Spending a Windfall: American Precious Metals and Euro-Asian Trade, 1492-1815

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  - From 1500 to 1800, *silver* comprised 90% of China's imports from Europe and European colonies (Pomeranz 2001, p.273)
- China had scarcity of precious metals and difficulties in setting a monetary standard

What we do

- "[T]he rise of European trade with the east should be seen primarily as a consequence not of trade routes to the east but of the discovery of America [because of the discovery of precious metals]" (Harley 2004, p.179)

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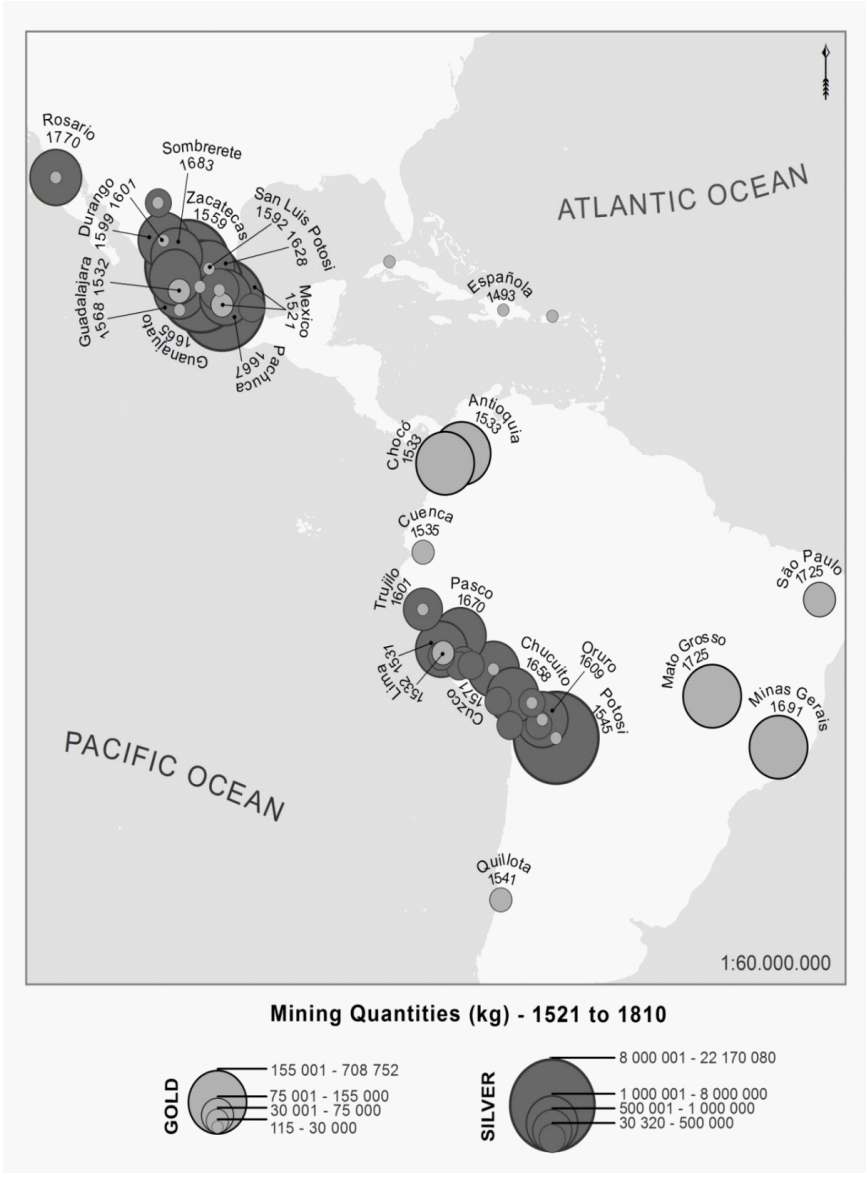
- **We test this hypothesis** using a structural model which can simulate the counterfactual
- Using a dynamic general equlilibrium model, we construct a quantiative counterfactual in which a new route to Asia is found, without the discovery of precious metals

Llamas carrying precious metals in America

Motivation


Rosario
1770
Sombrerete
1683
Durango
1599 1601
Zacatecas
1559
San Luis Potosi
1592 1628
Guadalajara
1568 1532
Mexico
1521
Guanajuato
1665
Pachuca
1667
ATLANTIC OCEAN
Española
1493
Antioquia
1533
Choco
1539
Cuenca
1535
Trujillo
1601
Pasco
1670
Lima
1532 1531
Cuzco
1571
Chucuito
1658
Oruro
1609
Potosi
1545
São Paulo
1725
Mato Grosso
1725
Minas Gerais
1691
PACIFIC OCEAN
Quillota
1541
1:60.000.000
Mining Quantities (kg) - 1521 to 1810
GOLD
155 001 - 708 752
75 001 - 155 000
30 001 - 75 000
115 - 30 000
SILVER
8 000 001 - 22 170 080
1 000 001 - 8 000 000
500 001 - 1 000 000
30 320 - 500 000

Why is this important?

