Chioms: An Input-Output Modeling System Dynamics

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General Features

- Dynamic forecasting model 1997-2025
- Current Prices
- Guided by MUDAN (national model)
- 29 of 31 provinces (Tibet and Hainan omitted)
- 33 industries

General Features Continued

- Prices are exogenous from MUDAN
- Bilateral Inter-provincial exports and imports by sector
- Four categories of final demand: households, government, fixed investment, inventory change
- Four categories of value added: depreciation, wages, taxes, surplus

General Features continued

- Consistent data base with provincial accounts (old) for 1997
- Nearly * consistent with reported foreign exports and imports from yearbood

- * Except for Beijing and Fujian

Central equation

$$(1)\ q = Aq + f + e - m$$

where
q is a vector (all vectors are of length 33) of domestic regional production,
A is a matrix of direct input-output coefficients
f, e and m are defined below.

Domestic Final Demand

$$(2)\ f = hhc + g + v + vc$$

where
hhc is a vector of household consumption
g is vector of government consumption
v is a vector of investment and
vc is a vector of inventory change.

Exports

$$(3) e = fe + \sum_{j=1}^{nprov} B_{i,j}$$

Where

fe is foreign exports

B is a matrix of inter provincial exports

Imports

$$(4) m = fm + \sum_{i=1}^{nprov} B_{i,j}$$

Where

fm is foreign imports

B is a matrix of inter provincial exports

Household Consumption

- Total estimated on a provincial per capita basis
- MUDAN national per capita
- Provincial Income: wages plus a portion of profits
- The portion of profits is the determined is the same for all provinces and determined by the national portion
- Based upon data from 1995-2002

Household consumption cont'd

$$(5)\ln hhcpc = a_0 + a_1 \ln nathhcpc + a_2 \ln provinc$$

Where

a_1

ln hhcpc is the log of provincial per capita consumption;
ln nathhcpc is the log of national per capita consumption;
ln provinc is log of sum of provincial wages and portion of provincial surplus;
the coefficient on ln natthhcpc is constrained to be approximately .5.

Investment

- Log function of national investment, provincial GDP
- Coefficient on national investment constrained to .3

Inventory Change

- Simple equation in which inventory change represents the closure amount from the actual stock of inventories to a desired level

Government

- Growth rate is estimated relative to that of the national government growth

Employment/productivity

- Exogenous productivity trends from MUDAN applied as movers to provincial 1997 levels

Wages

- Wage rates exogenously obtained from MUDAN applied to provincial employment to yield wages by sector

Depreciation

- Function of the estimated capital stock (total)

Taxes

- Provincial tax rates to move (as levels) as the national tax rate of the corresponding national sector
- Tax rates are then multiplied by output to obtain levels of provincial taxes

Surplus

- Computed as a residual
- Output less intermediate inputs, wages, taxes and depreciation
- Surplus rates determined as surplus/output

Imports

- Most complicated portion of the model
- Two parts: foreign and domestic
- Computed as a share of domestic demand (imports/(output+imports-exports)
- Sum of the two parts constrained

  O < sum < 1.
- Foreign Share moves like that of national imports

Domestic Imports - share

- Domestic share a function relative profitability of the product in the province
- and the perceived distance of other provincial suppliers
- Thus as the profit rate (surplus/output) rises the domestic import share falls and
- As the perceived distance from other provinces falls the domestic share increases
- Share elasticities are currently arbitrary

Domestic Imports – Perceived Distance

- Share depends on the percentage *change* in the perceived distance
- Leaving aside sector subscripts the perceived distance, pd, is defined as follows where S is the share matrix corresponding to B and D is a matrix of distances between provinces i and j (measured in hours).

$$(6)\, pd = \sum_{i=1}^{nprov} S_{i,j} * D_{i,j}$$

Changes to Distance

- Exogenous factors such as new or faster highways, railways, canals, new airport facilities, etc
- Endogenous factors include extremely rapid growth relative to history and the national economy

Imports Concluded

- Foreign and domestic import share are combined and domestic output and total imports are computed
- Imports are then separated into foreign and domestic
- Domestic imports are then used to compute the B matrices of the domestic export functions

