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THE IMPACT OF TRADE LIBERALIZATION
ON REGIONAL GROWTH AND POVERTY
IN TUNISIA

Rim Chatti and Faycel Zidi

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Rim Chatti and Faycel Zidi

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Send correspondence to:

Rim Chatti
Ministère des Finances du Québec
Email: rim.chatti@videotron.ca

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Abstract

The paper focuses on how trade reform affected regional growth during the stage of economic transformation. The main question addressed is whether progressive trade liberalization has an impact on regional economic growth and poverty and reduces regional disparities amongst the Tunisian regions. The paper explores the factors behind such transformations. In order to achieve this goal the paper is divided into 3 sections. The first section briefly describes the data and model underlying the study. The second section presents the simulation results on regional growth and poverty. Simulation results reveal that all the regions experience better economic performance with freer-trade, but poverty outcomes differ from one region to another. The concluding remarks are presented in the last section.

ملخص

تركز هذه الورقة البحثية على مدى تأثير الإصلاح التجاري على النمو الإقليمي خلال مرحلة التحول الاقتصادي. والسؤال الرئيسي الذي تطرحه هذه الدراسة هو ما إذا كان التحرير الإقليمي للتجارة له تأثير على النمو الاقتصادي الإقليمي و معدلات الفقر، وهل يقلل من التفاوت الإقليمي بين الأقاليم المختلفة في بلد مثل تونس. والدراسة تبحث في العوامل التي تقف وراء مثل هذه التحولات. ولتحقيق هذا الهدف تم تقسيم الورقة إلى ثلاثة أقسام. القسم الأول يصف بإيجاز أهم البيانات والنماذج التي تعتمد عليها هذه الدراسة. أما القسم الثاني فيعرض نتائج المحاكاة على نسب النمو الإقليمي ومعدلات الفقر. وتبين نتائج المحاكاة أن جميع المناطق تشهد أداء اقتصادي أفضل إذا تم تحرير التجارة، ولكن نتائج الفقر تختلف من منطقة إلى أخرى. وترد الملاحظات الختامية في القسم الأخير.

1. Introduction

Trade is generally considered to have a beneficial impact on economic growth. However, the spatial distribution of the benefits of trade remains questioned and debated. Different theories and empirical analysis often reach contrasting results on the spatial economic impact of trade. Some suggest that trade leads to greater concentration of economic activity and greater polarization [Krugman (1991), Venables (1998), Fujita et al. (1999) and Venables and Limão (1999)] while others underline that that trade liberalization ultimately leads to a reduction of disparities [Sachs and Warner (1995)].

In Tunisia, production activity, trade and employment are mainly concentrated in the capital Tunis, and to some extent in the Coastal North-East and Center-East. The Inland West Regions lag far behind, with a marginal contribution to the economic activity. It is not surprising to note that the North-West and Center-West are the only regions not adequately urbanized, with over 65 % of the population living in rural areas. As a consequence, 7.3 % of the population living in these two regions is poor (against a national level of 4.6 %), and they represent 45 % of the country poor.

The aim of this paper is to explore the regional impact of trade liberalization in Tunisia by analyzing the evolution of spatial disparities, using a dynamic regional computable general equilibrium model.

The paper focuses on how trade reform has affected regional growth during the stage of economic transformation. The main question is whether progressive trade liberalization has an impact on regional economic growth and poverty, and reduces regional disparities amongst the Tunisian regions. The paper explores the factors behind such transformations. In order to achieve this goal the paper is divided into three sections. The first section briefly describes the data and model underlying the study. The second section presents the simulation results on regional growth and poverty. The concluding remarks are presented in the last section.

2. Data and Methodology

Data used in this paper is extracted from the 2000 Tunisian Budget and Consumption Expenditures Households' survey (BCEHS), the 2004 Tunisian Regional Social Accounting Matrix (SAM), the 1997–2006 enterprises surveys, the 2004 Tunisian Population Census (PC) and the 2005 Tunisian Employment Survey (ES). The regional SAM includes accounts distinguished by six regions (Tunis, North-East, North-West, Center-East, Center-West and South) for 30 activities and commodities, five primary factors, four household categories and 30 enterprises, as well as accounts for the government budget, balance of payments, capital accumulation and inventories.

