The Economic Effects of Improving Investor Rights in Portugal*

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Abstract

The Portuguese economy has performed remarkably well since joining the EU in 1986. Output per worker grew at an annual rate of 2.25%. The relative price of investment has declined. Real investment has increased compared to output, in part fuelled by an increase in capital inflows. At the same time, resource allocation seems to have improved as well: firm-level data shows a significant decline in the dispersion of labor productivity and size across firms. This paper argues that improvements in outside investor rights that have taken place since Portugal joined the EU is a prime candidate to explain this set of facts.

Key words. Macroeconomics, Investment Rate, Relative Prices, Resource Misallocation, Investor Protection, Optimal Contracts, Portugal.

JEL Codes: E22, F43, G32, G38, O16, O17, O41.

1 Introduction

Since joining the European Union (then the European Economic Community) in 1986, the Portuguese economy has undergone a radical transformation.

Its performance, at least until recently, has been remarkable. Income grew faster than the EU average, nearly doubling its level in just 20 years. Labor productivity increased significantly. The price of investment relative to the price of consumption declined. Investment rates also increased in real terms, although more modestly. This was in part fuelled by a larger inflow of foreign capital.

This paper provides evidence that, since joining the EU, the dispersion of both firm-level productivity and firm size have declined significantly. This suggests an improvement in resource allocation across Portuguese firms.

Joining the EU also led to many important reforms. This paper puts particular emphasis on those affecting institutional quality, namely those improving corporate governance and investor protection. Investor protection is the label adopted by La Porta, Lopez-de Silanes, Shleifer, and Vishny (1998) to characterize the extent to which outside investors are protected from the expropriation of their returns by managers and other firm insiders. Before joining the EU, the Portuguese commercial code dated from 1888. Since then, Parliament passed a new company law (in 1986), much more protective of outside investors' rights, approved a modern securities law (1991), and significantly revised bankruptcy laws (1993). Transparency was greatly increased with the creation of a centralized system of information about credit risks. Arguably, there have been improvements in law enforcement as well.

The main goal of this paper is to understand whether Portugal's post-1986 economic performance can be at least in part attributed to this improvement in investor protection.

Our approach is to rely on a model of the Portuguese economy, i.e. an explicit description of (i) agents' motives and constraints and of (ii) their interaction. The model may then be used as a laboratory, where agents are subjected to some of the policy changes that the Portuguese economy has faced since joining the EU. Chiefly among them is the improvement in investor protection. Another potentially important policy change is the movement started in 1987 towards the creation of the Single European Market, which abolished the restrictions on intra-EU movements of people, goods, services, and capital. The model traces individual and economy-wide responses to the different policy changes, which can be compared with the evidence. Our main goal is to understand which policies can simultaneously account, in a qualitative sense, for key macro and micro-level facts that characterized the Portuguese economy since the mid-1980's.

Our artificial economy is the one developed in Castro, Clementi, and MacDonald (2004, 2009). It is an extension of the standard Overlapping Generations growth model, featuring imperfect investor protection. The model predicts that an economy which provides better legal protection to outside investors channels more savings to the entrepreneurial sector, and does it more efficiently. More efficiency means less distortions at the micro level, resulting in a better aggregate performance.

Our main conclusion is that the improvement in investor protection is a prime candidate to explaining the post-1986 evidence. Among the alternative policy changes considered, none is consistent with all facts. The liberalization of capital movements alone would have implied a significant outflow of capital and a decline in output relative to trend. Since the pre-EU standard of investor protection in Portugal was much poorer than in the rest of Europe, savings would have fled the country. Also, policies leading to improvements in either aggregate or investment-specific productivity cannot account for the improvement in micro-level resource allocation. Productivity enhancements simply shift the production possibilities frontier outward, without affecting the wedge between private and social re-

turns.

This paper is part of a recent literature that studies the economic implications of imperfect investor protection and financing frictions. Apart from Castro, Clementi, and MacDonald (2004, 2009), other contributions to this literature are Amaral and Quintin (2007), Antunes, Cavalcanti, and Villamil (2008), Erosa and Hidalgo-Cabrillana (2008), Albuquerque and Wang (2008), Buera and Shin (2008a) and Buera, Kaboski, and Shin (2009). These papers are mostly concerned with explaining the cross-country variation in economic outcomes. A few, such as Albuquerque and Wang (2008) and Antunes, Cavalcanti, and Villamil (2008), consider steady-state effects of hypothetical institutional reforms, namely those achieving the perfect protection benchmark. Buera and Shin (2008a) study the transitional dynamics of an initially poor economy that is subject to financing frictions and micro–level distortions.

We are not aware of any previous attempt to employ a model in order to (i) trace down an economy's response to the implementation of a specific institutional reform, and (ii) test such response against data for a broad range of variables.[1]

In an interesting recent paper, Buera and Shin (2008b) also model an economy subject to financing frictions, impediments to international capital flows, and allocational distortions. Such distortions take the form of exogenous firm-specific wedges, rather than arising endogenously from testable assumptions on cross–sectoral heterogeneity, as it the case here. Buera and Shin study the response of their economy to a reduction in any of the three inefficiencies they model, and compare it qualitatively with the actual experience of countries that undertook similar reforms, such as Chile, Estonia, India, Israel, Korea, Mauritius, and Thailand.

The remainder of this paper is organized as follows. Section 2 describes some facts about the performance of the Portuguese economy since joining the EU, both macro and micro-level facts, and discusses the main policy changes that have taken place. Section 3 describes the model, and Section 4 calibrates it to the Portuguese economy. Section 5 describes the policy experiments and presents the results. Section 6 concludes. Appendices A and B present some details about the data and the model's computation, respectively.

2 Portugal, 1978-2006

This section illustrates some empirical observations about the performance of the Portuguese economy since 1978. Although macro-level data extends from 1978 until 2006, micro-level data only spans the 1981-2005 period. All the data are yearly. See Appendix A for further details.

2.1 Macro Data

Figure 1 shows that Portugal's real GDP per worker (real GDP divided by the total labor force[2]) grew at an average annual growth rate of 2.24 percent between 1978 and 2006. Growth was moderate at 0.93 percent per year in the years prior to joining the EU; it accelerated significantly to 2.59 percent between 1986 and 2000; it has been slightly negative, at -0.45 percent, since then.

Refer to Figure 2. The left panel reports the ratio of nominal gross fixed capital formation over nominal GDP - nominal investment rate for short. The nominal investment rate

[1] See, however, Tavares (2004) for a model-free attempt at gauging the potential effect of further investor protection reforms on Portuguese economic growth.

[2] Real variables are in millions of 2000 chained Euros.

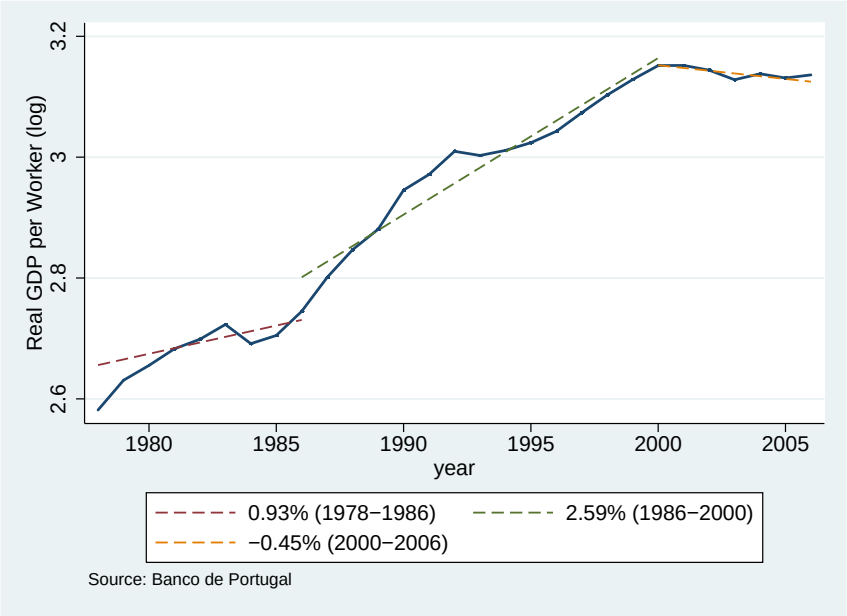

Figure 1: **REAL GDP PER WORKER**

declined at an average rate of about 1 percent per year. Its evolution was very uneven, although much of the variation can be attributed to the high cyclical variability of investment. The right panel plots the ratio of real gross fixed capital formation to real GDP - real investment rate for short.[3] Over the whole 1978-2006 period, the real investment rate in Portugal rose at an yearly average of 0.74 percent. Growth was faster between 1986 and 2000, at about 1.4 percent per year.

The left panel of Figure 2 reflects the expenditure effort that went into domestic investment: how many cents were spent in investment for each Euro of income. In Portugal, less and less resources have been devoted to investment. Is this bad news? Does it mean that actual investment has suffered? The right panel shows that the answer is no. Real investment did actually grow faster than real output. The reason is that investment goods have become cheaper, relative to consumption goods. Even if Portugal is sacrificing less consumption for the purpose of investment, it is obtaining a higher yield in terms of capital.

Figure 3 plots the price of investment relative to the price of consumption, from 1978 to 2004. The data is from Heston, Summers, and Aten's (2006) version 6.2 of the Penn World Tables. The relative price has indeed dropped, at an average annual rate of 1.12 percent. Most of the decline occurred after 1986.

Figure 4 plots the trade balance relative to GDP.[4] The trade balance is total exports minus total imports of goods and services, and corresponds to the net domestic output that is shipped abroad. The left panel shows that the ratio of the nominal trade balance to nominal output (nominal trade balance over output for short) peaked around 1986, and has displayed a slight negative trend since then. We find it hard to attribute any long-term significance to the plunge in net exports in the early to mid 1980's, given that Portugal was in recession back then. The right panel displays the real trade balance over real

[3] Only the nominal investment rate has a share interpretation. Although the real investment rate does not have a share interpretation, it still provides useful information about the relative growth rates of real investment and real output. See Whelan (2002).

[4] Data limitations prevent us from also considering the current account.

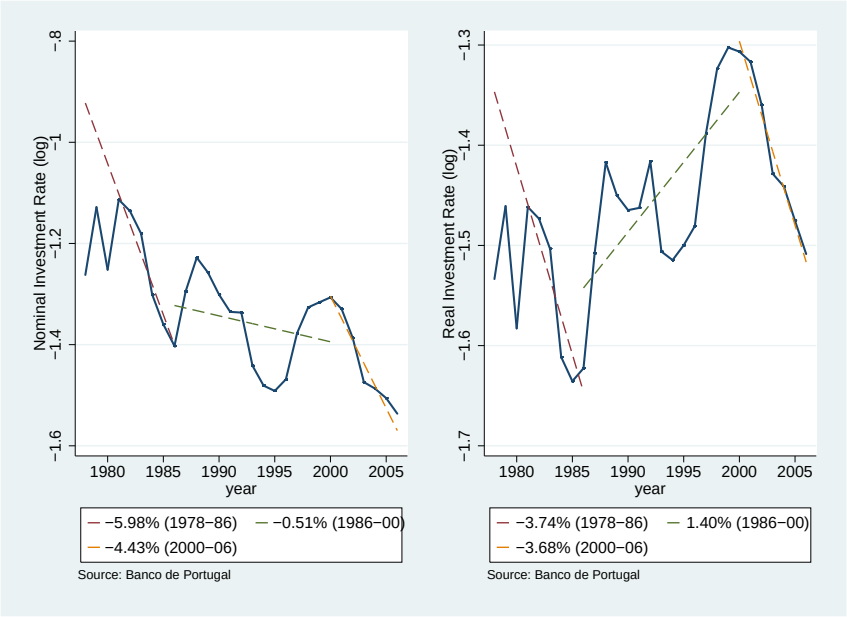

Figure 2: **INVESTMENT RATE**

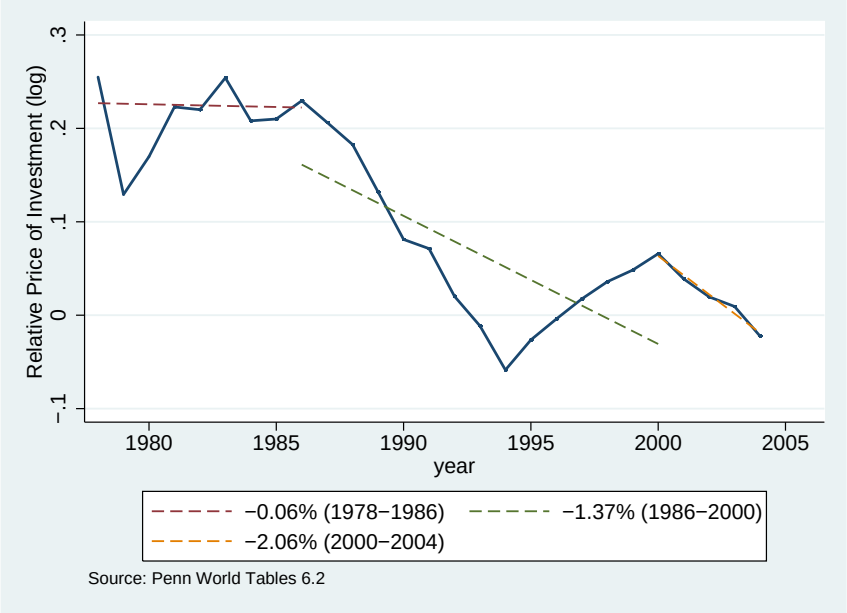

Figure 3: **RELATIVE PRICE OF INVESTMENT**

Figure 4: **TRADE BALANCE RELATIVE TO GDP**

GDP - real trade balance over output, for short.[5] In real terms, net exports have declined significantly relative to output since 1986. Here is one interpretation of this evidence. According to the left panel, Portugal has been spending slightly more on imports, in net terms. The right panel documents that, in spite of this, the real value of imports has been increasing a lot faster than real GDP. This is, once again, due to the dynamics of relative investment prices.

