

Financial Engineering and Economic Development*

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Abstract

In countries with well functioning credit markets, increases in financial activity often take the form of financial engineering. We use a structural framework to characterize and quantify the connection between financial engineering activities and economic development. In our model, producers split the stochastic cash flows they generate to create securities that appeal to investors with heterogeneous tastes. Lowering security creation costs leads to more financial investment but the effects on capital formation, output and aggregate productivity are small at best, and may be negative. Much of the investment boom caused by increased financial engineering activities is spent on security creation costs and rents, with little or even negative effects on development and productivity. These findings could help explain why the correlation between financial development, growth and productivity is weak at best among high income nations.

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1 Introduction

A vast literature – see e.g. [Goldsmith \(1969\)](#), [McKinnon \(1973\)](#), [Shaw \(1973\)](#), [King and Levine \(1993\)](#), and [Rajan and Zingales \(1998\)](#) – has documented that financial and economic development are highly correlated across countries. This empirical regularity has spurred a structural literature that models and quantifies the connection between finance, investment, innovation and resource allocation.¹

More recently, however, a number of papers have argued, on empirical and theoretical grounds, that the effect of financial intermediation on growth and productivity becomes weaker, if not negative, at high levels of financial development.² [Arcand, Berkes, and Panizza \(2015\)](#), for instance, make the empirical case that once private credit reaches 100% of GDP, additional increases in private intermediation have a negative impact on growth. A leading explanation for this tapering is that once the allocative benefits of better credit markets are exhausted, the nature of financial activity expansion changes. Whereas at early stages of development credit expansion leads to the funding of new and highly productive projects, eventually financial development emphasizes security engineering activities. Our goal in this paper is to characterize and quantify the link between financial engineering activities and economic development.

To that end, we focus on the role the financial sector plays in creating securities that cater to the needs of heterogeneous investors. To understand the idea, consider an economy that

¹In [Aghion, Howitt, and Mayer-Foulkes \(2005\)](#), for instance, agency problems limit innovators' access to finance which dampens long term growth. [Banerjee and Newman \(1993\)](#), [Galor and Zeira \(1993\)](#), [Aghion and Bolton \(1997\)](#) and [Piketty \(1997\)](#) argue that similar agency problems can cause poverty traps. Quantitatively, [Amaral and Quintin \(2010\)](#) argue that the effect of these frictions is large. [Midrigan and Xu \(2014\)](#) find that these frictions have a lower impact once agents are given more time to self-finance, but [Moll \(2014\)](#) argues that the mitigating effects of self-financing depend critically on the nature of the idiosyncratic shocks producers face. For related exercises, see e.g. [Erosa \(2001\)](#), [Jeong and Townsend \(2007\)](#), [Erosa and Cabrillana \(2008\)](#), [Quintin \(2008\)](#), [Buera, Kaboski, and Shin \(2011\)](#), [Buera and Shin \(2013\)](#), [Caselli and Gennaioli \(2013\)](#). Papers that study the finance-development nexus qualitatively include [Greenwood and Jovanovic \(1990\)](#), [Bencivenga and Smith \(1991\)](#), [Khan \(2001\)](#) and [Amaral and Quintin \(2006\)](#). [Hopenhayn \(2014\)](#) provides a detailed review of the literature on finance and misallocation.

²See [Sahay, Cihak, N'Diaye, Barajas, Pena, Bi, Gao, Kyobe, Nguyen, Saborowski, Svirydzenka, and Yousefi \(2015\)](#) for a recent review of the empirical literature.

contains agents who, by taste or by constraint, only want to invest in safe securities. Without some financial engineering, the capital these agents are able to provide cannot be tapped to finance risky investment projects. By creating new securities that transform risky cash flows into securities with different characteristics, financial intermediaries allow heterogeneous agents to combine their resources and fund projects whose fundamental characteristics may not meet the particular needs of any specific type of investor. Financial engineering makes it possible to activate projects that could not be funded otherwise.

It follows that, all else equal, a fall in security creation costs leads to more spending on the securities created by the production sector. But this boom in financial investment may not lead to an increase in productive capital formation, output or TFP. In fact, we argue analytically, and show via simulations, that a large share of the financial investment boom may be dissipated into security creation costs and producer/intermediation rents rather than spent on actual capital formation. As a result, the effect of increases in security creation activities on GDP is small at best and may well be negative.

As for aggregate TFP, financial engineering booms tend to cause productivity declines. In our model, all active projects operate at their optimal scale. Our producers are not borrowing constrained: they can borrow as much as they want at equilibrium prices. This is the sense in which our model economy should be thought of as representing countries with well functioning markets. In such an economy, a reduction in security creation costs does lead to the entry of producers whose projects were not profitable until it became cheaper to sell different parts of the associated cash-flows to different investors. But there is no reason to expect that those new producers are high-TFP producers. In an environment where all projects are operated at, or near, their optimal scale, high-TFP producers tend to be profitable whether or not the cash-flows they generate can be repackaged. The producers that become active as a result of increased financial engineering tend to be low average productivity producers.

This aspect of our environment is in sharp contrast to what emanates from traditional models of misallocation, as described for instance by [Hopenhayn \(2014\)](#). In those models, mitigating financial disruptions allows producers to operate closer to their optimal scale, which

drives wage rates up and causes low-productivity managers to exit. Both aspects – projects operating closer to their optimal scale and the exit of less productive managers – result in higher TFP, as it is conventionally measured. In our model, lowering security creation costs allows previously infra-marginal producers to become profitable, which tends to lower TFP. Financial engineering booms, that is, tend to be bad for aggregate productivity.

We formalize these ideas in a dynamic extension of [Allen and Gale \(1989\)](#)'s optimal security design model. Our overlapping generation environment contains agents who are risk-neutral and other agents who are highly risk-averse and have a high willingness to pay for safe securities. Absent transaction costs, it would be optimal for producers to sell the safe part of the stochastic cash-flows they generate to risk-averse agents and the residual claims to risk-neutral agents. But splitting cash-flows in this fashion is costly. As a result of these costs, some potentially profitable projects are left inactive, which results in less investment broadly defined. While the implications of varying security creation costs for overall investment are clear, the impact on output, or average productivity, of making the splitting of risky cash-flows cheaper is fundamentally ambiguous.

Welfare-wise we do find that households are better off in economies with low security creation costs than in economies with high security creation costs. Our central finding is positive in nature: there is no reason to expect a strong positive connection between the volume of financial engineering activities, development and growth.³ In that sense our message is related to, but substantially different from, that of [Gennaioli, Shleifer, and Vishny \(2012\)](#). In that paper, investors neglect tail risks and, as a result, invest excessively in securities perceived to be safe. In their model, security creation is typically excessive. Small news can cause investors to sharply revise their beliefs, causing financial and economic crises. Security issuance booms caused by neglected risks can be detrimental from a social point of view and lead to fragility and welfare losses. In this paper, we show that even when security engineering

³In this paper, we concentrate our attention on the level effects of financial engineering. However, a version of our model with intergenerational linkages as in [Aghion and Bolton \(1997\)](#), [Banerjee and Newman \(1993\)](#) or [Bénabou \(1996\)](#) immediately implies that financial engineering booms also have ambiguous effects on growth in environments where it is endogenous.

booms are caused by fully understood fundamental factors – hence are not excessive in any way – they typically fail to be associated with significant long term gains in economic activity and productivity.

2 The environment

Consider an economy in which time is discrete. Each period, a mass one of two-period lived atomistic households is born. For simplicity, we will assume that these households only value consumption at the end of the second period of their life. Each household is endowed with a unit of labor which they deliver inelastically in the first period of their life for a competitively determined wage. Since they do not value consumption in the first period, they invest all their labor earnings at the beginning of the second period of their life and consume the proceeds from this investment at the end of the period.

Fraction $\theta \in (0, 1)$ of these households – type 1 households – are risk-neutral. The remainder – type 2 households – are infinitely risk-averse, in the sense that they seek to maximize the lowest possible realization of their investment return. That is, risk-averse agents have Leontief preferences over contingent consumption plans when old, with equal weights on each state. Formally, let η_t denote the realization of aggregate uncertainty at date t , which we will fully describe below. Risk-neutral agents order consumption plans $c(\eta_t)$ according to

$$U_1(c(\eta_t)) = E(c(\eta_t)),$$

where E is the standard expectation operator, whereas risk-averse agents assign utility

$$U_2(c(\eta_t)) = \min\{c(\eta_t)\}$$

to the same bundle.

The economy also contains a large mass of one-period-lived producers at each date t . A

unit mass of those producers operate a safe technology that transforms capital k_t into the consumption good according to Ak_t^ω where $A > 0$ and $\omega < 1$. These producers rent capital at gross rate R_t from households. From the point of view of a given atomistic household then, and in any equilibrium, this technology offers a safe gross return R_t . We assume that households can borrow from one another at rate R_t or, equivalently, that they can hold negative investments in the safe technology.

In what follows, selling securities to risk-averse agents only makes sense if their willingness to pay for safe securities is higher than that of risk-neutral agents. To deliver this feature in a tractable way, assume that risk-averse agents incur transaction or time costs that erode their gross payoff from the safe technology by a ratio $\delta \in (0, 1)$. Letting $r_{1,t}$ and $r_{2,t}$ denote the net payoffs for the two agent types at date t , we have

$$1 + r_{1,t} = R_t > (1 - \delta)R_t = 1 + r_{2,t}.$$

This assumption makes the opportunity cost of capital lower, hence the willingness to pay for safe securities higher, for risk-averse households than for risk-neutral households.

The remaining producers can each operate a project whose activation requires an investment of one unit of the consumption good at the start of any period. Project production, unlike the safe technology, is risky. Specifically, an active project operated by a producer of skill $z_t > 0$ yields gross output

$$z_t^{1-\alpha} n_t^\alpha$$

at the end of period t , where $\alpha \in (0, 1)$ and n_t is the quantity of labor employed by the project.

The skill level, z_t , of a particular producer is subject to aggregate uncertainty. Producers must decide whether to activate their project before knowing whether aggregate conditions $\eta \in \{B, G\}$ are good (G) or bad (B). This aggregate shock follows a first-order Markov process with known transition function $T : \{B, G\} \rightarrow \{B, G\}$. Producer types are a pair,

$z = (z_B, z_G) \in \mathbb{R}_+^2$ of skill levels. What we mean here is that if a producer is of type (z_B, z_G) , then their idiosyncratic productivity is z_B during bad times and z_G during good times.

The mass of producers in a given Borel set $Z \subset \mathbb{R}_+^2$ is $\mu(Z)$ in each period. We assume that $z_G \geq z_B$ almost surely and that μ has continuous derivatives.⁴ Producer types are public information. We follow the same convention as [Allen and Gale \(1989\)](#) and assume that producers consume at the start of the period when they receive the proceeds from selling their projects.

After the aggregate shock is realized, conditional on having activated a project, and taking the wage rate, w_t , as given, a producer of talent z solves

$$\Pi(w_t; z) \equiv \max_{n>0} z^{1-\alpha} n^\alpha - n w_t,$$

where Π denotes net operating income. Let

$$n^*(w_t; z) \equiv \arg \max_{n>0} z^{1-\alpha} n^\alpha - n w_t$$

denote the profit-maximizing labor used, given values of the aggregate shock and the wage. We note, for future reference, that n^* is linear in the realized level z of skill.

Investments in projects are intermediated. Specifically, a representative intermediary can buy any given project for a project-type-specific price $\kappa(z_B, z_G)$ that is determined in equilibrium. Producers become active when $\kappa(z_B, z_G) \geq 1$ since they must fund the unit of capital they need but can consume any amount in excess of that.⁵

The intermediary finances its investment by selling securities, i.e. claims to the project's output, to households. A security is a mapping from the aggregate state to a non-negative

⁴The assumption that all producers are more productive during good times is not essential but makes the exposition quicker by implying that producer profits are higher in good times than in bad times for all types. Assuming continuous density functions makes all mappings from prices to excess demands continuous in our existence proof. The case where μ features positive mass points can be handled by introducing lotteries, as in [Halket \(2014\)](#).

⁵This presumes that active producers have the ability to commit to activate their project once they receive funds.

dividend. We require that dividends be non-negative for the same reasons as in [Allen and Gale \(1989\)](#). Allowing negative dividends is formally similar to allowing households to short-sell securities. As is well known, doing so can lead to non-existence, even in one-period versions of the environment we describe. More importantly perhaps, financial engineering could not generate private profits if short-sales were unlimited, since any value created by splitting cash-flows could be arbitrated away in the traditional Modigliani-Miller sense.⁶ As a result, no costly security creation would take place in equilibrium.

