Does Capital Scarcity Matter?

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Capital Account Liberalization

- Allocative Efficiency Role: Capital account liberalization allows capital to flow from countries where it is abundant to countries where it is scarce.
- Capital flows into liberalizing countries lower the cost of capital, increase investment and economic growth leading to a permanent increase in the standard of living (Fisher 1998, 2003; Obstfeld, 1998; Rogoff, 1999; Summers, 2000; Henry, 2007).

- Research on the macroeconomic impact of capital account liberalization finds few, if any, robust effects of liberalization on real variables (i.e. investment and GDP per capita).
- Surveys by Edison, Klein, Ricci, and Slok, 2004 and Prasad, Rogoff, Wei, and Kose, 2003.
- Most studies employ cross-sectional regressions designed to measure long-run permanent differences in growth rates in economic variables of interest.

A Permanent Level Effect?

- Textbook theory of liberalization in contrast calls for a study of a temporary rather than a permanent growth effect (Henry, 2007).
- Cross-sectional regressions that do not finding permanent growth effects therefore do not undermine the predictions of the neoclassical model.
- Employing empirical techniques to measure the temporary growth but permanent level effect would be a more appropriate way to test whether predictions about the impact of liberalization hold up in the data.

A Permanent Level Effect?

- In the neo-classical framework the increase in growth following financial liberalization is a transitory phenomenon driven by a windfall accumulation of capital.
- KAL$\Longrightarrow$ permanent increase in the level of the capital stock in steady state$\Longrightarrow$pinned down by r*.
- Along the transition path from the autarkic to integrated steady state, capital grows *temporarily* at a higher rate.
- In the integrated steady state, the level of the capital stock has increased permanently.
- The temporary increase in the growth rate of capital thus leads to a permanent increase in the level of the capital stock.

And a Temporary Growth Effect...

- Simultaneously, the growth rate of output increases as the economy transitions from its autarky steady state to an integrated steady state.
- As K/Y ratio changes from its autarky level to the level predicted by an integrated equilibrium$\Longrightarrow$ steady state growth rate in the liberalizing economies returns to its growth rate in autarky.
- Financial liberalization leads to a *permanent* increase in the level of per capita output, the growth effect is only *transitory*.

Looking in Vain for a Permanent Growth Effect?

- Permanent growth effects $\Longrightarrow$TFP changes
- In the neo-classical model$\Longrightarrow$TFP changes are independent of the capital account regime.
- Since cross sectional regressions test whether liberalizations lead to a permanent growth effect, it is not surprising that they do not find a significant relationship.
- Temporary growth effect prediction$\Longrightarrow$ look at transition dynamics following financial liberalization.
- In looking at transitional short-term effects$\Longrightarrow$ obvious question$\Longrightarrow$Are the transitional effects economically meaningful?