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- Importance of Asian luxuries in promoting Europe's industrial development (Berg 2004, 2007)
  - Porcelain, tea, silk (the iphones of the time)

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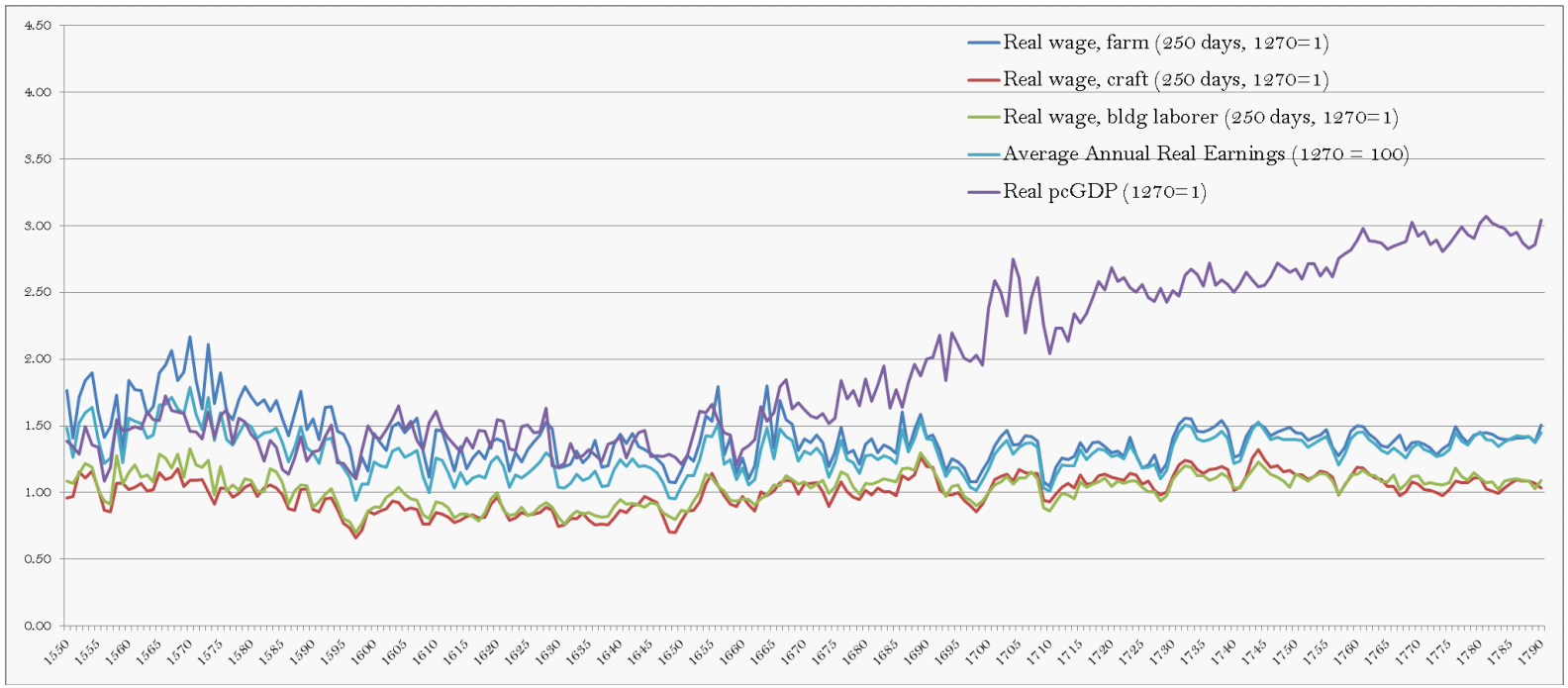

Source: Broadberry et al (2015)

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Preview of results

- Even with the new sea routes to Asia, without American precious metals early modern Euro-Asian trade would have been negligible
- Simulated dynamic general equilibrium model with calibrated transaction costs suggests that under the monetary injection European purchases of Asian goods are up to **4.5 times** those of the unshocked baseline scenario
- Most of the observed increase in Euro-Asian trade is explained by the monetary injections, as opposed to a fall in transportation costs

American treasure: arrivals to Europe

	Fine silver, tones	**Gold, tones**
Initial stock, Europe (1492)	3 600	297
Imports to Europe		
1500-1600	7 500	150
1601-1700	26 168	158
1701-1800	39 157	1 400
Total imports	72 825	1 708

Sources: Costa, Rocha and Sousa (2010), Hamilton (1970), Morineau (1985), Braudel and Spooner (1967), Velde and Weber (2000)

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- The **only** difference is that only the European economy receives a monetary windfall
- 2 agents, 2 consumption goods, and money