Selling securities to risk-neutral agents is free – this is a mere normalization. Selling securities to risk-averse agents, on the other hand, requires bearing a cost $\zeta > 0$. One simple way to justify this is to assume that risk-averse agents are physically separated from other agents in the environment, in which case ζ measures the cost of reaching them.⁷ Alternatively, one can assume that risk-averse agents only discover the type of project used to back the securities they purchase if effort cost ζ is borne by the issuer. Paying this cost enables producers, or the intermediaries representing them, to distinguish themselves from producers with worthless projects – producers whose productivity type is $(z_B, z_G) = (0, 0)$ – in a manner that is visible to risk-averse agents. In that interpretation, ζ represents the cost of providing the additional disclosures, guarantees and rating assessments certain investors – institutional investors, say – require.

More broadly, the main comparative statics we carry out looks at the effect of varying that cost from zero to a value such that no cash-flow splitting takes place. Variations in ζ , in that sense, stand in for institutional or technological changes that make financial engineering easier or more difficult.⁸

⁶See [Allen and Gale \(1989\)](#) for the formal version of this argument.

⁷One could then think of these agents as foreign investors, for example. [Corbae and Quintin \(2016\)](#) use this interpretation to discuss the effects of the saving glut – the fact that foreign appetite for US safe assets has increased over the past two decades – on the US business cycle.

⁸Instead of making the security creation cost fixed and independent of other objects in the environment, one could assume that ζ reflects at least in part a labor input cost. When lowering security creation costs exogenously – the main experiment we perform in this paper – causes wages to increase, creation costs would then rise for endogenous reasons. That would only reinforce our main finding that lowering those costs has a small effect on output, at best.

Given these assumptions, the intermediary can pay ζ to create two securities – one for each household type – or avoid that cost by creating only one security that she then sells to risk-neutral agents. In the one-security case, profits are:

$$q_{1,t}(B)\Pi(w_t(B); z_B) + q_{1,t}(G)\Pi(w_t(G); z_G) - \kappa(z_B, z_G), \quad (2.1)$$

where $q_{1,t}(\eta_t)$ is the willingness-to-pay of households of type 1 for deliveries in aggregate state η_t at date t , given the current history; an equilibrium object intermediaries take as given.

If the intermediary decides to create two securities, profits are instead:

$$q_{1,t}(G) \left[\Pi(w_t(G); z_G) - b \right] + q_{2,t}b - \kappa(z_B, z_G) - \zeta, \quad (2.2)$$

where

$$b \leq \Pi(w_t(B); z_B),$$

is the payment promised to risk-averse agents and $q_{2,t}$ is the willingness to pay of risk-averse agents for risk-free promises. This expression uses an equilibrium fact we will establish in section 3.2: it only makes sense for intermediaries to sell risk-free securities to risk-averse agents. Intuitively, excess returns have no value for risk-averse investors and the intermediary can sell any excess return to risk neutral agents. Since $\Pi(w_t(B); z_B)$ is the lowest possible realization of profits, this is the highest risk-free cash flow the intermediary can sell. It is profitable for the intermediary to purchase projects of type (z_B, z_G) provided a feasible menu of securities exists such that profits are non-negative.

Old households of type $i \in \{1, 2\}$ enter date 0 with wealth $a_{i,0} > 0$. The aggregate state of the economy in that initial period is summarized by $\Theta_0 = \{a_{1,0}, a_{2,0}, \eta_{-1}\}$ where $\eta_{-1} \in \{B, G\}$ is the aggregate shock at date $t = -1$. An equilibrium, then, is an amount k_t invested in the safe technology by households at date t , a rental rate R_t , state-contingent project prices $\{\kappa_t(z_B, z_G)\}_{t=0}^{+\infty}$ for each producer type, wage rates $\{w_t(\eta)\}_{t=0}^{+\infty}$ for each $\eta \in \{B, G\}$, security menus for each project and household types, consumption plans $\{c_{i,t}\}_{t=0}^{+\infty}$ and security

purchases for each household type and, finally, pricing kernels $\{q_{1,t}, q_{2,t}\}$ such that, at all dates and for all possible histories of aggregate shocks:

1. Old agents consume the payoff of their security holdings at each date, while young agents save their entire labor income;
2. Security menus solve the intermediary's problem;
3. Profits are zero for the intermediary (i.e. κ equals gross security creation profits);
4. Producers endowed with the safe technology behave competitively and consume their rents so that, in particular

$$R_t = A\omega k_t^{\omega-1};$$

5. Producers of type z are active if, and only if, $\kappa_t(z_B, z_G) \geq 1$;
6. The market for labor clears:

$$\int_{Z_{\Theta_t}} n^*(w_t(\eta); z) d\mu = 1 \text{ for all } \eta \in \{B, G\},$$

where Z_{Θ_t} denotes the set of active projects for aggregate state Θ_t at date t ;

7. The market for each security type clears.

Aggregate spending on securities cannot exceed aggregate wealth because R_t diverges to infinity at any date as investment in the safe technology falls. But it is possible that the supply of securities created for one agent type exceeds their wealth. Risk-neutral agents can borrow and lend at R_t , so that their willingness-to-pay must satisfy

$$q_{1,t}(\eta) = \frac{T(\eta_t|\eta_{t-1})}{1 + r_{1,t}} = \frac{T(\eta_t|\eta_{t-1})}{R_t}$$

for $\eta_t \in \{B, G\}$ at any date given the most recent realization, η_{t-1} , of the aggregate shock. The market for risky securities always clear at the implied prices.

As for safe securities, at any date t where risk-averse agents invest positive amounts in the risk-free technology,

$$q_{2,t} = \frac{1}{1 + r_{2,t}} = \frac{1}{(1 - \delta)R_t}.$$

On the other hand, when market clearing for safe securities requires that risk-averse agents borrow, we must have $q_{2,t} = \frac{1}{1+R_t}$. To make computations easier, we will assume that the fraction θ is low enough that risk-averse agents do not need to borrow at any point in equilibrium, so that $q_{2,t} = \frac{1}{(1-\delta)R_t}$ at all histories. Section 4 will establish that such an equilibrium always exists.

3 Properties of equilibria

3.1 Aggregation and GDP accounting

The aggregate production function that results from adding up the individual projects' production plans takes a familiar neoclassical form. In order to derive it, let $Z_\Theta \subseteq \mathbb{R}_2^+$ denote the set of types that operate projects (an equilibrium object to be fully characterized later) given the aggregate state, Θ , of the economy, where we dispense with time subscripts to reduce clutter. Let K denote the aggregate quantity of capital used to operate active projects in a given period. In equilibrium this has to equal the measure of projects activated:

$$K = \int_{Z_\Theta} d\mu.$$

It will be useful to define the average productivity among active projects when the realization of the aggregate state is $\eta \in \{B, G\}$:

$$\bar{z}(\eta) \equiv \frac{\int_{Z_\Theta} z_\eta d\mu}{\int_{Z_\Theta} d\mu},$$

and to note that this implies $K\bar{z}(\eta) = \int_{Z_\Theta} z_\eta d\mu$.

In equilibrium, the measure of labor supplied is one at all dates, but generalizing to other, off-equilibrium employment levels, let N denote the total mass of employment. Then, for the labor market to clear, and using the solution to the projects' labor choice problem, we must have that for each possible realization, η , of the aggregate shock:

$$\begin{aligned}
N &= \int_{Z_\Theta} n^*(z_\eta, w(\eta)) d\mu \\
&= n^*(1, w(\eta)) \int_{Z_\Theta} z_\eta d\mu \\
&= n^*(1, w(\eta)) K \bar{z}(\eta).
\end{aligned}$$

We can now write the aggregate production function given aggregate capital, aggregate labor and the aggregate productivity shock:

$$\begin{aligned}
F(\eta, K, N) &= \int_{Z_\Theta} z_\eta^{1-\alpha} n^*(z_\eta, w)^\alpha d\mu \\
&= \int_{Z_\Theta} z_\eta n^*(1, w(\eta))^\alpha d\mu \\
&= \int_{Z_\Theta} z_\eta \left(\frac{N}{K \bar{z}(\eta)} \right)^\alpha d\mu \\
&= \left(\frac{N}{K \bar{z}(\eta)} \right)^\alpha \int_{Z_\Theta} z_\eta d\mu \\
&= \bar{z}(\eta)^{1-\alpha} N^\alpha K^{1-\alpha}.
\end{aligned} \tag{3.1}$$

This is a standard-looking neoclassical production function, where the term $\bar{z}(\eta)^{1-\alpha}$ plays the role of measured TFP, which in this environment is a function of the efficiency of activated projects.

As we will discuss in more depth in section 5.2, this expression immediately implies that the effects of making security creation cheaper on TFP must be ambiguous. Unlike in traditional models of financial development, there are no untapped efficiency gains at the project level. The net impact of any change in the environment on TFP boils down to whether new entrants

are more or less productive than already active and exiting producers. If anything, and as we will confirm via numerical simulations later, new entrants following a drop in security creation costs are more likely to be relatively low-productivity producers. Simply put, highly productive producers are active regardless of whether security creation is cheap or expensive.

The set of equilibrium conditions defined above implies an aggregate feasibility constraint that must hold every period. Letting

$$K_t^E = \theta a_{1,t-1} + (1 - \theta) a_{2,t-1}$$

denote economy-wide wealth at the start of the period, we can write the part of the capital stock devoted to the safe technology as $K_t^S = K_t^E - I_t$, where I_t , investment in risky projects, is formally defined below. Output is the sum of risky project output and safe technology proceeds:

$$Y_t = F(A_t, K_t, N_t) + A (K_t^S)^\omega .$$

On the expenditure side and starting with consumption, recall that households only consume when old. Define aggregate consumption as the sum of each agent type's consumption,

$$C_t \equiv \theta c_{1,t} + (1 - \theta) c_{2,t} + c_{E,t+1} + c_{S,t},$$

where $c_{E,t+1}$ is the consumption of risky producers, which has to equal the proceeds

$$\int_{Z_\Theta} (\kappa_{t+1}(z) - 1) d\mu$$

from selling projects net of the capital put in place, while $c_{S,t}$ is the consumption of safe producers, which has to equal their rents, $(1 - \omega)A (K_t^S)^\omega$. Because producers consume at the start of the period while households consume at the end, date $t + 1$ consumption by producers occurs at the same time as date t consumption by households and, in particular,

must come from date t GDP.⁹

Aggregate investment is the sum of next period's capital and the expenditures intermediaries incur in creating new securities:

$$I_t = K_{t+1} + \int_{Z_\Theta} \zeta 1_{b(z)>0} d\mu.$$

The result is that we can express the aggregate feasibility constraint in a familiar form,

$$C_t + I_t = Y_t.$$

That is, GDP equals the sum of aggregate consumption and investment.

3.2 Financial policies

This section solves the stand-in intermediary's problem in a given period, given pricing kernels $(q_1, q_2) \in \mathbb{R}_+^2 \times \mathbb{R}_+$, and the wage, $w(\eta)$, for each possible realization of the aggregate shock $\eta \in \{B, G\}$. It is important to observe, first, that we can treat each project type separately. There is no role in our model for combining claims from different project types to create a new pool and a new set of securities.¹⁰ Next, we formally establish that, in equilibrium, it only makes sense for intermediaries to sell safe securities to risk-averse agents, a fact we have already used in the description of the environment.

Lemma 1. *In any equilibrium, the consumption of risk-averse agents is risk-free and they only purchase risk-free securities.*

All proofs are in the appendix. The argument is simple: selling risky securities to risk-averse agents would imply that producers and the intermediary are leaving money on the

⁹This timing convention is convenient because producers sell their projects and earn their rents when investment takes place at the start of the period. [Allen and Gale \(1989\)](#) follow the same convention.

¹⁰Our agents can extract the risk-free portion of any combination of assets in one step. In practice, this process often involves the re-securitization of securities from different projects.

table. Consider then a particular project type $z \equiv (z_B, z_G)$ and rewrite the maximum profit the intermediary can generate as:

$$q_2 b + q_1(G) \left(\Pi(w(G); z_G) - b \right) + q_1(B) \left(\Pi(w(B); z_B) - b \right) - \kappa(z_B, z_G) - \zeta \mathbf{1}_{\{b > 0\}},$$

where the non-negativity restriction on payoffs imposes:

$$b \leq \Pi(w(B); z_B).$$

The following remark will help us fully characterize the intermediary's optimal policy:

Lemma 2. *In any equilibrium, κ is monotonic among active projects.*

Given this monotonicity of project prices, the binary decision of whether or not to operate a project is monotonic in z . Given activation, it also turns out that the financial policy of intermediaries satisfies a simple bang-bang property, recorded in the following proposition:

Proposition 3. *If the intermediary activates projects of type $z \equiv (z_B, z_G)$, then it also activates all projects of type $z' > z$. Furthermore, among active projects and μ -almost surely:*

1. *Either $b(z) = 0$ or $b(z) = \Pi(w(B); z_B)$*
2. *$b(z_B, z_G)$ is monotonic in z_B in the sense that given z_G , $b(z'_B, z_G) \geq b(z_B, z_G)$ whenever $z'_B > z_B$, strictly so when $b(z_B, z_G) > 0$.*

These results follow from a fundamental feature of environments in the spirit of [Allen and Gale \(1989\)](#) such as ours: producers take state prices as given, hence have a linear objective defined over a convex set, which, in turn, leads to bang-bang financial policies. When producers choose to create some risk-free debt, they maximize the production of such debt. In addition, whether it is profitable for producers to issue risk-free securities depends on z_B alone. Lowering security creation costs, therefore, promotes the entry of relatively safe producers and, given the impact of this entry on factor prices, promotes the exit of previously

active but relatively low z_B producers. These considerations will play a key role in interpreting the outcome of our upcoming simulations.

