Trade Credit Constraints and Aggregate Dynamics*

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Abstract

I study the aggregate implications of trade credit constraints faced by exporting firms in a small open economy general equilibrium model with heterogeneous producers. Exporters must finance fixed export costs with external credit, but borrowing capacity is limited by domestic financial development. Quantitative results show that, despite sizable firm-level distortions, trade credit constraints can have muted aggregate effects. Two general equilibrium mechanisms account for this result: tighter constraints reduce export participation but raise average exporter productivity through selection, and endogenous wage adjustment dampens the transmission of shocks to profits and export activity. The aggregate relevance of trade credit constraints increases when firm productivity is less dispersed and when labor supply is more elastic. Overall, the analysis clarifies how firm-level financial frictions interact with general equilibrium forces in shaping aggregate outcomes.

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1 Introduction

Exporting firms typically face large upfront costs, including market entry expenses, distribution networks, and regulatory compliance. These costs are often financed through trade credit or other forms of external finance, yet access to such funding is frequently limited by financial frictions. A substantial empirical literature documents strong firm-level effects of trade credit constraints, showing that tighter financial conditions reduce export participation and, in some cases, export volumes (Chaney, 2016; Manova, 2013). While these micro-level distortions are well established, how they translate into aggregate outcomes once general equilibrium adjustments are taken into account remains less well understood.

This paper studies the general equilibrium implications of trade credit constraints in an open economy with heterogeneous firms. I develop a dynamic small open economy model with monopolistically competitive firms à la Melitz (2003), in which firms must finance fixed export costs using external funds. Borrowing capacity is limited by the degree of domestic financial development, which governs how much export revenue can be pledged as collateral. Embedding these firm-level financial frictions in general equilibrium allows the model to capture endogenous adjustments in wages, firm entry, and exporter composition, and to assess how these forces jointly shape aggregate dynamics.

The main finding is that trade credit constraints can have surprisingly limited aggregate effects in general equilibrium, even when they generate sizable distortions at the firm level. Across economies with very different degrees of financial development, aggregate consumption, output, and wages respond similarly to productivity shocks, despite large differences in export participation, exporter productivity, and export profits. In other words, strong firm-level financial distortions do not necessarily imply large aggregate fluctuations once equilibrium adjustments are taken into account.

Two mechanisms are central to this result. First, tighter trade credit constraints reduce the number of exporting firms (the extensive margin), but they also raise the average productivity of exporters by restricting export activity to more productive firms. This increase in average exporter productivity—the selection effect—partially offsets the contraction in exporter participation. Second, endogenous wage adjustment in general equilibrium compresses firm profits and dampens firms' responses along all margins: entry, exporting, and production. Together, these forces stabilize aggregate outcomes even as financial frictions strongly reshape the composition of exporters.

The analysis highlights three channels through which trade credit constraints operate: the extensive margin of exporting, the average productivity of exporters, and the intensive margin of exporter profits. While each margin is highly sensitive to financial development in isolation, aggregate outcomes depend on how these margins interact in general equilibrium. The paper shows that this interaction is shaped by structural features of the economy. When firm productivity is less dispersed, the selection effect weakens relative to the extensive margin, making aggregate outcomes more sensitive to financial development. Likewise, when labor supply is more elastic and wage adjustment is weaker, trade credit constraints exert a larger aggregate impact.

The contribution of the paper is therefore not to argue that trade credit constraints are unimportant, but to clarify the general equilibrium forces that govern how firm-level financial frictions aggregate. Even under stringent borrowing constraints—where firms can pledge only a small fraction of export revenues as collateral—the model shows that aggregate responses may remain modest once selection and wage adjustment are accounted for. At the same time, the framework identifies environments in which financial development matters more, highlighting the roles of firm heterogeneity and labor market structure.

The modeling assumptions are intentionally stark. Exporting firms must finance fixed export costs externally and cannot rely on accumulated internal funds or domestic profits. In practice, firms may partially self-finance export costs through retained earnings, internal capital accumulation, or the use of assets as collateral. Abstracting from these channels allows the model to isolate the role of trade credit frictions in a transparent way and can be interpreted as a worst-case environment in which financial constraints bind tightly.

Importantly, this makes the main results conservative: if aggregate effects remain limited under such stringent assumptions, they are unlikely to be larger once firms are allowed additional financing margins. At the same time, the framework clarifies how selection and wage adjustment operate independently of these omitted channels and provides a useful benchmark for understanding when trade credit frictions are likely to matter in aggregate.

By explicitly linking firm-level trade credit constraints to aggregate dynamics in general equilibrium, the paper helps bridge the gap between strong micro-level evidence on financial frictions in exporting and the relatively limited understanding of their aggregate implications in quantitative open-economy models. The results underscore that the macroeconomic consequences of trade credit constraints depend critically on firm heterogeneity and labor market adjustment, and they clarify the conditions under which firm-level financial distortions can translate into meaningful aggregate effects.

Related Literature.—This paper relates to the literature on financial constraints and firms' international activities. A large body of empirical work documents that credit frictions affect export participation, export volumes, and multinational activity (Antràs and Foley, 2015; Desai et al., 2008; Manova, 2008). Manova et al. (2015) provides firm-level evidence that financial constraints shape firms' international engagement. On the theory side, Manova (2013) and Chaney (2016) study trade credit constraints in partial equilibrium heterogeneous-firm models and identify the firm-level channels through which financial frictions distort export decisions. Foley and Manova (2015) provide a comprehensive survey of this literature.

This paper contributes to this strand by analyzing trade credit constraints in a dynamic general equilibrium environment. While the model's firm-level implications are consistent with existing partial equilibrium results, the analysis shows how general equilibrium adjustments—operating through firm selection and endogenous wage responses—can substantially alter the aggregate implications of trade credit frictions.

The paper also relates to the open-economy macroeconomics literature that incorporates heterogeneous firms and exporter dynamics into dynamic general equilibrium models, such as Ghironi and Melitz (2005) and Fattal Jaef and Lopez (2014). These studies feature endogenous export participation and firm entry in open-economy business-cycle frameworks but abstract from financial frictions affecting firms' export decisions. In contrast, the present framework introduces trade credit constraints that operate directly on exporters and examines how these firm-level financing frictions interact with general equilibrium forces in an open economy. Unlike models that emphasize financial frictions operating through household borrowing or sovereign debt constraints (Bianchi, 2011; Mendoza, 2010), the focus here is on financial frictions at the level of exporting firms.

Closely related is Leibovici (2021), who studies the general equilibrium effects of financial frictions on international trade in a multi-industry model with input–output linkages. He shows that financial development reallocates trade toward capital-intensive sectors, while aggregate effects remain limited. The present paper is complementary. Rather than focusing on *cross-sectoral* reallocation, I abstract from input–output linkages and examine how trade credit frictions shape firm selection and exporter productivity *within* an industry, allowing me to isolate the role of firm-level heterogeneity and wage adjustment in determining aggregate outcomes.

Finally, the paper relates to work on the role of credit constraints during the 2009 global trade collapse. While some studies argue that tighter credit conditions for exporters following the financial crisis contributed to the sharp decline in world trade (Amiti and Weinstein, 2011; Chor and Manova, 2012), others conclude that financial frictions played at most a secondary role and were not the primary driver of the collapse (Bems et al., 2013; Eaton et al., 2016). The results here are consistent with the latter view, highlighting how sizable firm-level financial disruptions need not translate into large aggregate trade effects.

The rest of the paper is organized as follows. Section 2 describes the model and equilibrium. Section 3 presents the quantitative results and economic intuition. Section 4 concludes.

2 Model

The economy is a small open economy populated by a representative household and a continuum of heterogeneous firms. There are two sectors: tradable and nontradable. In the nontradable sector, a homogeneous good is endowed each period in the fixed amount Y^N. In the tradable sector, a continuum of monopolistically competitive firms produces differentiated goods. Foreign variables are denoted with an asterisk.

2.1 Household

2.1.1 Preferences

Household preferences follow a standard nested CES structure. The final consumption bundle C_t is a composite of tradable and nontradable goods, defined as

$$C_t \equiv \left[\omega {C_t^T}^{\frac{\eta-1}{\eta}} + (1-\omega){C_t^N}^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}}, \tag{1}$$

where C_t^T and C_t^N denote the tradable and nontradable bundles, respectively. The parameter η governs the elasticity of substitution between tradables and nontradables, and ω is the weight on tradables.

The tradable bundle C_t^T is a CES composite of imported and domestically produced tradables:

$$C_t^T \equiv \left[{C_{D,t}^T}^{\frac{\xi-1}{\xi}} + {C_{I,t}^T}^{\frac{\xi-1}{\xi}}\right]^{\frac{\xi}{\xi-1}}. \tag{2}$$

where ξ the elasticity of substitution between imported and domestic tradables.

The domestically produced tradable bundle is itself a CES aggregator of differentiated varieties,

$$C_{D,t}^T \equiv \left[\int_{i\in\Omega_t} q_{D,t}(i)^{\frac{\sigma-1}{\sigma}} di\right]^{\frac{\sigma}{\sigma-1}}, \tag{3}$$

where Ω_t denotes the set of available domestic goods in period t and σ is the elasticity of substitution across varieties.

By the CES property, the corresponding price indices are

$$P_t \equiv \left[\omega^\eta {P_t^T}^{1-\eta} + (1-\omega)^\eta {P_t^N}^{1-\eta}\right]^{\frac{1}{1-\eta}}, \tag{4}$$

$$P_t^T \equiv \left[{P_{D,t}^T}^{1-\xi} + {P_{I,t}^T}^{1-\xi}\right]^{\frac{1}{1-\xi}}, \tag{5}$$

$$P_{D,t}^T \equiv \left[\int_{i\in\Omega_t} p_{D,t}(i)^{1-\sigma} di\right]^{\frac{1}{1-\sigma}}. \tag{6}$$

Here, P_t^N denotes the price of of the nontradable good, $p_{D,t}(i)$ the price of each domestically produced variety, and $P_{I,t}^T$ the price of the imported tradable bundle. All prices are expressed in a common accounting unit. I normalize $P_{I,t}^T = 1$, so the imported tradable bundle serves as the numeraire.

The implied demand for each domestic variety and for imported tradables is

$$q_{D,t}(i) = \omega^\eta \left(\frac{p_{D,t}(i)}{P_t}\right)^{-\sigma} \left(\frac{P_t^T}{P_t}\right)^{\xi-\eta} \left(\frac{P_{D,t}^T}{P_t}\right)^{\sigma-\xi} C_t, \tag{7}$$

$$C_{I,t}^T = \omega^\eta \left(\frac{P_t^T}{P_t}\right)^{\xi-\eta} \left(\frac{P_{I,t}^T}{P_t}\right)^{-\xi} C_t$$

where the focus is on the aggregate imported bundle rather than individual foreign varieties, since foreign variables are taken as exogenous.

Demand for the nontradable good is

$$C_t^N = (1-\omega)^\eta \left(\frac{P_t^N}{P_t}\right)^{-\eta} C_t.$$

2.1.2 Intertemporal problem

The representative household is endowed with labor L each period and can trade two assets: (i) an internationally traded risk-free bond that delivers one unit of the tradable bundle next period, and (ii) shares of a domestic mutual fund that holds all domestic firms and distributes their profits as dividends. The household chooses consumption C_t, next-period bond holdings B_{t+1}, and mutual fund shares $x_t \in [0, 1]$ to maximize lifetime utility:

$$\max \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{C_t^{1-\gamma}}{1-\gamma},$$

subject to the budget constraint

$$\begin{aligned} & P_t C_t + P_t^T B_{t+1} + \frac{\nu}{2} P_t^T B_{t+1}^2 + \tilde{v}_t (M_{D,t} + M_{E,t}) x_{t+1} \\ = {} & W_t L + P_t^N Y^N + (1 + r_t^*) P_t^T B_t + (\tilde{v}_t + \tilde{\pi}_t) M_{D,t} x_t + T_t. \end{aligned} \tag{8}$$

Here, $\beta \in (0, 1)$ is the discount factor and γ the coefficient of relative risk aversion. All bond-related terms are scaled by P_t^T because the bond promises tradable goods. The interest rate r_t^* is exogenous from the perspective of this small open economy. $\tilde{v}_t$ denotes the mutual fund price, $\tilde{\pi}_t$ its dividend, $M_{D,t}$ the mass of incumbent domestic firms, and $M_{E,t}$ the mass of entrants. The household's income derives from labor, the nontradable endowment, bonds, and mutual fund returns. The term $\frac{\nu}{2} P_t^T B_{t+1}^2$ is a bond adjustment cost (Schmitt-Grohé and Uribe, 2003), rebated as T_t in equilibrium but not internalized by the household.

Given C_t, the allocation across varieties and the nontradable good is a static problem. Since mutual fund shares are only traded domestically, $x_t = 1$ in equilibrium.

The household's first-order conditions imply Euler equations for bond holdings and mutual fund shares:

$$1 + \nu B_{t+1} = \beta \mathbb{E}_t \left[\frac{P_t}{P_{t+1}} \frac{P_{t+1}^T}{P_t^T} \left(\frac{C_{t+1}}{C_t} \right)^{-\gamma} (1 + r_{t+1}^*) \right], \tag{9}$$

$$\tilde{v}_t = \beta (1 - \psi) \mathbb{E}_t \left[\frac{P_t}{P_{t+1}} \left(\frac{C_{t+1}}{C_t} \right)^{-\gamma} (\tilde{v}_{t+1} + \tilde{\pi}_{t+1}) \right]. \tag{10}$$

2.2 Firms

2.2.1 Technology and pricing

Firm i's production technology in period t is

$$q_t(i) = A_t a_i l_i,$$

where A_t is aggregate productivity and a_i is firm-specific productivity, drawn from distribution $G(a)$ with support $[a_{\min}, \infty)$. l_i is labor input. Since firms with the same productivity are symmetric in equilibrium, I follow convention and drop the i subscript, indexing varieties by productivity a.

The unit cost of production is $\frac{W_t}{A_t a}$, where W_t is the wage rate. There is no fixed cost of domestic production. Exporting entails two additional costs. First, an iceberg trade cost: delivering one unit abroad requires shipping $\tau > 1$ units. Second, a fixed export cost F_X (in effective labor units), paid each period. A fraction $\mu \in [0, 1]$ must be paid in foreign labor, $\mu \frac{F_X}{A_t^*}$, and the remaining $1 - \mu$ in domestic labor, $(1-\mu)\frac{F_X}{A_t}$. This formulation follows Chaney (2016), with empirical motivation from Goldberg and Campa (2010), who estimate that 50–70% of entry costs are denominated in foreign currency.

Total costs for a firm with productivity a for domestic sales and exports are therefore

$$\begin{aligned}
TC_{a,D,t}(q_D) &= \frac{W_t}{A_t a} q_D, \\
TC_{a,X,t}(q_X) &= \frac{W_t}{A_t a} \tau q_X + (1-\mu)\frac{W_t}{A_t} F_X + \mu \frac{W_t^*}{A_t^*} F_X,
\end{aligned}$$

where W_t^* is the foreign wage. Fixed costs depend on productivity in both countries, as in Ghironi and Melitz (2005) and Fattal Jaef and Lopez (2014).

Under monopolistic competition, firms set prices as constant markups over marginal cost:

$$p_{D,t}(a) = \frac{\sigma}{\sigma-1}\frac{W_t}{A_t a},$$
$$p_{X,t}(a) = \frac{\sigma}{\sigma-1}\frac{\tau W_t}{A_t a}.$$

Profits from domestic sales and exports are

$$\pi_{D,t}(a) = \frac{1}{\sigma}p_{D,t}(a)q_{D,t}(a)$$
$$\pi_{X,t}(a) = \frac{1}{\sigma}p_{X,t}(a)q_{X,t}(a) - (1-\mu)\frac{W_t}{A_t}F_X - \mu\frac{W_t^*}{A_t^*}F_X$$

where $q_{D,t}(a)$ is given in equation (7).

Foreign demand for home varieties with productivity a is

$$q_{X,t}(a) = \omega^\eta \left(\frac{p_{X,t}(a)}{P_t^*}\right)^{-\sigma} \left(\frac{P_t^{T*}}{P_t^*}\right)^{\xi-\eta} \left(\frac{P_{I,t}^{T\,*}}{P_t^*}\right)^{\sigma-\xi} C_t^*. \tag{11}$$

For convenience, define the remaining part of export demand as

$$q_{X,t}^{rem} \equiv \omega^\eta \left(\frac{P_t^{T*}}{P_t^*}\right)^{\xi-\eta} \left(\frac{P_{I,t}^{T\,*}}{P_t^*}\right)^{\sigma-\xi} P_t^* C_t^*$$

so that export demand can be written compactly as $q_{X,t}(a) = p_{X,t}(a)^{-\sigma} P_t^{*\sigma-1} q_{X,t}^{rem}$ with $q_{X,t}^{rem}$ taken as.

2.2.2 Trade credit constraints

Without additional frictions, all firms with productivity a such that $\pi_{X,t}(a) \geq 0$—equivalently, firms above a productivity threshold—choose to export, as in Melitz (2003)-type models. In practice, however, exporters often face financial constraints because they must rely on external capital to cover large upfront fixed costs. These constraints tend to be more severe than for domestically oriented firms for several reasons: (i) entering foreign markets requires additional expenditures such as market research, product localization, and distribution networks; (ii) cross-border shipping increases working capital needs due to longer delivery times; and (iii) exchange rate fluctuations raise risk.[1]

To capture these frictions in a tractable way, I assume that exporting firms must pay fixed export costs in advance, fully financed through external borrowing from international lenders and repaid out of export revenues.[2] The model abstracts from firms' internal funds or net worth accumulation. This assumption can be interpreted as a "worst-case benchmark" that isolates the role of trade credit constraints.

Firms borrow by pledging export revenues as collateral. However, they can divert a fraction $1-\kappa$ of revenues, generating a pledgeability problem. As a result, lenders are willing to finance only up to a fraction κ of expected export revenues. The parameter $\kappa \in (0,1]$ captures the degree of financial development or contract enforcement in the economy (Mendoza et al., 2009). Importantly, this formulation implies that financial constraints bind more tightly for firms with lower export revenues, which in the model correspond to lower-productivity exporters. This is a modeling device that allows the analysis to isolate how trade credit constraints interact with firm selection in general equilibrium.

The resulting borrowing constraint is

$$\kappa \cdot r_{X,t}(a) \geq (1-\mu)\frac{W_t}{A_t}F_X + \mu\frac{W_t^*}{A_t^*}F_X,$$

where $r_{X,t}(a)$ denotes export revenue of a firm with productivity a.[3]

Equivalently, the constraint can be written as

$$\pi_{X,t}(a) \geq \frac{1-\kappa}{\kappa}\left[(1-\mu)\frac{W_t}{A_t}F_X + \mu\frac{W_t^*}{A_t^*}F_X\right]. \tag{12}$$

[1] For a detailed overview of trade credit constraints, see Foley and Manova (2015).

[2] Chaney (2016), in a partial equilibrium model, assumes instead that fixed costs are financed out of domestic profits and shows that constrained firms may arise under certain conditions. By assuming repayment from export revenues, as in this paper, one can guarantee the existence of financially constrained firms without imposing additional assumptions that may fail in general equilibrium.

[3] For simplicity, I assume the interest rate on external borrowing is negligible. Since it is exogenous to domestic firms, this assumption has no qualitative effect on the results.

Thus, only firms with sufficiently high productivity and export profits are able to serve foreign markets.

If $\kappa = 1$, diversion is impossible and the model collapses to the standard Melitz framework without financial frictions. If $\kappa < 1$, some firms with positive export profits are nevertheless unable to export due to borrowing constraints. As κ decreases, the set of financially constrained firms expands. Conditions (12) and (13) define two productivity cutoffs:

$$\pi_{X,t}(\bar{a}_{X,t}) = 0, \tag{13}$$

$$\pi_{X,t}(\bar{a}_{\kappa,t}) = \frac{1-\kappa}{\kappa}\left[(1-\mu)\frac{W_t}{A_t}F_X + \mu\frac{W_t^*}{A_t^*}F_X\right]. \tag{14}$$

It follows that $\bar{a}_{X,t} \leq \bar{a}_{\kappa,t}$. These cutoffs classify firms into three groups. Firms with productivity $a \in [a_{\min}, \bar{a}_{X,t})$ are insufficiently productive to export and serve only the domestic market. Firms with $a \in [\bar{a}_{X,t}, \bar{a}_{\kappa,t})$ are productive enough to earn positive export profits but are prevented from exporting by financial constraints. Firms with $a \in [\bar{a}_{\kappa,t}, \infty)$ export. If $\kappa = 1$, then $\bar{a}_{X,t} = \bar{a}_{\kappa,t}$ and no firm is financially constrained.

2.2.3 Entry, exit, and ownership

Entry and exit follow Melitz (2003). The ownership structure is closest to Ghironi and Melitz (2005) and Fattal Jaef and Lopez (2014). In each period, an infinite mass of potential entrants exists. To enter, a firm must pay a sunk cost F_E in effective labor units, $\frac{F_E}{A_t}$. Upon entry, the firm draws productivity from $G(a)$ with support $[a_{\min}, \infty)$ and then decides whether to export in addition to serving the domestic market. Financial constraints may prevent exporting even when profitable.

Because there is no fixed cost of serving the domestic market, all entrants at least produce domestically. Firms face an exogenous exit probability ψ each period. For tractability, I assume a one-period time-to-build lag, so entrants in t begin production in $t + 1$. Prospective entrants are forward-looking and enter if the expected present value of entry equals the sunk entry cost. The free-entry condition is therefore

$$\tilde{v}_t = \frac{W_t}{A_t} F_E, \tag{15}$$

where

$$\tilde{v}_t = \mathbb{E}_t \sum_{s=0}^{\infty} [\beta(1-\psi)]^s \frac{P_t}{P_{t+s}} \frac{U_C(C_{t+s})}{U_C(C_t)} \tilde{\pi}_{t+s}. \tag{16}$$

Here, $\tilde{v}_t$ is the average firm value conditional on entry, with $\tilde{\pi}_{t+s}$ denoting average profits, discounted by both exit risk and the household's stochastic discount factor $\beta^s \frac{P_t}{P_{t+s}} \frac{U_C(C_{t+s})}{U_C(C_t)}$. Because all firms produce domestically, the expected value of entrants equals the average value of incumbents. The free-entry condition determines the mass of new entrants $M_{E,t}$ each period. With the time-to-build lag, the mass of domestic firms evolves as

$$M_{D,t+1} = (1-\psi)(M_{D,t} + M_{E,t}). \tag{17}$$

The mass of exporters is

$$M_{X,t} = (1 - G(\bar{a}_{\kappa,t})) M_{D,t}. \tag{18}$$

Firms are owned by a mutual fund that distributes average profits $\tilde{\pi}_t$ as dividends. Households trade shares x_t of this fund at price $\tilde{v}_t$. Iterating the mutual fund Euler equation forward and applying the law of iterated expectations yields the expected value of entry in (16).[4]

2.2.4 Productivity distribution and aggregation

Following Ghironi and Melitz (2005), firm productivity a is drawn from a Pareto distribution with lower bound $a_{\min}$ and shape parameter $\alpha > \sigma - 1$: $G(a) = 1 - \left(\frac{a_{min}}{a}\right)^{\alpha}$. The parameter α governs the dispersion of productivity: higher α implies less dispersion, with draws concentrated near $a_{\min}$. In the limit, as $\alpha \to \infty$, the density collapses to 1 at $a_{\min}$. For

[4] See Appendix A.1 for the derivation.

aggregation, it is convenient to define $\theta \equiv \left[\frac{\alpha}{\alpha-(\sigma-1)}\right]^{\frac{1}{\sigma-1}}$.

As in Melitz (2003)-type models, aggregation can be done by focusing on the average firm rather than tracking each firm. Define the average productivity of all domestic firms, $\tilde{a}_D$, and of exporters, $\tilde{a}_{X,t}$, as

$$\tilde{a}_D \equiv \left[\int_{a_{min}}^{\infty} a^{\sigma-1} dG(a)\right]^{\frac{1}{\sigma-1}}, \tag{19}$$

$$\tilde{a}_{X,t} \equiv \left[\frac{1}{1-G(\bar{a}_{\kappa,t})}\int_{\bar{a}_{\kappa,t}}^{\infty} a^{\sigma-1} dG(a)\right]^{\frac{1}{\sigma-1}}. \tag{20}$$

Since domestic production entails no fixed cost, all firms produce domestically, making $\tilde{a}_D$ time-invariant. By contrast, $\tilde{a}_{X,t}$ varies with the export cutoff $\bar{a}_{\kappa,t}$. Using θ, these expressions simplify to $\tilde{a}_D = \theta \cdot a_{\min}$ and $\tilde{a}_{X,t} = \theta \cdot \bar{a}_{\kappa,t}$.

Average profits from domestic sales and exporting are

$$\tilde{\pi}_{D,t} \equiv \pi_{D,t}(\tilde{a}_D),$$

$$\tilde{\pi}_{X,t} \equiv \pi_{X,t}(\tilde{a}_{X,t}).$$

Since a fraction $1-G(\bar{a}_{\kappa,t})$ of firms export, average total profits are

$$\tilde{\pi}_t = \tilde{\pi}_{D,t} + (1-G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t}. \tag{21}$$

which corresponds to the dividends paid by the mutual fund.

Average prices can be defined analogously as $\tilde{p}_{D,t} \equiv p_{D,t}(\tilde{a}_D)$ and $\tilde{p}_{X,t} \equiv p_{X,t}(\tilde{a}_{X,t})$. Price indices then simplify to

$$P^T_{D,t} = M_{D,t}^{\frac{1}{1-\sigma}} \tilde{p}_{D,t}, \tag{22}$$

$$P^T_{X,t} \equiv \left[\frac{1}{1-G(\bar{a}_{\kappa,t})}\int_{\bar{a}_{\kappa,t}}^{\infty} p_{X,t}(a)^{1-\sigma} M_{X,t} dG(a)\right]^{\frac{1}{1-\sigma}} = M_{X,t}^{\frac{1}{1-\sigma}} \tilde{p}_{X,t}. \tag{23}$$

2.3 Small open economy monopolistically competitive equilibrium

The price of the nontradable good P_t^N is determined by market clearing:

$$(1-\omega)^{\eta}\left(\frac{P_t^N}{P_t}\right)^{-\eta} C_t = Y^N. \tag{24}$$

The labor market clearing condition pins down the wage rate:

$$L = M_{D,t}\frac{q_{D,t}(\tilde{a}_D)}{A_t\tilde{a}_D} + M_{E,t}\frac{F_E}{A_t} + M_{X,t}\left(\frac{\tau q_{X,t}(\tilde{a}_{X,t})}{A_t\tilde{a}_{X,t}} + (1-\mu)\frac{F_X}{A_t}\right). \tag{25}$$

The first term is labor used in domestic production, the second is labor for entry, and the last two terms represent variable input and the domestic component of exporters' fixed costs.

For later quantitative analysis, I define aggregate variables: exports X_t, imports I_t, net exports NX_t, the capital account CA_t, and GDP GDP_t:[5]

$$\begin{aligned}
X_t &\equiv \frac{1}{1-G(\bar{a}_{\kappa,t})}\int_{\bar{a}_{\kappa,t}}^{\infty} p_{X,t}(a)q_{X,t}(a)M_{X,t}dG(a),\\
I_t &\equiv P_{I,t}^T C_{I,t}^T,\\
NX_t &\equiv X_t - I_t,\\
CA_t &\equiv P_t^T B_{t+1} - (1+r_t^*)P_t^T B_t,\\
GDP_t &\equiv P_t C_t + NX_t.
\end{aligned}$$

Then, a small open economy equilibrium is defined as follows.

Definition (Monopolistically competitive equilibrium)**.** *a) prices P_t, P_t^T, P_t^N, $P_{D,t}^T$, $p_{D,t}$, and $p_{X,t}$; b) wage rate W_t; c) consumption C_t, C_t^T, C_t^N, $C_{D,t}^T$, $C_{I,t}^T$, $q_{D,t}$, and $q_{I,t}$; d) bond holdings B_t; e) mutual fund share x_t; f) productivity cutoffs $\bar{a}_{X,t}$ and $\bar{a}_{\kappa,t}$; g) average productivity $\tilde{a}_D$ and $\tilde{a}_{X,t}$; h) average profit $\tilde{\pi}_{D,t}$, $\tilde{\pi}_{X,t}$, and $\tilde{\pi}_t$; i) value of mutual fund $\tilde{v}_t$; and j) mass*

[5] In this model, $NX_t \neq CA_t$ since part of export costs are paid to foreign agents. Specifically, $NX_t = CA_t + M_{X,t}\mu\frac{W_t^*}{A_t^*}F_X$. Alternatively, redefining $NX_t \equiv X_t - I_t - M_{X,t}\mu\frac{W_t^*}{A_t^*}F_X$ restores $NX_t = CA_t$.

of firms $M_{D,t}$, $M_{X,t}$, and $M_{E,t}$ such that 1) *a follows the definition of prices indices and the pricing rules of firms;* 2) *c, d, and e solve the household problem given a, b, h, i, and j;* 3) *c satisfies the definition of composite consumption;* 4) *f satisfies the definition of productivity cutoffs given a, b, and c;* 5) *g is defined by equation (20) and (21) given f;* 6) *h and i satisfy households' Euler equation for mutual funds given a and c;* 7) *a and j satisfy the free entry condition given b;* 8) *j evolves following equation (18) and (19); and* 9) *a and b clear markets given c and j.*

In Appendix A, I present some theoretical implications of the model in partial equilibrium including the effect of changes in the real exchange rate, home and foreign aggregate productivity, and price levels on the export productivity cutoff, the number of exporters and the average exporter profit.

3 Quantitative Analysis

In this section, I quantitatively solve the model to examine its implications for aggregate dynamics following an aggregate productivity shock. I compare simulated impulse responses across different levels of financial development to assess how trade credit constraints operate within the model. While the partial-equilibrium effects of productivity, wages, and prices on the export cutoff are analytically tractable (see Appendix A), their interaction in general equilibrium is ambiguous and therefore requires quantitative analysis.

The results show that, under the baseline calibration, aggregate responses are relatively muted even when firm-level distortions are substantial. Two mechanisms are central to this outcome. First, changes in average exporter productivity partially offset movements in the number of exporters, with the strength of this channel depending on the dispersion of firm productivity. Second, endogenous wage adjustment in general equilibrium further dampens the transmission of trade credit frictions, with the importance of this mechanism varying with the elasticity of labor supply.

3.1 Calibration

The calibration follows standard values from the open-economy macro and heterogeneous-firm trade literature and is intended to provide a quantitative benchmark for the model's mechanisms rather than a structural estimation.

One model period corresponds to a quarter, and the baseline parameter values are summarized in Table 1. For preferences, I adopt standard values: a discount factor $\beta = 0.98$ and risk aversion $\gamma = 2$. The weight on tradables is set to $\omega = 0.5$ to match a 50% steady-state tradable share, following Lombardo and Ravenna (2012). For substitution elasticities, I use $\eta = 0.83$ between tradables and nontradables (a conservative value from Bianchi (2011)), $\xi = 1.5$ between domestic and imported goods (from Fattal Jaef and Lopez (2014)), and $\sigma = 6$ across varieties, consistent with Broda and Weinstein (2006), which implies a 20% markup. The bond adjustment cost parameter $\nu = 0.02$ targets a steady-state bond-to-GDP ratio of 10%, following Aguiar and Gopinath (2007).

Minimum productivity is normalized to $a_{\min} = 1$. The Pareto shape parameter is set to $\alpha = 5.6$, following Bernard et al. (2003) and Ghironi and Melitz (2005), to match the standard deviation of log U.S. plant sales (1.67). Iceberg trade costs are set to $\tau = 1.3$, in line with Ghironi and Melitz (2005) and Obstfeld and Rogoff (2000). Export fixed costs are $F_X = 0.005$, chosen to match an exporter share of 21% as in Bernard et al. (2003), together with foreign variables. The foreign labor share of fixed export costs is $\mu = 0.6$, the median of the 50–70% range estimated by Goldberg and Campa (2010). Entry costs are normalized to $F_E = 1$. The exogenous exit rate $\psi = 0.025$ targets 10% annual job destruction in U.S. data, as in Ghironi and Melitz (2005). Labor L and the nontradable good Y^N are normalized to 1 and 10, respectively. Foreign variables are calibrated jointly with F_X to reproduce the 21% exporter share.

In the baseline, I set $\kappa = 1$ as a frictionless benchmark and also consider $\kappa = 0.1$ to illustrate the effects of limited financial development.

