Trade Shocks and the Transitional Dynamics of Markups

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EEA-ESEM 2022
Milano, Italy

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   - Motivation
   - Literature
   - Mechanisms
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   - Supply Side
   - Demand Side
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"Trade isn't about goods. Trade is about information. Goods sit in the warehouse until information moves them." C. J. Cherryh

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- Trade liberalisations come with greater exposure to foreign competition that reduce the monopoly power of the domestic firms. This effect is believed to amplify the traditional welfare gains from trade that are attributable to specialisation, increasing returns to scale, and the expansion of import varieties (Krugman (1979)).
- In the context of the workhorse modern trade theory that features monopolistic competition, firm heterogeneity, and a large class of homothetic preferences, some argue that these additional welfare gains reflected in variable markups are relatively small (Arkolakis et al. (2012, 2018)).
  - The focus is on shifts from the steady state of autarky to the free trade equilibrium, which are instant, zero-probability events, something that Thomas J. Sargent famously calls "MIT shocks".
  - Are welfare outcomes any different when we account for a more plausible course of **transitional dynamics**?

- We argue that in the context of forward-looking firms, transitional dynamics are important for at least three empirically-relevant stylized facts:
  - (1) **anticipation**: the outcomes of trade deals are often anticipated in advance as they take months, if not years, to be negotiated (Moser and Rose (2012)). Price markups may therefore adjust in the run up to the trade shock, but *ex-ante* it is unclear in which direction.
  - (2) **sequencing**: even when the terms of the new trade deals are eventually hammered out and announced to the public, the actual changes in trade barriers are usually phased in gradually (Chisik (2003); Khan and Khederlarian (2021)).
  - (3) **dynamic trade elasticity**: independent of sequencing, trade flows take time to fully adjust in response to trade shocks (Boehm et al. (2020); Alessandria et al. (2021)). Price markups may therefore reflect not just the market structure today, but also what it is expected to be in the future.

- There is a large body of empirical literature that supports our choice of modelling consumer preferences with **inter-temporal non-separabilities**. Many empirical studies on consumer behaviour find that consumer choices across different brands or for the overall basket of goods are affected by past consumption choices (Heckman (1981), Chaloupka (1991), Naik and Moore (1996), Chintagunta (1998), Chintagunta et al. (2001), Seetharaman (2004), Carrasco et al. (2005), Alvarez-Cuadrado et al. (2016), Raval and Rosenbaum (2018)).
- Much of the above empirical literature is motivated by the early theoretical work on **consumption habits** (Pollak (1970), Spinnewyn (1981), Boyer (1978, 1983), Becker and Murphy (1988)).
- More recent work in the business cycle literature utilises the **deep habit framework** to study the dynamics of firm price markups in the context of unanticipated shocks (Ravn et al. (2006, 2010), Di Pace and Faccini (2012), Jacob and Uusküla (2019)).

- We generate a **dynamic trade elasticity**, which is lower (in absolute value) in the short-run than in the long-run. This result is consistent with many other studies (Baldwin (1992); Hooper et al. (1998); Gallaway et al. (2003); Alessandria and Choi (2007); Yotov and Olivero (2012); Boehm et al. (2020); Anderson et al. (2020); Bhattarai and Kucheryavyy (2020); Alessandria et al. (2021)).
- Expectations about future trade policy play a central role for the transitional dynamics in our model. We therefore recognise a buoyant new line of research that studies the **interaction between trade, announcements, and uncertainty** (Crowley et al. (2018, 2020); Caldara et al. (2020); Novy and Taylor (2020); Douch and Edwards (2021)).
- There are also others that address the prospect of pro-competitive effects of trade in **anticipation of trade reforms** (Staiger et al. (1994); Tharakan (1995); Handley and Limão (2017); Alessandria et al. (2019); Khan and Khederlarian (2021); Metiu (2021)).

- The **welfare amplification effects** of markups goes all the way back to Krugman (1979).
- Some argue that the welfare gains from variable markups are relatively large (Simonovska and Waugh (2014); Edmond et al. (2018)).
  - But Arkolakis et al. (2018) argues that welfare gains from variable markups are relatively small in the context of static and deterministic models with homothetic preferences. In fact, they can even be negative if consumer preferences are non-homothetic.
  - Our model is different, because it generates trade adjustment dynamics and time-varying markups with deep habits, which is a special case of homothetic preferences that escapes this argument.
- There are also other models of time-varying markups (Bilbiie et al. (2019); Peters (2020)) or markups that are related to market size (Melitz and Ottaviano (2008)), but their purpose is not directed at the anticipation effects of future trade policy changes.

- Our main contribution is a **simple theoretical model** that simultaneously accounts for all three of the above stylised facts (**a.k.a. Krugman *meets* Ravn et al.**).
- Our starting point is the ubiquitous “new" trade theory (Krugman (1979, 1980); Melitz (2003)). But we depart from the traditional approach that features constant elasticity of substitution (CES) preferences for domestic and foreign varieties, because as is well known, it implies constant markups.
- We augment the standard CES preferences with “deep" habits due to Ravn et al. (2006, 2010): individual consumption choices of a specific variety today are influenced by the past choices of their own as well as their friends, family, and neighbours (i.e. the “Joneses").
- Consequently, when the trade shock hits the economy, the initial impact on trade flows is subdued, because “old habits die hard". But as time passes, individuals start to slowly “catch up with the Joneses", which causes trade flows to gradually transition to the new steady state. By construction, this generates a dynamic trade elasticity and explains the **stylised fact (3)**.

