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## **The 9th Annual Conference of Economic Forum of Entrepreneurship & International Business**

**Venue: LMH, University of Oxford, United Kingdom**

**Date: February 1st, 2023.**

**Food Security, Food Insecurity,  
Consumer Behavior, Social Welfare,  
Sustainability**

**A quantifying approach**

**From Micro to Macro**

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Dean; Forward Academy

# How to explain the concept of the “Food insecurity”



- Health Canada defines food insecurity as **“the inability to acquire or consume an adequate diet quality or sufficient quantity of food in socially acceptable ways, or the uncertainty that one will be able to do so.”** (Health Canada, 2020a).

# How to explain the concept of the “Food Security”

- The 1996 World Food Summit provided a broad definition of food security: **“Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.”** (FAO, 1996).

<https://doi.org/10.1177/00307270221113601>



# Food Security in Canada

In its vision statement, the FPC (Food Policy Canada) includes a variation on the widely accepted 1996 World Food Summit definition of food security. Specifically, the vision statement declares the following.

***“All people in Canada are able to access a sufficient amount of safe, nutritious, and culturally diverse food. Canada’s food system is resilient and innovative, sustains our environment and supports our economy.”*** [emphasis added] (AAFC, 2019).

<https://doi.org/10.1177/00307270221113601>

# How to measure food security?

*Simply that;*

*Households that are not identified as food insecure are presumed to be food secure.*

<https://doi.org/10.1177/00307270221113601>

# Four types of people when it comes to food insecurity

- **A more protective person against food insecurity.**



- **A food-secure person.**

- **A vulnerable person to food insecurity.**



- **A food insecure person.**

# Food secure versus food insecure





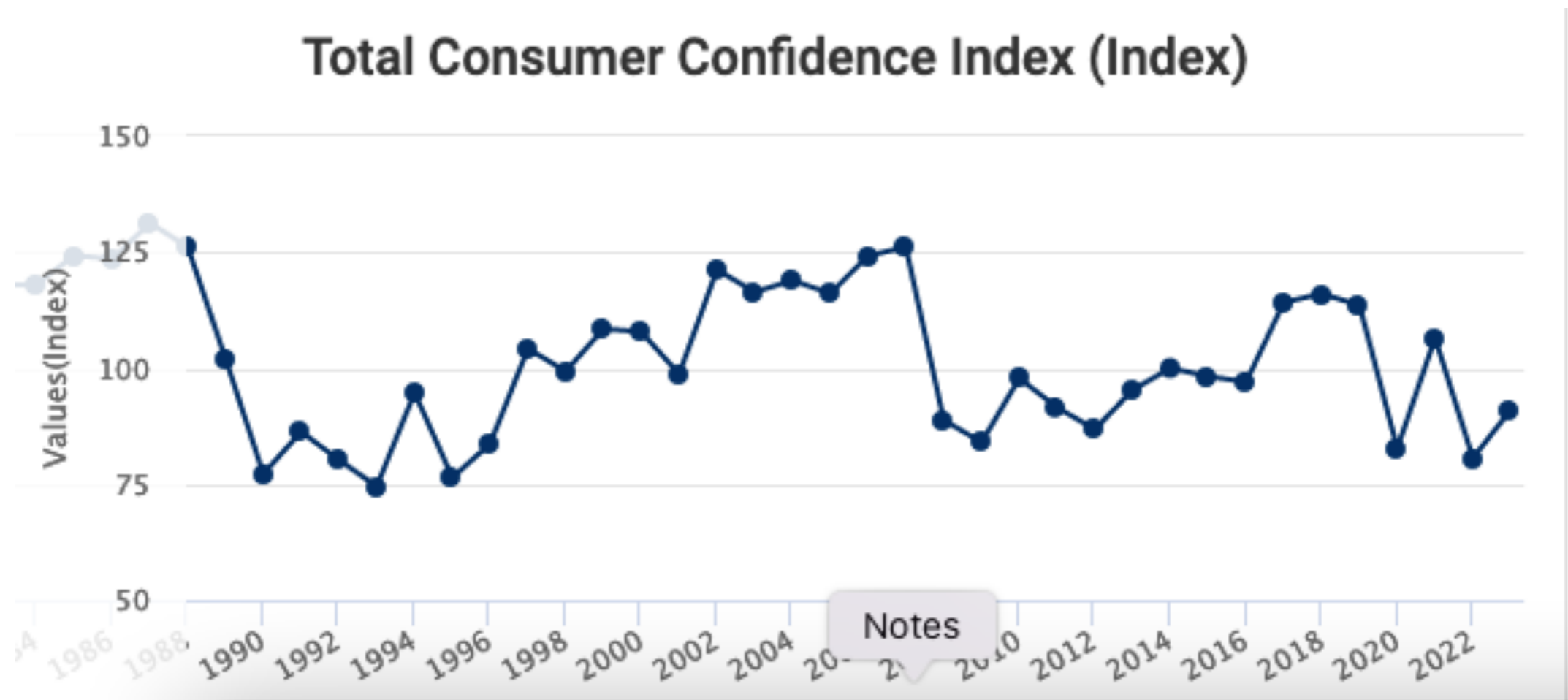
# How to measure “Food insecurity”