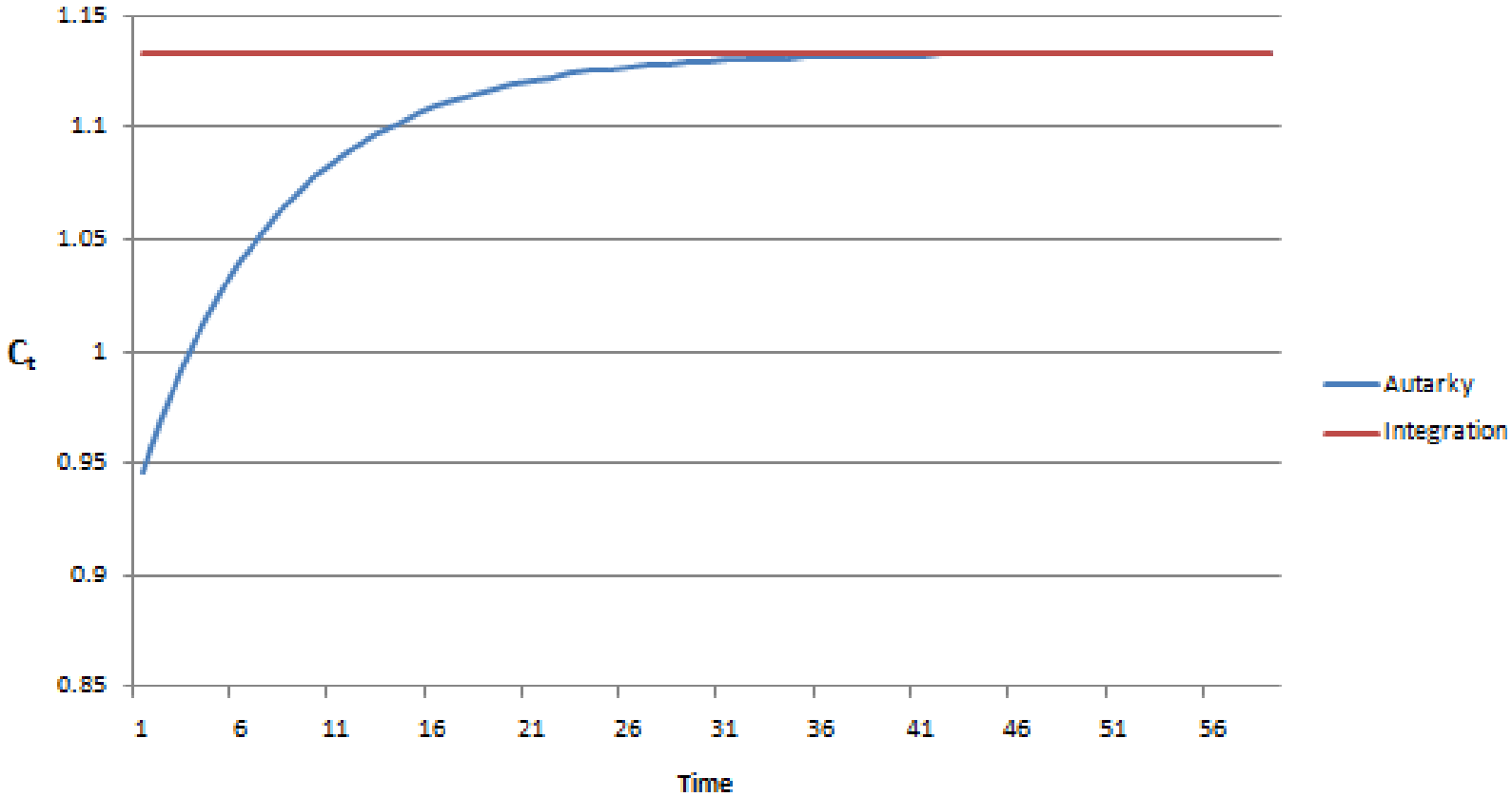
- This paper quantifies the welfare impact of a permanently higher level of income per capita brought about by temporarily higher growth in the aftermath of financial liberalization.

A policy-relevant horizon

- With infinitely-lived agents, the increase in consumption (welfare) brought about by financial liberalization may not be quantitatively important over the infinite lifetime consumption path (Gourinchas and Jeanne, 2006).
- However, if the lion's share of the welfare benefits from financial liberalization accrue over relatively short horizons in the early years after the policy is implemented, should we focus on a finite horizon to measure welfare?

- Computationally, the point is a simple one
- If the increase in growth is temporary and occurs in the early years following the policy change, when we quantify the percent increase in annual consumption relative to the infinite horizon consumption stream the welfare increase implied by financial liberalization is small.
- However, when the percent increase in annual consumption is viewed in relation to a shorter finite horizon consumption stream, the welfare effects of financial liberalization are quite considerable.

Consumption in Autarky and Integration



- This approach provides insights about how much agents would have to be compensated to not implement financial liberalization.

Or

- In the first X years, by what percent of annual autarkic consumption would you need to compensate agents in order to not liberalize?

- Our estimates show that in the first few years, agents would have to be compensated pretty highly in order to make them indifferent between implementing and not implementing the policy change.
- The finding stems from the fact that the initial effects of the policy change are big $\Longrightarrow$ lion's share of the welfare increase happens early.

Quantifying Welfare from a Temporary Increase in Growth

- Question: what is the capital to effective labor ratio implied by an exogenously given world interest rate?
- Answer determines how much the capital to effective labor ratio in autarky will have to change for an exogenously given world interest rate when a country opens up.
- The welfare effects of moving from autarky to an open capital account $\Longrightarrow$ depends on the magnitude of the capital wedge.
- Extent of capital scarcity in autarky$\Longrightarrow$ used to evaluate the welfare benefits of capital account liberalization.

