Literature review
Household Energy Use Modeling– A summary on the methodology

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LIST OF DEFINITIONS

Preface

Contents

0.1 Purpose of review

The purpose of this review is to summarize the approaches of household energy end-use modeling and the relevant statistical methods for simulation and model assessment. The knowledge here is applied to AIM/PHI-energy development.

0.1.1 crossref

different styles of clickable definitions and theorems

- nameref: Gaussian distribution
- autoref: Definition A.1, algorithm 1.5.1
- cref: Definition A.1,
- hyperref: Gaussian,

0.1.2 ToC (Table of Content)

- mini toc of sections at the beginning of each chapter
- list of theorems, definitions, figures
- the chapter titles are bi-directional linked

0.1.3 header and footer

fancyhdr

- right header: section name and link to the beginning of the section
- left header: chapter title and link to the beginning of the chapter
- footer: page number linked to ToC of the whole document

0.1.4 bib

- titles of reference is linked to the publisher webpage e.g., [**kitaev2002classical**]
- backref (go to the page where the reference is cited) e.g., [**childsUniversalComputationQuantum2009**]
- customized video entry in reference like in [**babaiGraphIsomorphismQuasipolynomial2016**]

0.1.5 preface, index, quote (epigraph) and appendix

index page at the end of this document...

0.1.6 symbol and glossary (abbreviation)

examples: $\mathbb{R}$, SVM, $\vec{v}$

usage

- glossary package

```
pdflatex notes_template.tex
makeglossaries notes_template
pdflatex notes_template.tex
```

- glossary-extra package and bib2gls

```
pdflatex notes_template.tex
bib2gls notes_template
pdflatex notes_template.tex
```

0.2 Related Tools

0.2.1 VSCode

Extension: Latex Workshop by James Yu

settings

0.2.2 lualatex and latexmk

.latexmkrc configuration file

```
$pdflatex␣=␣'lualatex␣-synctex=1␣-interaction=nonstopmode␣--shell-escape␣%O␣%S';
@generated_exts␣=␣(@generated_exts,␣'synctex.gz');
$pdf_mode␣=␣1;

add_cus_dep('glo',␣'gls',␣0,␣'makeglo2gls');
sub␣makeglo2gls␣{
system("makeindex␣-s␣'$_[0]'.ist␣-t␣'$_[0]'.glg␣-o␣'$_[0]'.gls␣'$_[0]'.glo");
}
```

To explain ....

```
# Also delete the *.glstex files from package glossaries-extra. Problem is,
# that that package generates files of the form "basename-digit.glstex" if
# multiple glossaries are present. Latexmk looks for "basename.glstex" and so
# does not find those. For that purpose, use wildcard.
$clean_ext = "%R-*.glstex";

push @generated_exts, 'glstex', 'glg';

add_cus_dep('aux', 'glstex', 0, 'run_bib2gls');

# PERL subroutine. $_[0] is the argument (filename in this case).
# File from author from here: https://tex.stackexchange.com/a/401979/120853
sub run_bib2gls {
    if ( $silent ) {
    #    my $ret = system "bib2gls --silent --group '$_[0]'"; # Original version
        my $ret = system "bib2gls --silent --group $_[0]"; # Runs in PowerShell
    } else {
    #    my $ret = system "bib2gls --group '$_[0]'"; # Original version
        my $ret = system "bib2gls --group $_[0]"; # Runs in PowerShell
    };

    my ($base, $path) = fileparse( $_[0] );
    if ($path && -e "$base.glstex") {
        rename "$base.glstex", "$path$base.glstex";
    }

    # Analyze log file.
    local *LOG;
    $LOG = "$_[0].glg";
    if (!$ret && -e $LOG) {
        open LOG, "<$LOG";
    while (<LOG>) {
            if (/^Reading (.*\.bib)\s$/) {
        rdb_ensure_file( $rule, $1 );
```

```
        }
    }
    close LOG;
    }
    return $ret;
}
```

0.2.3 Zotero and Better-bibtex

[todo] https://retorque.re/zotero-better-bibtex/ customized entry, e.g., **Online Video**

0.3 Copyright and License

- GitHub Repo: `https://github.com/Jue-Xu/Latex-Template-for-Scientific-Style-Book`
- Overleaf template: `https://www.overleaf.com/latex/templates/latex-template-for-scientific-style` `ntprxjksmqxx`

Part I

Econometric Models

Chapter 1

Econometric Models

Contents

gls examples:

- Greatest Common Divisor (GCD); Greatest Common Divisor; GCD; Greatest Common Divisor (GCD)

1.1 Cointegration and Error-Correction Model (ECM) and Simultaneous Equation Model (SEM)

[**NaiefEltony1995**]

This paper tests two models for energy demand projection on Kuwait data and forecast the future energy demand in Kuwait. The price and income elasticities were estimated.

1.1.1 Method 1: ECM

Cointegration and Error-Correction Model (ECM) takes into account the time-series characteristics of the data. It combines cointegration techniques and an error-correction model and has the advantages of

- Being easy to distinguish between the short- and long- run response.
- Estimating the speed of adjustment toward the long-run values.