Exports

- Domestic Exports computed from domestic imports of other provinces and S matrices
- Foreign exports begin with the 1997 share by province of total foreign exports
- Total foreign exports move exactly as national (MUDAN) exports
- Provinces share of foreign exports changes as its relative (to other provinces) profitability changes

Three Experiments

- Subsidize apparel industry in Sichuan—how much does it cost per job and how many jobs are generated with taxes increased in Guangdong
- Alter national government expenditure to include infrastructure development in western provinces to reduce travel time
- Change tax structure by taxing rich coastal provinces and lower taxes in the west (combined with infrastructure development)

Sichuan's Share of Imports of other Province's Apparel Imports

Apparel Subsidy - compensating tax changes GDG		2004	2010	2025	2004-2010
Sichuan Tax rate		0.04	-0.1	0.01	Percent
					Change
4	Shanxi	0.0006	0.0008	0.0007	33.3
5	IMAR	0.0011	0.0014	0.0013	27.3
22	Chongqing	0.0156	0.0201	0.0183	28.8
19	Guangdong	0.0004	0.0005	0.0005	25.0
29	Qinghai	0.0022	0.0028	0.0025	27.3
30	Ningxia	0.0022	0.0029	0.0026	31.8

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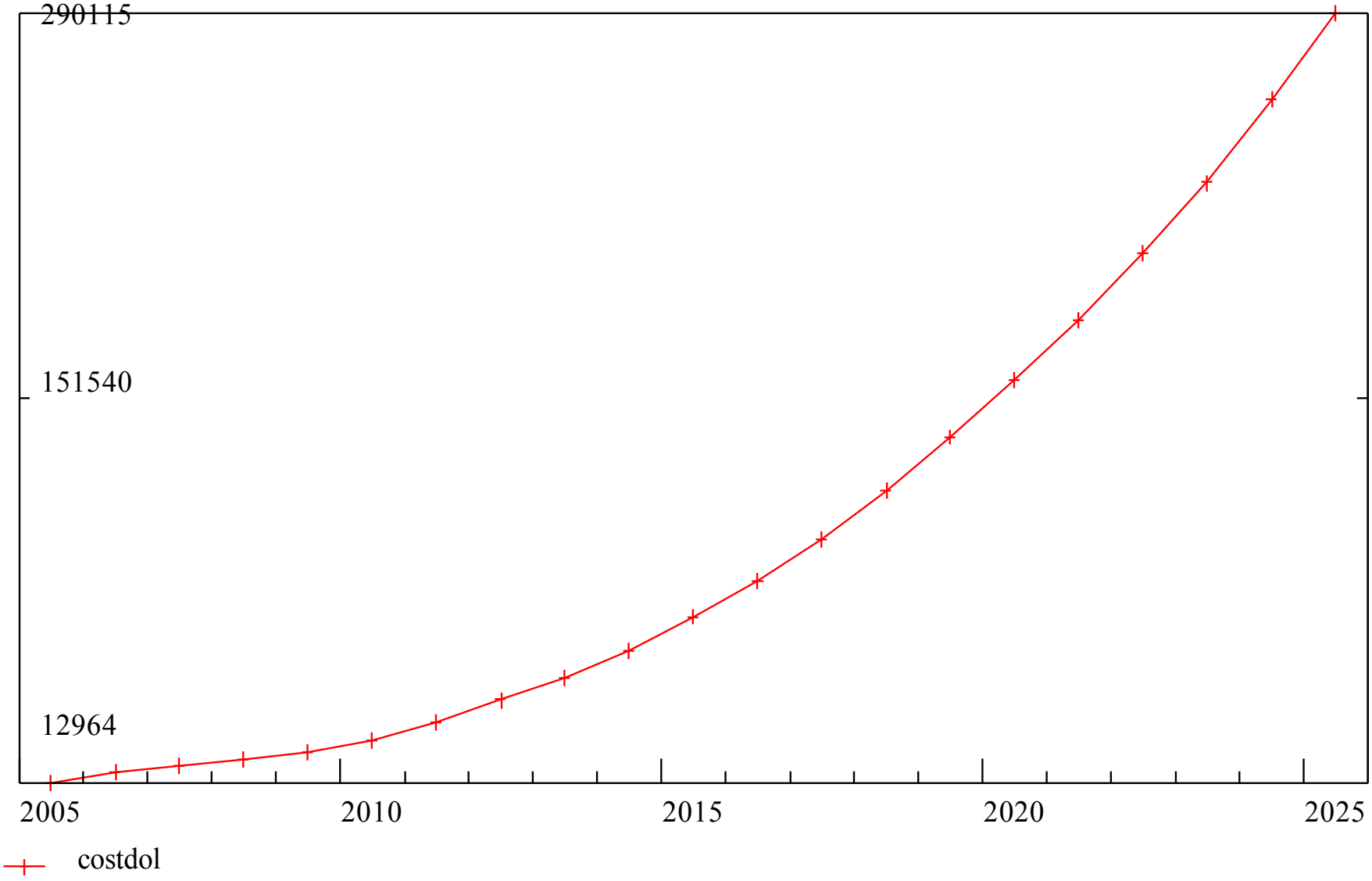
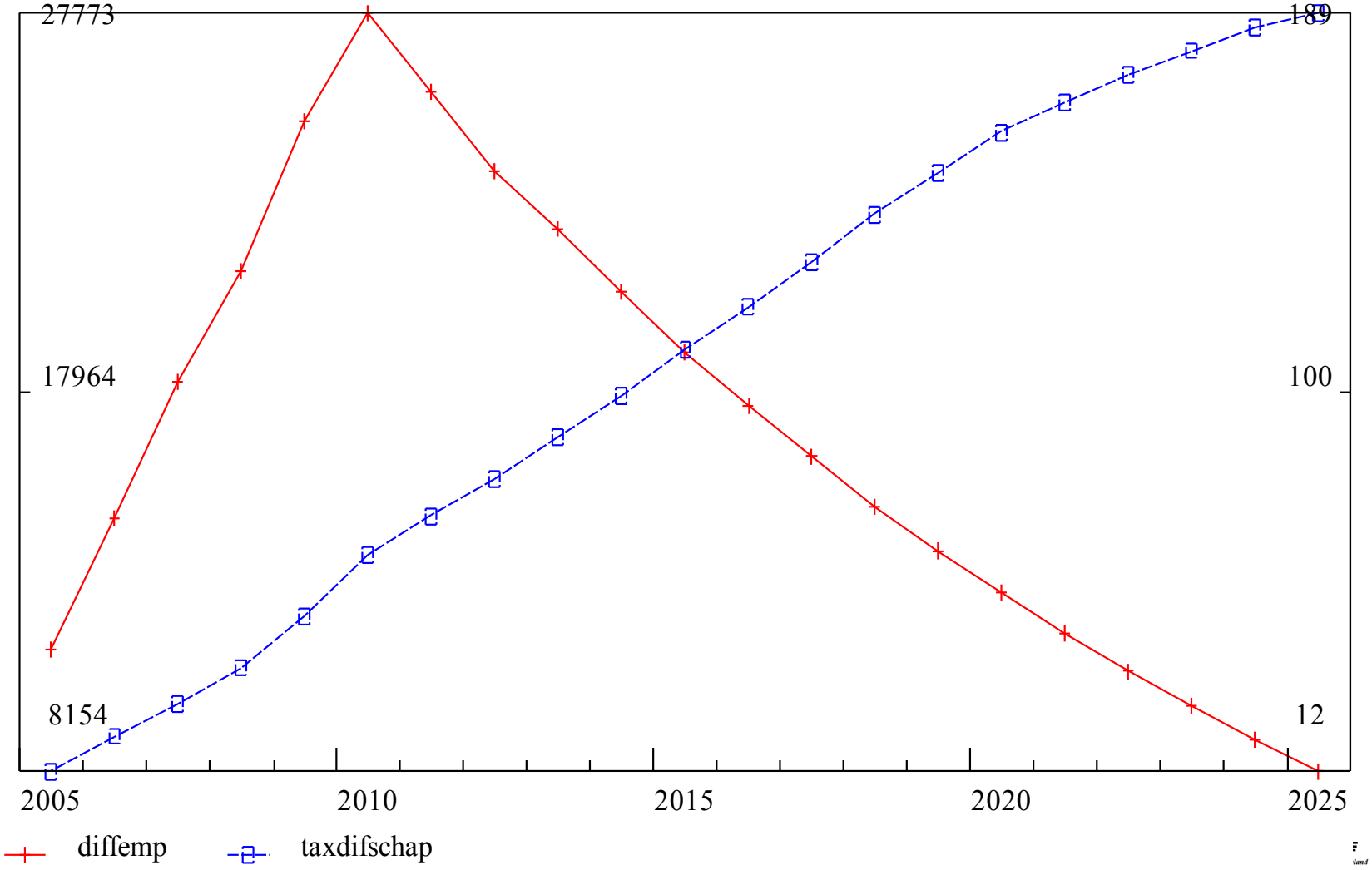
Cost per job in Sichuan