4 Existence

Existence of an equilibrium given initial conditions $\Theta_0 = \{a_{1,0}, a_{2,0}, \eta_{-1}\}$ requires, first, that an interest rate and wages exist that clear capital and labor markets in the first period. Since both types save their entire wages when young and those savings become the new starting wealth, conditions that guarantee existence in each period also guarantee that a well-defined path of wealth exists. It is easy to show, using standard arguments, that decreasing returns imply that all those paths live in a set that is bounded away from zero and bounded above.

Take starting conditions Θ_0 as given. Capital available to be deployed is $K^E = \theta a_{1,0} + (1 - \theta)a_{2,0}$. Some of this capital – call it K^S – is invested in the safe technology, and this pins down the gross safe return R , as well as the willingnesses to pay (q_1, q_2) for securities. A pair of wages, then, yields a mass K of producers that choose to be active and a set Z_{Θ_0} of active producer types.

For equilibrium, we need a pair of wages that clears markets. This, in turn, implies a level of security creation costs and an overall demand for capital. We have an equilibrium if, and only if, demand for capital by the production sector, i.e. spending on securities, equals $K^E - K^S$.¹¹ We will now establish that the associated fixed point problem always has a solution.

Proposition 4. *An equilibrium exists. Furthermore, all equilibria feature strictly positive investment in the safe technology at all dates and histories.*

The fact that strictly positive storage must be part of every equilibrium justifies our expression for pricing kernels. It also means that our economy contains a traditional neoclassical feedback effect from capital formation to the opportunity cost of capital. More resources can

¹¹Equivalently, the requirement is that I , as defined in section 3.1, equals starting aggregate wealth minus the safe technology capital, K^S and minus risky producer rents.

be deployed in the risky production sector only provided investors are compensated at a higher rate.

As in the static version of this problem studied by [Allen and Gale \(1989\)](#), it would be difficult to provide general conditions that guarantee uniqueness in this environment with endogenous security design. While this complicates comparative statics considerations somewhat, our model does yield clear predictions for the impact of making security creation cheaper, as we will now show.

5 Comparative statics

5.1 Security creation costs and investment

Take a particular economy and assume that security creation costs unexpectedly fall in a particular period. Obviously, holding wages and safe returns the same, more producers find it profitable to operate and it follows that lower costs should cause more spending on securities. This section formalizes the consequences of this effect.

One complication is that the economy's evolution is affected not just by fundamental parameters, but also by the realization of aggregate shocks. To deal with this issue, we will compare economies that experience identical aggregate shock draws and show that, given these draws, lowering security creation costs implies higher spending on securities on impact. To simplify the analysis, but with little impact on the economic ideas formalized in this section, we concentrate our attention on a parametric case where the two wages must always co-move. [Section 5.3](#) illustrates the general nature of our comparative statics results via numerical simulations.

To simplify the analysis then, assume that producers are scaled up versions of one another in the sense that $\frac{z_G}{z_B}$ is μ -almost surely a constant. Put another way, almost surely, $z_G = zA_G$ while $z_B = zA_B$, where $z > 0$ is the producer's idiosyncratic skill level and $A_G > A_B > 0$ are aggregate shocks common to all producers. Under those assumptions, the search for market

clearing wages becomes one dimensional. The fact that Z_Θ is set prior to the realization of the aggregate shock, and hence is the same regardless of that realization, means that if we know what bad time wages $w(B)$ are, only one value of $w(G)$ can also clear wages during good times. Furthermore, the Cobb-Douglas functional forms we have assumed for production functions imply that $\frac{w(G)}{w(B)}$ is a constant greater than one.

Proposition 5. *Assume that $\frac{z_G}{z_B}$ is μ -almost surely a constant. Assume that in a given economy and in a particular period, security creation costs suddenly fall. An equilibrium path exists where spending on securities rises on impact.*

Falling security creation costs, in other words and not surprisingly, cause financial investment booms. It would seem intuitive that this should lead to output gains and more wealth accumulation over time. Our simulations below reveal that this intuition can fail to hold. Before turning to those simulations however, we will first discuss why the connection between security creation costs and output may not be monotonic in our environment.

5.2 Security creation costs and economic development

The previous section has shown that lower security creation costs tend to lead to more spending on securities. It would seem natural to expect then that the total expected payoff on that investment should be higher. In turn, since that total payoff at the end of each period has to be gross output by risky producers, it would follow that the risky-project output must be higher in expected terms. Under the parametric assumption we made in the previous section (to wit, the assumption that $\frac{z_G}{z_B}$ is μ -almost surely a constant) and since wages are linear in GDP, both wages would then have to rise. It would then follow from these arguments that for a given path of aggregate shocks, wealth, investment, output and wages are uniformly higher following falls in security creation costs.

Where does this simple logic fail? A fall in security creation costs leads to an increase in the participation of risk-averse investors into the risky production sector. These investors require less return on their investment. While total spending on securities must rise, it is not

the case that the total payoff on this investment (i.e. the gross output of risky producers) must also rise. In fact, our simulations below will show that much of the investment boom caused by falling security creation costs is spent on greater securitization expenditures and producer rents, and that capital formation in the risky project sector can in fact fall.

To clarify this point further, note that in our model, we must have, following any change in the environment,

$$\begin{aligned}
 \text{Change in capital formation} &= \text{Change in spending on securities} \\
 &\quad - \text{Change in security creation expenditures} \\
 &\quad - \text{Change in risky producer rents.} \tag{5.1}
 \end{aligned}$$

We argued above that the first term on the right-hand-side must go up as ζ falls. Security creation expenditures, on the other hand, cannot be monotonic in ζ since they are zero when ζ is zero and must return to zero once ζ is so large that no cash-flow splitting takes place. There must be regions, in other words, where expenditures on creation costs rise as ζ falls. Our simulations will show that this effect can be large enough to dominate the behavior of the other components of capital formation. Our simulations will also show that the final term, producer rents (which equal the sum of all κ 's net of the capital put in place), can be non-monotonic in ζ as well, but it plays a negligible role, quantitatively, in our findings.

As for aggregate productivity, the connection between financial spending and TFP is embodied in the aggregate expression (3.1) we derived in section 3.1. Financial development leads to a rise in TFP if, and only if, the average quality of active projects rises. Intuitively, and as we will confirm quantitatively in the next section, a fall in security creation costs leads to the entry of producers who, comparatively speaking, can produce higher amounts of perfectly safe output. The effect of security creation costs on TFP, then, depends on whether those safe producers tend to be productive producers. In most models (e.g. Greenwood and Jovanovic (1990) or Silva (2010)) risky projects are assumed to be more productive. This accords well with basic economic intuition. It only make sense to take on riskier projects if

average payoffs are higher. So it seems natural to expect that, if anything, a greater share of safe projects will lead to lower TFP.

To make this stark, a comparison of our model with traditional models of financial development is useful. In standard models, TFP differences across economies stem from resource misallocation across projects.¹² In our framework, individual projects are always operated at their optimal level. This is the key sense in which our model represents economies with well functioning financial markets. In particular, project-level TFP is independent of the particular security structure used to finance production. Therefore, as security creation costs decrease and capital deepening occurs, TFP increases if, and only if, the average TFP of new entrants is higher than that of incumbent projects.

In traditional models of misallocation, mitigating financial disruptions allows producers to operate closer to their optimal scale, which drives wage rates up and causes low productivity managers to exit. Both effects result in higher TFP as it is conventionally measured. In our model, lowering security creation costs allows previously infra-marginal producers to become profitable, which can, and typically does, lower TFP. More finance does not mean more output, wealth or higher TFP, as we will now confirm via numerical simulations.

5.3 Numerical simulations

5.3.1 Parameters

To illustrate the mechanisms described above, we will now compare economies that differ only in security creation costs via numerical simulations. Starting with an economy with no security creation costs, we increase these costs until no cash-flow splitting takes place in equilibrium.

We will think of one period as 25 years. Starting with the safe technology, we normalize A to 1. We then set the parameter governing returns to scale on safe production to $\omega = 0.37$ which, in our upcoming simulations, implies a yearly rate of return of about 4% for risk-

¹²See [Restuccia and Rogerson \(2008\)](#) or [Amaral and Quintin \(2010\)](#).

neutral households. We set δ , the transaction costs risk-averse agents face to 0.22 so that the difference in yearly interest rate returns between risk-neutral and risk-averse households is about 100 basis points, a value comparable to estimates of the Treasury convenience yield produced, for example, by [Krishnamurthy and Vissing-Jorgensen \(2012\)](#). The most common interpretation of this convenience yield is as a premium the most risk-averse investors are willing to pay for default-free and perfectly liquid assets, which corresponds to the purpose of δ in our model.

We specify the transition matrix T for aggregate shocks so that the probability of remaining in the bad state is $T_{BB} = 0.2$ and the probability of remaining in the good state is $T_{GG} = 0.9$. This implies that the economy spends close to 90 percent of the time in the good state. We then make

$$\mathcal{Z} = \{(z_B, z_G) : z_G \geq z_B \text{ and } (z_B, z_G) \in [0, \bar{z}] \times [0, \bar{z}]\},$$

with $\bar{z} = 5.3$. This implies a fraction of savings devoted to securities of two-thirds, while a third goes to the safe technology.

The skill distribution function $\mu(Z)$ is a truncated bivariate normal with mean $(0.01, 0.02)$ which implies a (project) output difference of 1% a year between good times and bad times (28% for a 25 year period). The variance-covariance matrix is symmetric with off-diagonal elements of 0.02 and diagonal elements of 0.08. The resulting distribution of aggregate shocks is shown in [figure 1](#). This skill distribution also implies a ratio of producer rents to value added by the risky production sector of around 10% throughout our simulations, which is reasonable given the approximation for this moment obtained by [Corbae and Quintin \(2016\)](#) using US private corporate sector data.

Below, we will want to make sure that our main points are not sensitive to particular aspects of the distribution of talent. To that end, we will also produce results for distributions of talent with more dispersion of talent (twice the benchmark marginal variances) and less dispersion (half the variance). Because of the truncation at the 45 degree line, changing the

dispersion also changes the mean of the distribution. We will show results with and without adjustments to keep the mean constant as we vary dispersion.¹³

5.3.2 Algorithm

Standard arguments show that our economies eventually converge to a stochastic steady-state, i.e. an invariant distribution of all endogenous variables in our model.¹⁴ To obtain statistics for all endogenous variables in this stochastic steady-state, we adopt a traditional Markov chain Monte Carlo approach.¹⁵ Specifically, our algorithm is as follows:

1. Given parameters, solve for household and intermediary policy functions for every possible aggregate state of the economy;
2. Draw a 1000-period sequence of aggregate shocks $\{\eta_t\}_{t=1}^{1000}$ using the Markov transition matrix T and record the value of all endogenous variables starting from an arbitrary value of aggregate wealth;
3. After dropping the first 100 periods, so that assumed initial conditions have at most a negligible effect on the value of endogenous variables, compute average values for all endogenous variables.

To facilitate comparisons across economies with different costs, we use the same draw of random aggregate shocks throughout our simulations. Figure 3 displays sample paths for our economy for two distinct levels of security creation costs. Spikes in aggregate values are caused by changes in aggregate conditions and, to a lesser extent, by the endogenous responses of financial policies and factor prices. Not surprisingly given the long-period nature of our model endogenous variables transit in very few periods to their new level following changes in aggregate conditions. As a result, our economy converges quickly to its stochastic steady

¹³Experimenting with more extreme distributions – such as uniform distributions – likewise, did not change the basic nature of our results.

¹⁴See Brock and Mirman (1972).

¹⁵See Tierney (1994).

state regardless of initial conditions. The figure also shows that changes in security creation costs amount essentially to level shifts in the behavior of endogenous variables. Our upcoming discussion focuses on the long-term average value of those variables given a particular level of security creation costs.