Model

- European representative agent problem

$$\max_{c_{ee}, c_{ea}, m_{et}} \sum_{t=0}^{\infty} \beta^t u\left(c_{eet}, c_{eat}, m_{e,t}\right)$$

$$\text{s.t.} \quad p_{1t} c_{eet} + p_{2t} c_{eat}\left(1+b\right) + m_{e,t} \leq p_{1t} A_e + m_{e,t-1} + d_t.$$

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- c_{eet}: consumption in Europe of European goods
- c_{eat}: consumption in Europe of Asian goods
- $m_{e,t}$: precious metals
- b: iceberg cost
- A_e: production in Europe
- d_t: discoveries of precious metals

Closing the system

- Analogous problem for the Asian representative agent

Closing the system

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- Market clearing conditions

$$
\begin{aligned}
L_e c_{eet} + L_a c_{aet} (1+b) &= L_e A_e \\
L_e c_{eat} (1+b) + L_a c_{aat} &= L_a A_a \\
L_e m_{e,t} + L_a m_{a,t} &= L_e m_{e,t-1} + L_e d_t + L_a m_{a,t-1}
\end{aligned}
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- L_e: population in Europe
- L_a: population in Asia

Functional forms

$$
\begin{aligned}
u\left(c_{et}, m_{et}\right) &= \frac{\left[a c_{et}^{\eta} + (1-a)\, m_{et}^{\eta}\right]^{\frac{1-\sigma}{\eta}} - 1}{1-\sigma} \\
\text{where } c_{et} &\equiv \left[\omega^{\frac{1}{\gamma}} c_{eet}^{\frac{\gamma-1}{\gamma}} + (1-\omega)^{\frac{1}{\gamma}} c_{eat}^{\frac{\gamma-1}{\gamma}}\right]^{\frac{\gamma}{\gamma-1}}
\end{aligned}
$$

Equilibrium

$$p_{1t}A_e + m_{e,t-1} + d_t - p_{1t}c_{eet} - p_{2t}c_{eat}\left(1+b\right) - m_{e,t} = 0$$

$$\frac{c_{eet}}{c_{eat}} = \frac{\omega}{1-\omega}\left(\frac{p_{2t}\left(1+b\right)}{p_{1t}}\right)^{\gamma}$$

$$\begin{aligned}\left(1-a\right)m_{et}^{\eta-1} &= ac_{et}^{\eta-1}\frac{\partial c_{et}}{\partial c_{eet}}\frac{1}{p_{1t}} - \\ &\quad -\beta\left[\frac{ac_{et+1}^{\eta}+(1-a)m_{et+1}^{\eta}}{ac_{et}^{\eta}+(1-a)m_{et}^{\eta}}\right]^{\frac{1-\sigma-\eta}{\eta}} ac_{et+1}^{\eta-1}\frac{\partial c_{et+1}}{\partial c_{eet+1}}\frac{1}{p_{1t+1}}\end{aligned}$$

Calibration

	Parameter	Value
Calibrated structural parameters		
Discount factor	β	0.98
Elasticity of Substitution Parameter	σ	2
Elasticity of Substitution Parameter	η	-0.32
Elasticity of Substitution	γ	2
Home bias	ω	0.86
Consumption weight	a_e	0.75
Population, Europe (millions)	L^E	74
Population, Asia (millions)	L^A	360
European Income	A_e	826.1
Asian Income	A_a	985.0
Estimated structural parameters		
Euro-Asian trade transct. cost (bf. the new rout)	b^i	10
Euro-Asian trade transct. cost (aft. the Discoveries)	b^f	8

