Banking and Financial Access Reforms, Labor Markets, and Financial Shocks*

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Abstract

The degree of firms' and households' participation in the domestic banking system differs considerably in developing and emerging economies (EMEs) relative to advanced economies (AEs). We use a small-open-economy framework with endogenous firm entry, monopolistic banks, household and firm heterogeneity in access to the banking system, and labor search frictions to analyze the labor market and aggregate consequences of banking and financial access reform in EMEs. While fostering bank competition contributes to smoother unemployment and aggregate fluctuations, bolstering household financial inclusion can offset those gains, especially amid interest rate shocks. Accounting for the prevalence of both financially-excluded firms *and* households in EMEs plays a key role for characterizing the impact of reforms. Our results suggest that, if undertaken, banking reform should be comprehensive by fostering household financial inclusion and bank competition in tandem.

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1 Introduction

The degree of domestic financial and banking development in advanced economies (AEs) and developing and emerging economies (EMEs) differs in three key respects.[1] First, the majority of small firms in EMEs—which account for a significant share of employment, job creation, and the universe of firms—do not participate in the domestic banking system (Beck and Demirgüç-Kunt, 2006; Beck, Demirgüç-Kunt, and Martínez Pería, 2007; IFC, 2010, 2013; Ayyagari, Demirgüç-Kunt, and Maksimovic, 2011). This stands in contrast with the majority of firms in AEs, most of which have access to bank credit. Second, less than 50 percent of the population in EMEs holds an account at financial institutions, compared to more than 90 percent in AEs (Global Financial Development Report, 2014, henceforth GFDR, 2014). Third, EMEs' banking sectors tend to be less competitive and face higher net interest margins relative to those in AEs. High banking sector concentration and limited household financial inclusion—two manifestations of underdeveloped banking systems—can affect firms' access to, and use of, external finance (Love and Martínez Pería, 2015), firm and employment growth, and the economy's response to domestic and external (financial) shocks. With room for additional structural reforms, EMEs have recently put forth several domestic financial reform initiatives.[2] However, little is known about the impact of these reforms on labor market and macroeconomic performance in an EME context, where limited firm and household inclusion in the banking system prevail and external financial shocks are important contributors to business cycle fluctuations.

In this paper, we build a small-open-economy (SOE) business cycle model with endogenous firm entry and a monopolistically-competitive banking sector, labor market frictions, and household and firm heterogeneity in access to the domestic banking system. Specifically, our framework features two household and firm categories—financially-excluded and financially-included. The model is calibrated to a representative EME where productivity shocks and foreign interest rate shocks—which can be interpreted broadly as financial shocks

[1] The following facts are documented in more detail in Section 2 below.

[2] For evidence on structural reforms, see Prati, Gaetano Onorato, and Papageorgiou (2013), Hollweg, Lederman, and Mitra (2015), and Dabla-Norris, Ho, and Kyobe (2015), among others.

that affect the provision of credit by the domestic banking system, among other things—are the main drivers of aggregate fluctuations. Using the model, we analyze the implications for labor market dynamics and aggregate fluctuations from banking reforms that bring the banking system in EMEs to AE standards. First, we consider a reform that brings the share of individuals in households with access to the domestic banking system via bank deposits to AEs' levels, holding the level of bank competition at EME levels. Second, we consider an expansion in bank competition that reduces banks' net interest margins to AE levels, holding the share of the individuals with access to the domestic banking system at EME levels. Third, we consider a joint expansion in bank competition and the share of the individuals in households with access to the banking system—a *comprehensive banking reform*—that reproduces AEs' degree of domestic banking development. These experiments shed light on the channels through which reform operates in an environment where firms' and households' access to the banking system is segmented.

Our findings suggest that, under a baseline calibration that replicates the average level of domestic banking development in EMEs (as reflected in banks' net interest margins) and amid financial shocks, bolstering household financial inclusion without simultaneously fostering a more competitive banking system leads to higher labor market and aggregate volatility. Conversely, fostering bank competition without increasing households' access to the banking system leads to reductions, albeit quantitatively limited, in labor market and aggregate volatility. Importantly, we illustrate how comparisons of our EME-consistent framework with a more standard model that is better tailored to AEs—specifically, a model where all firms and individuals participate in the banking system—suggest that similar reforms lead to *unconditional* reductions in unemployment and aggregate fluctuations in the latter. This stark difference with respect to the reform outcomes under our EME-consistent framework stresses two crucial messages of our work. First, explicitly accounting for key defining features of EMEs' domestic banking development—high rates of household and firm non-participation in the banking system—is important for a comprehensive assessment of the impact of banking reforms on labor markets and macroeconomic performance in EMEs. Put differently, financially-excluded firms and households should be included in any analysis of bank reform in EMEs, especially as these firms account for a large share of the universe of firms and a sig-

nificant share of employment and economic activity in these economies. Second, structural banking reforms in EMEs should tackle bank competition and household financial inclusion *in tandem* in order to limit the adverse effects of increased household financial inclusion on volatility. That is, banking reforms should be more comprehensive in nature. Finally, we also show that comprehensive banking reforms have the potential to reduce labor market and aggregate volatility in EMEs if they are accompanied by productivity gains among firms that participate in the banking system.

The economic intuition behind our results traces back to how reform affects households' consumption dynamics, how the latter feed into firm creation decisions and firms' employment and investment decisions via households' discounting of the future, and how households' firm ownership affects firms differentially. Specifically, bolstering household financial inclusion in the banking system reduces (increases) financially-excluded (financially-included) households' steady-state labor income and makes their consumption more (less) volatile. Higher (lower) consumption volatility makes firms' discounting of the future more (less) volatile, which translates into more (less) volatile financially-excluded-firm (-included-firm) vacancy creation, investment, as well as more (less) volatile firm creation among financially-excluded (-included) households. Despite the fact that financially-excluded firms represent a much smaller share of the universe of firms under the reform, their stronger response via labor demand, investment, and firm creation contributes to generating higher labor market and aggregate volatility. Conversely, bolstering bank competition alone fosters firm entry among firms that participate in the banking system, employment creation and investment, and labor income. However, financially-excluded firms and households also benefit from this via improvements in their relative price, which bolster firm entry, investment, and wages among these firms as well. As a result, both financially-included and -excluded households enjoy higher consumption, with financially-included households and firms benefiting disproportionately more from the reform. This stabilizes cyclical consumption dynamics across all households, which contributes to smoother fluctuations in employment creation and investment, and ultimately to smaller unemployment and output fluctuations.

Given these two results, it is therefore not surprising that a *comprehensive banking reform reflected in both greater household financial inclusion and bank competition* generates

a tension between the former and the latter, with the effect of greater household financial inclusion being the quantitatively-dominating force given the relatively larger gap in household financial inclusion between EMEs and AEs. Thus, greater labor market and aggregate volatility ensues amid comprehensive banking reform. Of note, this tension is not present in an environment without financially-excluded firms since banking reform, regardless of how it manifests itself, stabilizes financially-included households consumption and firm creation dynamics, and therefore firms' employment and investment decisions. Thus, the presence of financially-excluded firms coupled with the underlying firm ownership structure inherent to segmented access to the banking system in EMEs (i.e., financially-excluded firms owned by financially-excluded households) plays a key role in explaining the adverse effects of banking reform on volatility. Given the role of consumption dynamics in explaining the impact of reforms, the presence of interest rate shocks—which, given our framework, can be interpreted broadly as embodying shocks to the financial system—play a central role in contributing to the changes in volatility that arise from banking reforms. Therefore, more broadly, our findings stress the relevance of considering financial shocks in the quantitative analysis of such reforms.

Our work is closest to the literatures on endogenous firm entry and business cycles (Bilbiie, Ghironi, and Melitz , 2012, or BGM; Etro and Colciago, 2010); endogenous entry and labor market dynamics (Shao and Silos, 2013; Colciago and Rossi, 2015); and endogenous firm entry and the banking sector (Mandelman, 2010; Totzek, 2011; La Croce and Rossi, 2015; Rossi, 2015).[3] Our work also builds on recent theoretical work on financial development and firm dynamics (Arellano, Bai, and Zhang, 2012), financial development, heterogeneous labor markets, and business cycles (Epstein and Finkelstein Shapiro, 2016; Epstein, Finkelstein Shapiro, and González Gómez, 2017), as well as well-known work on financial shocks

[3]Shao and Silos (2013) show that a model with endogenous firm entry and labor search frictions is useful to explain the cyclical movements in U.S. income shares. Colciago and Rossi (2015) show that a similar model with Cournot competition can explain the empirical response of unemployment and price markups to productivity shocks in the U.S. Mandelman (2010) shows that an imperfectly competitive banking sector can amplify business cycles in EMEs. Totzek (2011) shows that endogenous bank entry à la BGM contributes to successfully reproducing the cyclical dynamics of U.S. financial and macro variables. La Croce and Rossi (2015) find that the interaction between endogenous firm entry and monopolistically competitive banks amplifies business cycle fluctuations. See Olivero (2010) for work that analyzes business cycles and monopolistic competition in the banking system while abstracting from endogenous firm entry.

and EME business cycles (Neumeyer and Perri, 2005; Uribe and Yue, 2006; Akinci, 2013). In particular, the joint inclusion of labor search frictions and endogenous firm entry in our framework is in line with a growing set of studies on structural reforms in goods and labor markets (Cacciatore and Fiori, 2016; Cacciatore, Ghironi, and Fiori, 2016; Cacciatore, Duval, Fiori, and Ghironi, 2016a,b). However, this literature has focused primarily on AEs. Finally, our focus on banking reforms in a context with endogenous firm entry is related to recent quantitative studies on banking deregulation in the U.S. (Stebunovs, 2008; Notz, 2012; Cacciatore, Ghironi, and Stebunovs, 2015, among others). All told, our contributions to the literature are threefold. First, we are the first to focus on the relevance of differences in the depth of domestic financial and banking development in EMEs relative to AEs for the analysis of structural reforms. Second, in contrast to much of the existing literature, which has focused on AEs, we analyze the impact of banking sector reforms on aggregate outcomes *and* labor markets in EMEs.[4] Third, we provide a framework that merges a tractable monopolistic banking system, endogenous firm entry, and equilibrium unemployment in the presence of heterogeneous firm and household participation in domestic credit markets. Importantly, we show that accounting for this heterogeneity is not only consistent with EMEs, but also crucial for characterizing the aggregate implications of banking sector reforms in these economies.

The rest of the paper is structured as follows. Section 2 presents empirical evidence on domestic banking development across economies that supports our theoretical framework. Section 3 presents our framework. Section 4 explores the quantitative implications of banking and financial access reforms that bring a representative EME to AE standards. Section 5 concludes.

2 Empirical Background

Firms' Formality Status and Participation in Banking System Table 1 shows that 70 percent of firms in AEs are registered with their country's authorities and are therefore

[4]The existing theoretical literature on banking deregulation, which has centered on the U.S., abstracts from considering the consequences for employment dynamics. For empirical evidence on employment and banking system regulatory changes in the U.S., see Lee and Stebunovs (2016).

categorized as formal. Moreover, the majority of these firms have bank loans. In contrast, only one third of firms in EMEs are formal, and while most of these firms have a checking account and are therefore basic participants in the domestic banking system, only half of them have bank loans.[5] Thus, the majority of firms in EMEs are unregistered or informal. Firm informality is often associated with less transparent and precarious accounting practices, which contribute to these firms' limited access and participation in the domestic banking system: only a minuscule share of informal firms have a checking account and/or to bank loans and credit. Firm informality is also associated with the prevalence of (self-employed, micro, and small) *household-operated* firms, where the latter's *internal* accounts are often indistinguishable from those of their owners.[6] Therefore, informal firms that do not participate in the banking system are more likely than not to be owned and operated by households who do not participate in the system either.[7] Importantly, these firms account for a significant share of employment in EMEs: while informal employment represents roughly 50 percent of the labor force in EMEs, it only accounts for roughly 15 percent of the labor force in AEs (OECD, 2009; European Social Survey).[8] All told, Table 1 confirms that formal firms in EMEs represent a smaller share of total firms relative to AEs, that only a fraction of these firms participate in the banking system, and therefore that *a relatively small fraction of all firms* in EMEs participates in the domestic banking system (IFC, 2010, 2013).

[5]Data on the share of firms with a checking account in AEs is not available.

[6]Using World Bank Enterprise Survey data (which only includes formal firms), we find a relatively strong and negative relationship between the share of the population with a financial account and the percent of firms with legal status of sole proprietorship (the best available proxy of the degree of household-owned firms).

[7]Indeed, given the nature of financial markets, it would be unlikely for (household) firm owners to own firms that participate in the banking system without doing so themselves (via financial account ownership). This is particularly applicable to ownership of micro and small firms, which tend to be informal and account for a large share of the universe of firms in EMEs (IFC, 2010, 2013).

[8]Informal employment is defined as employment without a contract or unregistered with the appropriate government entities and is highly prevalent among micro and small firms, where the latter are primarily informal (IFC, 2010, 2013).

Table 1: Firm Categories and Firm Access to Bank Financing in Advanced and Emerging Economies

Country Group	Firm Category	Share of Total Firms (%)	Share of Firms with Checking Account (% Firms)	Share of Firms with Access to Bank Credit (% Firms)	Share of Firms with Bank Loans (% Firms)	Banks as a Source of Financing (% Firms)
AEs	Formal	69.3	–	–	68.0	90.2
	Informal	30.7	–	–	–	–
EMEs	Formal	30.9	90.8	70.2	48.7	84.7
	Informal	69.1	33.1	12.4	11.8	–

Sources: Eurostat an Survey of Access to Finance of Enterprises (SAFE, 2011) (for advanced economies, or AEs) and IFC Enterprise Finance Gap Database 2010 (for emerging economies, or EMEs). Notes: The sample of AEs is comprised of: Austria, Belgium, Finland, and The Netherlands based on data availability. The sample of EMEs is comprised of: Argentina, Brazil, Colombia, Ecuador, Malaysia, Mexico, Peru, Philippines, South Africa, and Turkey. The data on the fraction of formal and informal firms for AEs is based on IFC data for Australia, Austria, Belgium, Canada, Denmark, Finland, Netherlands, New Zealand, Norway, and Sweden. Data from the SAFE and the IFC databases is not strictly comparable: the above evidence is only meant to illustrate the disparities in firms' access to bank finance in the two country groups. Firms are categorized as formal if they are registered micro (1-4 employees), very small (5-9 employees), small (10-49 employees), and medium (50-250 employees) enterprises. Informal firms are not registered with tax authorities and includes one-person firms regardless of whether these are registered. See https://www.smefinanceforum.org/data-sites/ifc-enterprise-finance-gap for more details. The share of firms with a loan in AEs encompasses bank loans or bank overdrafts. These data are not available by firm category for AEs. Similar evidence on firms' access to credit is presented in Epstein, Finkelstein Shapiro, and González Gómez (2017).

Households' Participation in Banking System and Banking Structure Table 2 shows that individuals' participation in the domestic banking system and the level of domestic banking development—proxied by the economy's share of the population with an account at financial institutions and the domestic credit-GDP ratio, respectively—are considerably lower in EMEs relative to AEs. In fact, less than half of the population in EMEs has an account at financial institutions, compared to more than 90 percent in AEs.[9] Second, the degree of domestic bank competition and bank penetration—embodied in banks' net interest margins, the Lerner Index, and the number of commercial bank branches per 100,000 adults—is lower in EMEs relative to AEs.[10]

[9]Evidence on usage of financial accounts in EMEs and AEs confirms a similar pattern: virtually all individuals in AEs have used their accounts for transactions in the recent past. This stands in contrast with only a small fraction of individuals in EMEs having done so (the correlation between the share of individuals in the economy with an account at financial institutions and the share of individuals depositing/withdrawing at least once in a typical month is 0.999). For similar evidence, see Beck, Demirgüç-Kunt, and Martinez Peria (2007).