Welfare Effects$\Longrightarrow$Financial Autarky to Financial Integration

- Use the apparatus in Gourinchas and Jeanne (2006).
- Agents live in an infinite-horizon Ramsey world.
- In autarky, the economy has an endogenous consumption path $\Longrightarrow$rate of time preference.
- Assume that the autarkic economy converges to a world steady state. K/AL$\Longrightarrow$ r*.
- Allows us to fix the size of the capital gap.
- Instantaneous convergence to world steady state when a country opens up.
- Model apparatus used to quantify the Hicksian consumption equivalent welfare gain from moving to financial integration from autarky.

Gourinchas and Jeanne (2006)

- Infinite-horizon Ramsey model.
- Production is Cobb-Douglas.
- CRRA utility.
- Raw labor grows at the population growth rate n.
- Labor-augmenting technical change grows increases the ratio of effective labor to raw labor at a rate of g.
- Rate of pure time preference is ρ. Discount factor is $\beta = 1 + \rho$.
- The rate of capital depreciation is δ.

Gourinchas and Jeanne (2006)

$$U_t = \sum_{s=0}^{\infty} \beta^s N_{t+s} u(c_{t+s})$$

$$s.t. \quad \tilde{k}_{t+1} = \frac{f(\tilde{k}_t) + (1-\delta)\tilde{k}_t - \tilde{c}_t}{(1+n)(1+g)}$$

using

$$f(\tilde{k}_t) = \tilde{k}_t^{\alpha} \qquad u(c_{t+s}) = \frac{c_{t+s}^{1-\gamma}}{1-\gamma}$$

F.O.C

$$R_t = \alpha \tilde{k}_t^{\alpha-1} + 1 - \delta$$

$$\tilde{c}_t = (\beta R_{t+1})^{-1/\gamma}(1+g)\tilde{c}_{t+1}$$

Gourinchas and Jeanne (2006)

- An autarkic (closed) economy's interest rate R_t is less than the world interest rate $R_w^*$and $lim_{t\to\infty} R_t = R^* = R_w^*$
- After liberalizing:
  - the capital account the interest rate becomes $R^*$and capital flows into the economy
  - the economy is catapulted to its steady state level of capital $\tilde{k}_w^* = \left(\frac{\alpha}{R_w^* + \delta - 1}\right)^{\frac{1}{1-\alpha}}$
  - the growth rate, g, temporarily increases until $\tilde{k}_w^*$is reached

Welfare Calculation (GJ)

$$\sum_{t=0}^{\infty}(\beta(1+n))^t \log\left(g^t \tilde{c}_t^{aut}(1+\mu)\right) = \sum_{t=0}^{\infty}(\beta(1+n))^t \log\left(g^t \tilde{c}_t^{int}\right)$$

$$\sum_{t=0}^{\infty}(\beta(1+n))^t \log\left(g^t \tilde{c}_t^{aut}\right) + \log(1+\mu)\sum_{t=0}^{\infty}(\beta(1+n))^t = \sum_{t=0}^{\infty}(\beta(1+n))^t \log\left(g^t \tilde{c}_t^{int}\right)$$

$$\log(1+\mu) = \frac{\sum_{t=0}^{\infty}(\beta(1+n))^t \log\left(g^t \tilde{c}_t^{int}\right) - \sum_{t=0}^{\infty}(\beta(1+n))^t \log\left(g^t \tilde{c}_t^{aut}\right)}{\sum_{t=0}^{\infty}(\beta(1+n))^t}$$

$$\mu = \exp\left(\frac{\sum_{t=0}^{\infty}(\beta(1+n))^t \log\left(g^t \tilde{c}_t^{int}\right) - \sum_{t=0}^{\infty}(\beta(1+n))^t \log\left(g^t \tilde{c}_t^{aut}\right)}{\sum_{t=0}^{\infty}(\beta(1+n))^t}\right) - 1$$