- **Food Insecurity =  $f(\text{financial factors, social and cultural factors, human behaviour, uncertain macro factors})$ .**
- **Financial factors:** Household’s disposable income, food prices. In short, “the consumer surplus. *“assuming the gross consumption can be derived as a function of the disposable income”.* *“We can as well consider wealth”.*
- **Social/ cultural factors:** Cultural diversity, family kinship, community cooperation, age, gender, education, and isolation & bleakness. “This can be measured via a survey to determine the number of population that suffer from negative social/ cultural integration” - For simplicity it can be measured by number of immigrants to Canada every-year.
- **Human behaviour toward food assistance programs:** Positive behaviour toward food assistance programs, or negative behaviour toward food assistance programs. “A cognitive game approach.” — *For simplicity we consider positive behaviour toward social assistances. This can be measured by consumer confidence index.*
- **Uncertain macro-factors:** Food supply chain blocks, crises, etc. “This should be the random term and for simplify it’s considered s a white noise disturbance term.”

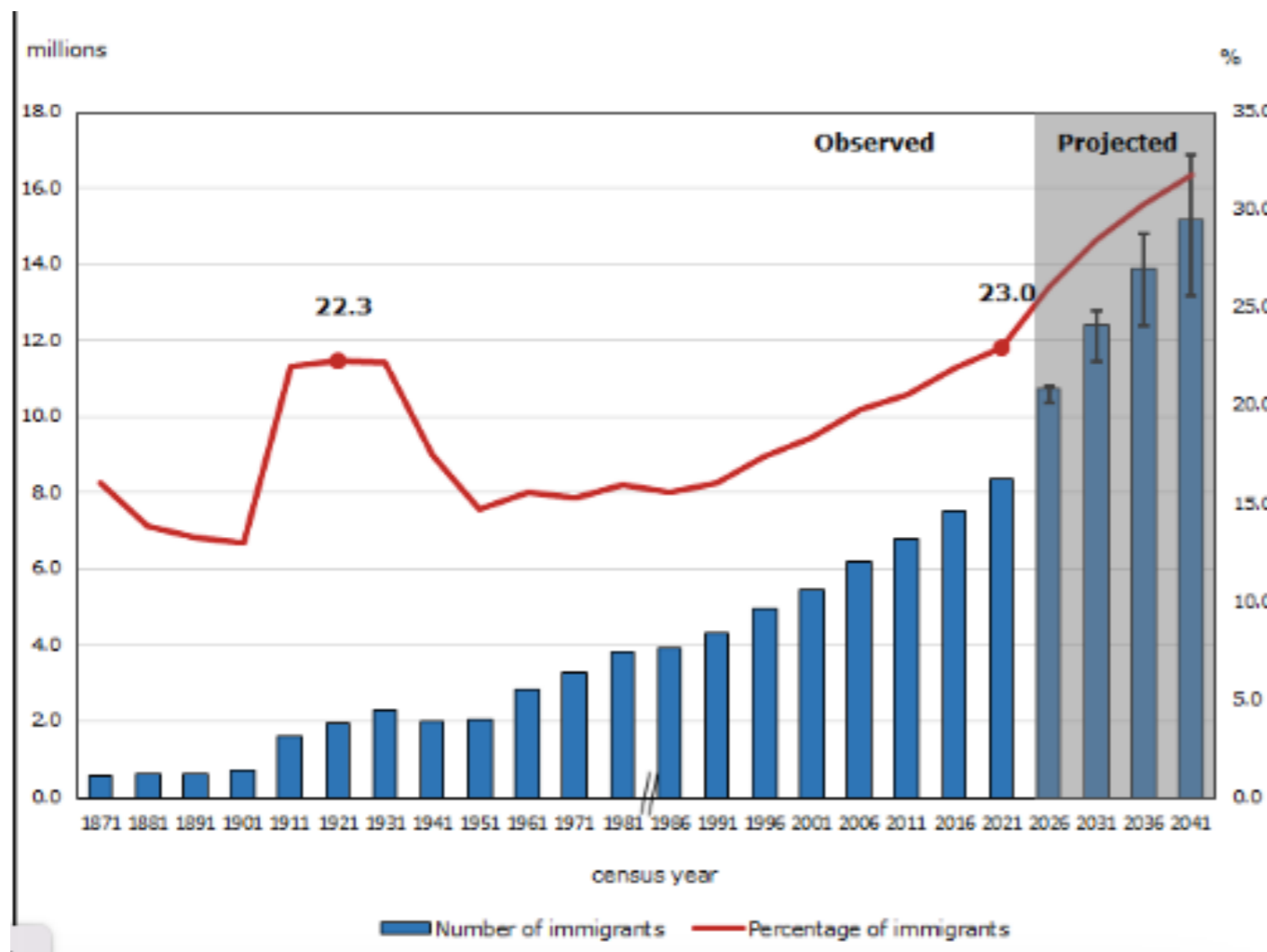
# How to measure “Food insecurity”