5.3.3 Optimal Financial policies

Figure 2 shows the intermediary's optimal policy decisions for an economy with an intermediate level of security creation costs. A significant mass of projects is left inactive because they are unprofitable in expected value terms, regardless of the security structure used to finance them – this is the darker area in the figure, labeled $\Pi < 0$. Among activated projects, a subset is productive enough to be more profitable after issuing riskless securities. This is the set identified by the label $\Pi^H \geq \Pi^I$. For these projects, the price that the risk-averse households are willing to pay is enough to compensate the intermediary for security creation costs. For projects that do not pay enough in bad times, but pay enough in good times, the intermediary simply issues one risky security. This is the set identified by the label $\Pi^H < \Pi^I$.

The slope of the line separating the activated projects from those that remain dormant is different in the two operating regions: it is steeper for the safe-security issuing set. Intuitively, productivity in bad times is more valuable when safe securities are issued, given the higher willingness to pay of risk-averse households. As a consequence, a marginal decrease in z_B in that region needs to be compensated with a larger rise in z_G in order to keep profits constant, when compared to the region where only risky securities are issued.

A vertical line separates the two active regions. That is because once a project is active, whether or not it is more profitable to issue safe securities does not depend on z_G as we established in proposition 3. Only z_B matters in this case.

Figure 4 shows how the intermediary's policies change when security creation costs increase from $\zeta_0 = 0$ to $\zeta_4 = 1$. When there are no security creation costs, all active producers issue safe securities because $q^2 > q^1(B) + q^1(B)$, which is guaranteed by the fact that $r_2 < r_1$.

This is shown in panel A of the figure by the straight diagonal line. As costs become strictly positive and we move from ζ_0 to $\zeta_1 = 0.1$ (represented by the broken diagonal lines in panel A of the figure), holding wages and the amount devoted to the safe technology fixed, profits from issuing safe securities fall. As a consequence, some of the projects that were hitherto issuing safe securities stop doing so but continue to operate issuing only risky securities, while others stop operating altogether (those labeled *Exit* in panel A). This releases capital and labor and puts downward pressure on wages, allowing projects that were dormant (because they had a relatively low z_B) to become profitable under the lower wages and to start operating financed by risky securities exclusively (those labeled *Enter* in panel A) and re-equilibrate the capital and labor markets at a lower level of wages and capital.

Given that all operating projects require one unit of capital to operate, capital formation is given by the measure of operating projects. In this region, it turns out that the measure of exiting projects (these are labeled *Exit* in red weighted by the density of projects) is larger than that of entering ones, and as a consequence, capital formation is falling as security creation costs increase. This process continues as security creation costs grow further from ζ_1 to $\zeta_2 = 0.34$ (panel B of Figure 4). At this point, the measure of exiting projects (that were hitherto issuing safe securities) is still larger than that of entering ones, resulting in a net decrease in active projects, as can be seen in panel A of Figure 5. However, as security creation costs continue to grow further, from ζ_2 to $\zeta_3 = 0.44$, the mass of safe-security issuing projects that stop operating dwindles (panel C of Figure 4) and is surpassed by the mass of entering projects (issuing risky securities exclusively) resulting in net entry, and giving rise to the non-monotonic relationship between security creation costs and active projects seen in panel A of Figure 5. Eventually, there are no exiting projects and there are only entering projects issuing risky securities exclusively (panel D).

5.3.4 Output, capital formation and TFP

One of the main points we make in this paper is that the relationship between security creation costs, output and TFP is generally non-monotonic. This occurs despite the fact that spending on securities, i.e. investments in risky projects, decrease monotonically as security creation costs rise (panel B of Figure 5). As captured by expression (5.1) and as a matter of accounting, capital formation (i.e. the mass of active projects) equals security purchases minus the sum of security creation expenditures and producer rents. Panels A, B, E, and F of Figure 5 show these four variables.

The behavior of security creation costs is the dominant cause of non-monotonicity. The mass of projects issuing safe securities falls monotonically with security creation costs (the darker area in panel A of Figure 5). Initially, spending on security creation also rises, going from zero (since creating safe securities is free when $\zeta = 0$) to strictly positive. Both effects lead to less capital formation, i.e. a decreasing mass of active projects. But eventually, the fact that ever fewer projects choose to issue safe securities leads to a sharp decrease in security creation expenditures, which more than offsets the fall in gross investment, and allows the mass of active projects to rise.

Expression (5.1) allows for a precise breakdown of the change of capital formation in the non-monotonic part of panel A. Specifically, as ζ rises from around 0.30 to 0.65 capital formation goes from its trough to a new peak in our simulations, rising by about 10%. Since producer rents are essentially flat in that region (see panel F), they account for a mere -1% of the total change. Security spending falls throughout and accounts for -88% of the change, leaving security expenditures to account for 187% of the trough-to-peak change in capital formation. Remarkably, this happens even though, at their peak, security creation expenditures account for under 2.5% of GDP. These expenditures manage to dominate the behavior of capital formation for a while because the overall change in capital formation is relatively small at around 1% of trough-level GDP.

Turning now to TFP, Panels A and C of figure 7 display an inverse relationship between

project output and average TFP. As security creation costs rise, the set of entering projects (issuing risky securities exclusively) has higher productivity in good times and lower productivity in bad times, compared to the exiting ones and to the average operating project. Because good times are more frequent than bad times under our parameterization of T , this means that, initially, average TFP is increasing as security creation costs rise, as shown in panel C of Figure 7. Nonetheless, project output is falling in this range (panel A of Figure 7), because the fall in the measure of projects outweighs the average TFP increase. As security creation costs continue to rise, average TFP eventually starts falling as the net entering project becomes less productive than average. Nonetheless, because net entry is positive and the measure of operating projects increases enough, output also increases, as the extensive margin once again dominates.

Panels B and D of Figure 7 show overall GDP (risky project output plus safe output) and the measured productivity of capital as defined by overall GDP divided by $(K^E)^\alpha$ where K^E is total wealth. Both measures exhibit a non-monotonic relationship with security creation costs.

These findings are not sensitive to even drastic changes in the shape of the producer talent distribution, as figure 6 shows. Changing the dispersion of the talent distribution also moves around the mean talent level considerably (since the distribution is truncated) and consequently shifts the levels up and down, but the non-monotonic relationship between security creation costs and endogenous variables remains.

5.3.5 Financial engineering and economic development: a new perspective

Figure 8 summarizes the quantitative connection between financial activities, as we have modeled them in this paper, and economic development, for three sets of economies that differ in terms of the dispersion of producer talent, after adjusting the mean so that the average level of talent is the same across economies.

As the ratio of spending on securities to GDP rises, output measures (whether project

output or GDP broadly defined) initially fall. At high levels of security spending – once security creation becomes essentially free – output does begin rising. In addition to being non-monotonic, the impact of even large increases in spending on securities is small. Productivity is, likewise, relatively flat across economies with varying levels of security creation. As we have discussed above, it shows a negative relationship with output. This is because when more spending on securities does lead to more capital formation, it also tends to lead to the activation of relatively low productivity projects.

On the other hand, variations in financial development caused by fundamental differences in producer talent across economies are associated with potentially big output effects in our model, like in traditional models. Figure 9 illustrates this by considering the same three levels of dispersion in talent as before, but without adjusting the mean so that, as a result of the truncation, more dispersion now implies more talented producers on average. High average producer talent economies do display more intermediation and higher output and TFP than low average talent economies. This experiment corresponds to the traditional “Enterprise leads, finance follows” view of financial development associated with [Robinson \(1952\)](#). Richer economies feature more economic activity, and hence more intermediation. Across subgroups of economies a strong positive correlation between finance and development emerges. But within homogeneous economies – among economies with similar real fundamentals – security creation booms do not result in big output effects. In fact, they may very well lower output.

5.3.6 Welfare

Our economy contains five categories of agents: households of two distinct types, safe producers, risky producers, and intermediaries. Assume we give each of these types of agents a choice of which economy to be born in, knowing only that they will be born in stochastic steady-state. Would they select an economy with high or low security creation costs?

The welfare of risk-averse households is monotonic in wages times the net return on the safe technology. The consumption of risk-neutral households is subject to aggregate risk

but, in expected terms, the return on their investment must also be the return on the safe technology in equilibrium. It follows that, in welfare terms, both household types order distinct economies in exactly the same way. Both types of producers, for their part, simply consume their rents. The intermediary always makes zero profits hence is indifferent across economies with different security creation costs.

Figure 10 shows how stochastic steady-state welfare relates to security creation costs for these various agent types. Since wages are linear in project output, household welfare essentially tracks project output and hence looks very similar to panel A in figure 7. In particular, households want to be born in an economy with zero security creation costs. However, just like project output and for the exact same reasons, household welfare is not monotonic in security creation costs. There are regions where lowering security creation costs lowers household welfare.

Safe producers prefer economies with higher securitization costs because such economies exhibit higher safe technology rents. The effect of security creation costs is not fully monotonic, however, because raising those costs also lowers wealth. That effect dominates initially, as panel C of figure 10 shows.

Risky producers, as a group and for obvious reasons, rank economies in essentially the opposite order from safe producers. Lower security creation costs – holding wages the same – render more projects profitable. As has been the theme throughout this paper, general equilibrium effects on factor prices cause the relationship between these costs and average risky producer welfare to be non-monotonic, as shown on Figure 10, but despite those effects average risky producer welfare is maximized at zero creation costs. Before knowing their exact productivity type then, this category of agents, like households, would opt for an economy with zero security creation costs.

It is important to recognize, however, that not all risky producers prefer low creation costs. Recall that exogenous changes in security creation costs causes some risky producers to enter and others to exit. Obviously, entering producers benefit from a reduction in ζ , but exiting producers see their welfare fall as their rents go from positive to zero. As we

discussed in section 5.3.3, exiting producers tend to be producers with a high ratio of z_G to z_B when security creation costs rise, while entering producers have the opposite feature. In other words, relatively safe producers – specifically, those whose productivity is relatively high during bad times but are not especially productive during good times – are those who benefit the most from increased financial engineering activity.¹⁶

6 Empirical correlation between financial engineering and development

The predictions of our model are broadly borne out by basic correlations between measures of financial complexity and economic development for a cross-section of countries. In particular, in the data, there is a positive, unconditional, association between measures of financial complexity and development, largely consistent with panels B and C in Figure 9. After one conditions on income levels, this positive correlation largely vanishes, as our model would predict. We should make it clear that we view the numbers we present in this section as suggestive and broadly supportive of our findings, not as a substitute for a thorough econometric quantification of the connection between financial engineering activities and development.

Our measures of development are real GDP per capita in 2011 and measured TFP in the same year, as given by $\frac{Y}{K^{0.35}H^{0.65}}$, where Y is GDP, K is the capital stock and H is the product of employed workers and average hours worked. All measures were taken from the Penn World Table (Feenstra, Inklaar, and Timmer, 2015). The prevalence of financial engineering activities is harder to measure. In this section we consider two proxies for which data are available for a sufficiently large number of countries.

¹⁶Beyond ranking equilibria in welfare terms, what can be said about the efficiency of the allocation that prevail when security costs are low? Our equilibria are constrained efficient in the sense of Allen and Gale (1989). Reallocating securities across households does not lead to Pareto improvements. Using only the markets and technologies available to individuals, a social planner cannot make every one better off than they are in equilibrium.

6.1 Asset-backed securitization

Our first proxy for the intensity of financial engineering activities is asset-backed securitization in the traditional sense. In this context, the intermediary in the model plays the traditional role of channeling savings from households to borrowers and originates securities that are collateralized by the revenue streams the acquired projects produce. These securities may have multiple tranches, offering dividends with different risk profiles.

The global securitized debt market is growing fast. According to data from the Securities Industry and Financial Markets Association (SIFMA), the global amount of consolidated securitized debt outstanding went from \$4.8 trillion in 2000 to \$13.6 trillion in 2010. The United States accounts for over three quarters of all securitization volume, but several emerging countries such as China, South Africa, India and Malaysia have budding debt securitization markets growing at a fast pace.

We have data on outstanding securitized debt for a set composed mostly of developed countries.¹⁷ A large fraction of total securitized debt is backed by residential mortgages. In our model, the collateral backing securities is better interpreted as some form of commercial or business investment. With that in mind, we subtract the amount of outstanding residential mortgage-backed securities from our measure of outstanding securitization, although our results change little when all securitization activities are included.

6.2 Corporate bonds

The second measure of financial engineering activities we consider is the relative importance of private bond market capitalization across countries. Fundamentally, firms issue bonds in order to raise funds from investors who require more guarantees than equity investors and more liquidity than direct lenders might, and are willing to pay a premium for those features.