$$\mu = \exp\left[(1-\beta(1+n))\left(U_{int} - U_{aut}\right)\right] - 1$$

$$U_X = \sum_{t=0}^{\infty}(\beta(1+n))^t \log\left(g^t \tilde{c}_t^X\right)$$

GJ population weighted average

β	γ	α	$g*$	δ	n	μ
0.96	1	0.3	1.012	0.06	0.0074	1.74%

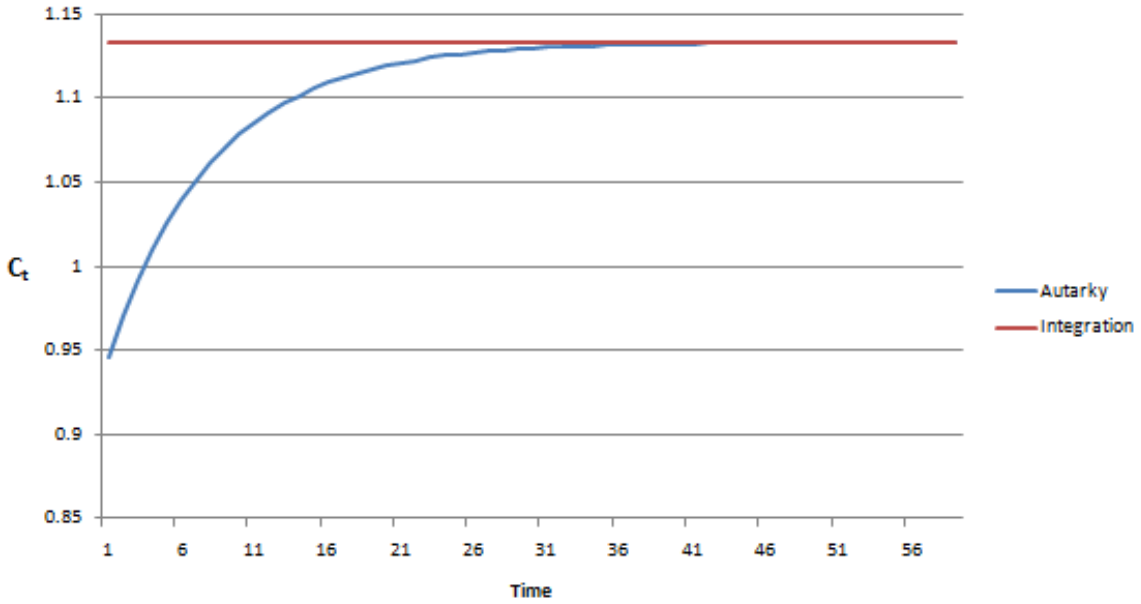
Angola

β	γ	α	$g*$	δ	n	μ
0.96	1	0.3	1.012	0.06	0.028	0.19%

- μ is the percent increase in annual autarkic consumption that would equate welfare under autarky and welfare under integration
- GJ report the population weighted average of μ for each country

Welfare Calculation (Finite Horizon)

- Welfare gain comes about because of the pre-convergence segment of the consumption stream



Welfare Calculation (Finite Horizon)

- Measuring the welfare gain using a finite horizon specifies the percent gain in autarkic consumption during the time period responsible for the welfare increase
  - finding the percentage increase in autarkic consumption (for every period in the infinite stream) that would equate lifetime welfare
  - finding the percentage increase in autarkic consumption (for a finite period following liberalization) that would equate finite welfare
- Far enough into the future, the discount factor makes the contribution of consumption to welfare negligible. For this reason, calculating the percent increase in consumption (μ) using consumption past a certain point in time will make smaller while representing consumption observations that have almost no contribution to welfare.