- Trade in our model is subject to iceberg costs (Samuelson (1954); Krugman (1980)), such that a fraction of imports “melt away" in transit. Unlike the traditional approach, we argue that a fraction of the iceberg costs depends on trade policy, somewhat similar to Steinberg (2019).
- We capture this by modelling iceberg costs as an AR(1) process, such that their current value depends on: (i) the steady state; (ii) a contemporaneous trade shock; and (iii) the lagged value of the iceberg costs, which controls the sequencing of the trade shock and accounts for the **stylised fact (2)**.
- We entertain two different types of trade shocks: **anticipated** and **unanticipated**.
  - Unanticipated (i.e. stochastic) trade shocks are random draws from a time-invariant distribution.
  - Anticipated trade shocks are announced to all firms and households in advance, such that all agents acquire perfect foresight.

- We argue that if firms are rational and forward-looking, then in theory they should recognise the fact that consumers are addicted to their variety, such that demand for their variety is persistent.
- And if the firms have some market power, they would choose to set optimally time-varying markups.
  - Specifically, when sales are expected to grow in the future, firms cut markups today, because if they give consumers "a head start" in terms of adjusting their habits, they can boost future sales and keep them elevated for longer.
  - By contrast, when future sales are expected to shrink, firms increase markups today as they exploit the fact that consumers are still “hooked" on their variety, which addresses **stylised fact (1)**.

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- Two countries: home (H) and foreign (F).
- Discrete time $t = \{1, 2, ...\}$.
- Continuum of households indexed by $\psi \in [0, \Psi + \Psi^*]$, where $\Psi, \Psi^* > 0$ is the mass of home and foreign populations.
- Continuum of monopolistically-competitive firms indexed by $\omega \in [0, \Omega + \Omega^*]$, where $\Omega, \Omega^* > 0$ is the mass of home and foreign firms.
- Firms are subject to fixed production costs and require labour as the sole non-tradable factor of production.
- Trade barriers are subject to shocks.

- CES preferences with deep habits:

$$C_t(\psi) = \left[\int_0^{\Omega} C_{H,t}(\psi,\omega)^{1-1/\eta} d\omega + \int_0^{\Omega^*} C_{F,t}(\psi,\omega)^{1-1/\eta} d\omega \right]^{1/(1-1/\eta)}, \quad (1)$$

$$C_{i,t}(\psi,\omega) = X_{i,t}(\psi,\omega) X_{i,t-1}(\omega)^{\theta}, \quad (2)$$

  where $i = \{H, F\}$ and $\eta > 1$.

- $C_t(\psi) > 0$ is real consumption of $\psi \in [0, \Psi]$ individual.
- $X_{i,t}(\psi,\omega) > 0$ measures the consumption of variety ω from country i by individual ψ at date t,
- $X_{i,t-1}(\omega) > 0$ is the stock of habit.
- $\theta > 0$ measures the intensity of habits.

- IRS technology:

$$X_{i,t}(\omega) = \begin{cases} \phi[L_{i,t}(\omega) - \alpha] & \text{if} \quad L_{i,t}(\omega) > \alpha, \\ 0 & \text{if} \quad L_{i,t}(\omega) \leq \alpha, \end{cases} \tag{3}$$

  where $\alpha, \phi > 0$ are constants.

- $L_{i,t}(\omega) > 0$ is the non-tradable labour input supplied by home households inelastically.

- Exogenous Samuelson's iceberg costs: $\tau_t - 1 > 0$.
- Law of One Price: $P^*_{H,t} = \tau_t P_{H,t}$, where $P_{H,t}$ and $P^*_{H,t}$ stand for the "F.O.B." and the "C.I.F." prices of home exports, respectively.
- Trade costs are in part time-invariant: $\bar{\tau} > 1$ (e.g. geographic distance and maritime transport costs)
- But there are shocks to import tariffs:

$$\tau_t = (1 - \rho)\bar{\tau} + \rho\tau_{t-1} + \sigma\varepsilon_t, \tag{4}$$

  where $-1 < \rho < 1$ and $\sigma > 0$.
- Unanticipated shocks: $\varepsilon_t \sim \text{iid}(0, 1)$ drawn at random.
- Anticipated shocks: $\{\varepsilon_t\}_{t=0}^{\infty}$ known to all at all times (i.e. perfect foresight).

Equilibrium

- General equilibrium:
  1. Allocations: $\{C_t(\psi), C_{i,t}(\psi,\omega), X_{i,t}(\psi,\omega), L_{i,t}(\psi,\omega)\}_{t=1}^{\infty}$ and $\{C_t^*(\psi), C_{i,t}^*(\psi,\omega), X_{i,t}^*(\psi,\omega), L_{i,t}^*(\psi,\omega)\}_{t=1}^{\infty}$;
  2. Prices $\{P_t, P_t^*, P_{i,t}(\omega), P_{i,t}^*(\omega), W_t, W_t^*\}_{t=1}^{\infty}$;
  3. Mass of varieties $\{\Omega, \Omega^*\}_{t=1}^{\infty}$;
- Conditional on
  1. Endogenous state variables $\{\tau_{t-1}, \tau_{t-1}^*, X_{i,t-1}(\omega), X_{i,t-1}^*(\omega)\}_{t=1}^{\infty}$;
  2. Exogenous state variables $\{\varepsilon_t, \varepsilon_t^*\}_{t=1}^{\infty}$;
- Satisfies:
  1. Home maximises utility by choosing $\{X_{i,t}(\psi,\omega)\}_{t=1}^{\infty}$ taking $\{P_{i,t}(\omega), P_t\}_{t=1}^{\infty}$, and $\Omega, \Omega^* > 0$ as given;
  2. Home firms maximise profits by choosing $\{P_{H,t}(\omega), X_{H,t}(\omega), X_{H,t}^*(\omega), L_{H,t}(\omega), L_{H,t}^*(\omega)\}$ taking W_t, $\Omega, \Omega^* > 0$, and the prices, inputs, and output of all other home and foreign varieties as given;
  3. Mass of varieties $\Omega, \Omega^* > 0$ is such that all home firms break-even;
  4. Feasibility constraints are satisfied;
  5. All markets clear.

