equation in Eq. (9) is a similar condition for employment of rural labor L_R.

Substitution elasticities in each industry are derived from Allen (1938) cross price elasticities S^j_{ik} between the input of factor i and the payment to factor k in industry j according to $\sigma^j_{ik} \equiv \hat{a}_{ij}/\hat{w}_k = \theta_{kj} S^j_{ik}$. The own price elasticity σ^j_{ii} is derived assuming linear homogeneity, $\Sigma_k \sigma^j_{ik} = 0$. Cobb–Douglas production implies unit Allen elasticities, $S^j_{ik} = 1$. Economy wide substitution elasticities are weighted across industries, $\sigma_{ik} \equiv \Sigma_j \lambda_{ij} E^j_{ik}$. Cobb–Douglas production implies $\sigma_{ik} = \Sigma_j \lambda_{ij} \theta_{kj}$.

Sensitivity to substitution is examined with constant elasticity of substitution CES that scales the Allen elasticity to values other than one. For instance, the stronger CES elasticity of 2 doubles the Cobb–Douglas substitution elasticities.

The third equation in Eq. (9) is energy imports, $E = \Sigma_j a_{Ej} x_j$. Differentiating and introducing substitution elasticities similar to Eq. (4),

$$E' = \sigma_{EU} w_U{}' + \sigma_{ER} w_R{}' + \sigma_{Ee} e' + \Sigma_j \sigma_{Ej} r_j{}' + \Sigma_j \lambda_{Ej} x_j{}'. \tag{5}$$

The international price of energy e is exogenous, the small open economy assumption. Energy imports E are endogenous.

Similar to labor employment, each of the eight industrial capital inputs are fully utilized according to $K_j = a_{Kj} x_j$. Differentiating,

$$K_j{}' = \sigma_{jU} w_U{}' + \sigma_{jR} w_R{}' + \sigma_{je} e' + \sigma_{jj} r_j{}' + x_j{}'. \tag{6}$$

Substitution elasticities for capital inputs with respect to input prices vary by industry. Capital input in an industry is not sensitive to prices of other industrial capital inputs.

Competitive pricing for each industry is stated $p_j = a_{Uj} w_U + a_{Rj} w_R + a_{Ej} e + a_{jj} r_j$. Differentiate and apply the cost minimizing envelope result to find

$$p_j{}' = \theta_{Uj} w_u{}' + \theta_{Rj} w_R{}' + \theta_{Ej} e' + \theta_{jj} r_j{}', \tag{7}$$

where θ_{ij} is the factor share of revenue in industry j paid to factor i. The competitive pricing condition (7) provides a set of eight equations in Eq. (9).

The next to the last equation in Eq. (9) accounts for changes in output Y. The total differential is $dY = N dw_U + L_R dw_R + E de + \Sigma_j K_j dr_j +$

Table 2
Import tariffs by commodity, GTAP %.

	Morocco	US
Wheat	23.6	2.6
Other cereals	10.0	0.6
Vegetables, fruits	31.7	4.7
Oil seeds	24.5	17.7
Red meat	199.5	5.3
Other animal products	22.4	0.6
Other agriculture	18.8	11.7
Fishing	0	0
Other minerals	1.0	0.04
Energy, metals	2.8	1.2
Vegetable oils and fats	101.5	4.3
Dairy products	69.2	42.5
Beverages and tobacco	29.1	3.0
Other food	46.0	13.0
Wearing apparel	22.6	11.8
Chemical products	15.9	1.7
Electronic equipment	8.0	0.1
Machinery and equipment	12.7	3.3
Other industrial manufacturing	10.6	2.6