Three-step projection

1. **Examine the time-series effect.**
   To test if the time-series have a unit root – whether it is first-difference, second-difference, or n-difference stationary series.
   A time-series process is considered *stationary* if the **mean and variance are constant over time** and if **the auto-correlation between values at two points depend only on the distance and not on the time period.**

Augmented Dickey-Fuller (ADF) test Running a regression for each series considered, with first-difference of the variables as the independent variable (δX_t, left-hand-side, LHS), and its first-lagged level (X_{t-1}) and the lagged first-differences (δX_{t-1}) as independent variables (RHS)

$$\Delta X_t = d_0 + d_1 \times X_{t-1} + \sum_{i=1}^{m} d_2 \times \Delta X_{t-1} + e_t \qquad \text{for m = 2,4,} \tag{1.1}$$

where e_t is the stationary random error that is normally distributed.
H_0: the not-differenced form of the series is nonstationary (the series, in itself, is nonstationary.) Reject H_0 if d_1 *is statistically significantand larger than the critical values reported in literature.*

Conventional Dickey-Fuller (DF) test Based on Eq. (1.1) when the RHS summation is deleted:

$$\Delta X_t = d_0 + d_1 \times X_{t-1} + e_t \qquad \text{for m = 2,4,} \tag{1.2}$$

H_0: the not-differenced form of the series is nonstationary (the series, in itself, is nonstationary.)
Reject H_0 if d_1 *is statistically significantand larger than the critical values reported in literature.*

2. **Investigate the cointegration between variables.**
   If the variables are found to be nonstationary, the second step would be carried out.
   Cointegration means the variables possess a long-run relationship. If each one of the variables are nonstationary but alinear combination of them is stationay, the variables could be considered cointegrated.
   And if they are found to be cointegrated, the long-run elasticities would be estimated from the cointegration regression.
   The following cointegrating regression is estimated because there are more than two variables:

$$\ln(E_t) = F_0 + F_1 \times \ln(P_t) + F_2 \times \ln(Y_t) + U_t, \tag{1.3}$$

   where E_t is the per-capita energy consumption, P_t is the real price of energy, Y_t is the real per-capita income. U_t is the residual (normal distribution).
   U_t should subject to a DF test. If the null hypothesis H_0 is accepted, the variables are cointegrated, and F_1 and F_2 are the price and income elasticities respectively.

3. **Estimate the short-run elasticities and the speed of adjustment from an ECM.**
   If the variables are cointegrated, the following ECM is estimated:

$$\Delta \ln(E_t) = J_0 + \sum_{i=0}^{n} J_{1i} \times \Delta \ln P_{t-i} + \sum_{i=0}^{m} J2_i \times \ln(Y_{t-i}) + \sum_{i=0}^{s} J_{3i} \Delta \ln(E_{t-i}) + J_4 \times U_{t-1} + Z_t, \tag{1.4}$$

   where the lag-order n, m, and s are chosen to make Z_t white noise, and with U_{t-1} given by Eq. (1.3).
   Coefficient J_{1i} is the short-run price elasticities, J_{2i} is the short-run income elasticity, and J_{4i} represents the speed of adjustment toward the long-run equilibrium.

Implementation

T-statistics from the conventional DF test and the ADF test are given to examine the stationarity and cointegration of variables (income, price, and energy demand). The cointegration Durbin-Watson (CRDW) test for the residuals in Eq. (1.2) and Eq. (1.3) are performed to reveal the cointegration.

1.1.2 Method 2: SEM

In a Simultaneous Equation Model (SEM), it is assumed that the **desired** energy demand per capita (E_t^*) in year t depends on the real price of energy (P_t) and real per capita GDP (Y_t) in the form of a log-linear function. The planned energy demand could be written as

$$\ln(E_t^*) = A_0 + A_1 \times \ln(P_t) + A_2 \times \ln(Y_t), \tag{1.5}$$

But the actual energy demand per capita (E_t) isnot necessarily equal to the desired level due to technological rigidity and the inertia in endusers' decision making. The actual demand E_t is thusly assumed to adjust towards the E_t^* with a lag such that it is a function of the current year's economic variables and the energy consumption in the previous year ($t-1$), as indicated by Eq. (1.6).

$$\ln(E_t) = \delta \times (A_0 + A_1 \times \ln(P_t) + A_2 \times \ln(Y_t)) + (1-\delta) \times \ln(E_{t-1}), \tag{1.6}$$

where $\delta(\in [0,1])$ and $(1-\delta)$ are the weighting coefficient between the current economic variables and the inertia from the previous year.

Y_t is an endogenous variable which depends upon the level of energy consumption (E_t), whose output is altered by the technology and the structure of the economy. The structural and technological characteristics are measured by *the percentage of output by the nonoil sectors* S_t. The relation is depicted as:

$$\ln(Y_t) = C_0 + C_1 \times \ln(E_t) + C_2 \times \ln(S_t), \tag{1.7}$$

Eq. (1.6) and Eq. (1.7) are simultaneously and endogenously determined.