- Demand for each variety takes time to adjust in the face of shocks to the iceberg costs:

$$X_{i,t}(\psi,\omega) = \left[\frac{P_{i,t}(\omega)}{P_t}\right]^{-\eta} C_t(\psi) X_{i,t-1}(\omega)^{\theta(\eta-1)}. \tag{5}$$

- This comes from maximising utility by choosing $X_{i,t}(\psi,\omega)$ for $i = \{H, F\}$ subject to $W_t h_t(\psi) = \int_0^{\Omega} P_{H,t}(\omega) X_{H,t}(\psi,\omega) d\omega + \int_0^{\Omega^*} P_{F,t}(\omega) X_{F,t}(\psi,\omega) d\omega$ taking $\{P_{i,t}(\omega), P_t\}_{t=1}^{\infty}$ and $\Omega, \Omega^* > 0$ as given.

Forward-Looking Price Markups

- Firms are rational, forward-looking, and recognise the persistence of consumer demand.
- Firms maximise the expected value of the firm $\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t (P_{H,t}(\omega) X_{H,t}(\omega) - W_t L_{H,t}(\omega))$
- Optimal price markup:

$$\frac{\phi P_{H,t}(\omega)}{W_t} = \left(\frac{\eta}{\eta - 1} \right) \frac{P_{H,t}(\omega) X_{H,t}(\omega)}{P_{H,t}(\omega) X_{H,t}(\omega) + \theta \beta \mathbb{E}_t [P_{H,t+1}(\omega) X_{H,t+1}(\omega)]}, \quad (6)$$

- Marginal cost: $W_t/\phi > 0$, such that $\phi P_{H,t}(\omega)/W_t \geq 1$ is the gross price markup.

- When expected future sales $\mathbb{E}_t[P_{H,t+1}(\omega)X_{H,t+1}(\omega)]$ grow relative to the current sales $P_{H,t}(\omega)X_{H,t}(\omega)$, markup falls

  .: **Firms know that "old habits die hard" and if they give consumers "a head start" in terms of adjusting their stock of habits, they can boost future sales further and keep them elevated for longer.**

- When future sales are expected to shrink relative to the current sales, markup rises.

  .: **Firms take advantage of the fact that their customers are still addicted to their variety.**

- Transitional dynamics following anticipated and unanticipated trade shocks are different.

- In the symmetric equilibrium, the model can be simplified:

$$\text{PP:} \quad \mu_t = \left(\frac{\eta}{\eta - 1}\right) \frac{s_t}{s_t + \theta\beta\mathbb{E}_t\left[s_{t+1}\right]}, \tag{7}$$

$$\text{SS:} \quad s_t = \Gamma_s \left(\mu_t c_t\right)^{1-\eta} \left(s_{t-1} - \alpha\right)^{\theta(\eta-1)}, \tag{8}$$

$$\text{CC:} \quad \mu_t c_t = \Gamma_c \left[\left(s_{t-1} - \alpha\right)^{\theta(\eta-1)} + \tau_t^{1-\eta}\left(1 - s_{t-1} - \alpha\right)^{\theta(\eta-1)}\right]^{1/(\eta-1)}, \tag{9}$$

  where $\Gamma_s = (\Omega\phi)^{(1+\theta)(\eta-1)} > 0$ and $\Gamma_c = \Omega^{1/(\eta-1)}(\Omega\phi)^{1+\theta} > 0$ are constants.

- Three equations and three unknowns: s_t (IPR); μ_t (mark-up); and c_t (consumption) conditional on trade costs τ_t.