2.2 Micro Data

Here we use data from the Portuguese Ministry of Employment's *Quadros do Pessoal* in order assess the efficiency of cross-firm resource allocation over the 1981-2005 period.

Figure 5 plots, for the whole economy, the evolution of the firm-level dispersion in labor productivity and in firm size. The measure of dispersion is the standard deviation of the logarithm (both series are normalized to take on the value of 1 in the first period).

Size is the total number of employees. Given the lack of data on firm-level value-added, we measure labor productivity as real sales per employee. As argued in Appendix A.1, under certain assumptions value added per employee is proportional to sales per employee. The constant of proportionality is a technological parameter (the share of intermediate goods in production) which may be assumed to be constant across firms within narrowly-defined industries. This is obviously not the case when considering firms across all sectors in the economy, as it is the case for the solid line in Figure 5.[6] While some caution is warranted in interpreting this evidence, we find it reassuring that the dispersion in firm size, which is not subject to this concern, had a similar evolution. Both dispersion measures have been declining since 1981, at a faster pace in the early to mid 1990s, and slower afterwards.

Associating a decline in the dispersion of firm-level productivity or size with an improvement in resource allocation is legitimate under a few assumptions about market

[5] The comment in footnote 3 applies here as well.

[6] As discussed in Appendix A.1, a further drawback of our productivity measure stems from the lack of firm or even sectoral level price deflators. Nominal sales are deflated by the GDP deflator.

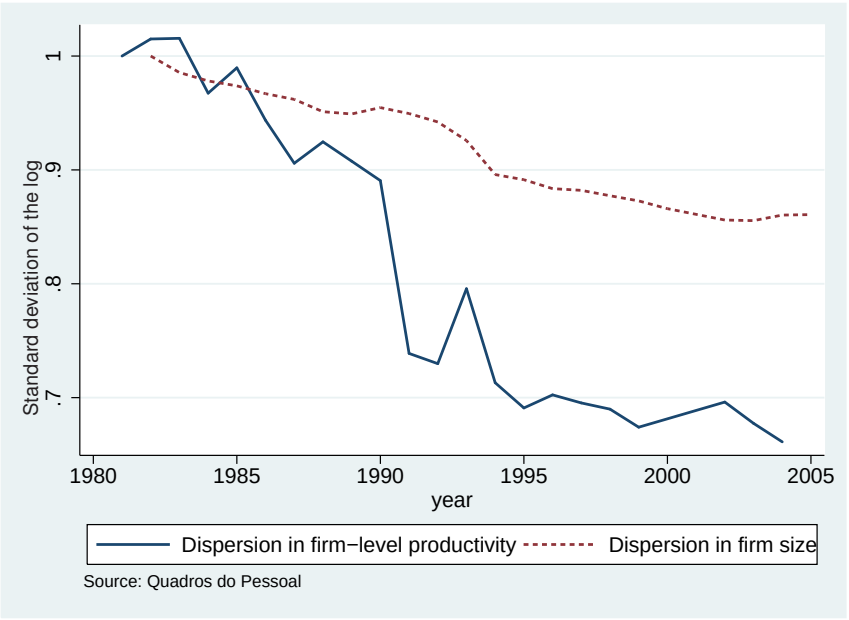

Figure 5: **DISPERSION IN FIRM-LEVEL PRODUCTIVITY AND SIZE**
(All sectors)

structure and production technology. To focus on the simplest set of assumptions, consider perfectly competitive markets, homogeneous goods, decreasing returns technology, and cross-firm differences in total factor productivity. Then, an efficient allocation entails equating marginal labor productivity across firms, with differences in size reflecting firm-level heterogeneity in total factor productivity. Cross-firm dispersion in either labor productivity or size in excess of the efficient benchmark must be accounted for by some kind of firm-level distortions. A decline in the dispersion of either labor productivity or size is indicative of decreasing distortions, at least as long as the cross-sectional dispersion in total factor productivity stays roughly constant.[7]

The observed decline in firm-level productivity and size dispersion might be due to a decline in within-sector dispersion, to a drop in cross-sector dispersion, or to changes in sectoral composition. This paper will emphasize the last two factors. Firms will be assumed to be homogeneous within sectors. One may ask: Can the evidence in Figure 5 be accounted for by a decline in dispersion within sectors? Although we won't provide a conclusive answer to this question, Figures 6-9 present some disaggregated evidence, at the 2-digit level.[8] The figure captions indicate how the 2-digit sectors are grouped into 1-digit categories. Table 3 in Appendix A.2 provides the complete association between sectors and industry codes.

Inspection of these figures reveals that the same pattern that was observed in the aggregate tends to hold at the 2-digit sectoral level. There are a few exceptions though: Tobacco Manufacturing (16), Radio, TV, and Communication Material Manufacturing (32), Automobile Manufacturing (34), Recycling (37), and essentially all sectors in Transportation, Storage, and Communications (60-64) and Real Estate, Rentals, Service Provision to Firms (70-74).

[7] Hsieh and Klenow (2007a) exploit a similar idea in their cross-country analysis. They infer distributions of firm-level distortions in China and India from observed differences in marginal products. As it is the case here, a large dispersion in factor allocation across firms, relative to some benchmark, is indicative of greater distortions.

[8] Ideally one would like to work with a finer classification. The small number of firms in several sectors prevents us from doing that.

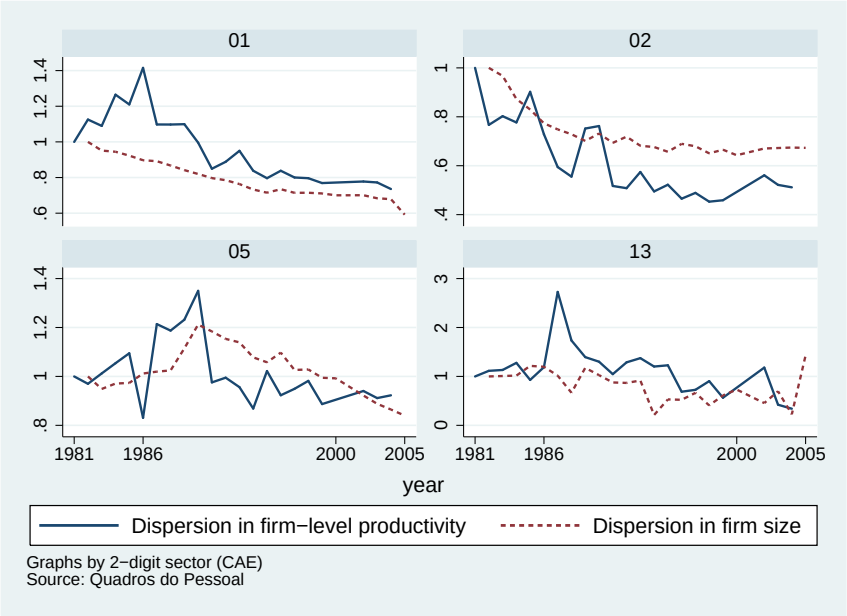

Figure 6: **DISPERSION IN FIRM-LEVEL PRODUCTIVITY AND SIZE**
(Agriculture, Animal Production, Hunting, Forestry (01,02), Fishing (05), and Extractive Industries (13,14))

In a few other sectors, among which Retail and Wholesale Trade (50-52) and Accommodation, Restaurants and Kindred Activities (55), the decline in productivity variation is marked, although the decline in size dispersion is either very modest or non-existent.

We conclude that sectoral heterogeneity is clearly not the whole story behind the pattern in Figure 5. Part of the improvement in resource allocation indeed appears to have taken place within 2-digit sectors. Our approach will be to abstract from within-sector distortions. We will focus on the misallocation that occurs between high risk sectors (e.g. investment good sectors such as machinery manufacturing), and low risk sectors (e.g. consumption good sectors like apparel manufacturing). In Section 5.6 we discuss some scenarios where within-sector improvements in resource allocation such as those documented in Figures 6-9 would be particularly relevant.

2.3 Policy Reforms

We provide a brief chronology of the main policy changes that took place in Portugal during the 1978-2006 period. We begin with the improvements in corporate governance and investor protection, and then describe other potentially relevant reforms.

There were major improvements in many of the institutional features affecting corporate governance and investor protection: Company Law, Securities Law, Bankruptcy Law, as well as law enforcement. Most of these major reforms were concentrated in a short period after Portugal joined the EU.

- 1986: Major revision of the existing Commercial Code of 1888, with the introduction of a new Company Law (*Código das Sociedades Comerciais*). The law became closer to those in effect in the rest of Europe, and significant improvements were made in terms of mandatory accounting practices and investor rights. The code has been revised on a regular basis since 1986.

- 1991: Creation of an independent Securities Commission (CMVM - *Comissão do*

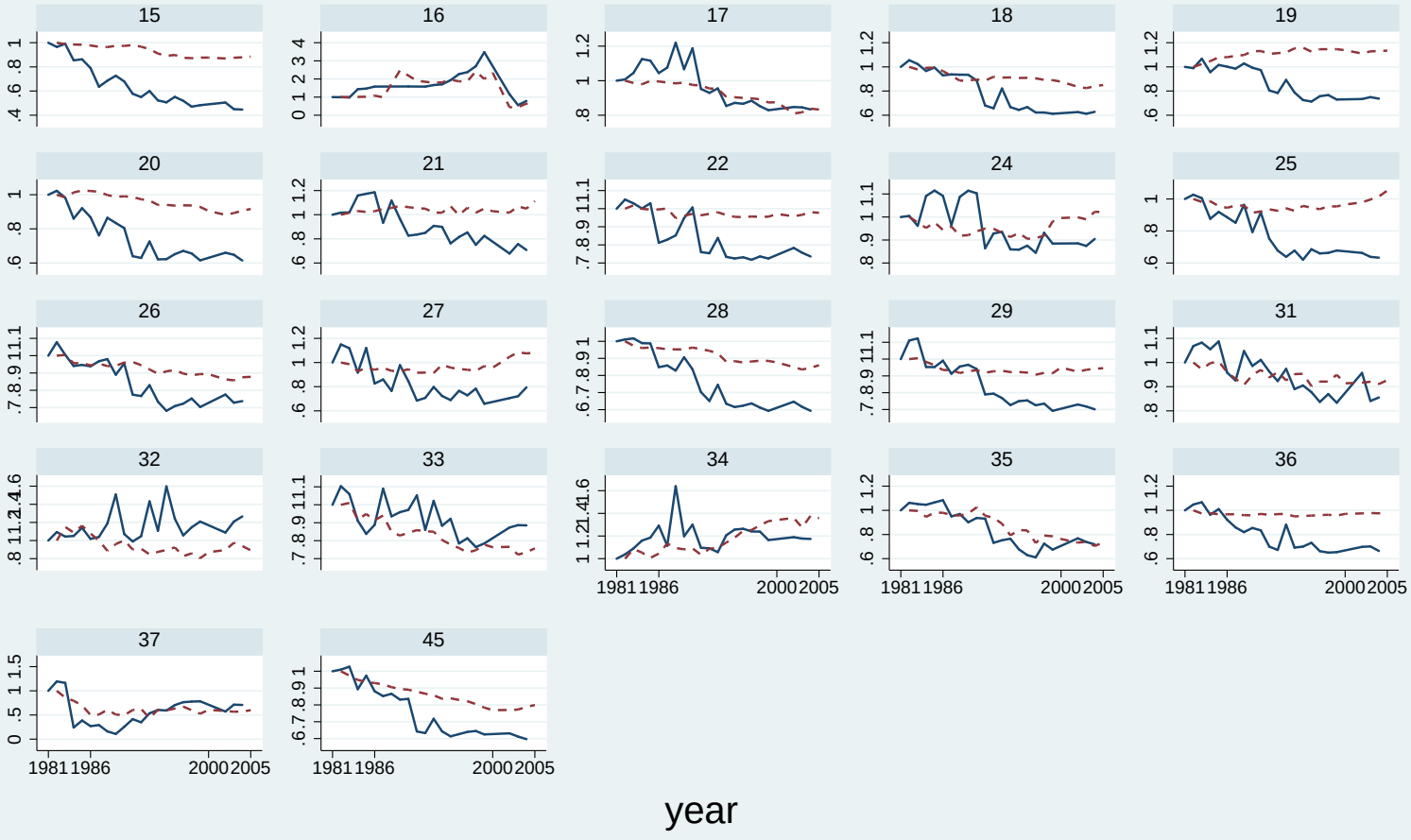

Figure 7: **DISPERSION IN FIRM-LEVEL PRODUCTIVITY AND SIZE**
(Manufacturing (15-37) and Construction (45))