The primary factors include capital, in addition to four different kinds of labor categorized according to their educational attainment (illiterate/primary/secondary/ university). Similarly, households are defined according to their educational attainment and regional location. Their desegregation was based on commodities expenditures patterns from the BCEHS and wage earning from the ES. While the BCEHS representative sample covers 6,000 households, the ES sample covers 49,138 employees. Consistency between the aggregate regional SAM and the micro-data was achieved by applying minimum cross-entropy, as proposed by Golan et al. (1994).

Key features of the Tunisian regional economy in 2004 can be derived from the regional SAM. The regional structure of the economy, including value-added, exports, households' consumption, public and private investments is reported in Table 1.

Almost all the economic indicators show the predominance of the capital, Tunis. Its contribution to GDP reaches 46%, whereas its share in total exports amounts to 39.8%. The capital is also has the lion's share of total private investment (56.5% of total investment).

Tunis is followed by the two coastal regions, the North-East and the Center-East. Together these two regions account for 35.7% of GDP, 44.1% of total exports and 29.2 % of total investment in 2004. As Table 1 reveals, the Center-West ranks last in terms of its contribution to GDP (4.1%), exports (0.8%) and investment (4.3%).

Public investment seems to favor Tunis and the North-East, which together control 46.9% of public investment. The remaining regions' share varies between 11.3% and 15.5%.

The regional structure of poverty reported in Table 2 shows poverty to be a rural phenomenon in Tunisia for the major part. Poverty is clearly more severe in the Center-West and the South, where 11% and 9.5% of rural people are poor, compared with a national rural headcount index of 7.4%. Rural poverty gap is also relatively high in the Center-West and the South, amounting respectively to 2.7% and 2.2%.

Turning to the number of poor people in Tunisia, there are 286.2 thousand rural poor and 151.9 thousand urban poor. Approximately 37.8% and 26.6% of the rural poor are concentrated in the Center-West and the South respectively, whereas 40.4% and 27.1% of the urban poor are concentrated in the South and the Center-West respectively.

The inter-regional dynamic CGE model framework details production, consumption, exports, local sales and investment on a regional basis. Leontief specification is used for intermediate demand, whereas nested CES specifications are used for production of value-added. The different labor factors, distinguished by level of education, are imperfect substitutes in production, and they in turn represent a composite which is imperfectly substitutable to the capital factor. Due to real wage rigidities, the supply of the different labor categories is greater than the need of industries. Labor markets do not clear and unemployment occurs.

Constant elasticity of transformation (CET) functions determine the supply of goods for the export national markets and Armington (CES) specifications describe the demand for imported and national goods. National goods, in addition, are a CES composite of all regional produced goods for the local market.

A Cobb-Douglas specification describes households' choice between bundles of goods.

The dynamics of economic growth in each region are driven by the interaction of many forces: public and private capital accumulation, exogenous technical progress, natural population growth and endogenous migration.

Harrigan and McGregor (1989), McGregor, Swales and Yin (1995), Rutherford and Törma (2003) show how net migration can be modeled in a CGE model. We follow their example and show that net migration relative to lagged labor force is a function of the standard of living and unemployment differential. The migration model is linear and of the form

$$\frac{Netmig_r}{L_{t-1,r}} = a_r + b_r \frac{Rgdp_r}{Agdp} - C_r \frac{Runemp_r}{Aunemp},$$

where $L_{t-1,r}$ is the lagged labor force in the region r , $Netmig_r$ is the net migration to the region r , $Rgdp_r$ is the *per capita* regional GDP, $Agdp$ is the national *per capita* GDP, $Runemp_r$ is the regional unemployment rate and $Aunemp$ is the national average unemployment rate.