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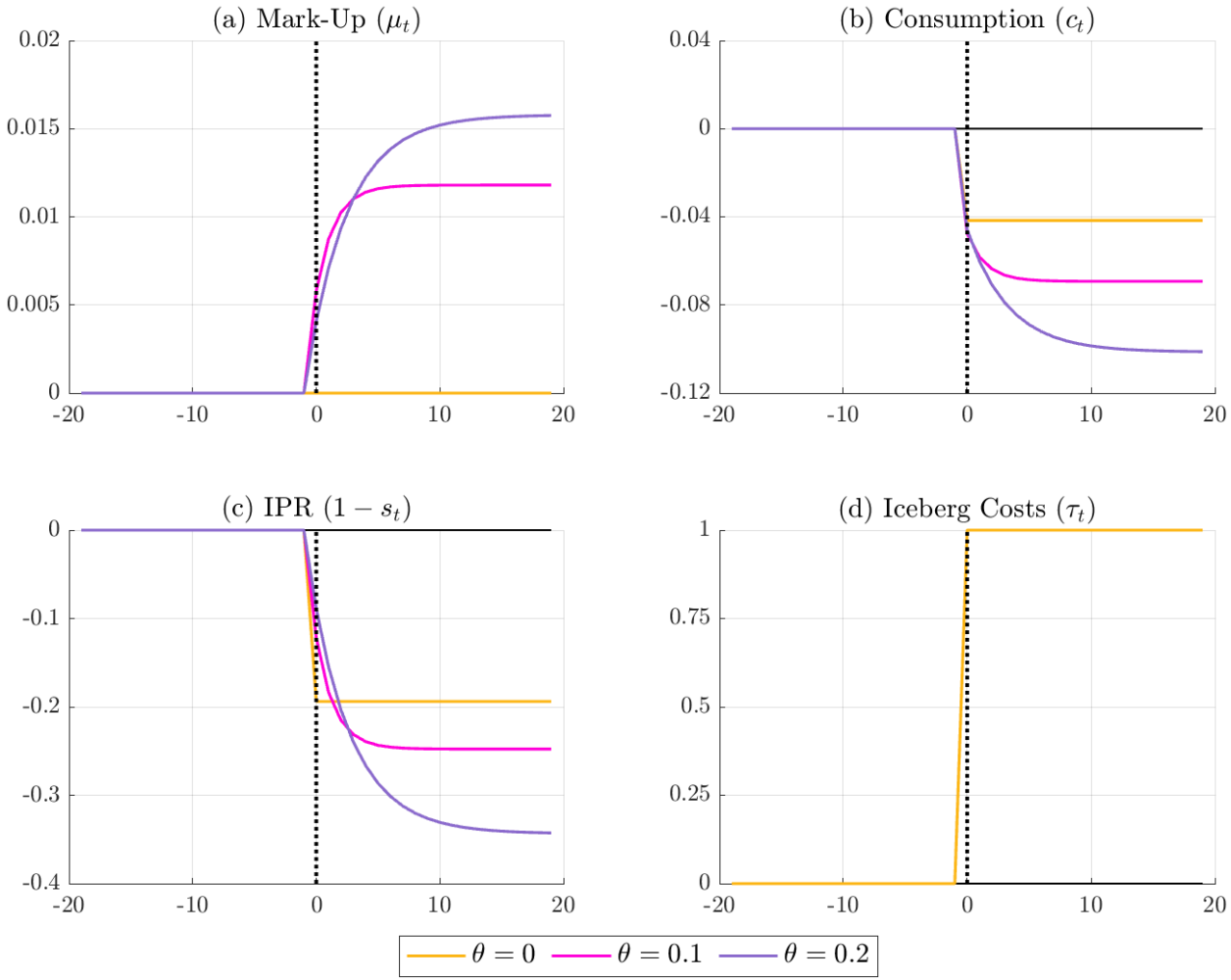
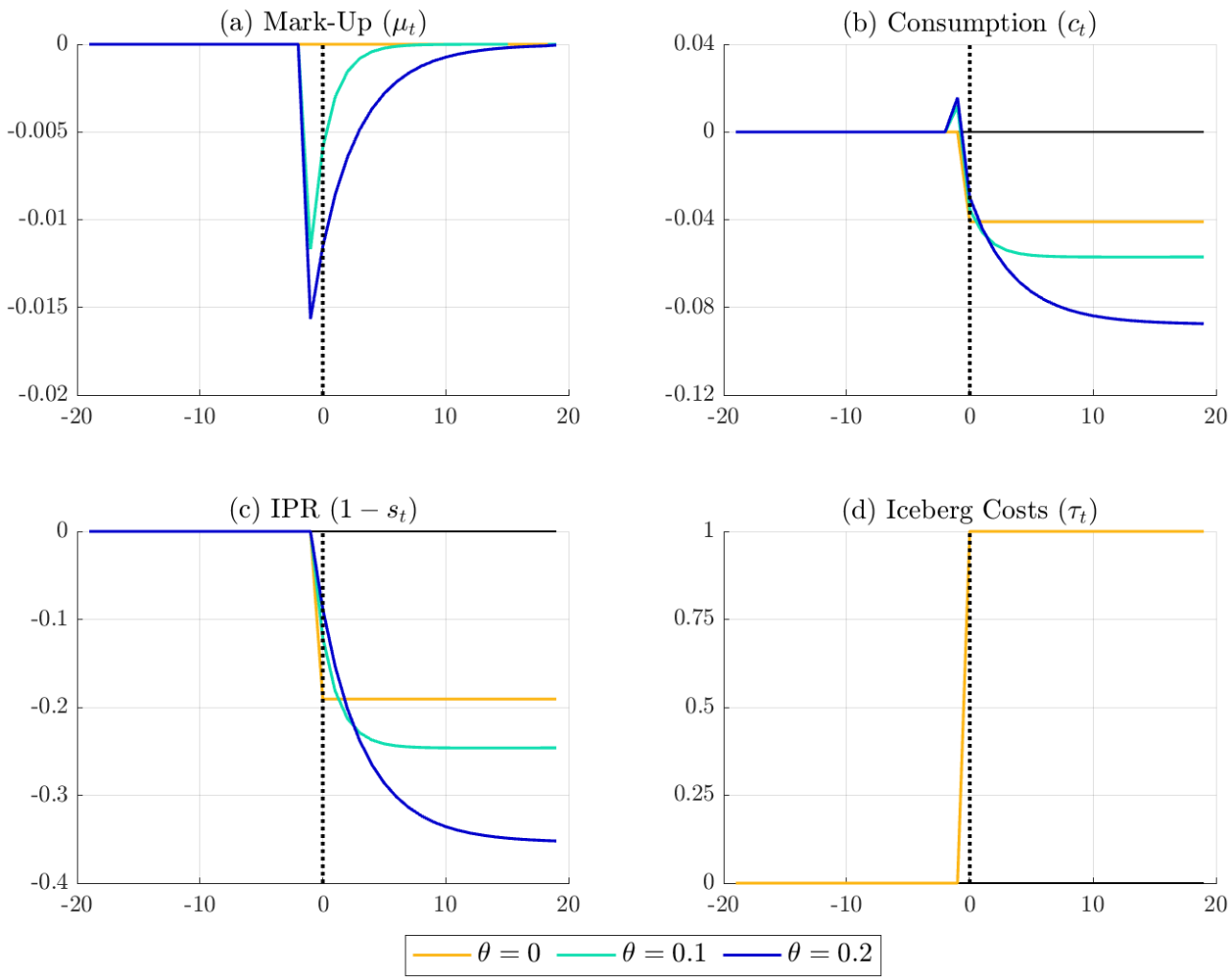
Permanent, Immediate, and Unanticipated 1% Increase in Iceberg Costs