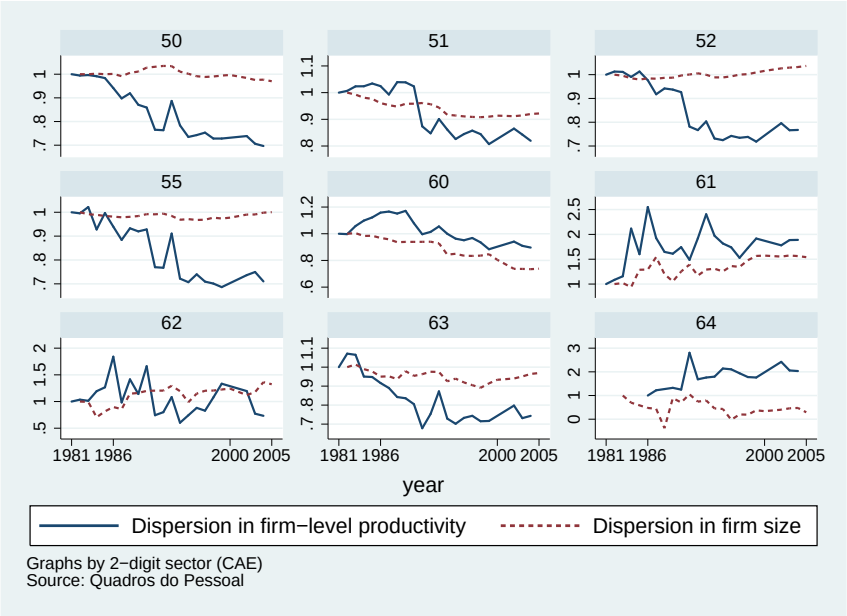

Figure 8: **DISPERSION IN FIRM-LEVEL PRODUCTIVITY AND SIZE**
(Retail and Wholesale Trade (50-52), Accommodation, Restaurants and Kindred Activities (55), and Transportation, Storage, and Communications (60-64))

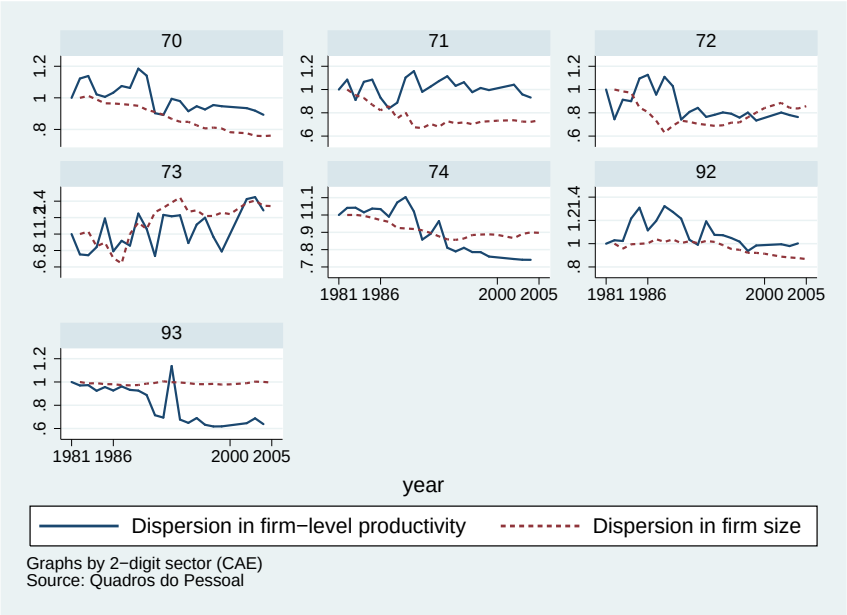

Figure 9: **DISPERSION IN FIRM-LEVEL PRODUCTIVITY AND SIZE**
(Real Estate, Rentals, Service Provision to Firms (70-74), and Various Services (92,93))

Mercado de Valores Mobiliários) in charge of regulating and supervising financial markets. The basic regulatory framework (Securities Law - *Código do Mercado de Valores Mobiliários*) was introduced in 1991 and significantly revised in 2000. The Bank of Portugal continued being the main regulator and supervisor of financial intermediaries, but a new Banking Law (*Regime Geral das Instituições de Crédito e Sociedades Financeiras*) was enacted in 1992.

- 1993: A new corporate Bankruptcy and Reorganization Law (*Código da Insolvência e Recuperação de Empresas*) was enacted, and subsequently revised in 1998. A further comprehensive reform, aimed at speeding up the bankruptcy process and dealing with poor enforcement, took place in 2004.

- 1993: Creation of a centralized database of the individual credit positions and credit ratings of every household and firm in Portugal (*Central de Responsabilidades de Crédito*). Information about firms started to be gathered in 1978, but the scope became much broader starting in 1993. Since then it essentially covers the universe of borrowers from Portuguese financial institutions. The database is managed by the Bank of Portugal, and the information is provided to lending financial institutions upon request.

- There were gradual improvements in law enforcement as well, for which there is no specific turning-point date. In spite of this progress, poor law enforcement (in particular the slow speed of the judicial system) is still the Achilles' heel of overall institutional development in Portugal.

Other major policy changes have taken place during this period. As it is the case for the improvements in investor protection, most of them occurred soon after Portugal joined the EU. They may also help explaining the economy's performance since 1986.

- 1987: The Single European Act is implemented, preparing the ground for the Single European Market. Like its EU partners, Portugal began abolishing barriers to the intra-EU movement of people, capital, goods, and services. The Single European Market finally took shape in 1993.

- 1988: Start of a large deregulation and privatization wave, with the approval of the *Privatization Law*. Had a large impact on the financial intermediation industry, previously heavily regulated and largely state-owned.

- 1999: The exchange rate between the Portuguese Escudo and the Euro is irrevocably set. In 2002, the Euro becomes the country's official currency.[9]

The main goal of this paper is to attempt to sort out the effects these different policies might have had on the Portuguese economy.

3 Model

The model is the simple extension of the standard two-period Overlapping Generations model of capital accumulation considered by Castro, Clementi, and MacDonald (2009). It features two sectors, labeled consumption and investment, and institutions that imperfectly protect outside investors' rights.

[9] Portugal joined the European Exchange Rate Mechanism in 1992. Participants to this arrangement were supposed to maintain a relatively stable value of their currencies against each other. As is well-known, its success was mixed. A period of instability during 1992 and 1993 lead to a relaxation of the commitment towards exchange rate stability.

3.1 Preferences

Population is normalized to one. Each period a new generation is born. An individual's utility from time t consumption is

$$u(c_t) = \frac{c_t^{1-\sigma} - 1}{1-\sigma},$$

where $\sigma > 0$ is the coefficient of relative risk-aversion. Future utility is discounted at rate $\beta > 0$.

Individuals are born identical and with no resources. When young, they employ their unit of time as managers of a firm. For this reason, we will refer to them as entrepreneurs.

3.2 Technology

An entrepreneur decides whether to produce consumption goods (C) or investment goods (I). The production of good $j = C, I$ is done according to

$$y_{jt} = z_{jt} k_{jt}^{\alpha},$$

where k_{jt} is capital, $0 < \alpha < 1$ is the share of capital in production, and $z_{jt} \in [0, +\infty)$ is the entrepreneur-specific productivity for producing good j. Assume $\log z_{jt}$ is normally distributed with mean μ_j and standard deviation η_j. With z_{jt} we denote the quality of the investment project. The two technologies differ only in the two parameters governing the productivity distribution.

3.3 Lending Contracts

Once chosen a sector, an entrepreneur borrows from financial intermediaries the funds needed to acquire the capital required by production. Then, he produces, receives profits, and allocates them between consumption and saving. Savings are used towards the purchase of capital, which is held until the next period and then rented out to the next generation of entrepreneurs. We will refer to old individuals as capitalists.

A central element of the model is the interaction between entrepreneurs and financial intermediaries. There are two important ingredients to it.

3.3.1 Information

The project's quality becomes known to the entrepreneur upon realization of the revenues and remains its private information throughout. Since lower-quality projects are required to pay back lower returns to the intermediary, this creates an incentive for the entrepreneur to under-represent his revenues. In fact, when misreporting the entrepreneur stands to profit from the difference between what he should have paid had he said the truth, and what he actually pays.

3.3.2 Institutions

Everything else equal, the return to misrepresentation (stealing) depends upon the institutions governing outside investors' rights. Countries with good institutions make stealing very inefficient - most of the resources stolen are lost in the process. In countries with poor institutions, instead, the return from stealing is high.

3.3.3 Intermediation Industry

The intermediation industry is perfectly competitive with free entry. It follows that the lending contracts offered by intermediaries will be constrained-efficient. They will provide the maximum expected utility for entrepreneurs, subject to being resource-feasible and incentive compatible.

3.3.4 Optimal Consumption-Saving Behavior

To formally characterize the lending contract, consider first an entrepreneur's consumption-saving decision. Let $v\left(m_t, r_{t+1}\right)$ denote the indirect utility of an agent born at time t, conditional on having received income m_t and on facing an interest rate r_{t+1}. Then,

$$v(m_t, r_{t+1}) \equiv u\left[m_t - s(m_t, r_{t+1})\right] + \beta u\left[(1 + r_{t+1})s(m_t, r_{t+1})\right],$$

where the optimal saving function $s(m_t, r_{t+1})$ is

$$s\left(m_t, r_{t+1}\right) \equiv \arg\max_s \left\{u\left(m_t - s\right) + \beta u\left[\left(1 + r_{t+1}\right) s\right]\right\}.$$

3.3.5 Optimal Contracting

Financial intermediaries rent out capital on behalf of capitalists, collect production from entrepreneurs, and provide the latter with their incomes, net of loan repayments.[10]

Due to perfect competition and free entry, there won't be any scope for cross-subsidization between contracts offered to different sectors. Without loss of generality, we can think of a single intermediary dealing with every entrepreneur operating in the same sector.

The optimal lending contract offered to an entrepreneur operating in sector j at time t then solves[11]

$$\max_{k_{jt} \geq 0, \tau_{jt}(z) \geq 0} \int v(\tau_{jt}(z), r_{t+1}) f_j(z) dz \qquad \text{(P1)}$$

subject to

$$v[\tau_{jt}(z), r_{t+1}] \geq v[\tau_{jt}(z') + \xi p_{jt}(z - z')k_{jt}^{\alpha}, r_{t+1}] \quad \text{for all} \quad z \geq z' \qquad (1)$$

$$\int \tau_{jt}(z) f_j(z) dz = p_{jt} \bar{z}_j k_{jt}^{\alpha} - (r_t + \delta) p_{It} k_{jt}, \qquad (2)$$

where p_{jt} is the relative price of good j in terms of consumption. Hence $p_{Ct} = 1$, and we denote the relative price of investment simply by $p_{It} = p_t$.

Upon observing the true z, an entrepreneur reports his productivity to the intermediary. This announcement, call it $\hat{z}$, may or may not equal z. Since the income transfer provided by the intermediary, $\tau_{jt}(\hat{z})$, is based upon the entrepreneur's announcement, misreporting may be in his best interest.

The optimal lending contract is a capital advance k_{jt}, and a schedule of conditional income transfers $\tau_{jt}(z)$, which maximize the entrepreneur's expected lifetime utility subject to constraints (1) and (2).

Condition (2) is a resource constraint. It requires that total transfers paid out by the intermediary equal total output obtained from entrepreneurs, net of rental payments to

[10] A more realistic alternative would be to assume that entrepreneurs pay a return to intermediaries. It turns out that the formulation we adopt is formally equivalent to this one, but leads to a simpler characterization of the optimization problem. See Castro, Clementi, and MacDonald (2004).

[11] Unless otherwise specified, integration is over the whole domain $[0, +\infty)$.

owners of capital. Since the risk faced by entrepreneurs is purely idiosyncratic, a law of large numbers applies.

Equation (1) is an incentive-compatibility constraint. It follows from the Revelation Principle, which allows us to restrict attention to contracts that induce truthful revelation. It ensures that if an entrepreneur is hit by a shock z, he is better-off by announcing $\hat{z} = z$ rather than $\hat{z} = z'$, for all $z' \leq z$.[12] Upon reporting $z' < z$, the entrepreneur would be required to surrender just $p_{jt} z' k_{jt}^{\alpha}$ to the intermediary. The difference $p_{jt}(z - z')k_{jt}^{\alpha}$ represents the resources stolen away from the intermediary, a fraction $\xi \in [0, 1]$ of which is available for consumption. The remainder is a deadweight loss.

The parameter ξ captures the level of investor protection, or more generally the quality of institutions. Countries with good institutions have lower ξ's, with $\xi = 0$ corresponding to the benchmark case of perfect investor protection. The latter is a situation in which stealing is never profitable. Similarly to those describing preferences and technology, ξ is a deep parameter of the model. It is the result of all law provisions and institutions which define and enforce shareholders' and creditors' rights.

3.4 International Trade

Since only investment goods are assumed to be traded internationally, there is no scope for intratemporal trade. Each country faces the relative price of investment that would prevail under autarky.