[10]Alternative measures for households' participation in the banking system, such as the share of workers that receive their wages in an account at financial institutions, provide similar conclusions regarding the

Importantly, jointly considering the shares of *formal* firms with a checking account in Table 1 and the share of individuals with an account at financial institutions in Table 2 provides useful information for determining firm ownership in a framework where firm and household heterogeneity is rooted in participation in the banking system. Indeed, it is unlikely that firms with an account at financial institutions would be owned by households who do not participate in or have access to the banking system, especially since a large share of total firms in EMEs are small, household-operated, and informal (Table 1; IFC, 2010, 2013).[11]

Table 2: Households and Domestic Banking System in Advanced and Emerging Economies

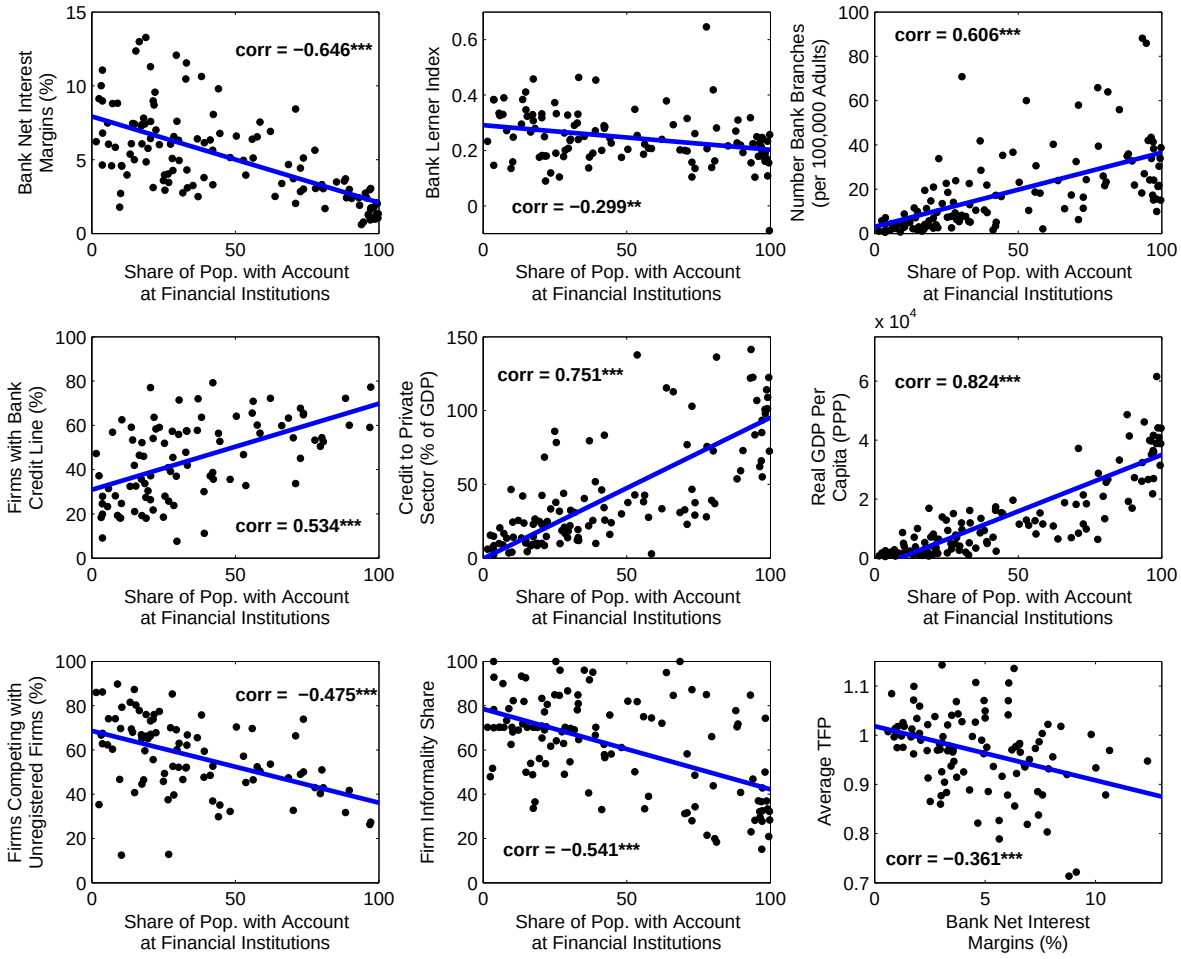
Country Group	Account at Fin. Institutions (% of Pop. Age 15+)	Domestic Credit to Private Sector (% of GDP)	Bank Net Interest Margins (%)	Bank Lerner Index	Commercial Bank Branches Per 100,000 Adults (Number)
AEs	92.6	110.4	2.04	0.198	35.3
EMEs	44.1	53.4	5.11	0.230	18.0

Sources: World Bank Global Financial Inclusion Database (account at financial institutions, 2011, formal firms with checking or savings account, average 2000-2011), World Bank World Development Indicators (domestic credit to private sector, average 2000-2011), World Bank Financial Development Structure (net interest margins, average 2000-2011), World Bank Global Financial Development Database (Lerner Index, average 2000-2011), and IMF Financial Access Survey (number of commercial bank branches per 100,000 adults, 2011). Notes: The AE country sample is comprised of: Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Luxembourg, Malta, New Zealand, The Netherlands, Norway, Portugal, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and United States (data for some countries may not be available for particular variables). The EME country sample is comprised of: Argentina, Brazil, Colombia, Indonesia, Malaysia, Mexico, Peru, Philippines, South Africa, Thailand, and Turkey. The Lerner Index is a measure of the degree of competition in the banking system, with a higher index being associated with a less competitive banking system (see the World Bank Global Financial Development Report for more details). The number of commercial bank branches represents a demographic measure of bank penetration. Similar evidence on households' participation in the domestic banking system is presented in Epstein, Finkelstein Shapiro, and González Gómez (2017).

disparities between AEs and EMEs (see Epstein, Finkelstein Shapiro, and González Gómez, 2017). The Lerner Index summarizes the degree of market power in the banking system, with a higher index implying a less competitive environment (see the World Bank's Global Financial Development Database). Equality-of-means tests suggest that the differences in net interest margins and the Lerner Index between AEs and developing and emerging economies (as well as differences in participation in the banking system) are statistically significant at conventional levels. A similar claim holds for the differences in the number of bank branches per capita.

[11] While we focus on EMEs, the facts below are even starker once we consider a wider country sample that includes all developing economies with available data.

Figure 1: Domestic Banking Development, Firm Structure, and Economic Development Across Countries



Sources: World Development Indicators, World Bank Global Financial Development Report 2015, IFC Enterprise Finance Database 2010, Penn World Tables. Notes: The lines in each of the subfigures represent regression lines. Each observation represents a country. The list of countries is presented in the Appendix. Similar patterns hold when we restrict the country sample to include only AEs and EMEs. Firm informality is defined as the share of firms that are not registered with tax authorities.

Domestic Banking Development, Bank Concentration, and Net Interest Margins

Figure 1 presents a general snapshot on firm and household participation in the domestic banking system as well as domestic banking and economic development across countries

using a comprehensive country sample that extends beyond AEs and EMEs.[12] In particular, the figure shows that economies with lower domestic banking development (as proxied by the share of individuals with an account at financial institutions) tend to have: (1) higher bank net interest margins; (2) a higher bank Lerner Index (implying less bank competition); (3) a smaller number of commercial bank branches per capita; (4) a smaller share of firms with bank credit lines; (5) larger shares of registered firms that face competition from unregistered (or informal) firms (and, incidentally, larger firm-informality shares); (6) and both lower real domestic credit-GDP ratios and lower levels of economic development. Finally, economies with higher bank net interest margins have lower average TFP.

Modeling Implications Four key empirical facts emerge as the building blocks of a suitable framework for the analysis of banking reforms in an EME context:

- Only a small segment of firms in EMEs is registered (or formal) and has access to the domestic banking system via account ownership and bank credit—there is firm heterogeneity in credit market access and participation;

- Less than half of the population in EMEs participates in the domestic banking system via account ownership—there is household heterogeneity in participation in the banking system;

- Third, registered (formal) firms tend to participate in the banking system by having an account at financial institutions and/or by relying on bank credit; as such, these firms are likely to be owned by individuals who also participate in the banking system via account ownership. In contrast to registered firms, most unregistered (informal) firms do not participate in the banking system, and these firms are more likely than not to be owned by individuals who do not participate in the banking system either;

- Fourth, registered firms face more direct competition from unregistered firms the less developed the banking system is. One implication is that firm output is likely to be

[12] See the Appendix for the full list of countries. The same patterns hold if we focus solely on AEs and EMEs.

highly substitutable between firm categories in economies with less developed banking systems.

3 The Model

The small open economy is comprised of households, banks, and firms. Following the EME business cycle literature, aggregate productivity shocks and foreign interest rate shocks drive aggregate fluctuations. There is a unit mass of households, where the latter are divided into two categories: financially-included (i) households with measure $0 < \lambda < 1$ of household members, and financially-excluded (e) households with measure $(1 - \lambda)$ of members.[13]

At the heart of the production structure are two firm categories (or sectors) of monopolistically-competitive wholesale firms. Each wholesale category has an unbounded number of potential entrants such that the number of wholesale firms in each category is endogenous. These firms depend on inputs supplied by perfectly-competitive intermediate-goods firms within their own category.

The first firm category of wholesale firms is comprised of financially-included (i) firms whose creation relies on banks financing the entirety of new firms' sunk costs of entry.[14] These firms, along with their *within-category,* perfectly-competitive intermediate-goods suppliers (also denoted by i), are owned by i households. The second category of wholesale firms is comprised of financially-excluded (e) firms whose creation relies on resources from e households to cover new firms' sunk costs of entry.[15] These firms, along with their *within-category,* perfectly-competitive, intermediate-goods suppliers (also denoted by e), are owned by e households. Intermediate-goods firms, regardless of their category, accumulate capital and demand labor to produce and are subject to labor search frictions, which leads to equilibrium unemployment.[16] Finally, differentiated output from the two categories of wholesale

[13]Given these assumptions, we use the terms "share of financially-included/-excluded households" and "share of individuals in financially-included/-excluded households" interchangeably in the rest of the paper.

[14]This assumption follows Stebunovs (2008) and Cacciatore, Ghironi, and Stebunovs (2015).

[15]Evidence for EMEs suggests that household savings are the main source of financing for the creation of micro and small firms (i.e. firms that, on average, have little to no access to bank credit in these economies) (Kantis, Ishida, and Komori, 2002; IFC 2010, 2013; GFDR, 2014).

[16]For a similar separation between labor search frictions and endogenous firm entry, see Cacciatore, Duval, Fiori, and Ghironi (2016).

firms is bundled by a perfectly-competitive retail firm that uses it to produce a final good.

Banks and wholesale and intermediate-output i firms are owned by i households. The latter supply deposits to banks and hold foreign debt, and their members can be employed in intermediate-output i firms. In turn, e households own wholesale and intermediate-output e firms and their members can be employed in e intermediate-output firms. There is perfect consumption insurance within each household but not across households. Absent an endogenous labor force participation margin, the total labor force is normalized to 1. In what follows, our notation is similar to Cacciatore, Duval, Fiori, and Ghironi (2016a).

3.1 Final Goods and Wholesale Aggregator Firms

A representative final goods firm aggregates total output from each firm category $Y_{i,t}$ and $Y_{e,t}$ to create a final good Y_t. Specifically, the firm maximizes profits $\Pi_{a,t} = [P_t Y_t - P_{i,t} Y_{i,t} - P_{e,t} Y_{e,t}]$ subject to the CES aggregator

$$Y_t = \left[(1-\alpha_y)^{\frac{1}{\phi_y}} (Y_{i,t})^{\frac{\phi_y - 1}{\phi_y}} + \alpha_y^{\frac{1}{\phi_y}} (Y_{e,t})^{\frac{\phi_y - 1}{\phi_y}} \right]^{\frac{\phi_y}{\phi_y - 1}}, \tag{1}$$

where P_t is the aggregate price level and $P_{i,t}, P_{e,t}$ are the sectoral price indices, $0 < \alpha_y < 1$, and $\phi_y > 0$ determines how substitutable $Y_{i,t}$ and $Y_{e,t}$ are in total output. The corresponding demand functions for the two sectoral output bundles can be written as:

$$P_{i,t}/P_t = (1-\alpha_y) (Y_t/Y_{i,t})^{\frac{1}{\phi_y}}, \tag{2}$$

and

$$P_{e,t}/P_t = \alpha_y (Y_t/Y_{e,t})^{\frac{1}{\phi_y}}, \tag{3}$$

where $P_t = \left[(1-\alpha_y) (P_{i,t})^{1-\phi_y} + \alpha_y (P_{e,t})^{1-\phi_y} \right]^{\frac{1}{\phi_y - 1}}$.

Perfectly competitive wholesale output aggregators in each firm category $j \in \{e, i\}$ demand differentiated goods from wholesale firms in each of the two categories. In particular, the sectoral output bundle from firm category j is $Y_{j,t} = \left(\int_{\omega_j \in \Omega_j} y_{j,t}(\omega_j)^{\frac{\varepsilon - 1}{\varepsilon}} d\omega_j \right)^{\frac{\varepsilon}{\varepsilon - 1}}$, where ε is the elasticity of substitution between goods, and $y_{j,t}(\omega_j)$ is differentiated output produced by firm ω_j within each firm category j. Ω_j is the subset of differentiated goods within each

firm category j that, in principle, the wholesale output aggregator firm can potentially purchase from (only a fraction of Ω_j ends up being produced each period). The corresponding price subindex is given by $P_{j,t} = \left(\int_{\omega_j \in \Omega_j} p_{j,t}(\omega_j)^{1-\varepsilon} d\omega_j\right)^{\frac{1}{1-\varepsilon}}$ where $p_{j,t}(\omega_j)$ is the price of the differentiated good produced by firm ω_j in firm category j. The optimal demand for differentiated goods in each firm category, which wholesale firms are subject to, are given by

$$y_{l,t}(\omega_l) = (1-\alpha_y)\left(\rho_{l,t}(\omega_l)\right)^{-\varepsilon}\left(\frac{P_{l,t}}{P_t}\right)^{\varepsilon-\phi_y} Y_{l,t}, \tag{4}$$

and

$$y_{s,t}(\omega_s) = \alpha_y\left(\rho_{s,t}(\omega_s)\right)^{-\varepsilon}\left(\frac{P_{s,t}}{P_t}\right)^{\varepsilon-\phi_y} Y_{s,t}, \tag{5}$$

where the real price $\rho_{j,t}(\omega_j) = p_{j,t}(\omega_j)/P_t$ for $j \in \{e, i\}$.

3.2 Incumbent Wholesale Firms

For an incumbent firm ω_j in category $j \in \{e, i\}$, individual profits are given by $d_{j,t}(\omega_j) = [\rho_{j,t}(\omega_j) - mc_{j,t}]\, y_{j,t}(\omega_j)$ where $mc_{j,t}$ is the price of intermediate output in category j. Each firm maximizes $\mathbb{E}_t \sum_{s=t}^{\infty} \Xi^j_{s|t}[(1-\delta)^{s-t} d_{j,s}(\omega_j)]$ subject to their demand from final goods firms, where $0 < \delta < 1$ is the exogenous exit probability and $\Xi^j_{s|t}$ is household j's stochastic discount factor (defined further below). The solution to this problem yields $\rho_{j,t}(\omega_j) = \mu mc_{j,t}$ where the markup $\mu = \varepsilon/(\varepsilon - 1)$.

Following the literature on endogenous firm entry (Bilbiie, Ghironi, and Melitz, 2012), there is an unbounded number of potential wholesale entrants into firm category $j \in \{e, i\}$. Let $N_{j,t}$ be the mass of firms in category j that are currently producing in period t. New entrants $N_{E,jt}$ in period t face a one-period production lag, so that they start producing in $t+1$, and all firms (whether incumbent or new entrants) exit with exogenous probability δ at the end of each period. Then, the current mass of firms in category j is given by $N_{j,t} = (1-\delta)\left(N_{j,t-1} + N_{E,jt-1}\right)$. Potential new firms in j need to incur an exogenous sunk entry cost ψ_j (expressed in terms of final goods) in order to enter their category.[17] Banks

[17] This cost can embody a number of factors, including physical and technological costs of entry as well as regulatory expenses and financial and institutional barriers (see, for example, Cacciatore, Duval, Fiori, and Ghironi, 2016a,b).

provide financing for the entirety of wholesale i firms' entry costs, whereas e households use internal resources to cover wholesale e firms' entry costs.

Entry of Wholesale e Firms The entry cost for wholesale e firms is financed using internal resources from e households. Since firms that would enter in period t anticipate their future profits post-entry, the present discounted value of expected profits obtained from period $t+1$ onwards is given by $e_{e,t}(\omega_e) = \mathbb{E}_t \sum_{s=t+1}^{\infty} \Xi^e_{s|t}(1-\delta)^{s-t} d_{e,s}(\omega_e)$. Free entry implies that in equilibrium and after imposing symmetry, $e_{e,t}(\omega_e) = e_{e,t} = \psi_e$ obtains.