The CGE model's full set of equations is given in the Appendix. In order to deal with the poverty issue, the CGE model communicates with a micro-simulation model given by the equivalent income of each of the 6000 household units, extracted from the 2000 BCEHS². The CGE model provides the prices and income changes of each household group. This information allows the micro-simulation model to infer the new equivalent incomes of each household unit, after classifying them according to the same characteristics as the CGE model household groups. The latter are then used to estimate poverty changes, given by the Foster-Greer-Thorbecke (FGT) (1984) class indices.

3. Simulation Results

We consider two scenarios. The first one is a Business as Usual (BaU) scenario, representing the progress of the Tunisian economy without any economic reforms over a period of 12 years, from 2004 to 2015. The dynamic path of the economy in the BaU is driven by exogenous technical progress and population growth. Economic growth is in addition triggered by capital accumulation and interregional migration flows. The first scenario is a benchmark against which the second scenario is compared.

The second scenario represents a progressive neutral elimination of tariffs on imports ending in 2015.

The simulation results of regional macroeconomic and poverty indicators are reported respectively in Tables 3 and 4. The simulation results reveal that all the Tunisian regions achieve positive economic growth over the period 2004–2015 in the BaU scenario. Although the ranking of the different regions in terms of their contribution to real GDP does not change, the share of the North-West, Center-West And South in real GDP increases by 1.3 %, 3.4 % and 3.1 % respectively at the expense of the great Tunis and the Center-East, between 2004 and 2015. Indeed the last two regions experience a fall in their contribution to real GDP, which falls by 0.7 %. Unemployment increased everywhere, except in the Center-West. This region actually witnesses a decline in the unemployment rate which goes from 11.7% in 2004 to 8.0% in 2015.

Compared to the BaU, the trade liberalization reform achieves better economic performance in all the regions, as can be seen from Table 3. At the end point and compared to the BaU, the real GDP increase resulting from free-trade varies from 5.0% in the great Tunis area to 7.8% in the South. Also, with openness to trade, the share of the Center-West and the South in real GDP jumped to 4.4% and 4.8% but at the expense of the national capital which sees a decline in its contribution to real GDP by 1.7 %.

The trade liberalization slows the increasing unemployment trend. At the end, and compared to the reference scenario, the unemployment rate falls everywhere, but more so in the North-East (36.9%), Center-East (33.6%) and Center-West (28.5%).

² The micro-simulation model is described in Bibi and Chatti (2007).

We now turn to the issue of assessing how the status quo and trade policy affect the poor. Table 4 presents the impact on poverty incidence and poverty gap at the regional level. The experiments indicate that in the reference scenario the share of poor population remains unchanged in all rural areas and urban North-East, North-West, Center-West and South. The incidence of poverty decreases over the simulation period only in urban Tunis and urban Center-East by 13.8% and 15.7% respectively. Nevertheless, trade liberalization is more favorable to poor people in both the Center-East and the South where the incidence of poverty falls respectively by 10.8% and 3.3% in 2015 compared to the BaU scenario, to reach 1.74% and 6.05%. With free trade, the percentage of urban poor also declines in the North-East by 10.1% to reach 1.96 % compared to 2.18 % in the BaU.

The poverty incidence rises in the rural North-West and Center-West by 5% and 2% respectively, but remains unchanged in other areas of the country, i.e. Tunis, rural North-East, Urban North-West and Center-West.

The headcount ratio change may fail to accurately capture the impact of any reform on the poor, since it only records those who escape poverty. Thus it may underestimate the effectiveness of the reforms, as most poor people may find their welfare improved but not enough to lift them out of poverty. The poverty gap resolves this drawback. From Table 4, it appears that in the reference scenario, except in the rural North-West, where it remains unchanged, the poverty gap in rural Tunis, North-East, Center-East and South decreases, meaning that the average income of those staying below the poverty line has in fact improved. Yet the average income of the poor decreases in the rural Center-West, which leads to a wider poverty gap.

With the progressive removal of tariffs, the average income of the poor rises by even more than the BaU in Tunis, North-East, Center-East and South leading to a fall in the poverty deficit. While a reverse pattern appears in both the North-West and the Center-West, where the well-being of the poor worsens.