Portugal, as well as all other countries, is modeled as a small economy that engages in borrowing or lending with the rest of the world. Let K_t^S be the aggregate capital supplied by residents and K_t^D be the domestic aggregate demand for capital. Then,

$$B_t \equiv p_t(K_t^S - K_t^D)$$

is the net foreign asset position, measured in consumption. Alternatively, $-B_t$ is net foreign debt (when $B_t < 0$ there is foreign investment in the small open economy). Let r^* be the constant world interest rate. The trade balance is

$$TB_t = B_{t+1} - (1 + r^*)B_t.$$

International capital mobility is limited. An economy with net foreign investment B_t incurs trading costs given by

$$\varphi \left(\frac{B_t}{Y_t} \right)^2 Y_t,$$

where $\varphi \geq 0$ and Y_t is GDP. All quantities are expressed in units of consumption. Letting $N_t \in [0, 1]$ denote the fraction of entrepreneurs that produce investment goods at time t, it follows that

$$Y_t = p_t N_t \bar{z}_I k_{It}^{\alpha} + (1 - N_t)\bar{z}_C k_{Ct}^{\alpha}.$$

Trading costs are a convex function of the size of net investment relative to output. They stand in for frictions such as the risk of sovereign default and restrictions to currency conversion. This specification accommodates any degree of international capital mobility, ranging from fully open ($\varphi = 0$) to fully closed economy ($\varphi = \infty$). Trading costs induce a wedge between the world interest rate and the domestic interest rate (r_t), which depends on φ as well as equilibrium variables. Countries with different institutions will thus have different equilibrium interest rates.

[12] It is not necessary to impose an analogous incentive compatibility constraint for $z' > z$. Reporting a productivity higher than the true level would require the entrepreneur to surrender more resources than he actually has, which is not feasible.

3.5 Competitive Equilibrium

We now turn to the formal definition of the competitive equilibrium for this economy.

Definition 1. *Given an initial aggregate supply of capital $K_0^S > 0$, a competitive equilibrium is a non-negative consumption level of the initial old c_0^o and sequences of young and old agents' non-negative consumption allocations $\{c_{jt}^y(z)\}_{t=0}^{\infty}$ and $\{c_{jt}^o(z)\}_{t=1}^{\infty}$, contracts $\{k_{jt}, \tau_{jt}(z)\}_{t=0}^{\infty}$, measures of entrepreneurs in the investment good sector $\{N_t\}_{t=0}^{\infty}$, aggregate capital demand $\{K_t^D\}_{t=0}^{\infty}$, aggregate capital supply $\{K_t^S\}_{t=0}^{\infty}$, relative investment prices $\{p_t\}_{t=0}^{\infty}$, and domestic interest rates $\{r_t\}_{t=0}^{\infty}$, such that*

1. $c_0^o = p_0 K_0^S (1 + r_0)$;
2. $c_{jt}^y(z) = \tau_{jt}(z) - s(\tau_{jt}(z), r_{t+1})$ *and* $c_{j,t+1}^o(z) = s(\tau_{jt}(z), r_{t+1})(1 + r_{t+1})$, *for* $j = C, I$;
3. $\{k_{jt}, \tau_{jt}(z)\}$ *solve problem* (P1) *for* $j = C, I$;
4. *Young individuals are indifferent between the two sectors:*

$$\int v(\tau_{It}(z), r_{t+1}) f_I(z) dz = \int v(\tau_{Ct}(z), r_{t+1}) f_C(z) dz; \tag{3}$$

5. *The aggregate supply of capital equals aggregate savings:*

$$p_t K_{t+1}^S = N_t \int s\left(\tau_{It}(z), r_{t+1}\right) f_I(z) dz + (1 - N_t) \int s\left(\tau_{Ct}(z), r_{t+1}\right) f_C(z) dz; \tag{4}$$

6. *Aggregate consumption equals the production of consumption goods:*

$$\begin{aligned} &N_{t-1} \int c_{It}^o(z) f_I(z) dz + N_t \int c_{It}^y(z) f_I(z) dz + \\ &(1 - N_{t-1}) \int c_{Ct}^o(z) f_C(z) dz + (1 - N_t) \int c_{Ct}^y(z) f_C(z) dz = (1 - N_t) \bar{z}_C k_{Ct}^{\alpha}; \end{aligned} \tag{5}$$

7. *The market for capital clears:*

$$K_t^D = N_t k_{It} + (1 - N_t) k_{Ct}; \tag{6}$$

8. *The aggregate profit from accessing world credit markets equals the aggregate cost:*

$$(r^* - r_t) B_t = \varphi \left(\frac{B_t}{Y_t} \right)^2 Y_t. \tag{7}$$

It is worth elaborating a little on (7). Suppose $r_t < r^*$. In this case, domestic residents wish to invest their capital abroad. It follows that $B_t > 0$. The term $(r^* - r_t) B_t > 0$ is the aggregate profit from investing abroad, i.e. net factor income from abroad. In equilibrium, residents must have no further interest in investing abroad. This happens when the aggregate profit equals the total trading costs. An analogous argument applies to the case of $r_t > r^*$.

3.6 Model Solution

This section provides a brief account of the model's solution. The details are in Castro, Clementi, and MacDonald (2009).

Because of isoelastic preferences, it turns out that $v(\tau_{jt}(z), r_{t+1}) = u(\tau_{jt}(z))\phi(r_{t+1})$ for some function ϕ, up to a constant. It follows that the solution to (P1) does not depend upon r_{t+1} and takes a particularly simple form. Transfers are given by $\tau_{jt}(z) = p_{jt}g_j(z)k_{jt}^{\alpha}$ for $j = C, I$, where $g_j(z) \geq 0$ is a sector-specific function that only depends on parameters. The capital advance in sector $j = C, I$ solves:

$$p_{jt}\left(r_t + \delta\right) = \alpha k_{jt}^{\alpha-1}\left(\bar{z}_j - \xi\omega_j\right) \quad \text{if } \xi \leq \xi_j^* \tag{8}$$

$$p_{jt}\left(r_t + \delta\right) = \alpha k_{jt}^{\alpha-1}(1-\xi)\bar{z}_j \quad \text{if } \xi \geq \xi_j^* \tag{9}$$

where

$$\omega_j \equiv \frac{\int u'[g_j(z)](\bar{z}_j - z)f_j(z)dz}{\int u'[g_j(z)]f_j(z)dz} \geq 0,$$

$$\xi_j^* \equiv \frac{1}{1 + \frac{\alpha}{1-\alpha}e^{-\sigma\eta_j^2}} \in (0,1).$$

Consider condition (8). The first-best level of capital obtains for $\xi = 0$. When $0 < \xi \leq \xi_j^*$, a wedge is introduced relative to first-best, governed by $\omega_j > 0$. Such wedge arises because truthful revelation can be achieved only by letting entrepreneurs bear part of firm-level risk. To see this, notice that the incentive-constraint (1), which binds for $\xi > 0$, implies

$$\tau_{jt}(z) - \tau_{jt}(z') = \xi p_{jt}\left(z - z'\right)k_{jt}^{\alpha} \quad \text{for all } z, z'.$$

It follows that

$$\mathrm{std}\left(\tau_{jt}(z)\right) = \xi p_{jt}k_{jt}^{\alpha}\mathrm{std}\left(z\right), \tag{10}$$

where std denotes the standard deviation. The key point is that the risk faced by entrepreneurs is increasing in firm size k_{jt}. Hence, advancing an extra unit of capital to entrepreneurs can be accomplished only by imposing on them a larger portion of idiosyncratic risk. Or, in other words, by reducing the insurance entrepreneurs receive against that risk. The term $\xi\omega_j > 0$ captures precisely the utility loss to entrepreneurs which derives from the higher risk. Their private gain of employing an extra unit of capital (right-hand-side of (8)) is lower than the first-best.

Condition (9) arises because, for ξ high enough ($\xi > \xi_j^*$), spreading transfers further apart violates the limited liability constraint $\tau_{jt}(z) \geq 0$ for some z. In order to satisfy this constraint, intermediaries must further reduce the capital advance. In this case, the marginal benefit of increasing capital (again the right-hand-side of (8)) becomes larger than the marginal cost. This implies a further wedge in the allocation of capital relative to first-best. For the parameterizations considered in this paper, it will always be the case that $\xi \leq \xi_j^*$, so that only condition (8) will be relevant.

Replacing the transfer schedule in (3) and (8)-(9), it is easy to verify that the relative price of investment p and the relative size of consumption good firms $Q \equiv k_{Ct}/k_{It}$ are both time-invariant. This feature dramatically simplifies the computation of the economy's transition to the steady-state.[13] Appendix B provides further details on the computation of the transition path.

[13] Castro, Clementi, and MacDonald (2009) concentrate their attention on steady-states. Here we will be interested in the transitional dynamics as well.

4 Calibration

4.1 Exogenous Growth

For the purpose of calibrating the model, Castro, Clementi, and MacDonald (2009) also consider exogenous growth. Let TFP in sector j be $\zeta_{jt} = \gamma^t z_{jt}$ for $j = I, C$, where $\gamma > 1$ is the gross growth rate (common to all countries) and z_{jt} is defined as above. It can be easily shown that a balanced growth path exists where the growth rate of aggregate output is $\gamma^{1/(1-\alpha)}$. As it is standard in the business cycle literature, one can derive the analogue of the equilibrium conditions of Section 3.5 in terms of detrended variables. In what follows, we denote detrended variables with a hat.

4.2 Parameter Values

We adapt the basic calibration methodology of Castro, Clementi, and MacDonald (2009). The model's parameters are summarized in Tables 1 and 2. The latter contains the policy parameters which characterize Portugal prior to joining the EU.

β	σ	α	δ	γ	r^*	η_C	η_I
0.1428	1.5	1/3	0.7099	1.3542	0.4986	0.9136	1.4736

Table 1: **PARAMETER VALUES**

ξ	φ	$\bar{z}_I$	$\bar{z}_C$
0.9402	21.8703	1	1

Table 2: **PRE-EU POLICY PARAMETERS**

We assume a 20-year model period. The values assigned to σ, α, and δ are standard in the literature. The latter implies an annual depreciation rate of 6%. We set the model's long-run annual output growth to 2.3%, the average annual growth rate of real GDP per worker in the Penn World Tables (and about the same as Portugal's during the 1978-2006 period).

Since our economy exhibits invariance to scale, we normalize $\mu_j = -\eta_j^2/2$, so that $\bar{z}_C = \bar{z}_I = 1$. We set the key parameters in η_I and η_C as in Castro, Clementi, and MacDonald (2009). Drawing from a panel of U.S. firms, they obtain estimates of firm-level risk. They report annual standard deviations of residual sales growth of 0.0646 for consumption good firms, and of 0.1042 for investment good firms. We calibrate η_I and η_C so that the standard deviation of sales growth in the model matches those figures, on an annual basis.

To assign a level of investor protection to Portugal, we once again follow Castro, Clementi, and MacDonald (2009). The model implies a one-to-one mapping between investor protection and relative prices. Denote it as $p(\xi)$. Then, for every country i, we can write:[14]

$$\frac{p(\xi_i)}{p(0)} = \frac{(P_I/P_C)_i}{(P_I/P_C)_1},$$

[14] This identification is valid under the assumption that ξ is the only source of cross-country heterogeneity in relative prices. This will not be the case if there are cross-country differences in sectoral productivity as well (actual, not measured productivity as in Hsieh and Klenow (2007b)). We will return to this issue in Section 5.1. Another potential difficulty would arise if the capital shares in the consumption and the investment sectors were significantly different. However, neither Chari, Kehoe, and McGrattan (1997) nor Hsieh and Klenow (2007b) find this to be the case.

where $(P_I/P_C)_i$ is country i's relative price divided by the world's value, from the Penn World Tables. Dividing it by $(P_I/P_C)_1$, where $i = 1$ denotes a benchmark country, eliminates the effect of world prices. As benchmark, we choose the country with the lowest relative price and we assume it enjoys perfect investor protection ($\xi_1 = 0$). Then, the above condition allows one to recover ξ_i from a country's relative price of investment.

Castro, Clementi, and MacDonald (2009) focus on the 1996 Penn World Table, in which case Singapore is the country with the lowest relative investment price. No matter the year, however, Singapore's relative price is always among the very lowest reported by the Penn World Tables. This motivates us to stick to it as the benchmark country. Between 1978 and 1985, i.e. before joining the EU, Portugal's average relative price of investment was 1.84 times that of Singapore. This implies $\xi = 0.9402$.

There are three parameters left to be calibrated, β, r^*, and φ. We follow Castro, Clementi, and MacDonald (2009) and select them jointly so that the model, with a ξ for each country computed as described above, closely matches the following three moments: (i) a cross-country average PPP-investment rate of 0.146 (the 1996 figure in the Penn World Table), (ii) an average interest rate of 4 percent among the top 5 percent richest countries (a figure commonly used in the business cycle literature), and (iii) a 4.2 percent interquartile range for the world interest rate (the figure recovered from Lustig and Verdelhan's (2007) data for the 1990's).

Adapting the basic calibration methodology of Castro, Clementi, and MacDonald (2009) means that the model is not tightly calibrated to Portuguese data. For this reason, we will emphasize mostly its qualitative implications.

5 Policy Experiments

We conduct four policy experiments: (i) an improvement in investor protection and increases in (ii) international capital mobility, (iii) aggregate (i.e. sector-neutral) TFP, and (iv) investment-specific TFP.