Table 1: Baseline parameter values

Parameters	Values	Targets/Sources
Preferences	$\beta = 0.98$, $\gamma = 2$, $\omega = 0.5$	standard, 50% tradable share
Elasticity of substitution	$\eta = 0.83$, $\xi = 1.5$, $\sigma = 6$	standard, 20% mark-up
Bond adjustment costs	$\nu = 0.012$	10% bond to GDP
Productivity distribution	$a_{min} = 1$, $\alpha = 5.6$	1.67 std. dev. log sales of US firms
Exporting costs	$\tau = 1.3$, $F_X = 0.0032$, $\mu = 0.6$	standard, 21% proportion of exporters
Entry cost and exit probability	$F_E = 1$, $\psi = 0.025$	10% annual destruction rate
Financial constraint	$\kappa = 1$	baseline value
Home country endowments	$L = 1$, $Y^N = 10$	baseline values
Interest rates	$r^* = 0.04$	standard
Foreign variables	$P^* = 1$, $W^* = 10$, $A^* = 1$, $q_X^{rem} = 5$	21% proportion of exporters
Stochastic process	$\rho_A = 0.906$, $\sigma_A = 0.00852$	Backus et al. (1992)

Aggregate productivity A_t follows an AR(1) process:

$$A_{t+1} = A_t^{\rho_A} \exp^{\epsilon_{t+1}},$$

where ϵ_t is white noise with standard deviation σ_A. I set $\rho_A = 0.906$ and $\sigma_A = 0.00852$, following Backus et al. (1992).

3.2 Impulse response functions

To compute impulse responses to an exogenous shock, I log-linearize the model around the steady state following Klein (2000). Figure 1 reports the percentage deviations of endogenous variables from steady state following a 1% increase in home productivity A_t under the frictionless benchmark with $\kappa = 1$. The simulated responses exhibit non-monotonic dynamics, reflecting the interaction between firm entry, wage adjustment, and household portfolio decisions in general equilibrium.

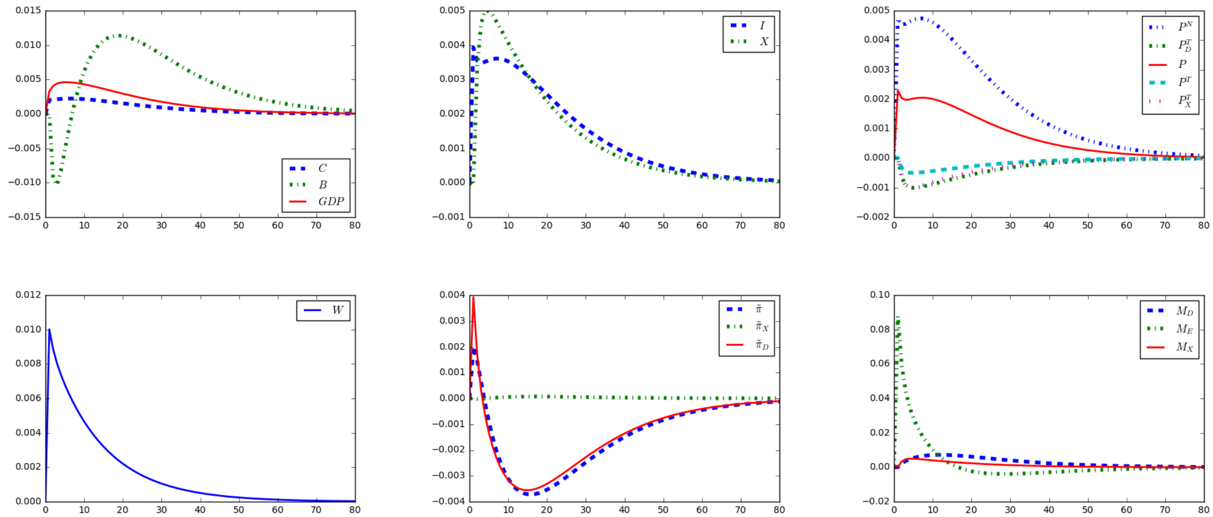
On impact, higher productivity lowers marginal production costs, leading to declines in the price indices of domestically produced tradables (P_D^T) and exports (P_X^T) of roughly 0.1%. As home varieties become more competitive abroad, exports X increase, peaking at about 0.5%. At the same time, higher expected profits raise the incentive to enter: the mass of new entrants M_E rises sharply, increasing the total number of domestic producers and exporters. Average domestic profit $\tilde{\pi}_D$ increases by around 0.4% while the response of average export profit $\tilde{\pi}_X$ is more muted. Within the model, this reflects the fact that the productivity shock is accompanied by a decline in the export cutoff $\bar{a}_\kappa$, which brings in relatively less productive exporters and dampens average export profitability. As a result, overall average profit $\tilde{\pi}$, defined as the weighted average of domestic and export profits, rises by about 0.2%.

On the household side, higher dividend income increases consumption. Because the supply of nontradables is fixed, higher demand translates into an increase in the nontradable price P^N of roughly 0.5%, raising the aggregate price index P by more than 0.2%. Labor demand also expands, pushing up the wage W by about 1%. Bond holdings B initially decline as imports respond more strongly than exports. Over time, as export revenues continue to grow and net exports improve, bond holdings recover and eventually peak at around 1.2% above steady state.

After approximately five quarters, profit responses change sign. This reversal arises endogenously in general equilibrium. First, the productivity shock decays more rapidly than wages, which adjust sluggishly due to entry and labor-market clearing. As a result, marginal costs rise relative to productivity, compressing firm profits. Second, from the household's perspective, rising bond holdings generate additional interest income, while labor income also increases. Because consumption adjusts more smoothly, the household budget constraint implies that dividend income—i.e., average firm profits—must decline. Together, these forces account for the non-monotonic profit dynamics observed in the simulations.

Figure 2 reports impulse responses for $\kappa = 0.1$, holding all other parameters at their baseline values. Relative to the frictionless benchmark, the simulated responses are very similar in both shape and magnitude. To further illustrate the role of financial development, 2 compares steady-state outcomes under $\kappa = 1$ and $\kappa = 0.1$. With the exception of average export profit $\tilde{\pi}_X$, the export cutoff $\bar{a}_\kappa$, and the exporter share $1 - G(\bar{a}_\kappa)$, most aggregate variables display only modest differences across the two calibrations. In particular, average

Figure 1: Responses to an A shock of 1% ($\kappa = 1$)



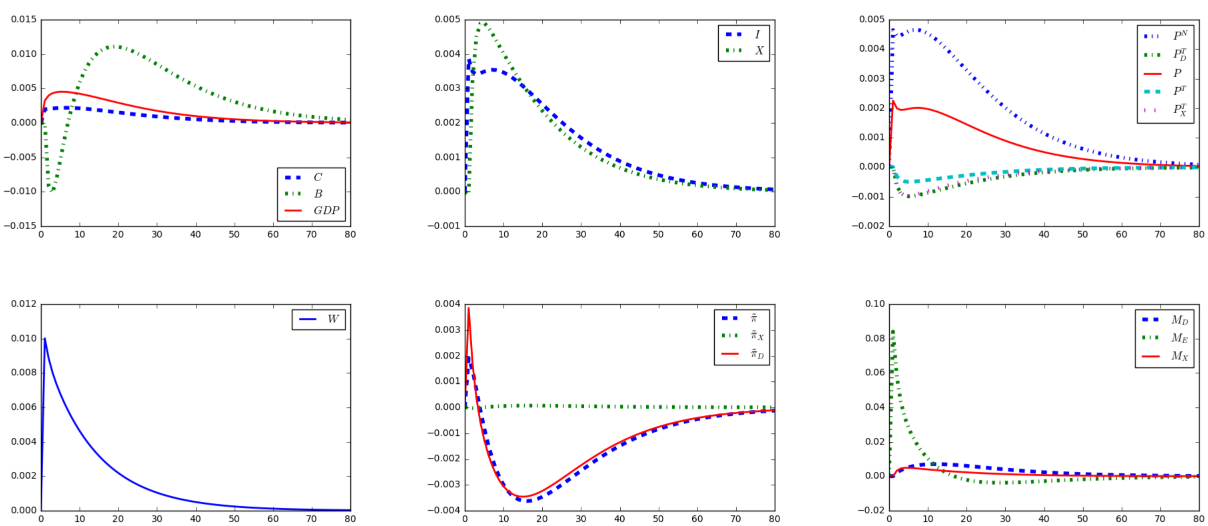
export profits are substantially higher when $\kappa = 1$ than when $\kappa = 0.1$, whereas the exporter share is much larger when $\kappa = 0.1$, reflecting the opposing movements of the intensive and extensive margins.

It is also useful to examine level deviations from steady state rather than percentage changes. Figures C.1 and C.2 show responses to a one-unit productivity shock under $\kappa = 1$ and $\kappa = 0.1$, respectively. While these units are not directly comparable to the percentage responses in Figures 1 and 2, they help clarify the relative insensitivity of aggregate variables to financial development within the model. Even in levels, the responses of most macroeconomic aggregates remain similar across values of κ, with notable differences concentrated in average export profits $\tilde{\pi}_X$ and the mass of exporters M_X. When financial development is lower, export profits respond more strongly, whereas under higher financial development, adjustments occur primarily through the extensive margin. Taken together, these results indicate that trade credit constraints mainly reallocate activity across firm-level margins, while aggregate outcomes are comparatively stable in the simulated economy. The next subsection examines the mechanisms underlying this offsetting behavior.

Table 2: Steady state values

Variables	Steady state values ($\kappa = 1$)	Steady state values ($\kappa = 0.1$)
Macro variables	$C = 8.62$, $C^T = 7.47$, $B = 1.6$, $I = 0.95$, $X = 0.95$, $GDP = 3.69$	$C = 8.60$, $C^T = 7.42$, $B = 1.6$, $I = 0.92$, $X = 0.91$, $GDP = 3.57$
Prices	$P = 0.42$, $P^N = 0.18$, $P^T = 0.25$, $W = 1.75$	$P = 0.42$, $P^N = 0.17$, $P^T = 0.25$, $W = 1.7$
Firm (average)	$\tilde{v} = 1.75$, $\tilde{\pi} = 0.08$	$\tilde{v} = 1.70$, $\tilde{\pi} = 0.08$
Firm (domestic)	$\tilde{\pi}_D = 0.04$, $M_D = 3.67$	$\tilde{\pi}_D = 0.04$, $M_D = 3.85$
Firm (exporter)	$\tilde{\pi}_X = 0.17$, $\tilde{a}_X = 2.05$, $1 - G(\bar{a}_\kappa) = 0.21$	$\tilde{\pi}_X = 1.98$, $\tilde{a}_X = 3.15$, $1 - G(\bar{a}_\kappa) = 0.02$

Figure 2: Responses to an A shock of 1% ($\kappa = 0.1$)



3.3 Intensive margin, extensive margin, and selection effect

In this subsection, I study how total export profit, defined as

$$(1 - G(\bar{a}_\kappa))\tilde{\pi}_X,$$

responds to a productivity shock in order to clarify why aggregate outcomes are relatively insensitive to financial development *within the model*. For convenience, I denote total export profit by $\tilde{\Pi}_X$.

The key observation is that aggregate firm profits depend on the exporter share and average export profits only through their product $\tilde{\Pi}_X = (1 - G(\bar{a}_\kappa))\tilde{\pi}_X$. Financial development κ affects the export cutoff $\bar{a}_\kappa$ through the trade credit constraint. This cutoff, in turn, determines the exporter share, average exporter productivity $\tilde{a}_X$, and average export profit $\tilde{\pi}_X = \pi_X(\tilde{a}_X)$. These components enter aggregate profits according to

$$\tilde{\pi} = \tilde{\pi}_D + (1 - G(\bar{a}_\kappa))\tilde{\pi}_X = \tilde{\pi}_D + \tilde{\Pi}_X.$$

This is the only equilibrium condition in which the exporter share and average export profits jointly affect aggregate firm profits. As a result, examining the behavior of $\tilde{\Pi}_X$ is sufficient to characterize the *direct* effect of financial development on aggregate profits. Indirect general equilibrium effects are considered in the next subsection.

Panel (d) of Figure 3 plots the response of $\tilde{\Pi}_X$, expressed as level deviations from steady state normalized by steady-state GDP, to a 1% productivity shock for different values of κ. On impact, $\tilde{\Pi}_X$ increases by roughly 0.001% of steady-state GDP.[6] Both the transitional dynamics and the steady-state levels of $\tilde{\Pi}_X$ are very similar across values of κ: in steady state $\tilde{\Pi}_X$ equals 0.0387 when $\kappa = 1$ and 0.0389 when $\kappa = 0.1$. Within the model, this similarity accounts for the limited sensitivity of aggregate outcomes to financial development.

[6]Because steady-state GDP is nearly identical under $\kappa = 1$ and $\kappa = 0.1$ (Table 2), this response can also be interpreted as the level deviation of $\tilde{\Pi}_X$ itself. The normalization simply aids interpretation.

To better understand this result, I decompose the response of $\tilde{\Pi}_X$ to a productivity shock—holding the wage W fixed—into three components:

$$\begin{aligned}\frac{\partial \tilde{\Pi}_X}{\partial A} = & \underbrace{-g(\bar{a}_\kappa)\tilde{\pi}_X \frac{\partial \bar{a}_\kappa}{\partial A}}_{\text{Extensive margin, }>0} \\ & + \underbrace{(1-G(\bar{a}_\kappa))\left[\frac{\sigma-1}{\sigma}\left(\frac{p_X(\tilde{a}_X)}{P^*}\right)^{1-\sigma}\frac{q_X^{rem}}{A} + (1-\mu)\frac{WF_X}{A^2}\right]}_{\text{Intensive margin, }>0} \\ & + \underbrace{(1-G(\bar{a}_\kappa))\left[\frac{\sigma-1}{\sigma}\left(\frac{p_X(\tilde{a}_X)}{P^*}\right)^{1-\sigma}\frac{q_X^{rem}}{\tilde{a}_X}\frac{\partial \tilde{a}_X}{\partial A}\right]}_{\text{Selection effect, }<0}. \end{aligned} \tag{26}$$

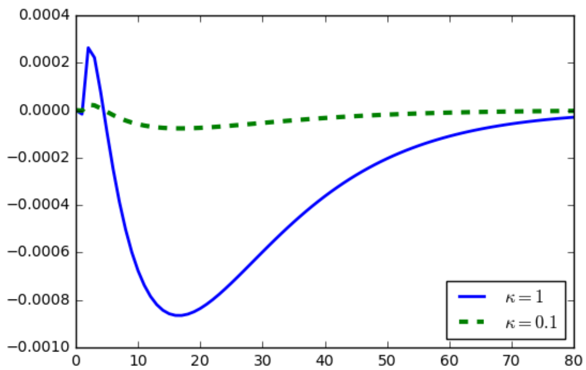
The first term captures the extensive margin: holding wages fixed, a positive productivity shock lowers the export cutoff and allows additional firms to export. The second term reflects the intensive margin, corresponding to higher profits for a representative exporter given productivity. The third term is the selection effect: as lower-productivity firms enter export markets following a decline in the cutoff, average exporter productivity falls, dampening aggregate export profits.

Figure 3 reports the responses of the extensive margin, intensive margin, selection effect, and total export profit to a 1% increase in productivity. For comparability, the intensive margin and total export profit are expressed as level deviations normalized by steady-state GDP; the selection effect is expressed relative to average firm productivity ($\frac{\alpha}{\alpha-1}$); and the extensive margin is shown in levels.

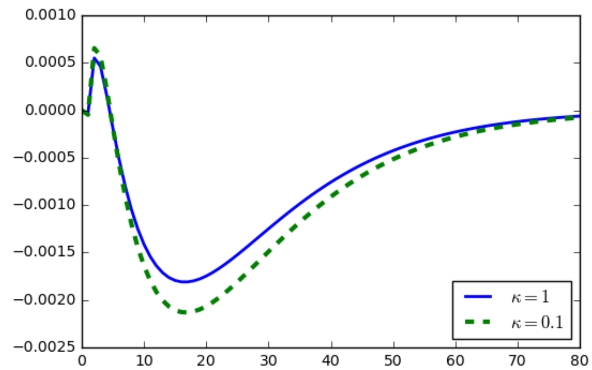
Panel (a) shows that, on impact, the exporter share rises by about 0.02 percentage points when $\kappa = 1$, whereas the response is much weaker under $\kappa = 0.1$. Thus, the extensive margin is more responsive in financially developed economies. Panel (b) reports the intensive margin, defined as the profit of a firm with steady-state average export productivity when $\kappa = 0.1$ (denoted $\tilde{a}_X^{ss}$).[7] Here, profits rise by about 0.05% of steady-state GDP after three quarters

[7] This choice is innocuous since $\tilde{a}_X^{ss}$ always lies above the export cutoff $\bar{a}_{\kappa,t}$ after the shock.

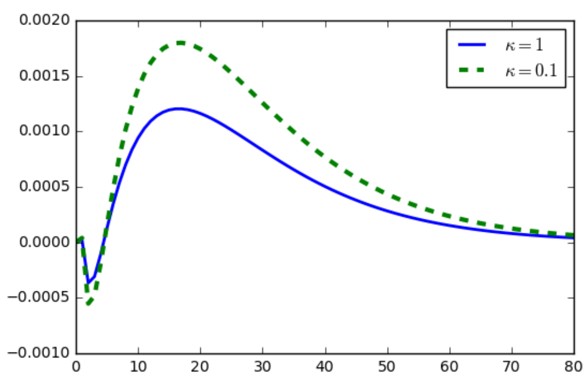
Figure 3: Responses of extensive margin, intensive margin, and selection ($\alpha = 5.6$)



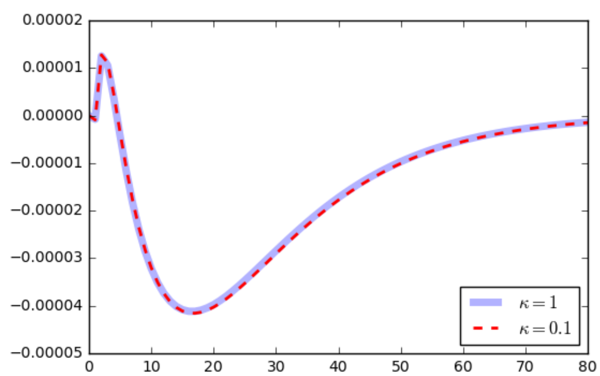
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$



(c) Selection $(\tilde{a}_{X,t})$



(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{\kappa,t})$

when $\kappa = 1$, with a slightly stronger response when $\kappa = 0.1$. Panel (c) shows the selection effect: when $\kappa = 0.1$, average exporter productivity falls by more than 0.05% relative to the average domestic productivity, and its response is consistently larger than under $\kappa = 1$. Finally, panel (d) confirms that total export profit $\tilde{\Pi}_X$ evolves almost identically across κ, consistent with earlier results.

In summary, Figure 3 illustrates that financial development alters the relative importance of the extensive margin and selection effects, but that these channels offset in aggregate within the model. When κ is high, the exporter share is larger and more responsive, whereas when κ is low, average exporter productivity is higher but more sensitive to shocks. These offsetting forces leave total export profits largely unchanged in both steady state and dynamics.

Three remarks are worth noting. First, the analysis emphasizes the extensive margin and selection channels because financial development affects the economy directly through the export cutoff. The intensive margin responds primarily through general equilibrium adjustments and therefore plays a secondary role.

Second, the responses in Figure 3 are general equilibrium outcomes, unlike the decomposition in equation (26). There, I hold wages constant for analytical convenience. In general equilibrium, however, wages also adjust, creating a second-order effect on $\tilde{\Pi}_X$. This wage adjustment explains why the responses in Figure 3 are non-monotonic and even change sign over time. The general equilibrium role of wages is examined in Section 3.5.

Finally, the analysis focuses on responses of the three channels and total export profit in *levels* rather than in percentage deviations from steady state. The insensitivity of aggregate outcomes to κ arises because the level of $\tilde{\Pi}_X$ is quantitatively invariant to κ, even though both the exporter share and average productivity are highly sensitive to it, as shown here and in the steady-state comparison of the previous subsection.

By contrast, percentage deviations can obscure this distinction when steady-state levels differ. For instance, Figure C.3 reports percentage responses of the three channels, which appear invariant to κ. This, however, merely reflects that the steady-state values of these variables differ with κ. For this reason, Figure 3 normalizes responses by steady-state GDP or average firm productivity, providing meaningful economic interpretation. For all other aggregate variables, I follow convention and present responses as percentage deviations from steady state, as in Figures 1 and 2.

The next subsection examines how the dispersion of firm productivity shapes the relative strength of the extensive margin and selection channels.

3.4 Financial development and productivity dispersion

This subsection examines how the sensitivity of total export profits to financial development depends on the dispersion of firm productivity. I proceed in two steps. First, holding A and W fixed, I illustrate how the level of total export profits varies with κ under different productivity dispersions. This helps clarify why steady-state outcomes are relatively insensitive to κ in the baseline calibration. Second, I study how dispersion affects the response of total export profits to a productivity shock using the decomposition in equation (26), which provides an interpretation for the impulse-response patterns in Figure 3.

To begin, consider why the level of total export profits $(1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t}$ is similar across values of *kappa* in the baseline calibration. Define $h(\kappa; \Theta) \equiv (1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t}$, where Θ collects A_t, W_t, and other model parameters. Thus, $h(\kappa)$ expresses total export profit as a function of κ given the environment. Similarly, define the extensive margin component $h_{EM}(\kappa; \Theta) \equiv 1 - G(\bar{a}_{\kappa,t})$ and the selection component $h_{SE}(\kappa; \Theta) \equiv \tilde{\pi}_{X,t}$.[8]

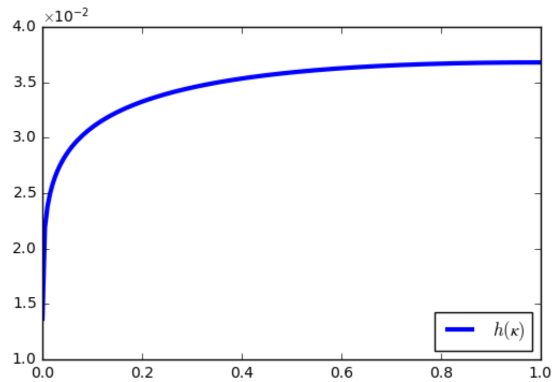
Suppressing Θ for simplicity, $h(\kappa)$ can be written as

$$h(\kappa) = \left(\frac{\sigma}{\sigma - 1}\frac{\tau W_t}{A_t}\right)^{-\alpha} \mathcal{F}_t \left(\frac{\sigma \mathcal{F}_t}{q_X^{rem} P_t^{*\sigma-1}}\right)^{-\frac{\alpha}{\sigma-1}} \left[\theta^{\sigma-1}\kappa^{\frac{\alpha-(\sigma-1)}{\sigma-1}} - \kappa^{\frac{\alpha}{\sigma-1}}\right], \tag{27}$$

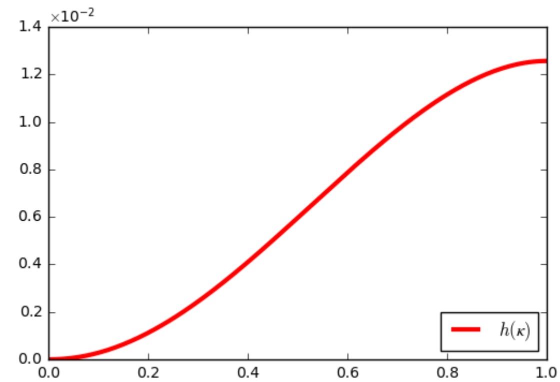
where $\theta = \left[\frac{\alpha}{\alpha-(\sigma-1)}\right]^{\frac{1}{\sigma-1}}$ and $\mathcal{F}_t = [(1-\mu)\frac{W}{A} + \mu\frac{W^*}{A^*}]F_X$, as defined earlier.

[8] For this partial-equilibrium illustration, A and W are held fixed. As a result, profits for a firm of given productivity do not vary with κ, and differences in $\tilde{\pi}_X$ arise entirely from changes in the composition of exporters.

Figure 4: $h(\kappa)$ with different α



(a) $\alpha = 5.6$



(b) $\alpha = 15.6$

The shape of $h(\kappa)$ is governed mainly by the Pareto shape parameter α and the elasticity of substitution σ, which jointly determine the exponents on κ. Figure 4 illustrates $h(\kappa)$ for different values of α holding σ fixed.

Panel (a) shows the baseline $\alpha = 5.6$, while panel (b) illustrates the case $\alpha = 15.6$. The latter corresponds to a much lower dispersion of firm productivity—implying a log-sales standard deviation of 0.09 versus 1.67 in the baseline. With $\alpha = 5.6$, $h(\kappa)$ is concave in κ. When α is larger, $h(\kappa)$ becomes more S-shaped, increasing the gap between low-κ and high-κ values.[9]

To understand how dispersion shapes h, it is useful to separate the extensive-margin and selection components. Rearranging yields:

$$h_{EM}(\kappa) = \left(\frac{\sigma}{\sigma - 1}\frac{\tau W_t}{A_t}\right)^{-\alpha}\left(\frac{\sigma \mathcal{F}_t}{q_X^{rem} P_t^{*\sigma-1}}\right)^{-\frac{\alpha}{\sigma-1}} \kappa^{\frac{\alpha}{\sigma-1}}, \tag{28}$$

$$h_{SE}(\kappa) = -\mathcal{F}_t + \mathcal{F}_t \frac{\alpha}{\alpha - (\sigma - 1)} \frac{1}{\kappa}. \tag{29}$$

[9]Panel (a) is drawn using the steady-state values of P and W under the baseline calibration, while panel (b) uses an alternative calibration with $\nu = 0.02$, $F_X = 0.0175$, and $\alpha = 15.6$, chosen to match the baseline targets. Note that this is a partial-equilibrium illustration, since A and W are held fixed. In general equilibrium, κ can also affect these variables, shifting the scale of $h(\kappa)$, while the curvature of $h(\kappa)$ is driven mainly by the exponents determined by α and σ.

The extensive-margin component h_{EM} increases with κ because higher financial development relaxes the trade credit constraint and allows more firms to export. By contrast, the selection component h_{SE} decreases with κ: as the cutoff falls, lower-productivity firms enter export markets, reducing average exporter productivity and profits. A higher α makes h_{EM} more convex in κ while flattening h_{SE}, which shifts the product $h = h_{EM} \cdot h_{SE}$ from concave to more S-shaped as dispersion falls.

The intuition is as follows. Starting from a low level of financial development, an increase in κ reduces the export cutoff and brings additional firms into exporting. When α is high (low dispersion), mass is concentrated near a_{min}. In that case, small increases in κ initially have limited effects on exporter entry, but once the cutoff approaches the dense region near a_{min}, the extensive margin responds more sharply, generating greater convexity in h_{EM}.

Turning to h_{SE}, recall that it captures the average productivity of exporters. With a given cutoff $\bar{a}_\kappa^*$, a higher α means that firms are more concentrated around $\bar{a}_\kappa^*$ within the region $[\bar{a}_\kappa^*, \infty)$. This lowers average exporter productivity, and hence average export profit, flattening the selection component h_{SE} as α rises.

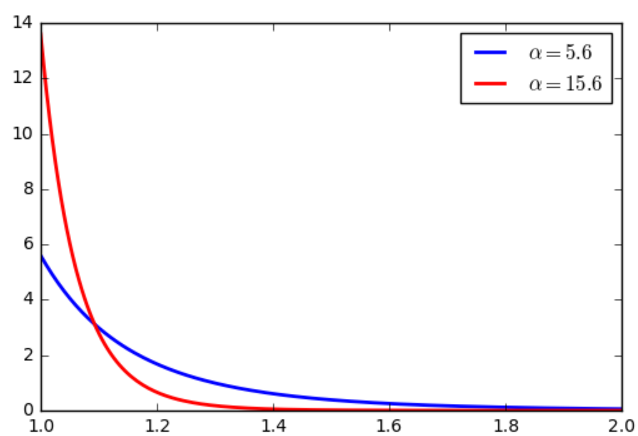
This logic helps interpret why, in the baseline calibration, total export profits are similar across κ values even though the exporter share and average exporter productivity can differ (Table 2). When dispersion is substantially lower, the interaction of extensive-margin and selection effects can generate larger differences in total export profits across κ. Table 3 reports the steady state for α=15.6. Relative to the baseline, differences in export participation and macro aggregates across κ become more pronounced, reflecting a weaker offset between extensive-margin and selection effects.

I next examine how productivity dispersion affects the dynamic response of the three channels in equation (26). Recall that the response of the extensive margin to a positive A shock is $-g(\bar{a}_\kappa)\tilde{\pi}_X \frac{\partial \bar{a}_\kappa}{\partial A}$ where its magnitude depends on the density of firms at the export

Table 3: Steady state values

Variables	Steady state values ($\kappa = 1$)	Steady state values ($\kappa = 0.1$)
Macro variables	$C = 6.63$, $C^T = 4.54$, $B = 0.96$, $I = 0.55$, $X = 0.60$, $GDP = 2.12$	$C = 6.42$, $C^T = 4.28$, $B = 0.96$, $I = 0.40$, $X = 0.40$, $GDP = 1.61$
Prices	$P = 0.31$, $P^N = 0.09$, $P^T = 0.24$, $W = 1.04$	$P = 0.25$, $P^N = 0.07$, $P^T = 0.20$, $W = 0.81$
Firm (average)	$\tilde{v} = 1.04$, $\tilde{\pi} = 0.04$	$\tilde{v} = 0.81$, $\tilde{\pi} = 0.03$
Firm (domestic)	$\tilde{\pi}_D = 0.04$, $M_D = 2.58$	$\tilde{\pi}_D = 0.02$, $M_D = 3.76$
Firm (exporter)	$\tilde{\pi}_X = 0.05$, $\tilde{a}_X = 1.18$, $1 - G(\bar{a}_\kappa) = 0.21$	$\tilde{\pi}_X = 1.52$, $\tilde{a}_X = 1.44$, $1 - G(\bar{a}_\kappa) = 0.00$

Figure 5: Productivity distribution $g(a)$



cutoff, $g(\bar{a}_\kappa)$. Figure 5 plots the productivity density $g(a)$ under two different values of α. Because lower financial development implies a higher cutoff, the difference in density evaluated at the two cutoffs is larger when the distribution is more concentrated near the lower tail—that is, when α is high. This amplifies the difference in extensive-margin responses across κ.

The response of the selection effect can be understood by examining how average exporter productivity changes with the cutoff. Recall that average exporter productivity is $\tilde{a}_X \equiv \frac{1}{1-G(\bar{a}_\kappa)} \int_{\bar{a}_\kappa}^{\infty} a dG(a)$. Differentiating yields

$$
\begin{aligned}
\frac{\partial \tilde{a}_X}{\partial \bar{a}_\kappa} &= \frac{g(\bar{a}_\kappa)}{1-G(\bar{a}_\kappa)}\left[\frac{1}{1-G(\bar{a}_\kappa)}\int_{\bar{a}_\kappa}^{\infty} a dG(a) - \bar{a}_\kappa\right] \\
&= \frac{g(\bar{a}_\kappa)}{1-G(\bar{a}_\kappa)}\Bigg[\mathbb{E}[a|a \geq \bar{a}_\kappa] - \bar{a}_\kappa\Bigg].
\end{aligned} \tag{30}
$$

When α is high, firms are more concentrated near the cutoff, so the conditional expectation $\mathbb{E}[a|a \geq \bar{a}_\kappa]$ lies closer to $\bar{a}_\kappa$, weakening the sensitivity of average exporter productivity to changes in the cutoff.

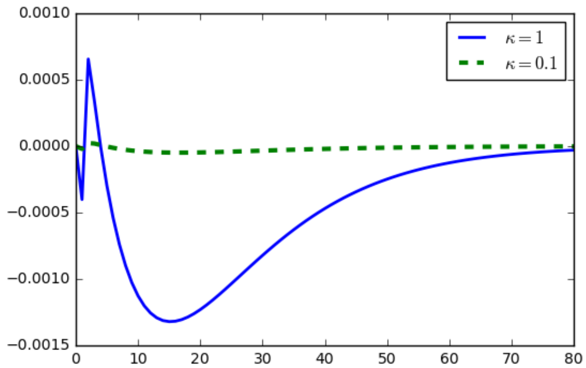
Figure 6 shows the responses of the extensive margin, intensive margin, selection effect, and total export profit when $\alpha = 15.6$, reported in the same normalization as Figure 3.[10] Consistent with the discussion above, the gap in extensive-margin responses between $\kappa = 1$ and $\kappa = 0.1$ is larger than in the baseline, while the selection response is muted. As a consequence, total export profits respond differently across κ, and aggregate variables become more sensitive to financial development in this low-dispersion case.