¹⁷Our data for Australia and New Zealand, Canada, Japan, Malaysia, South Africa, South Korea and the U.S., comes from SIFMA, while data for European countries (Belgium, France, Greece, Ireland, Italy, The Netherlands, Portugal, Russia, Spain and the United Kingdom) comes from the Association for Financial Markets in Europe.

Participating in bond markets is costly however, since it requires becoming listed on the corresponding exchanges, the production of issuer and issue ratings, not to mention compliance with accounting and disclosure standards. Participation in bond markets is profitable only when these costs are outweighed by the benefits of raising funds from heterogenous investors, just like in our model. One should expect bond market participation costs to vary a lot across countries. Nations such as the United States, with a long history of bond trading, high competition between exchanges, and established benchmarks for pricing (a well defined yield curve with high liquidity at all maturities) have low participation costs compared to nations with shorter bond trading histories and weaker institutions.

We have data on the market capitalization of private corporate debt (for both financial and non-financial corporations) as a fraction of GDP for 46 (developed and developing) countries compiled in the Financial Development and Structure Dataset, from [Beck, Demirguc-Kunt, and Levine \(1999\)](#), that uses the corporate debt data from the Bank for International Settlements.

6.3 Cross-country correlations

Panels A and C of figure 11 show how our cross-country measure of securitization correlates with GDP per capita and measured TFP.¹⁸ The correlation coefficients are positive at $r_{ALL} = 0.27$ and $r_{ALL} = 0.17$, respectively. The magnitudes are small because, as far as income is concerned, but for a few exceptions, our sample consists mostly of industrialized countries.

Looking instead at bond market capitalization allows us to enlarge our sample to include a larger number of developing countries. Panels B and D plot the results. The correlation coefficients rise to $r_{ALL} = 0.36$ and $r_{ALL} = 0.39$, for GDP per capita and measured TFP, respectively. One can now reject the null that these correlations are zero at the 2% level. These

¹⁸The economic development measures are for 2011 and are presented relative to U.S. values. The private bond market as a share of GDP is also for 2011. We found similar results to the ones we report below for 2009 and 2010, while 2012 leaves us with a much smaller sample for the private bond market data (26 countries instead of 46). The securitization values for the U.S. and the European countries are averages between 2007 and 2015. For the remaining countries the averages are for 2007 to 2010 because of data availability.

positive associations are in line with what simulated data from the model would deliver for a set of economies that differ in how productive their potential projects (e.g. human capital) are, just like panels B and C in Figure 9 imply.

However, when we restrict our attention to industrialized countries only, which we will take to be the economies whose GDP per capita is at least half that of the U.S., these correlation coefficients all drop, and even become slightly negative. To wit, the correlation between securitization and GDP per capita drops from $r_{ALL} = 0.27$ to $r_{TOP} = -0.13$; the correlation between securitization and TFP drops from $r_{ALL} = 0.17$ to $r_{TOP} = -0.11$; the correlation between private bonds and GDP per capita drops from $r_{ALL} = 0.36$ to $r_{TOP} = -0.05$; and the correlation between private bonds and TFP drops from $r_{ALL} = 0.39$ to $r_{TOP} = 0.2$. Moreover, the standard errors on all these restricted correlations are such that one can no longer reject the null that they are all zero. These flat, if not slightly negative, relationships are precisely what the model predicts once one conditions on an economy's underlying production possibilities, akin to focusing on a single economy type in panels B and C of Figure 9.

7 Conclusion

This paper shows that by allowing producers or intermediaries to create securities that appeal to investors with heterogeneous tastes, financial engineering leads to more investment broadly defined, which accords well with intuition. Less intuitive is the fact that the resulting securitization boom may not lead to increases in output, capital formation and TFP. Much of the spending on engineered securities may be dissipated into security creation costs and producer or intermediary rents. We view this as a natural explanation for the fact that the impact of financial development on economic development is weak, at best, in economies with already well-developed financial markets.

In this sense, it seems appropriate to think of financial development as consisting of two phases.¹⁹ In low-income economies, institutional gains and the resulting gains in financial

¹⁹This dichotomous view of financial development has a counterpart in the model of [Acemoglu, Aghion,](#)

activity enable productive, but previously constrained, producers to become active and/or operate more effectively. This results in economic development gains, as has been emphasized by the traditional literature on financial development. While the size of those gains may be a matter of debate,²⁰ there can be little disagreement on the direction of the effect during this initial phase of financial development.

Once higher levels of financial development are reached and markets function well, financial innovation tends to take the form of repackaging of fundamental cash-flows to create securities that appeal to the tastes of heterogeneous investors. Not only do we find the output and productivity effects of this second phase to be small, they may very well turn out to be negative.

and Zilibotti (2006) in which, in a nutshell, economic development consists first of harvesting low-hanging fruits but becomes tougher to sustain once obvious growth opportunities have been implemented.

²⁰See the contrasting views of Midrigan and Xu (2014) on one side and Moll (2014) and Amaral and Quintin (2006), on the other.

A Appendix

A.1 Proof of lemma 1

Assume, by way of contradiction, that an equilibrium exists in which, in a given period, the consumption bundle (c_B, c_G) of risk-averse agents is such that $c_B > c_G$. Then, given their preferences, risk-averse agents pay nothing for the bad-realization payoff on any security, as their marginal valuation of consumption in bad times is zero. Moreover, in order for $c_B > c_G$ to hold, a positive mass of securities with higher payoffs in the bad state than in the good state must be sold to risk-averse agents. But those producers (or the intermediary) would be better off selling the bad state payoff to risk-neutral agents. Doing so would raise their profits. The case in which $c_B < c_G$ can be similarly ruled out.

A.2 Proof of lemma 2

Assume, by way of contradiction, that, for a given (z_B, z_G) , there exist $(z'_B, z'_G) \geq (z_B, z_G)$ such that $\kappa(z'_B, z'_G) < \kappa(z_B, z_G)$. Then, if profits are zero at (z_B, z_G) , as must be true given free-entry, they have to be strictly positive at (z'_B, z'_G) , which cannot happen in equilibrium.

A.3 Proof of proposition 3

That participation is monotonic in (z_B, z_G) follows from the monotonicity of κ in productivity. As for financial policies, note that gross gains from issuing two securities rather than one are

$$[q_2 - (q_1(G) + q_1(B))]b,$$

since risk-neutral agents are willing to pay $q_1(G) + q_1(B)$ per unit of risk-free promise. These gains must exceed ζ to justify creating two securities. Since

$$q_2 = \frac{1}{R(1-\delta)} > \frac{1}{R} = q_1(G) + q_1(B),$$

gross gains are maximized at $b = \Pi(w(B); z_B)$. Obviously then, if it is profitable for a producer of productivity level z_B to sell securities to risk-averse agents, it is also profitable to do so for producers whose worst-case productivity is z'_B .

A.4 Proof of proposition 4

Start with an arbitrary guess, $K^S \leq \theta a_{1,0} + (1-\theta)a_{2,0}$, for safe technology capital and let R be the associated safe return, while (q_1, q_2) are the corresponding state prices. Given these, we will first find market clearing wages (w_G, w_B) . Find $w > 0$ such that when $(w_G, w_B) = (w, w)$ the labor market clears in the bad aggregate state. Such a w must exist, since demand for

labor in both aggregate states diverges to infinity as $w \mapsto 0$ while it goes to zero as $w \mapsto +\infty$, and since the underlying mapping is continuous.

At the resulting (w, w) there is (at least weakly and typically strictly) excess demand for labor in the good aggregate state, since $z_B \leq z_G$ μ -almost surely. Starting from the pair $(w_G, w_B) = (w, w)$ so constructed, start lowering the wage w_B in the bad state while increasing the wage in the high state to a level $w_G(w_B)$ such that markets continue to clear in the bad state. The mapping $w_G(w_B)$ is continuous and must diverge to $+\infty$ as w_B becomes small. At some point then, demand for labor in the good state must equal one, as needed, which gives us the market clearing pair of wages we needed. By construction of $w_G(w_B)$, the labor market still clears in the bad state. We now have a pair of wages which, given, K^S (hence R) clears both labor markets. Moreover, the resulting mapping from the guess for K^S to market clearing wages is continuous.

Given (R, w_B, w_G) , we can now compute (uniquely) spending on securities. In particular, we can compute total demand for capital and, for equilibrium, we need it to equal $\theta a_{1,0} + (1 - \theta)a_{2,0} - K^S$. The full mapping from the initial guess to this demand for capital by the production sector is continuous. It is enough, therefore, to show that for small enough initial guesses there must be an excess supply of investment funds, while for guesses large enough there is an excess demand for capital by producers. Take $K^S = K^E$, the largest possible initial guess. At that level of safe capital, the supply of capital to the production sector is zero. The arguments above show that a pair of wages exists that clears markets given the corresponding R . But this means, in particular, that some producers are active so that there is positive demand for capital by the production sector.

At the other end of the domain of definition of the mapping, assume K^S converges to zero so that R diverges to infinity. Labor market clearing requires that wages converge to zero as K^S does.²¹ So do, therefore, aggregate profits, since those are linear in wages at any optimal solution the the producer problem. Aggregate producer rents, since they are bounded above by the present value of expected profits, must then converge to zero as well. With vanishing wages, the mass of active producers must fall since the labor demand of each producer type diverges to infinity. This implies that demand for capital falls to zero, so that, eventually, there must be excess supply.

A.5 Proof of proposition 5

When $\frac{z_G}{z_B}$ is μ -almost surely a constant, producer skills are summarized by a one dimensional level z . In turn, producer participation in any given period is associated with a skill threshold \underline{z} , while the security design decision is governed by an upper threshold \bar{z} . Holding wages the

²¹To elaborate, this part of the argument requires two steps. First, one of the two wages must go to zero for there to be any participation by producers, since pricing kernels vanish and producers must fund at least one unit of capital. But since the set Z_{θ_0} of active producer types is common across realizations of the aggregate state, if labor markets clear with vanishing wages in the bad state, vanishing wages are also required for market clearing in the good state. It follows that if one of the two wages vanish, both must.

same in a given period, a marginal decrease in security creation costs lowers \bar{z} . It may lower \underline{z} as well, but only if $\underline{z} = \bar{z}$ to begin with, i.e. only if all producers already split cash-flows prior to the decrease in security creation costs.

If \underline{z} does not change following the decrease in security creation costs, labor markets continue to clear at the original wages. In that case, the only consequence of the decrease in security creation costs is an increase in spending on securities since the mass of producers that sell the safe part of their profits at a low discount rate has increased. This creates an excess demand for capital at the original safe capital level. If $\underline{z} = \bar{z}$ before the decrease in security creation costs then both thresholds move to the left. Bringing labor markets back to equilibrium now requires an increase in wages, hence a further increase in spending on securities, also implying an excess demand for capital.²²

In either case, there is an excess demand for capital at the original level K^S hence, using the same arguments as in our existence proof, there is an equilibrium with a safe capital level in $[0, K^S]$ hence a new equilibrium that features more spending on securities in the period in which creation costs fall, as claimed.

²²This specific part of the argument – as we discussed in the existence proof – follows from the fact that aggregate profits are linear in wages. The safe capital level pins down state prices. Holding the safe capital level constant, as we do in this paragraph, keeps state prices constant. Security spending – higher aggregate profits discounted at constant state prices, with possibly more cash-flow splitting – must go up.

