Vietnam infrastructure development
How to invest effectively

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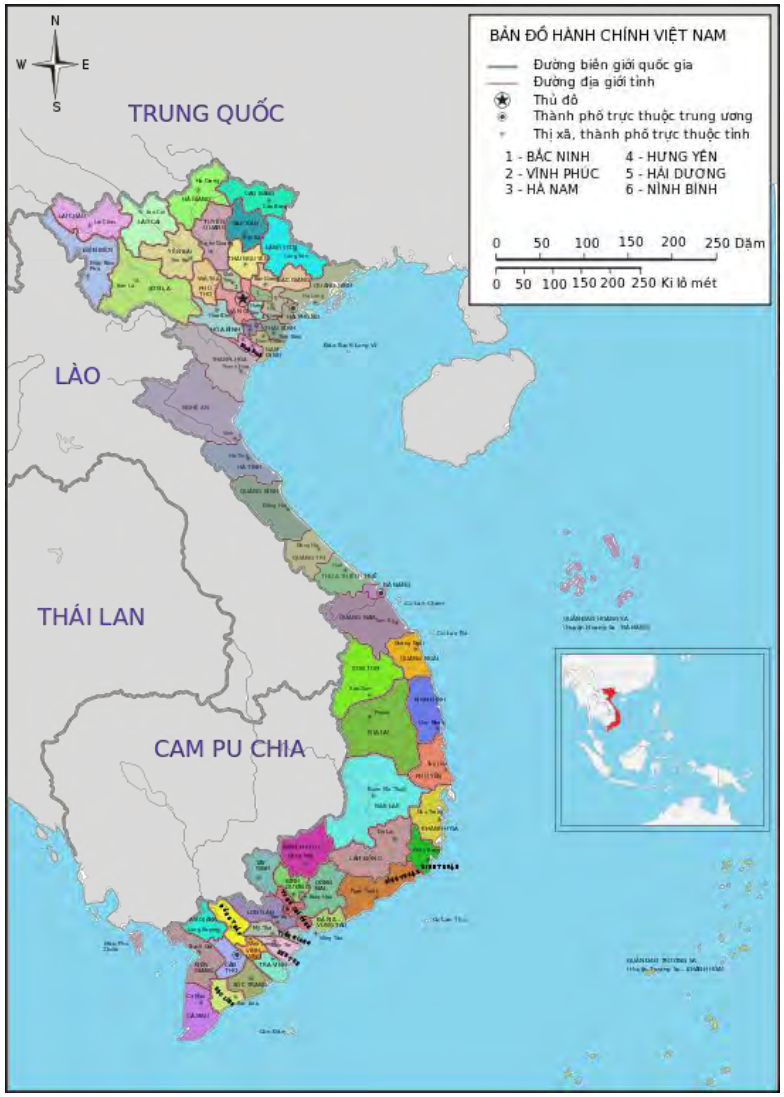
Outline

- Vietnam economy
- National Transportation Infrastructure System
- Urban Infrastructure System of Hanoi & HCMC
- Transit Development Plan of Hanoi & HCMC
- Computable General Equilibrium model
- Pocket Tour Guide

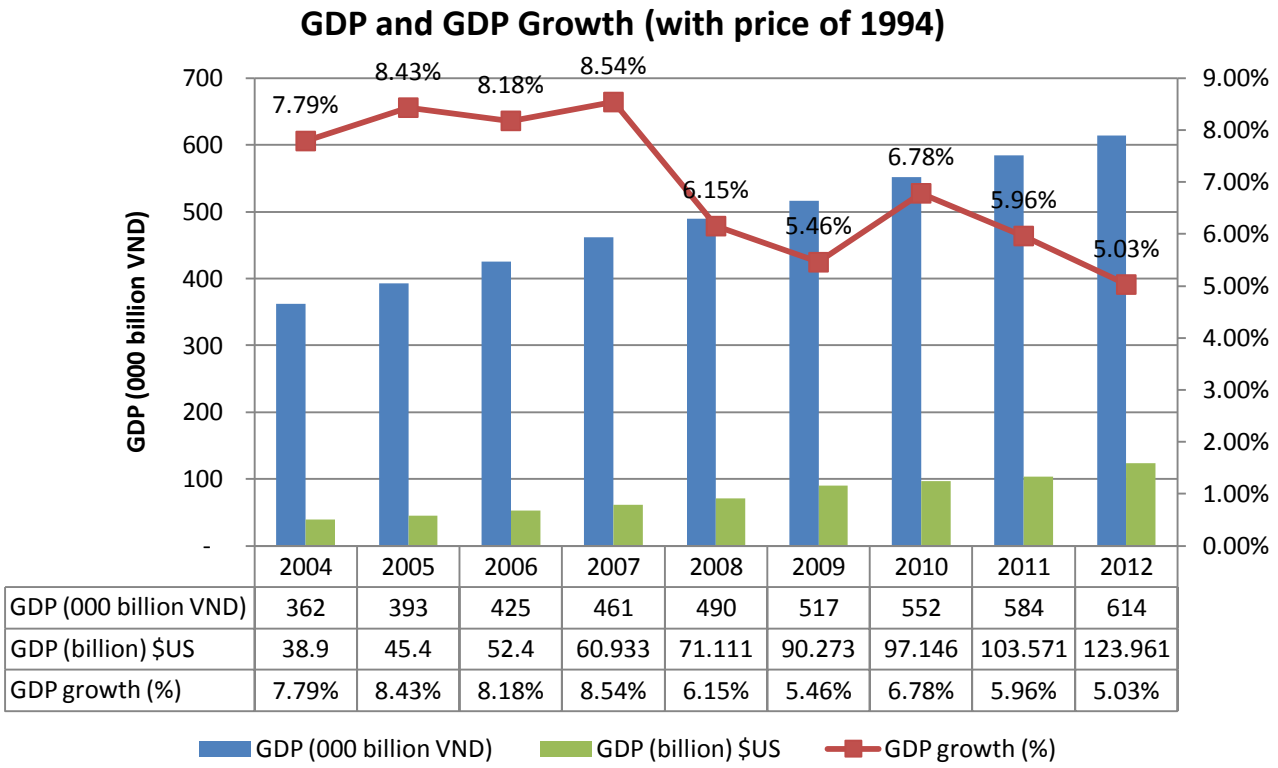
Vietnam at a glance
Administrator Subdivision



Capital: Hanoi (Hà Nội)
Largest city: Ho Chi Minh City (Hồ Chí Minh)
Area: 331,698 km²
Population: 91,519,289 (estimated 2012, 13th), (census of population 2009: 86,025,000)

1. Vietnam is divided into:
-58 provinces (Vietnamese: *tỉnh*) and,
-5 (Hanoi, Hai Phong, Da Nang, Ho Chi Minh and Can Tho) municipalities (*thành phố trực thuộc trung ương*), which are administratively on the same level as provinces.
2. The provinces are subdivided into
-provincial municipalities (*thành phố trực thuộc tỉnh*),
-townships (*thị xã*) and,
-counties (*huyện*), which are in turn subdivided into
-towns (*thị trấn*) or communes (*xã*). The centrally controlled municipalities are subdivided into districts (*quận*) and counties, which are further subdivided into wards (*phường*).

Vietnam at a glance
Economy



	2004	2005	2006	2007	2008	2009	2010	2011	2012
GDP (000 billion VND)	362	393	425	461	490	517	552	584	614
GDP (billion) $US	38.9	45.4	52.4	60.933	71.111	90.273	97.146	103.571	123.961
GDP growth (%)	7.79%	8.43%	8.18%	8.54%	6.15%	5.46%	6.78%	5.96%	5.03%

Source: General Statistics Office, GSO

Transportation Infrastructure System
Road network

- Road network: 280,905 km, density of 0.85 km/km^2 and 3.38 km/1,000 peoples; including
  - National: 17,646 km (6.28%): 7% 4 lanes; 43% good, 37% average, 20% poor and very poor condition;
  - Provincial: 25,449 km (9.06%);
  - District: 51,721 km (18.41%);
  - Commune :161,136 km (57.36%);
  - Urban: 17,025 km (6.06%); Specialized 7,837 km (2.79%).
- Developed highway speed: 6.3% /year.
- Vehicles: 34 mill. Motorbike, 1.8 mill. Motor vehicles. Transport volume: 470 mill.T; 23.3 bill. TKM; 1.8 bill pax. and 62 bill. Pax.km.