Welfare Calculation (Finite Horizon)

$$\sum_{t=0}^{T}(\beta(1+n))^t \log\left(g^t \tilde{c}_t^{aut}(1+\mu_T)\right) = \sum_{t=0}^{T}(\beta(1+n))^t \log\left(g^t \tilde{c}_t^{int}\right)$$

$$\sum_{t=0}^{T}(\beta(1+n))^t \log\left(g^t \tilde{c}_t^{aut}\right) + \log(1+\mu_T)\sum_{t=0}^{T}(\beta(1+n))^t = \sum_{t=0}^{T}(\beta(1+n))^t \log\left(g^t \tilde{c}_t^{int}\right)$$

$$\mu_T = exp\left(\frac{\sum_{t=0}^{T}(\beta n(1+n))^t \log\left(g^t \tilde{c}_t^{int}\right) - \sum_{t=0}^{T}(\beta(1+n))^t \log\left(g^t \tilde{c}_t^{aut}\right)}{\sum_{t=0}^{T}(\beta(1+n))^t}\right) - 1$$

$$\mu_T = exp\left[\left(\frac{1-\beta(1+n)}{1-(\beta(1+n))^{T+1}}\right)(U_{int} - U_{aut})\right] - 1$$

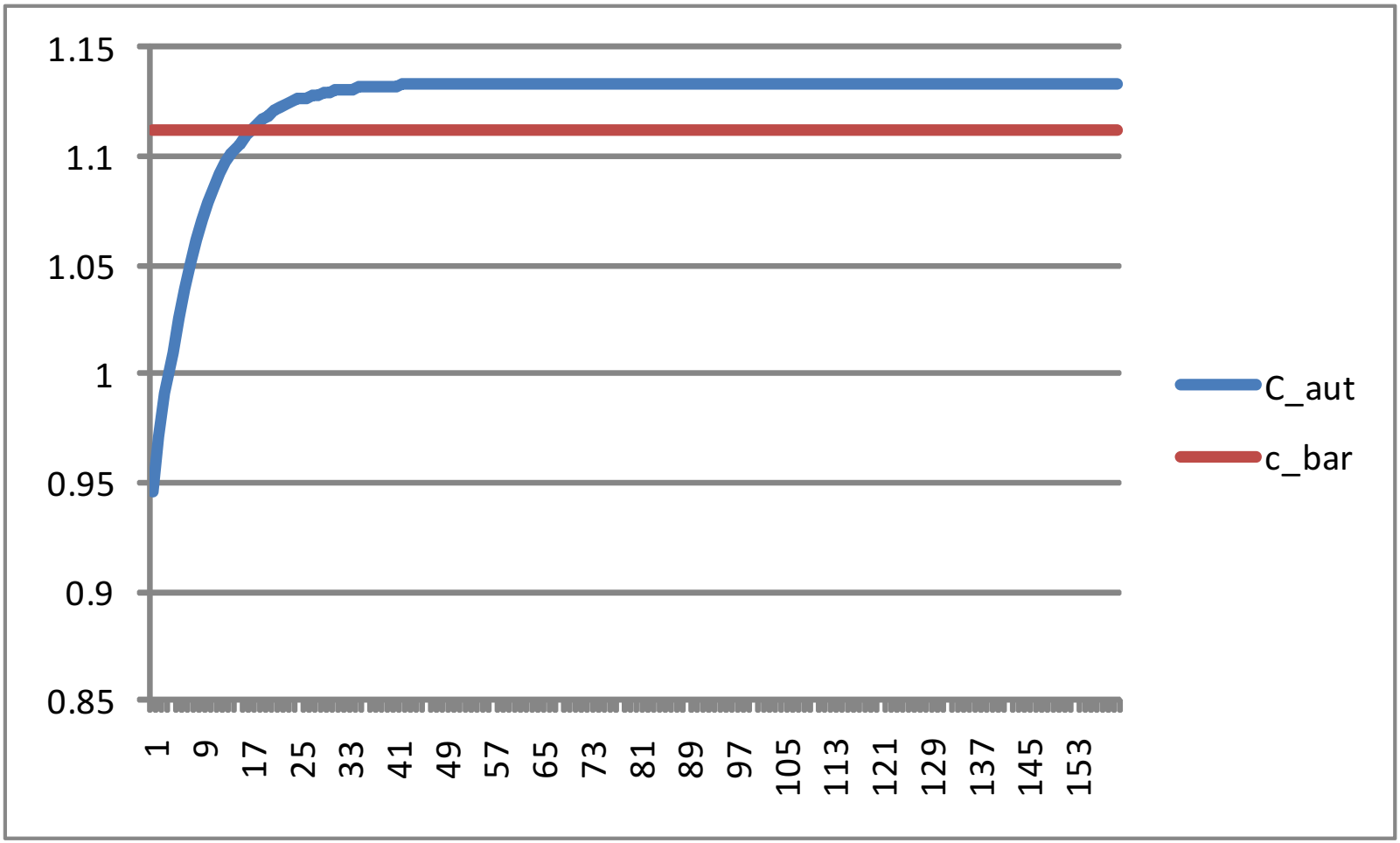
$$\left(\frac{1-\beta(1+n)}{1-(\beta(1+n))^{T+1}}\right) > (1-\beta(1+n)) \Rightarrow \mu_T > \mu$$