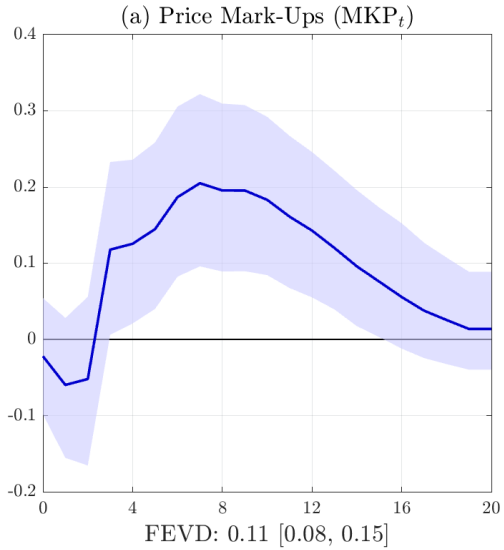


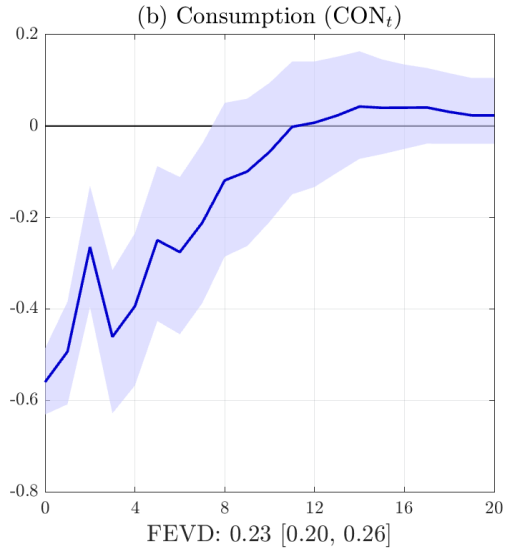
Permanent, Immediate, and Anticipated 1% Increase in Iceberg Costs

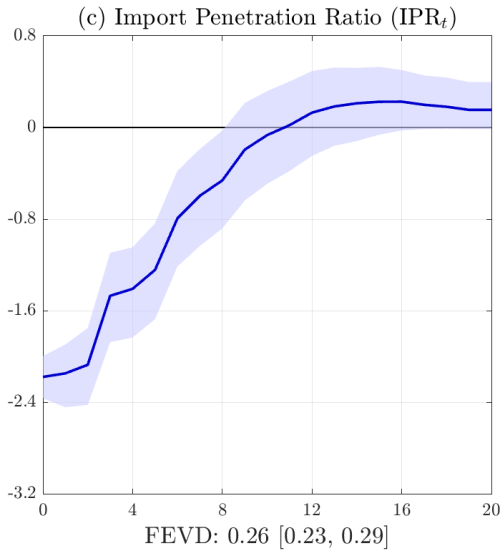


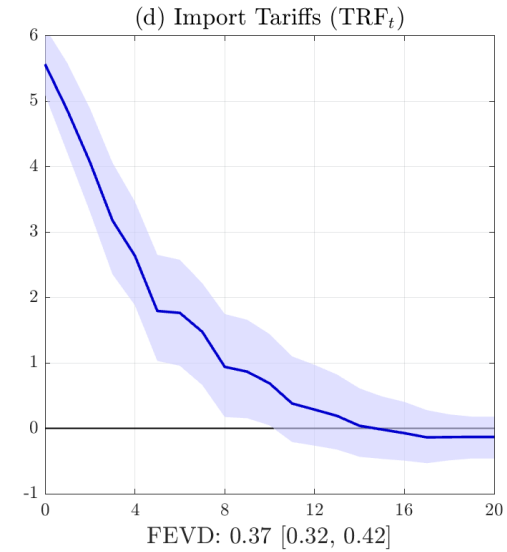
- Our empirical strategy involves modelling the simultaneous dynamics of four variables: (i) aggregate price markups (MKP_t) measured as the inverse labour share and obtained from Nekarda and Ramey (2020); (ii) import tariffs (TRF_t) measured as a ratio between customs duties and imports less customs duties; (iii) import penetration ratio (IPR_t), which captures the relative demand for home goods and foreign imports; and (iv) real aggregate consumption (CON_t), which captures shifts in aggregate demand for home goods and foreign imports.
- Let $h = \{0, 1, 2, ...\}$ denote the time horizon following a trade shock and $\text{IRF}_h^{\text{TRF}}$ denote the impulse response function of the import tariff. Upon impact, when $h = 0$, positive trade shocks cause not only an increase in TRF_t, but also a simultaneous decrease in CON_t and IPR_t.
- Our identification strategy therefore restricts the signs of $\text{IRF}_0^{\text{CON}} < 0$, $\text{IRF}_0^{\text{IPR}} < 0$, and $\text{IRF}_0^{\text{TRF}} > 0$, but only upon the impact of the trade shock, thereby allowing them to adjust freely thereafter.
- We do not restrict the impulse response of MKP_t in any way.