Figure C.4 reports percentage deviations from steady state. Unlike Figure C.3 (where $\alpha = 5.6$), the percentage responses here vary noticeably with κ. Part of this difference reflects that steady-state levels differ across κ when α=15.6, so the same level response can translate into different percentage changes. In particular, the selection effect appears more sensitive when $\kappa = 1$ because the steady-state value of $\tilde{a}_X$ is lower in that case. Total export profit $\tilde{\Pi}_X$ also shows a larger percentage response when $\kappa = 1$, consistent with the level-based evidence that, with lower productivity dispersion, variation in $\tilde{\Pi}_X$ is driven primarily by the extensive margin rather than offsetting changes in exporter composition. These differences in $\tilde{\Pi}_X$ help account for the larger sensitivity of aggregate variables to κ in the low-dispersion case.

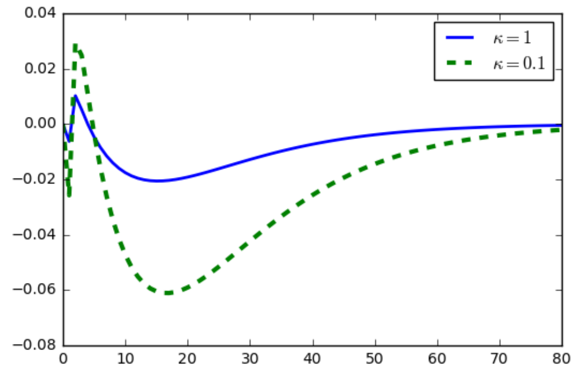
Figure 7 summarizes how aggregate responses vary with κ and α. With lower dispersion, financial development has a clearer impact on macro outcomes. At the same time, even in this

[10] Because steady-state GDP differs across κ values when α= 15.6, the normalization uses the baseline steady-state GDP for comparability. Normalizing by each case's own steady-state GDP yields qualitatively similar patterns.

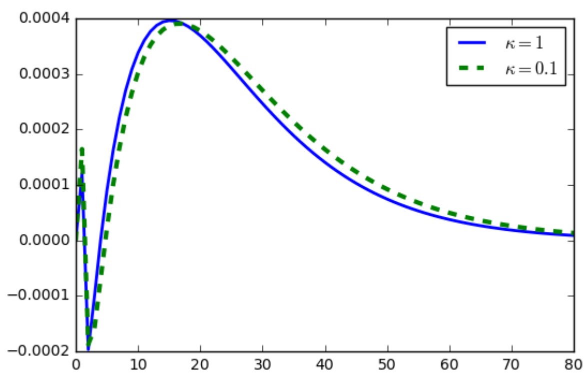
Figure 6: Responses of extensive margin, intensive margin, and selection ($\alpha = 15.6$)



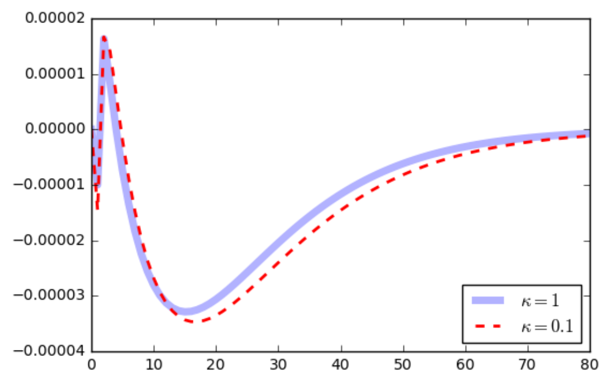
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$



(c) Selection $(\tilde{a}_{X,t})$



(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

case, the qualitative pattern of impulse responses remains similar across κ, and quantitative differences remain moderate relative to the size of the underlying shock and the parameter changes considered.

The main findings of this section can be summarized as follows. Lower financial development reduces the extensive margin of exporting, but this effect is partially offset by an increase in the average productivity of exporters, leaving aggregate outcomes relatively stable within the model. When productivity dispersion is low and firms cluster more tightly near the lower end of the distribution, financial development has a stronger influence on aggregate variables. Even in this case, however, the quantitative differences remain modest under the baseline calibration, reflecting the same offsetting forces highlighted above. The next subsection examines how general equilibrium wage adjustment further contributes to this attenuation.

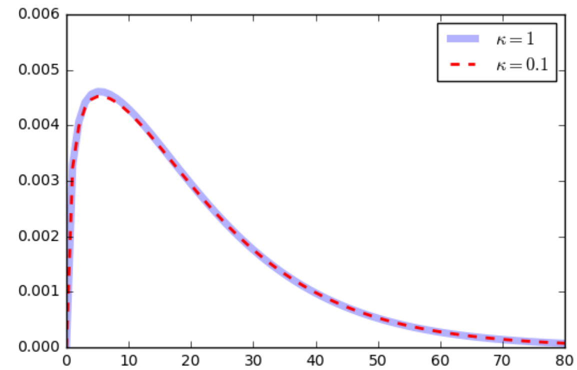
3.5 Understanding the general equilibrium effect

To isolate the role of general equilibrium forces, I conduct an auxiliary exercise in which the wage rate W_t is held fixed at its steady-state level. This counterfactual removes labor-market adjustment while leaving all other model mechanisms unchanged. Figures 8 and 9 report impulse responses to a 1% positive productivity shock under this assumption for $\kappa = 1$ and $\kappa = 0.1$, respectively.

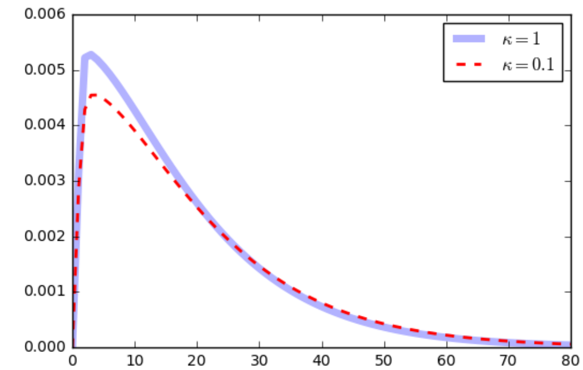
Fixing the wage rate substantially alters the transmission of the productivity shock. Because marginal costs no longer rise with increased labor demand, entry becomes significantly more profitable and the mass of new entrants increases sharply. Since households must finance this entry through purchases of mutual fund shares while labor income remains unchanged, consumption and imports decline on impact. As a result, price indices fall rather than rise, in contrast to the baseline general equilibrium responses.

More importantly, fixing wages reveals a strong dependence of aggregate outcomes on financial development. Figure 10 compares impulse responses under the baseline general

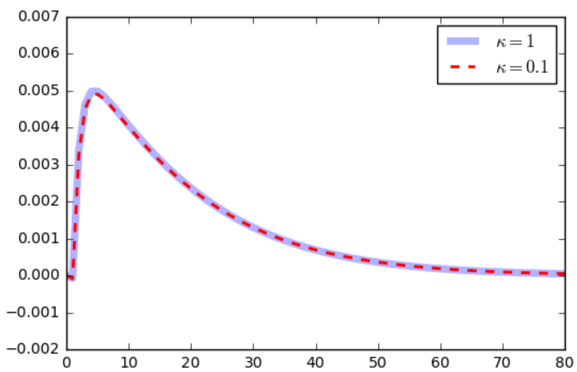
Figure 7: Impulse responses with different α and κ



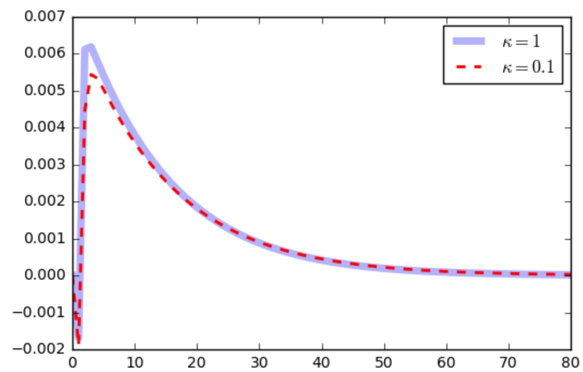
(a) GDP ($\alpha = 5.6$)



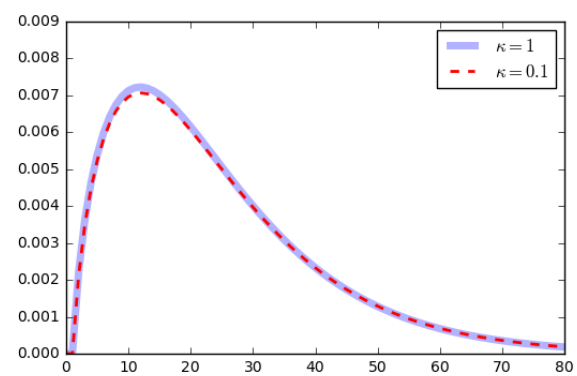
(b) GDP ($\alpha = 15.6$)



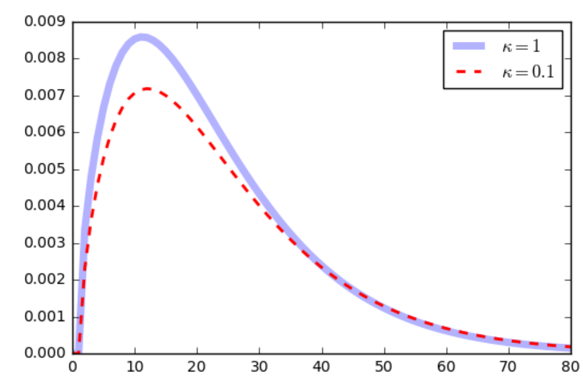
(c) X ($\alpha = 5.6$)



(d) X ($\alpha = 15.6$)

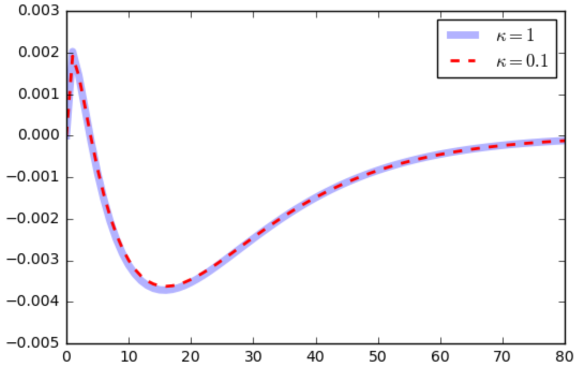


(e) M_D ($\alpha = 5.6$)

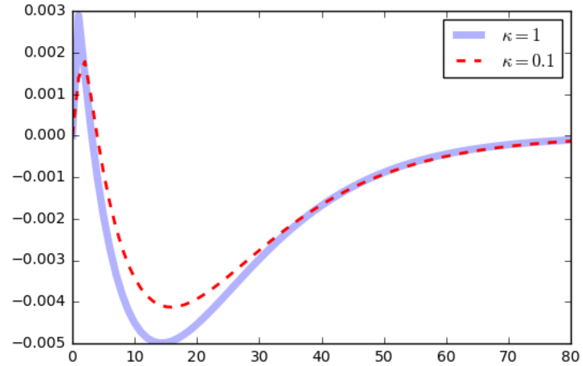


(f) M_D ($\alpha = 15.6$)

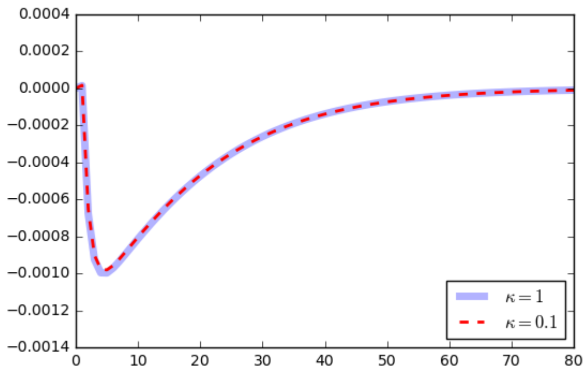
Figure 7 (continued): Impulse responses with different α and κ



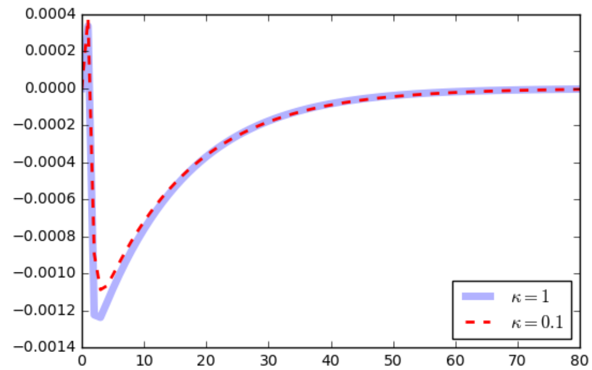
(g) $\tilde{\pi}$ ($\alpha = 5.6$)



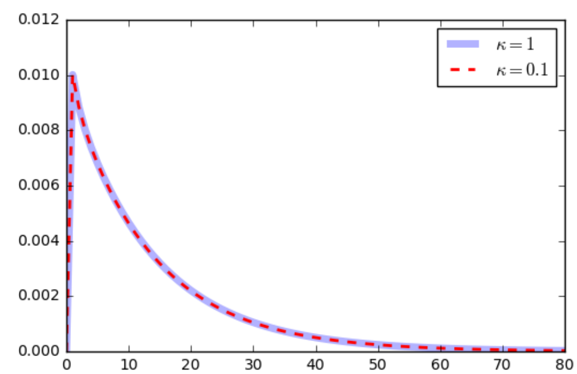
(h) $\tilde{\pi}$ ($\alpha = 15.6$)



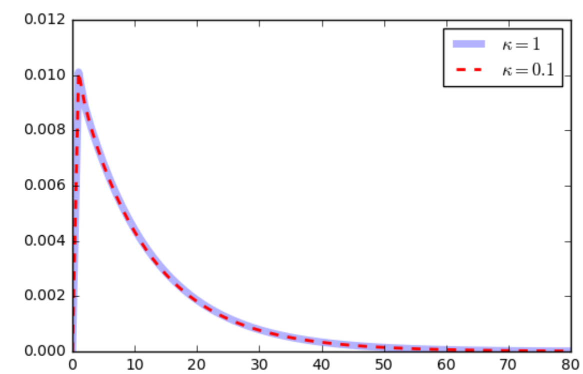
(i) P_X ($\alpha = 5.6$)



(j) P_X ($\alpha = 15.6$)



(k) W ($\alpha = 5.6$)



(l) W ($\alpha = 15.6$)

Figure 8: Responses to an A shock of 1% with constant W ($\kappa = 1$)

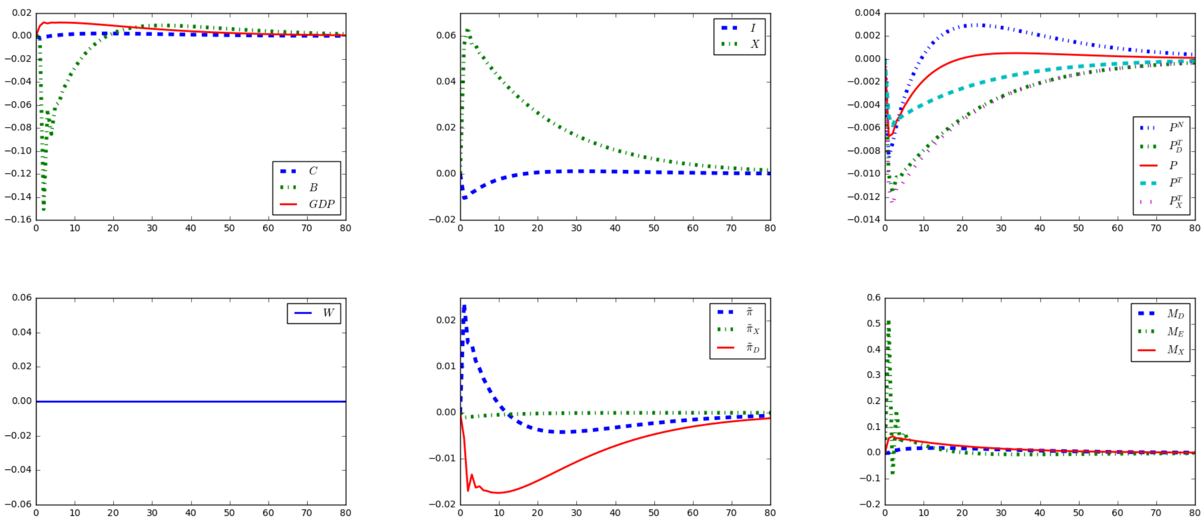
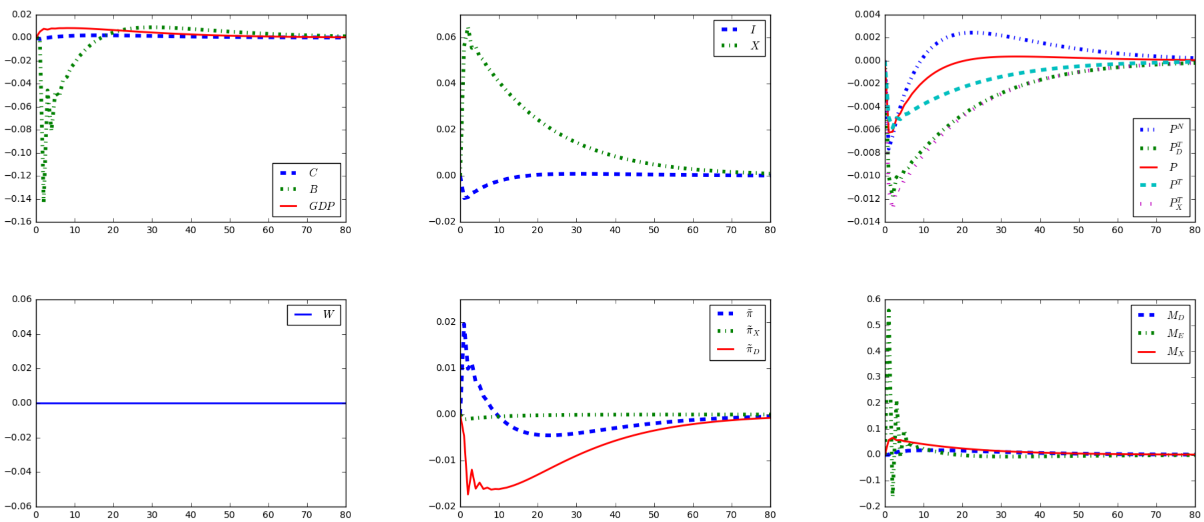


Figure 9: Responses to an A shock of 1% with constant W ($\kappa = 0.1$)



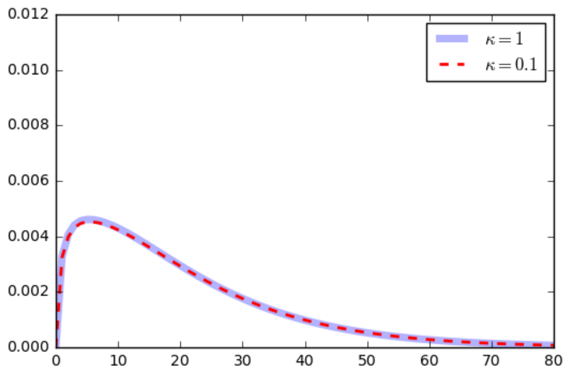
equilibrium (left panels) and the fixed-wage counterfactual (right panels). In general equilibrium, aggregate variables respond similarly across values of κ. In partial equilibrium, however, responses are markedly more sensitive when financial constraints are weak ($\kappa = 1$). This contrast indicates that wage adjustment is a key force behind the quantitative insensitivity of aggregate outcomes to financial development in the baseline economy.

The same conclusion emerges from examining exporter-level mechanisms. Figure 11 reports the responses of the extensive margin, intensive margin, selection effect, and total export profit when wages are fixed, using the same normalization as in Figure 3. As in general equilibrium, the extensive margin is more responsive when $\kappa = 1$, while the selection effect is more responsive when $\kappa = 0.1$. However, all three channels respond much more strongly in magnitude than in the baseline. Because higher productivity now translates directly into lower marginal costs without being offset by rising wages, total export profit $\tilde{\Pi}_X$ becomes substantially more sensitive to financial development.

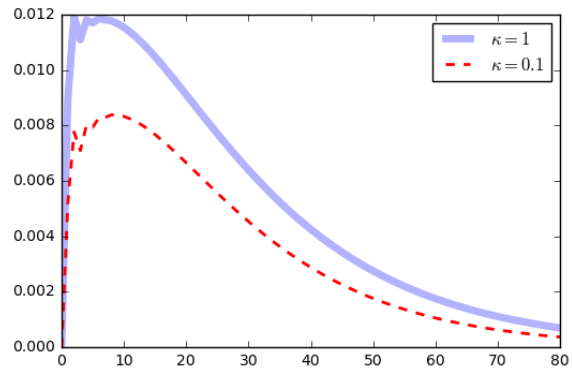
Figure 12 summarizes this point by comparing the response of $\tilde{\Pi}_X$ across three environments: the baseline calibration, the low-dispersion case with $\alpha = 15.6$, and the fixed-wage economy. While productivity dispersion affects the degree to which financial development matters, shutting down wage adjustment generates by far the largest divergence across κ. In the fixed-wage economy, the gap in the response of total export profit reaches nearly 0.005% of steady-state GDP—an order of magnitude larger than in the baseline general equilibrium.

These findings can be understood analytically. Recall that the response of total export

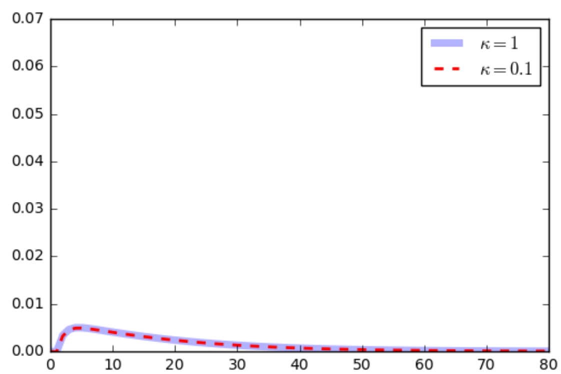
Figure 10: Impulse responses in general equilibrium (GE) and partial equilibrium (PE)



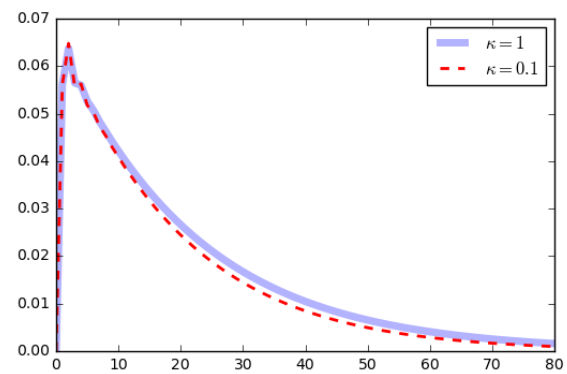
(a) GDP (GE)



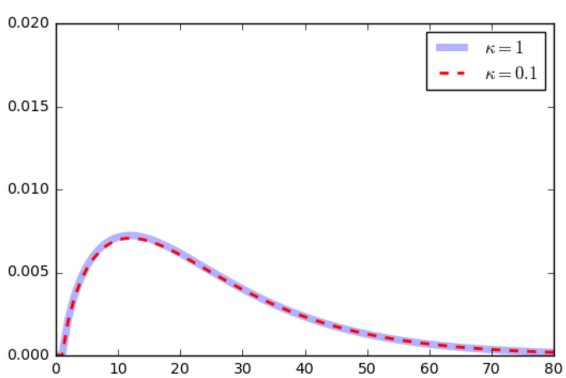
(b) GDP (PE)



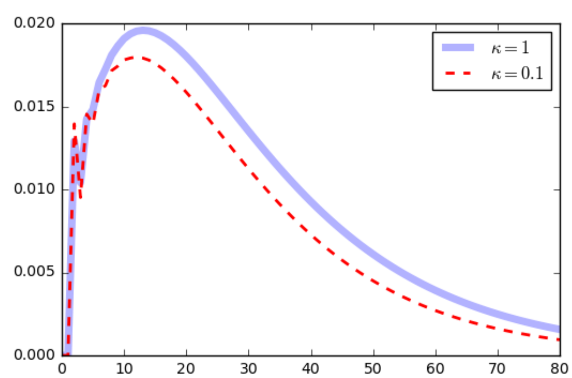
(c) X (GE)



(d) X (PE)

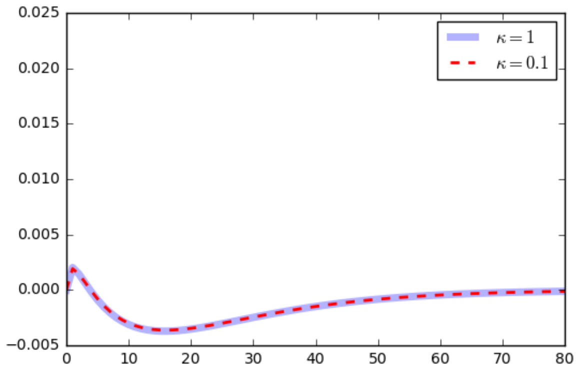


(e) M_D (GE)

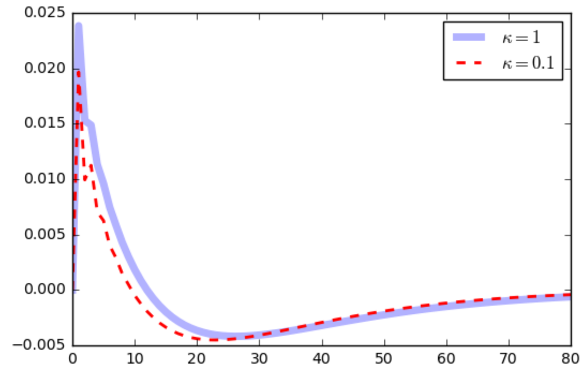


(f) M_D (PE)

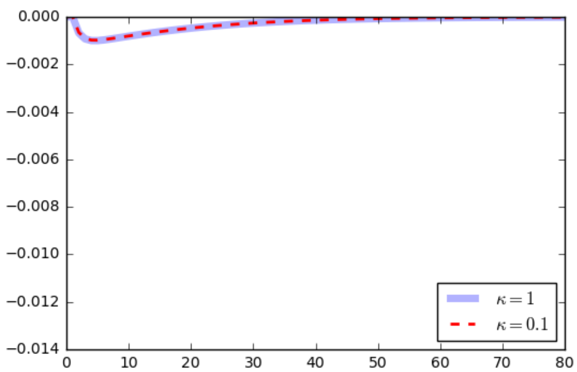
Figure 10 (continued): Impulse responses in general equilibrium (GE) and partial equilibrium (PE)



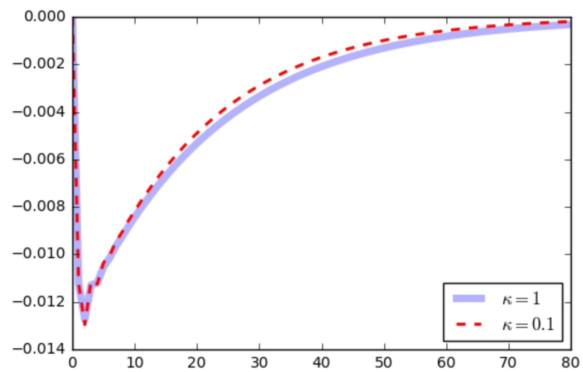
(g) $\tilde{\pi}$ (GE)



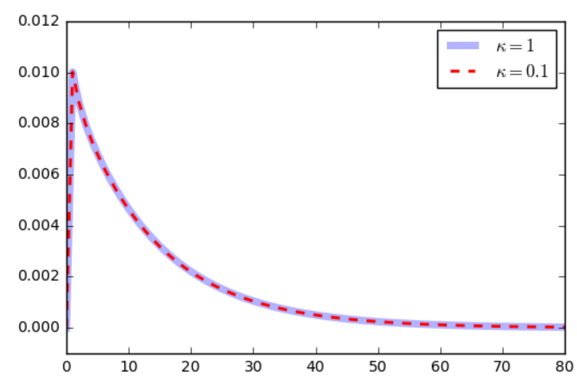
(h) $\tilde{\pi}$ (PE)



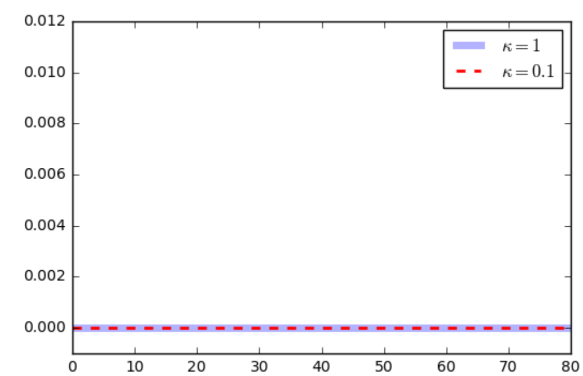
(i) P_X (GE)



(j) P_X (PE)

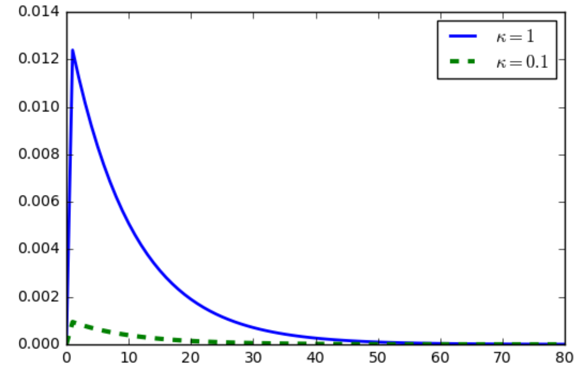


(k) W (GE)

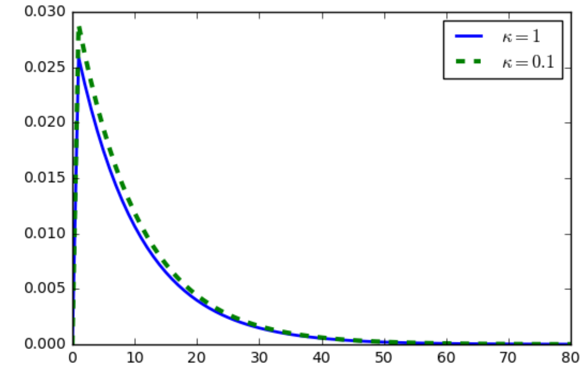


(l) W (PE)

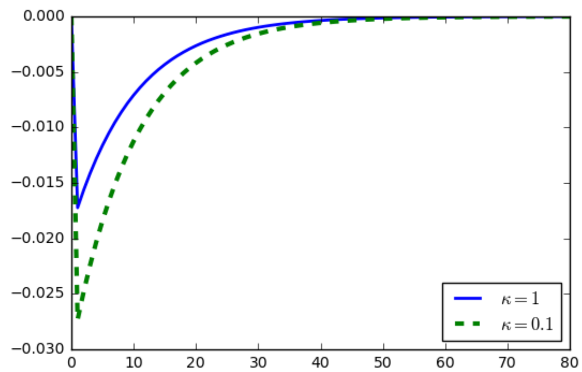
Figure 11: Responses of extensive margin, intensive margin, and selection (constant W)



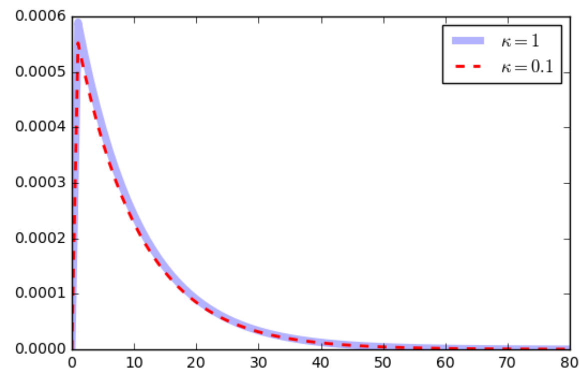
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$

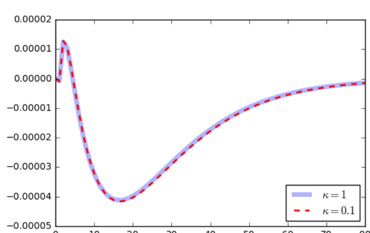


(c) Selection $(\tilde{a}_{X,t})$

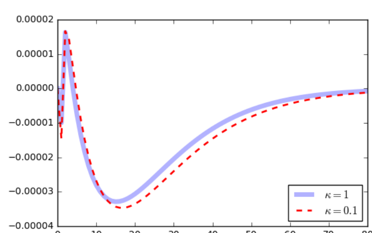


(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

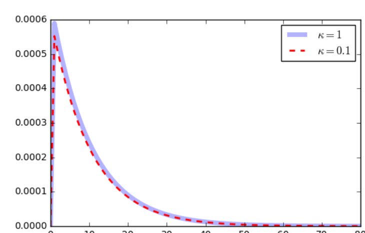
Figure 12: Response of $\tilde{\Pi}_X$ to a productivity shock



(a) $\alpha = 5.6$



(b) $\alpha = 15.6$



(c) Constant W

profit to productivity shocks can be decomposed as

$$
\begin{aligned}
\frac{\partial \tilde{\Pi}_X}{\partial A} = & \underbrace{-g(\bar{a}_\kappa)\tilde{\pi}_X \frac{\partial \bar{a}_\kappa}{\partial A}}_{\text{Extensive margin, >0}} \\
& + \underbrace{(1 - G(\bar{a}_\kappa)) \left[\frac{\sigma - 1}{\sigma} \left(\frac{p_X(\tilde{a}_X)}{P^*} \right)^{1-\sigma} \frac{q_X^{rem}}{A} + (1 - \mu) \frac{W F_X}{A^2} \right]}_{\text{Intensive margin, >0}} \\
& + \underbrace{(1 - G(\bar{a}_\kappa)) \left[\frac{\sigma - 1}{\sigma} \left(\frac{p_X(\tilde{a}_X)}{P^*} \right)^{1-\sigma} \frac{q_X^{rem}}{\tilde{a}_X} \frac{\partial \tilde{a}_X}{\partial A} \right]}_{\text{Selection effect, <0}}.
\end{aligned}
$$

In contrast, the response of total export profit to wage changes satisfies

$$
\begin{aligned}
\frac{\partial \tilde{\Pi}_X}{\partial W} = & \underbrace{-g(\bar{a}_\kappa)\tilde{\pi}_X \frac{\partial \bar{a}_\kappa}{\partial W}}_{\text{Extensive margin, <0}} \\
& + \underbrace{(1 - G(\bar{a}_\kappa)) \left[-\frac{\sigma - 1}{\sigma} \left(\frac{p_X(\tilde{a}_X)}{P^*} \right)^{1-\sigma} \frac{q_X^{rem}}{W} - (1 - \mu) \frac{F_X}{A} \right]}_{\text{Intensive margin, <0}} \\
& + \underbrace{(1 - G(\bar{a}_\kappa)) \left[\frac{\sigma - 1}{\sigma} \left(\frac{p_X(\tilde{a}_X)}{P^*} \right)^{1-\sigma} \frac{q_X^{rem}}{\tilde{a}_X} \frac{\partial \tilde{a}_X}{\partial W} \right]}_{\text{Selection effect, >0}}.
\end{aligned} \tag{31}
$$

Thus, following a positive productivity shock, general equilibrium wage increases dampen the extensive and intensive margins while partially offsetting selection. This dampening mechanism reduces the overall responsiveness of $\tilde{\Pi}_X$ and allows the three channels to offset one another more tightly.