Table 2: Welfare Gains from Capital Account Liberalization over Finite Horizons
82 non-OECD Countries

	Average 1995	Quartiles			
		First	Second	Third	Fourth
Sample Average k_0	1.81	0.65	1.2	1.88	3.35
Time Horizon	μ_T				
5	32.03	59.59	38.21	24.64	8.07
10	22.85	41.59	27.65	18.11	5.74
20	13.11	23.52	15.97	10.57	3.36
30	8.75	15.73	10.63	7.02	2.26
40	6.44	11.67	7.8	5.1	1.67
50	5.06	9.26	6.1	3.94	1.31
∞	1.47	3.08	1.68	0.9	0.36

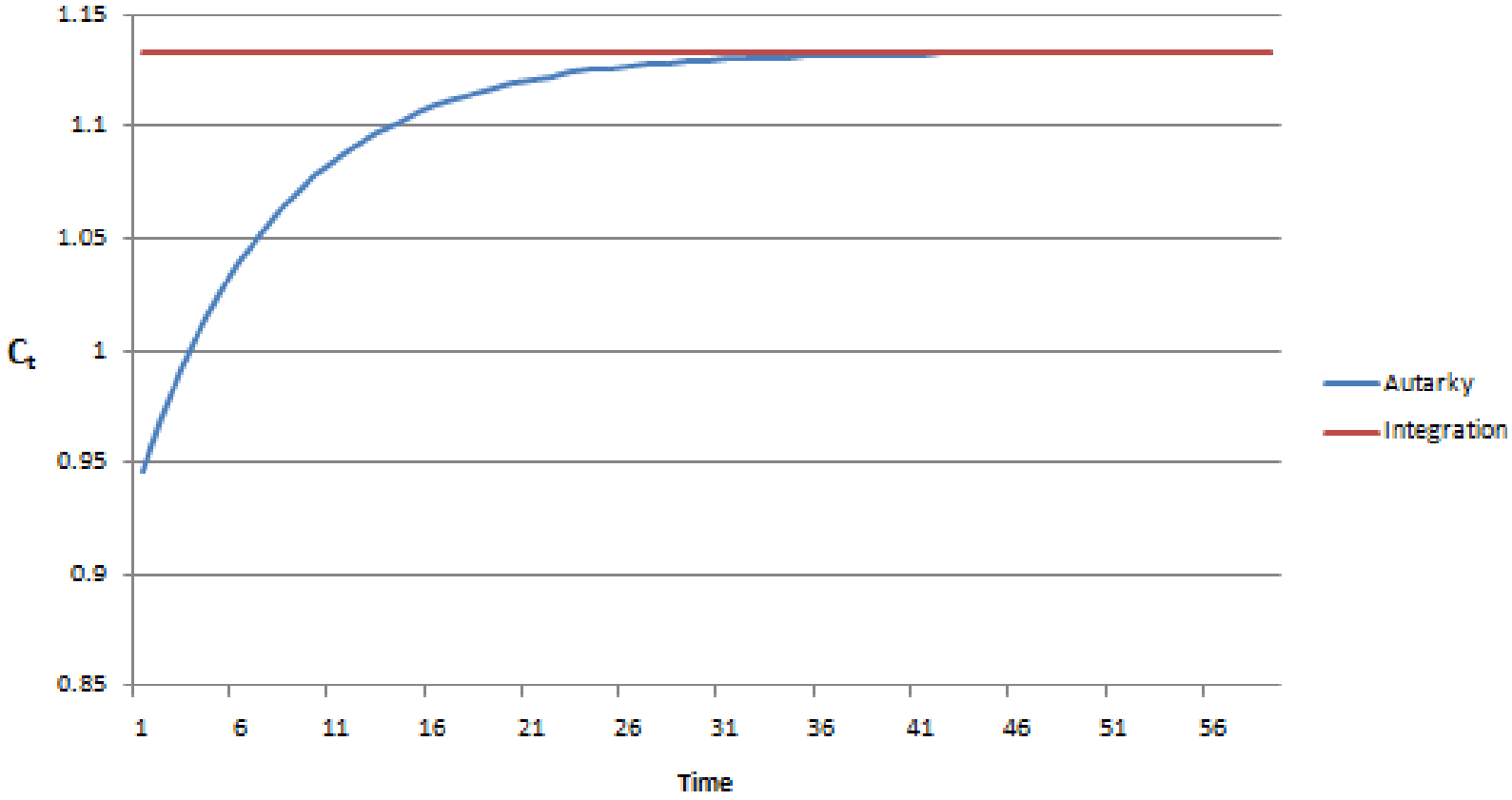
Accounting for Costs

- GJ assume that in integration, a constant flow of interest payments will be made to the rest of the world.



Accounting for Costs

- In an infinite horizon problem, however, the transversality condition implies that $lim_{T \to \infty} \left(\frac{1}{R}\right)^T B_{t+T+1} = 0$
- This means that after substituting out for B_t in the per period budget constraint $RB_t = C_t + I_t - Y_t + B_{t+1}$ and solving for steady state consumption we get
- $\bar{C} = \frac{R-1}{R}\left[RB_t + \sum_{t=0}^{\infty}\left(\frac{1}{R}\right)^t(\bar{Y} - \bar{I})\right]$


1.15
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51
56
Time
Autarky
Integration

Table 3: Welfare Gains from Capital Account Liberalization over Finite Horizons

	Average	Quartiles			
Sample	1995	First	Second	Third	Fourth
Average k_0	1.81	0.65	1.2	1.88	3.35
Time Horizon	μ_T				
5	37.34	68.89	44.83	29.13	9.32
10	27.7	49.82	33.77	22.36	6.94
20	17.49	30.69	21.52	14.54	4.51
30	12.91	22.44	15.93	10.86	3.38
40	10.49	18.14	12.95	8.87	2.77
50	9.04	15.6	11.17	7.67	2.4