Transportation Infrastructure System
Railway network

- 2,600 km, density 0.95 km/1000 km2; 3 km/million people;
- narrow gauge, single track;
- Exploitation speed is 80-60 km/h; manual handling at road crossing; speed through 29/25 bridges only 60/50 km/h.
- Transport volume: 8 mill. T and 23.3 bill. Tkm; 346 diesel locomotive (75% more than 15 years old); 842 passenger and 4,856 good wagons.

Transportation Infrastructure System Airport

- Airport: 22, including 3 international, 19 local airport, 41.8 mill. pax/year; increase of 23.8% /year.
- 3 Largest international airports:
  - Noi Bai: 6 mill. pax; runway: 45 x 3,800 x 2;
  - Da Nang: 1,3 mill.pax; runway: 45 x 3,048 x 2;
  - Tan Son Nhat: 12 mill. pax; runway: 2 x 3,800 x 2.

Transportation Infrastructure System Seaport

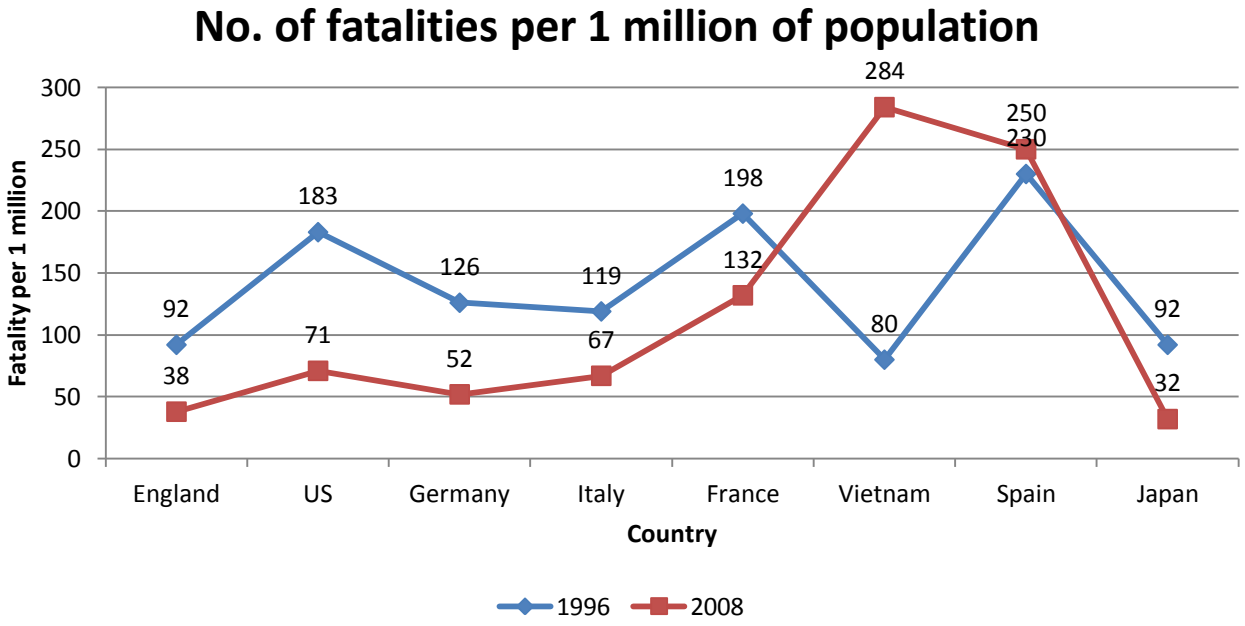
- Seaport: 49 including with 38 km length of the berth, through capacity 300 mill.T/year, including container 6,0 TEU, dry good: 165 mill.T; liquid good: 60 mill.T.
  - 17 ports type 1,
  - 23 type 2,
  - 9 port type 3,
- Inland waterway: 41,900 km can exploitation for transport but now only 15,436 km have been exploitation, above 3rd class, under central government management: 6735 km (7%); the rest is under the local authorities management, in the North: 2,700; the South 3,000 km; capacity 160 mill. T/year. Transport volume: 117 mill.T and 18 bill.TKm, and 162 mill pax and 3.2 bill. Pax.Km. 86,000 ships, average 70t/ship and 700,000 small ships






Transportation Accidence

- According to National Traffic Safety Committee report, in the first 4 months of 2013, there are 9,600 traffic accidences occur in all the country (3,364 fatalities and 2,349 injuries)
- Almost of traffic accidences are on road (>95%)



Source: Wikipedia

Urban Infrastructure System in municipal cities

Unequal development between region/provinces

Agglomeration occurs in the large cities (Hanoi, Hochiminh City)

Infrastructure development cannot catch up population growth

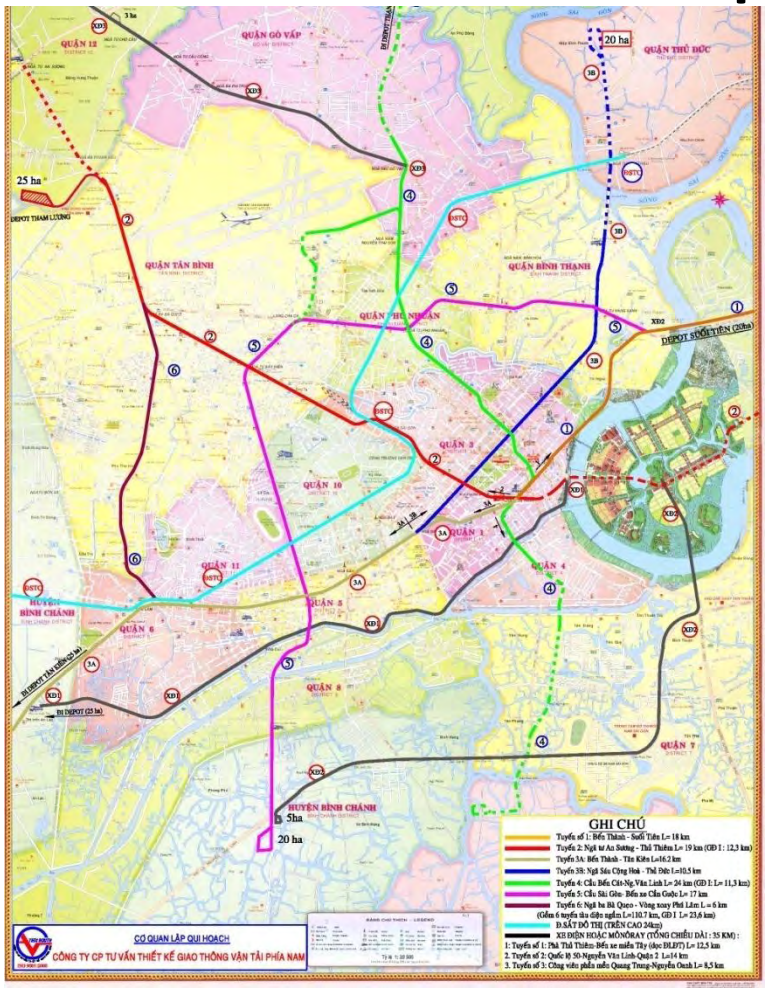
Daily life conditions in poor level (heath care, education, sanitary, transportation systems overload)

Travel Vehicles
Motorcycle Country

- Transport infrastructure inside urban area are on road system.
- Transit: bus only
- Private: almost motorcycle

