



Overview of Quantification Using ExSS

Kei Gomi, Kyoto University
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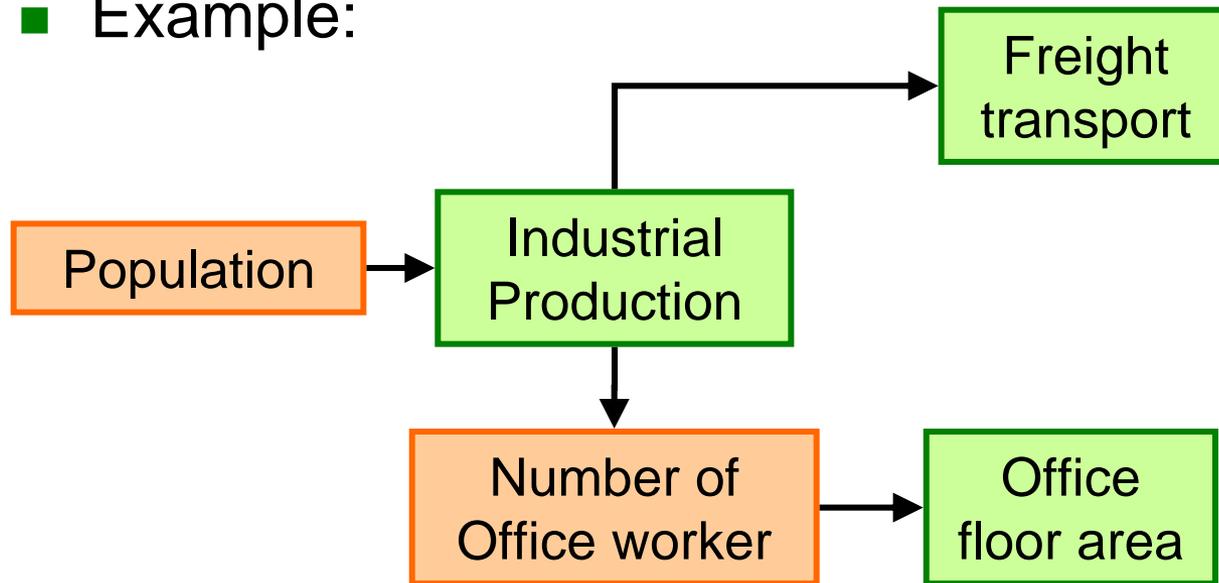
What's ExSS?

- Extended SnapShot tool
(extended from energy snapshot tool)
 - Needs: We need future image of our society to discuss LCS
(population, economic structure, land-use etc)
- >Quantitative future snapshot
- >Extend the estimation target to estimation of Driving Force