Transitional Dynamics with Unanticipated Trade Shocks (SVAR)



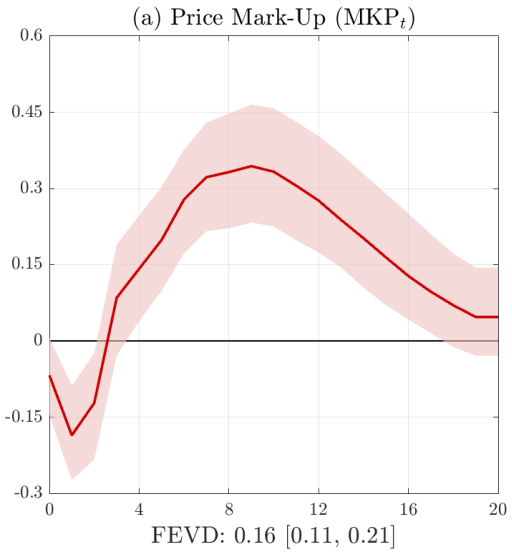


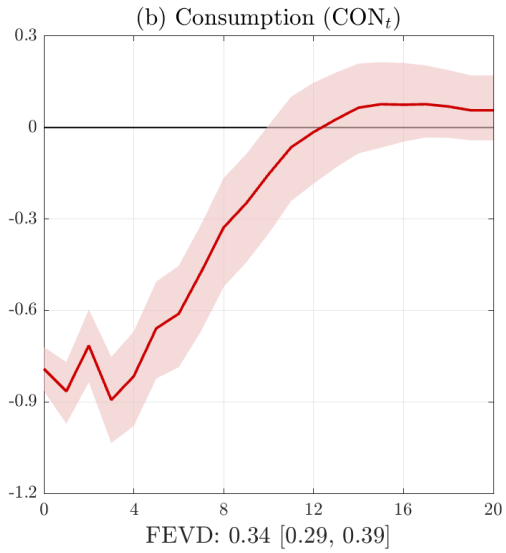


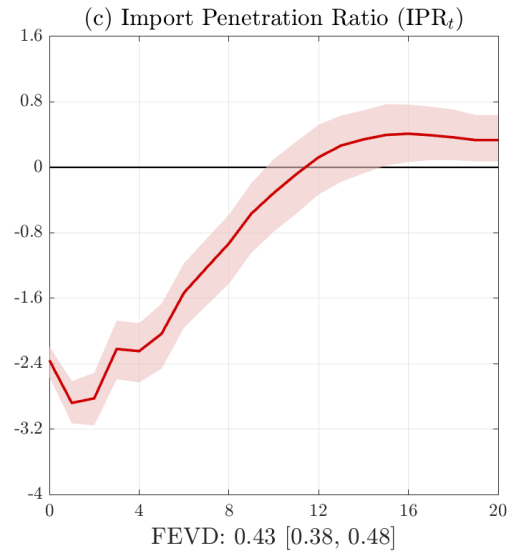


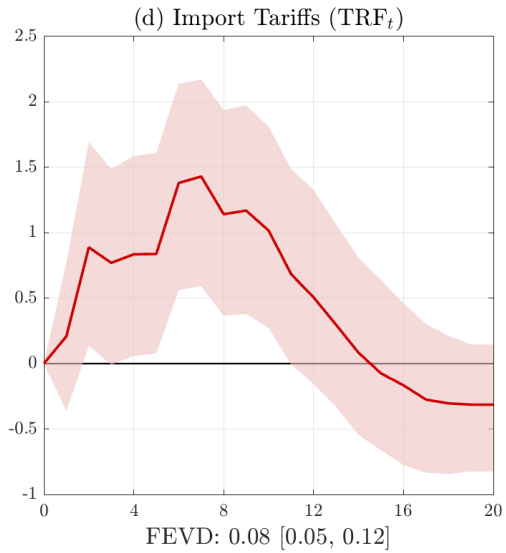
- We identify anticipated trade shocks using IRFs obtained by estimating a SVAR with the exact same dataset but with additional restrictions.
- We now impose that anticipated trade shocks upon impact cause the exact same simultaneous decrease in CON_t and IPR_t, but initially TRF_t remains unchanged.
- Our identification strategy therefore relies on restricting the signs of $\text{IRF}_0^{\text{CON}} < 0$, $\text{IRF}_0^{\text{IPR}} < 0$, and setting $\text{IRF}_0^{\text{TRF}} = 0$, but only upon the impact of the trade shock, thereby allowing them to adjust freely thereafter.
- We adopt this simultaneous sign- and zero-restriction approach by following the footsteps of Mountford and Uhlig (2009), who implement this identification strategy in the context of anticipated fiscal policy shocks. Arias et al. (2019) adopt a similar approach of identifying anticipated monetary policy shocks.
- In the robustness checks, we merge the signs-identified VAR with the news variable about the trade policy movements.

Transitional Dynamics with Anticipated Trade Shocks (SVAR)









- Caldara et al. (2020) analyze the effects of news about future tariffs. They construct the news-based index about trade policy. Similarly, Baker et al. (2016) construct a trade policy uncertainty index using newspaper searches.
- The problem of foresight in identifying macroeconomic shocks is well known. The key problem, as coined by Lippi and Reichlin (1994), is the so-called "non-fundamentalness," i.e., the inability to recover true shocks from the estimated ones since the MA process in non-invertible.
- Among key solutions to the identification of anticipated shocks is the so-called ""Expectational VARs", as coined by Perotti (2011).
  - The news variable is ordered first in the extended VAR.
- We re-run the 4-variable VAR with the news series, using both Caldara et al. (2020) and Baker et al. (2016) versions.
- Our results from the extended model with the additional news shock remain qualitatively similar to the baseline models.

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- We present empirical evidence that an increase in U.S. import tariffs causes U.S. price markups to increase, but it takes around one year for them to take off.
- If the trade shock is anticipated in advance, markups fall in the run up to the realisation of the trade shock and start to rise only thereafter (i.e. “J-curve" response).
- Understanding the transitional dynamics of markups is important, because small changes in markups can have large effects on welfare gains from trade.
- To account for these features, we extend the ubiquitous “new" trade theory of Krugman (1979, 1980) by incorporating deep habits into consumer preferences due to Ravn et al. (2006, 2010).
- Consumption habits are a widely-established empirical phenomenon and a popular analytical tool in the macro-finance literature.