- *Food Insecurity = f(financial factors, social and cultural factors, human behaviour, uncertain macro factors).*
- *$FI = f(X1, X2, X3, e);$*
- **Where;  $X1$  refers to the consumer surplus term.**
- **$X2$  refers to the social/ cultural integration term.**
- **$X3$  refers to the consumer confidence index.**
- **$e$  refers to the uncertainty.**

# Consumer Confidence Index in Canada - *Trend*



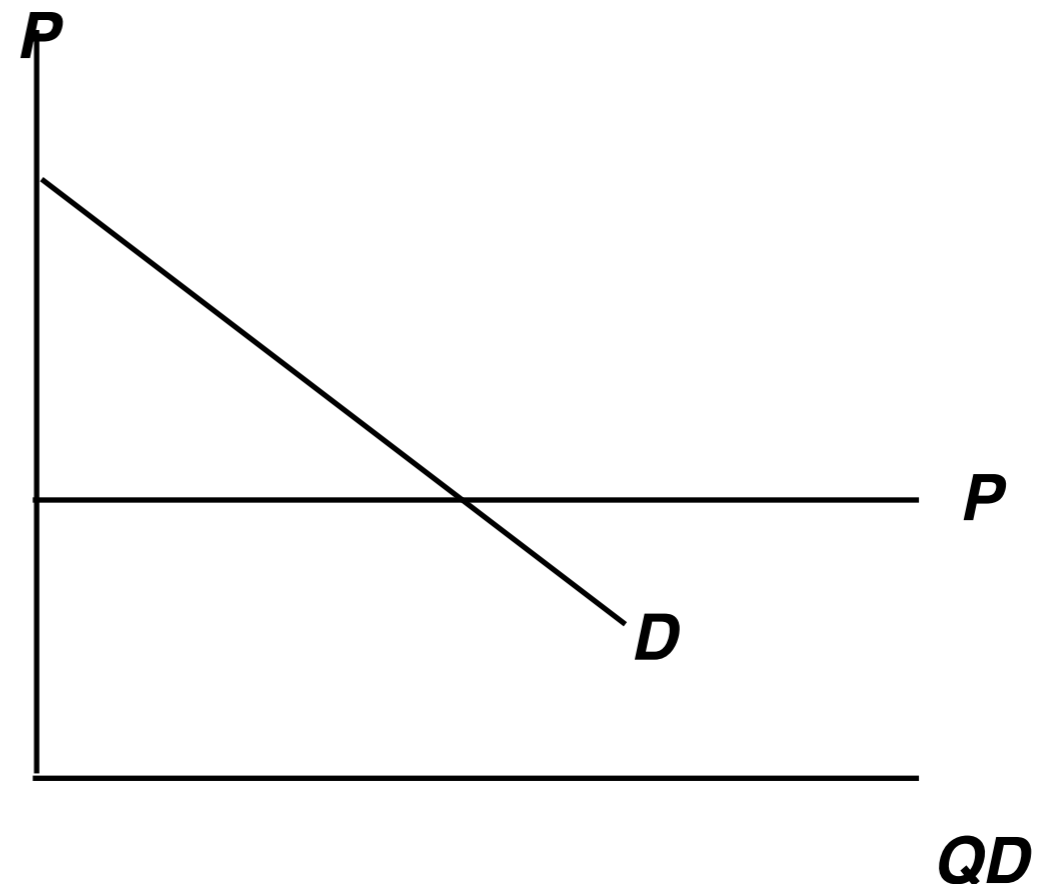
# Number and percentage of immigrants in Canada - *Trend*