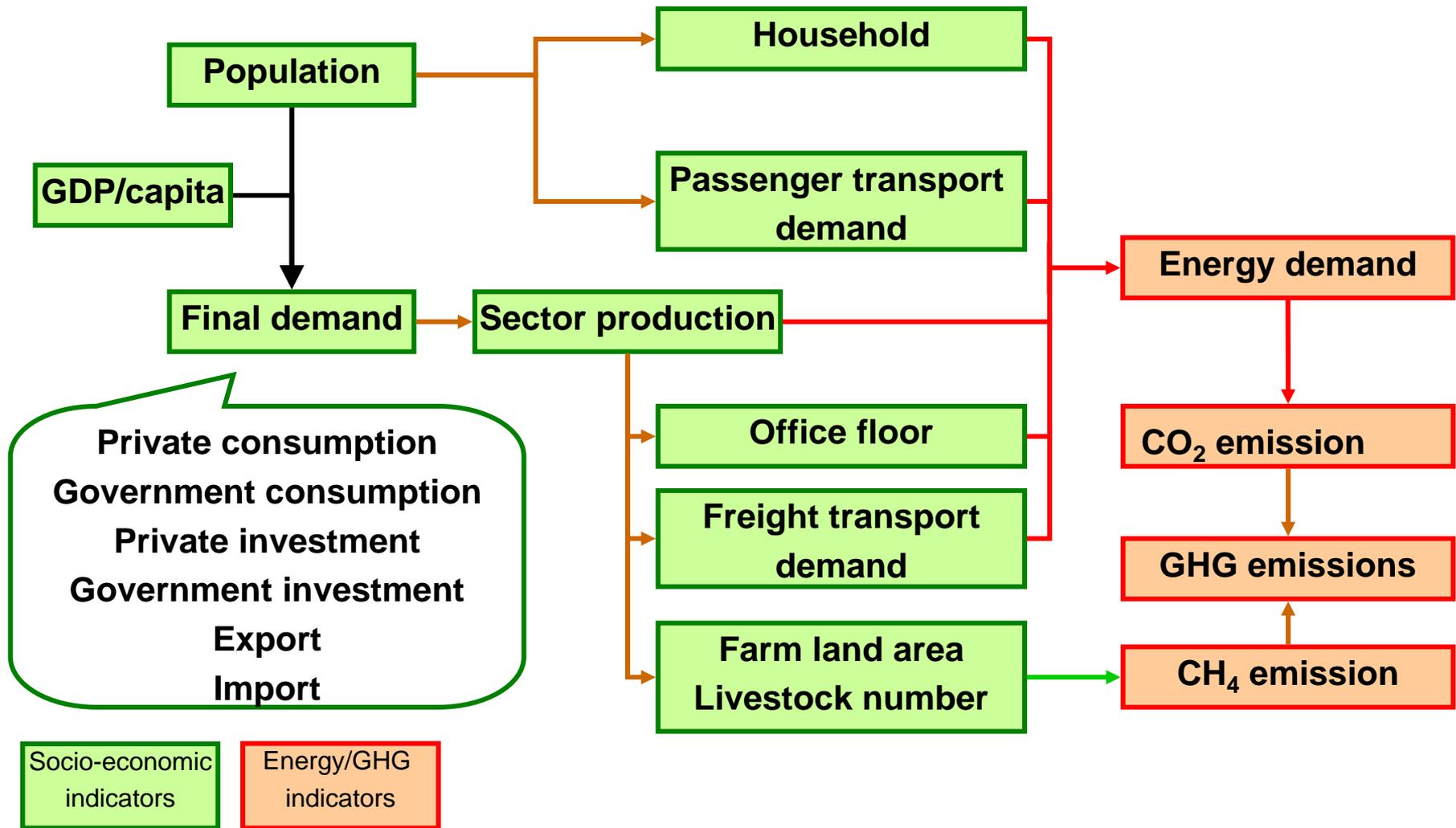
General Idea

- Activity level of each sector is related each other
- Example:



By formulating relationship between Indicators,
We can estimate Driving Forces simultaneously,
Under assumptions of future depictive image.

Structure of ExSS (early version)



→ Both by EXCEL & GAMS.