4. Concluding Remarks

In this paper we use a regional dynamic CGE model to assess the impact of trade liberalization on regional growth and poverty. Simulation results reveal that the economic performance of all the regions improves. In addition, the contribution of the Center-West and South to real GDP increases at the expense of great Tunis.

As to poverty, it increases in rural North-West and Center-West, meaning that growth spurs inequality between the poor and the non poor in these areas. Elsewhere, however poverty either decreases or remains unchanged.

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Table 1: The Regional Structure of the Tunisian Economy (%)

	Tunis	North East	North West	Center East	Center West	South	Total
Value-added	46.0	12.1	7.2	23.6	4.1	7.0	100
Exports	39.8	19.3	1.8	34.8	0.8	3.6	100
Households' consumption	22.7	12.1	11.0	24.7	10.8	18.3	100
Private investment	56.5	8.3	4.5	20.9	4.3	5.5	100
Public investment	21.8	25.1	12.8	13.5	11.3	15.5	100

Source: Authors' calculations based on the regional SAM.

Table 2: The Regional Structure of Poverty and Population

		Tunis	North East	North West	Center East	Center West	South	Tunisia
Poverty headcount (%)	rural	1.7	6.6	5.0	4.1	11.0	9.2	7.4
	urban	0.7	2.2	1.6	1.3	9.5	4.5	2.6
Poverty gap (%)	rural	0.2	1.6	1.0	0.5	2.7	2.2	1.7
	urban	0.1	0.4	0.4	0.2	2.5	1.0	0.6
Poor (thousand people)	rural	2.3	37.1	40.5	21.6	108.3	76.3	286.2
	urban	9.4	16.6	7.1	16.2	41.2	61.4	151.9
Population (thousand people)	rural	138.6	565.3	810.6	531.9	988.6	827.4	3862.5
	urban	1435.3	760.9	452.7	1277.3	433.8	1373.7	5733.7
Per capita consumption (TND)	rural	1016.4	878.1	840.1	1157.9	788.3	783.5	870.4
	urban	1829.6	1437.1	1446.4	1797.2	1167.5	1213.8	1542.4

Source: Authors' calculations based on the 2000 BCEHS.

Table 3: Regional Macroeconomic Indicators

	2004	2015	2015 FT
Real GDP (TBD)	31.101	33.081	35.072
Great Tunis	14.306	15.094	15.853
North-East	3.752	3.997	4.272
North-West	2.250	2.425	2.568
Center-East	7.348	7.783	8.313
Center-West	1.280	1.408	1.507
South	2.165	2.374	2.560
Exports (TBD)	16.703	17.202	19.045
Great Tunis	6.648	6.831	7.534
North-East	3.212	3.322	3.609
North-West	0.293	0.303	0.398
Center-East	5.813	5.998	6.702
Center-West	0.129	0.133	0.140
South	0.600	0.616	0.662
Imports (TBD)	19.345	19.817	21.901
Unemployment (%)			
Great Tunis	12.7	29.7	24.7
North-East	10.8	22.1	13.9
North-West	14.3	14.6	11.3
Center-East	8.9	24.1	16.0
Center-West	11.7	8.0	5.7
South	12.6	24.2	19.6

Source: Authors' calculations.

Table 4: Regional Poverty Indicators

		2004	2015	2015 FT
Poverty headcount (%)				
Great Tunis	Rural	1.69	1.69	1.69
	urban	0.65	0.56	0.56
	All	0.74	0.66	0.66
North-East	Rural	6.56	6.56	6.56
	urban	2.18	2.18	1.96
	All	4.05	4.05	3.92
North-West	Rural	4.99	4.99	5.24
	urban	1.56	1.56	1.56
	All	3.77	3.77	3.92
Center-East	Rural	4.06	4.06	3.47
	urban	1.27	1.07	1.02
	All	2.09	1.95	1.74
Center-West	Rural	10.95	10.95	11.17
	urban	9.50	9.50	9.50
	All	10.51	10.51	10.66
South	Rural	9.23	9.23	8.88
	urban	4.47	4.47	4.34
	All	6.26	6.26	6.05
Poverty gap (%)				
Great Tunis	Rural	0.16	0.14	0.12
	urban	0.10	0.09	0.08
	All	0.10	0.10	0.08
North-East	Rural	1.56	1.54	1.48
	urban	0.39	0.38	0.35
	All	0.89	0.88	0.83
North-West	Rural	0.98	0.98	1.03
	urban	0.36	0.36	0.38
	All	0.76	0.76	0.80
Center-East	Rural	0.51	0.48	0.36
	urban	0.19	0.19	0.15
	All	0.29	0.27	0.22
Center-West	Rural	2.75	2.76	2.83
	urban	2.47	2.47	2.52
	All	2.67	2.67	2.74
South	Rural	2.24	2.23	2.19
	urban	0.96	0.95	0.92
	All	1.45	1.43	1.40