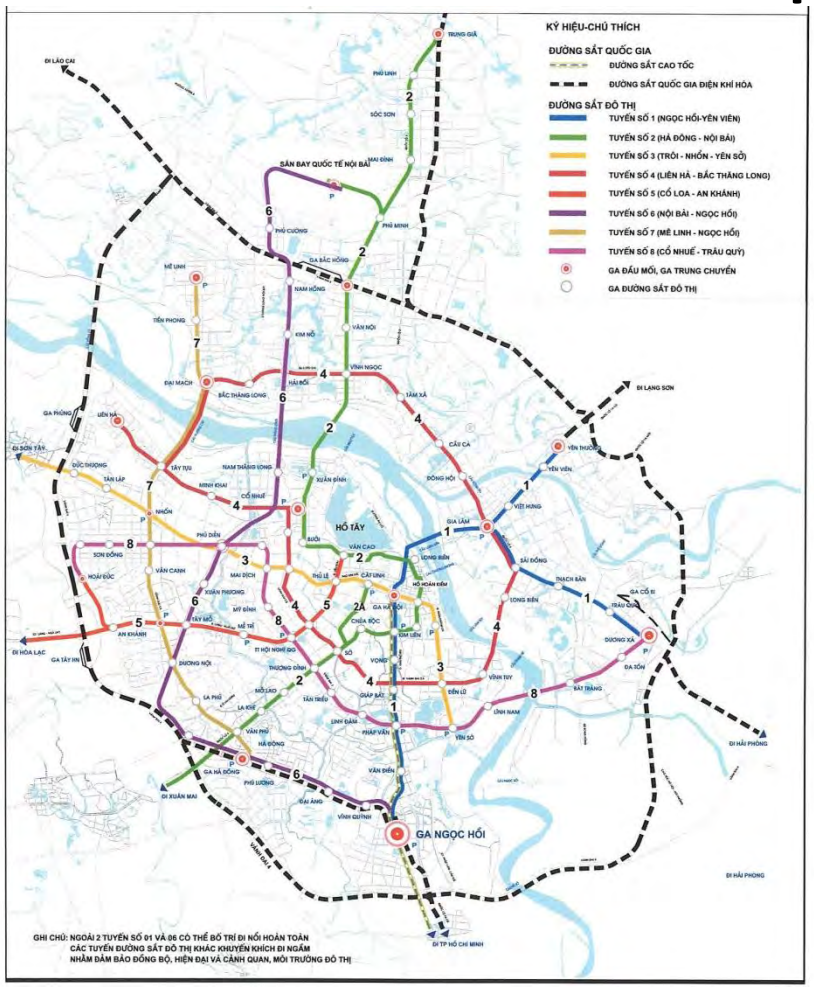
According to MoT: in Q1 2013, there are 28,535 autos and 691,599 motorcycle newly registered. In total, there are 37,023,078 MCs and 2,033,265 automobiles in all country. The number of MCs broke the “Road Transport Development Plan by 2020 and vision to 2030”, which has just been approved by PM in Feb 2013, in that, Vietnam will have ~36 million of MCs and 3.2~3.5 million of automobiles!!!

Urban Transport Infrastructure System Development Plan



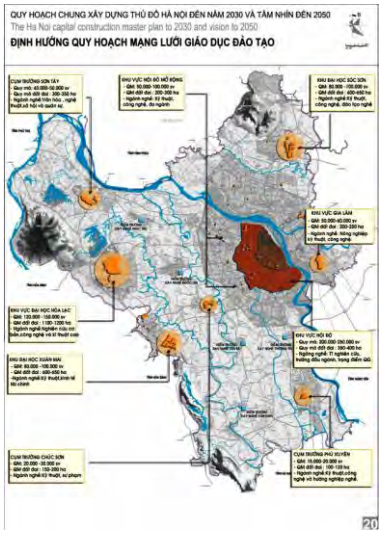
6 urban railway lines developed by 2020 in Ho Chi Minh City

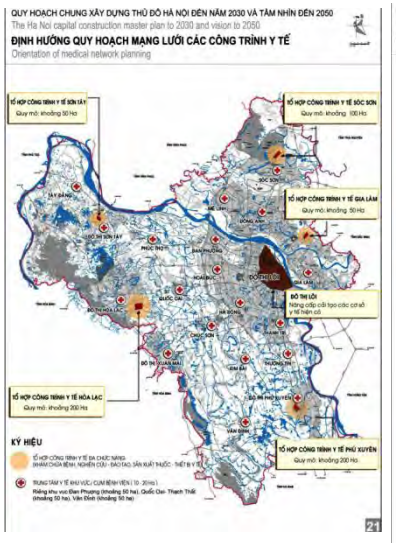
Urban Transport Infrastructure System Development Plan

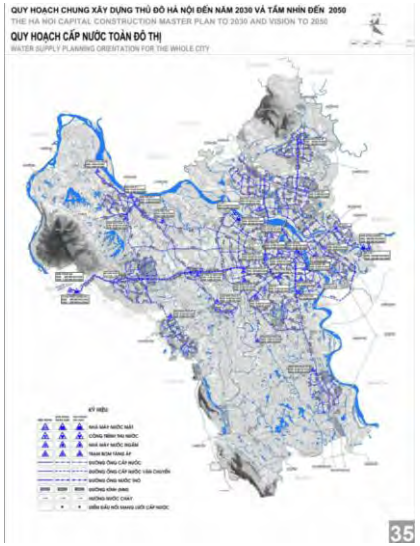


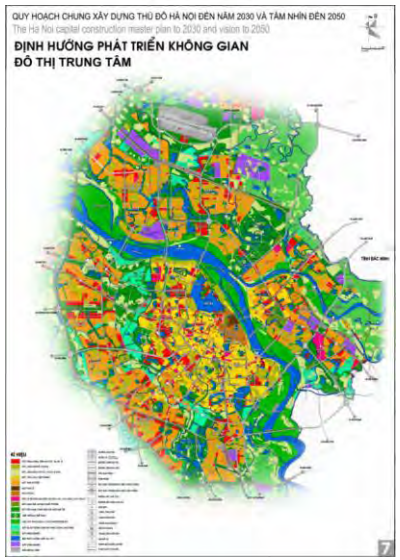
In the master plan, there will be 8 urban railway lines developed by 2030 in Hanoi Capital City

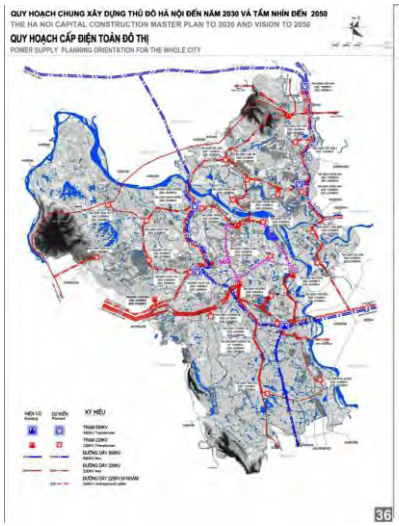
The Hanoi Capital Construction Master Plan to 2030 and Vision to 2050

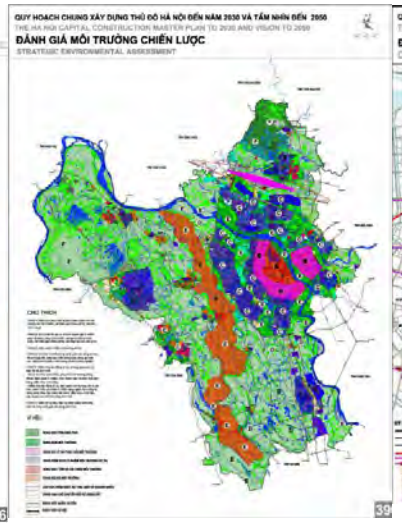












Computable General Equilibrium General Introduction

- The Computable General Equilibrium (CGE/CUE model) framework is used for making a snapshot of an economy in equilibrium state. It is a strong tool to evaluate the interaction effects on economic agents under policies.
- The model is in general based on the 2 basic economic principles:
  - **Optimization:** people try to choose the best patterns of consumption that they can offord.
  - **Equilibrium:** prices adjust until the amount that people demand of something is equal to the amount that is supplied.
- When the economy attains the general equilibrium state, the model's outputs would enrich the information (effects) of the policy/project under consideration and then can help decision-maker choosing a right or at least more appropriate alternative among the others.