The central lesson of this subsection is that wage adjustment in general equilibrium plays a crucial stabilizing role. By compressing profits and moderating exporter responses, endogenous wage movements sharply reduce the extent to which financial development affects total export profit and aggregate outcomes. When this adjustment is suppressed, differences in financial development translate into large and economically meaningful divergences in macroeconomic responses.

3.6 Financial development and labor supply

The previous subsection showed that wage adjustment in general equilibrium plays a central role in muting the aggregate effects of financial development. In the baseline economy, labor supply is perfectly inelastic and fixed at L. As a result, increases in labor demand translate one-for-one into higher wages, sharply compressing profits and dampening exporter responses. This extreme assumption provides a clean benchmark but may overstate the strength of the wage-adjustment channel.

This subsection generalizes the analysis by allowing for an elastic labor supply. The key question is whether the main mechanism—general equilibrium wage adjustment offsetting the effects of trade credit constraints—continues to operate once labor supply responds endogenously. I show that it does. While a more elastic labor supply weakens wage adjustment and amplifies the role of financial development, the interaction between wage movements, exporter selection, and productivity dispersion remains intact.

To introduce labor supply elasticity, I replace the baseline preferences with Greenwood–Hercowitz–Huffman (GHH) preferences (Greenwood et al., 1988). Households now choose labor supply L_t in addition to consumption and asset holdings, solving

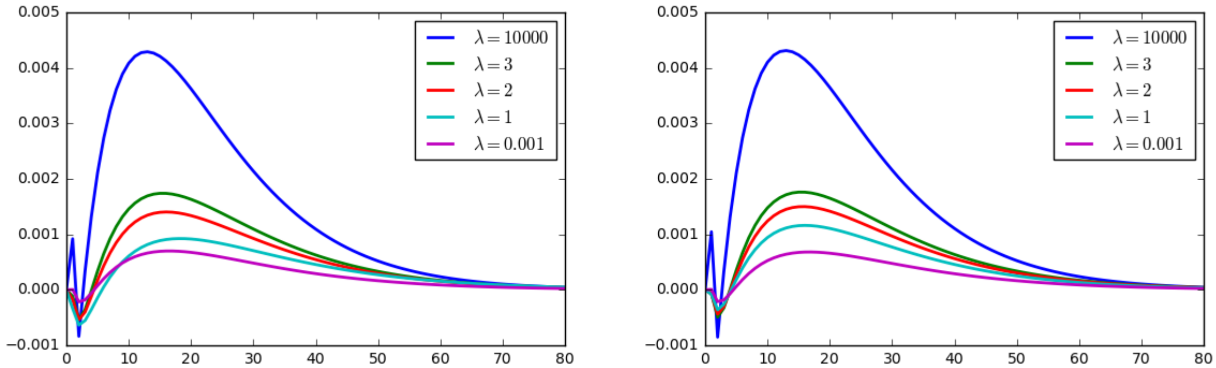
$$\max_{C_t, L_t, B_{t+1}, x_{t+1}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{1}{1-\gamma} \left(C_t - \rho \frac{L_t^{1+\frac{1}{\lambda}}}{1+1/\lambda} \right)^{1-\gamma}$$

subject to the same budget constraint as before and $0 \leq L_t \leq 1$. The resulting labor supply condition is

$$L_t = \rho^{\lambda} \left(\frac{W_t}{P_t} \right)^{\lambda}, \tag{32}$$

so that λ governs the elasticity of labor supply. As $\lambda \to 0$, labor supply becomes perfectly

Figure 13: Response of $\frac{W}{A}$ with different λ



(a) $\kappa = 1$ (b) $\kappa = 0.1$

inelastic, reproducing the baseline case.

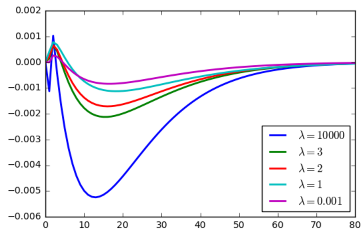
Figures C.31–C.35 report impulse responses when $\lambda = 0.001$. The results are nearly identical to those in the baseline economy, confirming that the earlier findings are not sensitive to small deviations from perfectly inelastic labor supply.

The role of labor supply elasticity becomes clearer when λ increases. Figure 13 plots the response of the effective marginal cost W/A to a 1% productivity shock across values of λ and κ. When labor supply is inelastic, wages rise sharply and offset productivity gains, leaving marginal costs relatively stable. As λ increases, labor supply becomes more responsive, wage adjustment weakens, and marginal costs fall more strongly following a productivity shock. This attenuates the dampening role of general equilibrium wage movements.

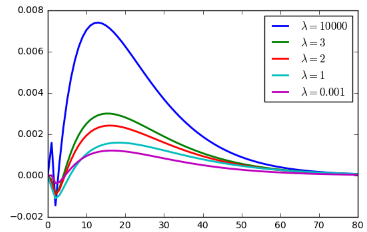
Figure 14 shows how this translates into exporter outcomes. As labor supply becomes more elastic, the extensive margin, selection effect, and total export profit respond more strongly to productivity shocks. In this environment, differences in financial development generate larger gaps in total export profit across values of κ, and these differences begin to spill over into aggregate variables. Nonetheless, even with fairly elastic labor supply, the quantitative effects remain moderate.

Finally, the interaction between financial development and firm productivity dispersion continues to matter when labor supply is endogenous. Figure 15 reports responses under $\lambda = 1$

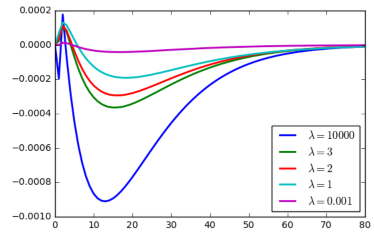
Figure 14: Responses of the extensive margin, selection, and total export profit by λ



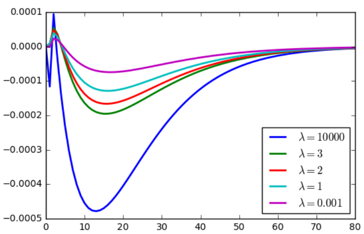
(a) $1 - G(\bar{a}_\kappa)$ $(\kappa = 1)$



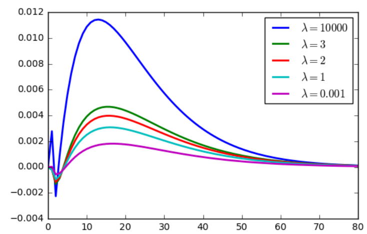
(b) $\tilde{a}_X$ $(\kappa = 1)$



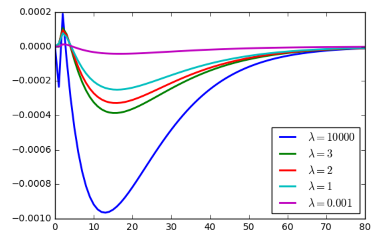
(c) $\tilde{\Pi}_X$ $(\kappa = 1)$



(d) $1 - G(\bar{a}_\kappa)$ $(\kappa = 0.1)$



(e) $\tilde{a}_X$ $(\kappa = 0.1)$



(f) $\tilde{\Pi}_X$ $(\kappa = 0.1)$

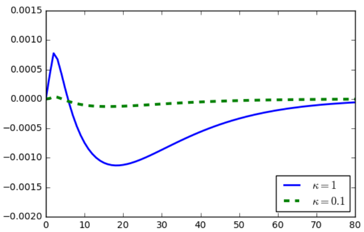
for two values of the Pareto shape parameter α. As in the baseline economy, lower productivity dispersion amplifies the sensitivity of the extensive margin to financial development while weakening the selection effect. Consequently, total export profit becomes more responsive to κ when firms cluster near the lower end of the productivity distribution.

Taken together, these results show that the baseline findings are not driven by the knife-edge assumption of perfectly inelastic labor supply. Wage adjustment remains a powerful general equilibrium force across a wide range of labor supply elasticities. While greater labor market flexibility allows financial development to play a larger role, its aggregate impact remains limited for empirically plausible values of labor supply elasticity and productivity dispersion.

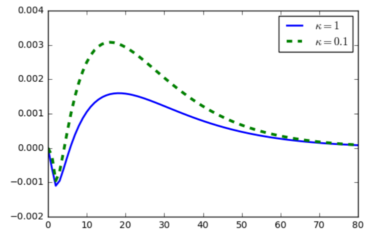
3.7 Robustness checks and additional exercises

This subsection reports a set of robustness checks designed to assess the sensitivity of the main results to alternative parameterizations, shocks, and model environments. I vary

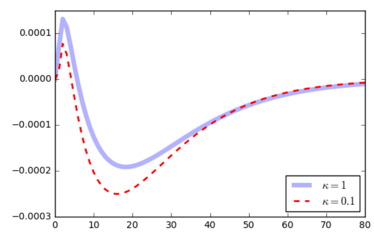
Figure 15: Responses of the extensive margin, selection, and total export profit when $\lambda = 1$



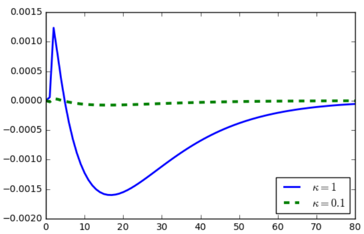
(a) $1 - G(\bar{a}_\kappa)$ ($\alpha = 5.6$)



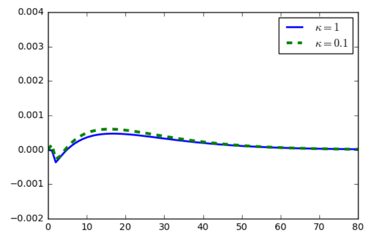
(b) $\tilde{a}_X$ ($\alpha = 5.6$)



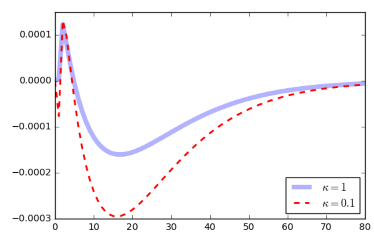
(c) $\tilde{\Pi}_X$ ($\alpha = 5.6$)



(d) $1 - G(\bar{a}_\kappa)$ ($\alpha = 15.6$)



(e) $\tilde{a}_X$ ($\alpha = 15.6$)



(f) $\tilde{\Pi}_X$ ($\alpha = 15.6$)

the elasticity of substitution across varieties, the nature of the exogenous shock, capital account openness, the presence of the nontradable sector, and the calibration of financial development and foreign demand. Across all exercises, the central mechanism remains intact: trade credit constraints primarily reallocate activity across firms, while general equilibrium adjustments—especially through wages—limit their aggregate impact.

Elasticity of substitution across varieties.—The baseline calibration sets the elasticity of substitution across varieties to $\sigma = 6$ following Broda and Weinstein (2006). As an alternative, I consider a lower elasticity, $\sigma = 2.5$, corresponding to a markup of 67%, consistent with estimates reported in Bernard et al. (2003). To maintain comparability, I recalibrate the Pareto shape parameter to $\alpha = 2.1$ to match the standard deviation of log U.S. plant sales. Figures C.5–C.6 report impulse responses of macro variables under $\kappa = 1$ and $\kappa = 0.1$. As in the baseline, aggregate dynamics remain largely insensitive to financial development.

Figures C.7–C.8 report responses of the extensive margin, intensive margin, selection effect, and total export profit. In level deviations, the extensive margin is more responsive when $\kappa = 1$, while the selection effect is more responsive when $\kappa = 0.1$, leaving total export profit $\tilde{\Pi}_X$ nearly invariant. When productivity dispersion is reduced by increasing α (Figure C.9), the extensive margin becomes more sensitive and the selection effect weaker, making $\tilde{\Pi}_X$ more responsive to κ. Figure C.10 shows that aggregate variables then exhibit greater sensitivity as well. These patterns mirror the baseline results, confirming that the mechanism does not hinge on the choice of σ.

Alternative shocks.—To assess whether the results depend on the nature of the shock, I replace the productivity shock with a 1% increase in the foreign price index P^*. Figures C.11–C.12 show impulse responses of macro variables, while Figures C.13–C.14 report responses of the three channels and total export profit. The qualitative and quantitative patterns remain unchanged: in levels, the extensive margin is more sensitive under high κ, the selection effect under low κ, and total export profit remains largely unaffected. Thus, the main conclusions are not shock-specific.

Capital account restrictions.—I next examine the role of capital account openness by effectively shutting down international borrowing through a very high bond adjustment cost ($\nu = 10000$). In this case, exports and imports move closely together, as unbalanced trade becomes prohibitively costly (Figures C.15–C.16). Nevertheless, the responses of the extensive margin, selection effect, and total export profit (Figures C.17–C.18) remain consistent with the baseline, indicating that capital account openness is not essential for the main results.

Nontradable sector.—To verify that the results do not rely on the presence of a nontradable sector, I repeat the analysis setting $\omega = 1$ (implemented as $\omega = 0.9999$). Figures C.19–C.22 show that the qualitative and quantitative conclusions remain unchanged.

Intermediate financial development.—In addition to the extreme values $\kappa = 0.1$ and $\kappa = 1$, I consider an intermediate level of financial development, $\kappa = 0.55$. Figures C.23–C.26 show that outcomes interpolate smoothly between the two extremes, with no qualitative changes.

Foreign demand calibration.—Finally, I assess sensitivity to the level of foreign demand. Increasing q_X^{rem} from 5 to 15 yields the impulse responses shown in Figures C.27–C.30. The main findings continue to hold.

Overall, these robustness checks confirm that the limited aggregate role of trade credit constraints is not driven by a particular calibration, shock, or modeling assumption. Instead, it reflects a general mechanism in which financial frictions operate through exporter selection and reallocation, while general equilibrium adjustments dampen their macroeconomic consequences.

4 Conclusion

This paper studies how trade credit constraints shape export dynamics and aggregate outcomes in a general equilibrium model with heterogeneous firms. The analysis combines firm-level selection into exporting with aggregate price and wage adjustment to assess how financial development affects both microeconomic margins and macroeconomic fluctuations. While tighter trade credit constraints substantially distort firm-level export behavior, their aggregate consequences are more limited than might be expected.

The key mechanism operates through the interaction between the extensive margin of exporting and selection. Lower financial development raises the export cutoff and reduces the share of exporting firms, but at the same time it increases the average productivity of exporters by selecting only the most productive firms into export markets. As a result, changes in the number of exporters are partially offset by changes in average exporter productivity, leaving total export profits—and hence aggregate outcomes—largely unchanged. The strength of this offset depends critically on the dispersion of firm productivity. When productivity is highly dispersed, as in empirically relevant calibrations, the selection effect is strong and nearly neutralizes movements in the extensive margin. When productivity dispersion is low, selection weakens relative to the extensive margin, and financial development has a more pronounced effect on aggregate outcomes.

General equilibrium wage adjustment further dampens the transmission of trade credit frictions. Positive productivity shocks raise wages, which compress profits and reduce firms' incentives to enter export markets. This wage response systematically weakens the extensive, intensive, and selection channels, stabilizing total export profits across different degrees of financial development. When labor supply is less elastic, wage adjustment is stronger and the dampening effect is amplified; when labor supply is more elastic or wages are held fixed, differences in financial development translate more directly into aggregate fluctuations. These results highlight the central role of labor market adjustment in mediating the aggregate impact of firm-level financial frictions.

The quantitative findings should be interpreted with appropriate caution, as the model abstracts from additional channels such as the use of firm assets as collateral or the dynamic accumulation of internal funds. Nonetheless, the core insights are robust across a wide range of specifications, shocks, and calibrations. Trade credit constraints are quantitatively important for firm-level export participation and profits, but their aggregate effects are endogenously stabilized by offsetting selection forces and general equilibrium wage adjustment.

More broadly, the results suggest that the macroeconomic consequences of financial frictions cannot be inferred directly from their microeconomic severity. Even when firm-level distortions are large, general equilibrium forces—particularly selection and factor price adjustment—can substantially mute their aggregate impact. Understanding when and why these stabilizing mechanisms break down remains an important direction for future research, especially in environments with endogenous financial accumulation, richer labor market dynamics, or sectoral heterogeneity in financial access.

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Appendix

A Partial Equilibrium Implications

Before moving on to the quantitative analysis, it is useful to look analytically at some of the partial equilibrium implications.

A.1 Export cutoffs and the RER

In this subsection, I first look at how exchange rate depreciation affects the extensive margin of exports. Recall that the export cutoff $\bar{a}_{\kappa,t}$ is determined by the trade credit constraint cutoff condition. For ease of notation, let's define the remaining part of export demand as $q^{rem}_{X,t} \equiv \omega^{\eta} \left(\frac{P_t^{T*}}{P_t^*}\right)^{\xi-\eta} \left(\frac{P_{I,t}^{T\ *}}{P_t^*}\right)^{\sigma-\xi} P_t^* C_t^*$ so that $q_{X,t} = p_{X,t}(a)^{-\sigma} P_t^{*\sigma-1} q^{rem}_{X,t}$ and $q^{rem}_{X,t}$ is exogenous. I further assume that $q^{rem}_{X,t}$ is constant.[11] Also, let $\mathcal{F}_t \equiv (1-\mu)\frac{W_t}{A_t}F_X + \mu \frac{W_t^*}{A_t^*}F_X$, and let $w_t \equiv \frac{W_t}{P_t}$ and $w_t^* \equiv \frac{W_t^*}{P_t^*}$ denote the wage rates denominated in units of the final consumption bundle in home and foreign countries. Then, the export cutoff $\bar{a}_{\kappa,t}$ is obtained as

$$\bar{a}_{\kappa,t} = \left(\frac{\sigma \mathcal{F}_t}{q^{rem}_{X,t,}} \frac{1}{\kappa}\right)^{\frac{1}{\sigma-1}} \frac{\sigma}{\sigma-1} \frac{\tau w_t}{A_t} \frac{P_t}{P_t^*}. \tag{33}$$

Define the RER as $e_t \equiv \frac{P_t^*}{P_t}$. An increase in RER corresponds to exchange rate depreciation. In the following, I first look at the effect of an increase in P_t and P_t^* separately and then the effect of an increase in e_t (RER depreciation).

First, given A_t, A_t^*, w_t, w_t^*, and P_t^*, the partial derivative of the export cutoff with respect to P_t is given as

$$\frac{\partial \bar{a}_{\kappa,t}}{\partial P_t} = \frac{\bar{a}_{\kappa,t}}{P_t} \left[1 + \frac{1}{\sigma-1} \frac{(1-\mu)\frac{P_t w_t}{A_t}}{(1-\mu)\frac{P_t w_t}{A_t} + \mu \frac{P_t^* w_t^*}{A_t^*}}\right] > 0. \tag{34}$$

The first term in the brackets corresponds to the the traditional price competitiveness effect through the marginal cost of production. The second term arises from the increased burden of fixed costs. Both channels negatively affect the profitability of exporters and increase the export cutoff. The size of the second term is increasing in the domestic input share of the fixed cost. Also, note that $\bar{a}_{\kappa,t} = \left(\frac{\sigma \mathcal{F}_t}{q^{rem}_{X,t,}} \frac{1}{\kappa}\right)^{\frac{1}{\sigma-1}} \frac{\sigma}{\sigma-1} \frac{\tau w_t}{A_t} \frac{P_t}{P_t^*}$. A fall in κ, which implies a less-developed financial market, amplifies the effect of changes in P_t on $\bar{a}_{\kappa,t}$.

Next, given A_t, A_t^*, w_t, w_t^*, and P_t, the partial derivative of the export cutoff with respect

[11] This formulation of $q^{rem}_{X,t}$ is similar to that in Demidova and Rodríguez-Clare (2009) and Demidova and Rodriguez-Clare (2013). However, I also assume that P_t^{T*}, $P_{I,t}^{T\ *}$, and C_t^* proportionally adjust so that $q^{rem}_{X,t}$ is constant regardless of P_t^*. On the contrary, $p_{X,t}(a)$ does not automatically change in proportion to P_t^* to offset its effect on $q_{X,t}$. This can be justified under the small open economy assumption that domestic firms cannot affect price indices in foreign countries. This assumption allows a tractable analytical analysis on the effect of changes in P_t^* on the domestic variables.

to P_t^* is given as

$$\frac{\partial \bar{a}_{\kappa,t}}{\partial P_t^*} = \frac{\bar{a}_{\kappa,t}}{P_t^*}\left[-1 + \frac{1}{\sigma-1}\frac{\mu\frac{P_t^* w_t^*}{A_t^*}}{(1-\mu)\frac{P_t w_t}{A_t} + \mu\frac{P_t^* w_t^*}{A_t^*}}\right]. \tag{35}$$

Similarly to the P_t case, the first term in the brackets is the traditional price competitiveness effect. In this case, its sign is negative since an increase in the foreign price means an increased price competitiveness of domestic products. However, the sign of the second term, which is the effect through the fixed cost, is positive because some fraction (μ) of the fixed cost should be paid in foreign labor and a higher P_t^* increases the burden of it. The size of this effect depends on the foreign share of the fixed cost μ, and as long as $\mu > 0$, it has a negative effect on the profitability of an exporter. As a result, unlike $\frac{\partial \bar{a}_{\kappa,t}}{\partial P_t}$, the sign of $\frac{\partial \bar{a}_{\kappa,t}}{\partial P_t^*}$ is ambiguous and depends on the relative strength of the two channels. Again, a lower κ amplifies the magnitude of the overall effect, but it does not affect the sign.

Now, consider a more general case where the RER (e_t) changes. Given A_t, A_t^*, w_t, and w_t^*, the derivative of the export cutoff with respect to the RER is given as

$$\frac{\partial \bar{a}_{\kappa,t}}{\partial e_t} = \frac{\bar{a}_{\kappa,t}}{e_t}\left[-2 + \frac{P_t}{\sigma-1}\frac{F_X}{\mathcal{F}_t}\left(-(1-\mu)\frac{w_t}{A_t} + \mu\frac{w_r^*}{A_t^*}e_t\right)\right]. \tag{36}$$

It can be rewritten as[12]

$$\begin{aligned}\frac{\partial \bar{a}_{X\kappa,t}}{\partial e_t} = \frac{\sigma}{\sigma-1}\frac{\tau w_t}{A_t}\left(\frac{\sigma\mathcal{F}_t}{q_{X,t}^{rem}}\right)^{\frac{1}{\sigma-1}}\left(\frac{1}{\kappa}\right)^{\frac{1}{\sigma-1}}\frac{1}{e_t^2}\Bigg[&\underbrace{-2}_{\text{price competitiveness effect}} \\ &+ \underbrace{\frac{P_t}{\sigma-1}\frac{F_X}{\mathcal{F}_t}\left(-(1-\mu)\frac{w_t}{A_t} + \mu\frac{w_r^*}{A_t^*}e_t\right)}_{\text{fixed cost valuation effect}}\Bigg].\end{aligned} \tag{37}$$

The effect of RER depreciation can be decomposed into two components. The first term inside the brackets corresponds to the classic price competitiveness effect of currency depreciation. RER depreciation increases home country exporters' price competitiveness abroad and lets less productive firms start exporting, thereby decreasing the export cutoff. The second term is the fixed cost valuation effect, and it arises since the export fixed cost consists of both home country and foreign country labor. Note that if foreign labor does not enter the export fixed cost ($\mu = 0$), only the price competitiveness effect is present and RER depreciation surely leads to a decrease in the export cutoff. If the share of foreign labor cost is large enough, RER depreciation can lead to a heavier fixed cost burden, which has a tightening effect on the trade credit constraint. The sign of the overall effect depends on the relative strength of the two channels. Moreover, a lower degree of financial development κ amplifies the magnitude of the overall effect. The results are summarized in the following proposition.[13]

[12] For the derivation, see Appendix B.2

[13] In the model of Chaney (2016), there are two productivity cutoffs, and only either the price competitiveness effect or the fixed cost valuation effect appears in each cutoff. In my model, there is only one export cutoff, and the two effects both affect the same cutoff.

Proposition A.1. Given A_t, A_t^*, w_t^*, and w_t^*,

1. if $\mu \leq \frac{\frac{w_t}{A_t}}{\frac{w_t}{A_t}+e_t\frac{w_t^*}{A_t^*}}$, $\frac{\partial \bar{a}_{\kappa,t}}{\partial e_t} < 0$;

2. if $\mu > \frac{\frac{w_t}{A_t}}{\frac{w_t}{A_t}+e_t\frac{w_t^*}{A_t^*}}$, an increase in e_t has a positive fixed cost valuation effect on $\bar{a}_{\kappa,t}$, and the sign of $\frac{\partial \bar{a}_{\kappa,t}}{\partial e_t}$ is ambiguous;

3. and a lower κ increases $|\frac{\partial \bar{a}_{\kappa,t}}{\partial e_t}|$ but does not affect the sign of $\frac{\partial \bar{a}_{\kappa,t}}{\partial e_t}$.

Intuitively, if the foreign input share of the fixed cost is small, the traditional price competitiveness effect of RER depreciation dominates and an exporter's profitability will increase. In contrast, if the foreign share is large enough, the overall effect of RER depreciation will depend on the relative strength of the price competitiveness channel and the fixed cost valuation channel. In addition, lower financial development amplifies these effects.

A.2 Export cutoff and production cost

Now consider how the export cutoff responds to the domestic wage given A_t, A_t^*, P_t, P_t^*, and w_t^*. The partial derivative of export cutoff with respect to the real wage is given as

$$\frac{\partial \bar{a}_{\kappa,t}}{\partial w_t} = \frac{\bar{a}_{\kappa,t}}{w_t}\left[1 + \frac{1}{\sigma-1}\frac{(1-\mu)\frac{P_t w_t}{A_t}}{(1-\mu)\frac{P_t w_t}{A_t} + \mu\frac{P_t^* w_t^*}{A_t^*}}\right] > 0. \tag{38}$$

Note that an increase in w_t has a similar price competitiveness effect and fixed cost effect to those of P_t. Intuitively, this is because a change in the production cost w_t is directly translated into a change in the price P_t. For a similar reason, a change in the foreign wage w_t^* has a similar effect on the domestic export cutoff to that of P_t^*. Moreover, lower κ has a similar amplifying effect without affecting the sign. Also, the response of the cutoff to a change in W_t can be easily obtained as $\frac{\partial \bar{a}_{\kappa,t}}{\partial W_t} = \frac{\partial \bar{a}_{\kappa,t}}{\partial w_t} = \frac{\partial \bar{a}_{\kappa,t}}{\partial w_t}\frac{1}{P_t}$.

Meanwhile, given P_t, P_t^*, w_t, and w_t^*, an increase in the aggregate productivity A_t lowers the production cost, and the export cutoff falls according to

$$\frac{\partial \bar{a}_{\kappa,t}}{\partial A_t} = -\frac{\bar{a}_{\kappa,t}}{A_t}\left[1 + \frac{1}{\sigma-1}\frac{(1-\mu)\frac{P_t w_t}{A_t}}{(1-\mu)\frac{P_t w_t}{A_t} + \mu\frac{P_t^* w_t^*}{A_t^*}}\right] < 0. \tag{39}$$

A.3 Export cutoff, extensive margin, and average export profit

The extensive margin of exports in the economy is given as $M_{D,t}(1-G(\bar{a}_{\kappa,t}))$, where $M_{D,t}$ is the mass of firms and G is the productivity distribution's cumulative distribution function. Given $M_{D,t}$, an increase in the export cutoff leads to a fall in the extensive margin of exports as

$$\frac{\partial(1-G(\bar{a}_{\kappa,t}))}{\partial \bar{a}_{\kappa,t}} = -\alpha\left(\frac{1}{\bar{a}_{\kappa,t}}\right)^{\alpha+1} < 0.$$

In addition, given A_t, A_t^*, P_t, P_t^*, w_t, and w_t^*, the average export profit of exporters $\tilde{\pi}_{X,t}$ responds to an increase in the export cutoff according to

$$\frac{\partial \tilde{\pi}_{X,t}}{\partial \bar{a}_{\kappa,t}} = \frac{\sigma - 1}{\sigma} \left(\frac{p_X(\tilde{a}_{X,t})}{P_t^*} \right)^{1-\sigma} \frac{q_{X,t}^{rem}}{\bar{a}_{\kappa,t}} > 0. \tag{40}$$

A.4 General equilibrium implications

In this section, I analytically showed how the export cutoff responds to a change in P_t, P_t^*, e_t, w_t or A_t; how the responses depend on the degree of financial development κ; and how the extensive margin of exports and the average export profit respond to a change in the export cutoff in partial equilibrium where other variables are held fixed. However, in general equilibrium, P_t, e_t, and w_t are all equilibrium outcomes and interact with each other. For example, in partial equilibrium, an increase in A_t lowers the cutoff, while an increase in W_t increases the cutoff. If an increase in A_t leads to an increase in W_t, the response of the export cutoff would be determined by the relative strength of the two competing forces in general equilibrium. Hence, it is a quantitative question of how the exports, and ultimately other macro variables including consumption and saving, respond to exogenous shocks in A_t or P_t^* in general equilibrium, and how the responses interact with financial development.