1.2 Quantifier

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1.3 Graph

babaiGraphIsomorphismQuasipolynomial2016 [**babaiGraphIsomorphismQuasipolynomial2016**]

1.4 Number theory

a Figure example

1.5 Algorithm

Algorithm 1.5.1: Primality testing - first attempt

input : Integer N and parameter 1^t
output: A decision as to whether N is prime or composite

for $i = 1, 2, \ldots, t$ **do**
  $a \leftarrow \{1, \ldots, N_1\}$ `// this is a comment`
  if $a^{N-1} \neq 1 \mod N$ **then**
    return ”composite”
return ”prime”

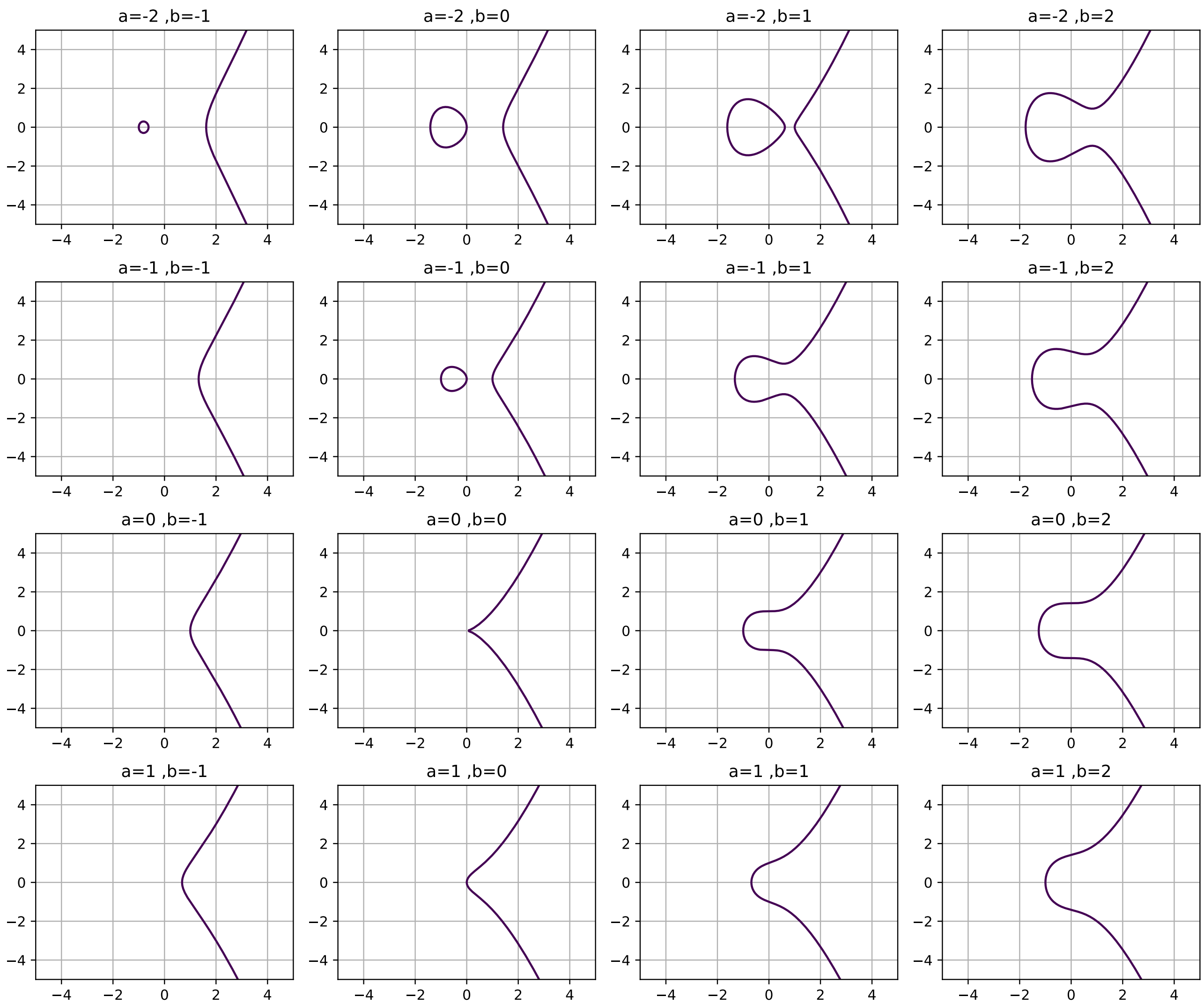

Figure 1.1: Elliptic curves [**childsUniversalComputationQuantum2009**]

Chapter 2

Machine Learning

Contents

2.1 Regression

2.1.1 Gradient descent

GD;

2.2 Support Vector Machine

SVM;

Part II

Physics

Chapter 3

Quantum Mechanics

3.1 Hamiltonian

$\hat{H}$;

3.2 Path Integral

L

3.3 Quantum Field Theory

QFT;

Appendix A

Formulas

A.1 Gaussian distribution

Definition A.1 (Gaussian distribution)**.** *Gaussian distribution*

Theorem A.1 (Central limit theorem)**.**

Alphabetical Index