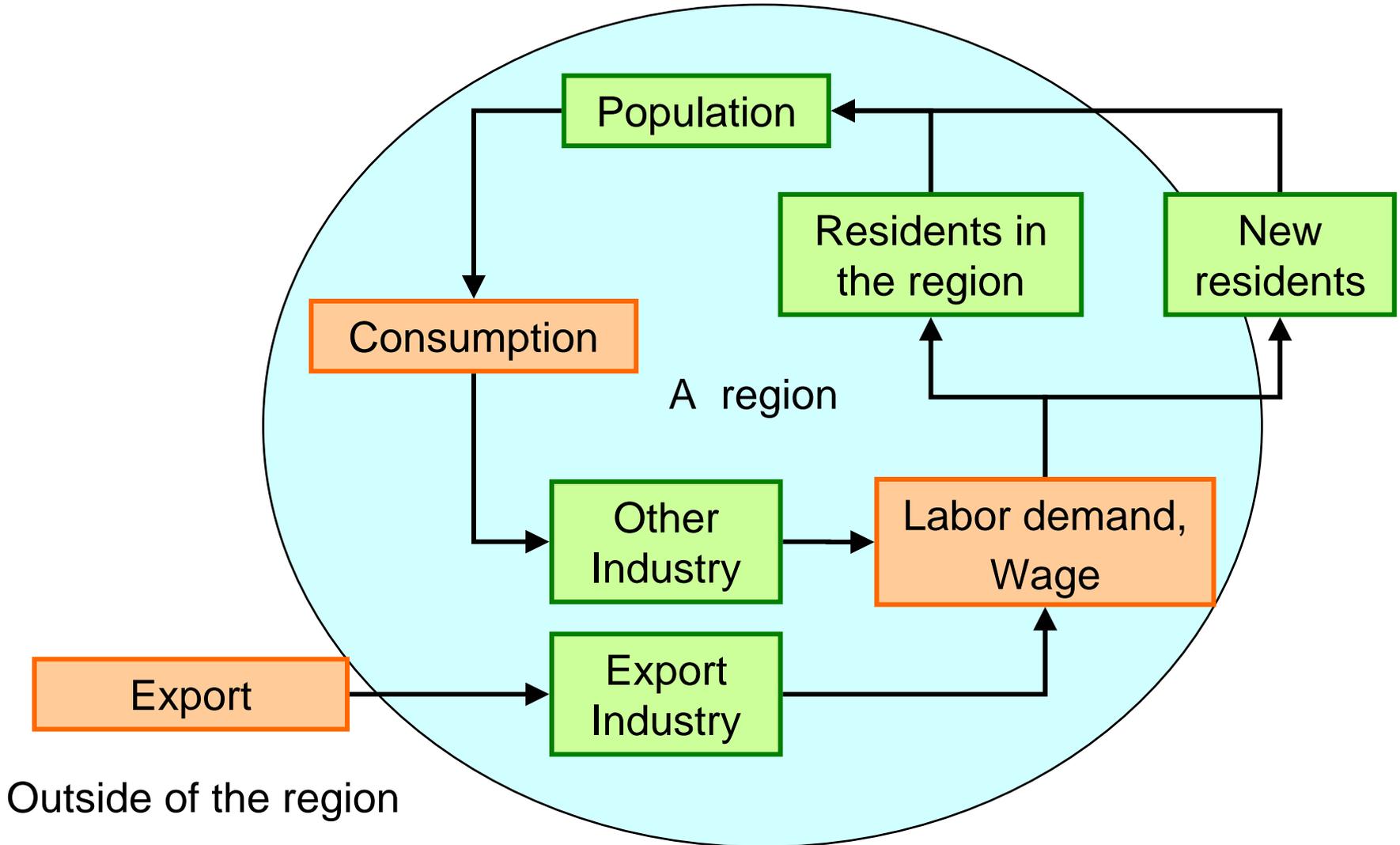


Some problem of application

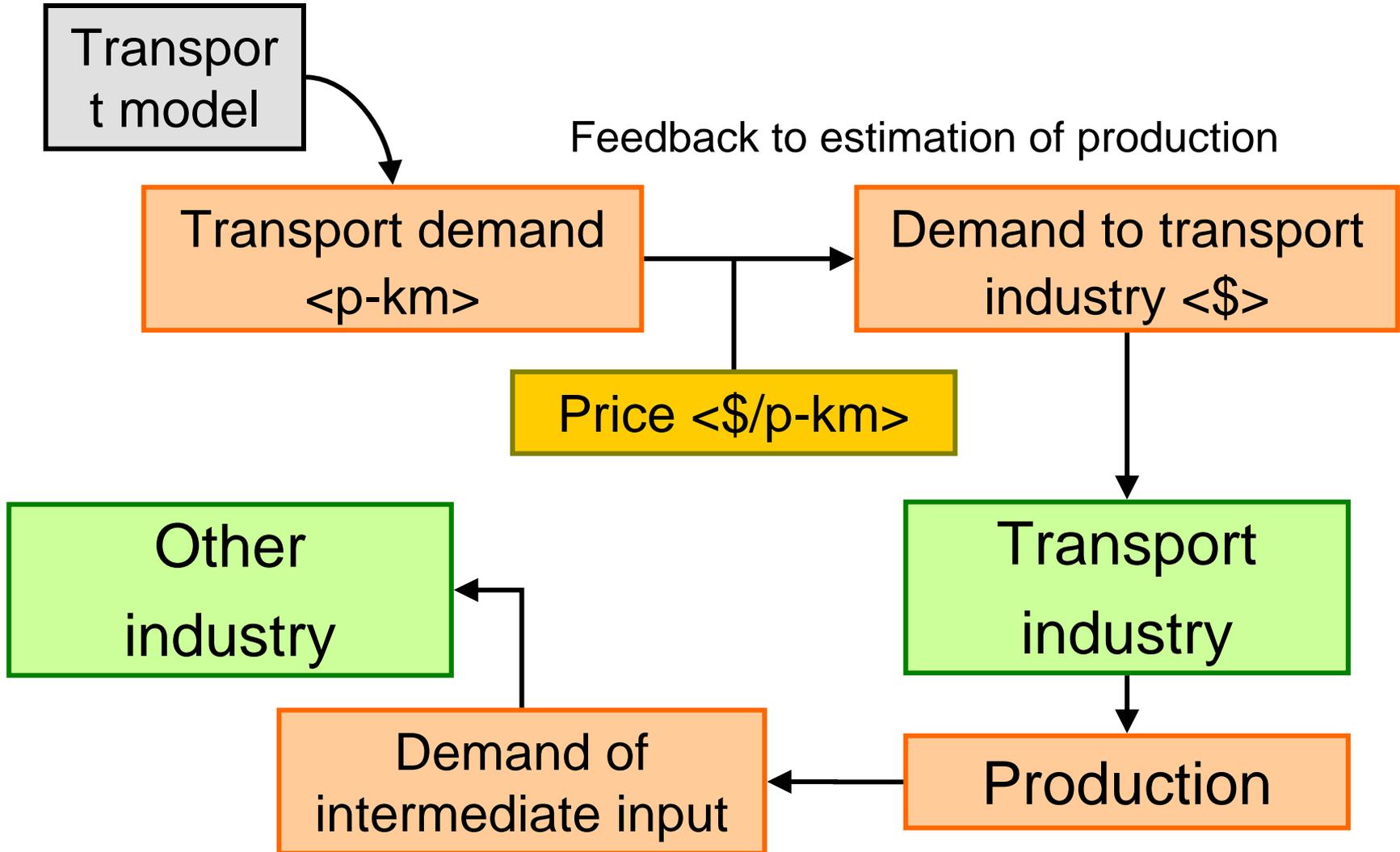
- Viewpoint of local development
 - Employment
 - Base industry (main export industry of the region)
->many municipalities try to attract investment of factories from outside of the region

- Transport & Energy industry
 - Energy demand (calculated by ESS) and production of energy industry
 - Transport volume (calculated by early ExSS) and production of transport industry

Export industry and population



Transport/Energy demand and Spillover





Let's solve them, simultaneously

Modeling policies are;

- To formulate those relationships in a set of simultaneous equations
- To use IO analysis to calculate spillover effect and feedback loop
- To find solution by numeric calculation program (GAMS)