B Derivation of equations

B.1 Derivation of equation (17) from equation (10)

$$\begin{aligned}
\tilde{v}_t &= \beta(1-\psi)\mathbb{E}_t\left[\frac{P_t}{P_{t+1}}\left(\frac{C_{t+1}}{C_t}\right)^{-\gamma}(\tilde{v}_{t+1}+\tilde{\pi}_{t+1})\right] \\
&= \beta(1-\psi)\mathbb{E}_t\left[\frac{P_t}{P_{t+1}}\left(\frac{C_{t+1}}{C_t}\right)^{-\gamma}\tilde{\pi}_{t+1}\right] + \beta^2(1-\psi)^2\mathbb{E}_t\left[\mathbb{E}_{t+1}\left[\frac{P_t}{P_{t+2}}\left(\frac{C_{t+2}}{C_t}\right)^{-\gamma}\tilde{\pi}_{t+2}\right]\right] \\
&\quad + \beta^2(1-\psi)^2\mathbb{E}_t\left[\mathbb{E}_{t+1}\left[\frac{P_t}{P_{t+2}}\left(\frac{C_{t+2}}{C_t}\right)^{-\gamma}\tilde{v}_{t+2}\right]\right] \\
&= \mathbb{E}_t\sum_{s=0}^{\infty}[\beta(1-\psi)]^s\frac{P_t}{P_{t+s}}\left(\frac{C_{t+s}}{C_t}\right)^{-\gamma}\tilde{\pi}_{t+s}.
\end{aligned}$$

B.2 Derivation of equaiton (31)

Total-differentiate equation (27) to get

$$\begin{aligned}
d\bar{a}_{\kappa,t} &= \frac{\sigma}{\sigma-1}\frac{\tau w_t}{A_t}\left(\frac{\sigma\mathcal{F}_t}{q^{rem}_{X,t}}\right)^{\frac{1}{\sigma-1}}\left(\frac{1}{\kappa}\right)^{\frac{1}{\sigma-1}}\left[\frac{1}{P^*_t}dP_t - \frac{P_t}{P^{*2}_t}dP^*_t\right. \\
&\quad \left. + \frac{P_t}{P^*_t}\frac{F_X}{(\sigma-1)\mathcal{F}_t}\left((1-\mu)\frac{w_t}{A_t}dP_t + \mu\frac{w^*_t}{A^*_t}dP^*_t\right)\right] \\
&\approx \frac{\sigma}{\sigma-1}\frac{\tau w_t}{A_t}\left(\frac{\sigma\mathcal{F}_t}{q^{rem}_{X,t}}\right)^{\frac{1}{\sigma-1}}\left(\frac{1}{\kappa}\right)^{\frac{1}{\sigma-1}}\left[\frac{1}{P^*_t}\left(-\frac{P^2_t}{P^*_t}de_t\right) - \frac{P_t}{P^{*2}_t}P_t de_t\right. \\
&\quad \left. + \frac{P_t}{P^*_t}\frac{F_X}{(\sigma-1)\mathcal{F}_t}\left((1-\mu)\frac{w_t}{A_t}\left(-\frac{P^2_t}{P^*_t}de_t\right) + \mu\frac{w^*_t}{A^*_t}P_t de_t\right)\right].
\end{aligned}$$

Rearranging the equation gives

$$\frac{\partial\bar{a}_{\kappa,t}}{\partial e_t} = \frac{\sigma}{\sigma-1}\frac{\tau w_t}{A_t}\left(\frac{\sigma\mathcal{F}_t}{q^{rem}_{X,t}}\right)^{\frac{1}{\sigma-1}}\left(\frac{1}{\kappa}\right)^{\frac{1}{\sigma-1}}\left[-\frac{2}{e^2_t} + \frac{P_t}{e^2_t(\sigma-1)}\frac{F_X}{\mathcal{F}_t}\left(-(1-\mu)\frac{w_t}{A_t} + \mu\frac{w^*_r}{A^*_t}e_t\right)\right].$$

C Additional impulse response functions

Figure C.1: Responses (level deviation from steady state) to an A shock of 1 unit ($\kappa = 1$)

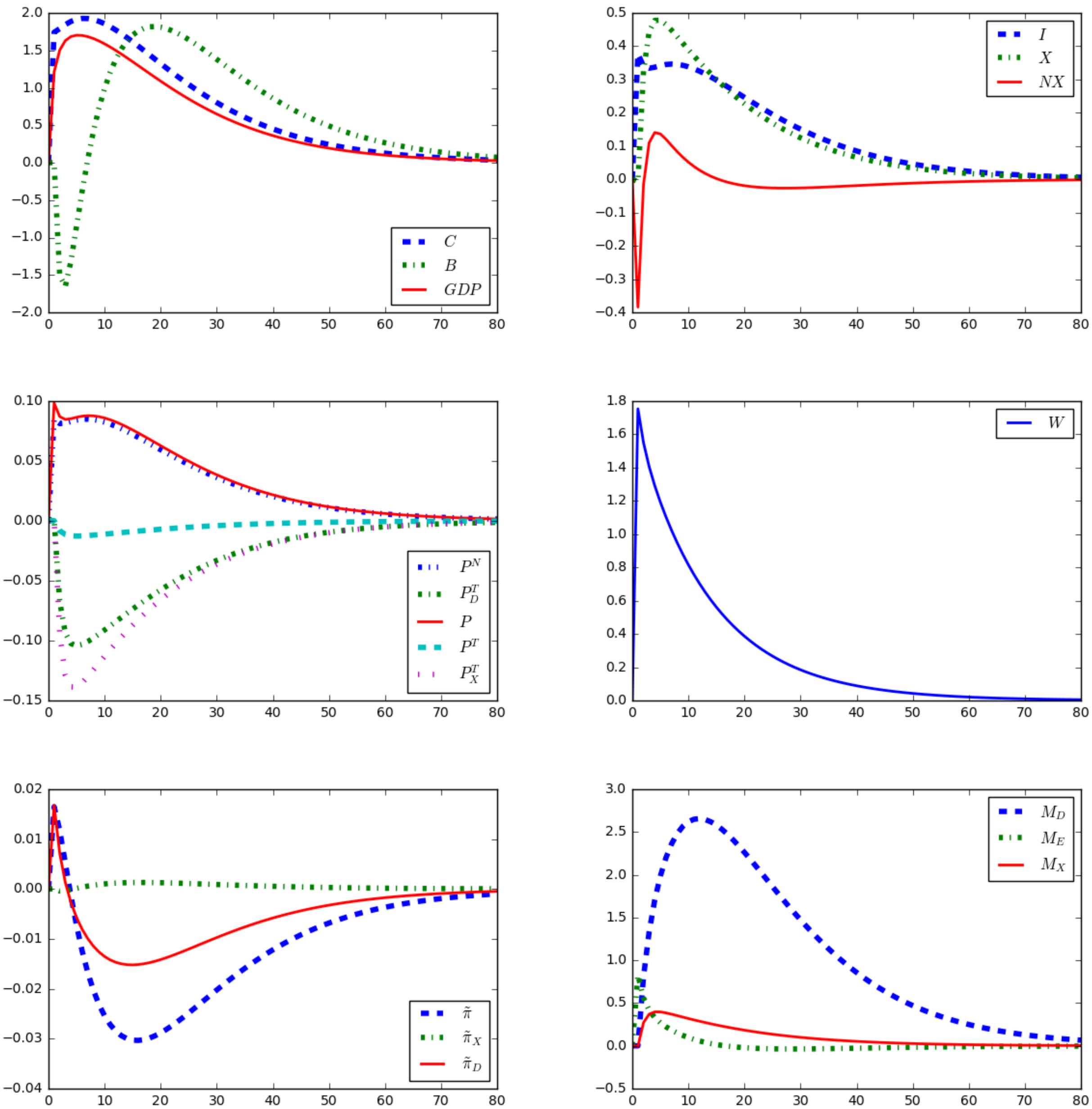


Figure C.2: Responses (level deviation from steady state) to an A shock of 1 unit ($\kappa = 0.1$)

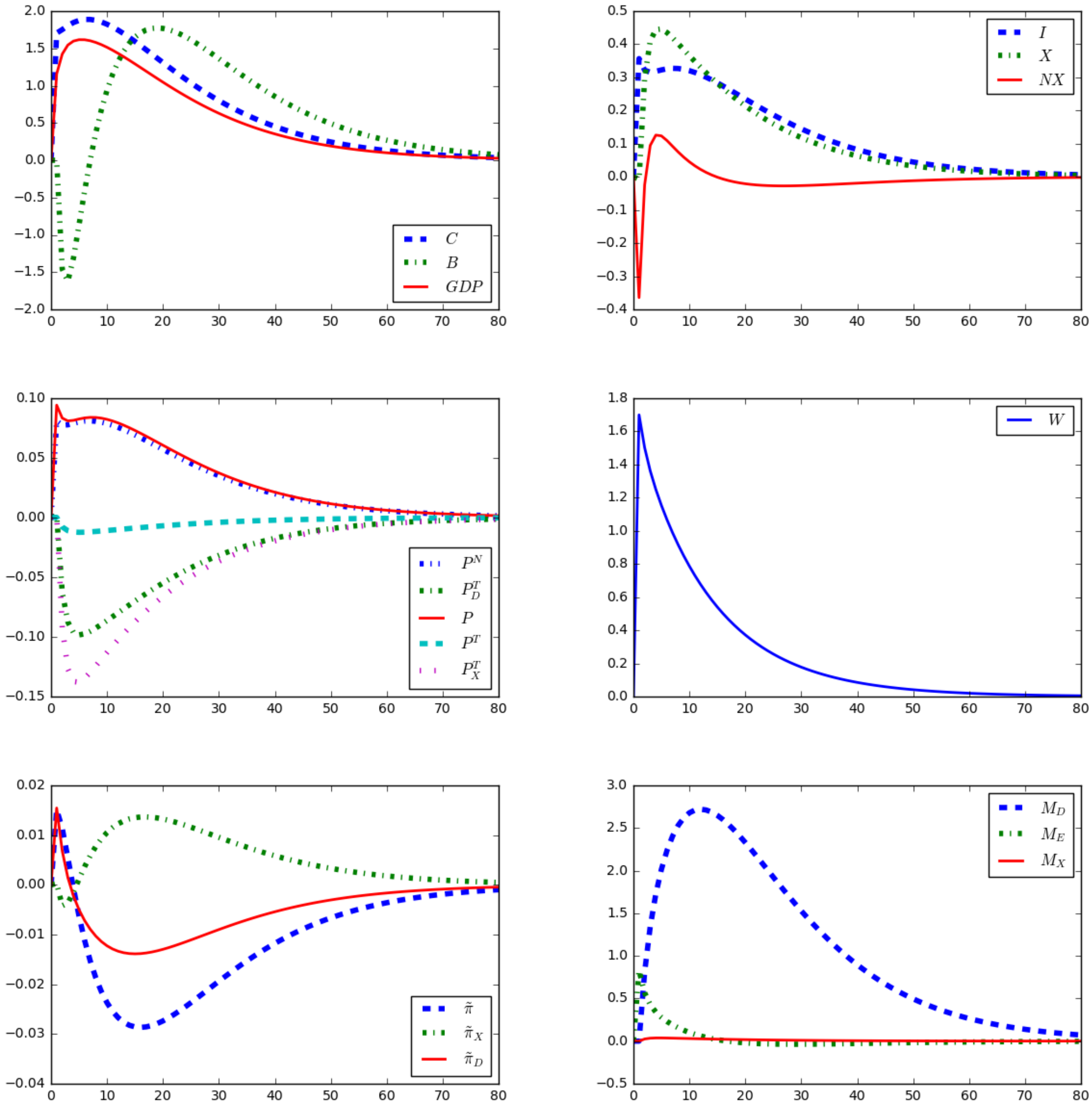
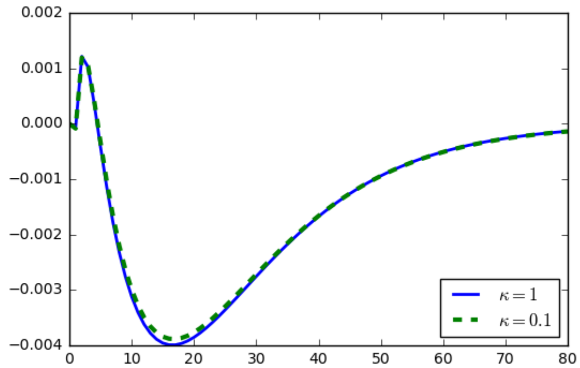
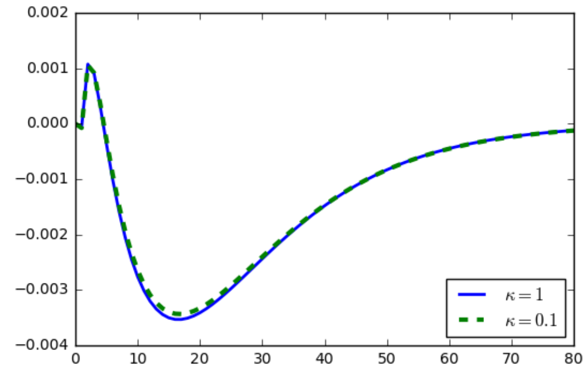


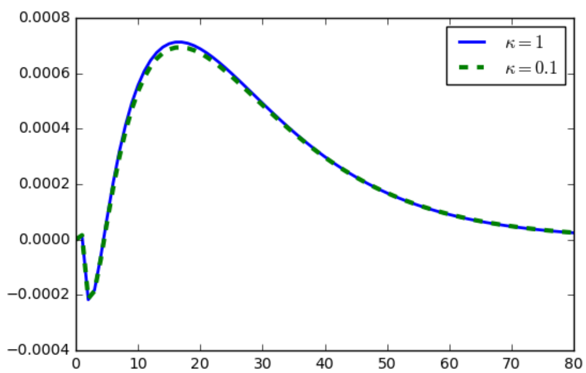
Figure C.3: Responses (percentage deviation from steady state) of extensive margin, intensive margin, and selection



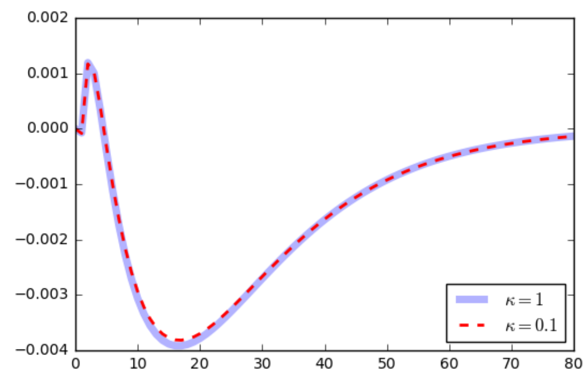
(a) Extensive margin $(1-G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$

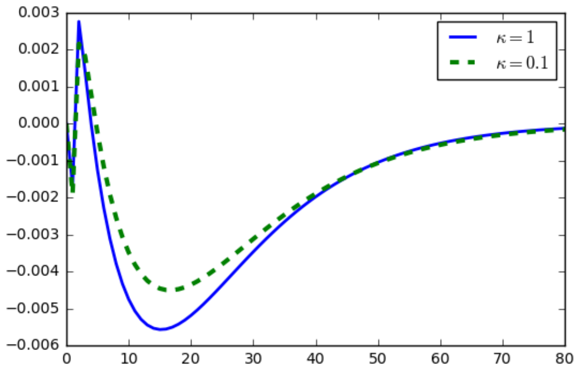


(c) Selection $(\tilde{a}_{X,t})$

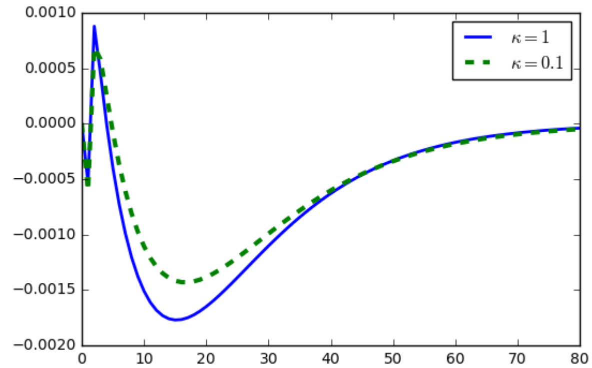


(d) Total export profit $((1-G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

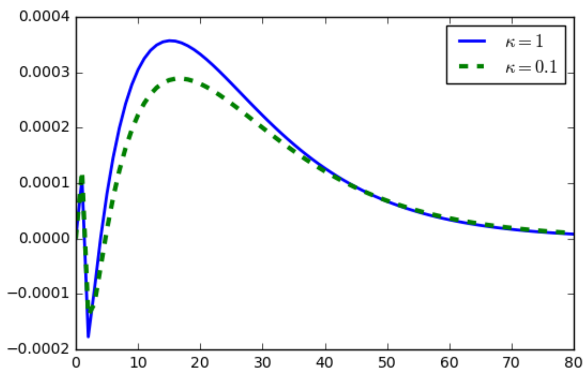
Figure C.4: Responses (percentage deviation) of extensive margin, intensive margin, and selection ($\alpha = 15.6$)



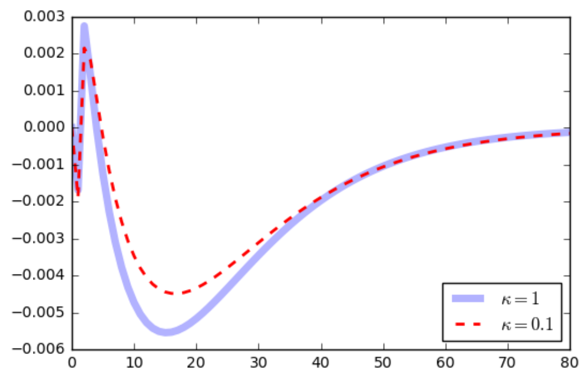
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$



(c) Selection $(\tilde{a}_{X,t})$



(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

Figure C.5: Response to an A shock of 1% ($\sigma = 2.5$, $\kappa = 1$)

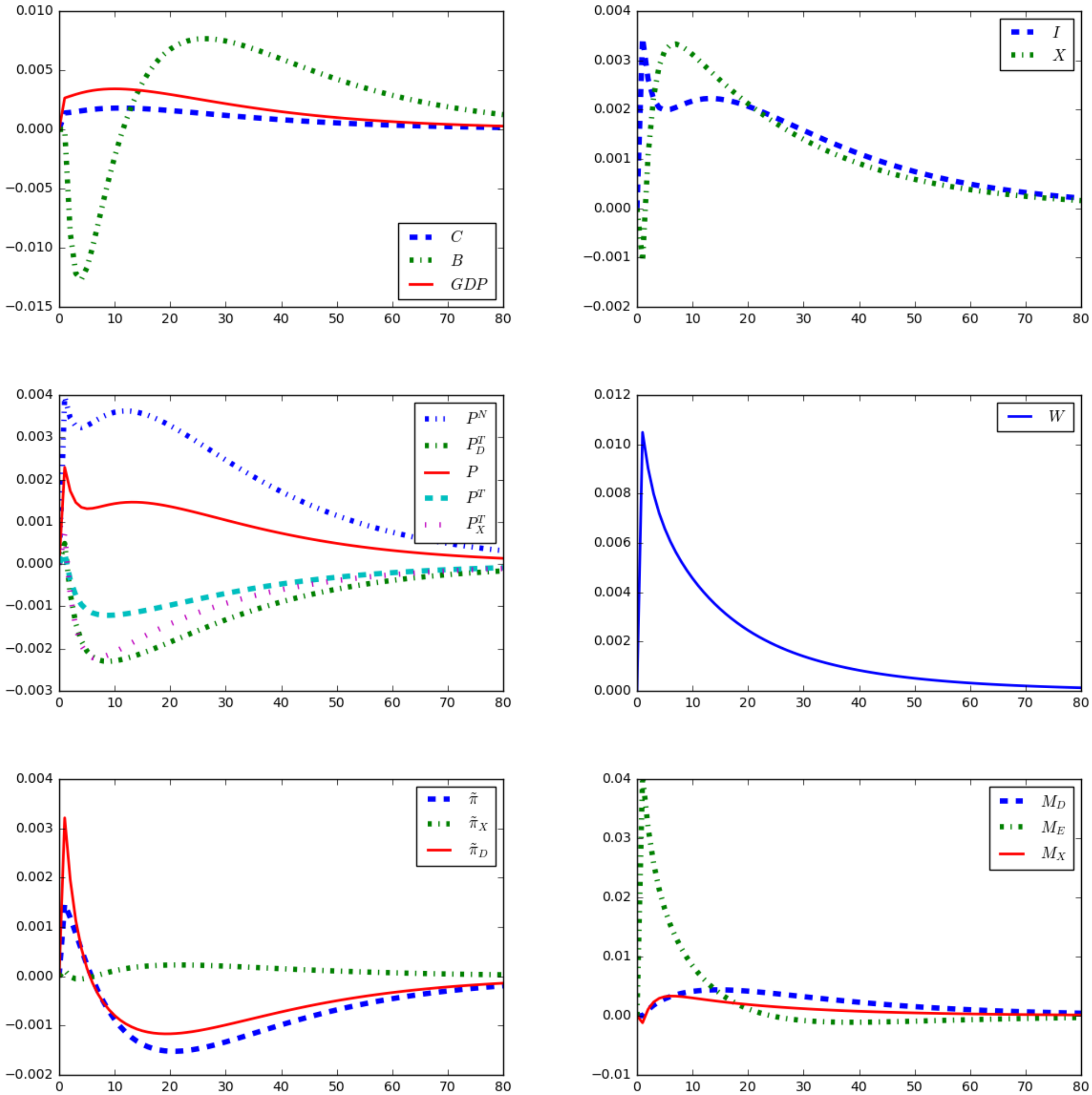


Figure C.6: Responses to an A shock of 1% ($\sigma = 2.5$, $\kappa = 0.1$)

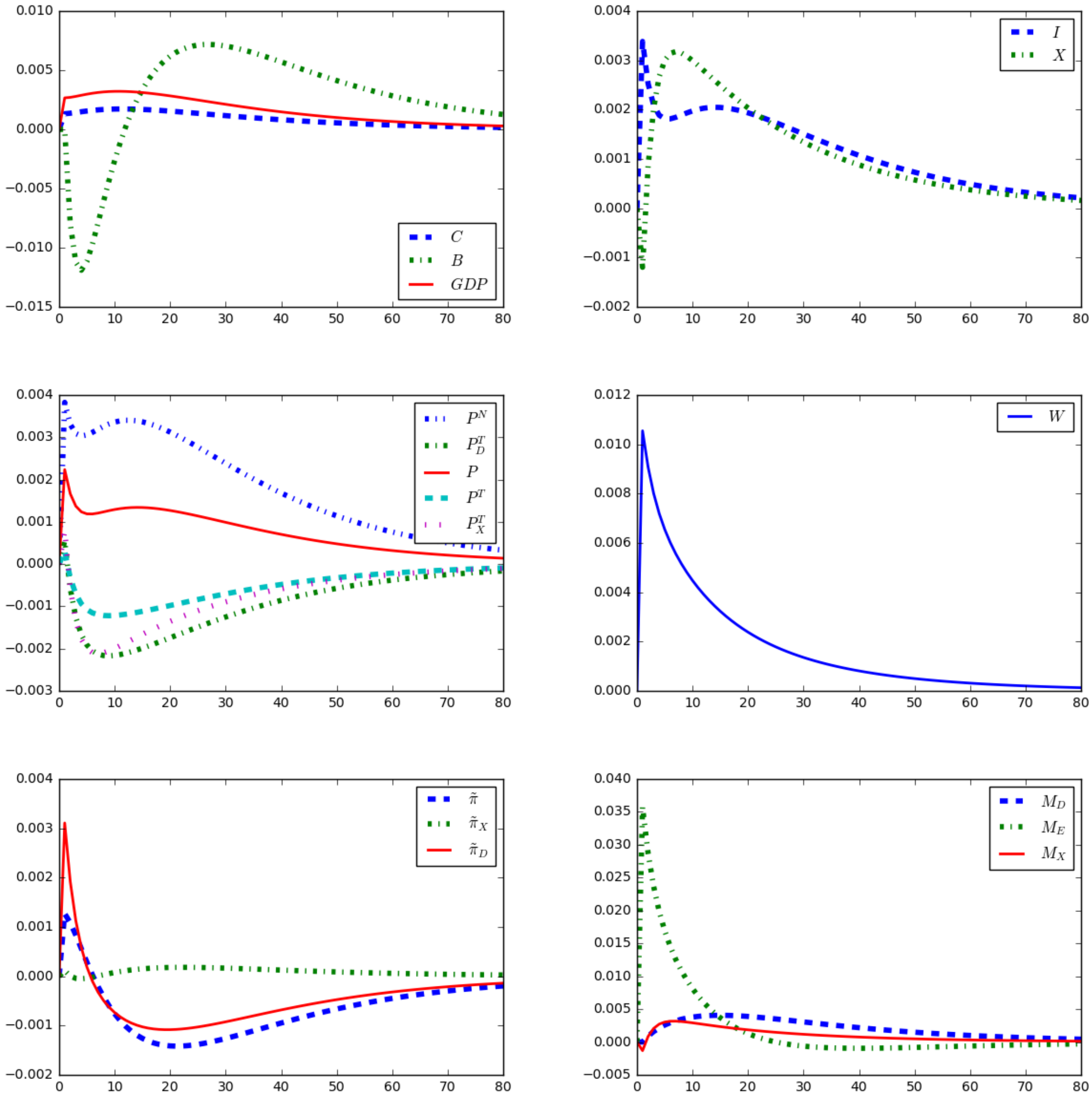
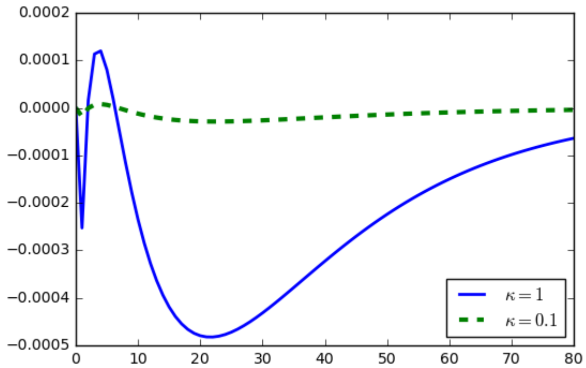
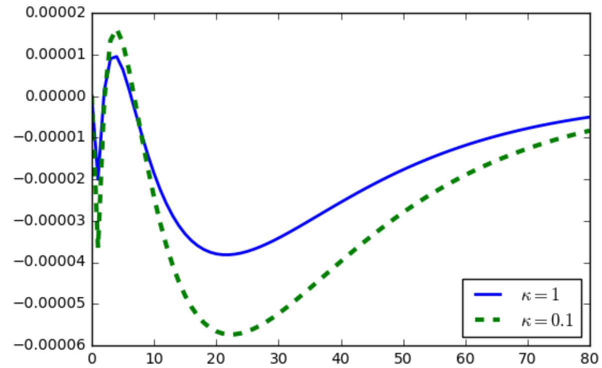


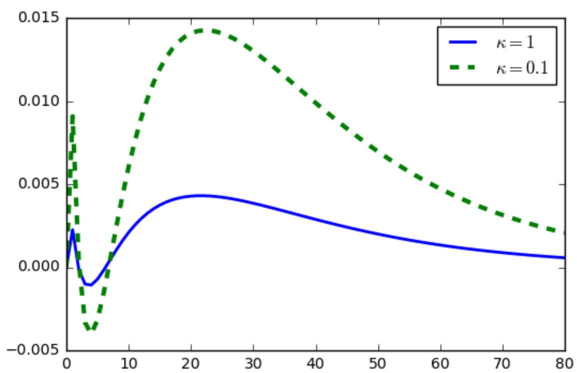
Figure C.7: Responses (level deviation) of extensive margin, intensive margin, and selection ($\sigma = 2.5$)



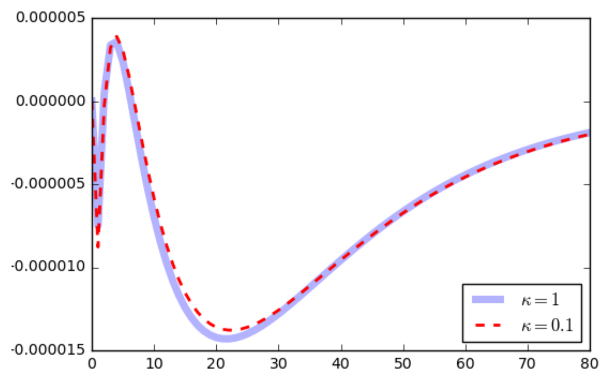
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$

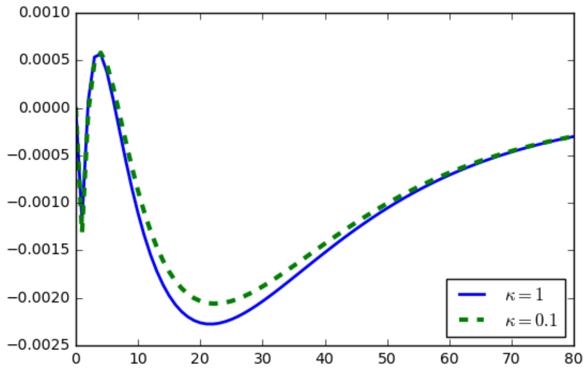


(c) Selection $(\tilde{a}_{X,t})$

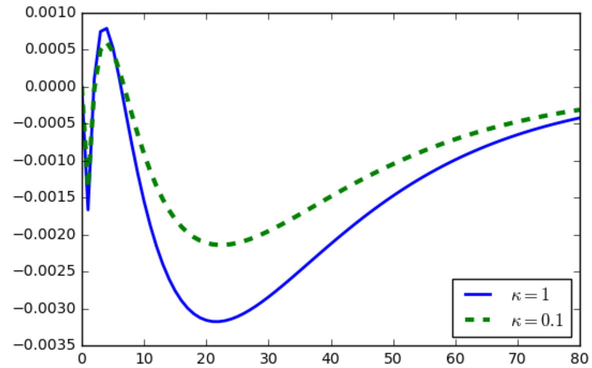


(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

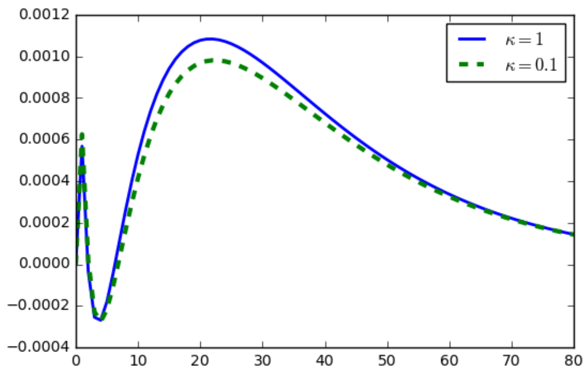
Figure C.8: Responses (percentage deviation) of extensive margin, intensive margin, and selection ($\sigma = 2.5$)



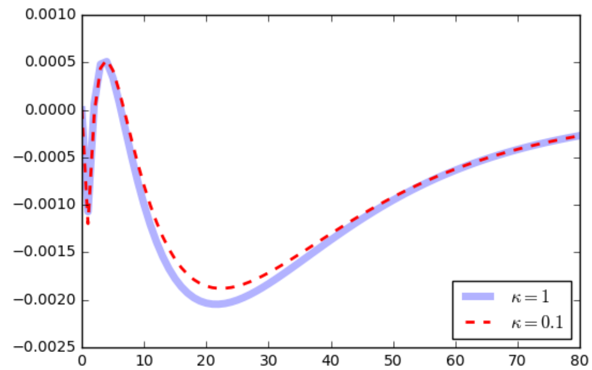
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$

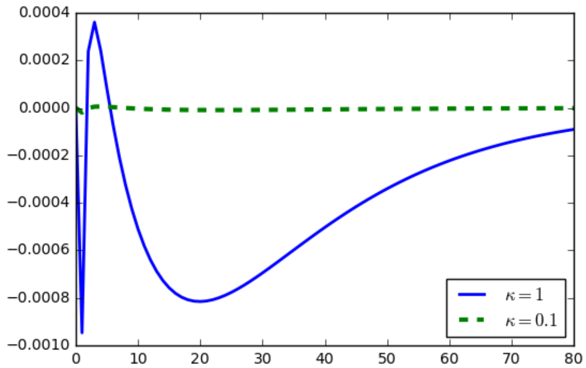


(c) Selection $(\tilde{a}_{X,t})$

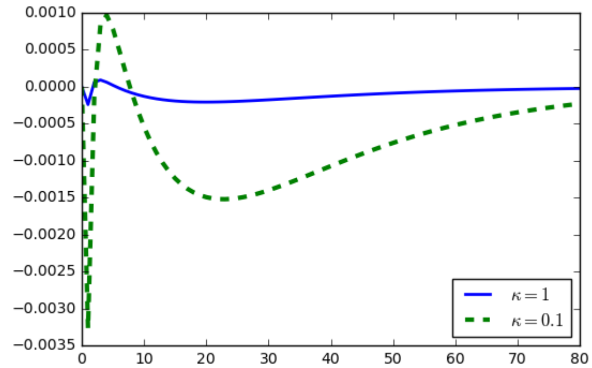


(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

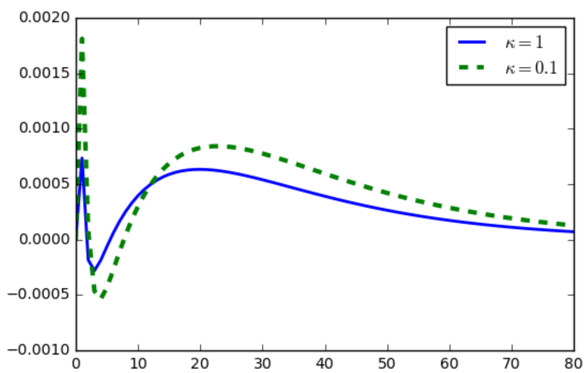
Figure C.9: Responses (level deviation) of extensive margin, intensive margin, and selection ($\sigma = 2.5$, $\alpha = 7.1$)