These experiments are meant to capture some of the main policy changes that Portugal faced during the post-1986 period. The first two, (i) and (ii), are easily associated with concrete reforms, and are the main focus of our analysis. This is not the case for experiments (iii) and (iv). Some reforms may, however, map into TFP changes. To the extent that they do, these two experiments will be useful as a guide for future research. Their success in explaining the data will determine whether there is any merit in identifying and studying such reforms.

We consider each policy experiment in isolation. Since different experiments turn out to very have different qualitative implications, this strategy will be informative about which among them is the most likely to have generated the data, both micro and macro.

We assume that the Portuguese economy was in steady-state until 1985. We will then assume that agents faced an unexpected, once-and-for-all policy change in 1986. Needless to say, it is neither true that all policy changes occurred in 1986 (some took place afterwards, some even before), nor that they came as a surprise. It is also not true that the Portuguese economy was in steady-state before 1986. These extreme assumptions, however, appear to be a good starting point.

5.1 Improvement in Investor Protection

Consider the effects of a permanent reduction in ξ. We compute the post-1986 level of ξ as in Section 4.2, matching the 2000-2003 average relative price of investment in Portugal over that of Singapore.[15] This yields $\xi' = 0.8018$. The remaining policy parameters are

[15] Unfortunately the Penn World Table does not report the price levels for Singapore in 2004.

held constant at their pre-1986 levels.

Bad investor protection is particularly harmful to firms operating in very risky sectors, namely those producing investment goods. In equilibrium, the relative price of investment must increase in order to encourage both entrepreneurs and capitalists to actually invest in those sectors. It follows that the sharp drop in the relative price of investment in Portugal since 1986 (Figure 3) provides indirect support for an improvement in investor protection.[16]

Figure 10 shows the paths for different variables starting from the initial steady-state (year 1966). All variables are normalized by their initial values, except for ξ_t, Q_t and r_t. The policy change occurs in 1986, with some adjustment taking place right then. The economy subsequently converges to the new steady-state. Figure 10 reveals that convergence is very fast: after 2006, i.e. after only a couple of model periods, there is hardly any adjustment left. The economy is essentially on the new balanced-growth path.

The improvement in investor protection removes distortions in the allocation of capital, no matter the sector. Private returns to capital increase, and so does the real interest rate. However, the allocation of capital improves relatively more in the investment good sector. Q_t becomes close to 1, which signals that the allocation of capital is now close to first-best.

The large reduction in distortions in the investment good sector encourages entrepreneurs to opt for that sector. N_t increases. The share of investment in total expenditure also rises, in spite of the drop in the relative price. The larger investment expenditure is financed in part by an inflow of foreign capital, attracted by the higher domestic return. This is why the trade balance drops relative to output.[17]

Let's now compare the implications just described with the evidence. In the data, we split the whole 1978-2005 sample period into three subperiods: (I) 1978-1985, (II) 1986-1999, and (III) 2000-2005. (I) is the pre-reform stage, (II) is when most reforms occurred, and (III) is the post-reform subperiod. The task of identifying analogous subperiods in the model is somewhat complicated by the fact that a model period is 20 years-long. To go around this issue, we assume that all variables remain constant within a model period. This allows us to obtain yearly observations from the model. Then, both in the actual data and artificial data, we focus on the average value for every variable in each subperiod.

Figure 11 plots six key variables. For each, the solid line represents the yearly data discussed in Section 2.1. The squares and the circles are associated with the subperiod averages in the data and in the model, respectively. The "real" investment rate and the "real" trade balance over GDP were computed by holding the relative price of investment constant at its initial level.[18]

Overall, the model performs quite well, at least qualitatively. Although the improvement in investor protection was not calibrated to match the post-1986 growth in Portugal's output per worker, the model matches the data reasonably well. It also replicates quite well the decline in the relative price of investment (by virtue of the calibration), the in-

[16] As pointed out in Section 4, identifying a change in ξ with a change in Portugal's relative price of investment relative to Singapore's may be problematic. If, at the same time, Portugal had become relatively more efficient at producing investment goods compared to Singapore, then the change in relative prices would also contain information about the higher relative productivity. The experiment considered in Section 5.4 illustrates this problem: changes in investment-specific productivity map into relative prices in a way qualitatively similar to investor protection. Since independent measures of either sectoral productivity or investor protection are very hard to come by, this appears to be a rather high hurdle to overcome. Considering overidentifying restrictions may provide a way around it. We are suggesting to inquire whether differences in relative productivity and in investor protection have different implications for the dispersion of other endogenous variables. This paper adopts this alternative strategy.

[17] Although this is not apparent from Figure 10, the improvement in investor protection has a permanent effect on the trade balance over GDP, which goes from a small positive number to a small negative number. In the new steady-state, Portugal is a net importer of capital.

[18] Instead of replicating the chain-weighted measurement procedure used in the data, the model's generated series are evaluated at constant prices.

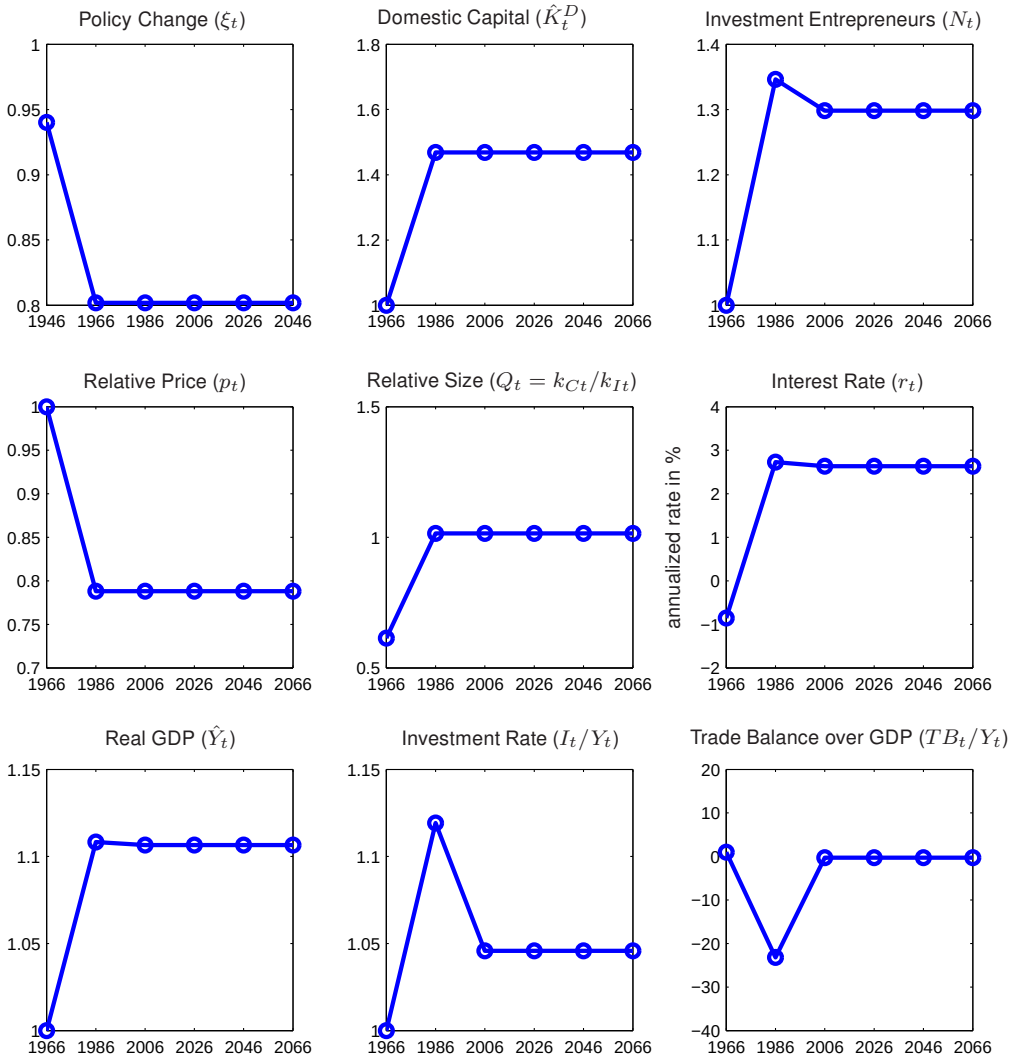

Figure 10: **IMPROVEMENT IN INVESTOR PROTECTION**

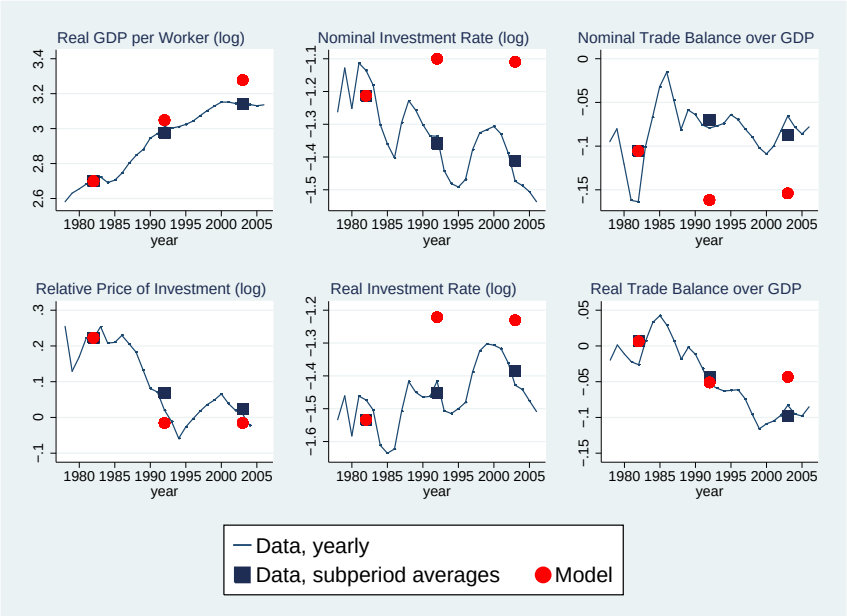

Figure 11: **IMPROVEMENT IN INVESTOR PROTECTION**

crease in the real investment rate, and the decline in the real trade balance over GDP. Finally, it produces a decline in the nominal trade balance over GDP throughout the whole sample period.[19]

The main inconsistency is that the nominal investment rate has declined, whereas the model predicts a slight increase. We should point out, however, that an increase in the nominal investment rate is not a robust implication of an improvement in investor protection. Castro, Clementi, and MacDonald (2009) show that the nominal investment rate can indeed remain flat or even decline with an improvement in investor protection (see their Figure 7). For a higher φ (i.e., if the Portuguese economy were initially less open to international capital flows than our calibration presumes), the model may actually produce a decline in the nominal investment rate, matching the post-1986 evidence for Portugal. When the economy is relatively more closed, an improvement in investor protection generates a larger interest rate increase. This may lead to a decline in saving (and investment), as income is redistributed away from entrepreneurs - the agents responsible for all saving in the model. See Castro, Clementi, and MacDonald (2004, 2009) for a more detailed discussion.

By considering the dispersion in firm-size, Figure 12 turns to the micro-level evidence. The data is that on the dispersion of unconditional firm size illustrated by the dotted line in Figure 5. Consistently with the data, the model produces a decline in size dispersion. The magnitude of such decline, however, is much too high.

5.2 Increased Openness to International Capital Flows

Figure 13 documents the dynamic response of the economy to a permanent 5 percent drop in φ. This experiment is meant to capture the liberalization of intra-EU capital flows, one of the pillars of the Single European Market implemented in 1993.

[19] We are not attributing much significance to the very low value of the nominal trade balance over GDP in the first subperiod. As previously pointed out, this owes much to only a few very negative values coinciding with the recession of the early 1980s.

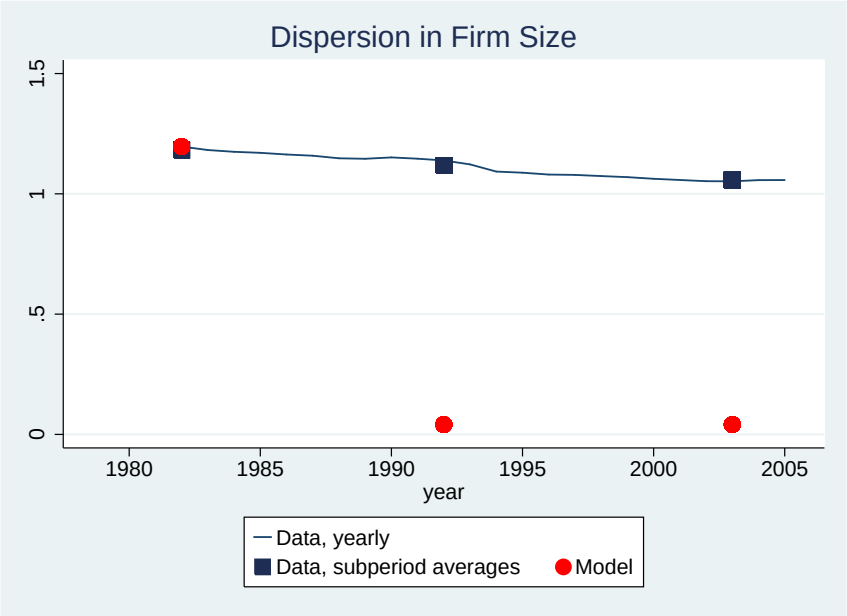

Figure 12: **FIRM SIZE DISPERSION, IMPROVEMENT IN INVESTOR PROTECTION**

The new value for φ ($\varphi' = 20.7768$) was chosen arbitrarily. Ideally, we would like to pick it to match the post-1986 evolution of output. This is not possible, as a drop in φ generates a fall in output relative to trend.