Banks and Entry of Wholesale i Firms We follow the exposition in Stebunovs (2008) and Cacciatore, Ghironi, and Stebunovs (2015) in modeling wholesale i firms' reliance on monopolistically-competitive banks. Since our objective is to explore the impact of banking reforms as reflected in exogenous changes in the degree of bank competition, we abstract from explicitly modeling the underlying reason for i firms' dependence on external finance from banks and simply assume that potential i firms require bank funds to finance their sunk entry costs. Furthermore, we assume that banks have enough power to set loan repayments to extract the entirety of i firms' profits $d_{i,t}$, and that each new firm requires a single loan to finance its sunk entry cost (i.e., the number of firms is the same as the number of loans; see Cacciatore, Ghironi, and Stebunovs, 2015).

An exogenous number of banks H competes over the number of loans supplied to wholesale i firms in a market characterized by Cournot competition. In particular, bank $h \in H$ caters to an endogenous number $N_i(h)$ of wholesale i firms and chooses how many potential wholesale i entrants $N_{E,it}$ it supplies new loans to. This decision is made in tandem with other banks, taking the latter's choices over loans as given and also taking into account firms' optimal decisions over their own pricing after entry. Since wholesale i entrants end up exiting before production takes place with exogenous probability δ, the evolution of bank h's stock of i firms in its portfolio is given by $N_{i,t}(h) = (1-\delta)\left(N_{i,t-1}(h) + N_{E,it-1}(h)\right)$. Then, the total number of incumbent wholesale i firms and i entrants is $N_{i,t} = \sum_h N_{i,t}(h)$ and $N_{E,it} = \sum_h N_{E,it}(h)$, respectively.

Since i households are the ultimate owners of banks and all i firms, bank h's problem

at the beginning of period t is to choose the desired number of loans $N_{i,t+1}(h)$ and new loans $N_{E,it}(h)$ to maximize the present discounted value of profits $\mathbb{E}_0 \sum_{t=0}^{\infty} \Xi^i_{t|0} \pi_{b,t}(h)$ subject to bank profits $\pi_{b,t}(h) = N_{i,t}(h) d_{i,t} + b_{t+1}(h) - \psi_i N_{E,it}(h) - R_t b_t(h)$ and the balance sheet constraint $b_{t+1}(h) = \psi_i N_{E,it}(h)$, where $d_{i,t}$ are wholesale i firm profits, $b(h)$ are household deposits in bank h, and R is the domestic gross real interest rate on bank deposits. Denoting the value to bank h of having one more active wholesale i firm in its portfolio by $Q_t(h)$, we have

$$Q_t(h) = \mathbb{E}_t \Xi^i_{t+1|t} \left\{ d_{i,t+1} + N_{i,t+1}(h) \left[\frac{\partial d_{i,t+1}}{\partial N_{i,t+1}} \frac{\partial N_{i,t+1}}{\partial N_{i,t+1}(h)} \right] + (1-\delta) Q_{t+1}(h) \right\}. \tag{6}$$

This expression is identical to the one in Stebunovs (2008) and Cacciatore, Ghironi, and Stebunovs (2015). The term in brackets on the right-hand-side captures bank h's internalization of the fact that having an additional firm in its portfolio implies more competition for all other firms in its portfolio, which in turn lowers profits for all incumbent firms in the latter (this occurs despite the fact that, for a given level of firm profits, expanding the loan portfolio brings in additional revenue for bank h). The third term on the right-hand-side captures the continuation value if the wholesale i firm survives into the next period, which occurs with exogenous probability $(1-\delta)$.

Bank h will continue to supply loans to wholesale i firm entrants until the marginal benefit of having a loan, $Q_t(h)$, is equal to the expected marginal cost, where the latter is given by the discounted cost of entry, taking into account that new entrants exit before production with exogenous probability δ. That is,

$$Q_t(h) = Q_t = \left(\frac{1}{1-\delta} \right) \psi_i. \tag{7}$$

This expression, which effectively characterizes wholesale i firms' optimal entry condition via banks' decisions to fund entrants, is also identical to the one in Stebunovs (2008) and Cacciatore, Ghironi, and Stebunovs (2015).

Absent idiosyncratic differences across banks, all banks make the same decisions so that

we can write

$$Q_t = \mathbb{E}_t \Xi^i_{t+1|t} \left[\left(1 - \frac{1}{H} \right) d_{i,t+1} + (1-\delta) Q_{t+1} \right]. \tag{8}$$

Intuitively, a larger number of banks H expands the number of firms by increasing the supply of loans and reduces a given bank's market power. Importantly, banks' net interest margin is defined as $\left[N_{i,t} d_{i,t} - R_{t-1} b_{t-1} \right] / N_{i,t} Q_t$, which is decreasing in the number of banks H in the economy.[18]

3.3 Intermediate Goods Firms

Intermediate-goods firms in category $j \in \{e, i\}$ are perfectly competitive and act as suppliers to wholesale firms in their respective category.[19] They produce using internally-accumulated capital and labor, where the latter is subject to search and matching frictions. In particular, let $m(u_{j,t}, v_{j,t}) = u_{j,t} v_{j,t} / (u^\xi_{j,t} + v^\xi_{j,t})^{1/\xi}$, $\xi > 0$, be a constant-returns-to-scale matching function in firm category j whose inputs are household-j unemployed individuals $u_{j,t}$ and vacancies $v_{j,t}$ (Den Haan, Ramey, and Watson, 2000).[20] Then, the category-specific job-finding and job-filling probabilities are defined as $f(\theta_{j,t}) = v_{j,t} / (u^\xi_{j,t} + v^\xi_{j,t})^{1/\xi}$ and $q(\theta_{j,t}) = u_{j,t} / (u^\xi_{j,t} + v^\xi_{j,t})^{1/\xi}$, respectively, where market tightness $\theta_{j,t} \equiv v_{j,t} / u_{j,t}$.

Intermediate-goods firms in category j choose capital accumulation $k_{j,t+1}$, vacancies $v_{j,t}$, and desired employment $n_{j,t+1}$ to maximize $\mathbb{E}_0 \sum_{t=0}^\infty \Xi^j_{t|0} \Pi_{j,t}$ subject to the definition of firm profits

$$\Pi_{j,t} = mc_{j,t} z_{j,t} n^{1-\alpha}_{j,t} k^a_{j,t} - w_{j,t} n_{j,t} - \kappa_j v_{j,t} - i_{j,t},$$

the evolution of capital

$$k_{j,t+1} = (1-\delta) k_{j,t} + i_{j,t}, \tag{9}$$

and the perceived evolution of employment

$$n_{j,t+1} = (1 - \rho^n_j) \left(n_{j,t} + v_{j,t} q(\theta_{j,t}) \right), \tag{10}$$

[18] This is consistent with the evidence on bank competition, net interest margins, and financial inclusion presented in Section 2.

[19] For simplicity, we assume that intermediate-goods firms in one category cannot act as suppliers to wholesale firms in the other category.

[20] This particular functional form guarantees that matching probabilities are always bounded between 0 and 1. Our results remain the same if we adopt a Cobb-Douglas matching specification.

where $mc_{j,t}$ is the real price of intermediate goods, κ_j is the flow cost of posting a vacancy, and ρ_j^n is the exogenous separation probability in category j. $z_{j,t}$ is exogenous category-specific productivity and follows a stochastic process. We obtain standard capital Euler equations and job creation conditions for each category j:

$$1 = \mathbb{E}_t \Xi^j_{t+1|t} \left[1 + \alpha mc_{j,t+1} z_{j,t+1} n^{1-\alpha}_{j,t+1} k^{a-1}_{j,t+1} - \delta \right], \tag{11}$$

and

$$\frac{\kappa_j}{q(\theta_{j,t})} = (1-\rho_j^n)\mathbb{E}_t \Xi^j_{t+1|t} \left\{ (1-\alpha) mc_{j,t+1} z_{j,t+1} n^{-\alpha}_{j,t+1} k^a_{j,t+1} - w_{j,t+1} + \frac{\kappa_j}{q(\theta_{j,t+1})} \right\}. \tag{12}$$

The intuition behind these conditions is standard: firms equate the expected marginal cost of posting a vacancy to the expected marginal benefit. Importantly, recall that optimal pricing behavior among wholesale firms implies that $\rho_{j,t}(\omega_j) = \mu mc_{j,t}$. Therefore, changes in the number of wholesale firms in the two categories will affect the hiring and investment decisions of intermediate-goods firms via $mc_{j,t}$.[21]

We assume bilateral Nash bargaining between workers and firms. Denoting by η the bargaining power of workers and by χ_j the contemporaneous value of searching for employment in firm category $j \in \{e, i\}$, the Nash real wage in j is standard:

$$w_{j,t} = \eta \left[(1-\alpha) mc_{j,t} z_{j,t} n^{-\alpha}_{j,t} k^a_{j,t} + \kappa_j \theta_{j,t} \right] + (1-\eta)\chi_j. \tag{13}$$

3.4 Households

Utility is of the CRRA form for all households: $\mathbf{u}(c_j) = c_j^{1-\sigma}/(1-\sigma)$ with $\sigma > 0$ for $j \in \{e, i\}$. A fraction $0 < \lambda < 1$ of the population belongs to financially-included (i) households. The remaining share of the population $(1-\lambda)$ belongs to financially-excluded (e) households.

Financially-Included (i) Households Households choose consumption $c_{i,t}$, bank deposits b_{t+1}, foreign debt holdings b^*_{t+1}, and the ownership shares in banks $x_{b,t+1}(h)$ to maxi-

[21] For a similar, one-sector employment structure without banks, see Cacciatore et al. (2016a).

mize $\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \mathbf{u}(c_{i,t})$ subject to the budget constraint:

$$c_{i,t}+b_{t+1}+b^*_{t+1}+x_{b,t+1}\sum_{h\in H} e_{b,t}(h) = R_t b_t + R^*_t b^*_t + w_{i,t}n_{i,t}+\chi_i u_{i,t}+x_{b,t}\sum_{h\in H}[\pi_{b,t}(h)+e_{b,t}(h)]+\Pi_{i,t}, \tag{14}$$

where $R^*_t = z_{r,t}R^* + \eta_b[\exp(b^*_t - \overline{b}^*) - 1]$. R^* is the gross real foreign interest rate, $\eta_b \left[\exp(b^*_t - b^*) - 1\right]$ is the debt-elastic component reflecting the country's risk premium, where $\eta_b > 0$ (Schmitt-Grohé and Uribe, 2003), and $z_{r,t}$ is a shock to the foreign interest rate. $e_{b,t}(h)$ is the price of of a claim to bank h's profits $\pi_{b,t}(h)$, and $\Pi_{i,t}$ are profits from intermediate-goods i firms. Unemployment among i household members is $u_{i,t} = \lambda - n_{i,t}$.[22] The first-order conditions yield the following standard Euler equations

$$\mathbf{u}'(c_{i,t}) = R_{t+1}\beta\mathbb{E}_t\mathbf{u}'(c_{i,t+1}) \text{ and } \mathbf{u}'(c_{i,t}) = R^*_{t+1}\beta\mathbb{E}_t\mathbf{u}'(c_{i,t+1}) \tag{15}$$

where $\Xi^i_{t+1|t} \equiv \beta\mathbf{u}'(c_{i,t+1})/\mathbf{u}'(c_{i,t})$. The Euler equation for share holdings of banks (after imposing symmetry) is

$$e_{b,t} = \mathbb{E}_t \Xi^i_{t+1|t}\left[\pi_{b,t+1} + e_{b,t+1}\right], \tag{16}$$

Intuitively, households equate the marginal cost of acquiring an additional bank share (the price of a claim to bank profits, e_b) to the expected marginal benefit of doing so (given by discounted future profits and the capital gain from holding bank shares).

Of note, interest rate shocks are one possible manifestation of financial shocks that affect, among other things, the provision of credit by the domestic banking system. Considering other types of financial shocks that affect the latter—such as shocks to ψ_i which, given banks' balance sheet constraint $b_{t+1}(h) = \psi_i N_{E,it}(h)$, can be broadly seen as shocks to banks' costs of providing resources for new firm ventures, which in turn affects firm creation—has qualitatively similar effects on labor markets and output to those from interest rate shocks.

Financially-Excluded (e) Households Households choose consumption $c_{e,t}$ and the ownership shares in household-dependent e firms $x_{e,t+1}$ to maximize $\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \mathbf{u}(c_{e,t})$ subject

[22] In principle, households are also subject to the perceived evolution of employment $n_{i,t+1} = (1 - \rho^n_i)(n_{i,t} + u_{i,t}f(\theta_{i,t}))$. Absent endogenous labor force participation, this law of motion is taken as given and employment is mainly demand-driven.

to the budget constraint:

$$c_{e,t} + x_{e,t+1} N_{E,et} e_{e,t} = w_{e,t} n_{e,t} + \chi_e u_{e,t} + x_{e,t} N_{e,t} \left[d_{e,t} + e_{e,t} \right] + \Pi_{e,t}, \tag{17}$$

where $e_{e,t}$ is the price of a claim to wholesale e firms' profits $d_{e,t}$ and $\Pi_{e,t}$ are profits from intermediate-goods e firms.[23] Unemployment among e household members is $u_{e,t} = (1 - \lambda) - n_{e,t}$. The first-order conditions yield the Euler equation for e firms

$$e_{e,t} = (1 - \delta) \mathbb{E}_t \Xi^e_{t+1|t} \left[d_{e,t+1} + e_{e,t+1} \right], \tag{18}$$

where $\Xi^e_{t+1|t} = \beta \mathbf{u}'(c_{e,t+1}) / \mathbf{u}'(c_{e,t})$.

3.5 Symmetric Equilibrium and Market Clearing

Intermediate output and wholesale output satisfy $z_{j,t} n_{j,t}^{1-\alpha} k_{j,t}^{a} = N_{j,t} y_{j,t}$ for each category $j \in \{e, i\}$. In turn, using the sectoral price indices and after imposing symmetry, we have $\rho_{j,t} = (P_{j,t}/P_t) N_{j,t}^{\frac{1}{\varepsilon - 1}}$. In addition, in equilibrium, $x_{b,t+1} = x_{b,t} = 1$ and $x_{e,t+1} = x_{e,t} = 1$. Finally, the economy's resource constraint is given by

$$Y_t = c_{i,t} + c_{e,t} + i_{i,t} + i_{e,t} + \kappa_i v_{i,t} + \kappa_e v_{e,t} + \psi_i N_{E,it} + \psi_e N_{E,et} + R^*_t b^*_t - b^*_{t+1}. \tag{19}$$

We define total consumption and investment as $c_t = c_{i,t} + c_{e,t}$ and $inv_t = i_{i,t} + i_{e,t}$, respectively. Furthermore, the total number of firms in the economy is $N_t \equiv N_{e,t} + N_{i,t}$.

4 Quantitative Analysis

4.1 Baseline EME Calibration

We calibrate the baseline economy to a representative EME. A period is a quarter. Following the EME business cycle literature, we set $\sigma = 2, \beta = 0.985$, $\delta = 0.025$, $\alpha = 0.32$. Following the literature on endogenous entry, we choose $\varepsilon = 6$ and experiment with alternative values

[23] In principle, households are also subject to the perceived evolution of employment $n_{e,t+1} = (1 - \rho^n_e) (n_{e,t} + u_{e,t} f(\theta_{e,t}))$.

as part of our robustness checks. EMEs generally lack formal safety nets, so we initially set $\chi_j = 0$ for $j \in \{e, i\}$. The steady-state gross real foreign interest rate is $R^* = 1.015$. We also set $\eta_b = 0.001$, a small number that does not affect aggregate dynamics but guarantees that foreign debt is stationary (García-Cicco, Pancrazi, and Uribe, 2010). Alternative values for η_b do not change our main conclusions. The exogenous separation probabilities are $\rho_j^n = 0.05$ for $j \in \{e, i\}$ (Bosch and Maloney, 2008; Epstein, Finkelstein Shapiro, and González Gómez, 2017). Based on the evidence in Section 2, the share of individuals in financially-included households is $\lambda = 0.44$. Given the high degree of competition that registered firms face from unregistered firms in EMEs (see Section 2), we set the elasticity of substitution between sectoral wholesale output $\phi_y = 5$, implying a high degree of substitutability.[24]

As a starting point, we assume symmetry in vacancy posting costs, sunk entry costs, and productivity across firm categories: $\kappa_e = \kappa_i = \kappa$, $\psi_e = \psi_i = \psi$, and $z_i = z_e = z = 1$. We explore asymmetries in all these parameters as part of our robustness analysis in the Appendix. In turn, we calibrate the parameters $\xi, \kappa, \psi, H, \alpha_y$, and $\overline{b}^*$ to match the following first-moment targets for a representative EME: a steady state unemployment rate if 8.2 percent (consistent with the average value in our EME sample; World Development Indicators), a vacancy-posting cost of 3.5 percent of steady-state quarterly average wages (consistent with evidence in Levy, 2007), a steady-state sunk entry cost of one third of steady state quarterly wages (consistent with evidence on the cost of obtaining a license in our sample of EMEs; World Bank Enterprise Surveys), a steady state annual bank net interest margin of 5.11 percent (see Table 2), a share of i-category output of 50 percent of total output, and a steady state annual foreign debt-output ratio of 0.30 (consistent with EMEs).[25] Alternative plausible targets for these parameters do not change our main conclusions. All told, we obtain the following parameter values: $\xi = 0.4258, \kappa = 0.0754, \psi = 0.7105, H =$

[24] This value generates a factual relationship between the level of economic development (as proxied by the level of total output) and the share of financially-included individuals as presented in Figure 1. The Appendix presents results for lower values of ϕ_y.