***It takes time for immigrants to be socially and culturally integrated. Different studies***

# How to measure the consumer surplus on the macro-level? From Micro-to Macro

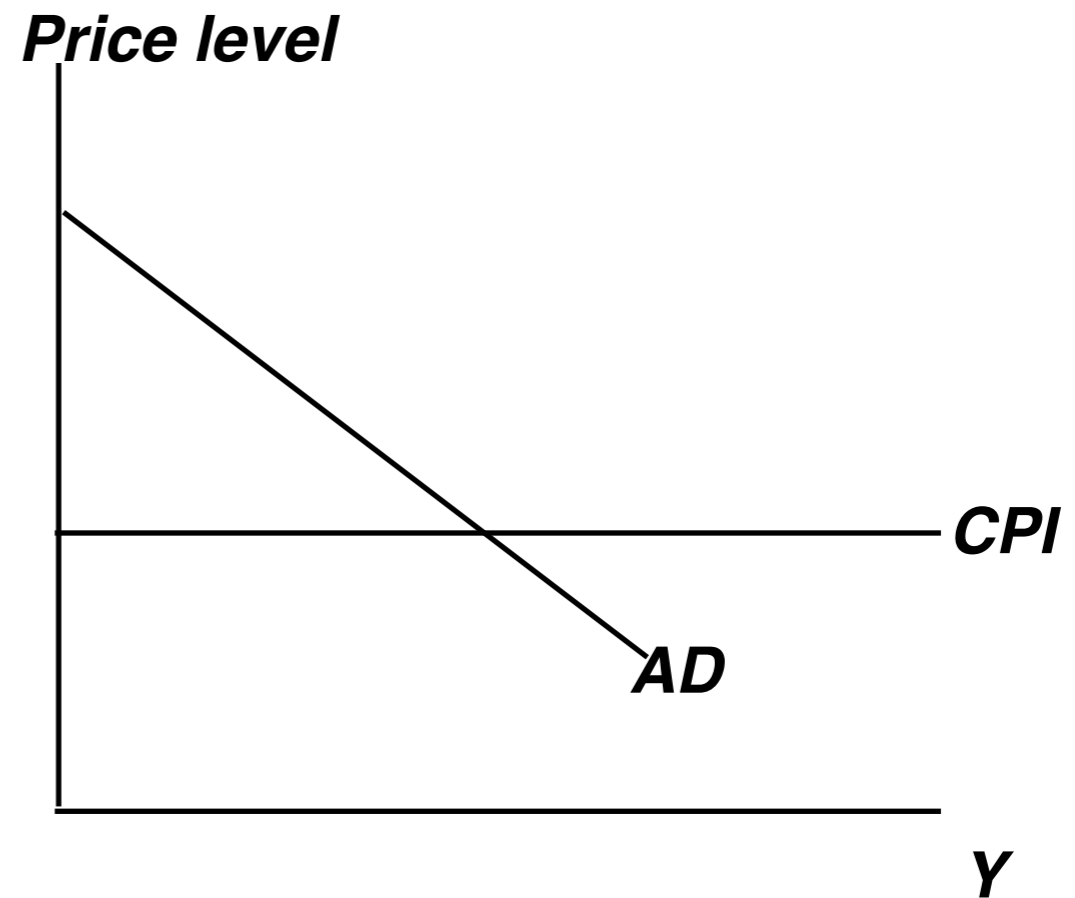
The consumer's surplus is measured by the difference between what the consumer is willing to pay and what he/she is actually paying.



DOI: 10.6007/IJAREMS/v3-  
i4/1066

# How to measure the consumer surplus on the macro-level? From Micro-to Macro

From a macro-economic perspective; we can take the CPI as a proxy of what the consumers are actually paying in the economy while the entire area under the aggregate demand is what the consumers are willing to pay. In different words; the consumer surplus is theoretically feasible within the area located under the demand and above the price.