Partially eliminating the obstacles to international capital flows leads to a drop in the investment rate and to a decline in domestic capital and output relative to trend. This happens because Portugal protected outside investors rather poorly before 1986, particularly compared to the rest of Europe. Opening up to international capital flows while keeping investor protection at its original level, gives incentives to Portuguese residents to invest their funds abroad. The nominal investment rate drops, and the trade balance increases relative to output. Capital flees the country.

Being cheaper for Portuguese to invest abroad, as less investment goods are lost in the process, less resources end up being allocated to the domestic production of investment goods (N_t declines slightly). Since this is the most distorted sector, allocating resources away from it raises the aggregate return on capital (r_t increases slightly).

Finally, since a reduction in barriers to international capital mobility affects neither relative productivity nor financing distortions, it has no effect either on the relative investment price or on relative firm size.

For a comparison of these implications and those of the remaining experiments with the evidence, we refer the reader to Section 5.5.

5.3 Increase in Aggregate TFP

Figure 14 displays the dynamic response of the economy to a permanent increase in both μ_I and μ_C, resulting in a 1 percent hike in aggregate (in the sense of sector-neutral) TFP ($\bar{z}'_I = \bar{z}'_C = 1.01$). This experiment is meant to capture improvements in the access of Portuguese firms to state-of-the-art production technologies, better management, or better access to distribution points, for example because of better public infrastructure such as roads. These improvements are assumed not to discriminate between investment and consumption good firms. The new parameter values were selected to loosely match the post-1986 evolution of output per worker.

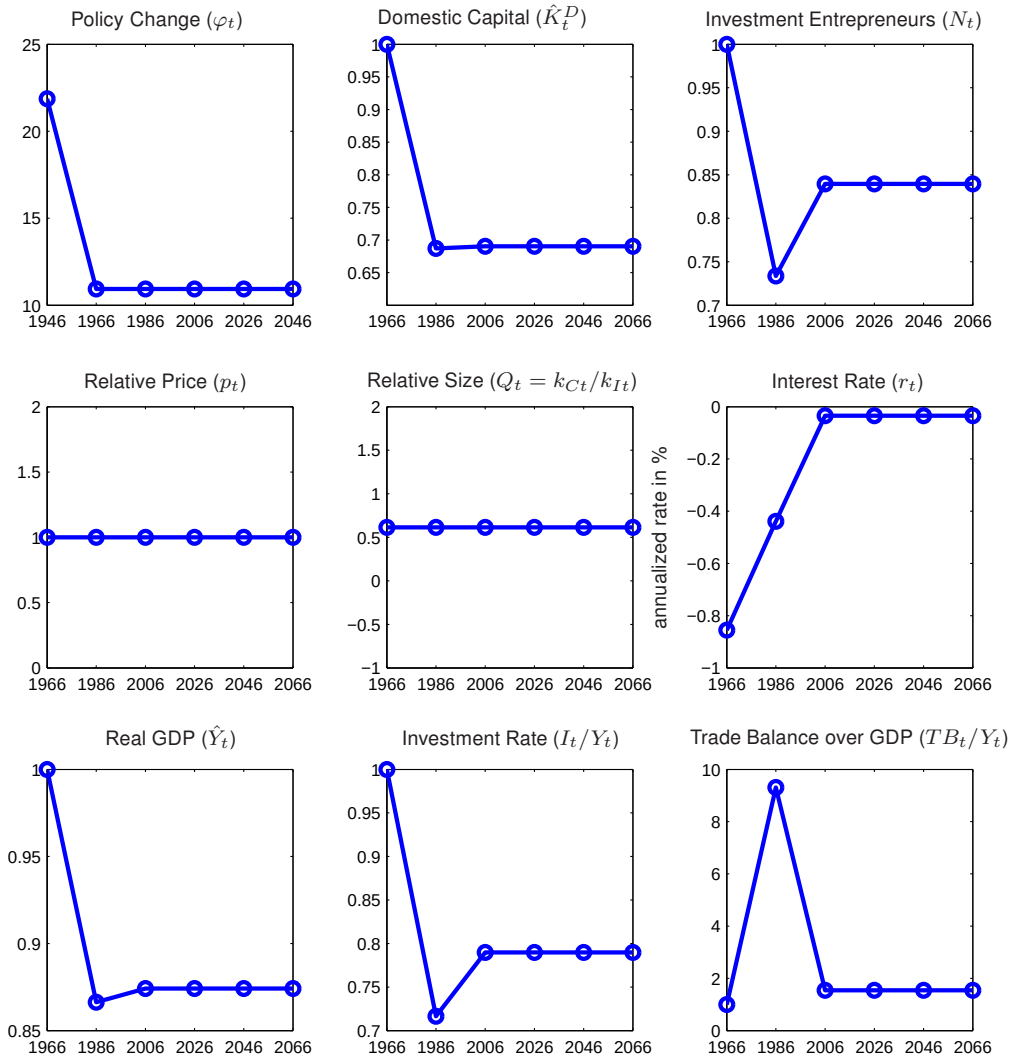

Figure 13: **INCREASED OPENNESS TO INTERNATIONAL CAPITAL FLOWS**

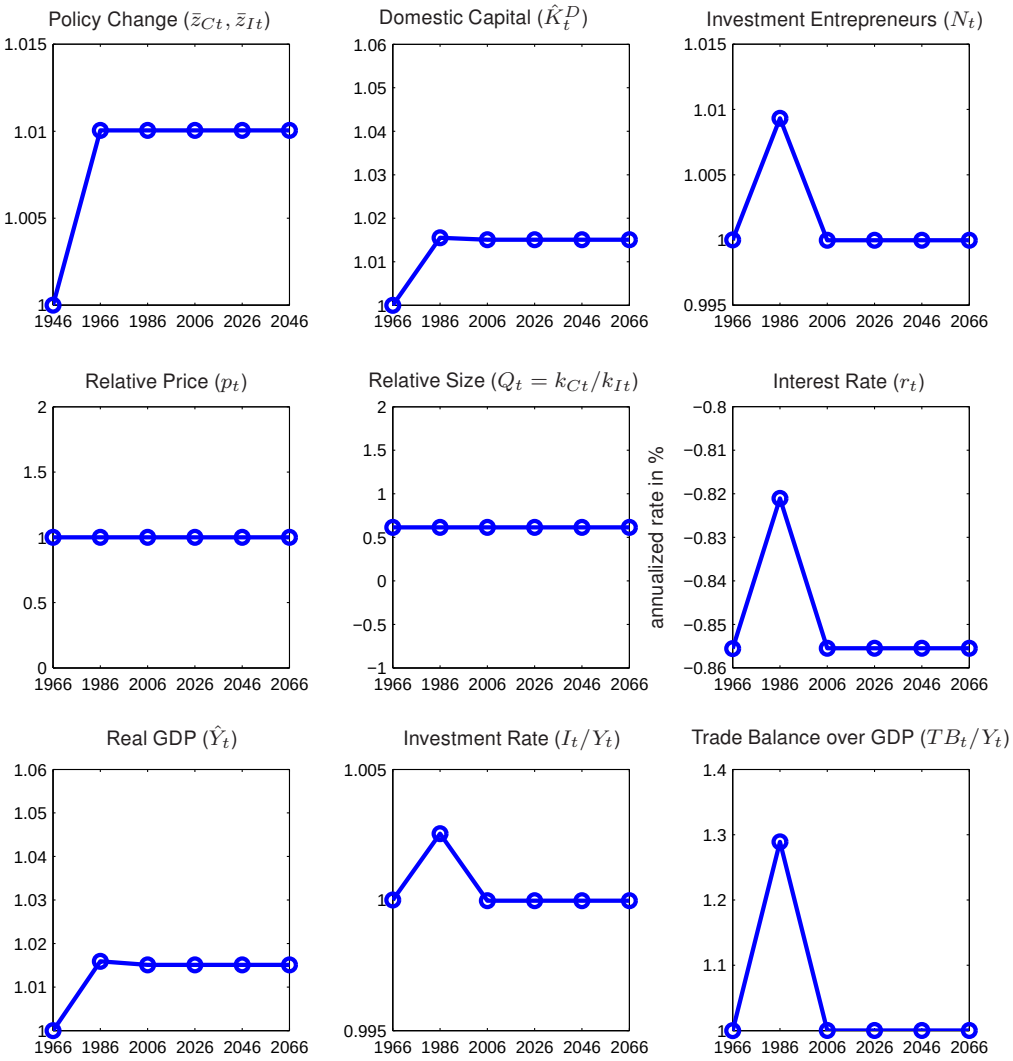

Figure 14: **INCREASE IN AGGREGATE TFP**

The real interest rate increases, reflecting the higher aggregate productivity for given capital. In turn, this encourages capital accumulation. As capital grows and reaches its new steady-state level, the interest rate returns to its initial value. The same holds for the investment rate, just like in the standard neoclassical growth model.

In a setup with no cross-country heterogeneity in institutions, a higher domestic return would also lead to a capital inflow. This is not the case here. The trade balance over GDP actually increases. This is because the protection afforded by investors in Portugal is still weaker than in other European countries, which implies that the return on capital is still low compared to the rest of Europe. As a result, Portuguese residents are led to invest their extra savings abroad.

Since this policy change does not have any impact on distortions, the dispersion in firm size is unaffected.

5.4 Increase in Investment-Specific TFP

Figure 15 documents the response to an increase in μ_I, leading to a 5 percent permanent rise in $\bar{z}_I$ ($\bar{z}_I' = 1.05$). This experiment is meant to capture the same kind of improvements discussed in the previous section, under the condition that they are biased towards investment good firms. Once again, the new parameter value was chosen to roughly match the post-1986 evolution of output per worker.

The only qualitative difference between an increase in aggregate TFP and an increase in investment-specific TFP is that the latter generates a drop in the relative price of investment. The relative price drops to encourage agents to invest in the consumption good sector, in spite of a relatively lower productivity.

5.5 Comparing the policy experiments

Figure 16 compares the effects of all four policy changes with the evidence. Recall that, due to our calibration, the increases in both the sector-neutral and investment-specific TFP are set to roughly match the post-1986 evolution of output per worker. The improvement in investor protection is not constructed in such a way. In spite of this, it is also able to match the post-1986 growth of output per worker fairly well.[20] The reduction in barriers to capital mobility, instead, predicts a counterfactual drop in output relative to trend.

The only policy change qualitatively consistent with the drop in the nominal investment rate is the increase in capital mobility, although the effect is small. All other reforms predict an increase in this variable. However, recall from the discussion in Section 5.1 that the nominal investment rate may decline following an improvement in investor protection, depending on the model's parameterization.

As pointed out above, in the data the nominal trade balance over GDP drops significantly in the early 1980s. Assessing which policies are consistent with the post-1986 behavior of this variable depends critically on the weight one attaches to this initial observation. Our preference is for attaching a low weight. In such scenario, the data suggests that the reforms are followed by a slight downward trend in the nominal trade balance over GDP. Only the improvement in investor protection is consistent with such a sustained decline. If instead one attaches a large weight to the initial observation, then the data suggests an increase in the nominal trade balance over GDP, followed by a decline. In this case, every policy change but the improvement in investor protection is consistent with the data.

[20] None of the policy experiments is consistent with the post-2000 slowdown in output per worker. Not even the increase in international capital mobility, which generates a decline in output per worker (relative to trend) that begins in 1986 and persists until 2000.