[25] The share of i-firm output in total output is obtained as follows. Using available evidence on the size of the informal sector as a share of GDP for Argentina, Brazil, Colombia, Ecuador, India, Indonesia, Malaysia, Mexico, Peru, Philippines, South Africa, Thailand, Turkey, and Vietnam from Schneider (2012), we find that average informality is around 33 percent of GDP. In turn, Table 1 suggests that 70 (12) percent of formal (informal) firms have access to bank credit. Therefore, roughly 50 percent of output is from firms that participate in the domestic banking system.

2.1097, $\alpha_y = 0.2389$, and $\overline{b}^* = 4.6212$. Finally, we assume that all shocks follow independent AR(1) processes in logs: $\ln(x_t) = (1-\rho_x)\ln(x) + \rho_x \ln(x_{t-1}) + \varepsilon_t^x$, where $\varepsilon_t^x \tilde{} N(0, \sigma_x)$ for $x = z, z_r$. For illustrative purposes, we set $\rho_x = 0.90$ and $\sigma_x = 0.01$ for $x = z, z_r$.[26]

4.2 Banking Reforms

Main Experiments We consider separately three main banking reform equilibria. First, banking reform reflected in an increase in the share of individuals in financially-included (i) households λ from 0.44 to 0.92 (consistent with the share in AEs), holding the level of bank competition (proxied by the number of banks H) and therefore net interest margins at their baseline EME levels (column (1) in Table 3). Second, banking reform reflected in an increase in the number of banks H such that banks' net interest margins fall to AEs' standards (this implies a reduction in net interest margins of 3.07 percentage points), holding λ at its EME level (column (2) in Table 3). Third, banking reform reflected in a joint increase in λ and H that replicates the level of banking sector development in AEs (i.e., an increase in λ from 0.44 to 0.92 and a reduction in net interest margins of 3.07 percentage points). We label this case as a *comprehensive banking reform* (column (3) in Table 3). Finally, for completeness, we also consider a comprehensive banking reform that is coupled with an increase in i-firm category productivity z_i from 1 to 2 (column (4) in Table 3).

Steady State Table 3 compares key steady-state variables in the baseline (EME) economy to the same variables across the banking reform equilibria stated above. Of note, under our baseline calibration, the endogenous share of financially-excluded firms in the baseline EME economy, $N_e/N = 0.655$, is broadly consistent with its empirical counterpart of 0.691 (see Table 1 in Section 2).

[26] We implement a first-order log-linear approximation to the equilibrium conditions and simulate the model for a large number of periods. All simulated data is filtered using an HP filter with smoothing parameter 1600.

Table 3: Steady State Under Different Banking Reform Equilibria

Variable	Baseline (EME) Economy	Higher λ	Higher H	Higher λ and H	Higher λ, H, and z_i
		(1)	(2)	(3)	(4)
Y	3.851	4.302	4.313	5.270	21.38
c	2.680	3.095	2.937	3.637	15.11
c_i	1.354	2.870	1.556	3.394	14.72
c_e	1.327	0.226	1.380	0.243	0.396
inv	0.638	0.713	0.715	0.873	3.544
N	16.71	13.75	22.93	26.57	107.2
N_i	5.758	11.89	11.54	24.57	104.0
N_e	10.95	1.861	11.39	1.997	3.247
N_e/N	0.655	0.135	0.497	0.075	0.0303
n_i	0.405	0.846	0.406	0.849	0.861
n_e	0.513	0.074	0.514	0.074	0.074
w_i	2.446	2.415	2.935	2.989	12.66
w_e	1.922	2.287	1.999	2.455	3.991
Labor Income$_i$	0.990	2.044	1.191	2.538	10.90
Labor Income$_e$	0.986	0.168	1.027	0.181	0.296
u	0.082	0.080	0.081	0.077	0.065
H	2.110	2.110	8.245	8.245	8.245
λ	0.440	0.920	0.440	0.920	0.920
Δ Net Int. Margin (Percentage Points)	0	0	-3.070	-3.070	-3.070

Three main conclusions emerge from Table 3. First, regardless of whether banking reform is reflected in more financially-included individuals (a higher λ) or higher bank competition (a higher H, implying lower net interest margins), reforms lead to higher steady-state total output, consumption, and investment, to a larger number of i firms in the economy, and to lower unemployment. Despite observing similar positive steady-state effects at the aggregate level, individual reforms have important compositional differences. Indeed, while higher bank competition alone (column (2)) has virtually no impact on the sectoral allocation of employment between e and i firms, this reform has positive effects on wages, labor income, and consumption for both household categories, and boosts the number of e and i firms.[27] In contrast, a reform that increases λ (column (1)) generates a sharp reallocation of employment from e firms to i firms, a substantial reduction (increase) in total labor income and consumption among e (i) households, a sharp increase in the number of i firms, and a large decrease in the number of e firms.

[27]The increase in bank profits as a result of the reforms also contributes to i households' change in consumption, but this is second-order relative to the changes in labor income.

Finally, a comprehensive banking reform—i.e., a joint increase in λ and H—generates macro outcomes that are consistent with more developed economies: higher of average output levels and a larger share of firms that participate in the banking system. Notably, the effects of an increase in λ described above are magnified under greater bank competition, and the change in λ appears to drive the allocation of employment, the share of i firms in the economy, and the composition of aggregate consumption. Of note, if comprehensive bank reform is accompanied by improvements in i firms' productivity, the changes in macro outcomes are broadly similar to those with a joint increase in λ and H, but quantitatively stronger in nature.

Changes in Labor Market and Aggregate Volatility Table 4 shows the *percentage point change* in the volatility of key labor market and macro aggregates under the above reform equilibria *relative to the baseline (EME) economy.* In particular, our results show that in an environment with limited participation of households and firms in the domestic banking system, comprehensive banking reform—i.e., greater household financial inclusion (λ) *and* greater bank competition (H)—does not lead to reductions in labor market and aggregate volatility *unless such reforms are accompanied by improvements in productivity among financially-included firms* (columns (3) and (4) in Table 4). Considering separate increases in λ and H sheds light on this result. Indeed, an increase in λ to AE levels holding bank competition (and i firms' productivity z_i) at its baseline EME levels leads to higher labor market and aggregate volatility across the board (column (1) in Table 4). Conversely, a higher number of banks H holding household financial inclusion (and i firms' productivity z_i) at its baseline level generates (small) reductions in labor market and aggregate volatility (column (2) in Table 4). As such, it is not surprising that a joint increase in λ and H leads to higher labor market and aggregate volatility on net (column (3) in Table 4).

Table 4: *Percentage-Point* Change in Volatility Relative to Baseline (EME) Economy

	Higher λ	Higher H	Higher λ and H	Higher λ, H, and z_i
	(1)	(2)	(3)	(4)
Percentage-Point $\Delta\sigma_Y$	2.27	−0.13	1.24	−1.19
Percentage-Point $\Delta\sigma_c$	1.26	−0.58	−0.06	−1.76
Percentage-Point $\Delta\sigma_{inv}$	9.29	−1.18	3.80	−7.76
Percentage-Point $\Delta\sigma_u$	0.54	−0.10	0.25	−0.41
Percentage-Point $\Delta\sigma_w$	2.34	−0.15	1.23	−1.35

To understand the mechanisms behind these results, Figures 2 and 3 show the impulse responses to temporary adverse aggregate productivity and interest rate shocks. While the increase in bank competition does contribute to lower labor market and aggregate volatility, the former is not strong enough to offset the downside from having a larger share of individuals exposed to interest rate shocks.[28]

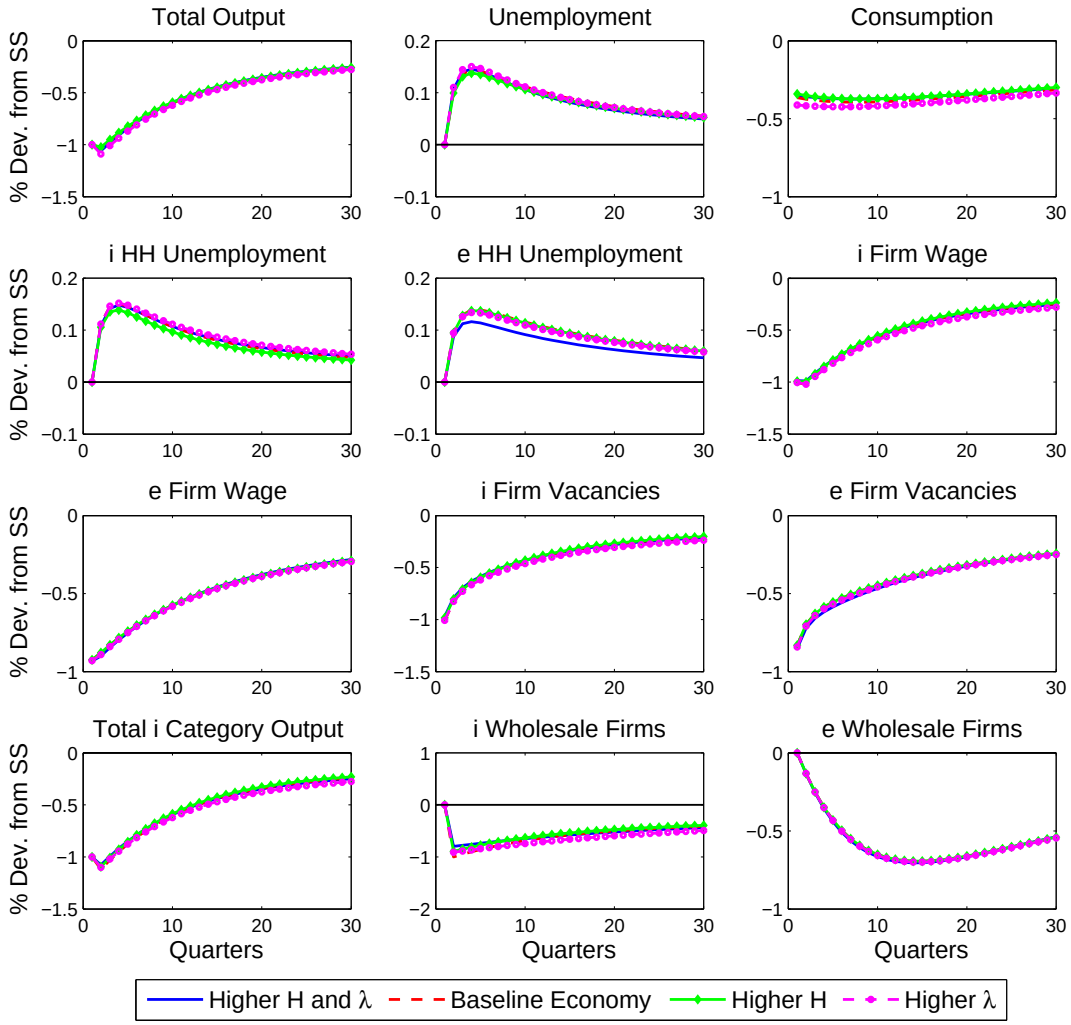


Figure 2: Response to a One Standard Deviation Reduction in Aggregate Productivity–Benchmark Model

[28]The fact that having a larger share of financially-included households can lead to a sharper response to shocks is related to the findings in Epstein, Finkelstein Shapiro, and González Gómez (2017). As shown in their work, the empirical response of unemployment and output to global financial risk shocks in economies with a larger share of financially-included households is stronger, and this share is responsible for explaining the patterns in the data amid global risk shocks.

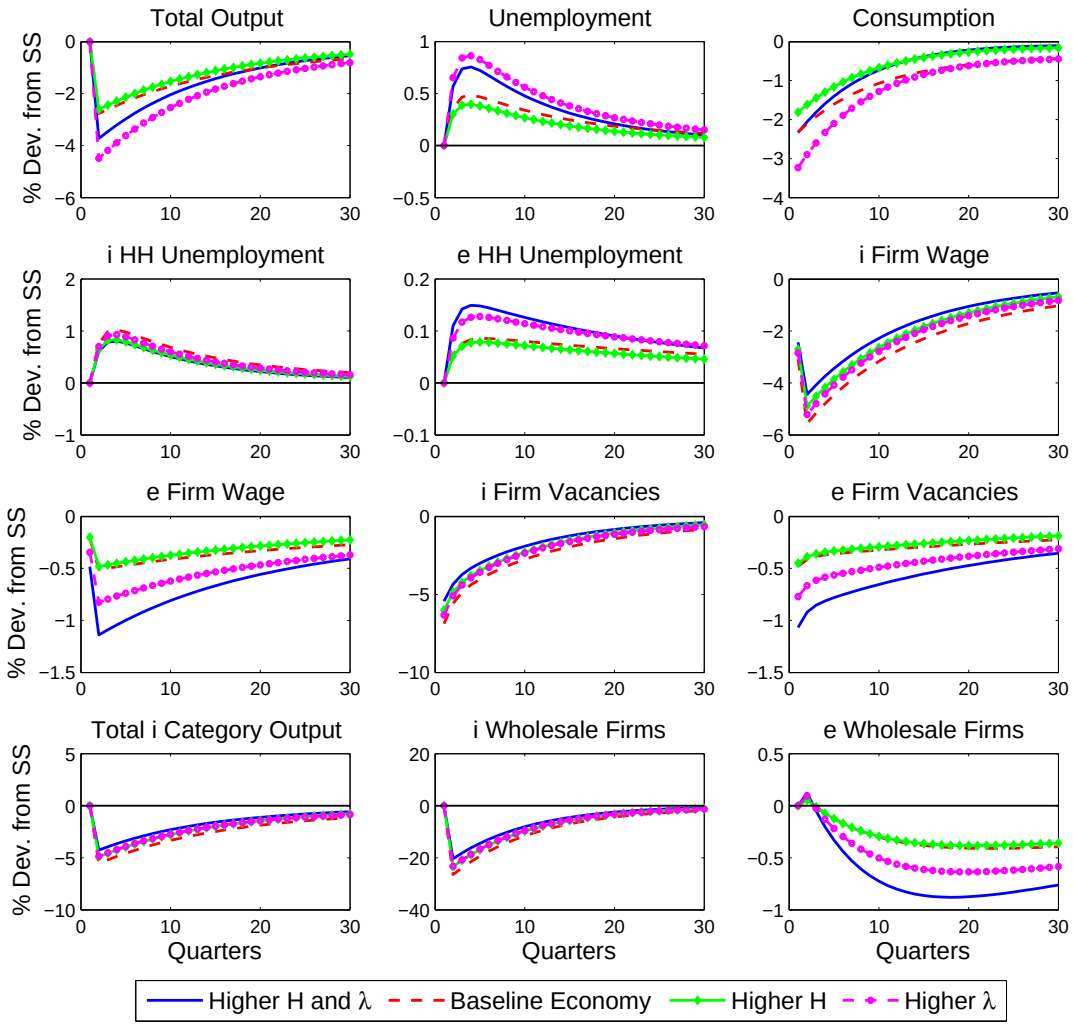


Figure 3: Response to a One Standard Deviation Increase in Foreign Interest Rates–Benchmark Model

Underlying Mechanisms Figures 2 and 3 suggest that interest rate shocks play a particularly relevant role for the impact of banking reforms on labor market dynamics and aggregate fluctuations. We note that interest rate shocks are one possible manifestation of financial shocks that affect, among other things, the provision of credit by the domestic banking system. Considering other types of financial shocks that affect the latter—such as shocks to ψ_i which, given banks' balance sheet constraint $b_{t+1}(h) = \psi_i N_{E,it}(h)$, can be broadly seen as shocks to banks' costs of providing resources for new firm ventures, which in turn affects

firm creation—delivers qualitatively identical results for output and unemployment relative to those from interest rate shocks.[29] Given this fact and following the EME business cycle literature, we focus on interest rate shocks.