DOI: 10.6007/IJAREMS/v3-  
i4/1066

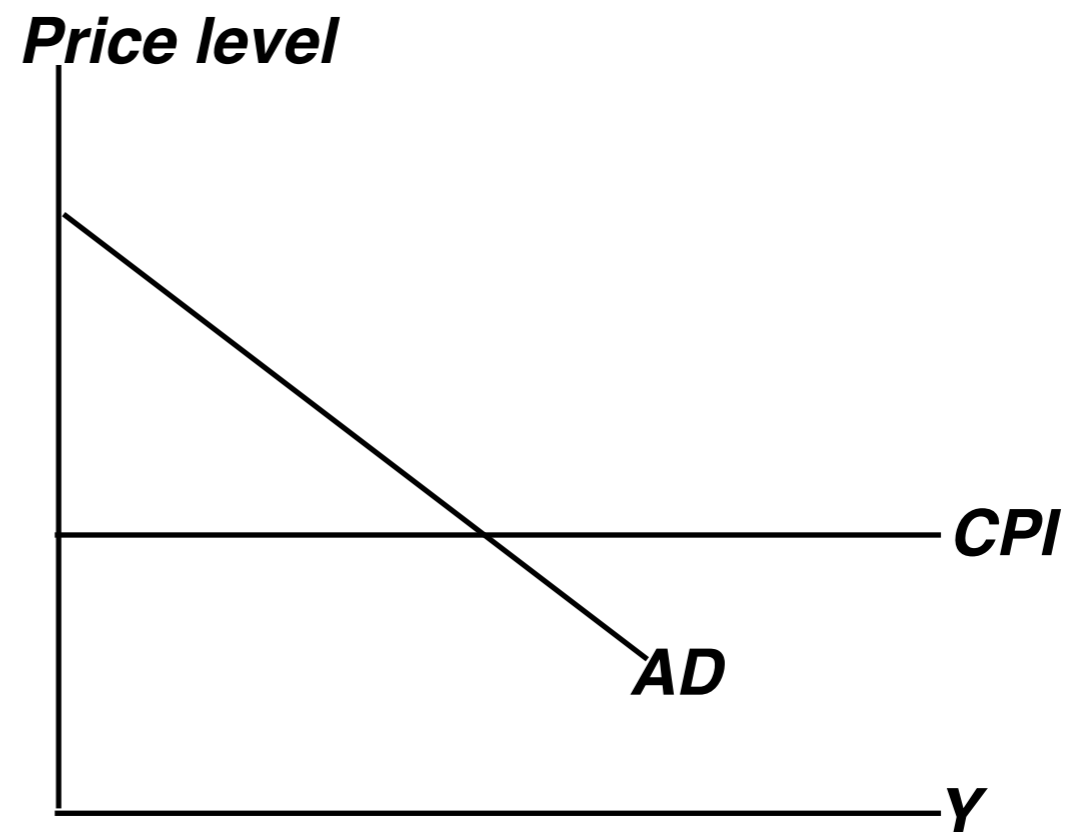
# How to measure the consumer surplus on the macro-level? From Micro-to Macro

Data in trend are available: <https://data.worldbank.org/country/CA>

If we consider on the macro-level that the entire demand is the gross nominal private consumption, then; the consumer

surplus on the macro-level can be determined mathematically as follows:

DOI: 10.6007/IJAREMS/v3-i4/1066



*The consumer surplus =  $\ln$  (nominal gross consumption) –  $\ln$  (CPI);  
this equals the real gross consumption.*

Therefore; the real gross consumption in the economy can be considered a proxy of the consumer surplus.

# How then to estimate the annual data of food security/ insecurity?

- **We can do so on two steps.**
- **Step 1:** by using the results of the Household Food Security Survey Module (HFSSM).
- *We then estimate the previously explained model. Selecting the best fit model. Then forecasting it to figure out the data trend of the food insecurity. “We can of sure control for all econometric problems”.*
- **$F_{lt} = a + bX_{1t} + cX_{2t} + dX_{3t} + e_t$ .**