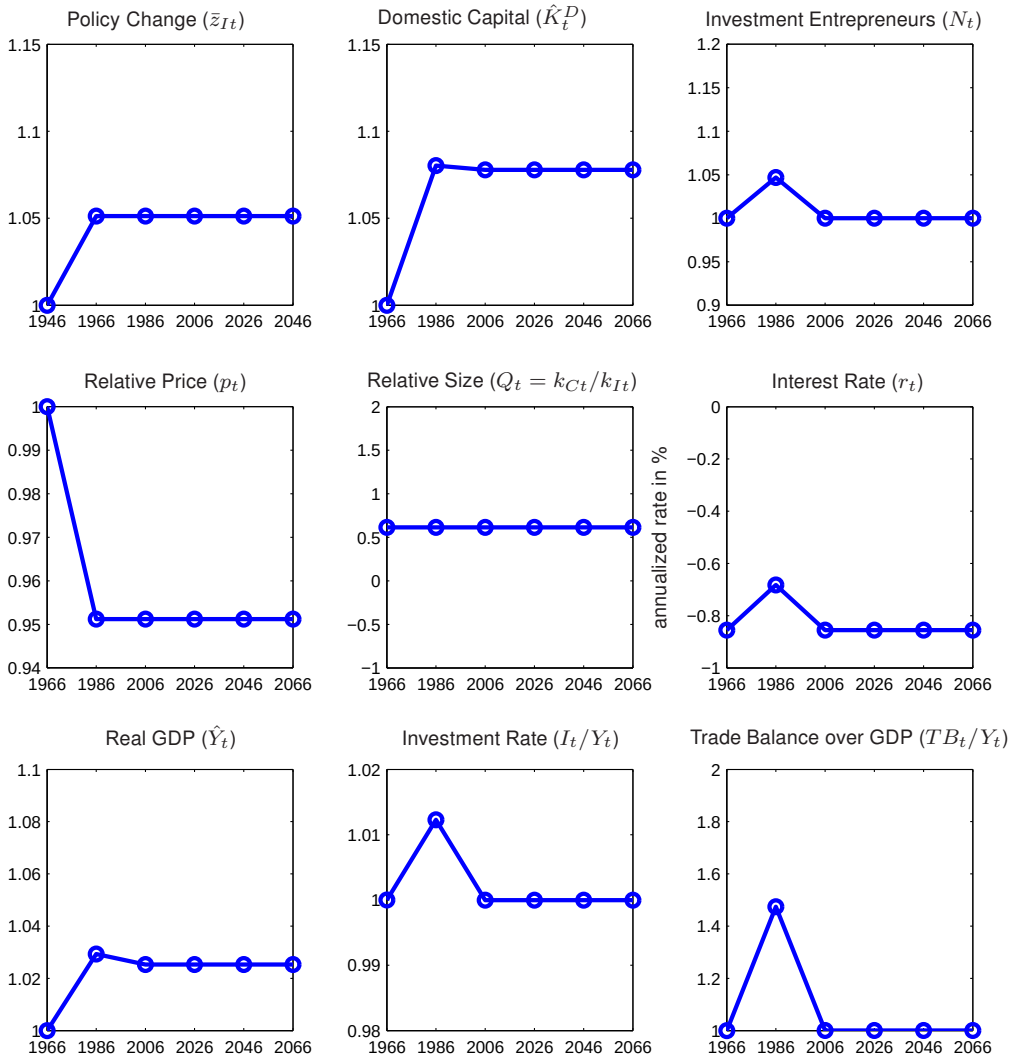

Figure 15: **INCREASE IN INVESTMENT-SPECIFIC TFP**

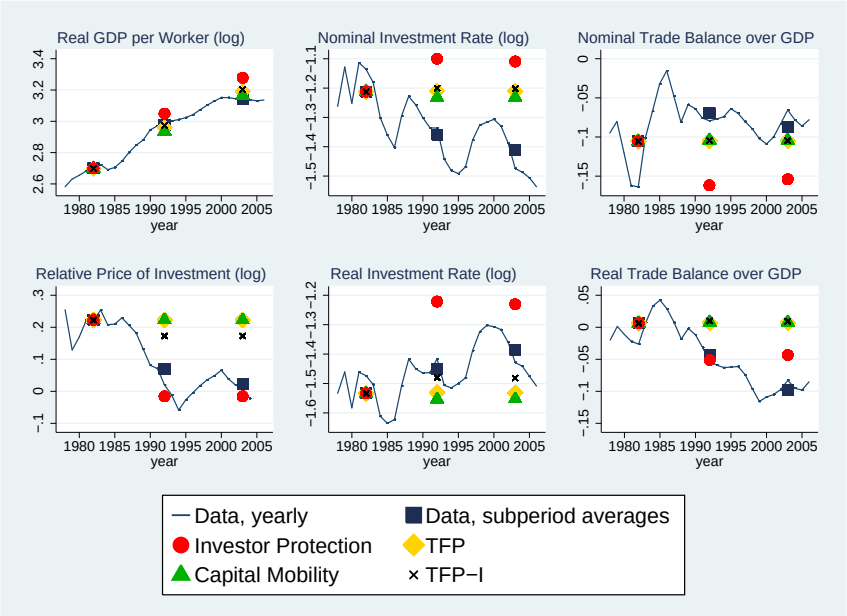

Figure 16: **POLICY COMPARISON**

Both the improvement in investor protection and the increase in investment-specific TFP can generate a drop in the relative price of investment. None of the other policies can.

We now turn to the implications for real investment rate and real trade balance over GDP. In the model, observations for these variables were obtained by holding the relative price of investment constant at its initial level. The dynamics of real variables differs from that of the nominal ones only for the improvement in investor protection and the increase in investment-specific TFP. The data shows a significant and sustained increase in real investment rate and a significant and sustained decline in the real trade balance over GDP. Only the improvement in investor protection is consistent with this dynamics. The rise in investment-specific TFP also predicts an increase in the real investment rate, but together with a slight increase in the real trade balance over GDP.

Figure 17 considers the implications for the dispersion in firm size. Both the improvement in investor protection and the increase in capital mobility have positive effects on resource allocation. The improvement in investor protection enhances the efficiency of resource allocation mostly because relative firm size approaches first-best (i.e. Q_t becomes close to 1). In the case of greater capital mobility, however, the result is due to selection. Relative size is unaffected (Q_t stays well below 1). However, this policy reallocates resources away from the investment sector and into the consumption sector, which is relatively less distorted. It is this change in sectoral composition that is responsible for the slight drop in size dispersion that follows a rise in capital mobility.

The improvement in TFP, either aggregate or investment-specific, generates a slightly higher dispersion in firm size. Since neither of these two policies affect relative firm size, the result is also due to a change in sectoral composition.

Taken together, these observations suggest that the improvement in investor protection is a prime candidate for rationalizing a wide set of post-1986 macro- and micro-level observations for the Portuguese economy. This reform is able to account for the higher output growth, for the sustained increase in both real investment and foreign capital inflows, and for the improvement in micro-level resource allocation. The main inconsistency

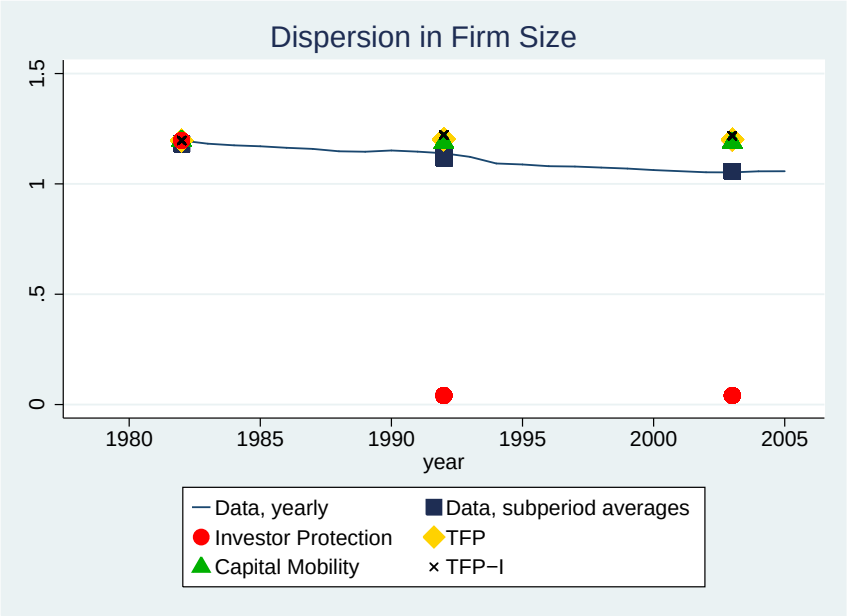

Figure 17: **POLICY COMPARISON - FIRM SIZE DISPERSION**

is, possibly, in the behavior of the nominal investment rate.[21]

5.6 Additional Policy Changes: A Discussion

What about other policy changes that we abstracted from? Several potentially important reforms, listed in Section 2.3, come to mind: (i) the increase in intra-EU labor mobility, (ii) the liberalization of intra-EU trade in goods and services, (iii) deregulation and privatization, and (iv) the achievement of exchange rate stability followed by the adoption of the Euro.

Labor Mobility The dismantling of barriers to intra-EU labor mobility, it seems fair to say, hasn't had a large impact on the Portuguese economy. Population outflows from Portugal, including migration to other European countries, were much larger prior to joining the EU. Indeed, lower outflows were a major contributor to the steady increase in net migration into Portugal throughout the 1980s, which actually became positive around 1993 (Table II.10 of Instituto Nacional de Estatística (2007)). Furthermore, although population inflows increased sharply in the 1990's, Fonseca, Caldeira, and Esteves (2002) and Instituto Nacional de Estatística (2007) document a decline in the share of EU nationals. The larger inflows are mostly accounted for by Africans, Eastern-Europeans, and Brazilians. It appears that migration flows in and out of Portugal reacted little to policies aimed at increasing intra-EU labor mobility. This is in fact a broader European feature, documented in Krueger (2000).

Liberalizing Trade in Goods and Services The liberalization of trade in goods and services appears to have had a larger impact. A few facts illustrate the point. Portugal's trade share of output increased significantly since 1986 (Amador, Cabral, and Maria

[21] What about combining an improvement in investor protection with lower barriers to international capital mobility? It turns out that lower barriers to capital mobility act by magnifying the response of the economy to better investor protection, with all the qualitative effects of the latter policy change preserved.

(2007)), and along with it its intra-EU trade share (Lima (2000)).Interestingly, most of this increase was of the intra-industry type (Amador, Cabral, and Maria (2007)).

A recent resurgence in trade theory, which started with Melitz (2003) and Bernard, Eaton, Jensen, and Kortum (2003), emphasizes the intra-industry resource allocation effects of trade. These papers show how trade may lead the most productive firms in a narrowly-defined industry to grow in size and eventually export, while the least productive firms either remain confined to the domestic market, or exit. While the cross-firm size distribution could either increase or decrease (since large firms grow larger and small firms shrink further, the net effect will depend on the relative mass of small versus large firms), the dispersion in firm-level productivity would certainly decrease (only relatively less productive firms exit). By improving the micro-level allocation of resources, trade may thus lead to a greater aggregate productivity.

Figures 7-9 are indeed consistent with a decline in the dispersion of firm-level productivity, conditional on industry. It then seems plausible that trade liberalization might also account for the micro-, and at least some of the macro-level post-1986 observations we have discussed in this paper. Introducing the features necessary to account for such type of effects in the current framework (e.g. introducing within-industry productivity dispersion) is both challenging and outside of the scope of this paper. It is, however, a fascinating topic for further research.

One way to empirically sort out the effects of improving investor protection from those of trade liberalization is to check whether the two reforms primarily affect different sectors. In the case of enhancements in investor protection, Castro, Clementi, and MacDonald (2009) show that most of the micro-level effects should stem from the reallocation between high and low- risk sectors. Along similar lines, Erosa and Hidalgo-Cabrillana (2008) emphasize that these effects should arise from the reallocation between high- and low-fixed cost sectors.

Consider now trade liberalization. Melitz (2003) and Bernard, Eaton, Jensen, and Kortum (2003) predict that most of the improvement in resource allocation should occur in sectors with high “tradability." Betts and Kehoe (2001) propose a definition of a good’s tradability in terms of (i) how substitutable it is to similar goods produced in different countries, and (ii) its trading costs. They argue, however, that tradability is well-proxied by observed trade volumes.

It follows that, in principle, one could verify whether most of the improvement in Portugal’s micro-level resource allocation occurred within high-tradability sectors, or across high and low risk/fixed-cost sectors. While a comprehensive analysis of this issue is beyond the scope of this paper, consider the main export-oriented manufacturing sectors identified by Amador, Cabral, and Maria (2007). These are Textiles, leather, and footwear (2-digit CAE 17 and 19), Food products, beverages and tobacco (2-digit CAE 15 and 16), Wood, paper, and printed products (2-digit CAE 20 and 21), and finally Motor vehicles and trailers (2-digit CAE 34). At first glance, the evidence is somewhat mixed. For example, productivity dispersion seems to have declined in Textiles, leather, and footwear, still the largest exporting sector in 2003. However, it was essentially flat in Motor vehicles and trailers, a sector whose weight in total exports grew significantly since 1986, becoming a close second in 2003.

Exchange Rate Stability and Adoption of the Euro We think of the whole process leading up to the adoption of the common currency in 1999. This includes joining the Exchange Rate Mechanism in 1992.

According to the common currency literature, two were the main benefits to Portugal from the stabilization of the exchange rate vis-a-vis other European countries and the adoption of the Euro. One consisted in the reduction in international transaction costs. Coupled with the elimination of exchange rate uncertainty, this likely promoted trade be-

tween Portugal and the other countries in the Euro zone. In fact, Frankel and Rose (2002) do find evidence that the establishment of common currency areas can produce this sort of effects. The consequences, however, are the same ones discussed previously for intra-EU trade liberalization (i.e. the elimination of other types of barrier).

The second benefit is lower inflation. We find hard to believe, however, that lower inflation may account for the evidence of Section 2. For one thing, researchers have had a hard time establishing a causal effect from inflation to long-run growth, even though countries with lower inflation do tend to grow faster (see Kocherlakota (1996)). It also appears that the performance of the Portuguese economy started deteriorating around 2000, as the establishment of the Euro zone was finalized, and with inflation already at a very low level.

Deregulation and privatization After joining the EU, the Portuguese economy went through a big wave of market deregulation and privatization. Whole sectors, like the financial sector, have been privatized. Barriers to entry were lowered and regulations were eliminated. [22] Can increased competition due to lower regulation explain the facts of Section A?

We start by recalling that our sample of firms excludes both firms that were mostly state-owned at some point in the sample, and firms in the most heavily regulated sectors. Still, it could be that higher competition in these sectors had beneficial effects on others. A further issue is that the aggregate data of Section 2.1 obviously includes all firms.

