

The Great Depression in Brazil

Eduardo Sanchez Astorino*

Mauro Rodrigues Junior†

Abstract

The Great Depression affected many countries, but their individual responses to this event varied greatly. In particular, the Brazilian Great Depression was characterized by a relatively small drop in output, as well as a fairly short recovery period. In this article we propose a general equilibrium, open economy model in which such behavior can be explained by the public policies directed at manipulating international coffee prices through the control of the supply of this commodity. In our model, the Brazilian government realizes its monopoly power over international coffee markets by burning its coffee stocks in order to drive prices upward. Our simulations indicate that government policies were successful in nullifying the impact of the Great Depression over the coffee sector, at an apparently large cost in terms of household consumption and investment. We also substitute the coffee burning policy for an equivalent exports tax and compare the effects of both policies on the rest of the economy.

Keywords: Great Depression; Brazil; Coffee; Open Economy

JEL Classification: E65, F41, N16

Resumo

A Grande Depressão afetou muitos países, mas suas respostas individuais a esse evento foram variadas. Em particular, a Grande Depressão no Brasil foi caracterizada por uma queda relativamente pequena na produção, assim como um período de recuperação relativamente curto. Neste artigo nós propomos um modelo de equilíbrio geral com economia aberta no qual este comportamento pode ser explicado pelas políticas públicas direcionadas para a manipulação dos preços internacionais do café por meio do controle da oferta desta mercadoria. Em nosso modelo, o governo brasileiro realiza seu poder de monopólio sobre o mercado internacional de café ao queimar os estoques de café para aumentar os preços. Nossas simulações indicam que as políticas governamentais foram bem sucedidas em anular o impacto da Grande Depressão sobre o setor cafeeiro, em troca de um custo aparentemente alto em termos de consumo das famílias e investimento. Nós também substituímos a política de queima do café por um imposto equivalente sobre exportações e comparamos os efeitos dessas duas políticas sobre o resto da economia.

Palavras-Chave: Grande Depressão; Brasil; Café; Economia Aberta

Classificação JEL: E65, F41, N16

Área 3: Macroeconomia, Economia Monetária e Finanças

*Aluno de mestrado em Teoria Econômica, FEA-USP

†Professor Doutor, Departamento de Economia, FEA-USP

Contents

1	The International Great Depression	2
2	An Open Economy Model	7
2.1	Households	8
2.2	Firms	8
2.3	Government	9
2.4	Foreign sector	9
2.5	General equilibrium	9
3	Simulations	9
4	Conclusions	15

1 The International Great Depression

The Great Depression did not affect all countries in a similar manner. While all countries experienced a similar drop in output, the size and persistence of this drop varied considerably. In Figure 1 we can see the behavior of per capita GDP for a few selected economies from 1925 to 1947, in 1990 International Geary-Khamis Dollars, taken from (Maddison, 2012):

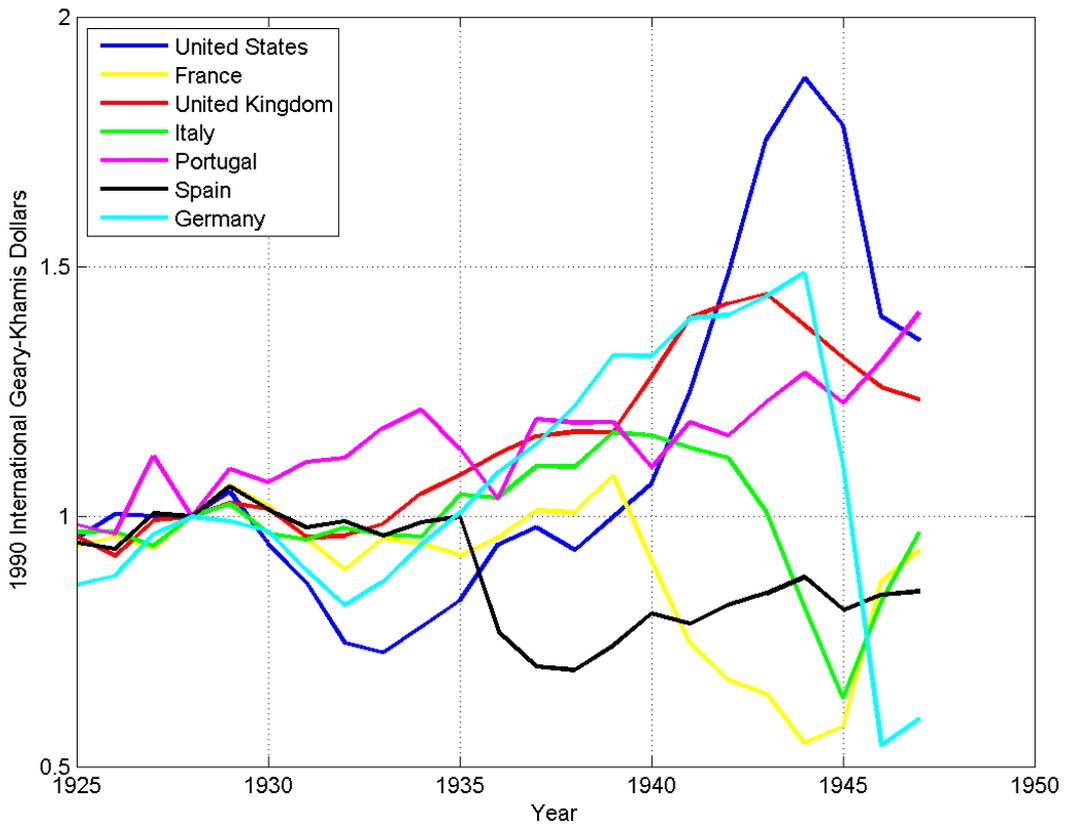


Figure 1: Per capita GDP for selected countries (1928 = 1)