Source: Authors' calculations.

Appendix

Intermediate consumption	$C I_{i,r,j} = i o_{i,r,j} X S_{i,r}$
Value added	$V A_{i,r} = i v_{i,r} S_{i,r}$
Marginal cost pricing	$M C_{i,r} = (1 - t x_{i,r} + t s_{i,r}) P X_{i,r}$
Marginal cost	$M C_{i,r} = \frac{C T_{i,r}}{X S_{i,r}}$
Total cost	$C T_{i,r} = C V_{i,r} + \sum_j P Q_j i o_{i,r,j} X S_{i,r}$
Capital demand	$K D_{i,r} = \left(\frac{X S_{i,r}}{A_{i,r}} \right)^{1 - \mu_{i,r}} \left(\frac{(1 - v_{i,r}) C V_{i,r}}{r k_{i,r}} \right)^{\mu_{i,r}}$
Composite labor demand	$L D_{i,r} = \left(\frac{X S_{i,r}}{A_{i,r}} \right)^{1 - \mu_{i,r}} \left(\frac{v_{i,r} C V_{i,r}}{p l_{i,r}} \right)^{\mu_{i,r}}$
Primary factors cost	$C V_{i,r} = r k_{i,r} K D_{i,r} + p l_{i,r} L D_{i,r}$
Labor demand by level of education	$L_{i,r,l} = \left(\frac{L D_{i,r}}{A L_{i,r}} \right) \left(\frac{\theta_{i,r,l} A L_{i,r} p l_{i,r}}{w_{r,l}} \right)^{\varepsilon_{i,r}}$
Composite labor total cost	$p l_{i,r} L D_{i,r} = \sum_l w_{r,l} L_{i,r,l}$
Export of good i from region r	$X E_{i,r} = \left(\frac{X S_{i,r}}{A E_{i,r}} \right) \left(\frac{P E_{i,r}}{A E_{i,r} (1 - \alpha_{i,r}) P X_{i,r}} \right)^{\mathcal{G}_{i,r}}$
Domestic sale of good i by firms in region r	$X D F_{i,r} = \left(\frac{X S_{i,r}}{A E_{i,r}} \right) \left(\frac{P D F_{i,r}}{A E_{i,r} \alpha_{i,r} P X_{i,r}} \right)^{\mathcal{G}_{i,r}}$
Total cost of composite output	$P X_{i,r} X S_{i,r} = P E_{i,r} X E_{i,r} + P D F_{i,r} X D F_{i,r}$
Export price	$P E_{i,r} = W P E_{i,r} E R$
Regional unemployment rate by level of education	$u_{r,l} = \frac{L S_{r,l} - \sum_i L_{i,r,l}}{L S_{r,l}}$

Composite consumption
good

$$XA_i = \sum_j \sum_r CI_{i,j,r} + \sum_d XAC_{d,i} + XAG_i + XAI_i + VSK_i$$

Composite consumption
demand of bundle d

$$XAC_{d,i} = \left(\frac{XC_d}{AC_d} \right) \left(\frac{AC_d \delta_{d,i} PC_d}{PQ_i} \right)^{\psi_d}$$