In principle, deregulation-induced competition would have had the same effect on resource allocation as trade-induced competition. Both could potentially account for the facts of Section 2.2. The considerations we made when considering the merit of trade liberalization apply here as well.

6 Conclusion

Around 1986, the year in which Portugal joined the EU, growth in GDP per worker gained substantial momentum, which lasted until the beginning of this century. In spite of a decline in the nominal investment rate, the same period has witnessed an increase in real capital expenditures as fraction of real output. This was possible thanks to a drop in the price of investment goods relative to consumption. Net capital inflows have also increased faster than real output. Finally, there is evidence of significant efficiency gains in the allocation of resources across firms.

This paper argues that the improvement in the protection of outside investors that took place in Portugal since joining the EU is a prime candidate to rationalize the evidence we have just summarized. According to the model first studied by Castro, Clementi, and MacDonald (2009), better investor protection improves the resource allocation by allowing firms to operate at a more efficient scale. This efficiency gain is particularly relevant in sectors where firm-level idiosyncratic risk is higher, such as those producing investment goods. It follows that the internal rate of return increases, attracting foreign capital, investment goods become less expensive compared to consumption goods, and investment rises as a fraction of output, particularly when measured at constant prices.

It is not uncommon to hear analysts of the Portuguese economy identify broad policy changes that may or may have not affected outcomes. This paper contributes to the policy debate by narrowly defining a set of reforms and by studying their implications in a rigorously micro-founded and internally consistent general equilibrium model.

[22] In spite of these improvements, Portugal is still characterized by tighter regulation than similarly developed countries, particularly regarding the time it takes for an entrepreneur to obtain legal status. See Cabral (2007).

Our discussion has identified alternative reforms, such as trade liberalization and market deregulation, that may be able to account for at least some of the evidence. It would be valuable to amend the model to make it amenable to the study of such policies.

Our main conclusion is that the spotlight should be on policies, such as those affecting investor protection and market competition, that impact the economy by inducing a series of micro-level efficiency gains that ultimately may lead to significant changes in macroeconomic outcomes.

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A Data

All macro-level data used in this paper was obtained from the Bank of Portugal's *Boletim Económico*, and spans the 1978-2006 period. The data on the relative price of investment is from Heston, Summers, and Aten's (2006) version 6.2 of the Penn World Tables, and it only spans the 1978-2004 period.

The micro-level data set is the *Quadros do Pessoal*, an annual survey conducted by the Portuguese Ministry of Employment which is mandatory for all Portuguese firms. We focus on the maximum available period length of data collection, 1982-2005, except for

2001 because no data is available for this year.[23] The *Quadros do Pessoal* contains a wealth of information on Portuguese firms (and workers). In this paper we focus on nominal sales, number of employees, and 2 and 3-digit sector of activity.

A.1 Sales

Ideally one would like to have information on value-added per firm. Unfortunately, *Quadros do Pessoal* does not have data on the cost of intermediate inputs. To circumvent this problem, we'll make some assumptions and we'll use some economic theory. Suppose firm i in sector j at time t produces according to

$$y_{ijt} = z_{ijt} k_{ijt}^{\alpha_j} x_{ijt}^{\gamma_j} \ell_{ijt}^{1-\alpha_j-\gamma_j},$$

where y_{ijt} is gross output (total sales), z_{ijt} is total factor productivity, k_{ijt} is capital services, ℓ_{ijt} are labor services, and x_{ijt} are the intermediate inputs. The parameters $\alpha_j, \gamma_j \in (0,1)$, the shares of capital and intermediate goods in production, are potentially sector-specific. Value-added (net output) is given by

$$va_{ijt} = p_{ijt}^y y_{ijt} - p_t^x x_{ijt},$$

where p_{ijt}^y is the price of firm i's output and p_t^x is the price of the intermediate input. If the market for intermediate goods is perfectly competitive, then

$$p_{ijt}^y \gamma_j \frac{y_{ijt}}{x_{ijt}} = p_t^x.$$

Replacing in the definition of value-added

$$va_{ijt} = (1-\gamma_j)\, p_{ijt}^y y_{ijt}.$$

In other words, value-added is proportional to nominal sales, and the constant of proportionality is sector-specific. Up to this constant, one can measure (real) value added by (real) sales. In most scenarios considered in this paper, this turns out to be very convenient - for sufficiently low levels of sectoral disaggregation, the results do not hinge upon knowing γ_j. Due to the absence of comprehensive data on firm or even sectoral level price deflators, nominal sales were deflated by the GDP deflator.

One issue in *Quadros do Pessoal*, relevant for computing labor productivity, is that sales and the number of employees measure in a given year do not refer to the same time period. For the following discussion, it's important to distinguish between the *data collection year* (the year attached to the variables in *Quadros do Pessoal*), and the *observation year* (the year the variable corresponds to). In any given data collection year, *Quadros do Pessoal* gathers information in the month of October. The information collected on nominal sales is always for the whole previous year. The observation year for sales is thus the year before the data collection year. Until 1993, the number of employees is for the month of March of that data collection year. However, since 1994, the number of employees is for the month of October of that data collection year - implying a one-year observation lag between sales and the number of employees since 1994. We'll assume that, until 1993, the information on the number of employees is coincidental with the information on sales. In this case, the observation year for both variables is the one before the data collection. After 1994, we need to lag the number of employees one year, so that sales collected in a given year coincides with the number of employees collected

[23] We note that until the mid to late 1980s, the survey was not mandatory for firms with less than 10 workers. This does not appear to introduce significant censoring, since one cannot detect a significant discreet increase in the number of firms with less than 10 workers at any year starting in 1992.

the year before. In this case, after 1994, sales and lagged employees refer both to the observation year prior to the data collection year. This procedure implies a missing observation for employees in the observation year 1993. we compute the number of employees in this year as the average between the number of employees in March 1993 (collected in 1993) and the number of employees in October 1994 (collected in 1994). It follows that there is no missing observation, due to this procedure, for the number of employees from observation year 1981 until 2005.

A.2 Sectoral Codes

The sectoral codes are CAE codes (Portuguese Classification of Economic Activities), Revision 2 (REV2). The challenge is to obtain codes that are consistent through time. The codes were revised twice since 1982, in 1995 and again in 2003. The 2003 change (from REV2 to REV2.1) is minimal, and affects only a couple of 3-digit codes (516 and 519, which can be easily recoded back to their REV2 values). The 1995 change (from REV1 to REV2) is more comprehensive, and sometimes there is not a one-to-one mapping between REV1 and REV2 codes at the 3-digit level, and more often at the 2-digit level. Another issue is that there is a non-negligible fraction of firms that change sectoral code for reasons unrelated to the official revision. We assigned REV2 codes to REV1 codes using the following rule. From 1994 to 1995, we assumed that every code change was due to the official revision. For each REV1 code in 1994, we computed the modal REV2 code, to which the largest number of firms switched in 1995. We attributed this code to firms that exited the sample before 1994.

A.3 Sample Selection

We eliminated observations with missing number of employees. We also eliminated firms with a share of public capital larger than 50 percent at any point in the sample. Finally, we eliminated firms in sectors that either tend to be highly-regulated, or are not primarily engaged in market activities: utilities (2-digit codes 40 and 41), public mail (3-digit sector 641), financial (2-digit codes 65, 66 and 67), public administration (2-digit code 75), education (2-digit code 80), health (2-digit code 85), public cleaning (2-digit code 90), individual's associations (2-digit code 90), and international organizations (2-digit code 99). We also eliminated firms with sector code 000000.

Table 3 contains the subset of sector codes that are used in this study, after applying the sample selection criteria.

B Transitional Dynamics

We consider the economy with exogenous TFP growth, as described in Section 4.1. For any variable x_t, let its detrended value be $\widehat{x}_t = \gamma^{-\frac{1}{1-\alpha}t} x_t$.

The price level p and the relative size Q are constant in a balanced-growth path. Also, detrended transfers depend on the time-invariant $g_j(z)$ functions. Since these objects are time-invariant, they may be computed independently from initial conditions. Given an initial level of capital supply $\hat{K}_0^S$, the economy's transition path is then fully characterized

A		**Agriculture, animal production, hunting and forestry**
	01	Agriculture, animal production, hunting, and related activities
	02	Forestry and related activities
B		**Fishing**
	05	Fishing, aquaculture and related activities
C		**Mining**
	13	Metal Ore Mining
	14	Other Mining
D		**Manufacturing**
	15	Food and beverage manufacturing
	16	Tobacco manufacturing
	17	Textile manufacturing
	18	Apparel manufacturing
	19	Leather and allied product manufacturing; Luggage manufacturing; Personal Leather Good Manufacturing; Footwear manufacturing
	20	Wood and cork product manufacturing; Basketry
	21	Pulp, paper and paperboard manufacturing
	22	Editing, printing and reproduction of pre-recorded information-supporting material
	24	Chemical manufacturing
	25	Rubber and plastic product manufacturing
	26	Other non-mineral product manufacturing
	27	Primary metal manufacturing
	28	Metal product manufacturing, except machinery and equipment
	29	Machinery and equipment manufacturing
	31	Electrical equipment and machinery manufacturing
	32	Radio, television, and communications equipment and appliance manufacturing
	33	Surgical and orthopedic instrument manufacturing; Watch, Optics, and precision instrument manufacturing
	34	Motor vehicle manufacturing; trailer and semi-trailer manufacturing
	35	Other transportation equipment manufacturing
	36	Furniture manufacturing; Other manufacturing
	37	Recycling
F		**Construction**
	45	Construction
G		**Wholesale and retail trade; Automotive and personal and household goods repair and maintenance**
	50	Motor vehicle dealers; Motor vehicle repair and maintenance; Motor vehicle fuel retail
	51	Wholesale trade (except motor vehicles)
	52	Retail trade (except motor vehicles, fuel, and maintenance and repair of personal and household goods)
H		**Accommodation and food services (restaurants and similar establishments)**
	55	Accommodation and food services (restaurants and similar establishments)
I		**Transportation, warehousing and communications**
	60	Terrestrial transportation; Pipeline transportation of oil and gas
	61	Water transportation
	62	Air transportation
	63	Support activities for transportation; Travel and tourism agencies, other support activities for tourism
	64	Mail services and telecommunications
K		**Real estate, rentals and leasing, and professional and technical services**
	70	Real estate
	71	Machinery and equipment rentals and leasing; Rentals and leasing of personal and household goods
	72	Computer related services
	73	Research and development
	74	Other activities and services supplied to firms
O		**Other activities related to collective, social, and personal services**
	92	Recreational, cultural and sports activities
	93	Other activities and services

Table 3: **TWO-DIGIT SECTOR CODES (CAE, REV. 2)**

by sequences $\{\hat{K}^S_{t+1}\}^{\infty}_{t=0}$, $\{\hat{K}^D_t\}^{\infty}_{t=0}$, $\{\hat{k}_{It}\}^{\infty}_{t=0}$, $\{N_t\}^{\infty}_{t=0}$, $\{r_t\}^{\infty}_{t=0}$ which solve:

$$\begin{aligned}
p\hat{K}^S_{t+1}\gamma^{\frac{1}{1-\alpha}} &= \kappa(r_{t+1})\hat{k}^{\alpha}_{It}\left[pN_t\mathrm{E}\left(g_I(z)\right)+(1-N_t)Q^{\alpha}\mathrm{E}\left(g_C(z)\right)\right] \\
(1-N_t)\bar{z}_C Q^{\alpha} &= N_t p\mathrm{E}\left(g_I(z)\right)+(1-N_t)\mathrm{E}\left(g_C(z)\right)Q^{\alpha} \\
&\quad -\hat{k}^{-\alpha}_{It}p\left[\gamma^{\frac{1}{1-\alpha}}\hat{K}^S_{t+1}-(1+r_t)\hat{K}^S_t\right] \\
\hat{K}^D_t &= \hat{k}_{It}\left[N_t+(1-N_t)Q\right] \\
r_t+\delta &= \alpha\hat{k}^{\alpha-1}_{It}\left(\bar{z}_I-\xi\omega_I\right) \\
(r^*-r_t)\hat{B}_t &= \varphi\left(\frac{\hat{B}_t}{\hat{Y}_t}\right)^2\hat{Y}_t
\end{aligned}$$

where

$$\begin{aligned}
\kappa\left(r_{t+1}\right) &\equiv \frac{1}{1+\beta^{-\frac{1}{\sigma}}\left(1+r_{t+1}\right)^{\frac{\sigma-1}{\sigma}}} \\
\hat{Y}_t &= \hat{k}^{\alpha}_{It}\left[N_t p\bar{z}_I+(1-N_t)\bar{z}_C Q^{\alpha}\right] \\
\hat{B}_t &= p(\hat{K}^S_t-\hat{K}^D_t).
\end{aligned}$$

The above system of equations defines the economy's transition mapping, from $\left(N_t, \hat{K}^S_t\right)$ into $\left(N_{t+1}, \hat{K}^S_{t+1}\right)$. Given $\hat{K}^S_0 > 0$, one needs to compute the unique value of N_0 that puts the economy on the saddle path. In practice, N_0 is computed as the value such that the economy converges to the steady-state starting from $\left(N_0, \hat{K}^S_0\right)$. The full solution sequences are obtained in the process of solving for N_0, by iterating forward on the economy's transition function.