Intuitively, banking reforms that increase the share of financially-included individuals without tackling bank competition implies that a larger segment of the economy—both in terms of household members and firms since the former own the latter—is vulnerable to interest rate shocks. This, in turn, implies sharper fluctuations in consumption and therefore in the way financially-included households and firms discount the future. Ultimately, this leads to higher labor market and aggregate volatility across the board. These results are in line with Epstein, Finkelstein Shapiro, and González Gómez (2017) in the context of global financial risk shocks. To understand the intuition behind the labor market and aggregate effects of banking reform, first note that the latter leads to non-negligible changes in households' steady-state consumption. This, in turn, is primarily due to the impact of reform on households' labor income (recall Table 3). In particular, comprehensive reform—i.e. an increase in both λ and H—sharply increases (decreases) steady-state i-household (e-household) consumption. This makes i-households' consumption less sensitive to shocks, but exacerbates the sensitivity of e-households' consumption to exogenous disturbances. In turn, this generates contrasting differences in the two households' valuation of the future via distinct movements in their stochastic discount factors.[30] This channel explains why interest rate shocks are important for generating reform-induced quantitative changes in volatility (recall Figures 2 and 3), as these shocks have a direct impact on consumption dynamics.

The link between reform and consumption dynamics also suggests that both household firm ownership and therefore firm heterogeneity in access to the banking system are critical for the volatility impact of reform, as we confirm further below. Indeed, in our framework, all firms are owned by households within their own category. This implies that, when comprehensive banking reform boosts i households' labor income and therefore consumption,

[29] Results available upon request.

[30] More formally, consider log-linear versions of each household category's stochastic discount factor: $\widehat{\Xi}^{j}_{t+1|t} = \mathbf{u}'(c_j)\left[\widehat{\mathbf{u}}'(c_{j,t+1}) - \widehat{\mathbf{u}}'(c_{j,t})\right]\left(\Xi^{j}\right)^{-1}$ for $j \in \{e, i\}$, where hatted terms denote log deviations from steady-state. Consider household i, who experiences higher steady-state c_i post-reform, implying that $\mathbf{u}'(c_i)$ is lower post-reform. Then, for a given deviation in c_i from steady-state, $\widehat{\Xi}^{i}_{t+1|t}$ becomes less sensitive post-reform.

these households' valuation of the future becomes more stable amid TFP and interest rate shocks. In turn, this stabilizes the expected marginal benefit of creating vacancies and accumulating capital by intermediate-goods i firms and the creation of wholesale i firms, which ultimately translates into more stable dynamics among i firms. The opposite takes place among e firms since e households' consumption is lower in steady-state and becomes more sensitive to shocks. As a result, both the creation of wholesale e firms and vacancy posting and investment decisions by intermediate-goods e firms become more volatile. This volatility offsets the benefits of reform among i-category firms, thereby leading to no volatility reductions or to reform-induced adverse effects on volatility. This is particularly apparent amid interest rate shocks (see Figure 3). Of note, the adverse of higher volatility among e households and firms on aggregate volatility as a result of comprehensive banking reform is particularly surprising given that these households and firms account for a smaller share of employment and economic activity post-reform.

The Role of Sectoral Firm Heterogeneity To highlight the importance of accounting for sectoral firm heterogeneity in participation in the banking system, Tables 5 and 6 show the results of a version of our framework with a single firm category. For ease of comparison, we maintain a two-household environment.[31] Table 6 also includes the volatility results from our benchmark model under the *comprehensive bank reform* for ease of comparison with the single-firm-category model. Of note, an increase in λ in the latter has no impact on steady-state allocations except for changes in sectoral employment and household consumption. In other words, while the composition of employment and consumption between financially-included and -excluded households changes under more household financial inclusion, macro aggregates remain unchanged when all firms participate in the banking system. This is inconsistent with the positive relationship between the share of individuals with financial accounts and the level of economic and financial development presented in Figure 1.

[31] Results from a model with a single household and firm category are qualitatively similar to those with two households and a single firm category. Also, the results below are similar to those in a version of the benchmark model where all firms rely on bank credit (and, incidentally, are owned by i households). See Figure A1 in the Appendix.

Table 5: Steady State Across Different Equilibria—Model with One Firm Category

Variable	Baseline (EME) Economy	Higher λ	Higher H	Higher λ and H
		(1)	(2)	(3)
Y	7.991	7.991	9.946	9.946
c	5.758	5.758	6.852	6.852
c_i	3.461	5.430	3.984	6.442
c_e	2.296	0.328	2.868	0.410
inv	1.324	1.324	1.648	1.648
N	76.03	76.03	158.1	158.1
n_i	0.404	0.845	0.405	0.848
n_e	0.514	0.073	0.516	0.074
u	0.082	0.082	0.079	0.079
H	2.110	8.245	8.245	8.245
λ	0.440	0.920	0.440	0.920
Δ Net Int. Margin (Percentage Points)	0	0	−3.070	−3.070

Table 6 and Figures 4 and 5 show that, with a single firm category, banking reforms reflected in higher household financial inclusion and a more competitive banking system unambiguously reduce output volatility. This is consistent with existing findings in one-household one-firm models for AEs (see, for example, Cacciatore, Ghironi, and Stebunovs, 2015).

Table 6: *Percentage-Point* Change in Volatility Relative to Baseline (EME) Economy—Model with One Firm Category

	Benchmark Model Higher λ and H	Model with One Firm Cat. Higher λ	Model with One Firm Cat. Higher H	Model with One Firm Cat. Higher λ and H
		(1)	(2)	(3)
Percentage-Point $\Delta\sigma_Y$	1.24	−0.09	−1.40	−1.46
Percentage-Point $\Delta\sigma_c$	−0.06	0.06	−1.36	−1.32
Percentage-Point $\Delta\sigma_{inv}$	3.80	0.18	−6.62	−6.45
Percentage-Point $\Delta\sigma_u$	0.25	−1.45	−0.79	−1.98
Percentage-Point $\Delta\sigma_w$	1.23	1.49	−1.35	−0.08

While the increase in household inclusion alone does increase consumption, investment, and wage volatility (column (1) in Table 6), both output and unemployment volatility are reduced. Moreover, while the reduction in volatility under a comprehensive banking reform is primarily explained by the positive impact of reform on the economy's response to interest rate shocks and the increase in bank competition (see column (2) in Table 6), the reform also makes the economy less sensitive to TFP shocks (Figures 4 and 5). This stands in contrast

with our results from the benchmark model, where the presence of interest rate shocks is fundamental for generating quantitative changes in volatility amid banking reforms.

Intuitively, with a single firm category that participates in the banking system, banking reform expands the amount of resources for firm creation. This leads to more demand for intermediate goods from wholesale firms. As a result, intermediate-goods firms increase capital accumulation along with vacancy posting. This results in an increase in intermediate-output firms' steady-state value from having a worker, which stabilizes these firms' response to shocks relative to the baseline economy with a less developed banking system. As a result, vacancies, investment, and employment become less volatile, which in turn contributes to lower consumption, unemployment, and output volatility. Of note, the fact that the majority of individuals in the economy are subject to interest rate shocks (i.e., λ increases from 0.44 to 0.92, implying that most individuals become financially-included) under the reform does not imply that consumption becomes more volatile. In fact, the gains from reform via greater bank competition are strong enough to offset the higher share of individuals exposed to interest rate shocks. This is not the case in our framework with both financially-excluded and -included firms, where the increase in household financial inclusion dominates and leads to higher volatility.

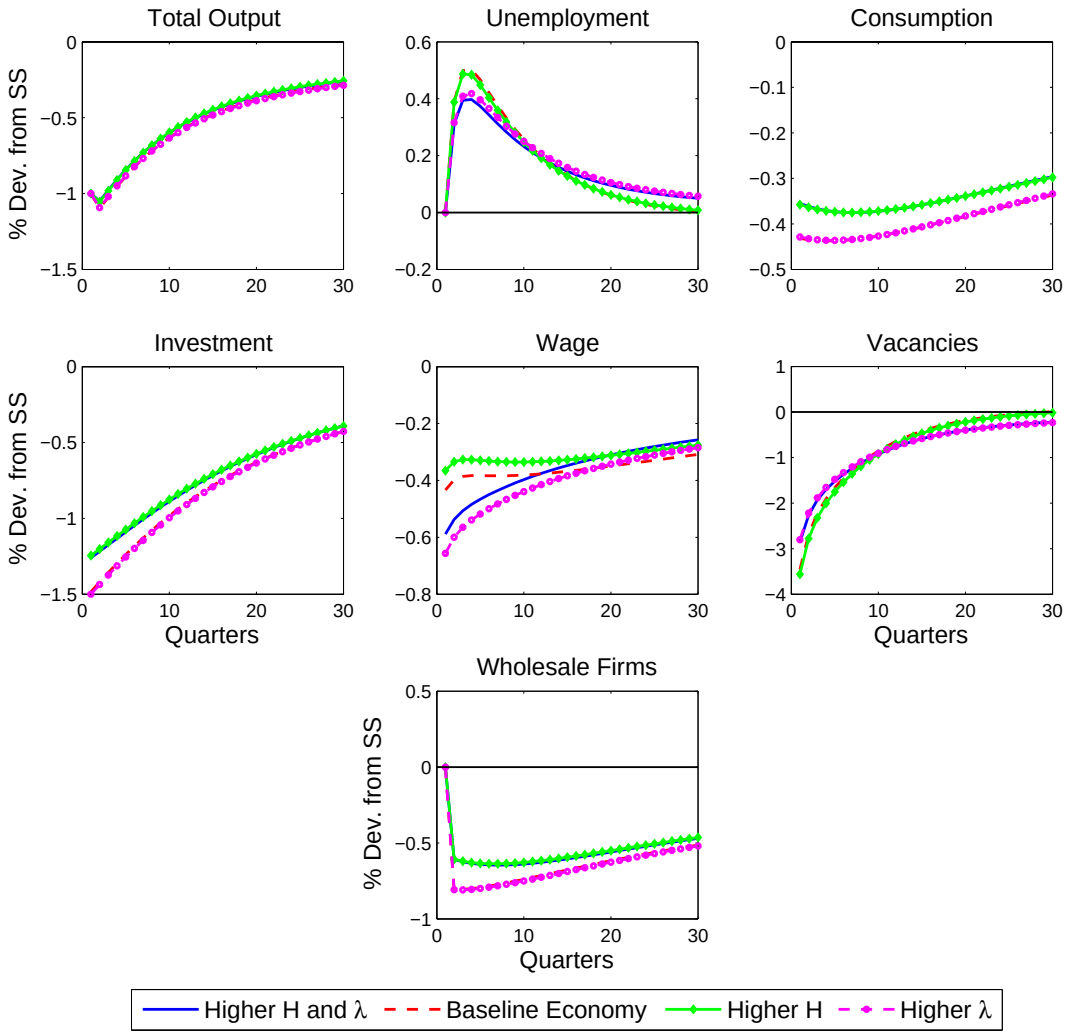


Figure 4: Response to a One Standard Deviation Reduction in Aggregate Productivity–Model with One Firm Category

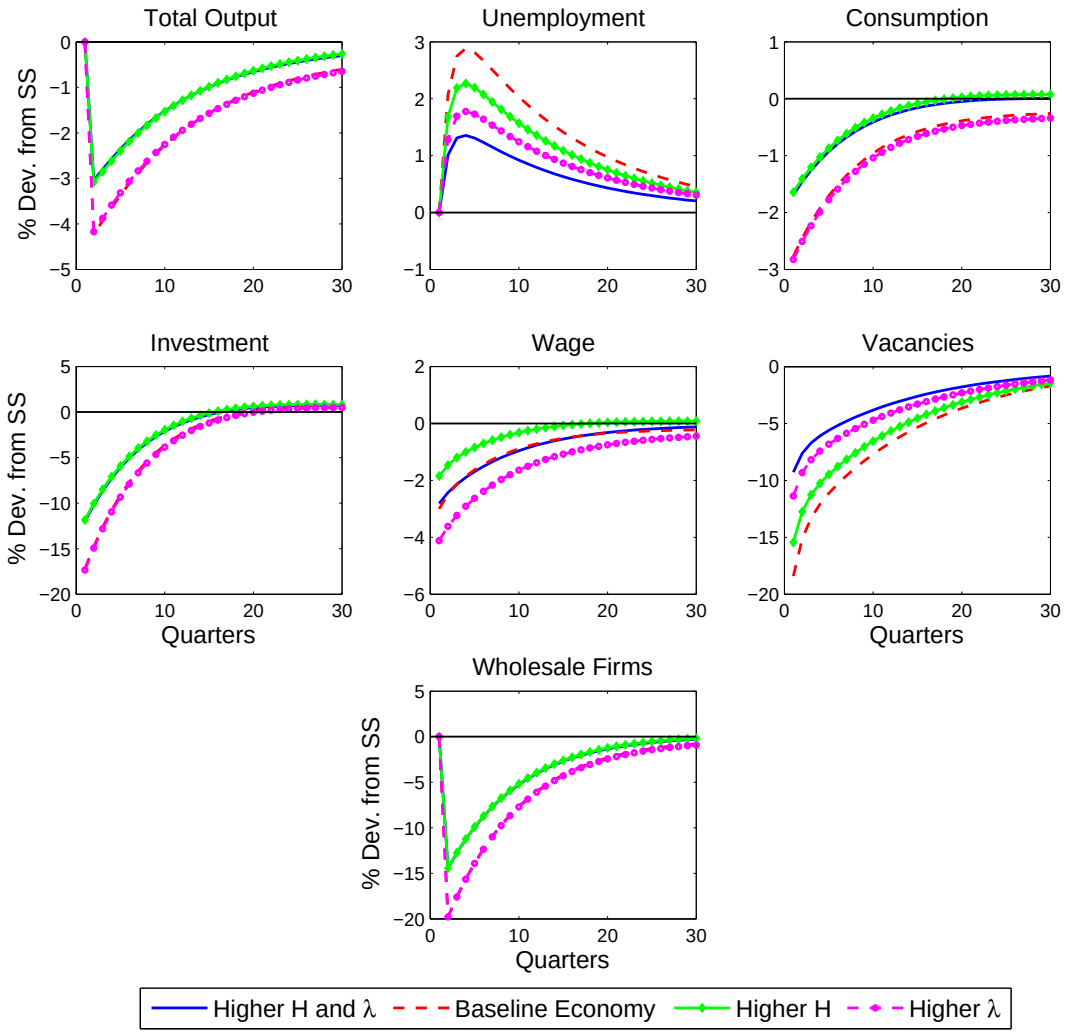


Figure 5: Response to a One Standard Deviation Increase in Foreign Interest Rates–Model with One Firm Category

The Role of Households' Firm Ownership Firm ownership by households—specifically, whether financially-excluded households own financially-excluded firms—plays an important role for the impact of banking reforms on labor market and aggregate volatility. Table 7 compares the results from comprehensive banking reform—a joint increase in λ and H—in the benchmark model to three main variants of our framework.[32]

First, allowing i households to own all firm categories (column (2) in Table 7) implies

[32]The Appendix presents impulse response functions for each of the model variants in Table 7.

a reduction in labor market and aggregate volatility as a result of reforms. In fact, the qualitative conclusions are similar to those from the model alternative with a single firm category.[33] Second, a model where i households own all i firms as well as wholesale e firms (column (3) in Table 7) still implies that same banking reforms are beneficial. However, the positive quantitative impact is more subdued. Finally, a model where i households own all i firms as well as intermediate goods e firms (column (4) in Table 7) implies that the major gains from banking reform arise from lower investment volatility, though the same reform leads to higher output and wage volatility. All told, assuming that e households own wholesale e firms is critical for explaining the adverse volatility consequences from banking reform. This traces back to the fact that comprehensive banking reform adversely affects e households, and if the latter own wholesale e firms, these firms will be adversely affected as well. In turn, this will feed into these firms' demand for output from intermediate-goods e firms. The higher volatility among e firms more than offsets the reform-induced gains among i firms, thereby leading to higher labor market and aggregate volatility.

Table 7: *Percentage-Point* Change in Volatility Relative to Baseline (EME) Economy—Benchmark Model vs. Alternative Firm Ownership Assumptions

	Benchmark Model Higher λ and H	i Households Own All Firms Higher λ and H	i Households Own e Wholesale Firms Higher λ and H	i Households Own e Intermediate Goods Firms Higher λ and H
	(1)	(2)	(3)	(4)
Percentage-Point $\Delta\sigma_Y$	1.24	−0.90	−0.80	0.87
Percentage-Point $\Delta\sigma_c$	−0.06	−1.37	−0.30	−0.30
Percentage-Point $\Delta\sigma_{inv}$	3.80	−4.02	0.77	−7.34
Percentage-Point $\Delta\sigma_u$	0.25	−0.31	−0.11	−0.02
Percentage-Point $\Delta\sigma_w$	1.23	−1.03	−0.71	0.31

Robustness Checks The Appendix presents results for several robustness checks for the benchmark model, including different values for the elasticity of substitution between sectoral output, heterogeneity in sectoral productivity and vacancy posting costs, and the contribution of i firms to total output, among others. All told and given reasonable alternative

[33] Assuming that i firms own all firms implies that e households' sole income source is labor income from e firms.

calibrations, our main conclusions remain unchanged.[34]

5 Conclusion

We study the impact of banking reforms in emerging economies (EMEs) using a small open economy model with endogenous firm entry and a monopolistically-competitive banking sector, labor market frictions, and empirically-factual household and firm heterogeneity in access to the domestic banking system. Calibrating the model to a representative EME where TFP and foreign interest rate shocks are the main drivers of aggregate fluctuations, we consider banking reforms that bring the banking system to AE standards via: (1) a higher share of financially-included households; (2) increased bank competition (reflected in lower net interest margins); and (3) a joint improvement in both (1) and (2)—i.e., a *comprehensive* banking reform.