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Figure 1: Productivity distribution

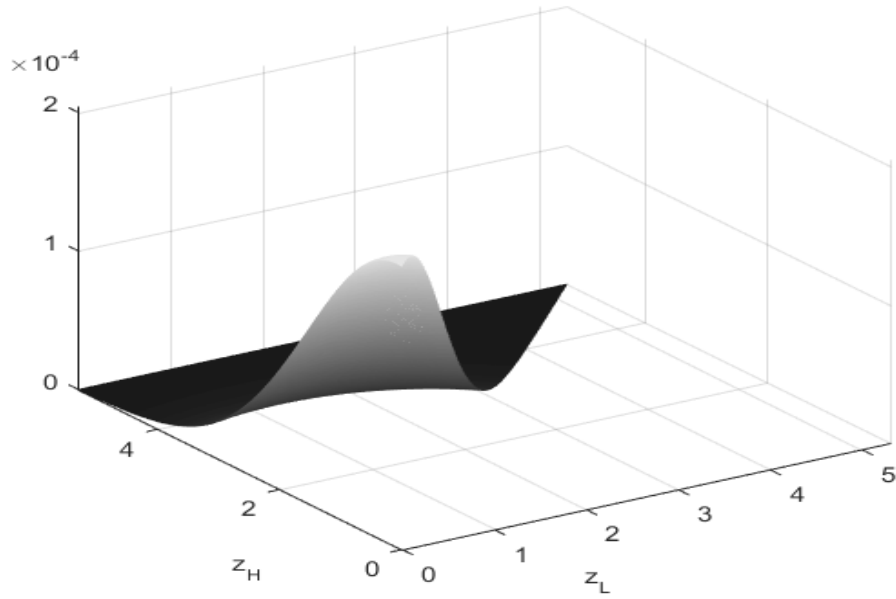


Figure 2: Intermediary's policies

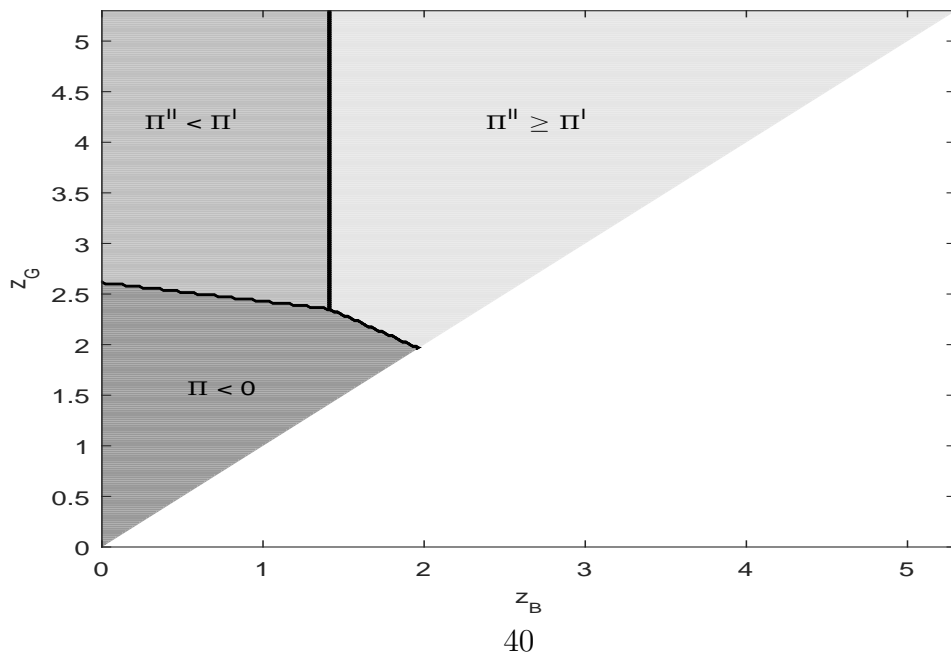


Figure 3: Simulating illustrative example economies

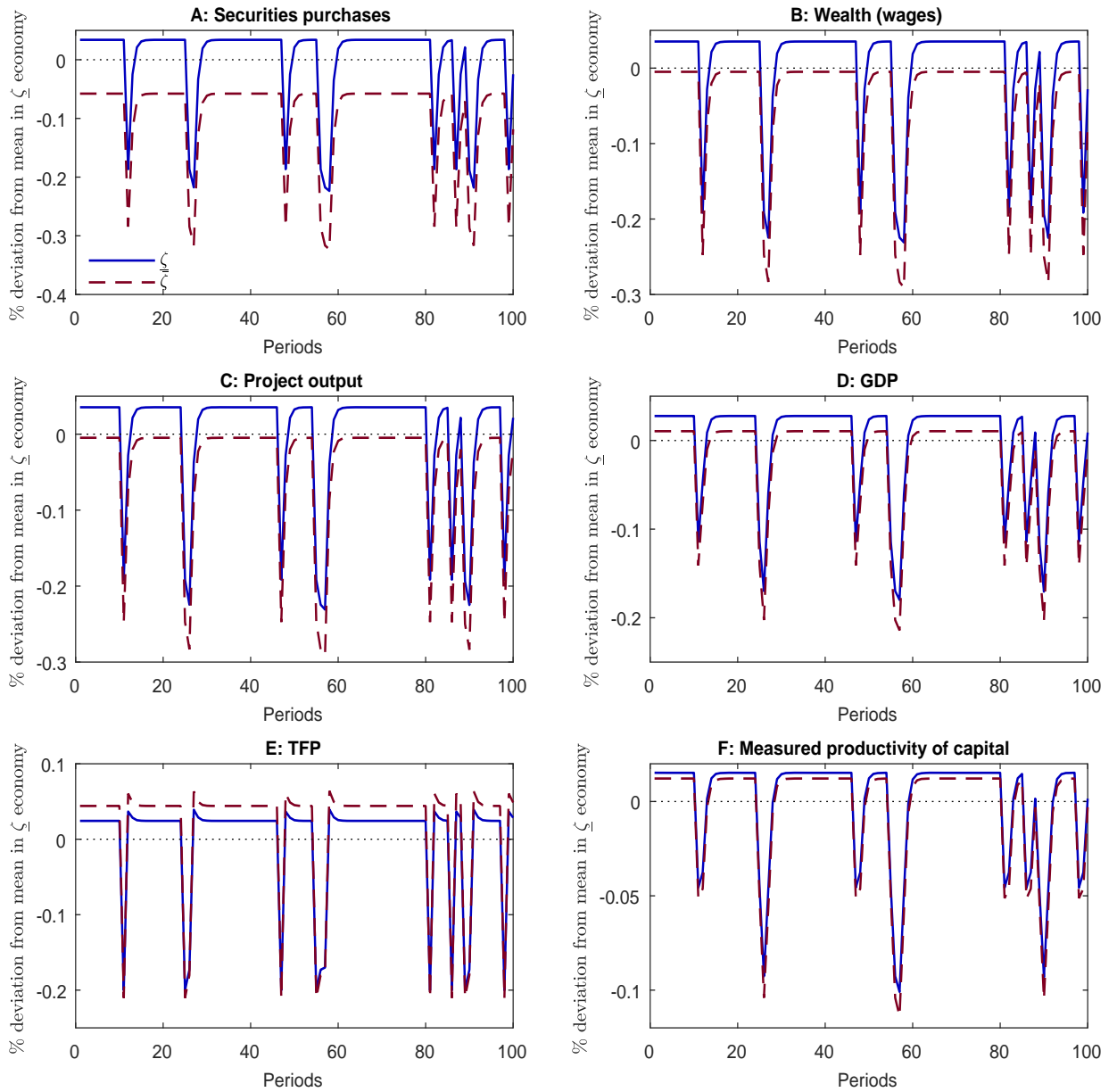


Figure 4: Changing security creation costs

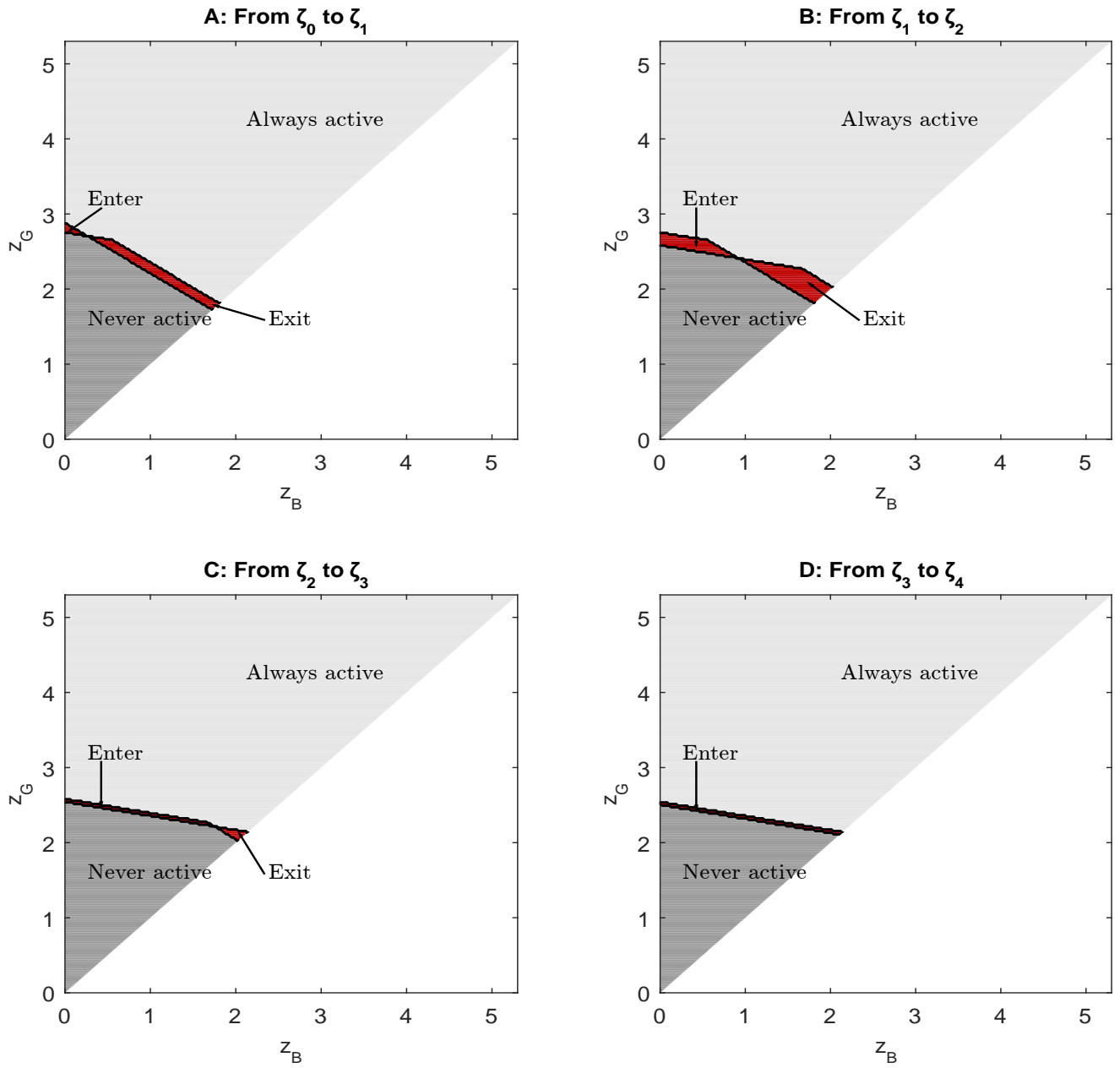


Figure 5: Varying security creation costs: outcomes I

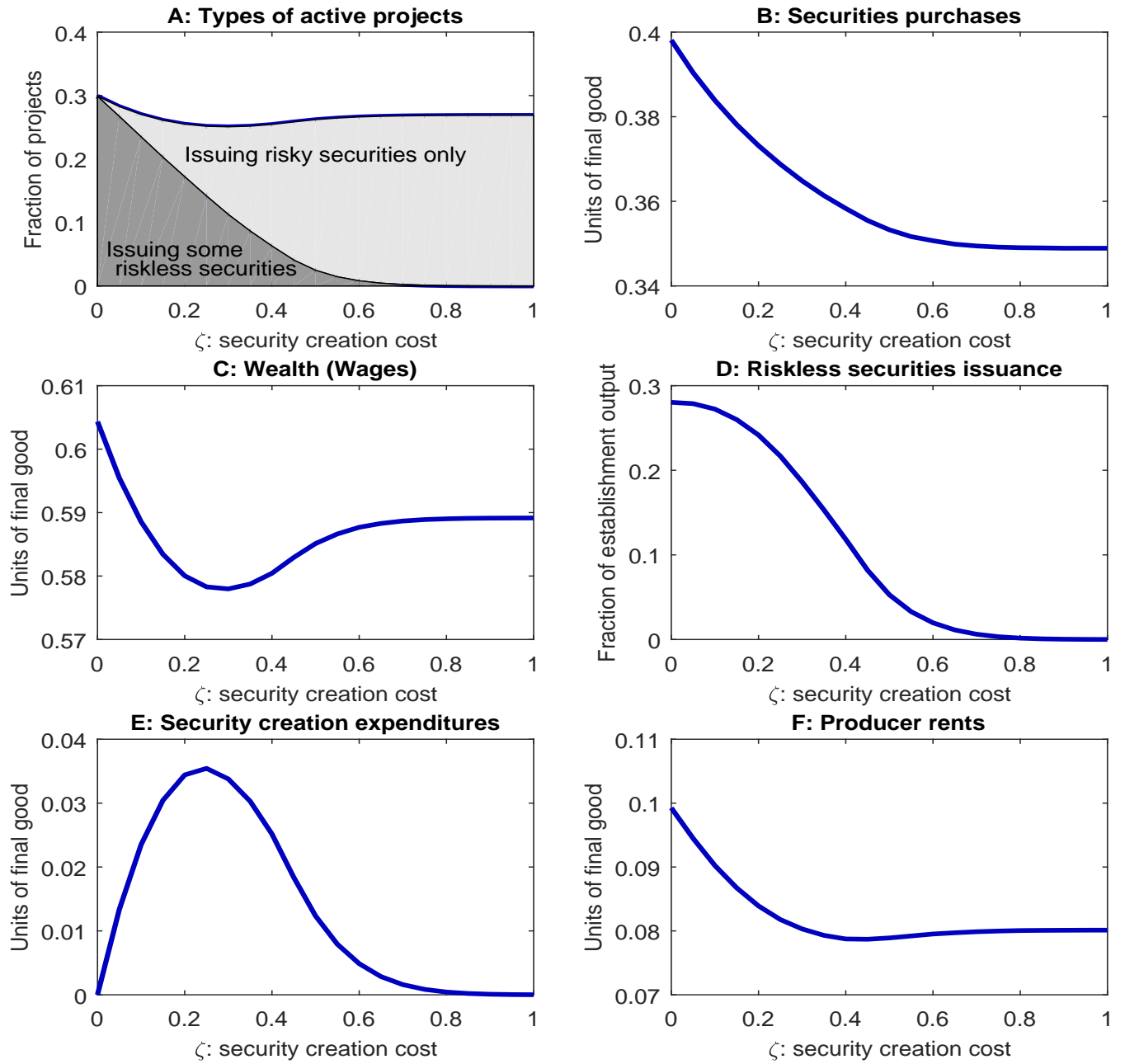


Figure 6: Varying security creation costs: outcomes I, different talent dispersion