CUE Model
Case study for Project Evaluation

- General assumptions:
  - Study region: 14 districts of “old” Hanoi comprised by 9 urban districts and 5 rural districts
  - Close model: all economic activities are assumed inside study region,
  - Behavior of 2 agents are modeling: consumer/absent landlord and producer
- Consumers:
  - Demand: commodity at any zone in study region and land for residence,
  - Supply: labor hour for production at any zone,
  - Also be absent landlord: all rental payment will accrue to all household/worker living in study region, on average.
- Producers:
  - Demand: only use labor time and land as input factors for production.
  - Supply: output of production (retail goods)
  - Perfect competitive in input factor markets.
  - Make zero profit, constant return to scale production function, freely join and leave the market.
  - All firms located in a model zone will be represented by 1 firm/producer

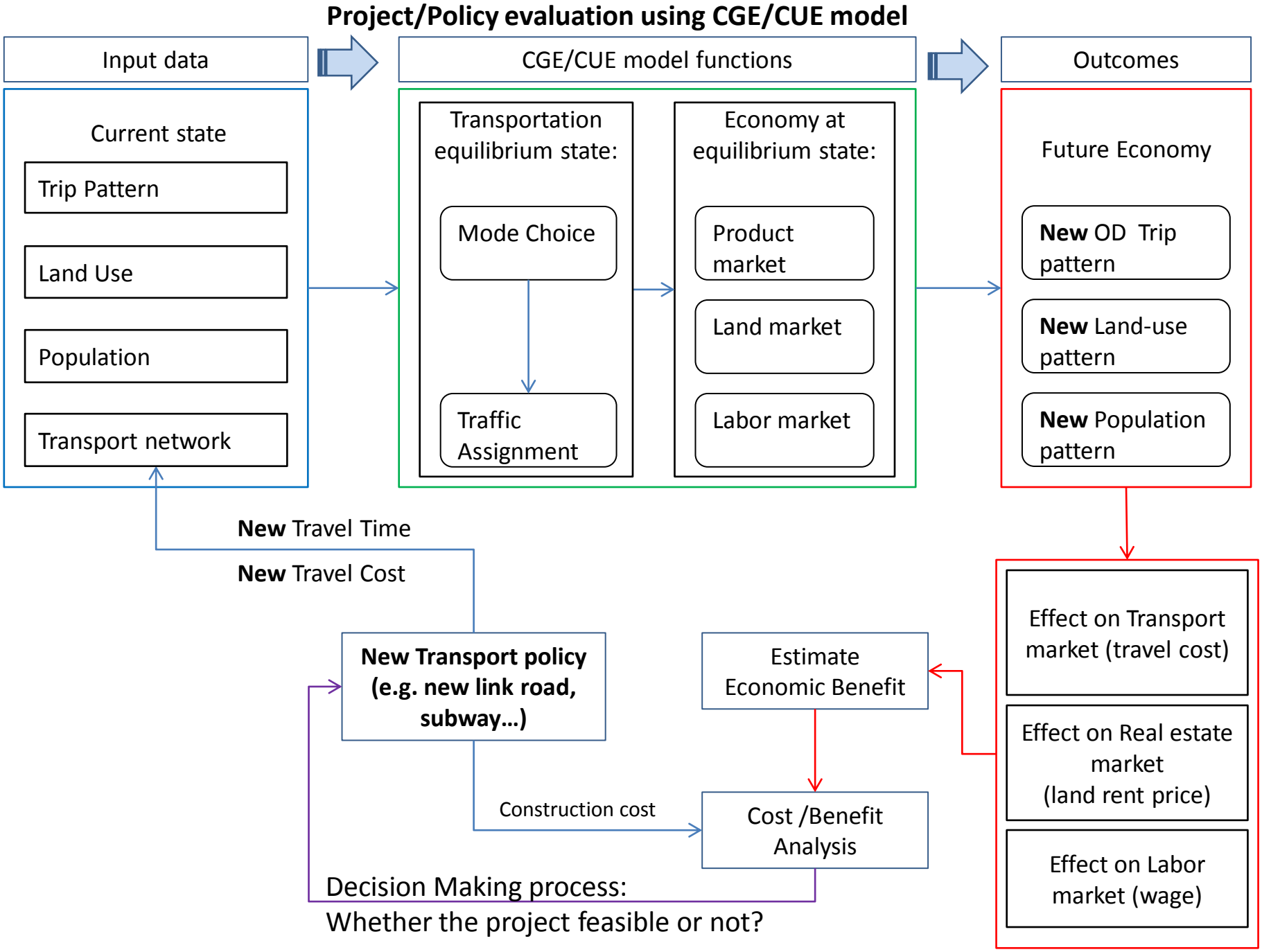
Trip and Land-use patterns for CUE model

- Trip pattern: Consider *Commuting* and *Shopping* trips
  - Commuting trips:
    - A typical worker will make only 1 (one) round trip for working,
    - Commuting trip will be assigned as home-based round trip, home-workplace-home
  - Shopping trips:
    - A typical worker can freely make any number of shopping trips under the constraint of working-traveling time endowment setting.
    - Shopping trips are also assumed to be a home-based round trip, home-shopping place-home.
    - 1 composite retail commodity per 1 shopping trip.
- Land-use pattern: land for *residence* and *production* at each zone are proposed the sum up of:
  - Commercial and Business (1)
  - Government and quasi-public (4)
  - Health and welfare (5)
  - Mixed residential and commercial (8)
  - Park and recreational (10)

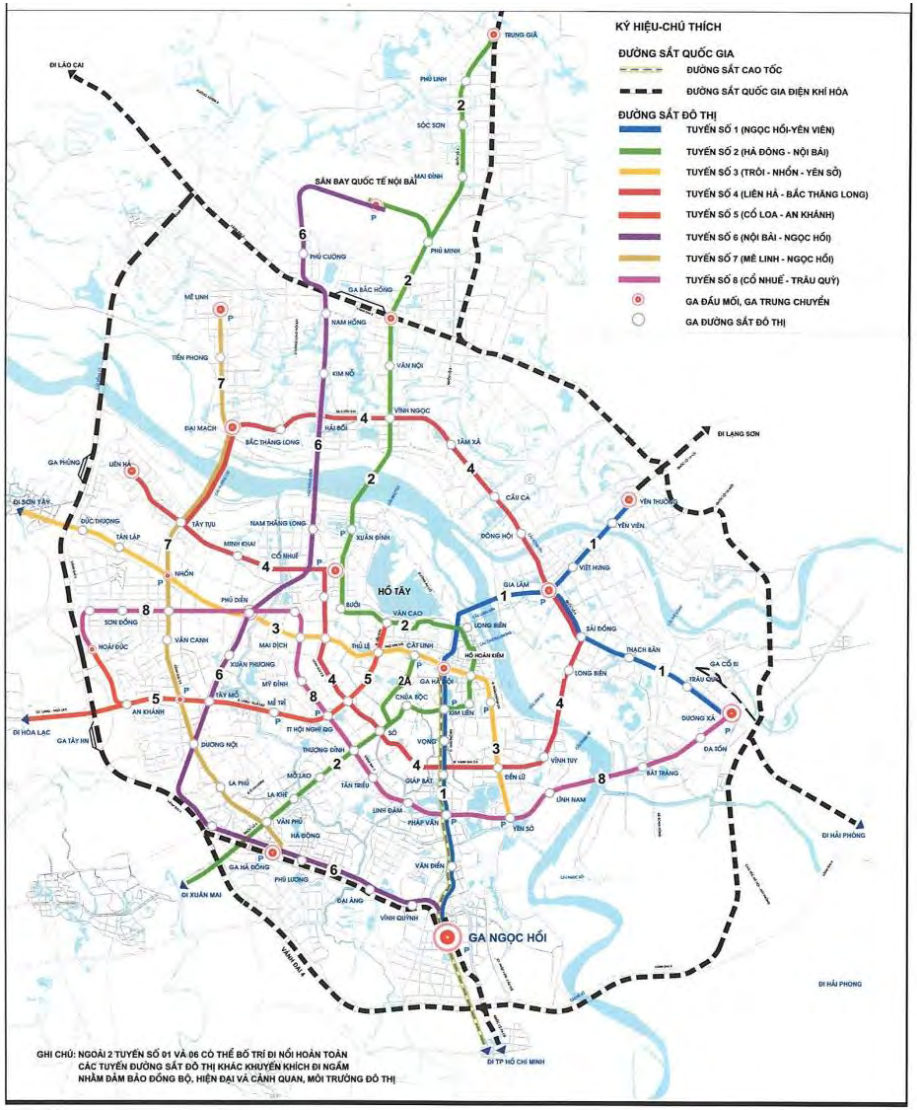
Trip pattern (Commuting and Shopping) from PT data 2005