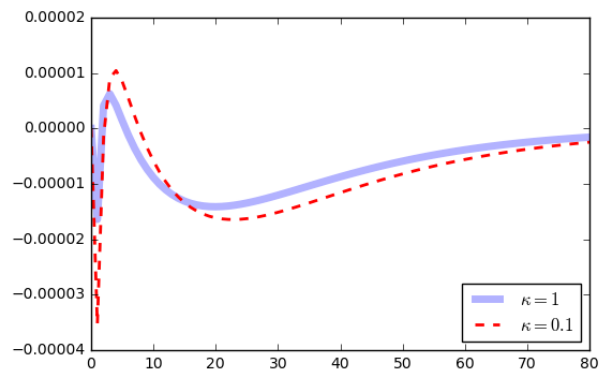
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$

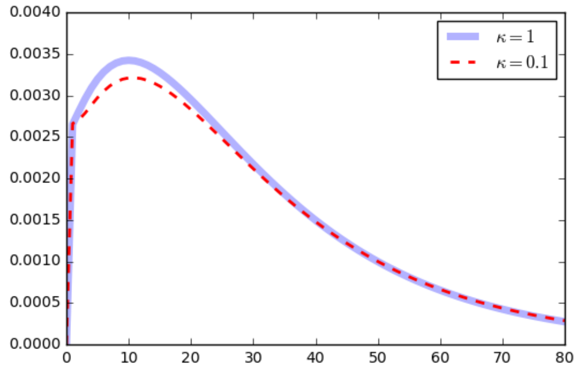


(c) Selection $(\tilde{a}_{X,t})$

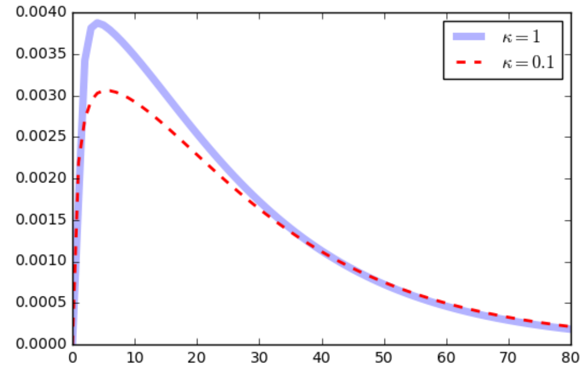


(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

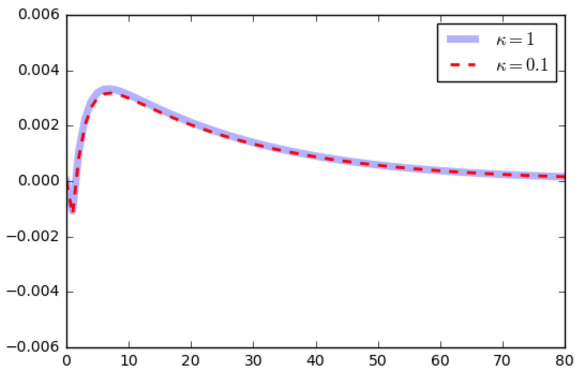
Figure C.10: Impulse responses with different α and κ ($\sigma = 2.5$)



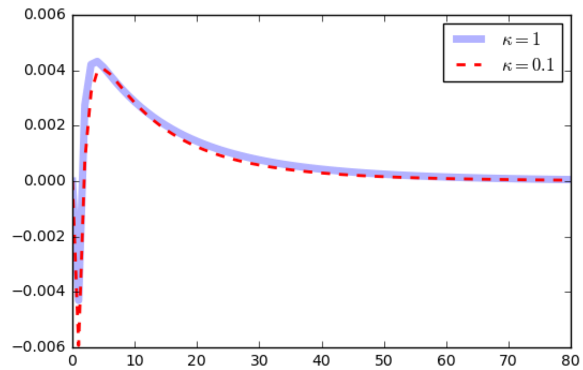
(a) GDP ($\alpha = 2.1$)



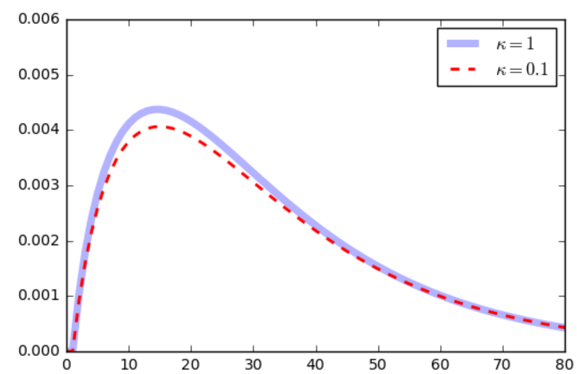
(b) GDP ($\alpha = 7.1$)



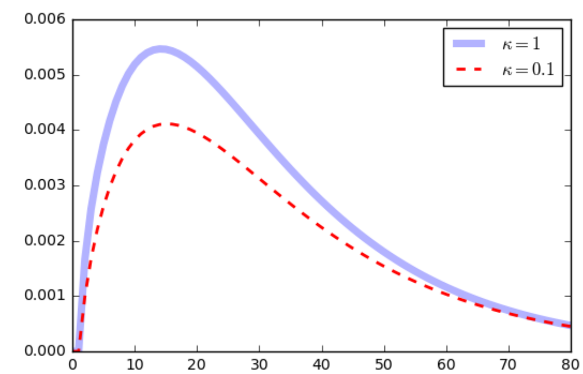
(c) X ($\alpha = 2.1$)



(d) X ($\alpha = 7.1$)

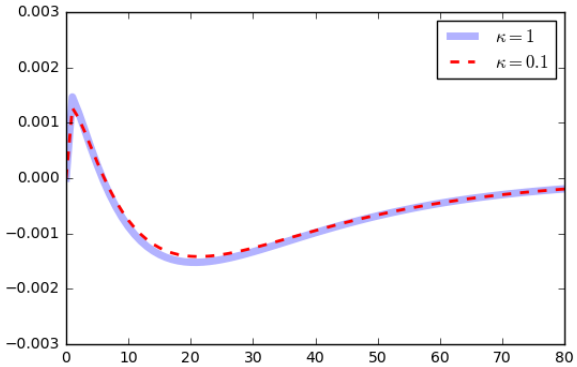


(e) M_D ($\alpha = 2.1$)

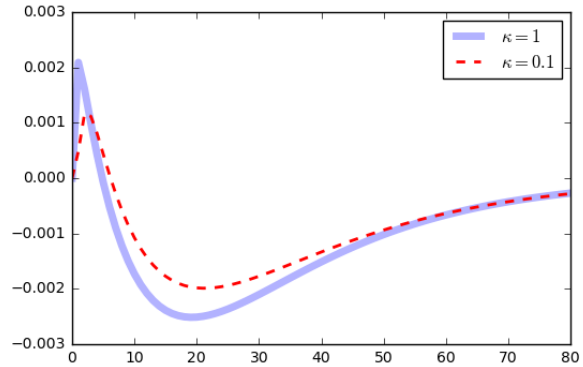


(f) M_D ($\alpha = 7.1$)

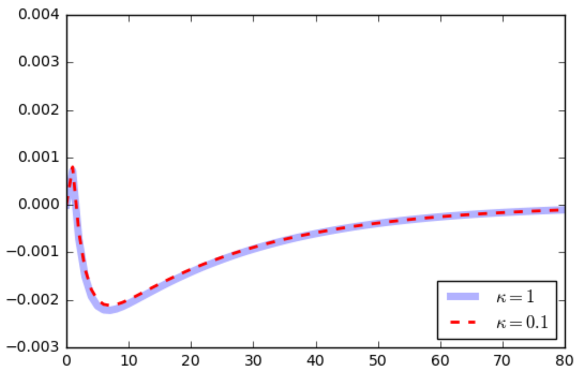
Figure A.10 (continued): Impulse responses with different α and κ ($\sigma = 2.5$)



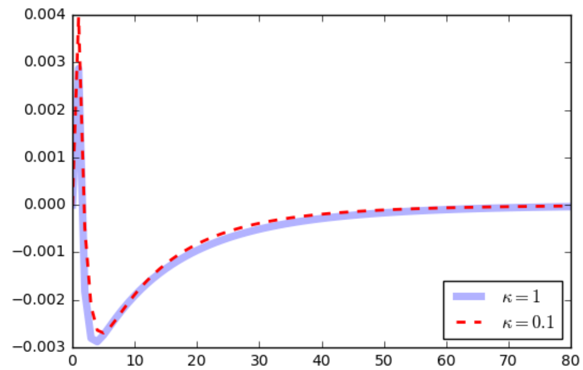
(g) $\tilde{\pi}$ ($\alpha = 2.1$)



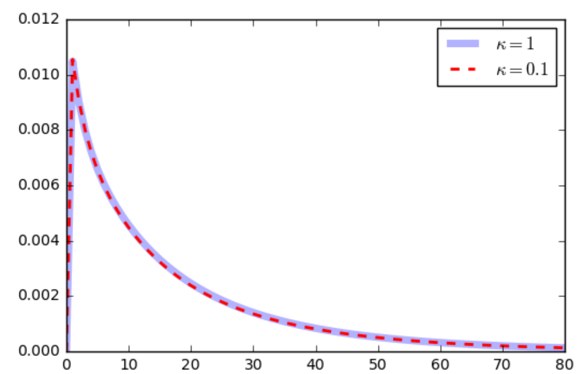
(h) $\tilde{\pi}$ ($\alpha = 7.1$)



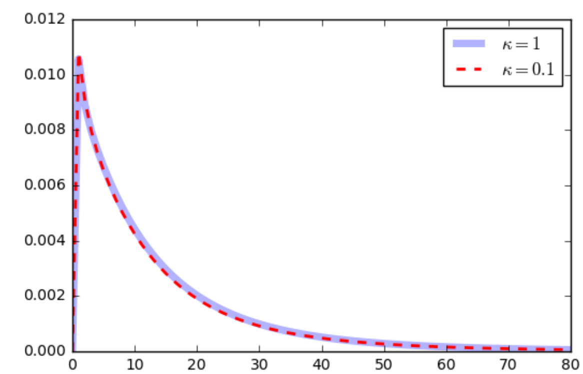
(i) P_X ($\alpha = 2.1$)



(j) P_X ($\alpha = 7.1$)



(k) W ($\alpha = 2.1$)



(l) W ($\alpha = 7.1$)

Figure C.11: Responses to a P^* shock of 1% ($\kappa = 1$)

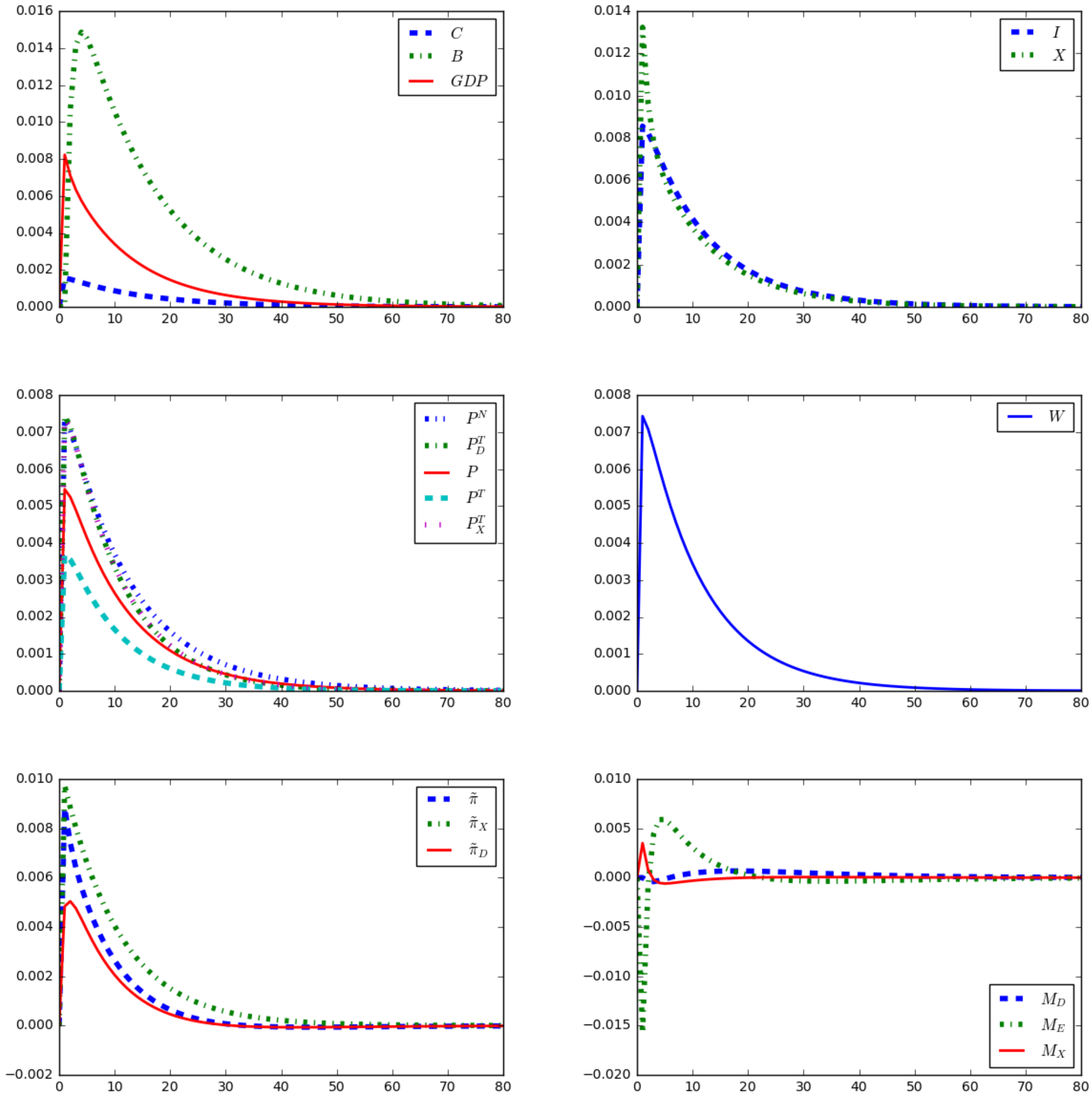


Figure C.12: Responses to a P^* shock of 1% ($\kappa = 0.1$)

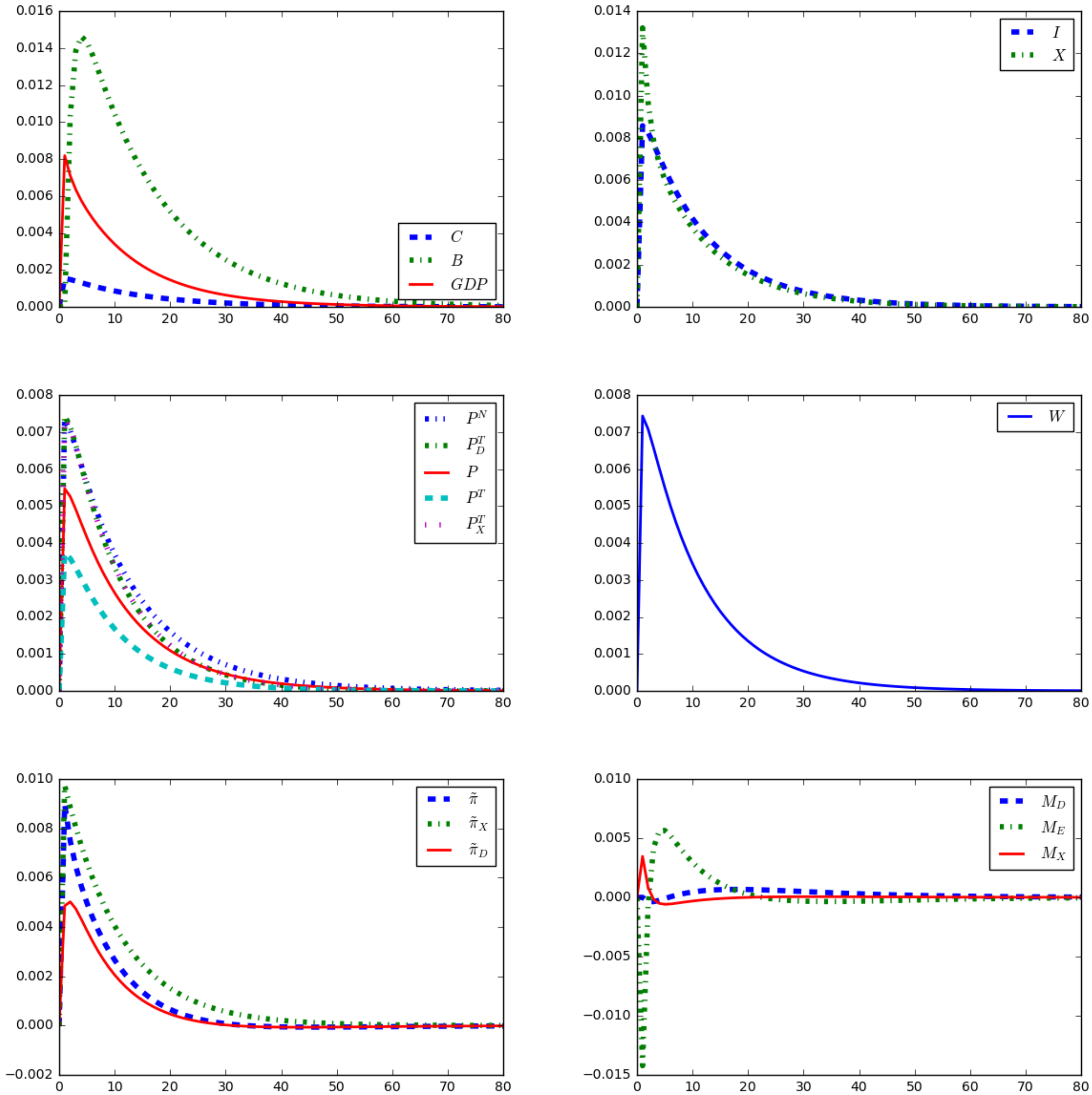
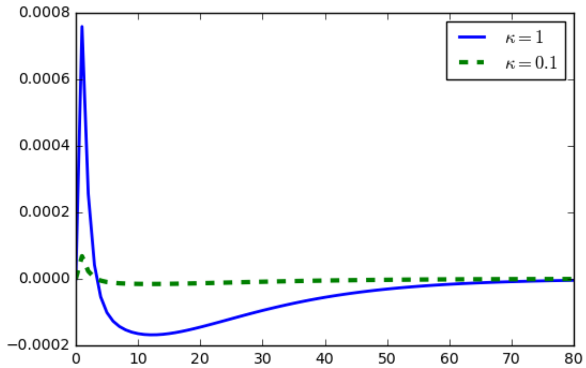
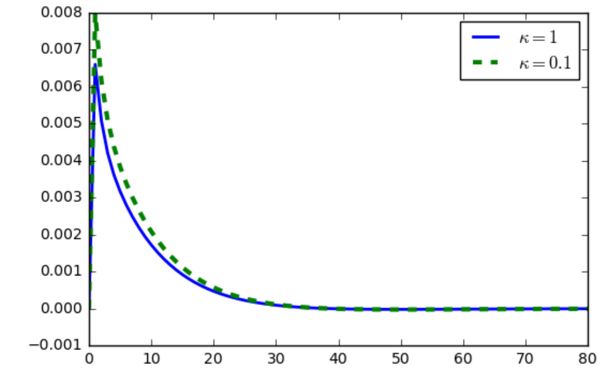


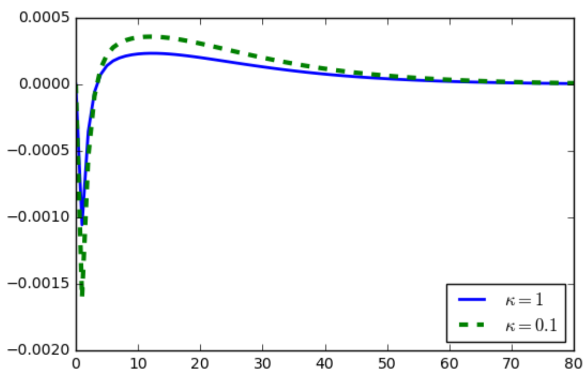
Figure C.13: Responses (level deviation) of extensive margin, intensive margin, and selection (P^* shock)



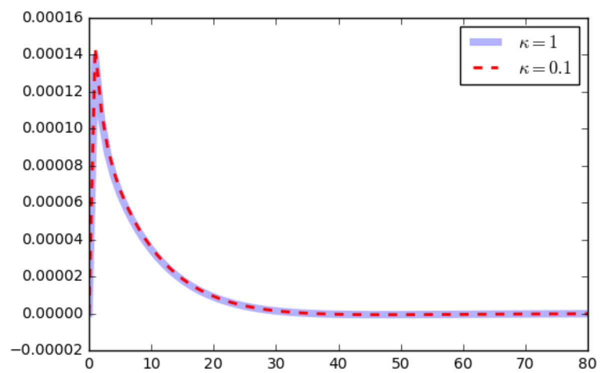
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$

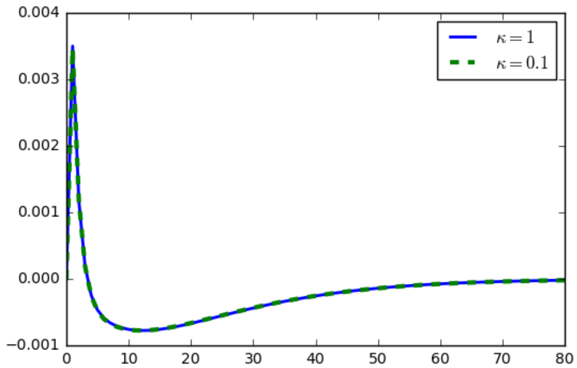


(c) Selection $(\tilde{a}_{X,t})$

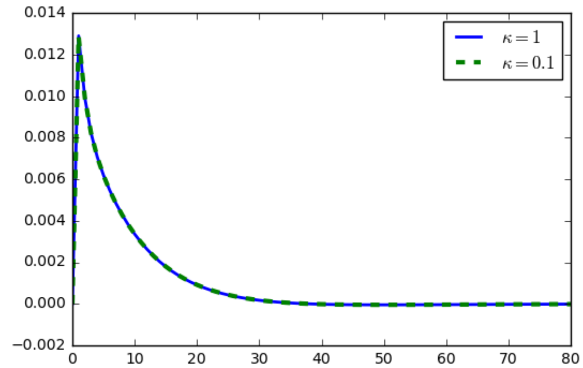


(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

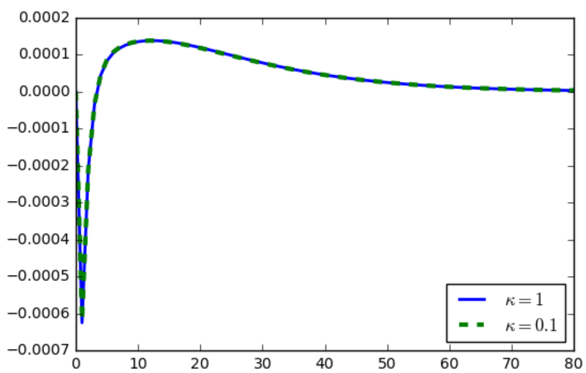
Figure C.14: Responses (percentage deviation) of extensive margin, intensive margin, and selection (P^* shock)



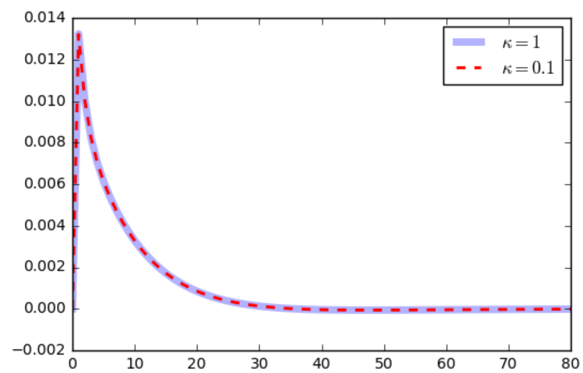
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$



(c) Selection $(\tilde{a}_{X,t})$



(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

Figure C.15: Responses to an A shock of 1% with zero CA ($\kappa = 1$)

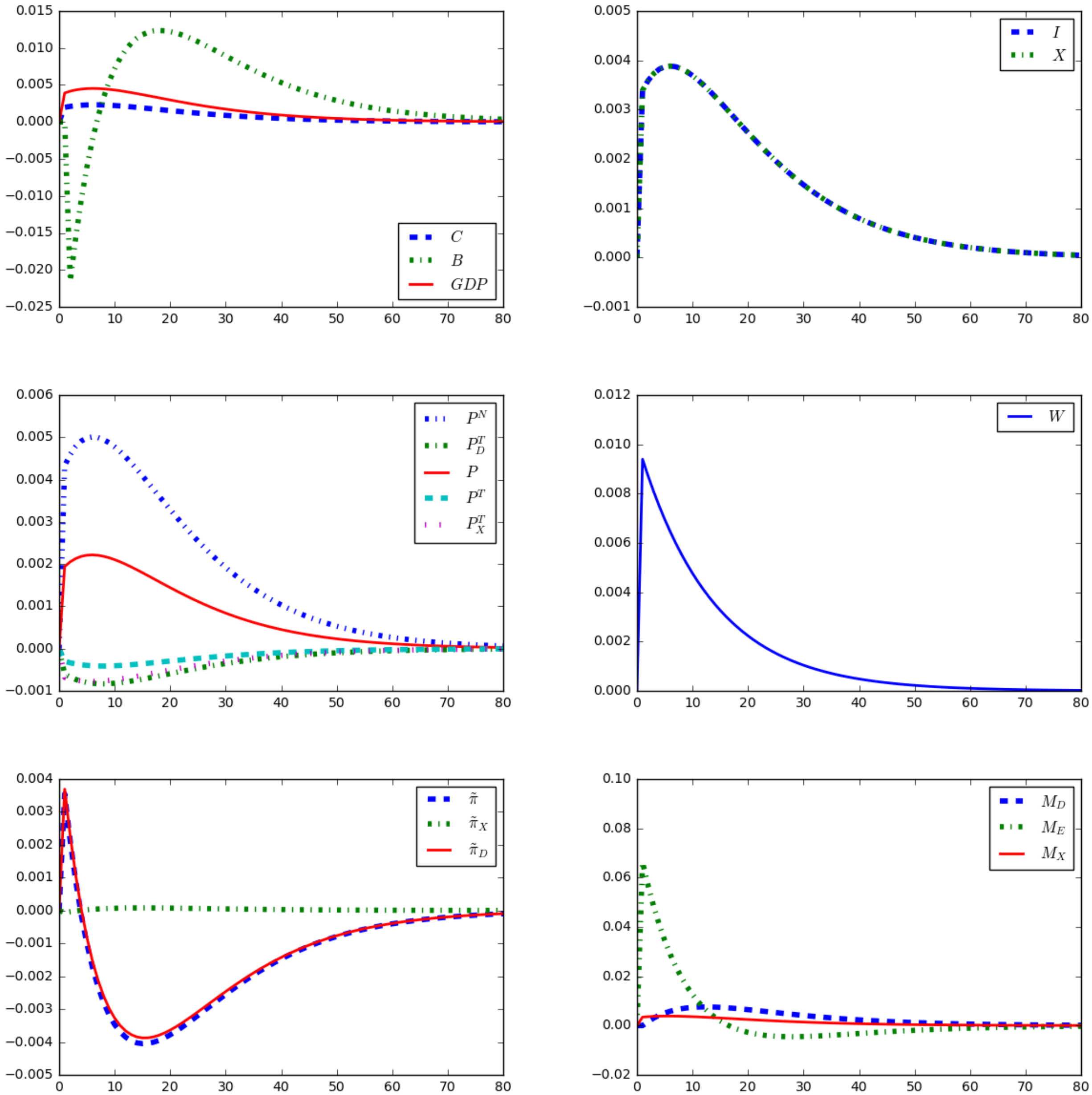


Figure C.16: Responses to an A shock of 1% with zero CA ($\kappa = 0.1$)

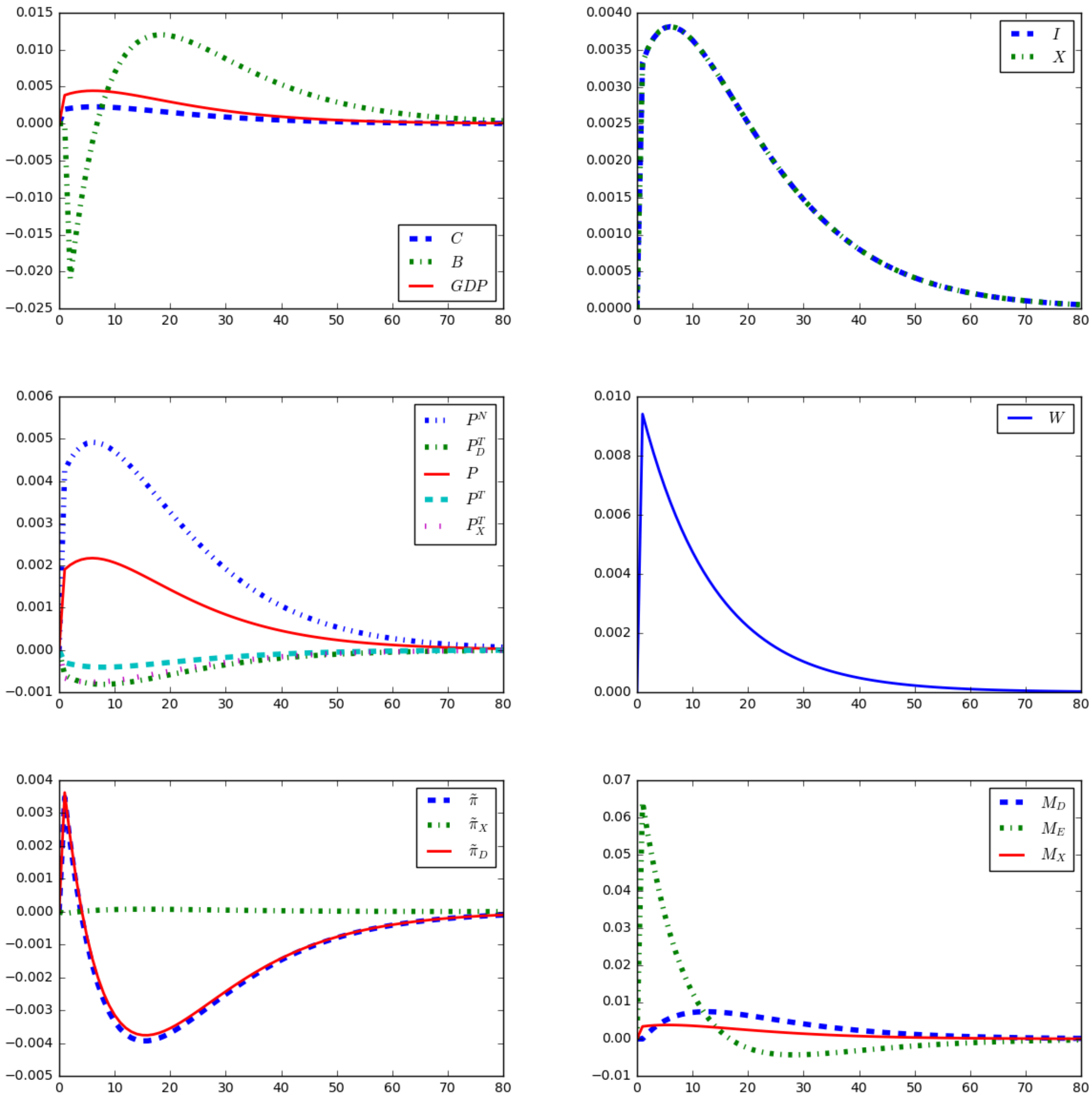
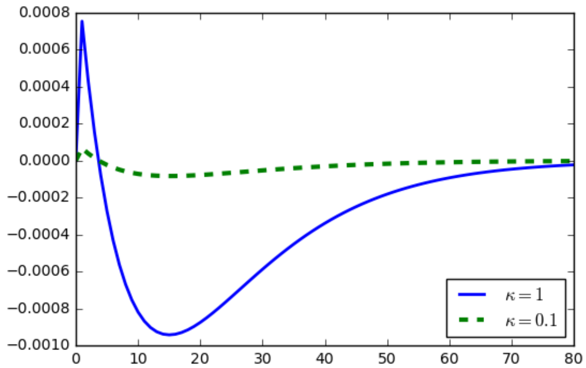
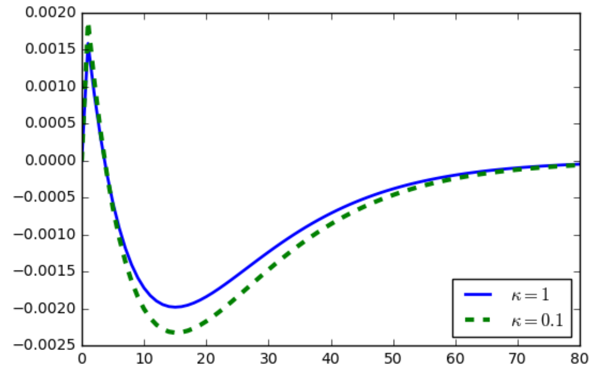