Total expenditure on bundle d

$$PC_d XC_d = \sum_i PQ_i XAC_{d,i}$$

Total households' demand on bundle d

$$PC_d XC_d = \sum_r \sum_l PC_d XCH_{d,l,r}$$

Household h in region r
demand of bundle d

$$XCH_{d,l,r} = \beta_{d,l,r} \frac{CTH_{l,r}}{PC_d}$$

Investment demand of good I

$$XAI_i = \rho_i \frac{ZI \times PK}{PQ_i}$$

Import price

$$PM_i = WPM_i (1 + tm_i) ER$$

Import demand of good I

$$XM_i = \left(\frac{XA_i}{AM_i} \right) \left(\frac{AM_i (1 - \lambda_i) PQ_i}{PM_i} \right)^{\rho_i}$$

Domestic demand of good I

$$XD_i = \left(\frac{XA_i}{AM_i} \right) \left(\frac{AM_i \lambda_i PQ_i}{PD_i} \right)^{\rho_i}$$

Total cost of Armington
composite good

$$PQ_i XA_i = PD_i XD_i + PM_i XM_i$$

Regional demand of good I

$$XDF_{i,r} = \left(\frac{XD_i}{AD_i} \right) \left(\frac{AF_{i,\zeta_{i,r}} PD_i}{PDF_{i,r}} \right)^{\psi_i}$$

Total cost of local composite good

$$PD_i XD_i = \sum_r PDF_{i,r} XDF_{i,r}$$

Non tradable goods

$$XA_i = XD_i$$

Government revenue	$YG = \sum_i tm_i wpm_i ER + \sum_i \sum_r tx_{i,r} XS_{i,r} PX_{i,r} - \sum_i \sum_r ts_{i,r} XS_{i,r} PX_{i,r} + \sum_l \sum_r k_{l,r} YH_{l,r} + shrg \times TRANSFER$
Government total consumption	$CTG = scg \times YG$
Government saving	$SG = ssg \times YG$
Interest payments on public debt	$int \times DEBT_{t-1} = Int Gov$
Public deficit	$Defficit = \sum_{gk} \sum_r IPub_{gk,r} PK - SG$
Regional public investment in the asset gk	$IPub_{gk,r} PK = shri_{gk,r} GDP$
Government consumption of good I	$XAG_i = agov_i \frac{CTG}{PQ_i}$
Capital return	$rk_{i,r} = kp_{i,r} PK$
Households' tax income	$IRM_{l,r} = \kappa_{l,r} YH_{l,r}$
Households' disposable income	$YD_{l,r} = (1 - \kappa_{l,r}) YH_{l,r}$
Households' saving	$SH_{l,r} = sh_{l,r} YD_{l,r}$
Intra-households transfers	$int ra_{-} h_{l,r,ll,rr} = tr_{l,r,ll,rr} YD_{l,r}$
Households' consumption expenditure	$CTH_{l,r} = cth_{l,r} YD_{l,r}$
Households' revenue	$YH_{l,r} = \sum_{ll} w_{r,ll} \sum_i L_{i,r,ll} + fk_{l,r} \sum_i \sum_{rr} DPROF_{i,rr} + \sum_{ll} \sum_{rr} tr_{l,r,ll,rr} YD_{l,r} + ER \times THROW_{l,r} + shr_{h,r} TRANSFER + shri_{h,r} \times int ertest$
Firms' profit	$PROF_{i,r} = rk_{i,r} KD_{i,r}$

Firms' profit net corporate taxes, transfers and interest payment	$NPROF_{i,r} = PROF_{i,r} - \varepsilon_{i,r} PROF_{i,r} - shrt_{i,r} PROF_{i,r} - shri_{i,r} PROF_{i,r}$
Firms' distributed profits	$DPROF_{i,r} = (1 - sf_{i,r}) NPROF_{i,r}$
Firms' non distributed profits	$NDP_{i,r} = sf_{i,r} NPROF_{i,r}$
Agents total transfers	$TRANSFER = ER \times TRROW + \sum_i \sum_r shrt_{i,r} PROF_{i,r}$
Total interest payment	$INTEREST = IntGov + \sum_i \sum_r shri_{i,r} \times PROF_{i,r}$
GDP	$GDP = \sum_i \sum_r PVA_{i,r} VA_{i,r}$
Value added price	$PVA_{i,r} VA_{i,r} = PX_{i,r} (1 - tx_{i,r} + ts_{i,r}) - \sum_j PQ_j CI_{i,r,j}$
Saving-Investment identity	$PK \times ZI = \sum_h \sum_r SH_{h,r} + SG + ER \times BOC + \sum_i \sum_r NDP_{i,r} - \sum_i PQ_i VSK_i$
Total investment	$ZI = \sum_{gk} \sum_r IPub_{gk,r} + \sum_i \sum_r INV_{i,r}$
Consumers' price index	$IPC_{r,l} = \sum_d \zeta_{d,r,l} PC_d$
Real wage	$rw_{r,l} = \frac{w_{r,l}}{IPC_{r,l}}$