Sample of GAMS window

```
IDE gamside: C:\Documents and Settings\K-Gom\デスクトップ\chpexsss\EXSS\ver9\20...
IDE File Edit Search Windows Utilities Help
Popshare
Sets.gms dc_sets.gms equations.gms

Sets

*生活
age                               *年齢の歳階級
/age1*age16/
age3c                              *年齢三区分 (旅客輸送モデルのため。0514は5歳-14歳)
/0514,1564,65/
agerap( age3c, age)              *五歳階級と三区分の対応
/0514.(age2, age3),1564.(age4*age13),65.(age14*age16)/
area                              *居住地域
/area1*area8, kyt, osk, hyg, nra, wky/
sex                               *性別
/m f /
work                              *労働
/wj nw/
pl ace                            *地域内外の通勤関係
/i ni n, i nout, out i n/
act                               *活動種(時間の使い方)
/act1*act19/

*産業連関表とエネルギーサービス
all set                            *ICとエネルギーサービス全て
/cl, ht, hw, k, em, hom, mycar, pd1*pd43, ni dt ot, nhc, wge, pft, rv,
pc, gc, godp, gi, pi, zai ko, ex, i m d n p r, tra, bus, car, tw, w k, bd,
ft, sfv, lfv, fr, fs, fa, i ndus/
esc( all set)                    *エネルギーサービス
```

```
IDE gamside: C:\Documents and Settings\K-Gom\デスクトップ\chpexsss\EXSS\ver9\20...
IDE File Edit Search Windows Utilities Help
Popshare
Sets.gms dc_sets.gms equations.gms

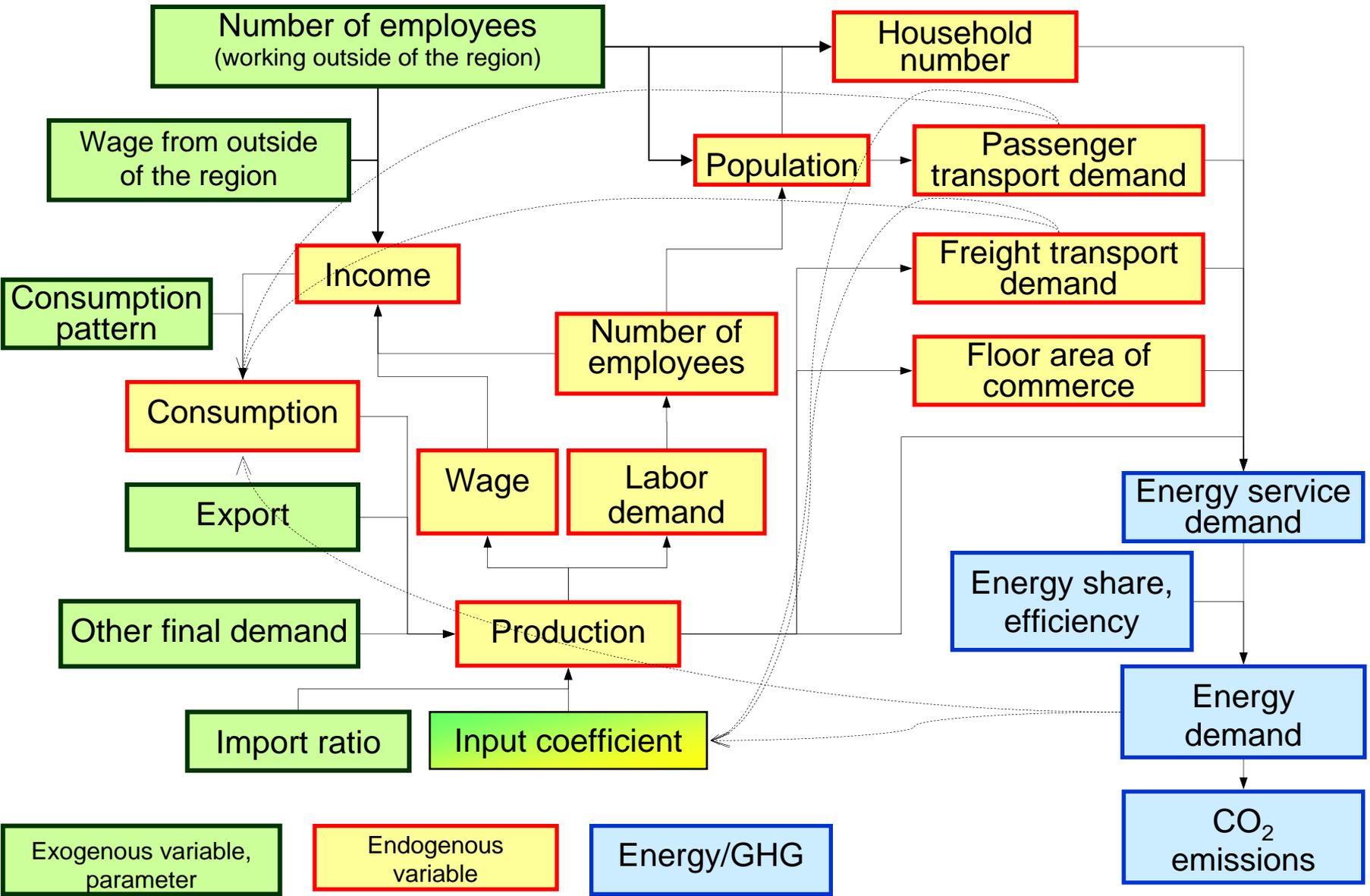
*生活**
*時間
eqTi ne( act) ..                 Ti ne( act) =e=
sun( sex, sun, area, sun, age, Pcp( sex, area, age) ) * W( sex, area, age) * Ti ne share( sex, "w", act, s
sun( sex, sun, area, sun, age, Pcp( sex, area, age) ) * ( 1 - W( sex, area, age) ) * Ti ne share( sex, "rw",
*人口
eqPp tot ..                      Pp tot =e= Pp work / W sum;