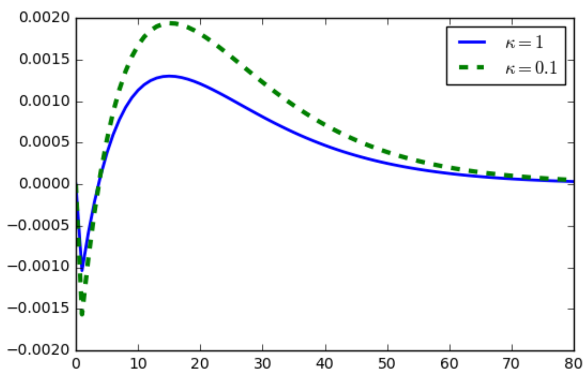
Figure C.17: Responses (level deviation) of extensive margin, intensive margin, and selection (zero CA)



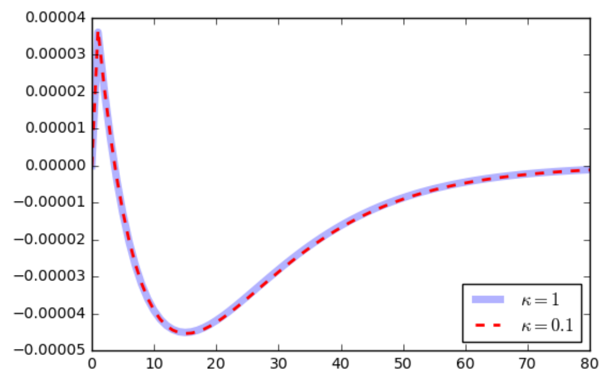
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$

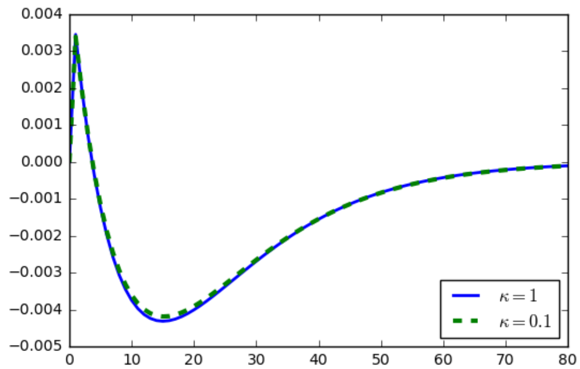


(c) Selection $(\tilde{a}_{X,t})$

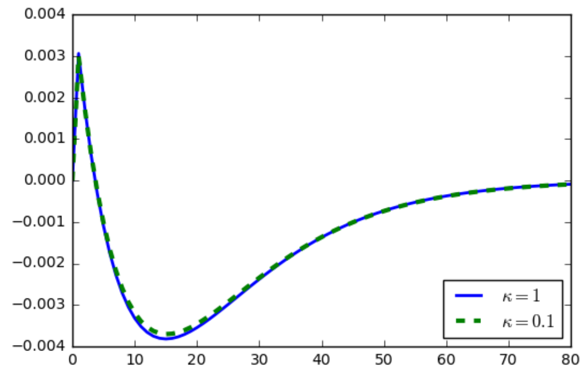


(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

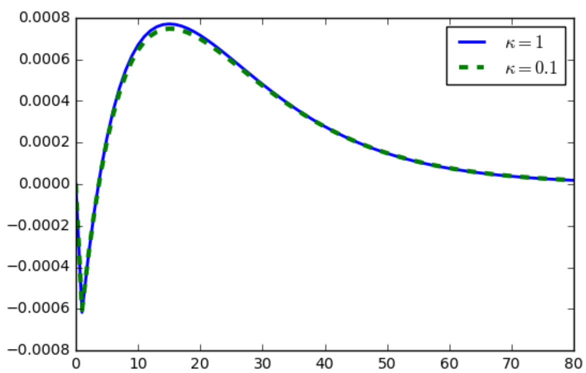
Figure C.18: Responses (percentage deviation) of extensive margin, intensive margin, and selection (zero CA)



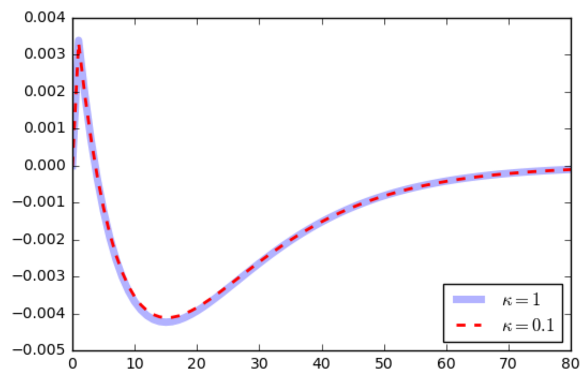
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$



(c) Selection $(\tilde{a}_{X,t})$



(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

Figure C.19: Responses to an A shock of 1% without the nontradable sector ($\kappa = 1$)

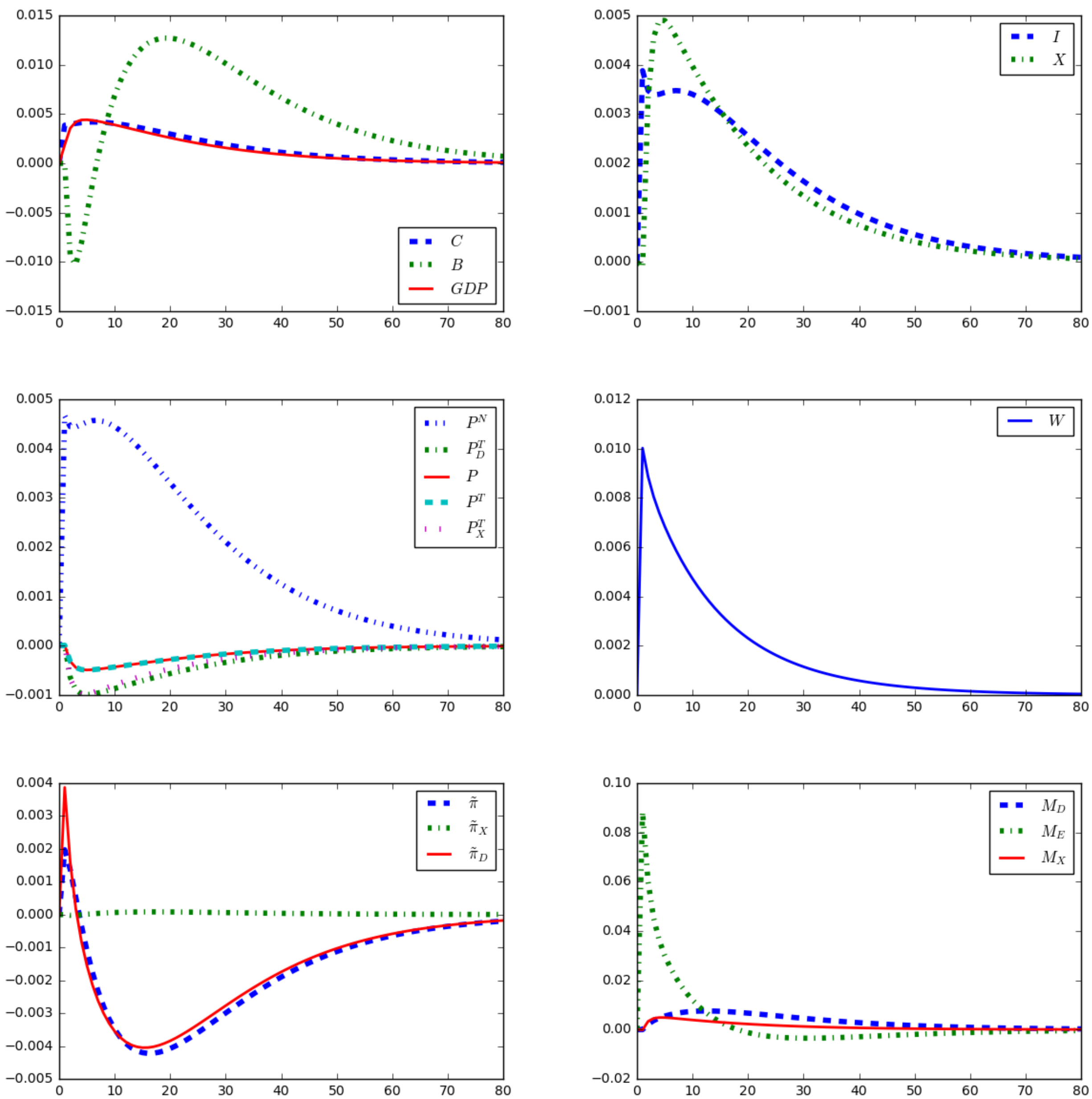


Figure C.20: Responses to an A shock of 1% without the nontradable sector ($\kappa = 0.1$)

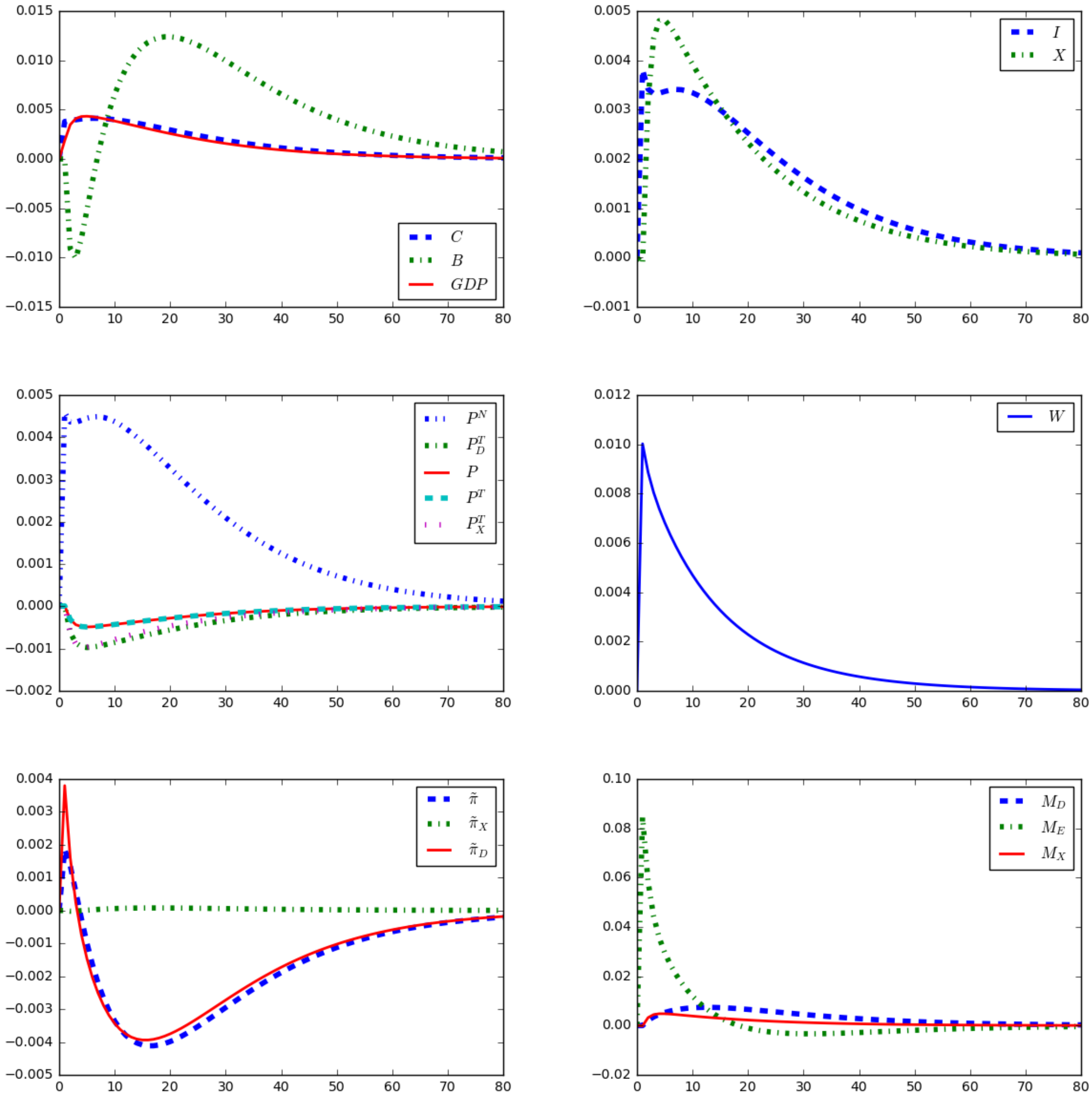
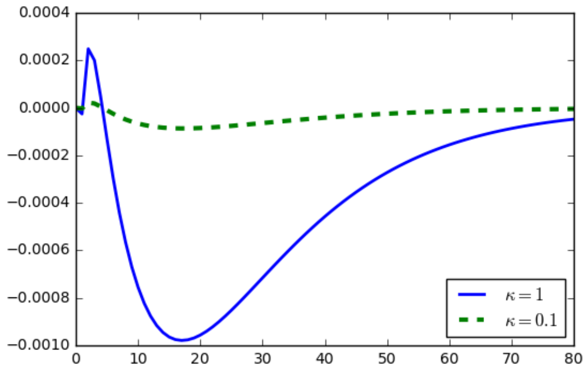
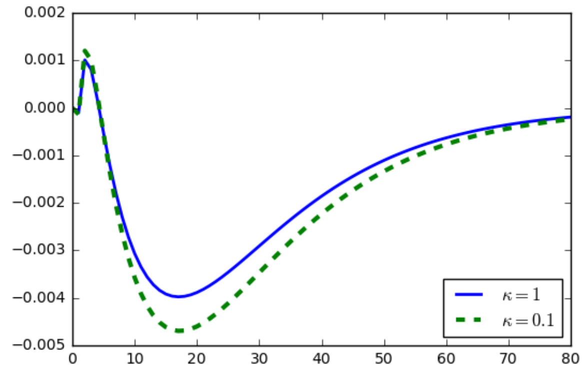


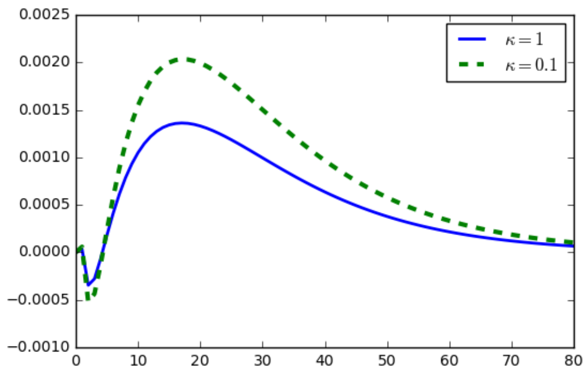
Figure C.21: Responses (level deviation) of extensive margin, intensive margin, and selection (without nontradables)



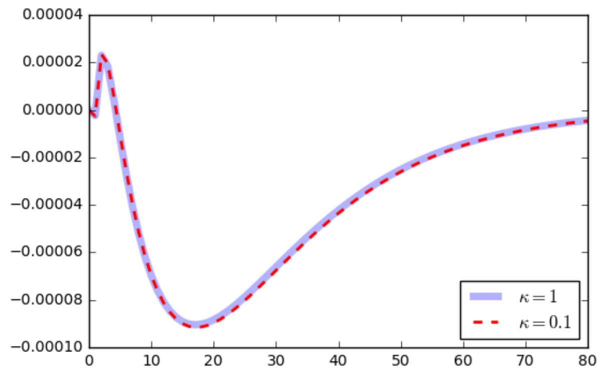
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$

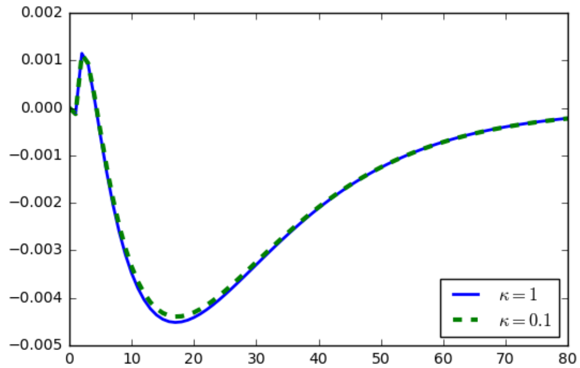


(c) Selection $(\tilde{a}_{X,t})$

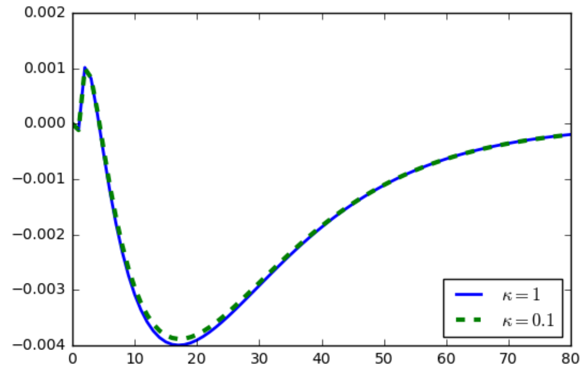


(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

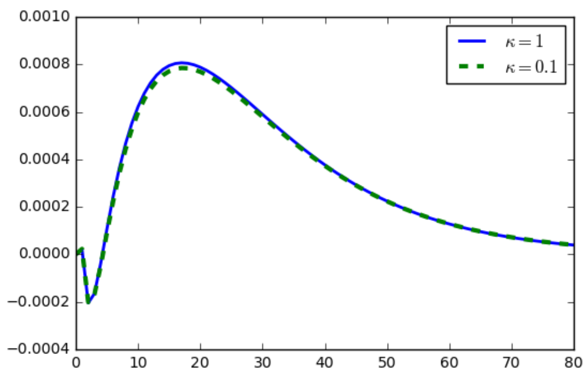
Figure C.22: Responses (percentage deviation) of extensive margin, intensive margin, and selection (without nontradables)



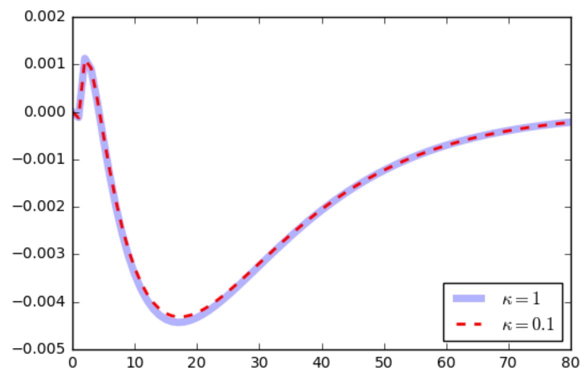
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$



(c) Selection $(\tilde{a}_{X,t})$



(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

Figure C.23: Responses to an A shock of 1% ($\kappa = 1$)

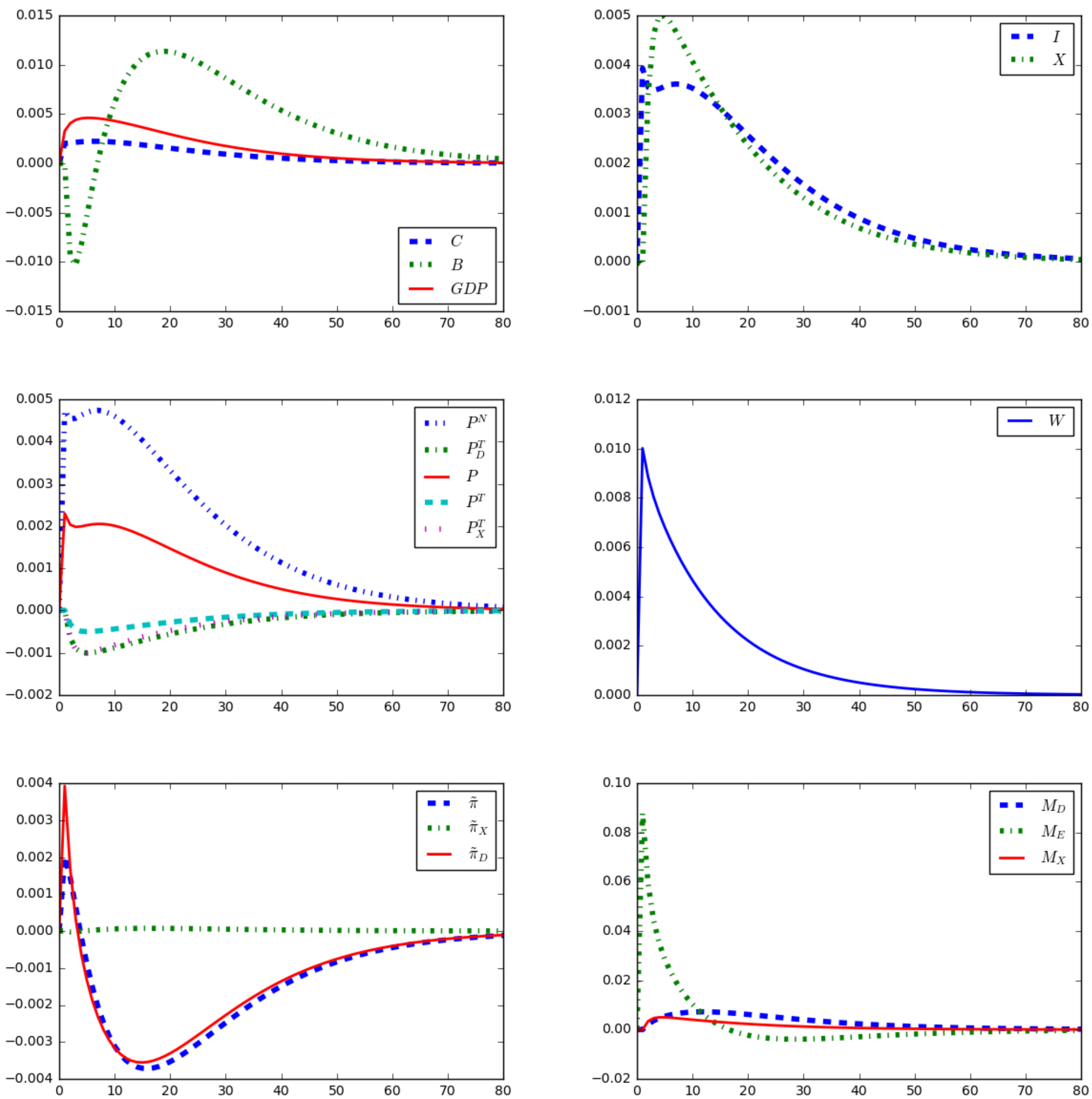


Figure C.24: Response to an A shock of 1% ($\kappa = 0.55$)

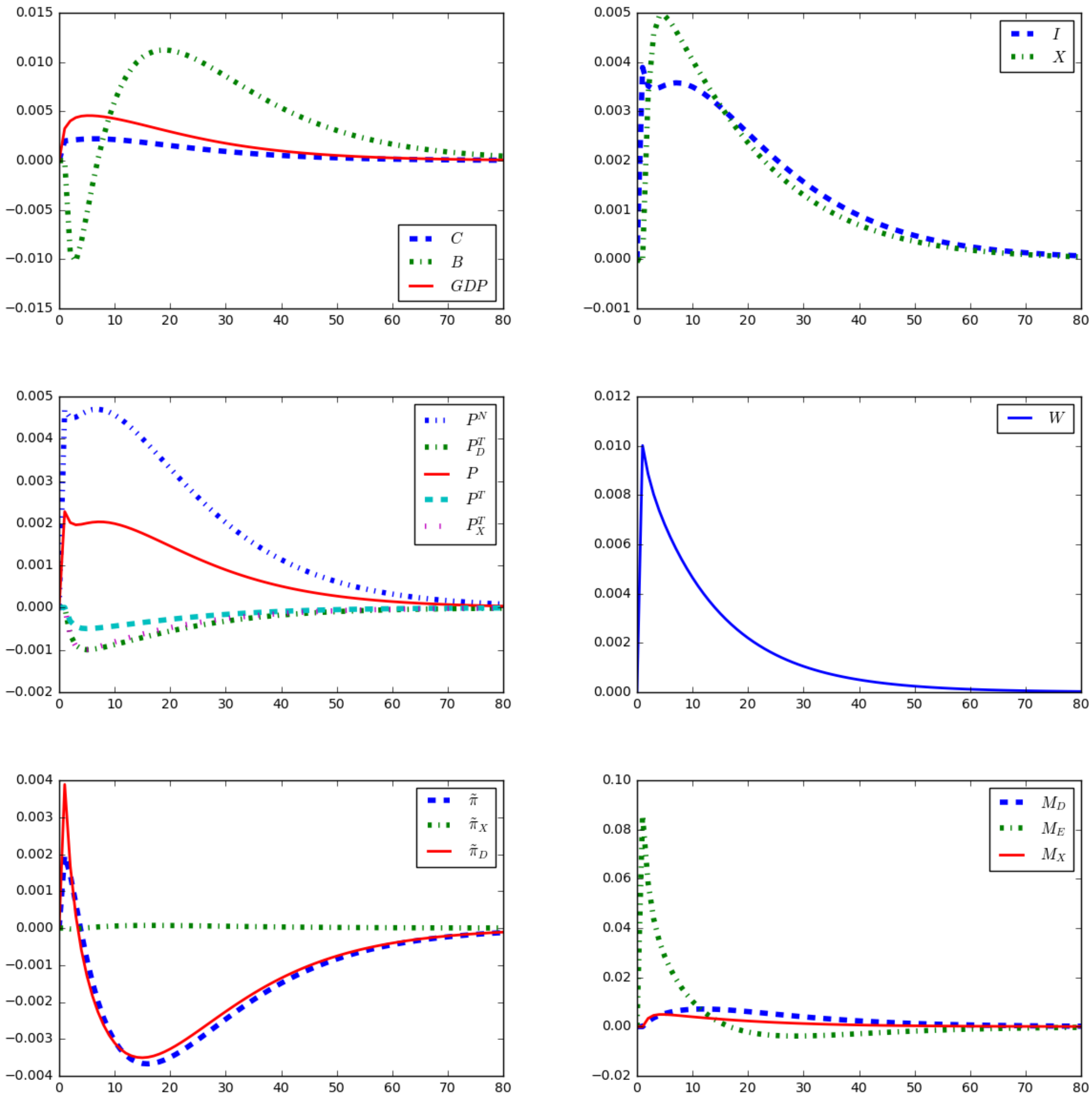
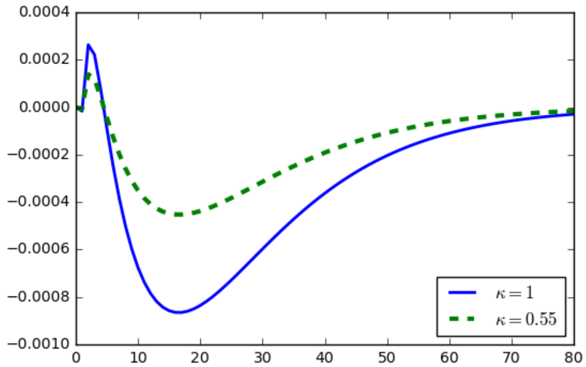
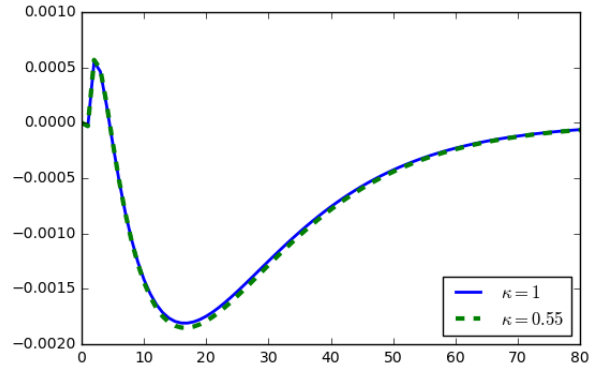


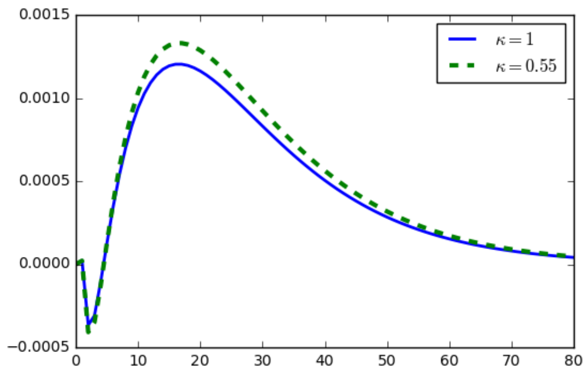
Figure C.25: Responses (level deviation) of extensive margin, intensive margin, and selection



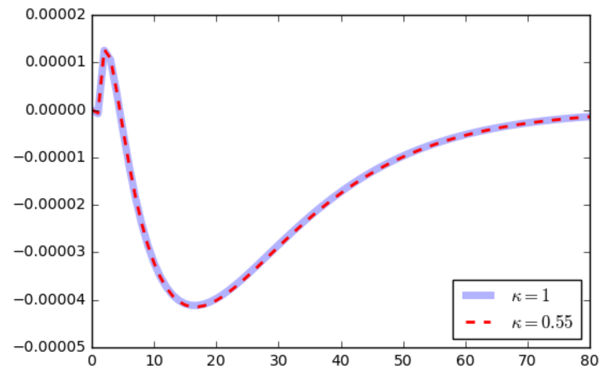
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$

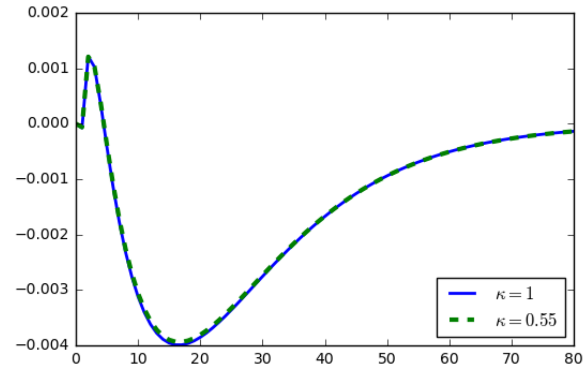


(c) Selection $(\tilde{a}_{X,t})$

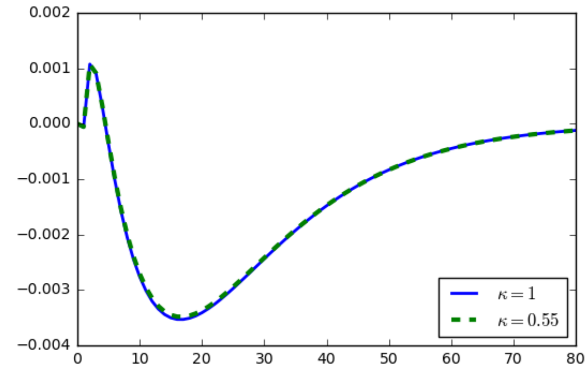


(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

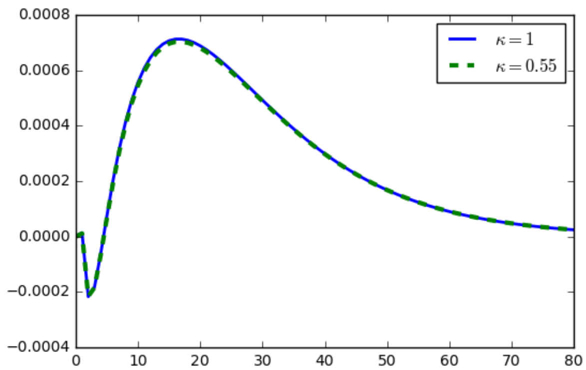
Figure C.26: Responses (percentage deviation) of extensive margin, intensive margin, and selection



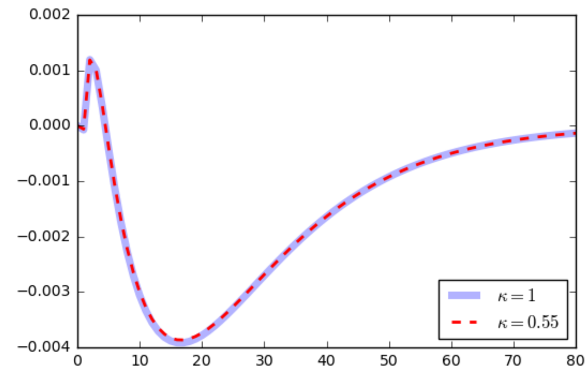
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$