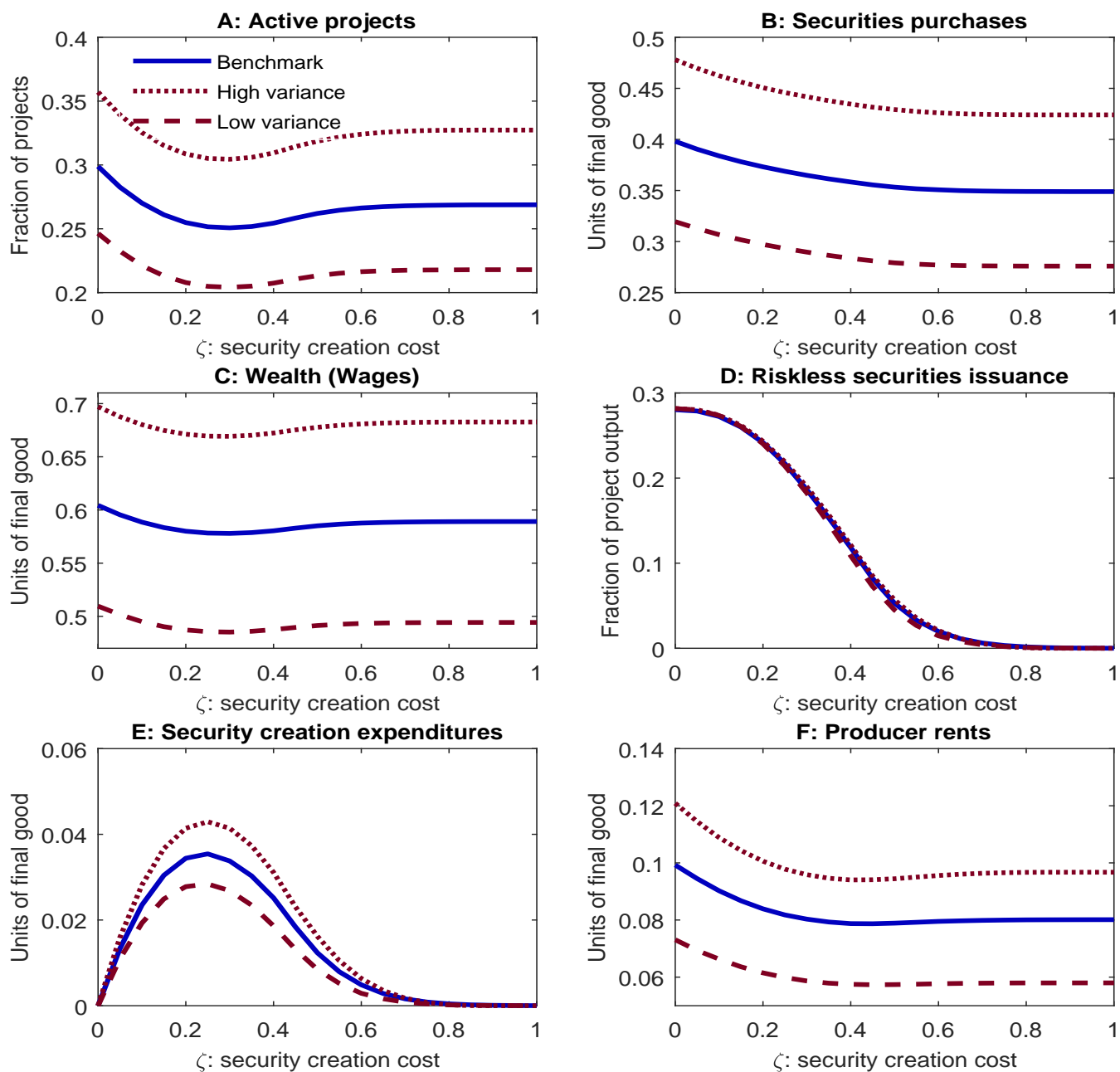
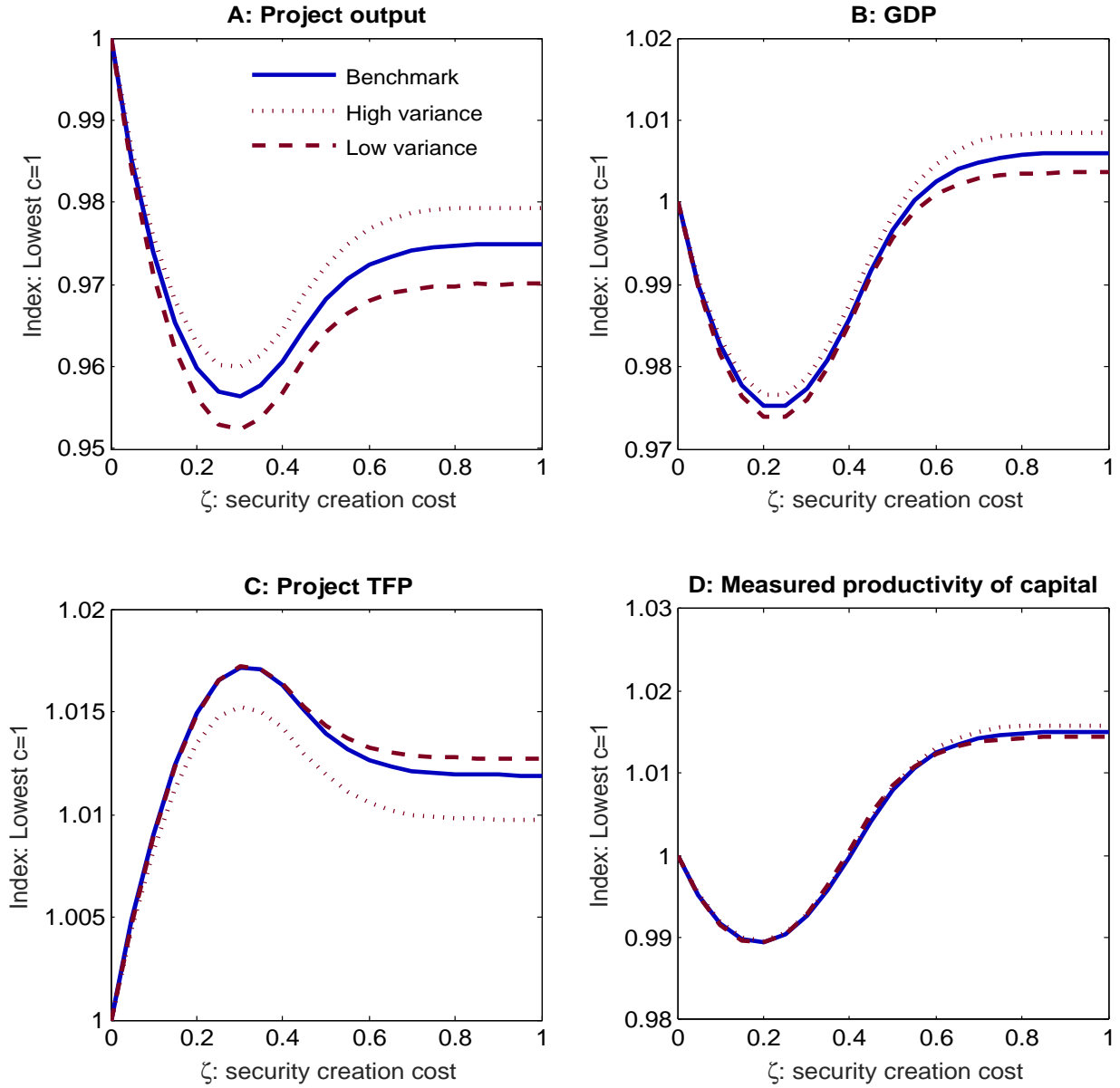
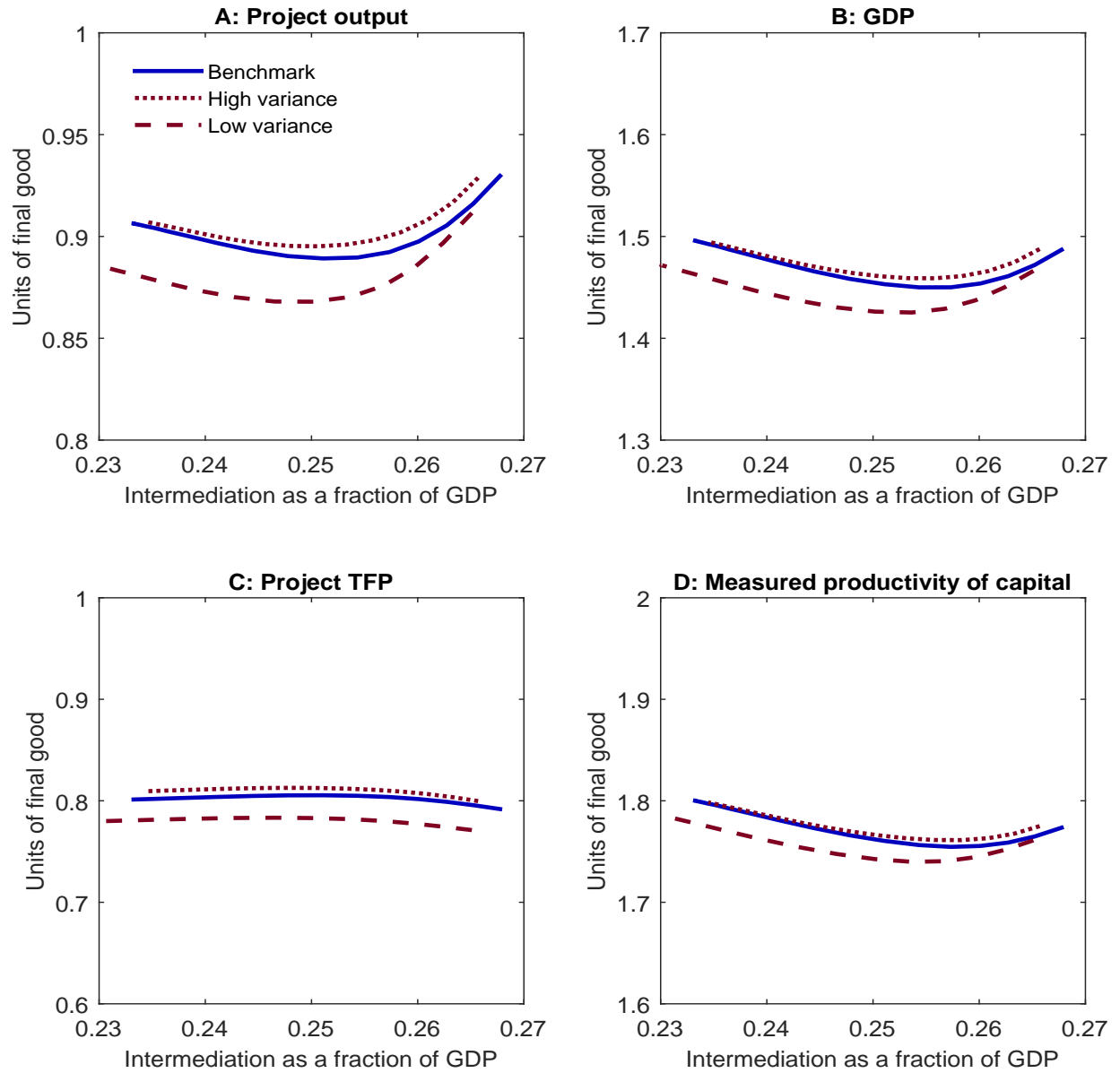