- With deep habits, we show that the initial impact of trade shocks is subdued, because “old habits die hard", but as time passes, consumers start to “catch up with the Joneses", which amplifies the adjustment of trade flows in the long-run.
- This not only helps us characterise the transitional dynamics of markups, but also generates trade elasticity dynamics similar to those documented in the recent empirical literature (Boehm et al. (2020)).
- When sales are expected to grow in the future, firms cut markups today, because if they give consumers “a head start" in terms of adjusting their habits, they can boost future sales and keep them elevated for longer. By contrast, when future sales are expected to shrink, firms increase markups today as they exploit the fact that consumers are still addicted to their variety.
- Last, we show (in the paper) that deep habits significantly almost double the welfare cost of trade shocks. Around two-thirds of the welfare cost amplification from deep habits is attributable to the dynamic trade elasticity and around one-third to the time-varying price markups.

Questions / Comments / Suggestions

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Outline

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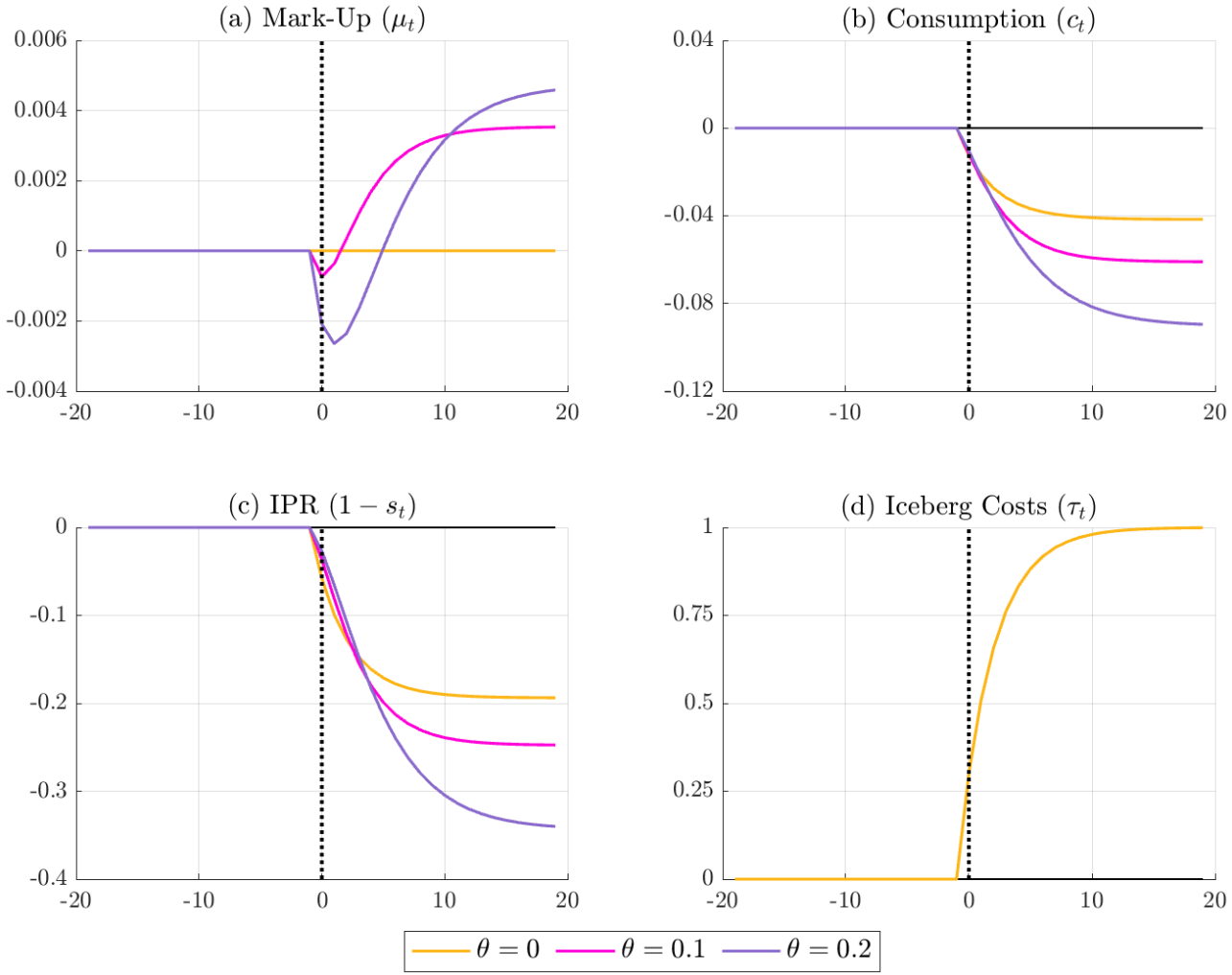
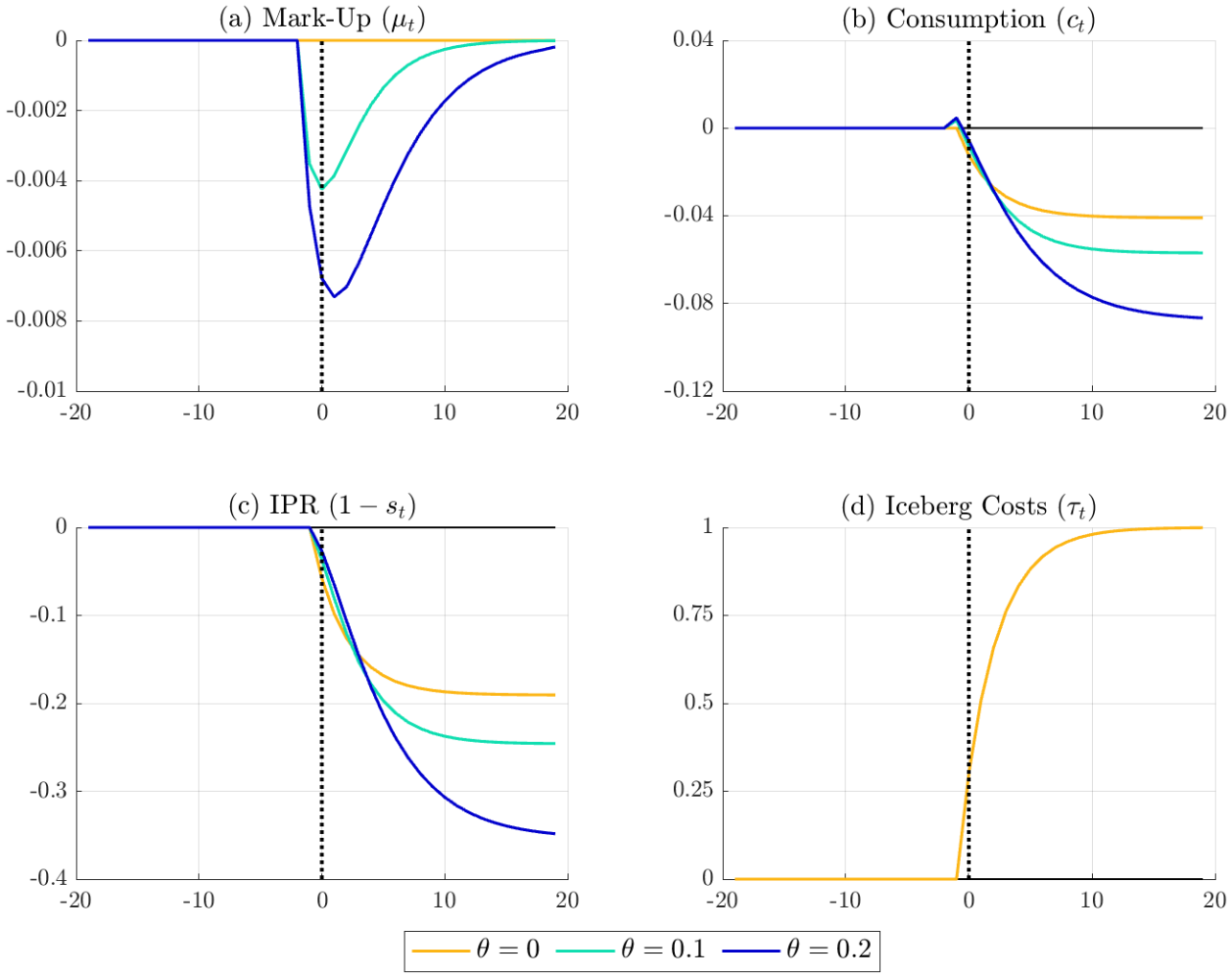
Appendix