Method

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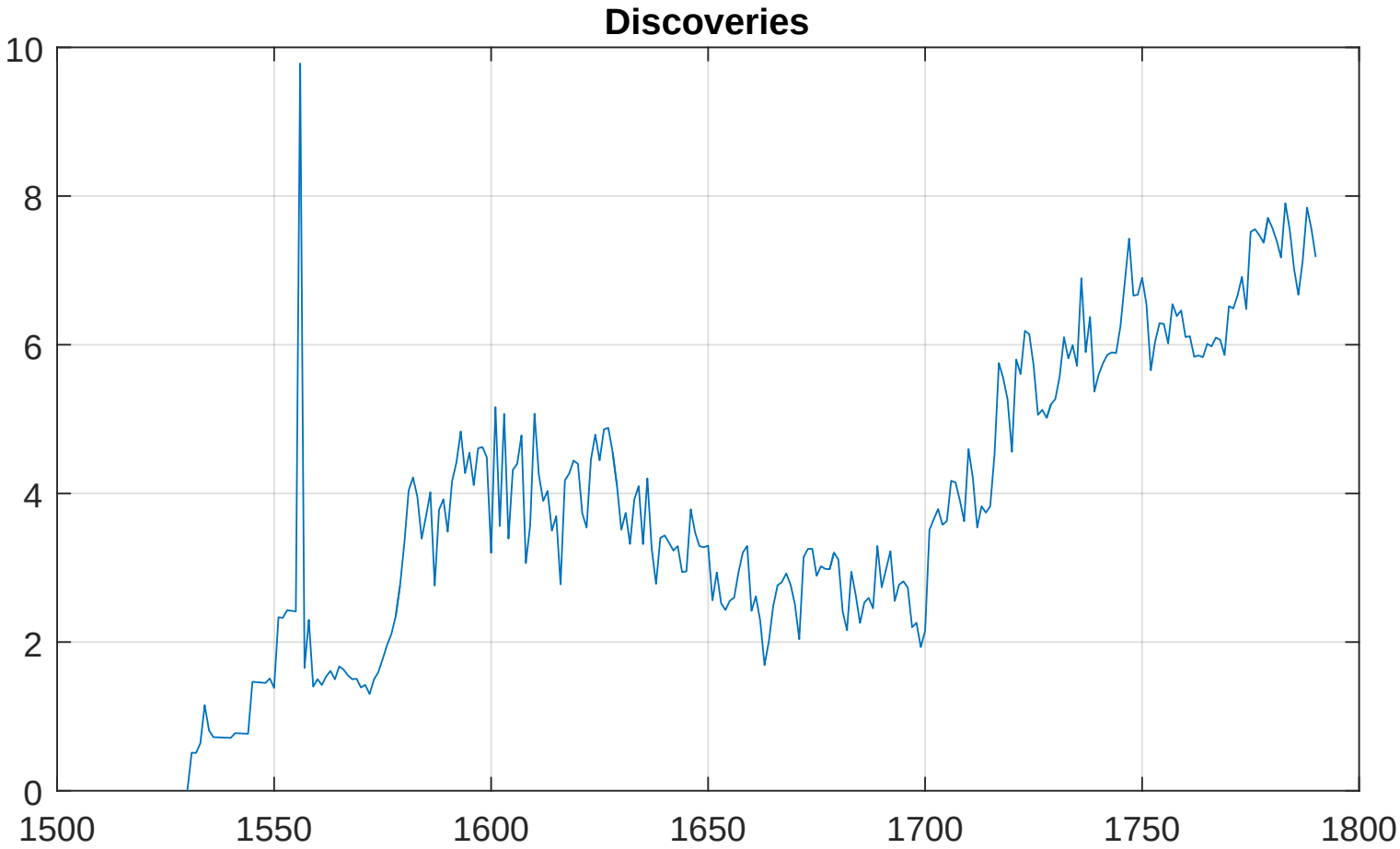
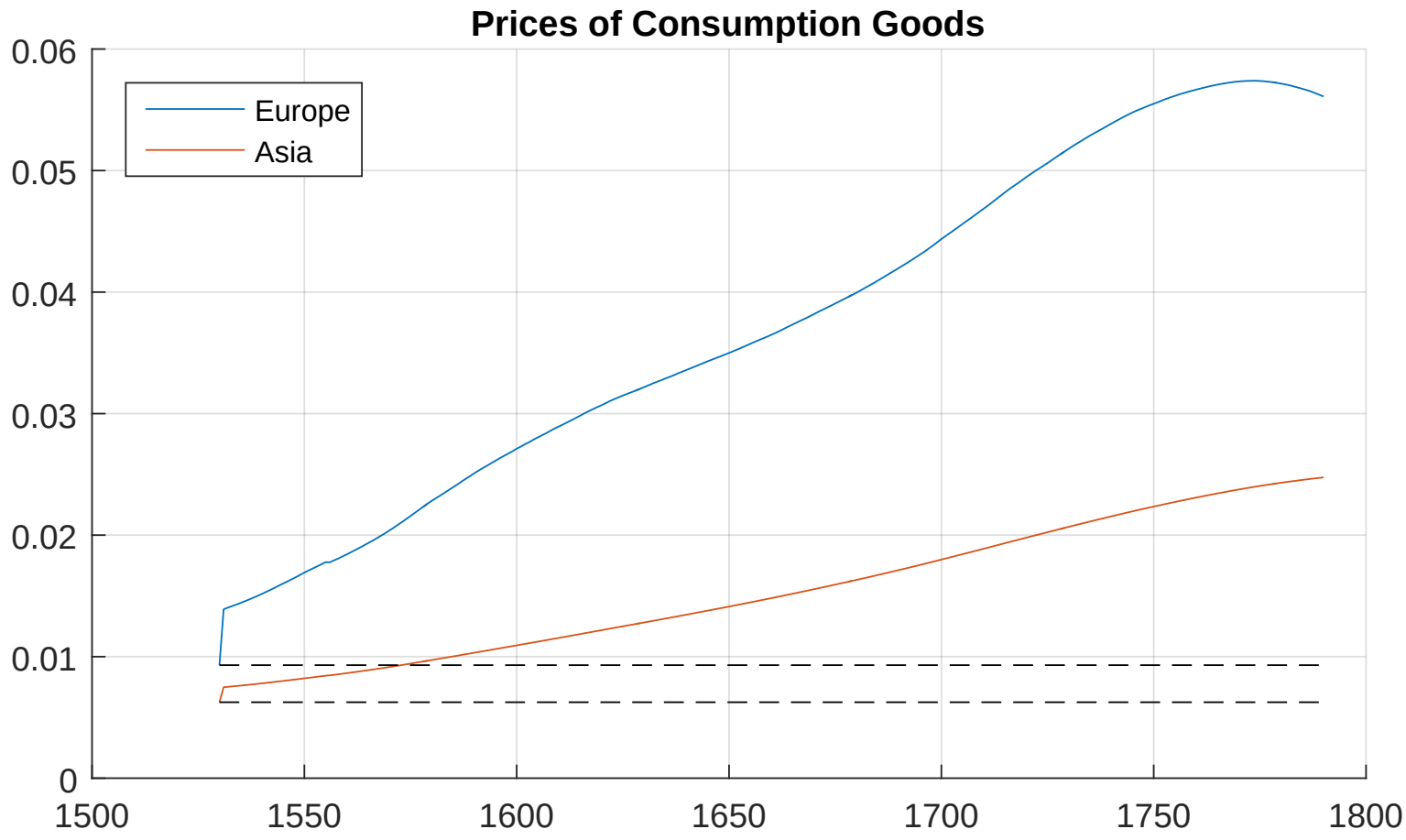
2. Find final steady state
   - Use data on accumulated discoveries of precious metals
3. Calculate the transition with data on the discoveries from 1531 to 1790
   - Decrease iceberg cost to simulate the discovery of the new route to Asia