Commuting		Demand (Working Zone)														ΣSupply
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Supply (Home Zone)	1	21,438	3,013	13,575	7,107	11,867	4,189	4,103	1,386	1,835	679	240	1,683	721	239	72,075
	2	5,669	7,960	4,986	3,107	3,701	1,375	1,994	505	747	222	177	852	341	156	31,792
	3	5,874	1,417	17,756	7,097	6,112	1,494	2,128	832	1,136	170	134	591	62	317	45,120
	4	8,245	2,083	17,275	34,637	10,305	4,542	3,463	4,304	1,874	390	240	961	781	386	89,486
	5	12,916	1,852	20,635	14,114	30,750	8,065	4,966	2,334	1,979	475	192	1,924	725	333	101,260
	6	5,409	1,056	6,488	6,306	10,231	19,010	2,680	1,868	985	201	150	1,132	731	201	56,448
	7	7,035	1,422	6,481	3,826	7,698	3,156	15,051	732	1,074	292	245	3,629	147	150	50,938
	8	3,309	982	8,606	12,699	5,917	4,016	1,220	18,660	1,026	344	99	1,212	2,033	147	60,270
	9	2,025	873	5,108	2,895	2,751	1,062	723	289	34,109	1,019	535	438	191	2,322	54,340
	10	375	95	140	46	190	47	94	-	94	92,700	1,698	188	-	93	95,760
	11	715	473	996	622	768	430	433	47	1,233	810	57,372	717	95	619	65,330
	12	4,341	1,578	3,402	1,724	3,790	3,158	5,410	394	933	296	543	36,271	345	197	62,382
	13	1,339	336	1,615	3,877	2,984	2,426	382	4,167	428	47	47	521	25,564	94	43,827
	14	1,043	425	2,712	1,232	891	189	285	379	11,239	234	707	282	237	47,523	67,378
ΣDemand		79,733	23,565	109,775	99,289	97,955	53,159	42,932	35,897	58,692	97,879	62,379	50,401	31,973	52,777	896,406

Shopping		Supply/Production (Shopped Zone)														ΣDemand
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Demand/Consumption (Home Zone)	1	55,762	5,458	13,769	5,384	6,264	1,217	2,060	916	2,630	3	4	1,191	90	262	95,010
	2	9,997	42,806	7,670	3,323	2,362	780	2,256	362	398	79	2	718	-	198	70,951
	3	10,566	1,610	47,313	5,514	5,761	715	2,548	684	990	74	44	1,425	259	370	77,873
	4	8,135	2,033	14,488	95,872	9,897	3,752	3,368	4,248	943	304	9	1,338	450	250	145,087
	5	15,839	1,870	31,428	25,357	89,522	4,662	4,759	1,709	4,147	238	1	1,333	766	1,247	182,878
	6	3,726	648	8,867	10,291	11,154	49,450	1,877	5,165	2,058	2	403	1,096	885	804	96,426
	7	6,453	2,748	7,428	3,171	4,946	1,426	49,148	645	1,090	1	1	2,051	45	-	79,153
	8	3,649	1,275	5,750	11,124	6,444	3,026	1,970	43,894	652	1	1,471	314	4,250	203	84,023
	9	3,463	1,370	6,047	1,460	3,976	972	576	83	61,524	339	2,185	270	165	1,860	84,290
	10	4	-	494	391	2	-	161	-	1,456	52,910	1,383	49	-	47	56,897
	11	538	55	1,826	1,015	147	1	211	38	1,218	969	99,289	160	-	2,434	107,901
	12	3,565	1,864	5,881	1,324	3,054	1,485	9,096	209	1,415	3	6	68,117	194	229	96,442
	13	933	49	2,244	2,142	1,465	1,307	391	1,314	202	-	-	98	33,688	-	43,833
	14	2,041	27	1,563	481	639	188	326	542	5,241	223	1,056	-	206	64,196	76,729
ΣSupply		124,671	61,813	154,768	166,849	145,633	68,981	78,747	59,809	83,964	55,146	105,854	78,160	40,998	72,100	1,297,493


Project/Policy evaluation using CGE/CUE model
Input data
CGE/CUE model functions
Outcomes
Current state
Trip Pattern
Land Use
Population
Transport network
Transportation equilibrium state:
Mode Choice
Traffic Assignment
Economy at equilibrium state:
Product market
Land market
Labor market
Future Economy
New OD Trip pattern
New Land-use pattern
New Population pattern
New Travel Time
New Travel Cost
New Transport policy (e.g. new link road, subway…)
Estimate Economic Benefit
Construction cost
Cost /Benefit Analysis
Decision Making process:
Whether the project feasible or not?
Effect on Transport market (travel cost)
Effect on Real estate market (land rent price)
Effect on Labor market (wage)

Hanoi Light Rail Transit System
West-East Pilot Line (Nhon - Hanoi Station)



Hanoi (before 2008)

Source: Haidep report

Travel time

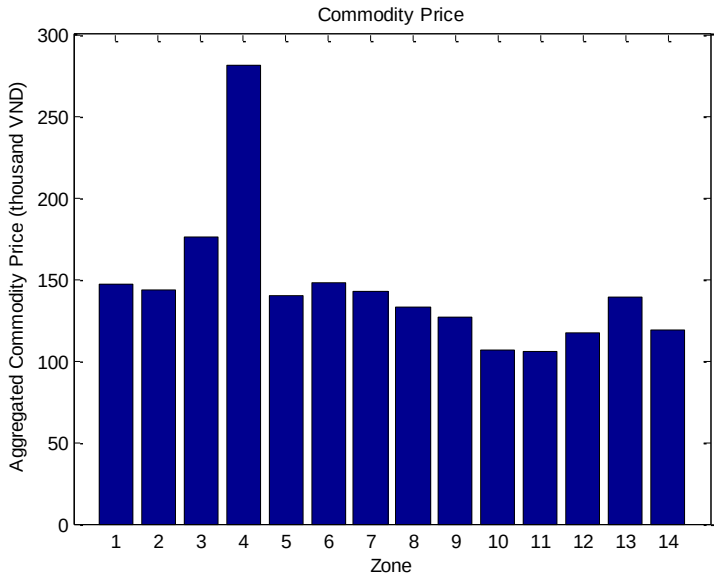
- Travel time matrix :
  - Case 0: No change
  - Case 2: West-East light rail pilot line is introduced, Nhon (Depart) -> Tu Liem (12) -> Cau Giay (7) -> Ba Dinh (1) -> Hoan Kiem (3). Total time is about 20 minutes -> assumed average 5 minutes (0.083h)/section => travel time matrix changed as follow:

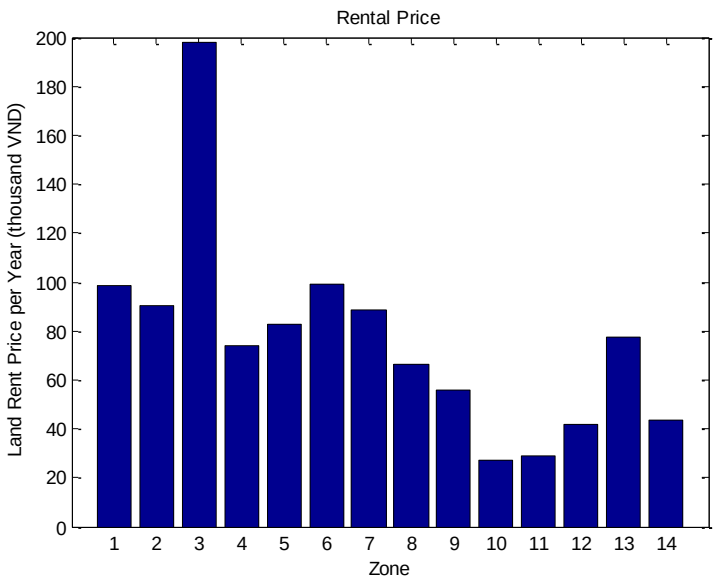
Travel time (hour)		Destination Zone													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Origin Zone	***1***	0.118	0.218	***0.083***	0.480	0.337	0.456	***0.083***	0.555	0.690	1.092	0.796	***0.167***	0.605	0.920
	2	0.215	0.183	0.512	0.540	0.399	0.495	0.231	0.618	0.726	0.997	0.701	0.375	0.668	0.957
	3	***0.083***	0.520	0.086	0.137	0.224	0.551	***0.167***	0.284	0.389	1.257	0.961	***0.250***	0.341	0.620
	4	0.517	0.575	0.176	0.119	0.265	0.500	0.388	0.232	0.444	1.312	1.016	0.649	0.287	0.675
	5	0.341	0.405	0.235	0.244	0.120	0.407	0.214	0.344	0.493	1.219	0.923	0.475	0.394	0.724
	6	0.458	0.497	0.561	0.488	0.401	0.115	0.308	0.483	0.809	1.211	0.915	0.441	0.525	1.039
	7	***0.083***	0.237	***0.167***	0.369	0.216	0.303	0.133	0.411	0.609	1.019	0.723	***0.083***	0.461	0.840
	8	0.577	0.641	0.308	0.237	0.350	0.500	0.431	0.234	0.552	1.421	1.124	0.660	0.205	0.783
	9	0.637	0.673	0.327	0.394	0.440	0.767	0.571	0.511	0.292	1.192	0.820	0.832	0.596	0.231
	10	1.055	0.959	1.202	1.269	1.184	1.175	0.983	1.372	1.144	0.659	0.343	1.054	1.422	1.015
	11	0.799	0.703	0.946	1.013	0.928	0.918	0.727	1.116	0.802	0.372	0.514	0.797	1.166	0.672
	12	***0.167***	0.367	***0.250***	0.626	0.474	0.436	***0.083***	0.643	0.867	1.081	0.784	0.330	0.693	1.042
	13	0.620	0.684	0.363	0.286	0.394	0.539	0.475	0.198	0.631	1.464	1.167	0.703	0.304	0.862
	14	0.857	0.893	0.547	0.614	0.660	0.987	0.791	0.731	0.220	1.052	0.680	1.052	0.816	0.406