Apparel subsidies in US$



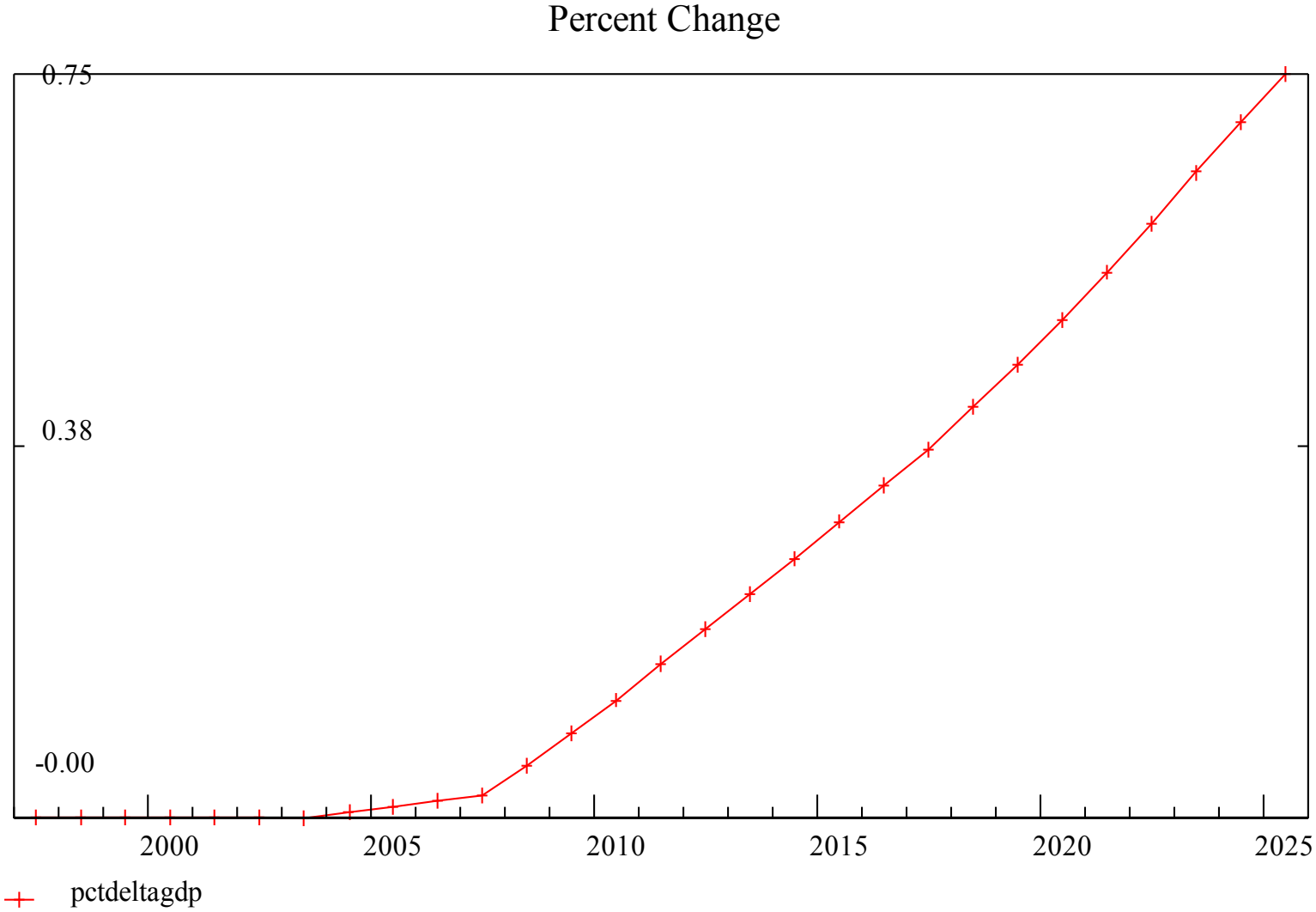
Jobs vs Tax loss



Change in Distance in Hours

	Beijing	Chongqing	Sichuan	Guizhou	Yunnan
Sichuan	-2.85	-2.85	0	-6.3	-5.7
Guizhou	-3.45	-3.45	-6.3	0	-6.3
Yunnan	-2.85	-2.85	-5.7	-6.3	0