Data



Results


Prices of Consumption Goods
Europe
Asia
0.06
0.05
0.04
0.03
0.02
0.01
0
1500
1550
1600
1650
1700
1750
1800

Results

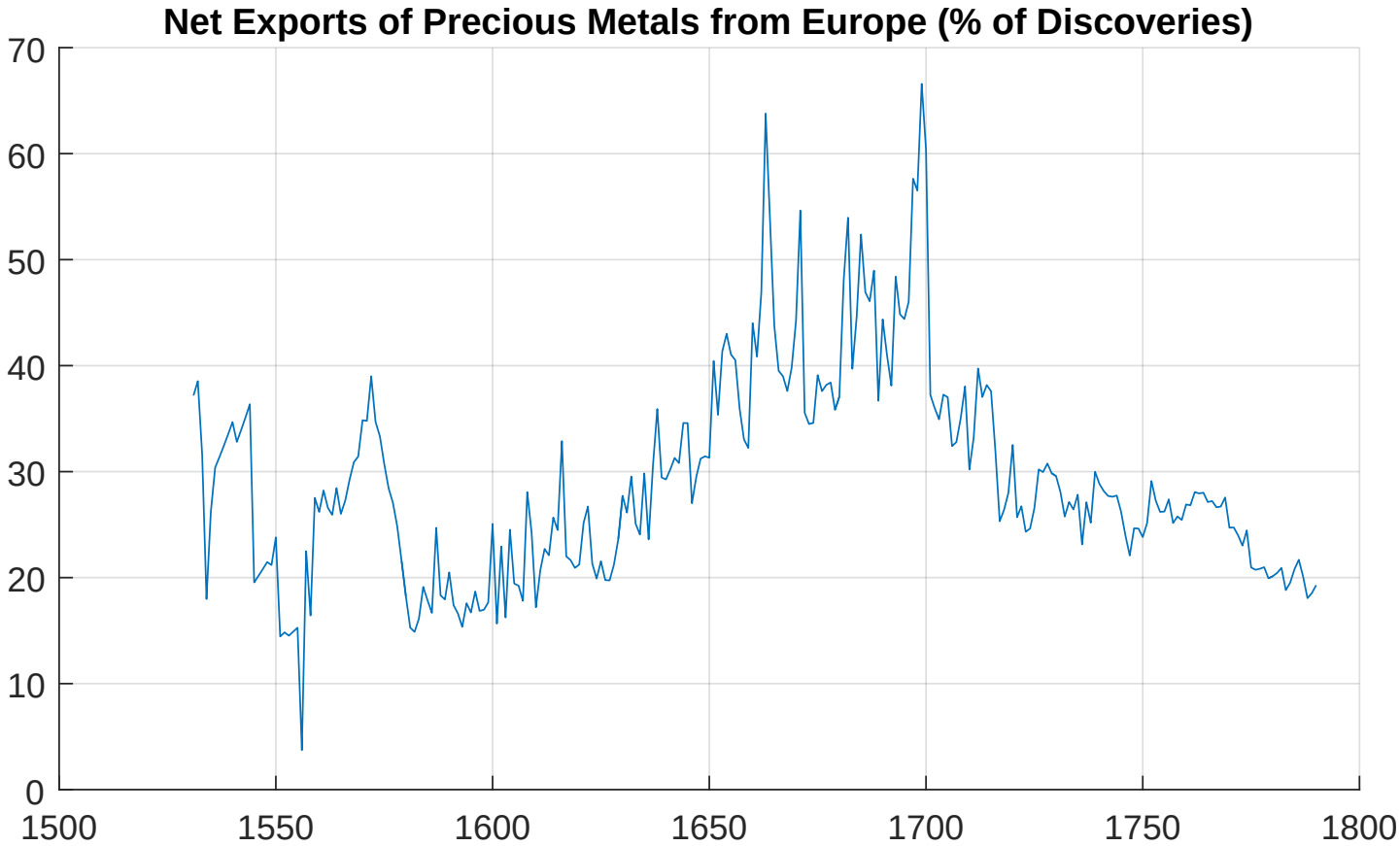
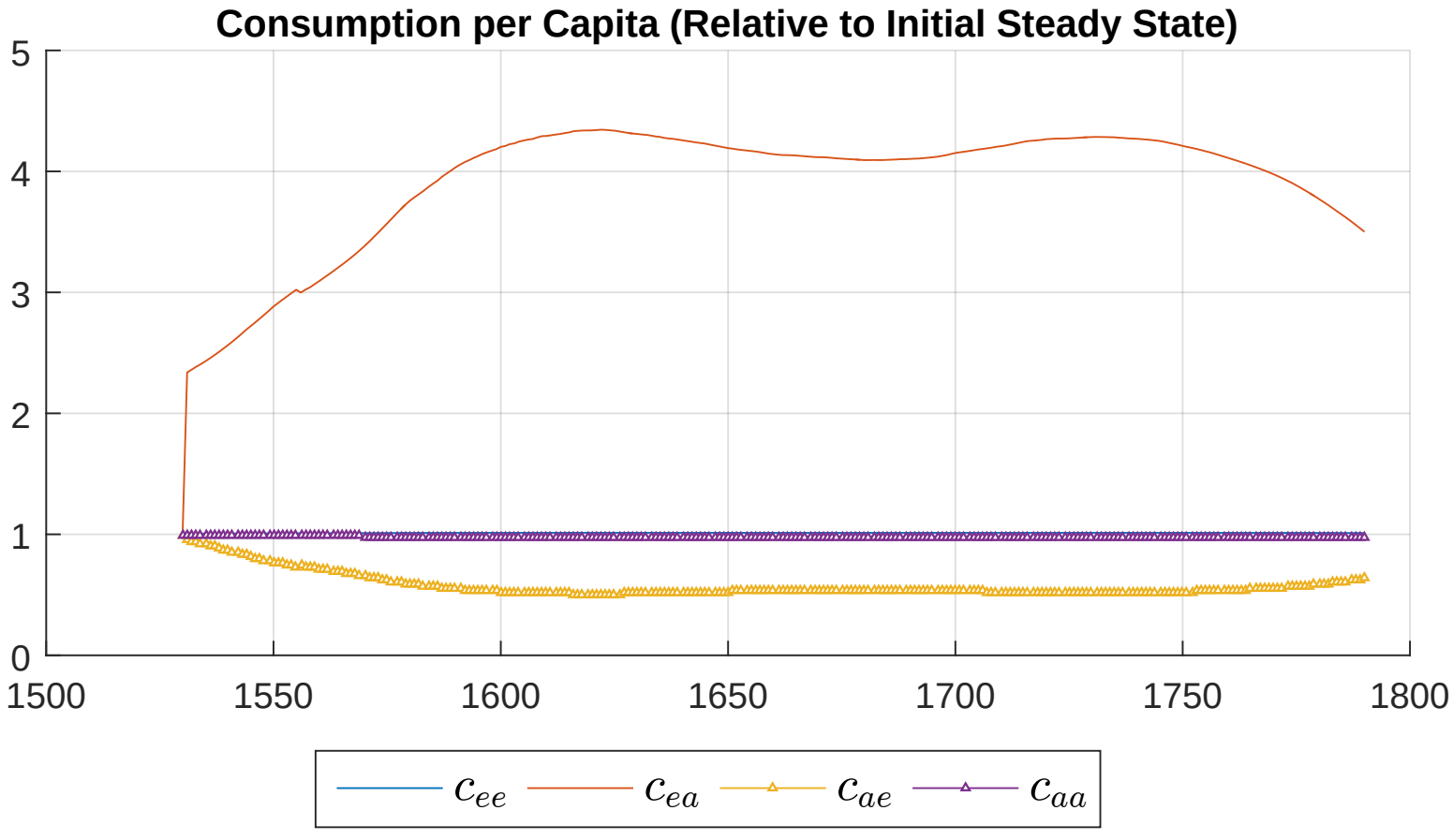