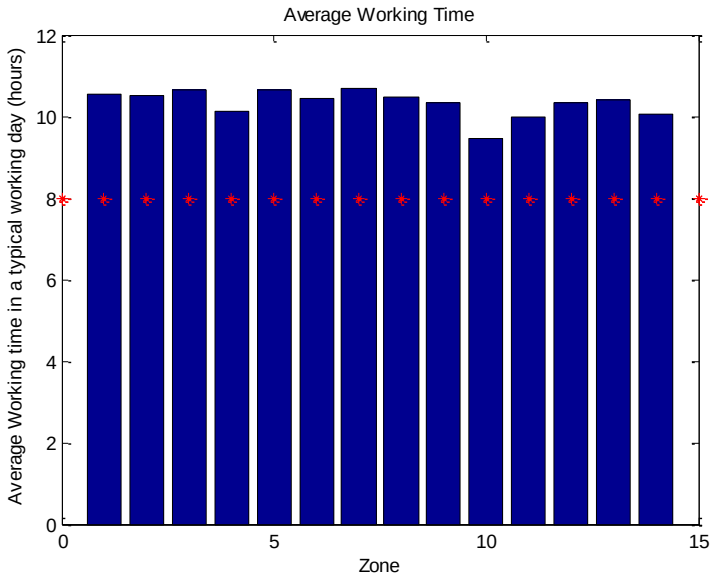
Summary for Simulation Settings

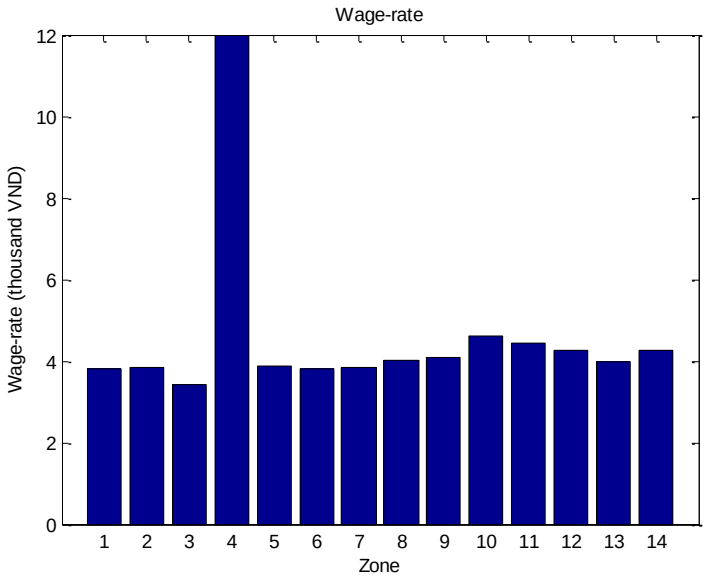
Simulation setting				
No.	**Exogenous variable and parameters**	**Value**	**Unit**	**Note**
I	**Exogenous variables**			
1	*Population and Worker*			PT data 2005
	-Population	2,952,035.00	(citizen)	
	-Number of worker	896,406.00	(workers)	
2	*Land-use*			Land-use data 2005
	-Residence	111,028,495.40	(m2)	summary table for detail
	-Production	12,638,252.20	(m2)	summary table for detail
3	*Working time*			Labor Legislation 2012
	- Number of working day/year	230.00	(days/year)	average estimation
	-Time endowment for working and traveling	12.00	(hours/day)	work: 8h, travel: 4h
4	*Transportation*			PT data 2005
	- Travel time	-	(hour)	real traffic assignment result
	- Travel cost	1,000.00	(VND/km)	min route OD matrix
II	**Parameters**			
5	*Consumers' expenditure share*			
	-Commodity (α)	0.80		roughly setting
	+ CES between retail goods by zone (η)	0.50		roughly setting
	-Housing (β)	0.20		roughly setting
6	*Producers' expenditure share for input factors*			PT data 2005, inference result
	-Labor (δ)	0.65		Regression result
	-Land (μ)	0.35		Regression result
	-Productivity (A)	0.15		Regression result
II	**Numeraire**			
	Wage rate in central zone (Hai Ba Trung, 4)	12,000.00	(VND/hour)	Estimated from PT data