Our experiments suggest that, under a standard calibration that matches the EME employment and firm structure, a reform-driven expansion of households' access to the banking system in the absence of increased bank competition leads to higher labor market and aggregate volatility. Conversely, increased bank competition without further household financial inclusion leads to reduced volatility, even though the reduction in the latter is quantitatively small. In turn, a comprehensive banking reform ultimately leads to higher labor market and aggregate volatility unless the reform is accompanied by productivity improvements. The presence of interest rate shocks—which are prevalent in EMEs and represent one manifestation of financial disturbances that affect the banking system—plays an important role in generating non-negligible quantitative differences in volatility across reform equilibria. We show that abstracting from financially-excluded firms—a key feature of EMEs—leads to drastically different policy outcomes, whereby banking reforms unconditionally lead to labor market and aggregate volatility regardless of how banking reform manifests itself, and regardless of whether productivity improves or not. Our findings point to key characteristics

[34] As should be expected, assuming that i-firm output represents a much larger share of total output relative to our baseline calibration—a counterfactual assumption given the evidence on the share of firms that do not participate in the banking system and their contribution to output—implies that reforms have positive effects on aggregate volatility.

of financial access and participation in EMEs that should be taken into account in the analysis of banking reform in these economies, as well as possible policy complementarities that can contribute to smoother business cycle fluctuations as a result of comprehensive banking reforms.

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A Online Appendix

A.1 Data Sources and Details: Figure 1

Tables 1 and 2 and Figure 1 are based on data from 2000 to 2011 from the World Bank's World Development Indicators (domestic credit to the private sector (% of GDP), real GDP per capita in PPP terms (constant 2011 international $)), the World Bank Global Financial Development Report 2014 (share of the population with accounts at financial institutions (% of population age 15+) in 2011), the IFC Enterprise Finance Gap Database 2010 (share of firms with credit line; share of informal and formal firms, share of formal and informal firms with bank loans), the World Bank Financial Development Structure Database 2011 (net interest margins, Lerner Index, share of firms competing with unregistered firms).

List of countries in Figure 1: Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bangladesh, Belarus, Belgium, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Dem. Rep. of Congo, Republic of Congo, Costa Rica, Côte d'Ivoire, Croatia, Cyprus, Czech Republic, Denmark, Djibouti, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Finland, France, Gabon, The Gambia, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea, Kyrgyz Republic, Lao PDR, Latvia, Lebanon, Lesotho, Liberia, Libya, Lithuania, Luxembourg, Macedonia, Madagascar, Malawi, Malaysia, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Rwanda, Senegal, Serbia, Sierra Leone, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Sudan, Swaziland, Sweden, Switzerland, Tajikistan, Tanzania, Thailand, Tunisia, Turkey, Uganda, Ukraine, United Kingdom, United States, Uruguay, Venezuela, Vietnam, Zambia. Data availability and coverage for each variable presented in Figure 1 varies by country.

A.2 Aggregation in Benchmark Model

To determine the equilibrium real relative price for each monopolistically-competitive wholesale firm category $j \in \{e, i\}$, consider

$$P_{j,t} = \left(\int_{\omega_j \in \Omega_j} p_{j,t}(\omega_j)^{1-\varepsilon} d\omega_j \right)^{\frac{1}{1-\varepsilon}}.$$

Dividing both sides by P_t, we have

$$\frac{P_{j,t}}{P_t} = \left(\int_{\omega_j \in \Omega_j} \left(\frac{p_{j,t}(\omega_j)}{P_t} \right)^{1-\varepsilon} d\omega_j \right)^{\frac{1}{1-\varepsilon}},$$

Imposing symmetry, we have

$$\frac{P_{j,t}}{P_t} = \frac{p_{j,t}}{P_t} \left(\int_{\omega_j \in \Omega_j} 1 d\omega_j \right)^{\frac{1}{1-\varepsilon}},$$

where we can define $p_{j,t}/P_t \equiv \rho_{j,t}$. Then, since there are $N_{j,t}$ wholesale firms operating in firm category j in period t, the above expression becomes

$$\frac{P_{j,t}}{P_t} = \rho_{j,t} N_{j,t}^{\frac{1}{1-\varepsilon}},$$

which can be rewritten as

$$\rho_{j,t} = \frac{P_{j,t}}{P_t} N_{j,t}^{\frac{1}{\varepsilon-1}}.$$

Similarly, recall that wholesale output at sectoral level is given by $Y_{j,t} = \left(\int_{\omega_j \in \Omega_j} y_{j,t}(\omega_j)^{\frac{\varepsilon-1}{\varepsilon}} d\omega_j \right)^{\frac{\varepsilon}{\varepsilon-1}}$. Imposing symmetry, we have

$$Y_{j,t} = y_{j,t} \left(\int_{\omega_j \in \Omega_j} 1 d\omega_j \right)^{\frac{\varepsilon}{\varepsilon-1}},$$

Then, since there are $N_{j,t}$ wholesale firms operating in firm category j in period t, the above expression becomes

$$Y_{j,t} = y_{j,t} N_{j,t}^{\frac{\varepsilon}{\varepsilon-1}}.$$

A.3 Equilibrium Conditions: Benchmark Model

Taking the stochastic processes $\{z_t, z_{r,t}\}$ as given, the allocations and prices $\{Y_t, mc_{i,t}, mc_{e,t}\}$,

$\{N_{E,et}, N_{E,it}, Q_t, n_{i,t}, n_{e,t}, k_{i,t}, k_{e,t}, v_{i,t}, v_{e,t}, w_{i,t}, w_{e,t}, b_t, b_t^*, e_{b,t}, e_{e,t}, \rho_{i,t}, \rho_{e,t}, Y_{i,t}, Y_{e,t}, c_{i,t}, c_{e,t}, P_{i,t}, P_{e,t}, P_t\}$ satisfy:

$$Y_t = \left[(1-\alpha_y)^{\frac{1}{\phi_y}} (Y_{i,t})^{\frac{\phi_y-1}{\phi_y}} + \alpha_y^{\frac{1}{\phi_y}} (Y_{e,t})^{\frac{\phi_y-1}{\phi_y}}\right]^{\frac{\phi_y}{\phi_y-1}}, \tag{20}$$

$$\rho_{i,t} = (\varepsilon/(\varepsilon-1))\, mc_{i,t}, \tag{21}$$

$$\rho_{e,t} = (\varepsilon/(\varepsilon-1))\, mc_{e,t}, \tag{22}$$

$$e_{e,t} = \psi_{e,t}, \tag{23}$$

$$Q_t = \left(\frac{1}{1-\delta}\right)\psi_{i,t}, \tag{24}$$

$$Q_t = \mathbb{E}_t \Xi_{t+1|t} \left\{\left(1-\frac{1}{H}\right) d_{i,t+1} + (1-\delta) Q_{t+1}\right\}, \tag{25}$$

$$n_{i,t+1} = (1-\rho_i^n)\left(n_{i,t} + v_{i,t} q(\theta_{i,t})\right), \tag{26}$$

$$n_{e,t+1} = (1-\rho_e^n)\left(n_{e,t} + v_{e,t} q(\theta_{e,t})\right), \tag{27}$$

$$1 = \mathbb{E}_t \Xi_{t+1|t} \left\{1 + \alpha mc_{i,t+1} z_{i,t+1} n_{i,t+1}^{1-\alpha} k_{i,t+1}^{a-1} - \delta\right\}, \tag{28}$$

$$1 = \mathbb{E}_t \Xi_{t+1|t} \left\{1 + \alpha mc_{e,t+1} z_{e,t+1} n_{e,t+1}^{1-\alpha} k_{e,t+1}^{a-1} - \delta\right\}, \tag{29}$$

$$\frac{\kappa_i}{q(\theta_{i,t})} = (1-\rho_i^n)\mathbb{E}_t \Xi_{t+1|t}^i \left\{(1-\alpha) mc_{i,t+1} z_{i,t+1} n_{i,t+1}^{-\alpha} k_{i,t+1}^a - w_{i,t+1} + \frac{\kappa_i}{q(\theta_{i,t+1})}\right\}, \tag{30}$$

$$\frac{\kappa_e}{q(\theta_{e,t})} = (1-\rho_e^n)\mathbb{E}_t \Xi_{t+1|t}^e \left\{(1-\alpha) mc_{e,t+1} z_{e,t+1} n_{e,t+1}^{-\alpha} k_{e,t+1}^a - w_{e,t+1} + \frac{\kappa_e}{q(\theta_{e,t+1})}\right\}, \tag{31}$$

$$w_{i,t} = \eta\left[(1-\alpha) mc_{i,t} z_{i,t} n_{i,t}^{-\alpha} k_{i,t}^a + \kappa_i \theta_{i,t}\right] + (1-\eta)\chi, \tag{32}$$

$$w_{e,t} = \eta\left[(1-\alpha) mc_{e,t} z_{e,t} n_{e,t}^{-\alpha} k_{e,t}^a + \kappa_e \theta_{e,t}\right] + (1-\eta)\chi, \tag{33}$$

$$\mathbf{u}'(c_{i,t}) = R_{t+1}\beta \mathbb{E}_t \mathbf{u}'(c_{i,t+1}), \tag{34}$$

$$\mathbf{u}'(c_{i,t}) = R_{t+1}^* \beta \mathbb{E}_t \mathbf{u}'(c_{i,t+1}), \tag{35}$$

$$e_{b,t} = \mathbb{E}_t \Xi^i_{t+1|t} \left\{ \pi_{b,t+1} + e_{b,t+1} \right\}, \tag{36}$$

$$e_{e,t} = (1-\delta) \mathbb{E}_t \Xi^e_{t+1|t} \left\{ d_{e,t+1} + e_{e,t+1} \right\}, \tag{37}$$

$$\rho_{i,t} = \frac{P_{i,t}}{P_t} N_{i,t}^{\frac{1}{\varepsilon-1}}, \tag{38}$$

$$\rho_{e,t} = \frac{P_{e,t}}{P_t} N_{e,t}^{\frac{1}{\varepsilon-1}}, \tag{39}$$

$$c_{e,t} + x_{e,t+1} N_{E,et} e_{e,t} = w_{e,t} n_{e,t} + \chi_e u_{e,t} + x_{e,t} N_{e,t} \left[d_{e,t} + e_{e,t} \right] + \Pi_{e,t}, \tag{40}$$

$$Y_{i,t} = N_{i,t}^{\frac{\varepsilon}{\varepsilon-1}} y_{i,t} = N_{i,t}^{\frac{1}{\varepsilon-1}} z_{i,t} n_{i,t}^{1-\alpha} k_{i,t}^{a}, \tag{41}$$

$$Y_{e,t} = N_{e,t}^{\frac{\varepsilon}{\varepsilon-1}} y_{e,t} = N_{e,t}^{\frac{1}{\varepsilon-1}} z_{e,t} n_{e,t}^{1-\alpha} k_{e,t}^{a}, \tag{42}$$

$$Y_t = c_{e,t} + c_{i,t} + i_{e,t} + i_{i,t} + \kappa_e v_{e,t} + \kappa_i v_{i,t} + \psi_{e,t} N_{E,et} + \psi_{i,t} N_{E,it} + R^*_t b^*_t - b^*_{t+1}, \tag{43}$$

$$P_{i,t}/P_t = (1-\alpha_y) \left(Y_t / Y_{i,t} \right)^{\frac{1}{\phi_y}}, \tag{44}$$

$$P_{e,t}/P_t = \alpha_y \left(Y_t / Y_{e,t} \right)^{\frac{1}{\phi_y}}, \tag{45}$$

$$P_t = \left[(1-\alpha_y) \left(P_{i,t} \right)^{1-\phi_y} + \alpha_y \left(P_{e,t} \right)^{1-\phi_y} \right]^{\frac{1}{\phi_y - 1}}, \tag{46}$$

given the definitions of the stochastic discount factors, the matching probabilities, and total unemployment, $u_t = 1 - n_{e,t} - n_{i,t}$.

A.4 Banking Reforms: Alternative Firm-Ownership Assumptions

The figures below show impulse response functions to productivity and interest rate shocks for several versions of the benchmark model under alternative assumptions regarding firm ownership and firms' access to bank credit.

Benchmark Model, All Firms Use Bank Credit Figures A1 and A2 show the response to shocks for a version of the benchmark model where all wholesale firms (both e and i) finance their sunk entry costs with bank resources. This implies that i households become the ultimate owners of e wholesale firms by owning all banks (as such, banks' value of having another e firm in its portfolio is discounted using i households' stochastic discount factor).

e households continue to own intermediate-goods e firms.

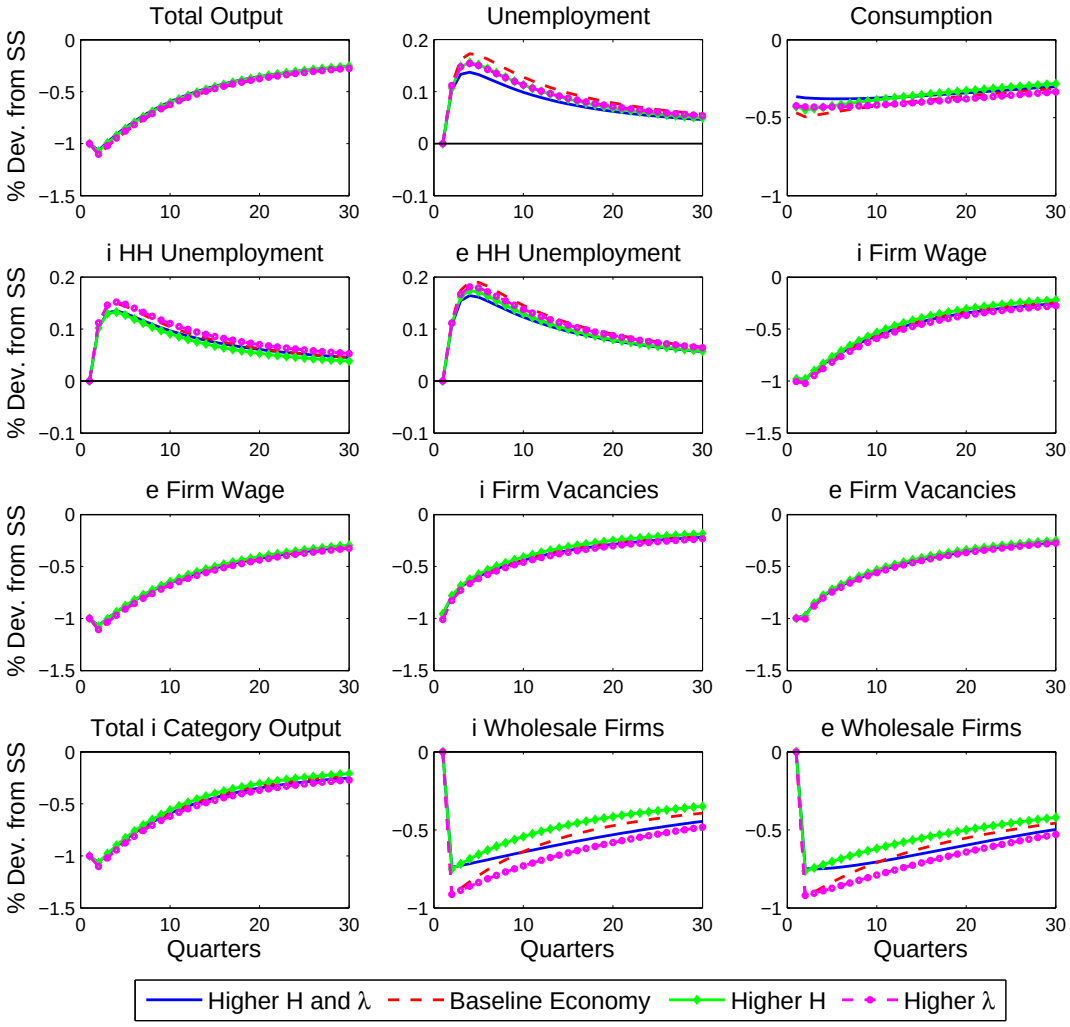

Figure A1: Response to a One Standard Deviation Reduction in Aggregate Productivity–Benchmark Model, All Firms Access Bank Credit