- **Step 2: by generating the data of the food insecurity from the previous model directly as follows >>>**
- **$FI = f(X1, X2, X3)$ ; considering the macro uncertainty is zero. Thus;**
- **$dFI = dX1. (\partial FI/\partial X1) + dX2. (\partial FI/\partial X2) + dX3.(\partial FI/\partial X3)$**
- **By minimizing the FI; then;  $dFI = a . dX1 + b. dX2 + c. dX3 = 0$ .**
- **Where;  $a$  is the sensitivity of the food insecurity to the change of the financial security.**
- **$b$  is the sensitivity of the food insecurity to the change of the human behaviour toward government's food security programs.**
- **$c$  is the sensitivity of the food insecurity to the change of the social/cultural factors.**
- We can figure out;  $a$ ,  $b$ , and  $c$  from the previous model. We then can calculate the left hand side of the equation to get the trend data of the food insecurity variable.

# **How to measure social welfare over time? Macro-sustainability**

**According to Weitzman (2001), “the difference in intertemporal welfare between two points in time of the same economy can be exactly measured by the difference in real national income plus a consumer surplus term.”**

Recalling Weitzman's statement and our macro-explanation of the consumer surplus; then;

***The intertemporal welfare between two points in time  $t$  &  $t-1$  = (The real national income + the real gross consumption) $_t$  – (the real national income + the real gross consumption) $_{t-1}$ .***

Now we have a quantitative variable that reflects the welfare over time.

# The impact of food security on social welfare over time - *Sustainability*

- With two quantitative variables; i.e., **food security** and **welfare**; we can then figure out the transitional dynamic impact of food security on the social welfare.
- ***By utilizing an intervention model >>>***

<https://doi.org/10.55493/5002.v12i5.4487>

$$W_t = a_0 + A(L)W_{(t-1)} + c_0 FS + B(L) \varepsilon_t,$$

- Where;  $W$  refers to the social welfare,  $FS$  refers to the food security,  $a$  is the constant term.
- $A(L) [1 + a_1L + a_2L^2 + \dots + a_qL^q]$  and  $B(L) [1 + b_1L + b_2L^2 + \dots + b_qL^q]$  are polynomials in lag operator.
- *After doing all relevant data check; we then run ARMA with intervention models up to ARMA (3, 3) until selecting the best fit model. By forecasting the model; we can then figure out the transitional dynamism of the impact of the food security on the social welfare. Done!*

- **Thank you!**

- **Ghada Mohamed**

# Appendix

- How is food insecurity measured in Canada?

# How is Food Insecurity measured in Canada?

**By using the Household Food Security Survey Module (HFSSM).**

- This tool of measuring food insecurity in Canada has been included in statistics Canada's Canadian Community Health Survey since 2004.
  - And in the Canadian Income Survey (CIS) since 2019.
- 
- Source: PROOF
  - The survey ranges to different degrees of food insecurity for households with/ without children.
  - *View the attached HFSSM*



# **Household Food Security Survey Module. (HFSSM)**

## **STAGE 1**

**Questions 1 - 5 — ask all households**

**Now I'm going to read you several statements that may be used to describe the food situation for a household. Please tell me if the statement was often true, sometimes true, or never true for you and other household members in the past 12 months.**

## **STAGE 2**

**Questions 6-10 – ask households passing the First Level Screen**

**IF CHILDREN UNDER 18 IN HOUSEHOLD, ASK Q6; OTHERWISE SKIP TO Q7.**

## **STAGE 3**

**Questions 11-15 – ask households passing the Second Level Screen .**

# Household Food Security Survey Module. (HFSSM)

## STAGE 1

**Q1.** The first statement is: you and other household members worried that food would run out before you got money to buy more. Was that often true, sometimes true, or never true in the past 12 months?

1. Often true 3. Never true
2. Sometimes true - Don't know / refuse to answer

**Q2.** The food that you and other household members bought just didn't last, and there wasn't any money to get more. Was that often true, sometimes true, or never true in the past 12 months?

1. Often true 3. Never true
2. Sometimes true - Don't know / refuse to answer

**Q3.** You and other household members couldn't afford to eat balanced meals. In the past 12 months was that often true, sometimes true, or never true?

1. Often true 3. Never true
2. Sometimes true - Don't know / refuse to answer

# Household Food Security Survey Module. (HFSSM)

## STAGE 1

**IF CHILDREN UNDER 18 IN HOUSEHOLD, ASK Q4 AND Q5; OTHERWISE, SKIP TO FIRST LEVEL SCREEN .**

Now I'm going to read a few statements that may describe the food situation for households with children.