Percent Changes in total GDP



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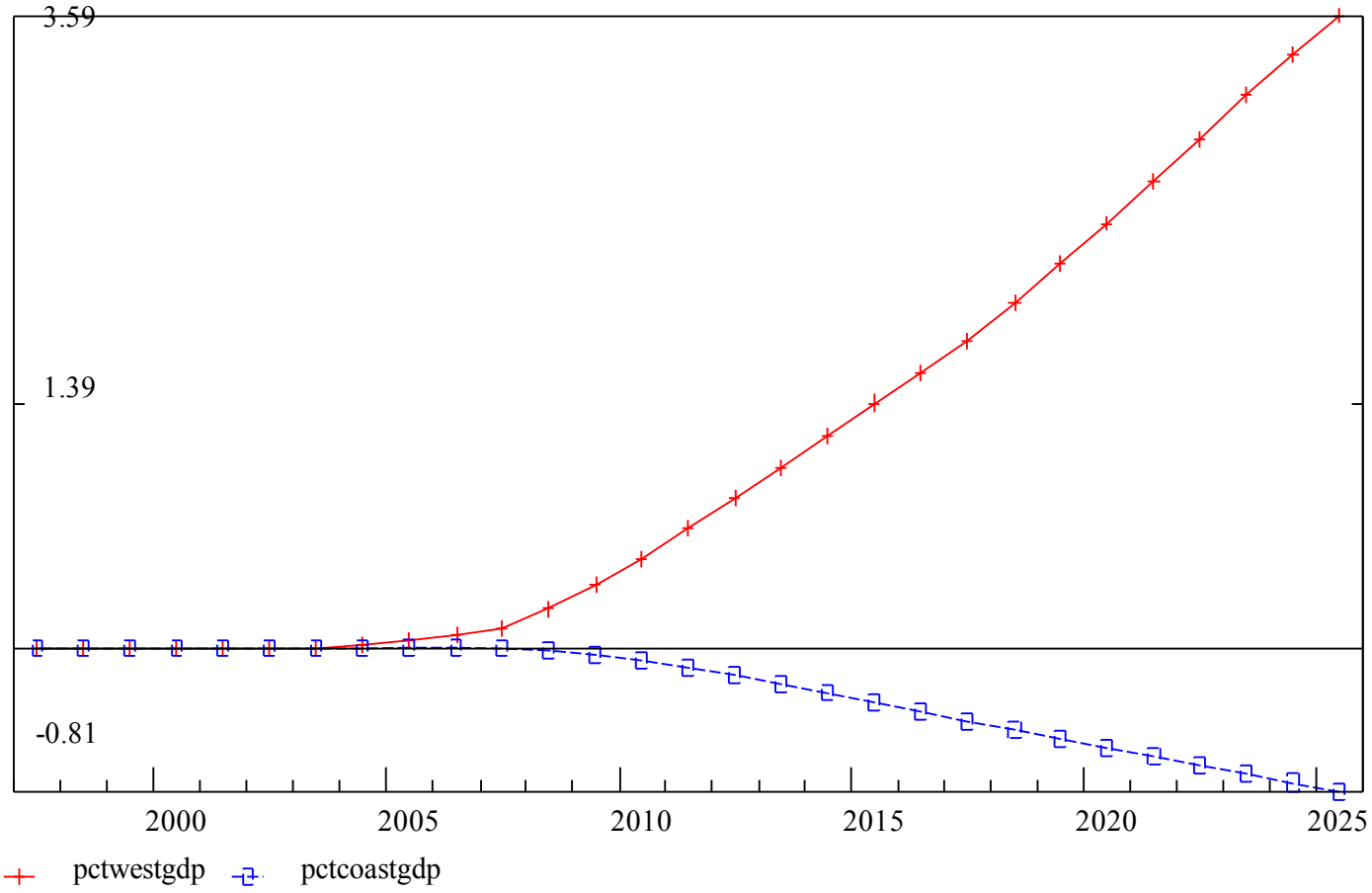
Percent Changes in GDP