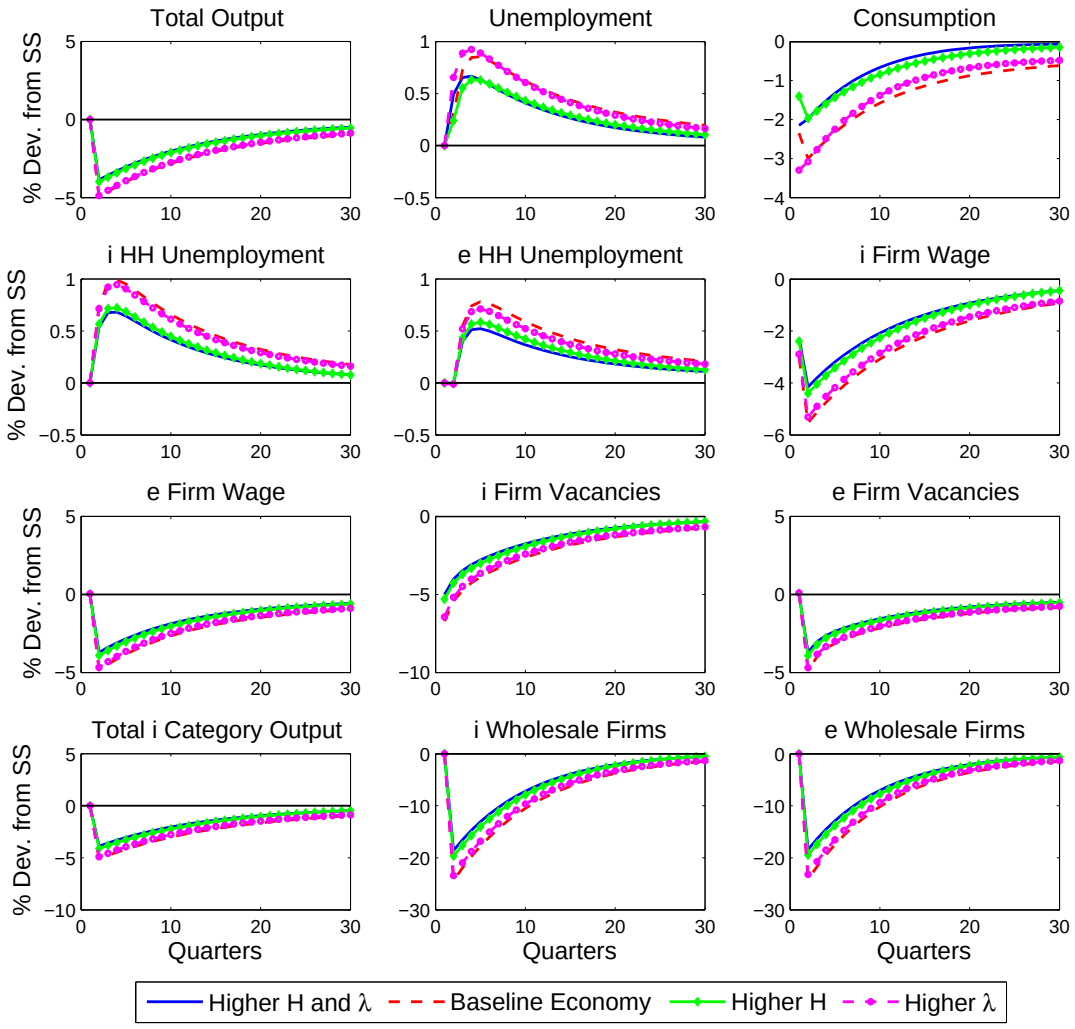

Figure A2: Response to a One Standard Deviation Increase in Foreign Interest Rates–Benchmark Model, All Firms Access Bank Credit

Benchmark Model, i Households Own All Firms Figures A3 and A4 show the response to shocks for a version of the benchmark where i households own all firms in the economy. As briefly stated in the main text, this implies that e households receive income solely from labor income in intermediate-goods e firms.

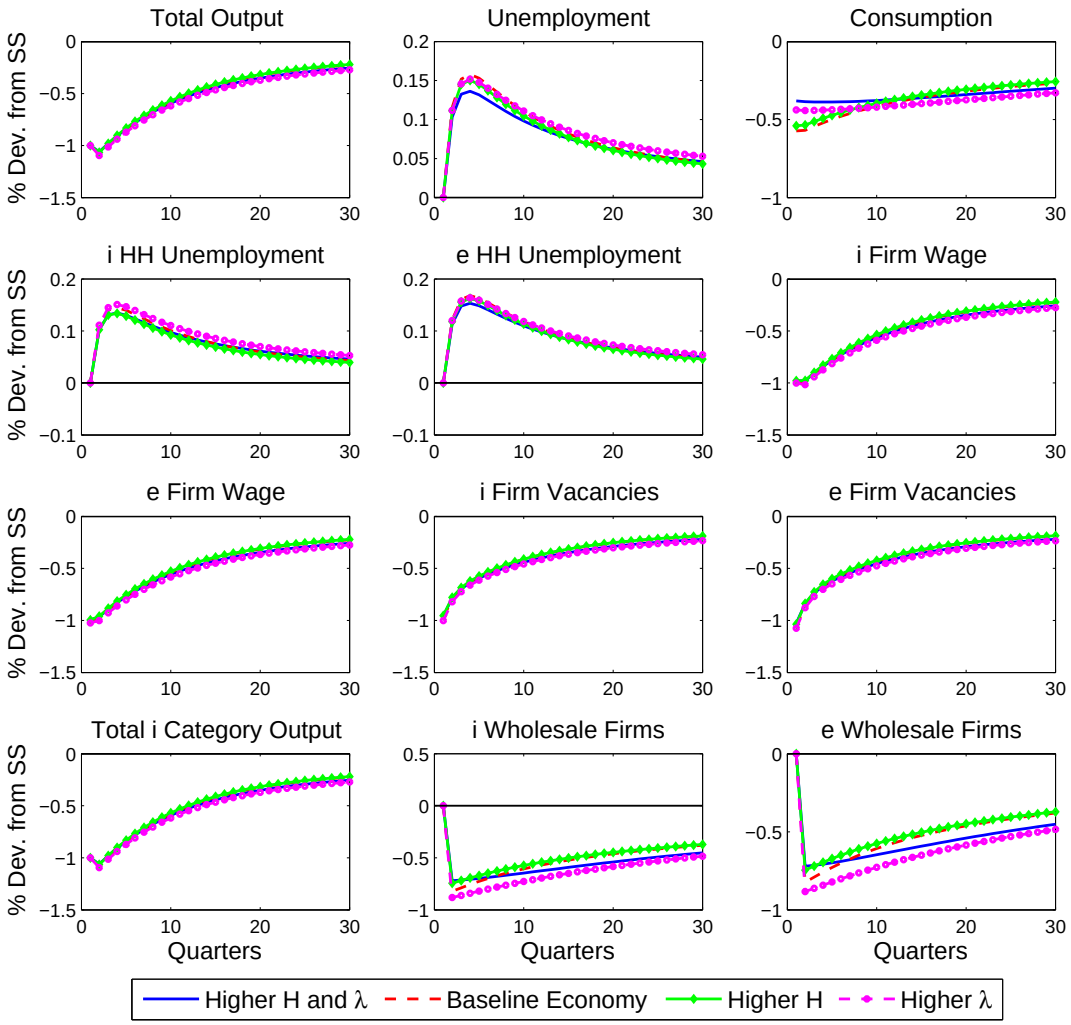

Figure A3: Response to a One Standard Deviation Reduction in Aggregate Productivity–*i* Households Own All Firms

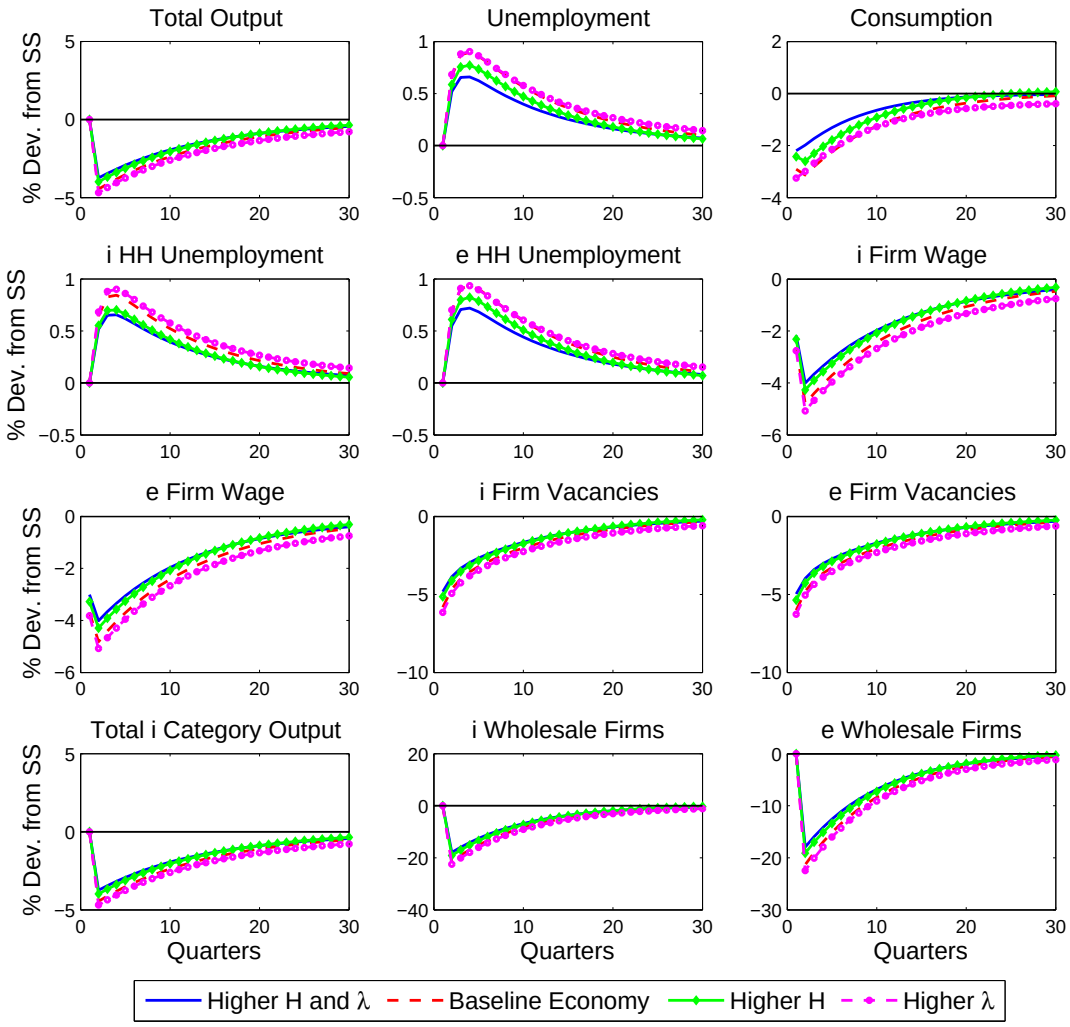

Figure A4: Response to a One Standard Deviation Increase in Foreign Interest Rates–i Households Own All Firms

Benchmark Model, i Households Own Wholesale e Firms Figures A5 and A6 show the response to shocks for a version of the benchmark where i households own all i firms and wholesale e firms. This implies that e households receive income from labor income in intermediate-goods e firms as well as these firms' lump-sum profits.

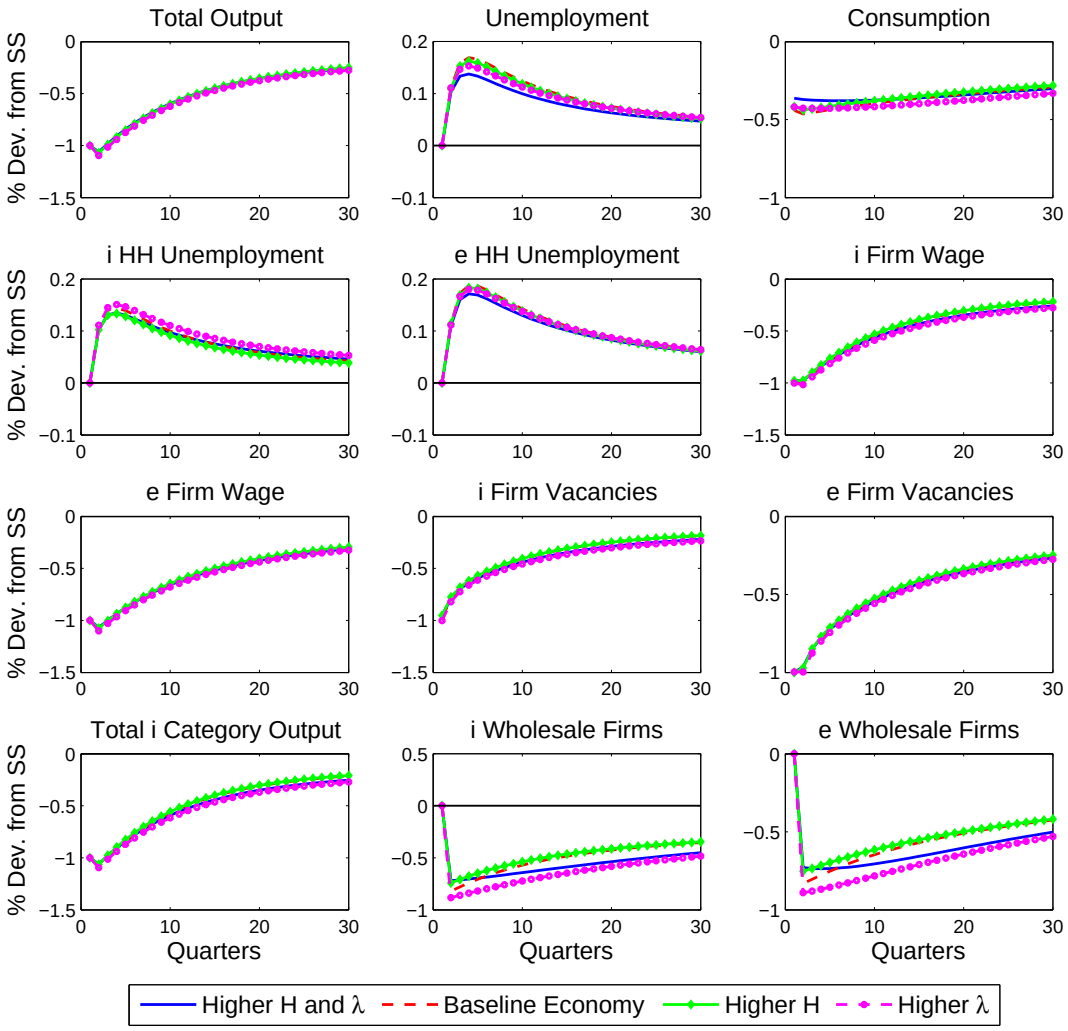

Figure A5: Response to a One Standard Deviation Reduction in Aggregate Productivity–i Households Own All i Firms and Wholesale e Firms