(c) Selection $(\tilde{a}_{X,t})$



(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

Figure C.27: Responses to an A shock of 1% ($\kappa = 1$, $q_X^{rem} = 15$)

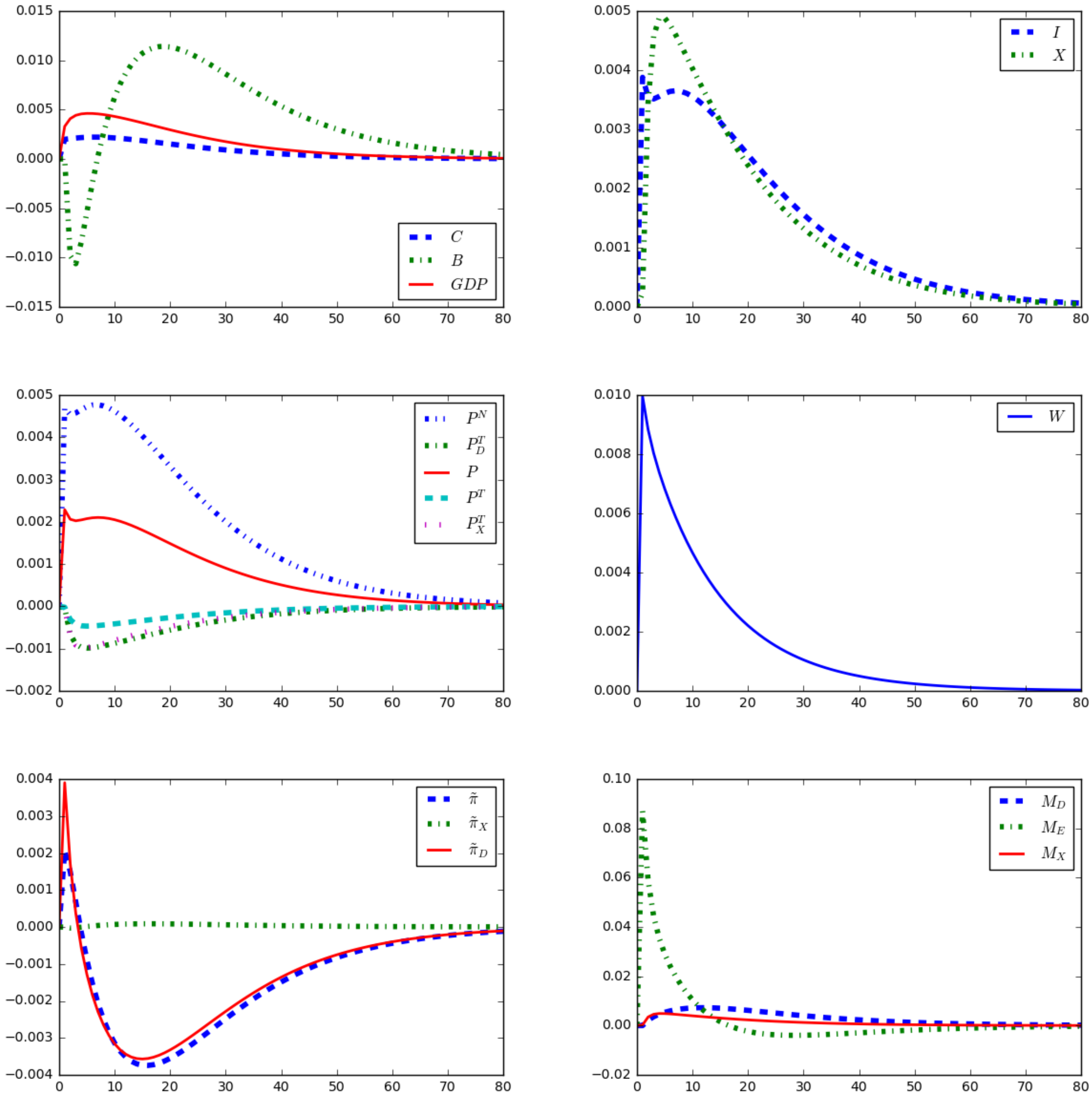


Figure C.28: Responses to an A shock of 1% ($\kappa = 0.1$, $q_X^{rem} = 15$)

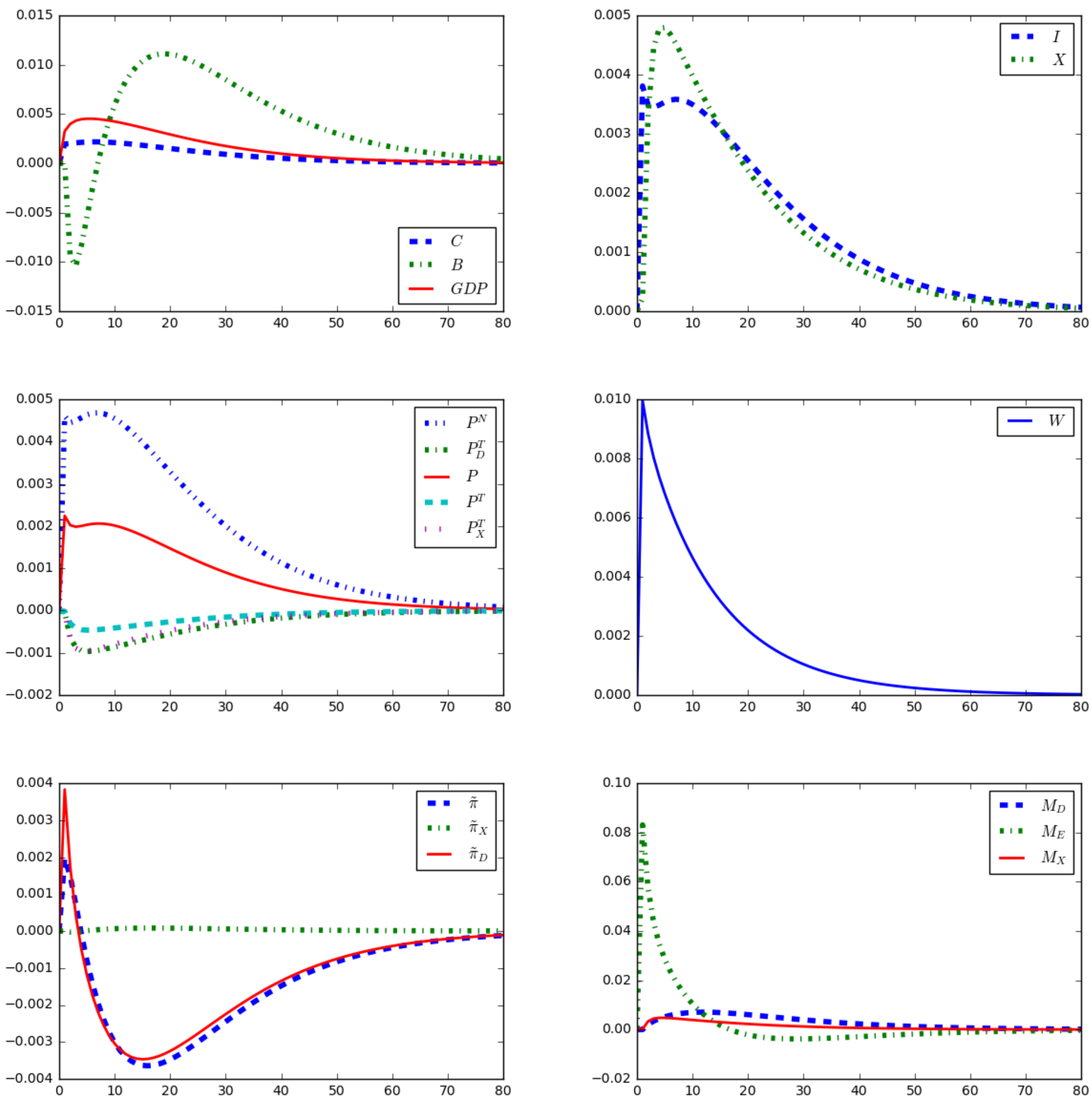
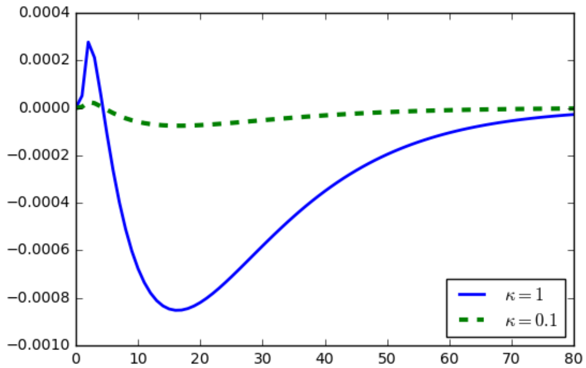
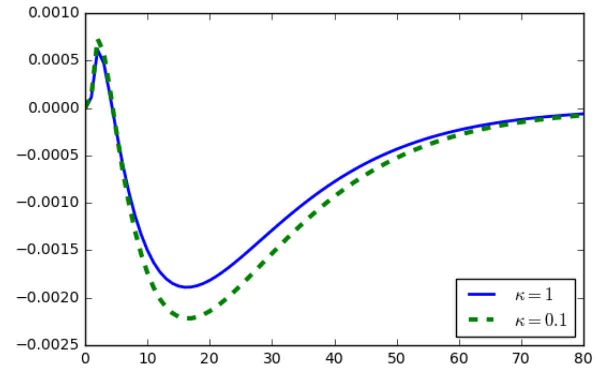


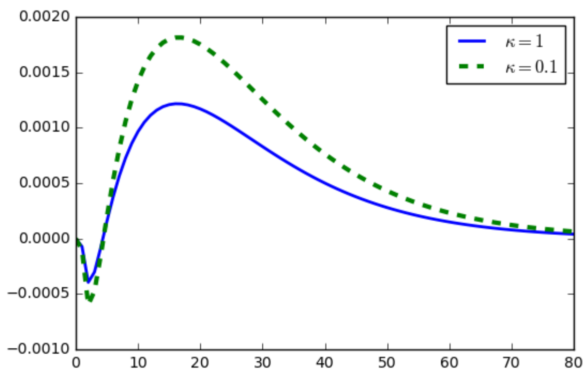
Figure C.29: Responses (level deviation) of extensive margin, intensive margin, and selection ($q_X^{rem} = 15$)



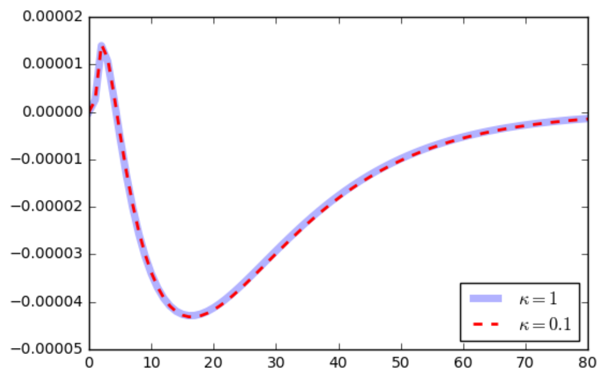
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$

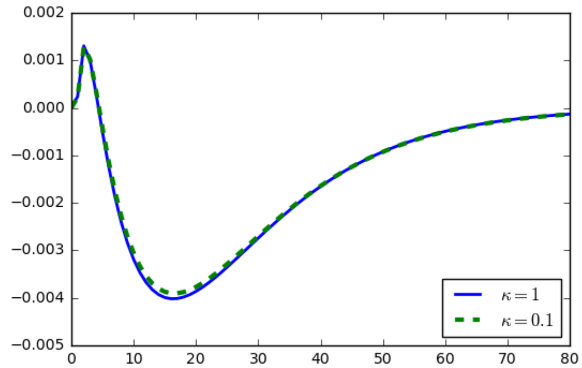


(c) Selection $(\tilde{a}_{X,t})$

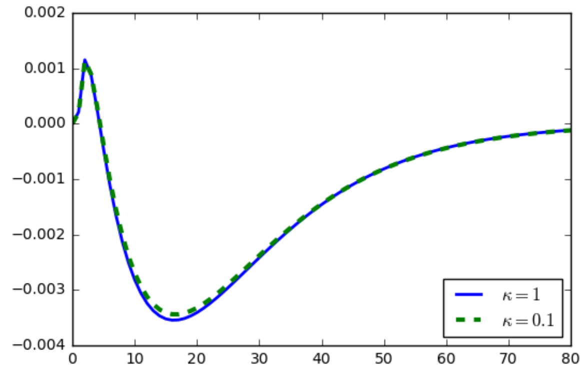


(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

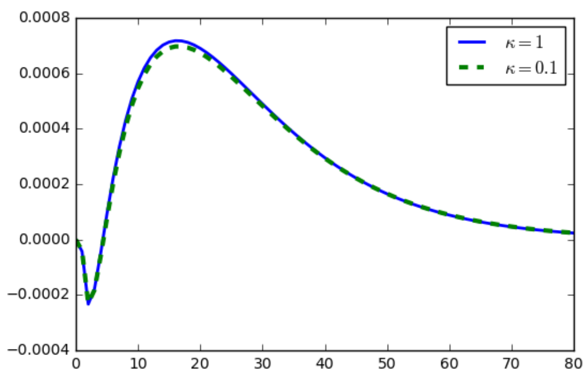
Figure C.30: Responses (percentage deviation) of extensive margin, intensive margin, and selection ($q_X^{rem} = 15$)



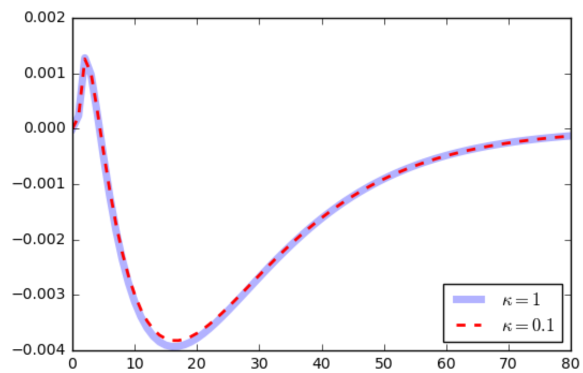
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$



(c) Selection $(\tilde{a}_{X,t})$



(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{X,t})$

Figure C.31: Responses to an A shock of 1% (GHH, $\lambda = 0.001$, $\kappa = 1$)

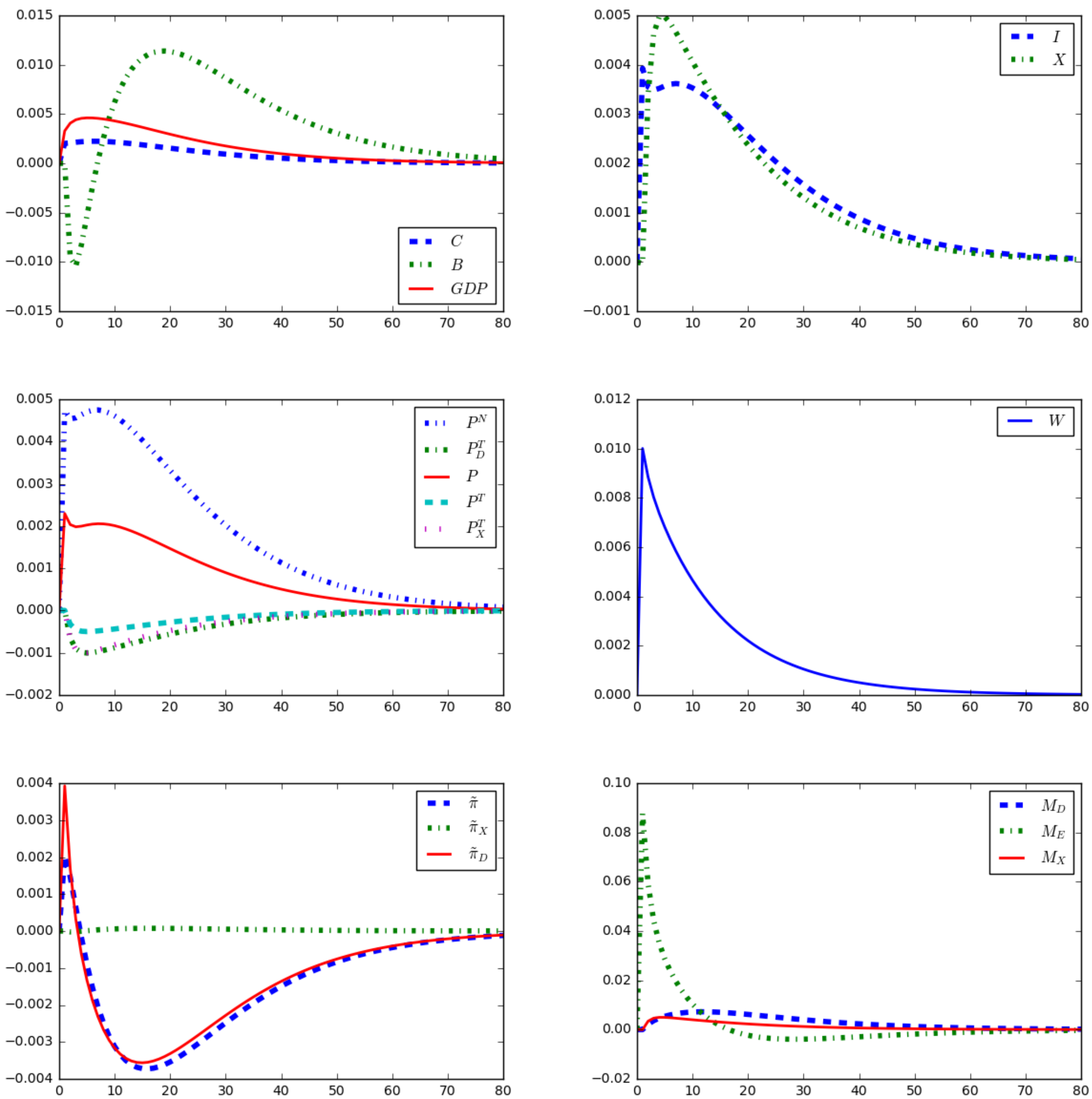


Figure C.32: Responses to an A shock of 1% (GHH, $\lambda = 0.001$, $\kappa = 0.1$)

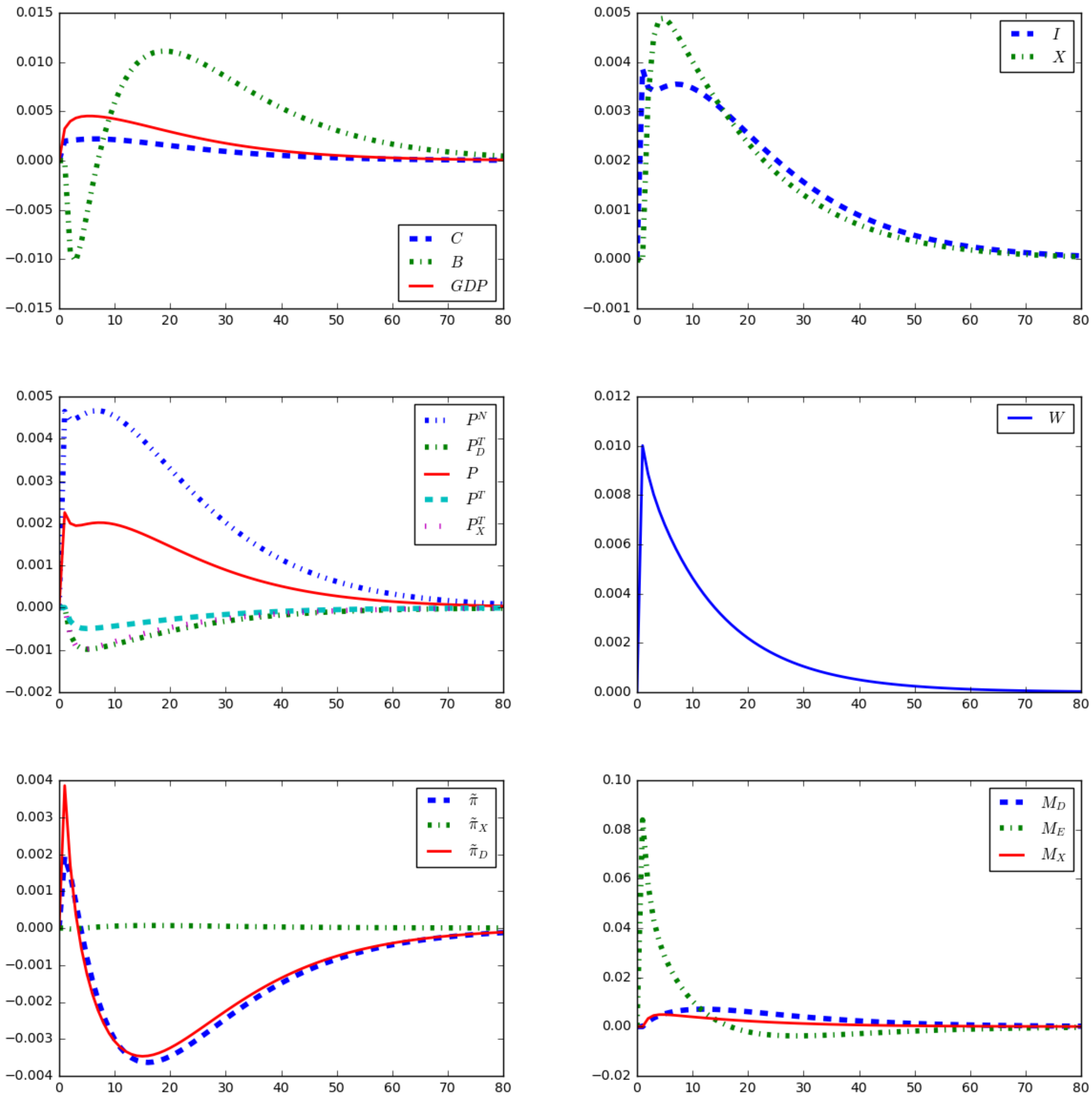
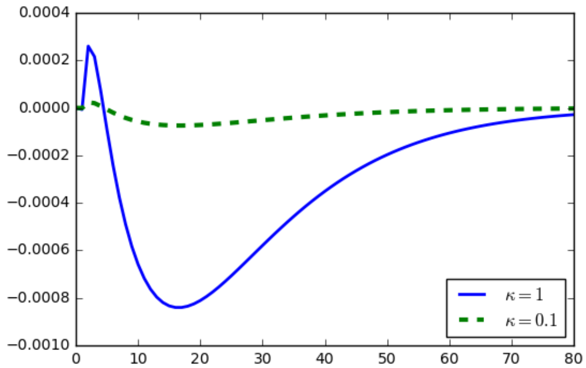
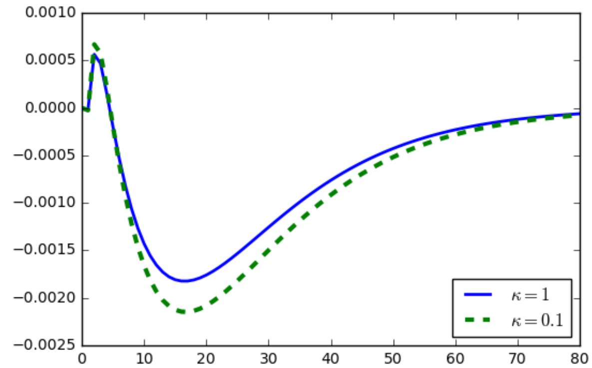


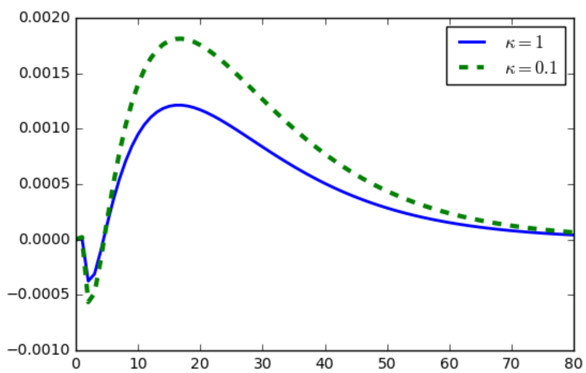
Figure C.33: Responses (level deviation) of extensive margin, intensive margin, and selection (GHH, $\lambda = 0.001$)



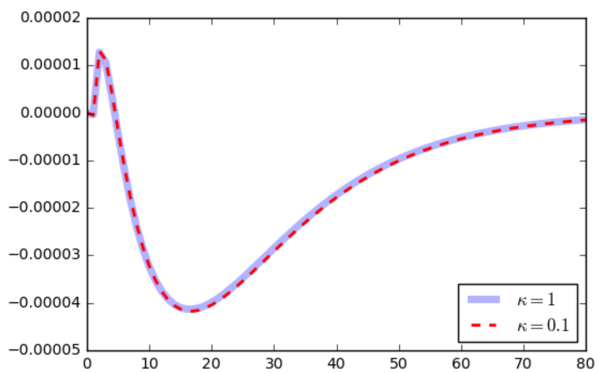
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$

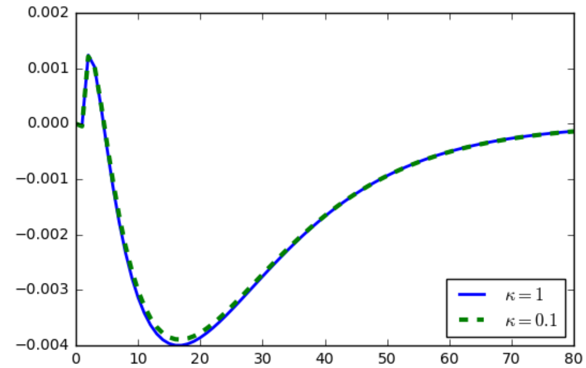


(c) Selection $(\tilde{a}_{X,t})$

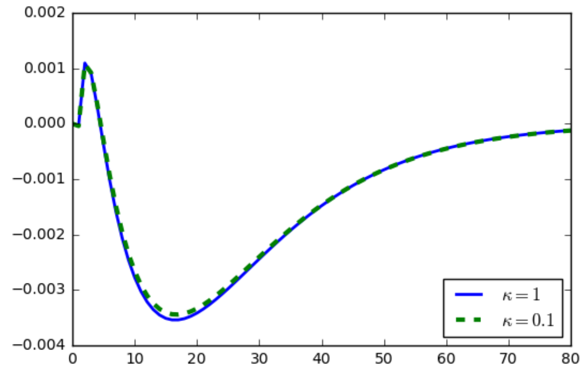


(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{\kappa,t})$

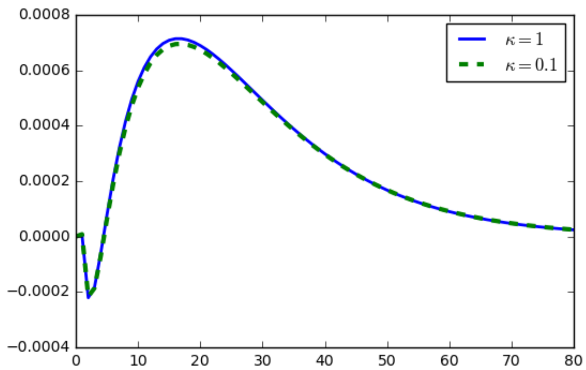
Figure C.34: Responses (percentage deviation) of extensive margin, intensive margin, and selection (GHH, $\lambda = 0.001$)



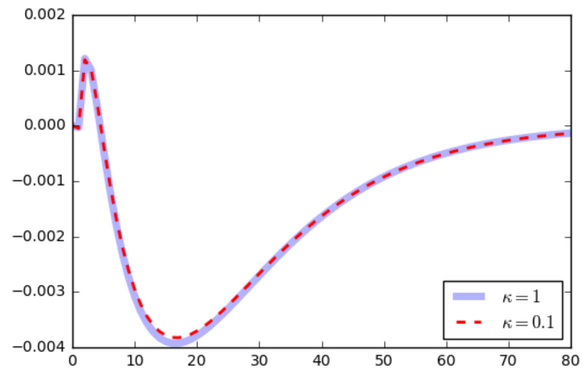
(a) Extensive margin $(1 - G(\bar{a}_{\kappa,t}))$



(b) Intensive margin $(\pi_{X,t}(\tilde{a}_X^{ss}))$

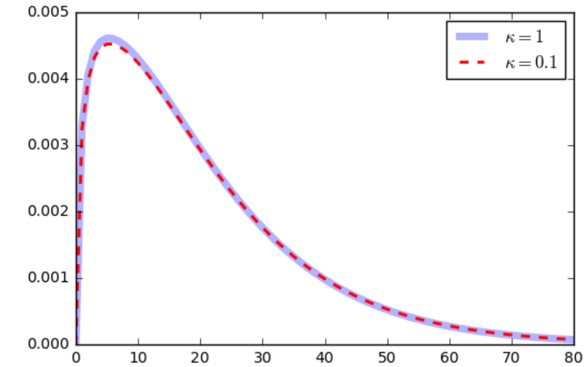


(c) Selection $(\tilde{a}_{X,t})$

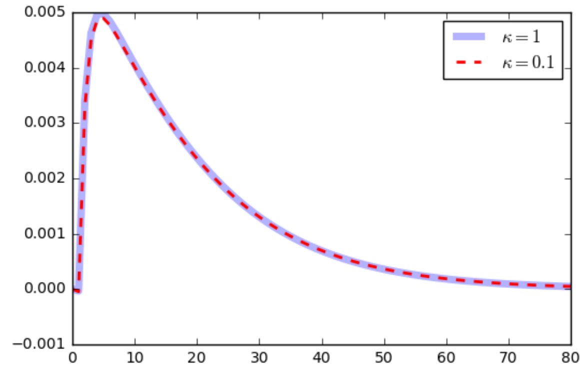


(d) Total export profit $((1 - G(\bar{a}_{\kappa,t}))\tilde{\pi}_{\kappa,t})$

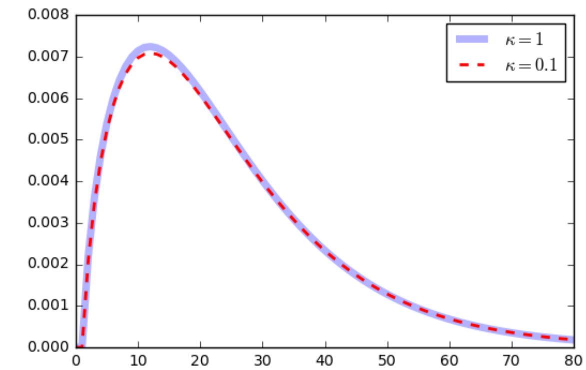
Figure C.35: Impulse responses (GHH, $\lambda = 0.001$)



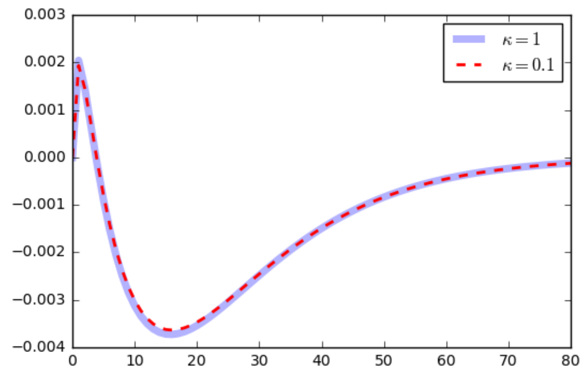
(a) GDP



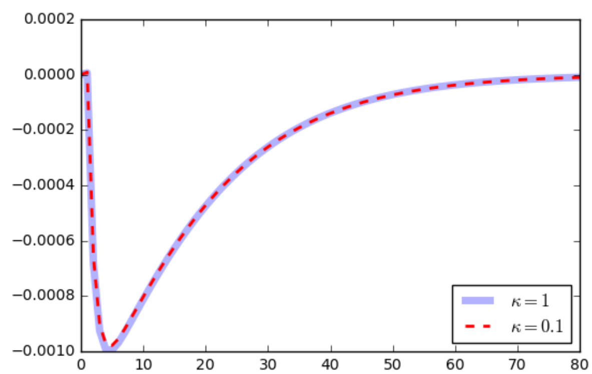
(b) X



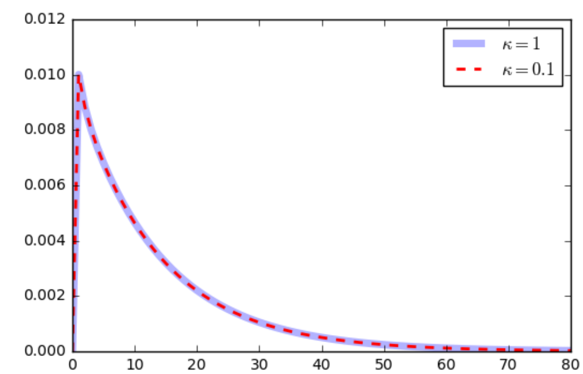
(c) M_D



(d) $\tilde{\pi}$



(e) P_X



(f) W