Simulation result (1)
Endogenous variable

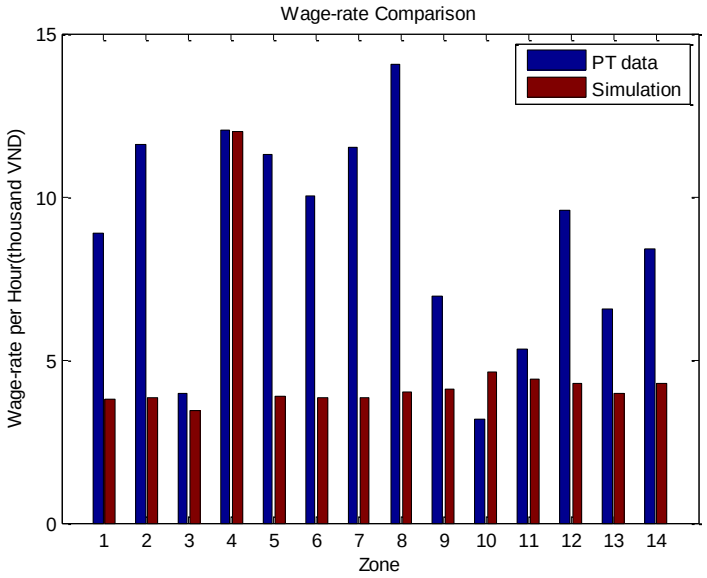


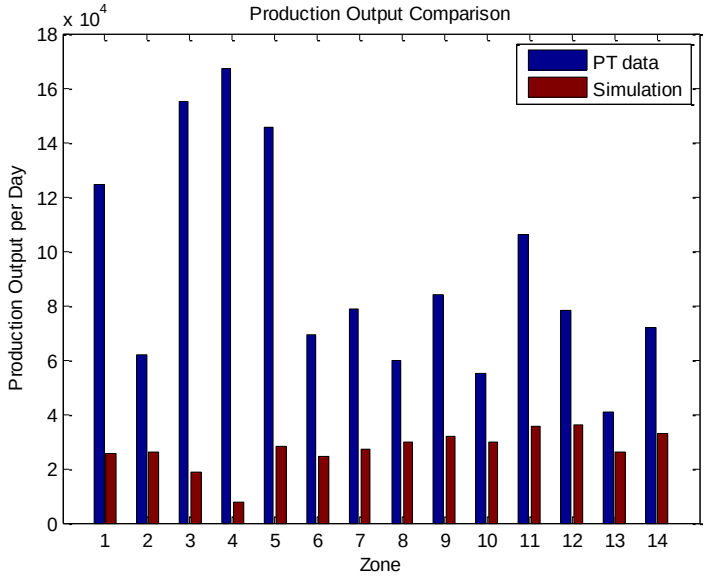


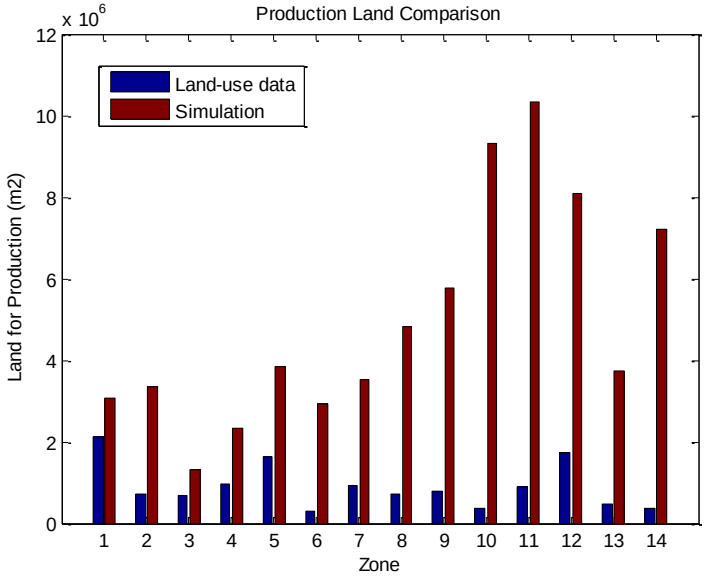


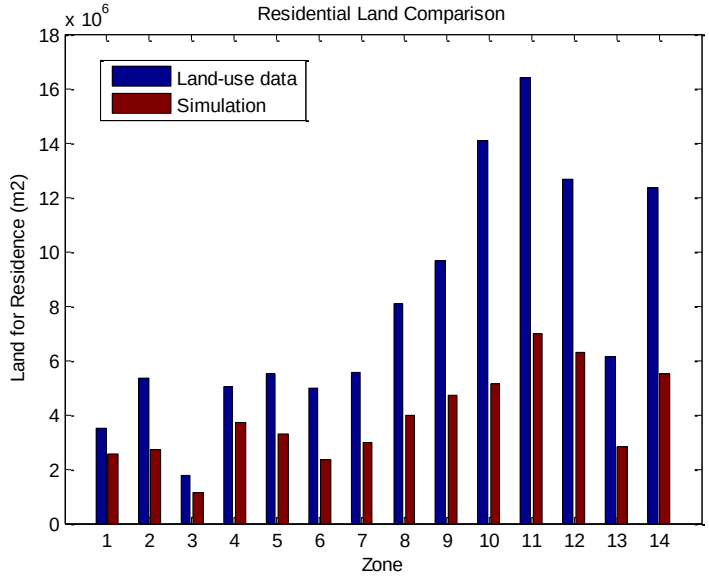


Simulation result (2)
Comparison with real data

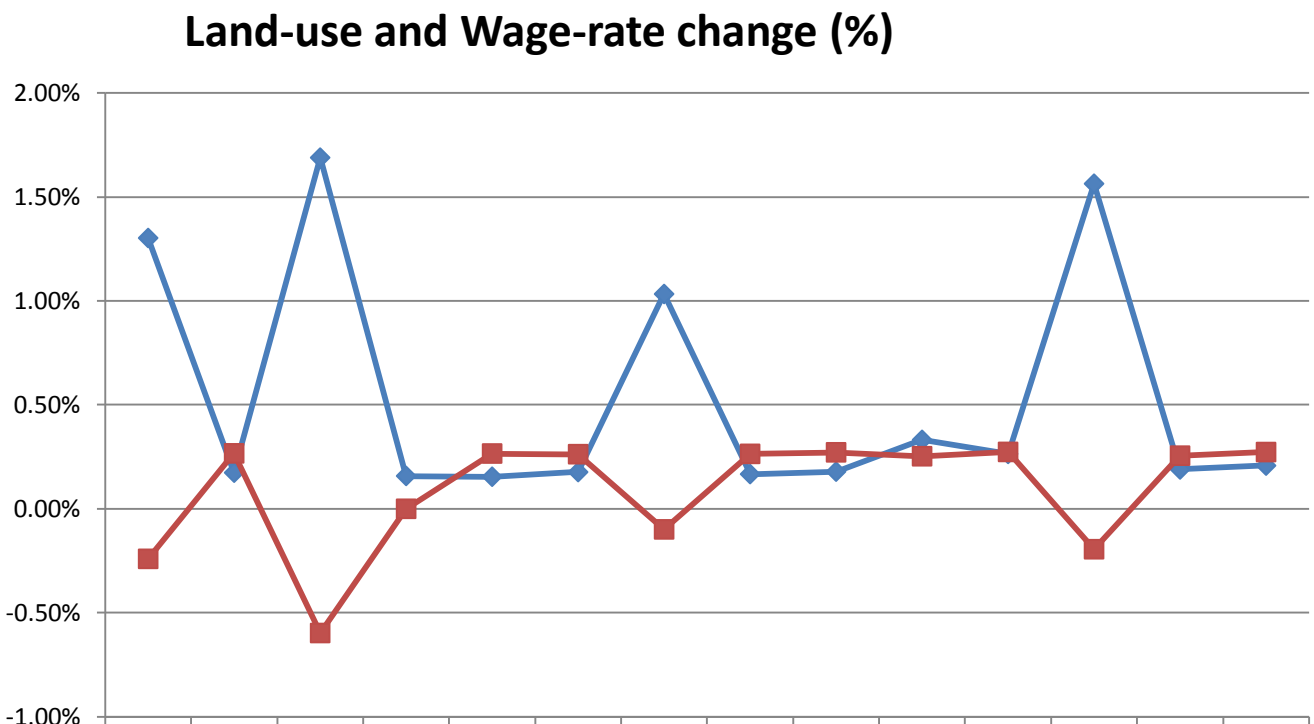






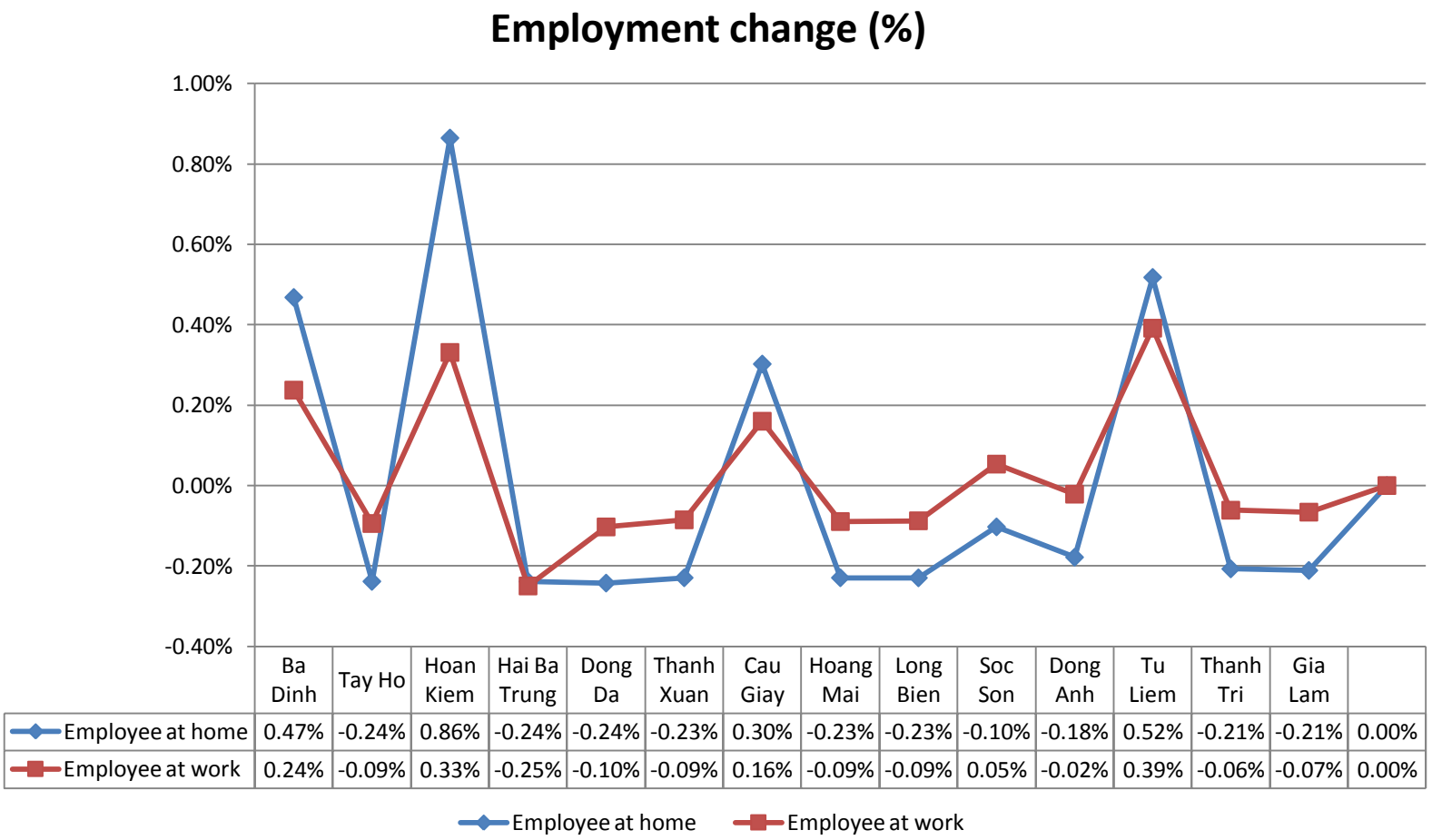


Simulation Results (4)
(0-2)