**Q4. You or other adults in your household relied on only a few kinds of low-cost food to feed the child(ren) because you were running out of money to buy food. Was that often true, sometimes true, or never true in the past 12 months?**

1. Often true 3. Never true
2. Sometimes true - Don't know / refuse to answer

**Q5. You or other adults in your household couldn't feed the child(ren) a balanced meal, because you couldn't afford it. Was that often true, sometimes true, or never true in the past 12 months?**

1. Often true 3. Never true
2. Sometimes true - Don't know / refuse to answer

# **Household Food Security Survey Module. (HFSSM)**

## **STAGE 1**

**FIRST LEVEL SCREEN (screener for Stage 2): If AFFIRMATIVE RESPONSE to ANY ONE of Q1-Q5 (i.e., “often true” or “sometimes true”), then continue to STAGE 2; otherwise, skip to end.**

# Household Food Security Survey Module. (HFSSM)

## STAGE 2

Questions 6-10 – ask households passing the First Level Screen

**IF CHILDREN UNDER 18 IN HOUSEHOLD, ASK Q6; OTHERWISE SKIP TO Q7**

**Q6. The child(ren) were not eating enough because you and other adult members of the household just couldn't afford enough food. Was that often, sometimes or never true in the past 12 months?**

1. Often true 3. Never true
2. Sometimes true - Don't know / refuse to answer

# **Household Food Security Survey Module. (HFSSM)**

## **STAGE 2**

The following few questions are about the food situation in the past 12 months for you or any other adults in your household.

**Q7. In the past 12 months, since last [current month] did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food?**

1. Yes
2. No (Go to Q8) - Don't Know / refuse too answer

**Q7b. How often did this happen?**

1. Almost every month
  2. Some months but not every month
  3. Only 1 or 2 months
- Don't know / refuse to answer

# Household Food Security Survey Module. (HFSSM)

## STAGE 2

**Q8.** In the past 12 months, did you (personally) ever eat less than you felt you should because there wasn't enough money to buy food?

1. Yes                      2. No  
- Don't know/ refuse to answer

**Q9.** In the past 12 months, were you (personally) ever hungry but didn't eat because you couldn't afford enough food?

1. Yes                      2. No  
- Don't know / refuse to answer

**Q10.** In the past 12 months, did you (personally) lose weight because you didn't have enough money for food?

1. Yes                      2. No                      - Don't know / refuse to answer

# **Household Food Security Survey Module. (HFSSM)**

## **STAGE 2**

**SECOND LEVEL SCREEN (screener for Stage 3): If AFFIRMATIVE RESPONSE to ANY ONE of Q6-Q10, then continue to STAGE 3; otherwise, skip to end.**



# Household Food Security Survey Module. (HFSSM)

## STAGE 3

### Questions 11-15 – ask households passing the Second Level Screen

**Q11.** In the past 12 months, did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food?

1. Yes
2. No (IF CHILDREN UNDER 18 IN HOUSEHOLD, ASK Q12; OTHERWISE SKIP TO END) - Don't know / refuse to answer

**Q11b.** How often did this happen?

1. Almost every month
  2. Some months but not every month
  3. Only 1 or 2 months
- Don't know / refuse to answer

# Household Food Security Survey Module. (HFSSM)

## STAGE 3

IF CHILDREN UNDER 18 IN HOUSEHOLD, ASK Q12-15; OTHERWISE SKIP TO END

Now, a few questions on the food experiences for children in your house

**Q12.** In the past 12 months, did you or other adults in your household ever cut the size of any of the children's meals because there wasn't enough money for food?

1. Yes                      2. No                      - Don't know / refuse to answer

**Q13.** In the past 12 months, did any of the children ever skip meals because there wasn't enough money for food?

1. Yes                      2. No                      - Don't know / refuse to answer

**Q13b.** How often did this happen?

1. Almost every month    3. Only 1 or 2 months  
2. Some months but not every - Don't know / refuse to answer month

# Household Food Security Survey Module. (HFSSM)

## STAGE 3

**Q14.** In the past 12 months, were any of the children ever hungry but you just couldn't afford more food?

1. Yes                      2. No                      - Don't know / refuse to answer

**Q15.** In the past 12 months, did any of the children ever not eat for a whole day because there wasn't enough money for food?

1. Yes                      2. No                      - Don't know / refuse to answer

**End of module**

*All pictures are from the internet.*