eqPp( sex, area, age) ..         Pp( sex, area, age) =e= Pp tot * Pp share( sex, area, age);
*消費支出
eqFC ..                          FC tot( "pc" ) =e= D * P C;

*産業**
*最終需要
eqFDv( pds, o fds) ..           FDv( pds, o fds) =e= FDv_ exo( pds, o fds);
eqFD tot( o fds) ..             FD tot( o fds) =e= FD tot_ exo( o fds);
eqFDv_ pc off( pds) ..          FDv( pds, "pc" ) =e= FDv_ exo( pds, "pc");
eqFD( pds) ..                   FC( pds) =e= sun( fds, FC tot( fds) ) * FDv( pds, fds);

*逆行列と生産額・付加価値
eqAnat( i, j) ..                Anat( i, j) =e= Anat_ target( i, j);
eqAi nv( i, k) ..               sun( j, ( I nat( i, j) - ( 1 - I MR( j) ) ) * Anat( i, j) ) * Ai nv( j, k) =e= I nat(
eqFD( i) ..                     FC( i) =e= sun( j, Ai nv( i, j) ) * ( ( 1 - I MR( j) ) * FC( j) + EX( j) );
eqAv( avs, pds) ..              Av( avs, pds) =e= FC( pds) * ( 1 - sun( i, Anat( i, pds) ) ) * Av( avs, pds)

*労働と所得**
*就業者数
eqLHC( ods) ..                  LHC( ods) =e= FC( ods) * MLP( ods);
```

Structure of ExSS (recent version)





Another application of ExSS

Sensitivity analysis

- We can use it to define which assumption is important to the result (CO₂ emission), by changing parameters and exogenous variables.
(ex. growth rate of per capita GDP, export structure, demographic composition, etc)



Conclusion

- Advanced step of creating a SnapShot of a LCS is, consistent estimation of Driving Force
 - ExSS can consider various assumptions of future society (but needs huge amount of data and modeling skill)
- > We are making manual and template to use EXSS for LCS scenario.

Coming soon!!



Thank you