A New Marginalism: Gauge Theory in Economics

Pia Malaney
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What is economics?
Differing Visions
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“the science which studies human behaviour as a relationship between ends and scarce means which have alternative uses”
- Lionel Robbins, 1932
What is economics? Differing Visions

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“The combined assumptions of maximizing behavior, market equilibrium, and stable preferences, used relentlessly and unflinchingly, form the heart of the economic approach”
- Gary Becker 1976, p.4
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The Quiet Crisis in Welfare Theory: The most dangerous question at the core

“Traditional neo-classical economics has worked with the assumption that preferences of agents in the economy are fixed. This assumption has always been disputed, and, indeed, in the social sciences outside of neoclassical economics the assumption has never been accepted by anyone.”

-C. Christian von Weizsäcker 2005
“The obstacle is the lack of an answer to the question: how can you do welfare economics, if preferences change endogenously? After all, preferences of individual agents are the basic measuring rod of economic welfare, of the performance generated in an economic system. How can we evaluate an economic system with a measuring rod that itself changes with the system?”

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The Quiet Crisis Continued...

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First Solution: Define the Problem out of Economics
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“...tastes neither change capriciously nor differ importantly between people. On this interpretation one does not argue over tastes for the same reason that one does not argue over the Rocky Mountains – both are there, will be there next year, too, and are the same to all men.”

-Gary Becker and George Stigler, 1977, De Gustibus Non Est Disputandum
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“That the problems [of change of taste] have remained central and largely unresolved for twenty five hundred years no doubt makes some economists think it wise to define them out of the discipline, at whatever cost in realism and relevance.
Next Solution: Ignore the Problem and hope it goes unnoticed

Challenge: Count the percentage of work on Changing Preferences as a fraction of all economic research.
Better Solution: Confront the Issue via a new economic marginalism

<table>
<thead>
<tr>
<th>Market Consumption</th>
<th>Welfare</th>
<th>Production</th>
<th>Geometry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tradeoff</td>
<td>Budget Constraint</td>
<td>Indifference</td>
<td>Shift</td>
</tr>
<tr>
<td>Increase/Decrease</td>
<td>Purchasing Power</td>
<td>Utility</td>
<td>Growth</td>
</tr>
</tbody>
</table>

**Generalized Income and Substitution Effects**

Note: The term ‘Marginal Revolution’ refers to the broad introduction of the differential calculus into economic theory
The Theory of the Consumer

Indifference Curves

Preferences

Budget Constraint

Consumption Basket

Marshallian Demand: Maximising welfare subject to budget constraint
Measuring Inflation and Growth: Mechanical Index Numbers in Disagreement

Laspeyres
\[ P_L(p^0, p^1, q^0, q^1) \equiv \frac{p^1 \cdot q^0}{p^0 \cdot q^0} \]

Paasche
\[ P_P(p^0, p^1, q^0, q^1) \equiv \frac{p^1 \cdot q^1}{p^0 \cdot q^1} \]

Tornqvist
\[ P_T(p^0, p^1, q^0, q^1) \equiv \prod_{n=1}^{N} \sqrt{ \left( \frac{p^1_n}{p^0_n} \right)^{(p^2_n q^0_n/p^0 \cdot q^0)} \cdot \left( \frac{p^1_n}{p^0_n} \right)^{(p^1_n q^1_n/p^1 \cdot q^1)}} \]

Fisher
\[ P_F(p^0, p^1, q^0, q^1) \equiv \sqrt{\frac{p^1 \cdot q^0}{p^0 \cdot q^0} \cdot \frac{p^1 \cdot q^1}{p^0 \cdot q^1}} \]

Divisia
\[ P_D(p^0, p^1, q^0, q^1) \equiv \exp\left( \int_{\alpha(0)}^{\alpha(1)} \sum_{i=1}^{n} \frac{p_i(t)q_i(t)}{\sum_{j=1}^{n} p_j(t)q_j(t)} \frac{dp_i(t)}{p_i(t)} \right) \]

Note: Ragnar Frisch proves in 1930 there is no index number satisfying 3 so called Fisher Axioms. Note that \( p^0 = p^1 \) gives an answer of 1 in all cases but the last.
Mechanical INP Solution by Decomposition into income and substitution effects

There are two natural connections. A trivial connection which allows no change and a connection that allows changes only by substitution effects. Switching from the former to the latter eliminates the index number problem for differentiable models.

This gives a new notion of constancy: economically constant.
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Cycling and other ‘Anomalies’

Economic Measurement views Path-Dependence incorrectly as an error and preference shifts as intractable:

“Any chain index number is likely to be flawed by path-dependence.”
-Nicholas Oulton LSE 2008

“[A] time varying objective function generally cannot be tracked by an economic index.”
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Welfare theory I:
The Problem of Overstating the Cost of Living

Cost Of Living Overstatement By CPI
Welfare theory I: The Problem of Overstating the Cost of Living
Welfare theory I: The Problem of Overstating the Cost of Living
Welfare Theory II

The Problem of Changing Preferences and the ‘Dogma’ of Stable Tastes

Problem of Changing Tastes:

- \( A = B \) at time 1
- \( B < C \) at time 2
- \( A < C \) always (if more is better)
A Solution to the Changing Preference problem

Finding an intrinsic way to match curves on the left with curves on the right without using numerical ‘cardinal’ labels.
Visualizing the intertemporal Economic Connection

- The best way to understand what the theory does may be to visualize it.
- We have to work hard to fit a picture in 3D.
- With 2-goods, the base space is 4 dimensional. Working with ratios of prices and quantities takes 4 to 2.
- Leaves 1 fiber dimension to plot an absolute quantity.
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Problem of Changing Tastes:

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\[ \begin{align*}
    f &= -y/(1+x*y) \\
    q &= 0 \\
    x &= \cos(2*\pi*t)+2 \\
    y &= \sin(2*\pi*t)+2 \\
    t &= 0.0
\end{align*} \]
$f := -y/(1+x*y)$
$q := 0$
$x := \cos(2*\pi*t)+2$
$y := \sin(2*\pi*t)+2$
$t := 0.0$

$\frac{y}{p_1/p_2} = 3.10$
$0.900$
$8.10$
$z = q_2$

$x = q_1/q_2$
$0.000$
$0.900$
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Cost Of Living Overstatement By CPI
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cardinal

\[ \sigma = \int \hat{O} \]

\[ \tau = \text{ORDINAL} \]
Beef price: $1.00
Beef quantity: 1.0000 lbs
Chicken price: $1.00
Chicken quantity: 1.0000 lbs
Budget: $2.00
COLA: 1.000000
α: 0.5000000
Beef price: $1.26
Beef quantity: 0.8081 lbs
Chicken price: $0.91
Chicken quantity: 1.2255 lbs
Budget: $2.14
COLA: 1.0684839
α: 0.4760279
Beef price: $1.35
Beef quantity: 0.7518 lbs
Chicken price: $0.88
Chicken quantity: 1.3070 lbs
Budget: $2.17
COLA: 1.0846478
α: 0.4676556
Beef price: $1.60
Beef quantity: 0.6170 lbs
Chicken price: $0.80
Chicken quantity: 1.5426 lbs
Budget: $2.22
COLA: 1.1106713
α: 0.4444444