Figure: "China was the main and ultimate destination—directly or through intermediaries—of Spanish American silver since the sixteenth century" (Irigoin 2009)

Results


Consumption per Capita (Relative to Initial Steady State)
5
4
3
2
1
0
1500
1550
1600
1650
1700
1750
1800
c_{ee}
c_{ea}
c_{ae}
c_{aa}

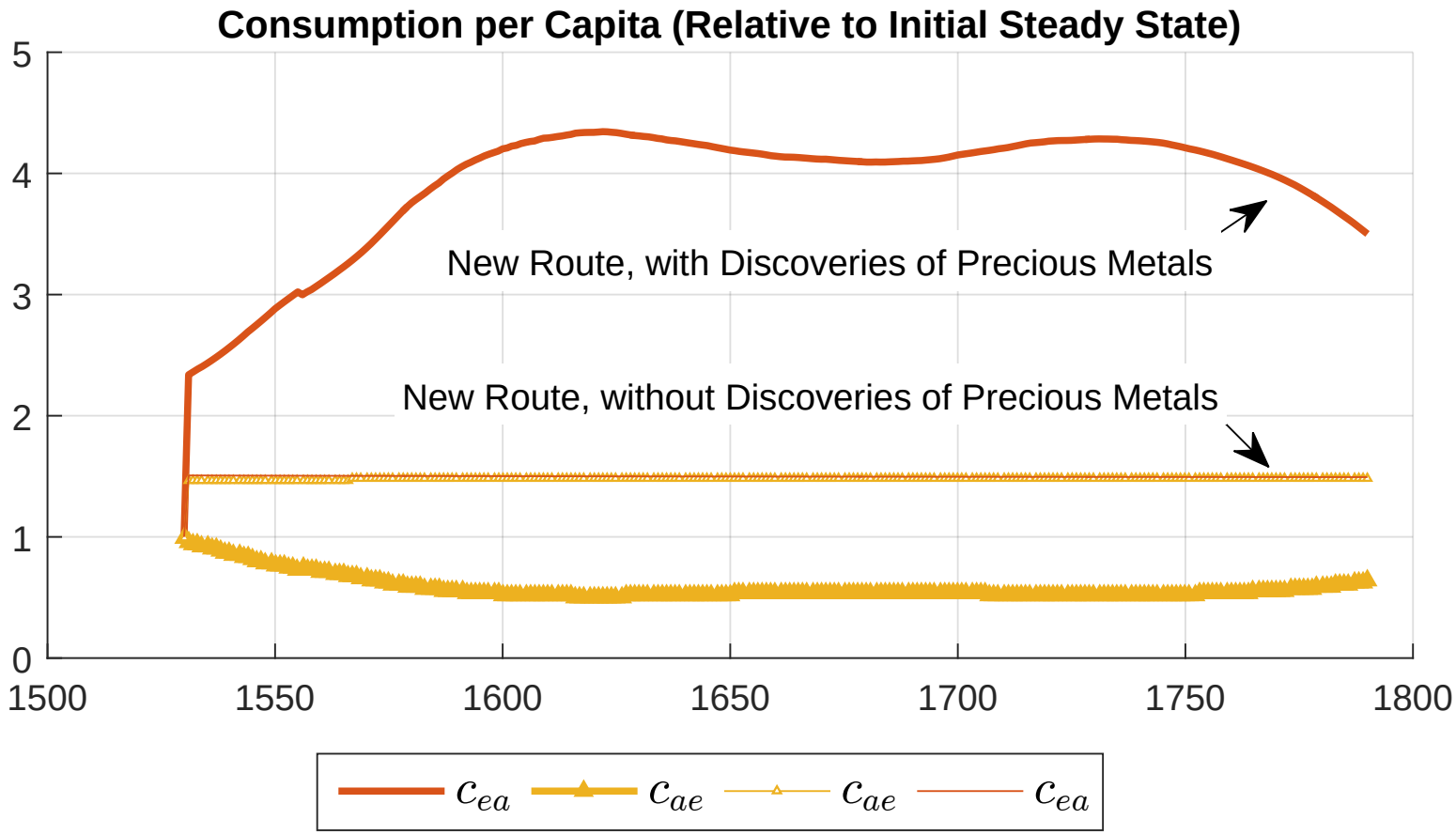
Results


Net Exports of European Goods to Asia (Relative to Initial Steady State)
1
0.9
0.8
0.7
0.6
0.5
0.4
1500
1550
1600
1650
1700
1750
1800

Results


European Net Imports of Asian Goods (Relative to Initial Steady State)
4.5
4
3.5
3
2.5
2
1.5
1
1500
1550
1600
1650
1700
1750
1800
$b_I = 10,\ b_F = 8,\ \eta_e = -0.02,\ \eta_a = -0.02,\ \gamma_e = 2.00,\ \gamma_a = 2.00$