West and Coast



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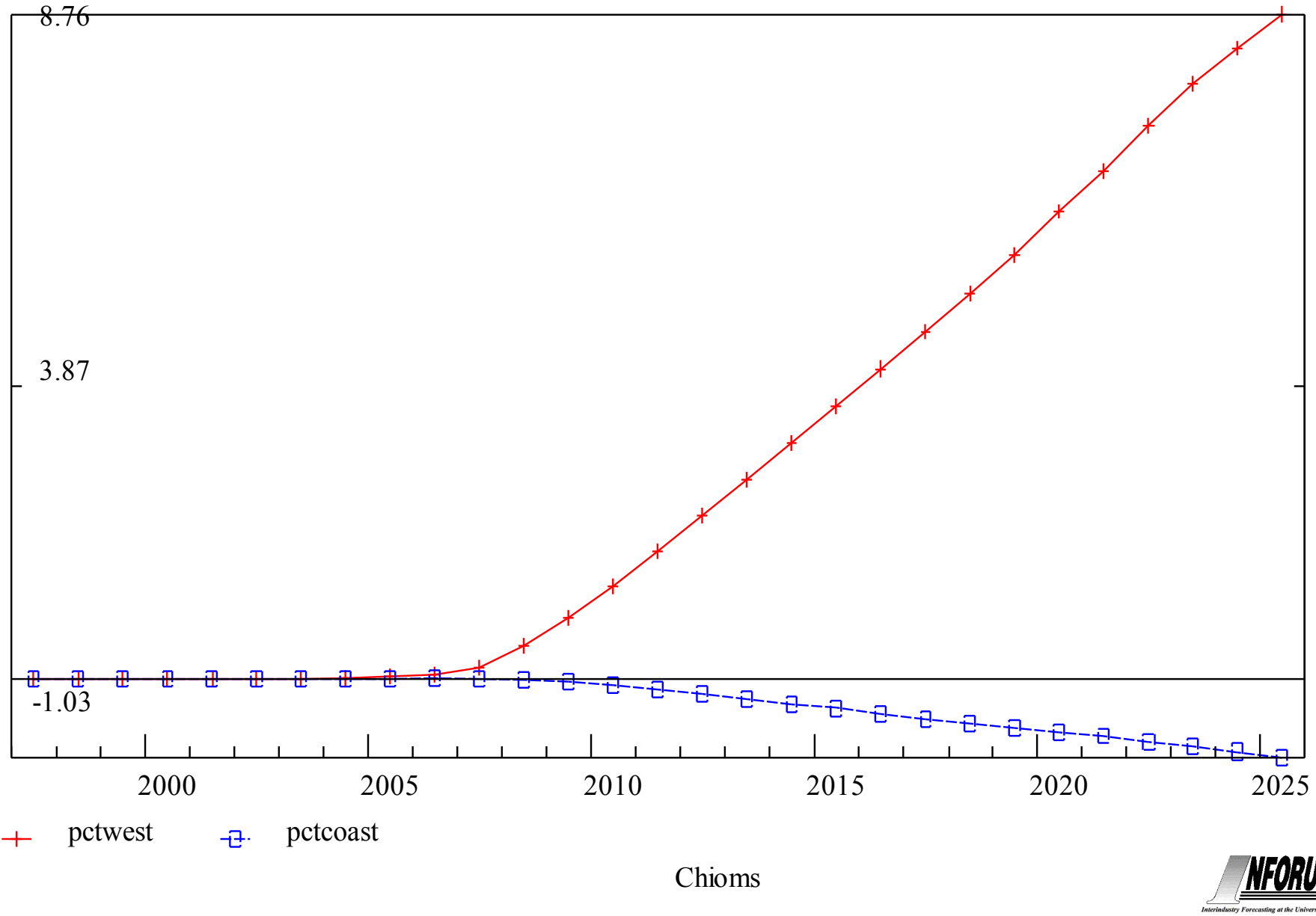
Western Provinces Total Exports

Percent Change



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