∞	5.28	9.05	6.54	4.52	1.42

Table 4: Welfare Gains from Capital account Liberalization: 50 Year Debt Contract, Benchmark Economy, Autarky Capital-Output Ratio= 1.4

Time horizon	μ_T
5	10.30%
10	7.56%
15	5.58%
20	4.69%
25	3.88%
30	3.31%
35	2.97%
40	2.61%
45	2.40%
50	2.25%

Robustness Checks

- Relaxing assumptions on the evolution of the interest rate
  $\longrightarrow R^*$vs. $\longrightarrow R^* + premium$
- Absolute convergence vs. relative convergence
- Different financial contracts
- Initializing at 1960 vs. 1995

Table 5: Welfare Gains from Capital account Liberalization over Finite Horizons (k_o=1960)

	Average	Quartiles			
Sample	1995	First	Second	Third	Fourth
Average k_0	1.81	0.65	1.2	1.88	3.35
Time Horizon	μ_T				
5	37.34	68.89	44.83	29.13	9.32
10	27.7	49.82	33.77	22.36	6.94
15	21.48	38.04	26.35	17.67	5.47
20	17.49	30.69	21.52	14.54	4.51
25	14.8	25.82	18.24	12.39	3.85
30	12.91	22.44	15.93	10.86	3.38
35	11.53	19.98	14.23	9.72	3.03
40	10.49	18.14	12.95	8.87	2.77
45	9.68	16.72	11.96	8.2	2.56
50	9.04	15.6	11.17	7.67	2.4
∞	5.28	9.05	6.54	4.52	1.42

Conclusion

- We provide a study of the transitional dynamics of policy changes that lead to a temporary growth effect.
- Note that we do not say that policies that lead to permanent effects on TFP and growth are not important.
- We simply point out that policy changes that lead to temporary growth but permanent level effects of this sort (like financial liberalization) can add up to significant increases in levels of per capita incomes.