Permanent, Gradual, and Unanticipated 1% Increase in Iceberg Costs



Permanent, Gradual, and Anticipated 1% Increase in Iceberg Costs



- We provide some stylised empirical evidence on the transitional dynamics of markups following unanticipated shocks to import tariffs using United States (U.S.) data that covers the period of 1960:Q1-2017:Q4.
- Our theory generates an empirically-consistent "J-curve" response of markups in response to a gradual and unanticipated trade shock.
  - Intuitively, home firm sales adopt an "S-shaped" time path, because changes in trade policy and "catching up with the Joneses" take some time to kick in. Initially, home firms expect future sales to increase by more than their current sales, which explains why markups fall upon impact (i.e. phase 1).
  - When consumers start to "catch up with the Joneses", home firm sales start to grow at an exponentially diminishing rate, such that the current increase in home firm sales start to exceed their expected future increase, in which case markups rise above the steady state (i.e. phase 2).
  - In the long-run, "catching up with the Joneses" eventually stops and markups reach their new and permanently higher steady state.
- By contrast, with immediate and unanticipated trade shocks, markups skip phase 1 and start to adjust according to phase 2 as soon as the trade shock hits the economy, which fails to generate the "J-curve" response.

- We also lay out evidence on the transitional dynamics of U.S. markups following anticipated shocks to the U.S. import tariffs.
- If the increase in U.S. import tariffs is anticipated, then following the initial impulse, which corresponds to the date of the trade policy announcement, U.S. markups fall and start to rise only around one year after, thereby making the aforementioned “J-curve" response even more pronounced.
- Our theory generates an analogous decrease in markups in the run up to an anticipated increase in iceberg costs.
- But contrary to the empirical evidence, when markups start to rise upon impact, they gradually revert to the pre-shock steady state and never rise above the steady state.
  - We reconcile this discrepancy by arguing that in practice trade policy announcements contain “noisy" information that some firms may be unable to process and take into the account when planning ahead, in which case some firms respond to all trade shocks as if they caught them by surprise.

Other Mechanisms?

- We are not the first to document the fact that anticipation of trade shocks plays a role in terms of trade adjustment dynamics.
- For instance, Khan and Khederlarian (2021) analyse the anticipation effects of NAFTA and show that there was a significant decline of U.S. import volumes in the run up to the U.S. import tariff cuts.
  - They argue that trade slowed down, because firms started to run down their inventories of intermediate imports in anticipation of lower trade costs in the future, which explains why “trade got worse before it got better" with a particular emphasis on the extensive margin (i.e. volumes).
- We acknowledge that firm inventories play an important role in trade adjustment dynamics, but show that the same adjustment patterns apply to the intensive margin (i.e. markups), which suggests that anticipation effects may be even larger than previously thought.
  - The intensive margin of trade adjustment dynamics can also be important, because small changes in markups can lead to considerable welfare gains.