Balance of payment deficit	$ER \times BOC = \sum_i ER \times WPM_i XM_i$ $- \sum_i \sum_r ER \times WPE_{i,r} XE_{i,r}$ $+ shrow \times int\ erest - \sum_h \sum_r ER \times THROW_{h,r}$ $- ER \times TRROW$
Firms' investment	$\frac{INV_{i,r}}{KD_{i,r,t-1}} = A_{i,r} \left(\frac{kp_{i,r}}{tin + \delta_{i,r}} \right)^{\zeta_{i,r}}$
Capital accumulation	$KD_{i,r} = (1 - \delta_{i,r}) KD_{i,r,t-1} + INV_{i,r}$
Government debt dynamics	$DEBT_t = DEBT_{t-1} + DEFICIT_t$ $LS_{r,l} = v_{r,l} L_r$
Regional labor supply	$L_r = \sum_l LS_{r,l}$
Regional labor supply growth	$L_r = L_{r,t-1} (1 + g_r) + MIG_r$
Regional net migration	$\frac{MIG_r}{L_{r,t-1}} = a + b \frac{Rgdp_r}{Agdp} - c \frac{ut_r}{Au}$
Regional per capita GDP	$Rgdp_r = \frac{\sum_r PVA_{i,r} VA_{i,r}}{L_r}$
Per capita GDP	$Agdp = \frac{GDP}{\sum_r L_r}$
Regional average unemployment rate	$ut_r = \sum_l \frac{LS_{r,l}}{L_r} u_{r,l}$
National average unemployment rate	$Au = \sum_l \sum_r \frac{LS_{r,l}}{L_r} u_{r,l}$

Endogenous Variables

$CI_{i,r,j}$

$XS_{i,r}$

$VA_{i,r}$

$MC_{i,r}$

$PX_{i,r}$

$CT_{i,r}$

$CV_{i,r}$

PQ_j

$KD_{i,r}$

$rk_{i,r}$

$LD_{i,r}$

$pl_{i,r}$

$L_{i,r,l}$

$w_{r,l}$

$XE_{i,r}$

$PE_{i,r}$

$XDF_{i,r}$

$PDF_{i,r}$

ER

$u_{r,l}$

$LS_{r,l}$

XA_i

$XAC_{d,i}$

XAG_i

XAI_i

XC_d

PC_d

$XCH_{d,l,r}$

$CTH_{l,r}$

ZI

PK

PM_i

XM_i

XD_i

PD_i

$PDF_{i,r}$

YG

$TRANSFER$

$YH_{h,r}$

CTG

SG

GDP

$IPub_{gk,r}$

XAG_i

$Deficit$

$kp_{i,r}$

GDP

$IRM_{l,r}$

$YD_{l,r}$

$SH_{l,r}$

$int ra_h_{l,r,ll,rr}$

$CTH_{h,r}$

$DPROF_{i,r}$

$INTEREST$

$PROF_{i,r}$

$NPROF_{i,r}$

$NDP_{i,r}$

$INV_{i,r}$

$IPC_{r,l}$

$rs_{i,r}$

$DEBT$

$MIG_{r,rr}$

ut_r

$Rgdp_r$

Exogenous Variables

$wr_{r,l}$

$wpe_{i,r}$

wpm_i

VSK_i

TRROW

BOC