Figure 7: Varying security creation costs: outcomes II



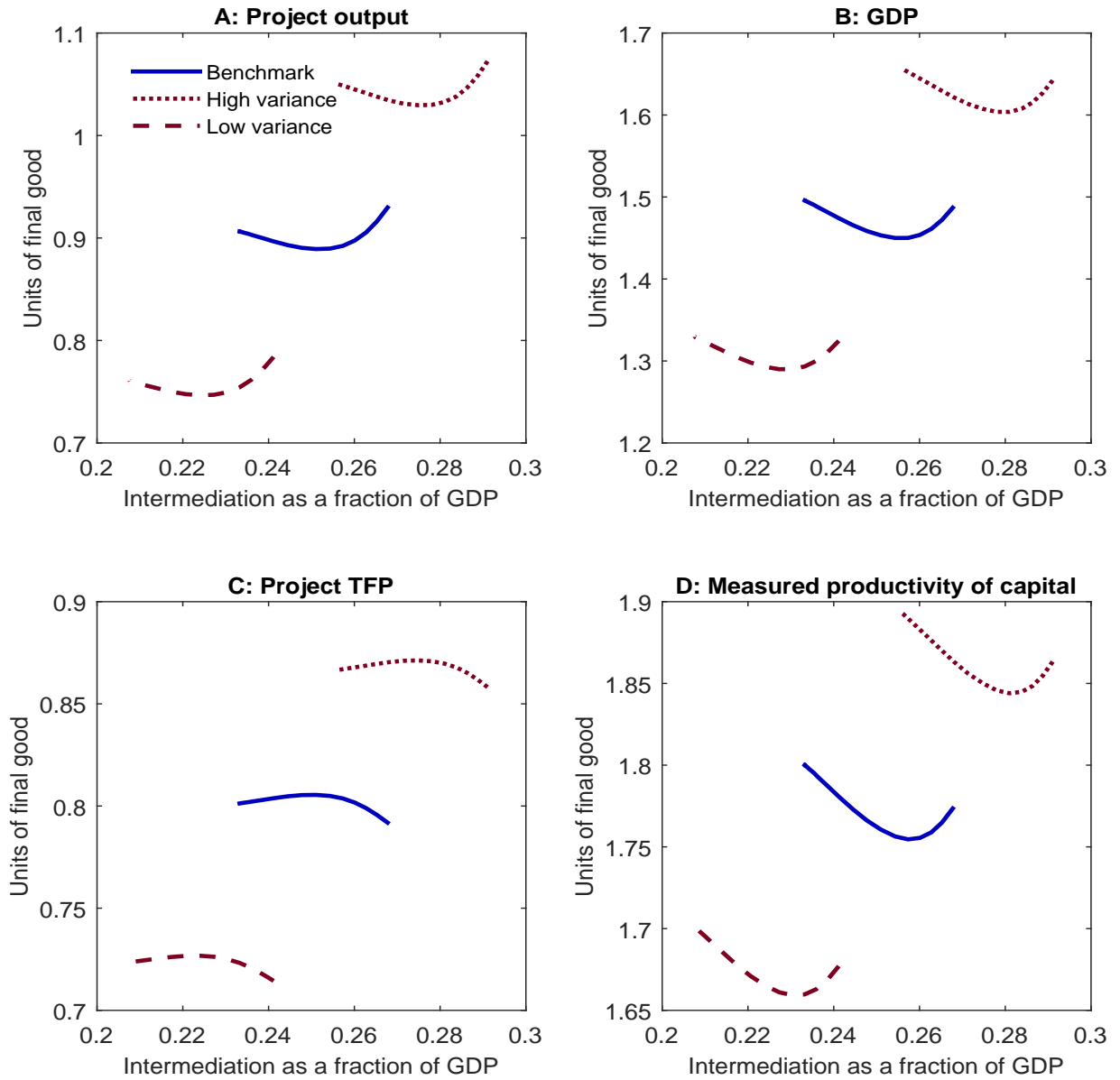
Note: Risky sector TFP (panel C) is value added by risky project divided by K^α where K is the stock of capital used by that sector. Measured productivity is overall GDP divided by $(K^E)^\alpha$ where K^E is wealth at the start of the period.

Figure 8: Spending on securities and economic development



Note: Risky sector TFP (panel C) is value added by risky project divided by K^α where K is the stock of capital used by that sector. Measured productivity is overall GDP divided by $(K^E)^\alpha$ where K^E is wealth at the start of the period.

Figure 9: Enterprise leads, finance follows



Note: Risky sector TFP (panel C) is value added by risky project divided by K^α where K is the stock of capital used by that sector. Measured productivity is overall GDP divided by $(K^E)^\alpha$ where K^E is wealth at the start of the period.

Figure 10: Welfare consequences of varying security creation costs

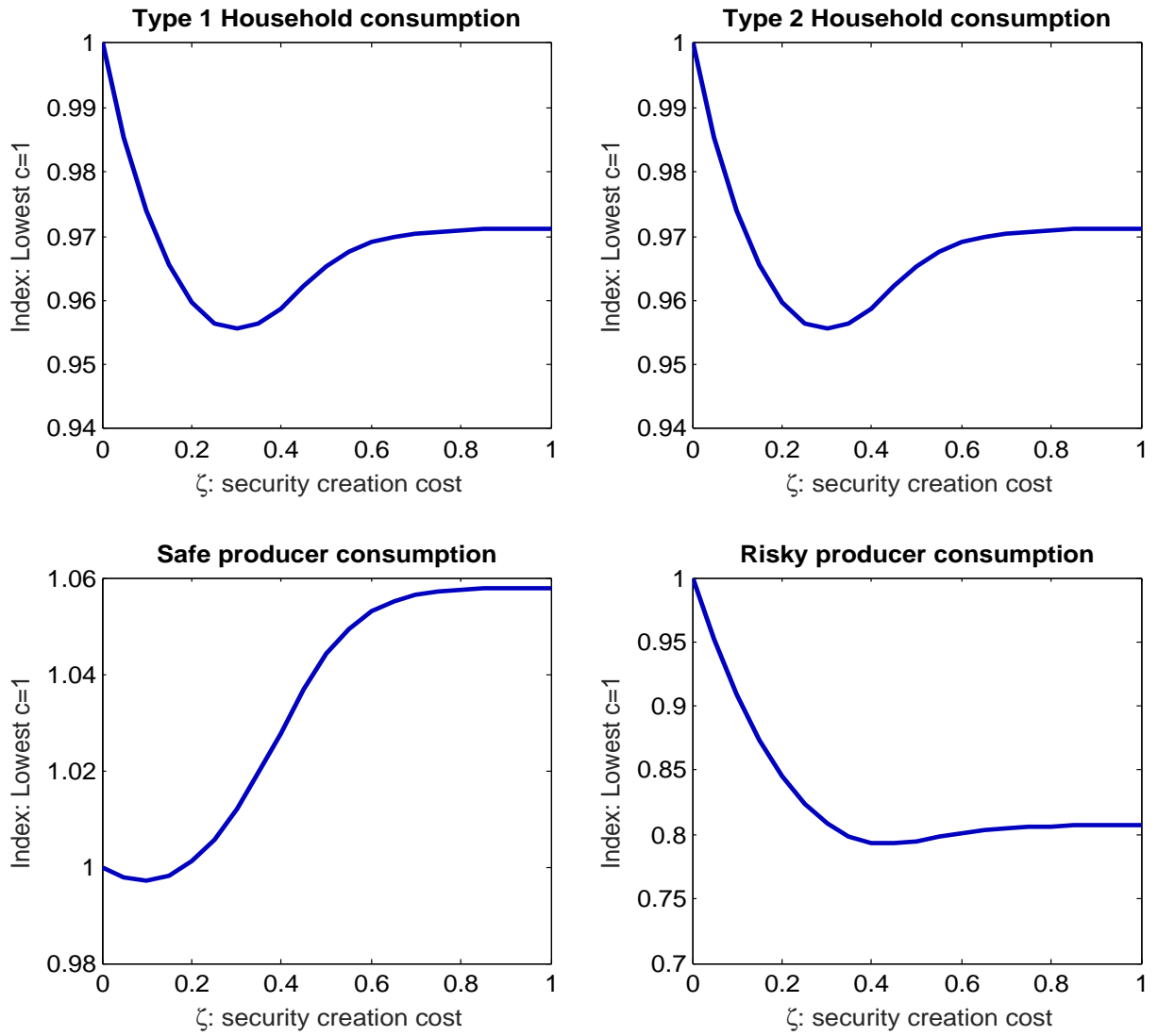
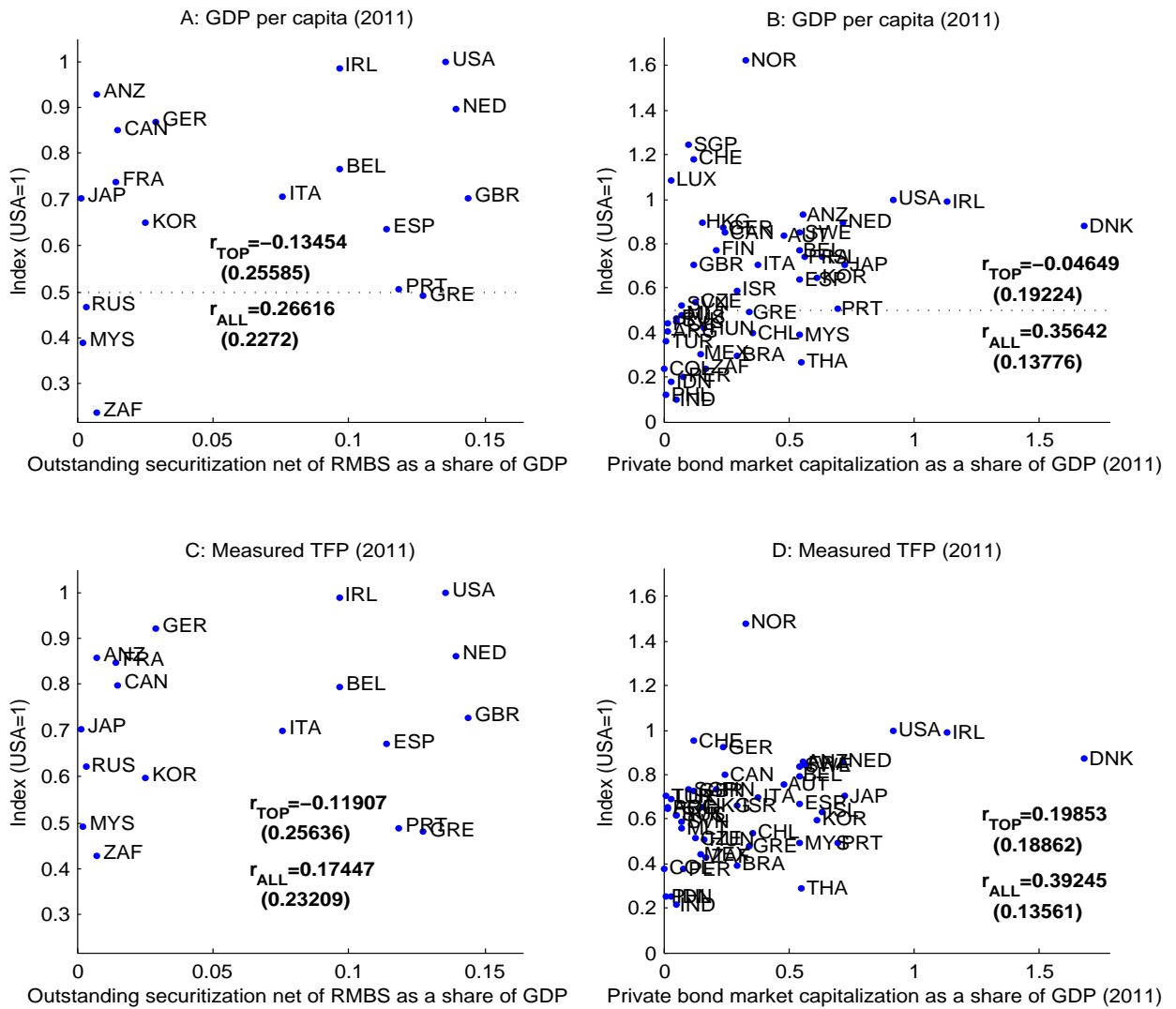


Figure 11: Measures of financial engineering and economic development



Sources: Penn World Tables, SIFMA, Financial Development and Structure Dataset, and authors' calculations.