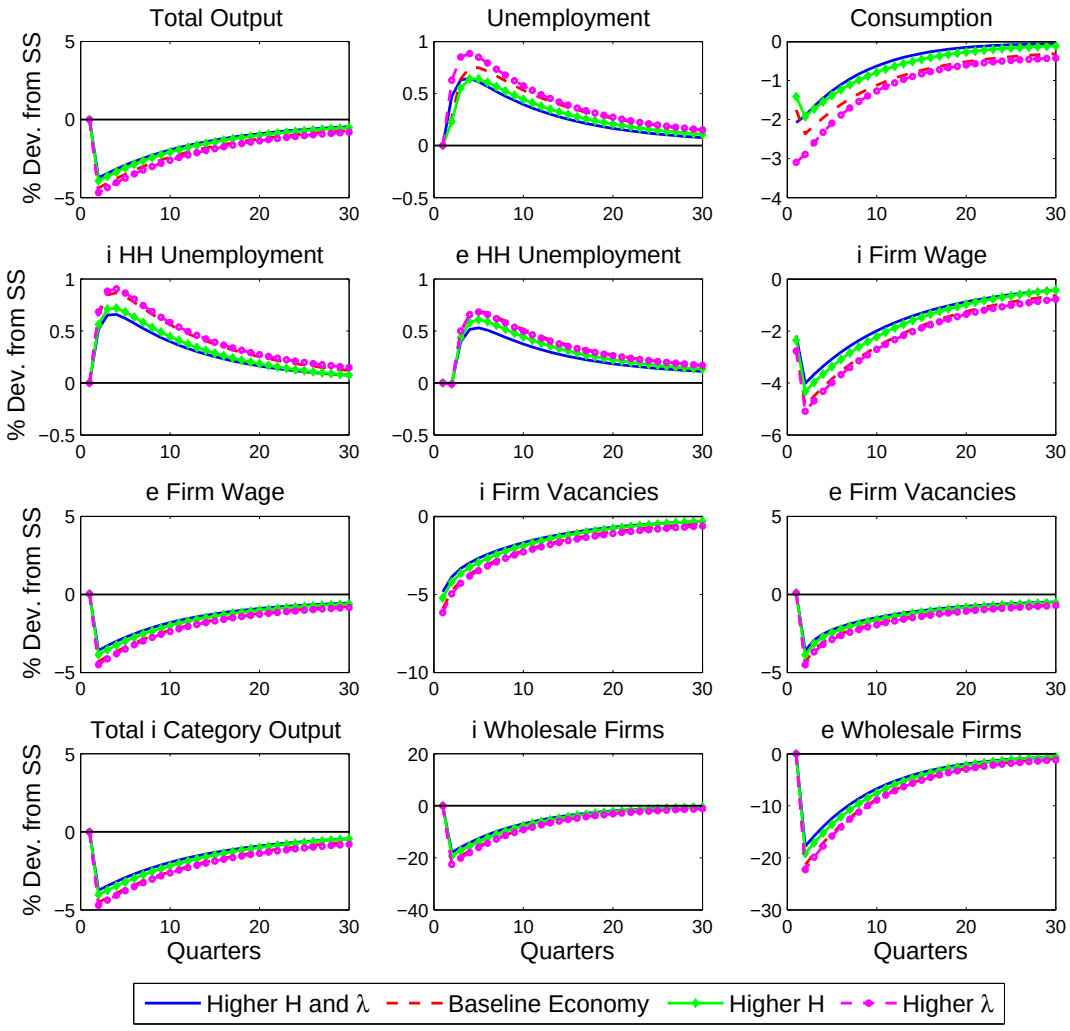

Figure A6: Response to a One Standard Deviation Increase in Foreign Interest Rates–i Households Own All i Firms and Wholesale e Firms

Benchmark Model, i Households Own Intermediate-Goods e Firms Figures A7 and A8 show the response to shocks for a version of the benchmark where i households own all i firms and intermediate-goods e firms. This implies that e households receive income from labor income in intermediate-goods e firms as well as wholesale e firms' profits and cover wholesale e firms' sunk entry costs.

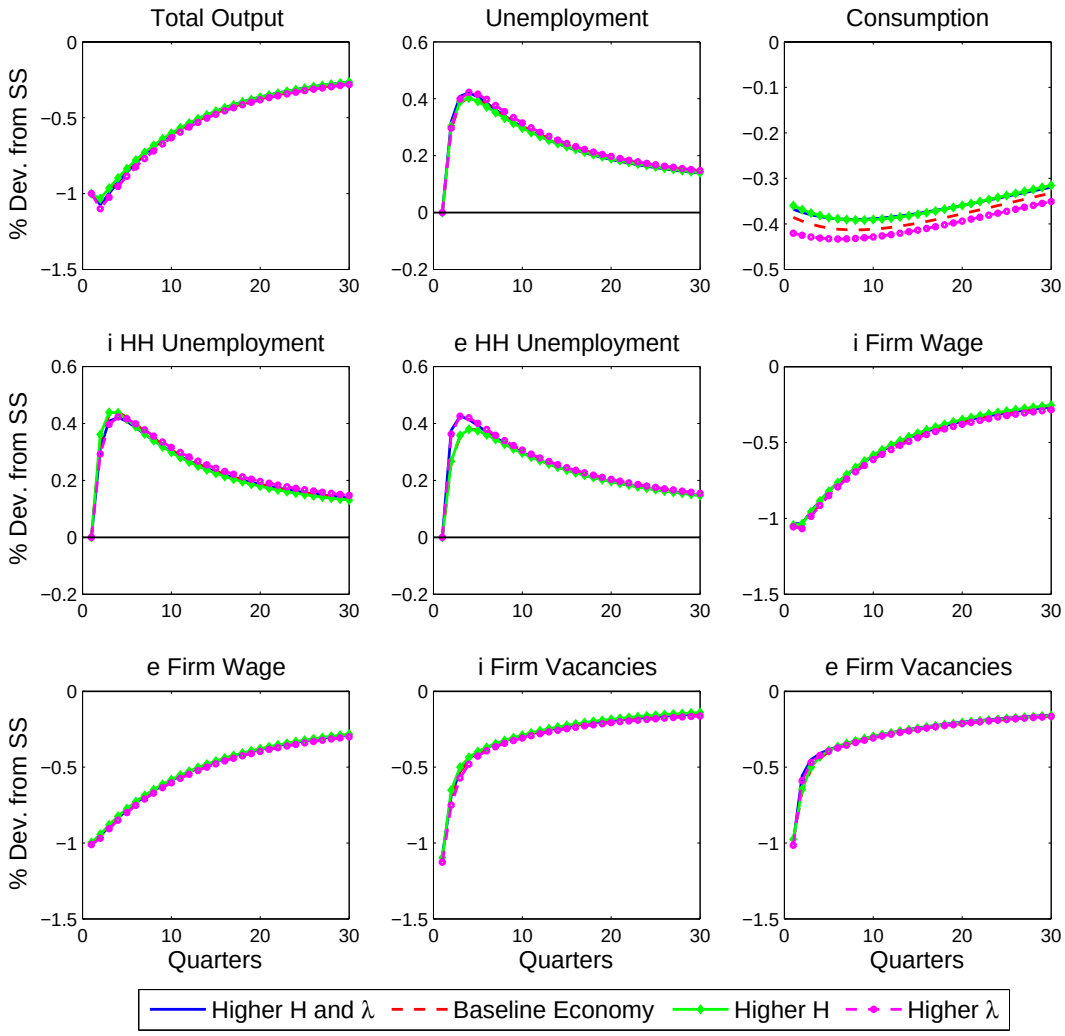

Figure A7: Response to a One Standard Deviation Reduction in Aggregate Productivity–i Households Own All i Firms and Intermediate-Goods e Firms

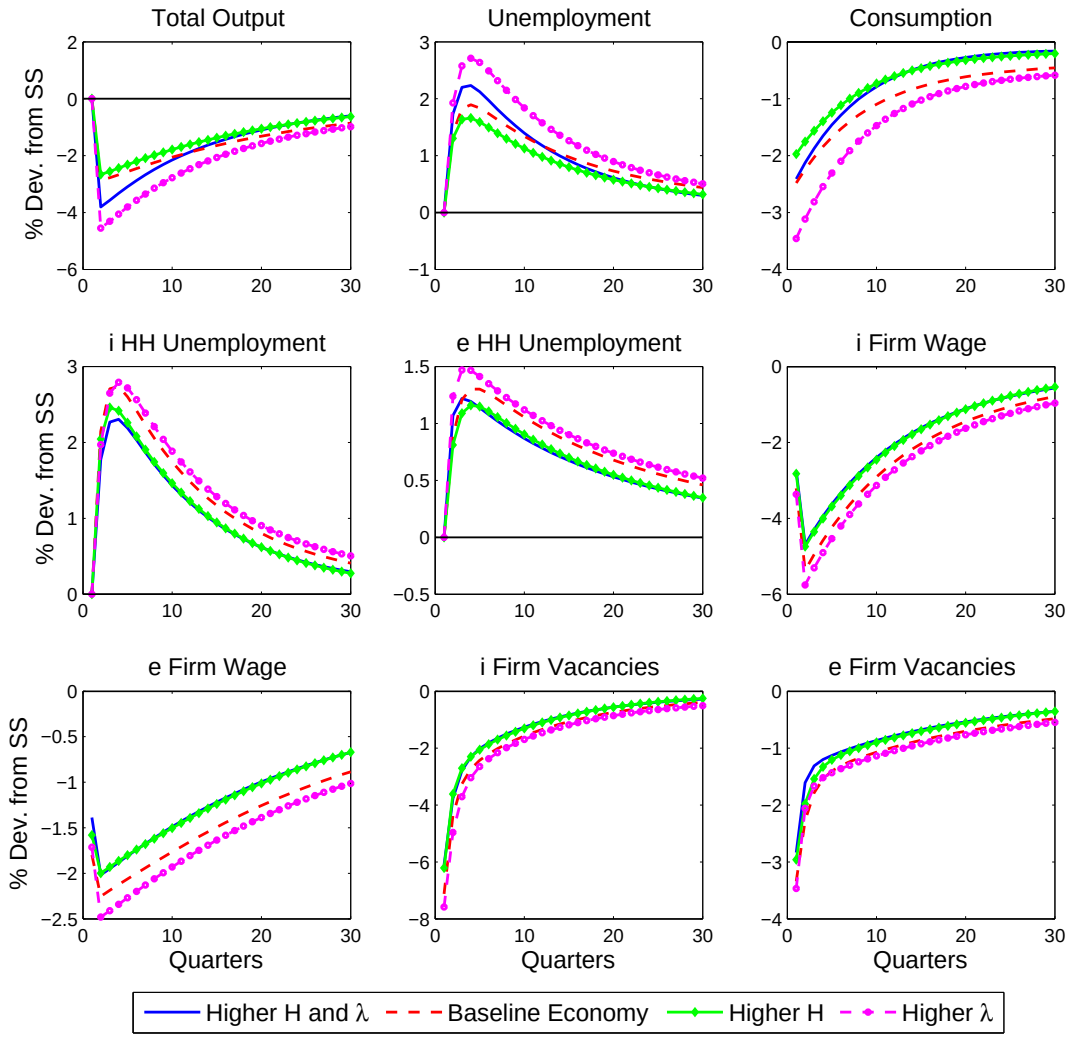

Figure A8: Response to a One Standard Deviation Increase in Foreign Interest Rates–i Households Own All i Firms and Intermediate-Goods e Firms

A.5 Sensitivity Analysis

Benchmark Model with $\phi_y = 1.5$ (vs. $\phi_y = 5$ in Baseline Calibration)

Table A1: Steady State Under Different Banking Reform Equilibria, $\phi_y = 1.5$

Variable	Baseline (EME) Economy	Higher λ	Higher H	Higher λ and H	Higher λ, H, and z_i
		(1)	(2)	(3)	(4)
Y	4.664	2.754	5.209	3.199	6.903
c	3.246	1.897	3.545	2.142	4.759
c_i	1.640	1.273	1.786	1.438	3.443
c_e	1.607	0.624	1.759	0.704	1.316
inv	0.773	0.457	0.863	0.530	1.144
N	16.71	8.799	22.94	13.77	29.55
N_i	5.758	4.584	10.97	9.017	20.69
N_e	10.95	4.215	11.97	4.757	8.857
N_e/N	0.655	0.479	0.522	0.345	0.230
u	0.082	0.096	0.080	0.092	0.078
H	2.110	2.110	8.245	8.245	8.245
λ	0.440	0.920	0.440	0.920	0.920
Δ Net Int. Margin (Percentage Points)	0	0	-3.070	-3.070	-3.070

Table A2: Percentage Point Change in Volatility Relative to Baseline (EME) Economy, $\phi_y = 1.5$

	Higher λ	Higher H	Higher λ and H	Higher λ, H, and z_i
	(1)	(2)	(3)	(4)
Percentage-Point $\Delta\sigma_Y$	1.38	-0.26	1.00	0.33
Percentage-Point $\Delta\sigma_c$	1.33	-0.62	0.40	-0.53
Percentage-Point $\Delta\sigma_{inv}$	6.80	-1.73	4.32	0.01
Percentage-Point $\Delta\sigma_u$	0.96	-0.08	0.74	0.20
Percentage-Point $\Delta\sigma_w$	1.50	-0.29	1.07	0.30

Benchmark Model with $\phi_y = 3$ (vs. $\phi_y = 5$ in Baseline Calibration)

Table A3: Steady State Under Different Banking Reform Equilibria, $\phi_y = 3$

Variable	Baseline (EME) Economy	Higher λ	Higher H	Higher λ and H	Higher λ, H, and z_i
		(1)	(2)	(3)	(4)
Y	4.649	4.295	5.201	5.197	13.80
c	3.236	3.057	3.541	3.561	9.672
c_i	1.635	2.654	1.843	3.116	8.935
c_e	1.602	0.403	1.698	0.445	0.738
inv	0.771	0.712	0.862	0.861	2.287
N	16.71	11.94	22.93	21.87	57.71
N_i	5.758	9.196	11.33	18.85	52.71
N_e	10.95	2.741	11.60	3.024	5.00
N_e/N	0.655	0.230	0.506	0.138	0.087
u	0.082	0.083	0.081	0.080	0.069
n_i	0.405	0.843	0.406	0.846	0.857
n_e	0.513	0.074	0.514	0.074	0.075
H	2.110	2.110	8.245	8.245	8.245
λ	0.440	0.920	0.440	0.920	0.920
Δ Net Int. Margin (Percentage Points)	0	0	-3.070	-3.070	-3.070

Table A4: Percentage Point Change in Volatility Relative to Baseline (EME) Economy, $\phi_y = 3$

	Higher λ	Higher H	Higher λ and H	Higher λ, H, and z_i
	(1)	(2)	(3)	(4)
Percentage-Point $\Delta\sigma_Y$	2.09	-0.21	1.20	-0.40
Percentage-Point $\Delta\sigma_c$	1.30	-0.62	0.05	-1.22
Percentage-Point $\Delta\sigma_{inv}$	8.84	-1.55	3.96	-4.06
Percentage-Point $\Delta\sigma_u$	0.66	-0.09	0.36	-0.21
Percentage-Point $\Delta\sigma_w$	2.18	-0.24	1.22	-0.52

Benchmark Model with Lower α_y For illustrative purposes, we consider a calibration where sectoral output from financially-included (i) firms represents 70 (vs. 50) percent of total output. This implies that $\alpha_y = 0.0267$. Under this calibration, comprehensive banking reform reduces aggregate volatility, though the changes the latter are quantitatively smaller relative to a model with a single firm category.

Table A5: Percentage Point Change in Volatility Relative to Baseline (EME) Economy, Lower α_y

	Higher λ	Higher H	Higher λ and H
	(1)	(2)	(3)
Percentage-Point $\Delta\sigma_Y$	0.81	−0.37	−0.38
Percentage-Point $\Delta\sigma_c$	0.02	−0.88	−1.30
Percentage-Point $\Delta\sigma_{inv}$	2.14	−2.47	−3.91
Percentage-Point $\Delta\sigma_u$	0.33	−0.09	0.08
Percentage-Point $\Delta\sigma_w$	0.76	−0.41	−0.50

Benchmark Model with Firm-Category Productivity Differentials For illustrative purposes, we consider a calibration where $z_i = 2$ and $z_e = 1$. Our main conclusions remain unchanged.

Table A6: Percentage Point Change in Volatility Relative to Baseline (EME) Economy, $z_i > z_e$

	Higher λ	Higher H	Higher λ and H
	(1)	(2)	(3)
Percentage-Point $\Delta\sigma_Y$	1.79	−0.26	0.63
Percentage-Point $\Delta\sigma_c$	0.90	−0.66	−0.40
Percentage-Point $\Delta\sigma_{inv}$	7.00	−1.81	1.11
Percentage-Point $\Delta\sigma_u$	0.44	−0.11	0.13
Percentage-Point $\Delta\sigma_w$	1.84	−0.29	0.60

Benchmark Model with Firm-Category Vacancy-Cost Differences For illustrative purposes, we consider a calibration where κ_e represent half of κ_i. Our main conclusions remain unchanged.

Table A7: Percentage Point Change in Volatility Relative to Baseline (EME) Economy, $\kappa_i > \kappa_e$

	Higher λ	Higher H	Higher λ and H	Higher λ, H, and z_i
	(1)	(2)	(3)	(4)
Percentage-Point $\Delta\sigma_Y$	2.09	−0.18	0.99	−0.83
Percentage-Point $\Delta\sigma_c$	1.13	−0.61	−0.20	−1.48
Percentage-Point $\Delta\sigma_{inv}$	8.40	−1.44	2.68	−5.98
Percentage-Point $\Delta\sigma_u$	0.51	−0.12	0.19	−0.35
Percentage-Point $\Delta\sigma_w$	2.17	−0.21	0.99	−0.96