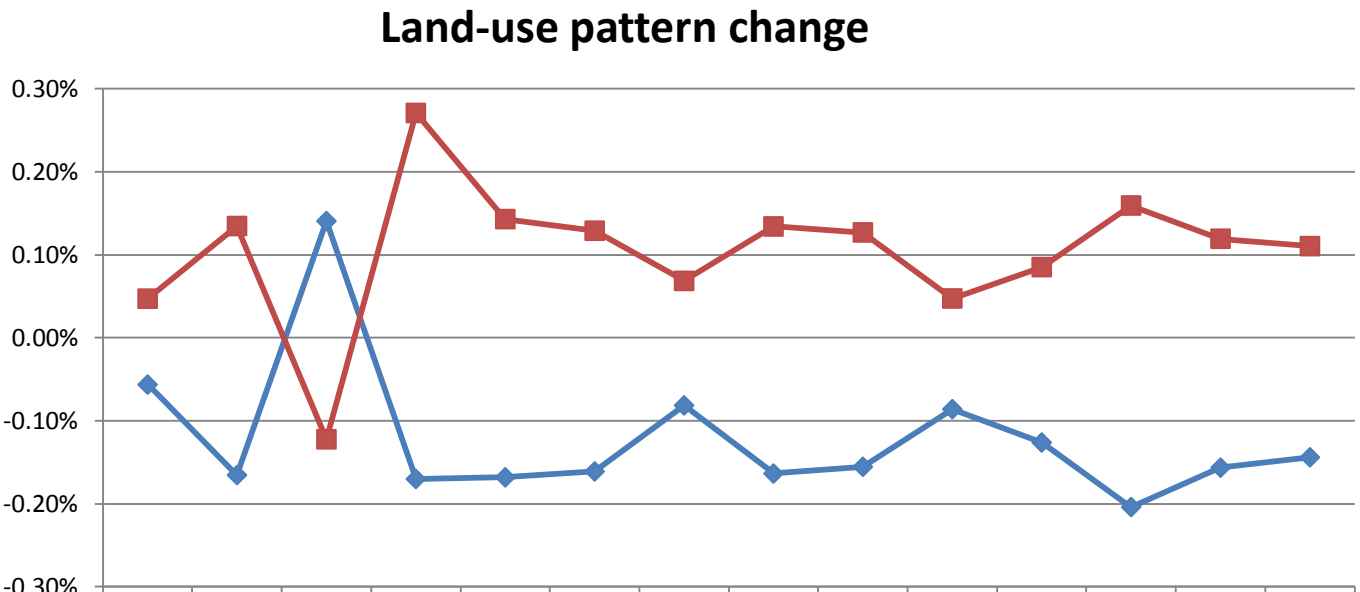
	Ba Dinh	Tay Ho	Hoan Kiem	Hai Ba Trung	Dong Da	Thanh Xuan	Cau Giay	Hoang Mai	Long Bien	Soc Son	Dong Anh	Tu Liem	Thanh Tri	Gia Lam
Land rent price change	1.30%	0.17%	1.69%	0.16%	0.15%	0.18%	1.03%	0.17%	0.18%	0.33%	0.26%	1.56%	0.19%	0.21%
Wage rate change	-0.24%	0.27%	-0.60%	0.00%	0.27%	0.26%	-0.10%	0.26%	0.27%	0.25%	0.27%	-0.19%	0.26%	0.27%

Simulation Results (5)
(0-2)



	Ba Dinh	Tay Ho	Hoan Kiem	Hai Ba Trung	Dong Da	Thanh Xuan	Cau Giay	Hoang Mai	Long Bien	Soc Son	Dong Anh	Tu Liem	Thanh Tri	Gia Lam	
Employee at home	0.47%	-0.24%	0.86%	-0.24%	-0.24%	-0.23%	0.30%	-0.23%	-0.23%	-0.10%	-0.18%	0.52%	-0.21%	-0.21%	0.00%
Employee at work	0.24%	-0.09%	0.33%	-0.25%	-0.10%	-0.09%	0.16%	-0.09%	-0.09%	0.05%	-0.02%	0.39%	-0.06%	-0.07%	0.00%

Simulation Results (6)
(0-2)



	Ba Dinh	Tay Ho	Hoan Kiem	Hai Ba Trung	Dong Da	Thanh Xuan	Cau Giay	Hoang Mai	Long Bien	Soc Son	Dong Anh	Tu Liem	Thanh Tri	Gia Lam
Residence	-0.06%	-0.17%	0.14%	-0.17%	-0.17%	-0.16%	-0.08%	-0.16%	-0.16%	-0.09%	-0.13%	-0.20%	-0.16%	-0.14%
Production	0.05%	0.13%	-0.12%	0.27%	0.14%	0.13%	0.07%	0.13%	0.13%	0.05%	0.09%	0.16%	0.12%	0.11%

Hanoi

Area: 3328,9 km² (largest city of Vietnam)
Population: 6,699,600 (estimated 2011),
(census of population 2009: 6.5 mil.)
10 urban districts, 18 suburban districts and 1 town
Capital and Politic center of Vietnam

Hue (Old Capital)


Capital City of Thua Thien – Hue Province
Area: 83.3 km²
Population: 340,0 00 (estimated 2010),
27 Wards
Capital of the last Dynasty of Nguyễn (1802-1945)



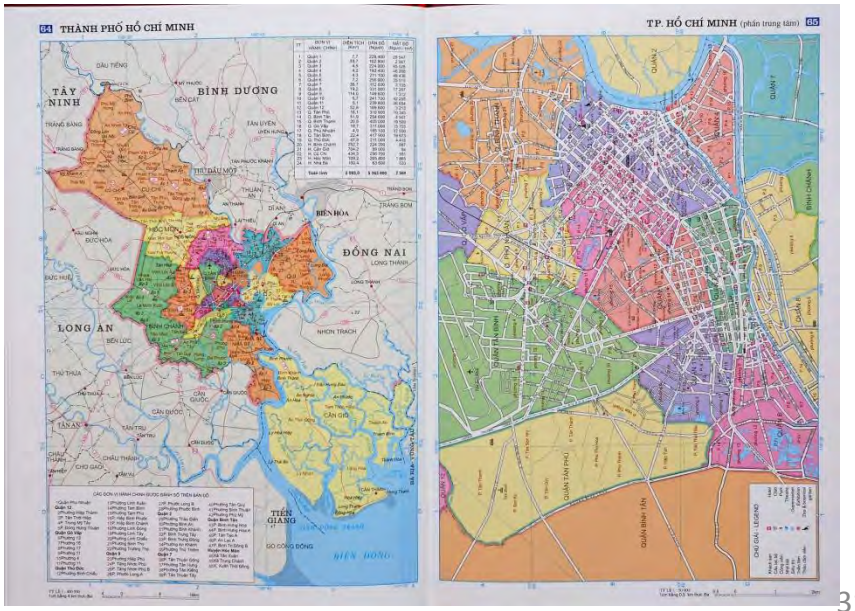



Danang

Area: 1,256 km^2
Population: 887,069 (census of population 2009)
7 urban districts and 1 suburban districts (Hoang Sa/Paracel Islands)
The leading industrial center of central Vietnam
Key industry: Tourism

Ho Chi Minh City

Area: 2,095 km^2 (second largest city of Vietnam)
Population: 7,521,138 (estimated 2011), (census of population 2009: 7,162,864)
17 inner/urban districts and 5 suburban districts
The most dynamic and attractive economy of Vietnam



The aim of life is self-development. To realize one's nature perfectly - that is what each of us is here for.

Oscar Wilde (1854 - 1900)

Thank you very much!