Results


Consumption per Capita (Relative to Initial Steady State)
5
4
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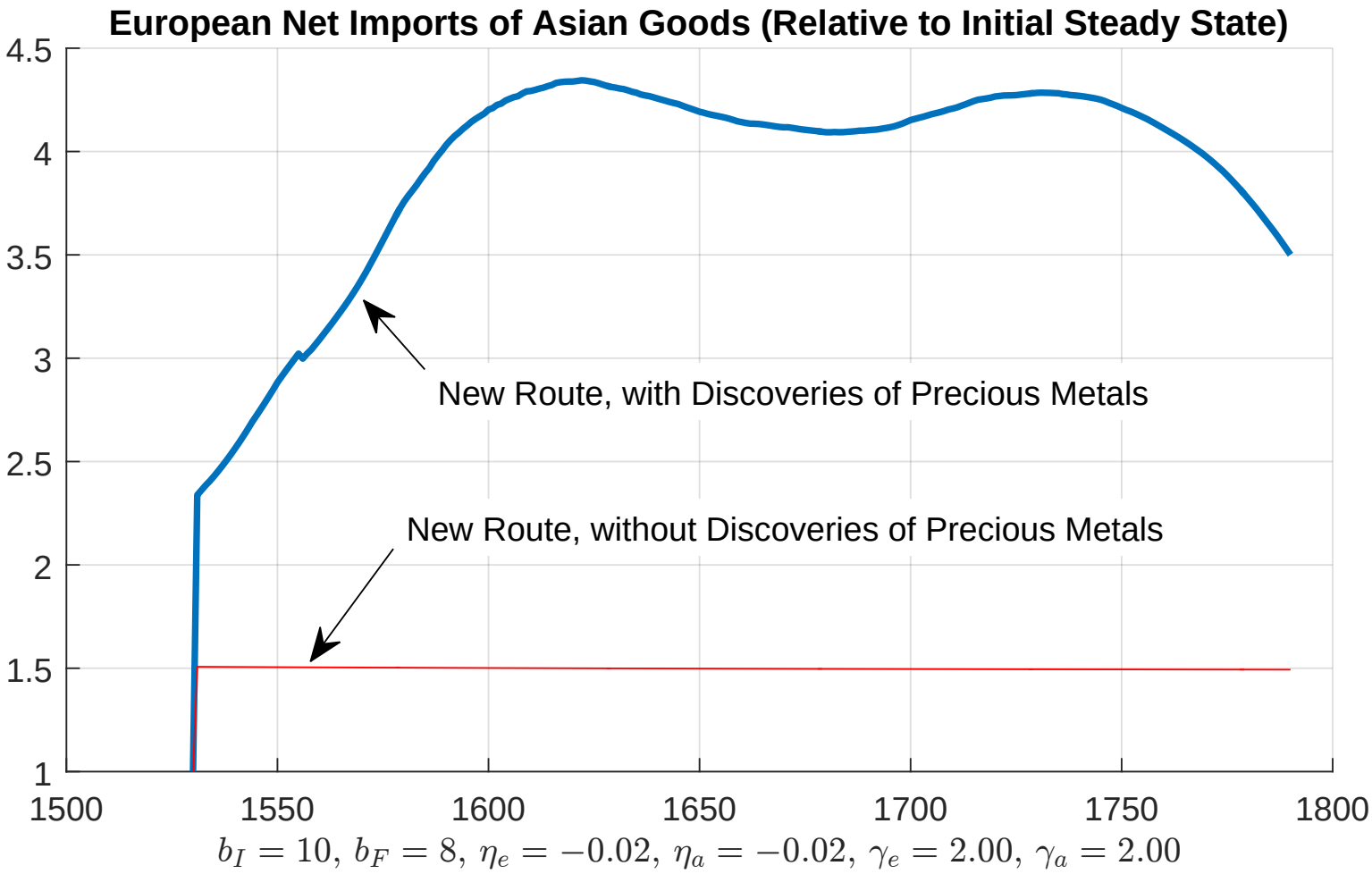
1500
1550
1600
1650
1700
1750
1800
New Route, with Discoveries of Precious Metals
New Route, without Discoveries of Precious Metals
c_{ea}
c_{ae}
c_{ae}
c_{ea}

Results


European Net Imports of Asian Goods (Relative to Initial Steady State)
4.5
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2.5
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1550
1600
1650
1700
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Our simulation matches the empirical facts

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- European agents have higher equilibrium consumption levels, but not much higher
- Equilibrium nominal price is higher in Europe
  - We hence explain the "standards of living debate" puzzle of early modern economic history which asks why were both nominal wages and prices higher in Europe (Allen 2005)

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  - "Spanish plunder was mainly in the form of precious metals. These were very important in financing European trade with Asians, *who were not very interested in buying European products*" Maddison (2007, p.312)
- Instead, our explanation emerges as a consequence of rational agents taking decisions in a dynamic, GE context

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