As we can see, countries like the United States, Germany, France and Spain suffered relatively large falls in their per capita GDP, while Portugal, Italy and the United Kingdom suffered minor drops in their economic activity. In Figure 2 we can see the implications of the Great Depression in terms of long term growth of per capita GDP¹:

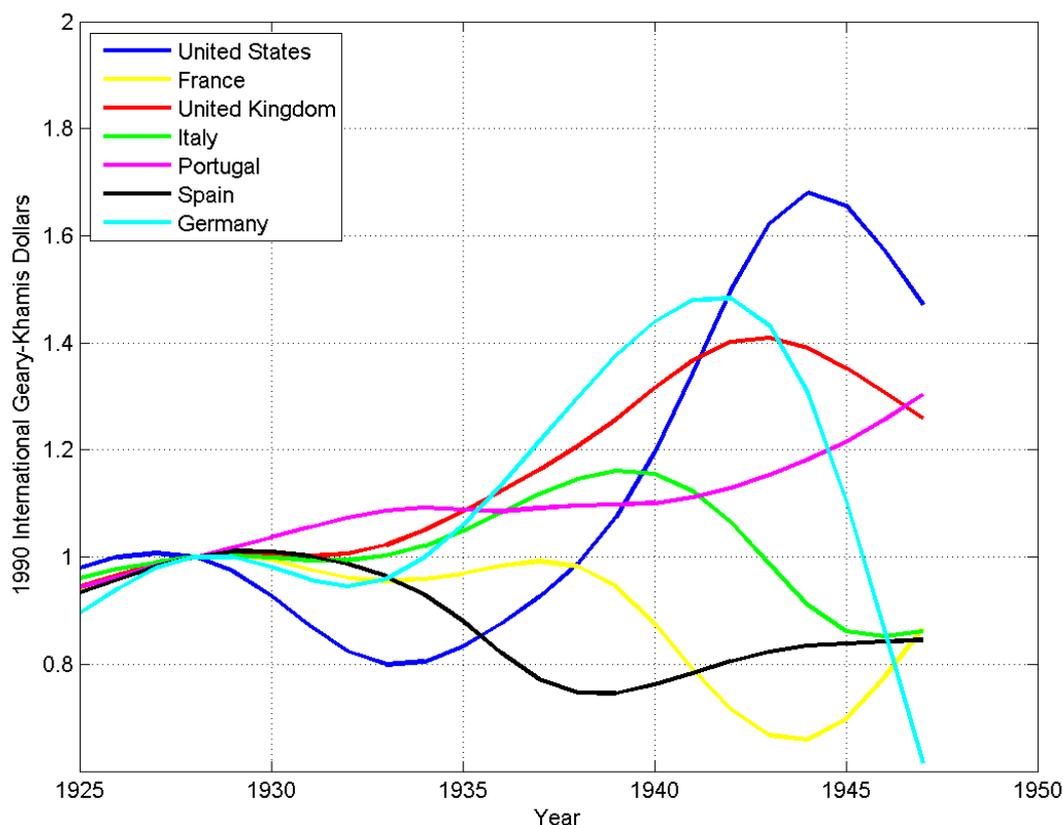


Figure 2: GDP per capita trend for selected countries (1928 = 1)

The Great Depression shock was capable of removing these economies from their long term balanced growth path. According to the data, the United States only returned to its 1928 trend by 1938, nine years after the Wall Street Crash. While none of the above featured economies display a recovery period as long as the U.S., we can also cite Germany, France and Spain as cases of severe, long term recession, while the trend of countries like the United Kingdom and Italy seem to have stayed in their 1928 level for 3 to 4 years, also dropping from their long term path.

The late 1990s marked the beginning of a research program which aimed at explaining such questions of impact and permanence of the Great Depression shock with the tools provided by the neoclassical growth model². The paper which started this line of study is (Cole & Ohanian, 1999), in which the authors present a growth model calibrated for the U.S. economy from 1929 to 1939. By utilizing a combination of large real and monetary shocks, Cole and Ohanian are able to account for the initial economic downturn which lasts from 1929 to 1933, however they find that their model predicts a fast recovery from 1934 onward. As we can see in the data above, the U.S. economy remained depressed for a much longer time. The authors conclude their study by pointing that this discrepancy between the data and their artificial economy is likely

¹This data was acquired by running an HP filter in the data from (Maddison, 2012), with a smoothing parameters of 6.25 to account for the fact we only had annual data.

²(Vroey & Pensieroso, 2006) gives an interesting analysis of this literature.

caused by the set of policies known as the New Deal, which prolonged the depression by hampering the adjustment of real wages and by facilitating the formation of monopolies and cartels.

There are many studies which follow the methodology laid out in (Cole & Ohanian, 1999) and find similar results with regards to the role of public policy in the depth and duration of the Great Depression in other countries. In (Cole & Ohanian, 2002) the authors analyze the role of public policy in the prolonged depression in the United Kingdom, from 1918 to the beginning of World War II. A similar analysis is found in (Beaudry & Portier, 2002) for the case of the French Great Depression. In (Perri & Quadrini, 2002) the authors explain the contagion of the Italian economy through the "tariff war" and the government-enforced stability of real wages, both of which took place in the interwar period. Finally, the volume (Kehoe & Prescott, 2007) collects these and many other articles which analyze episodes of deep economic recession through the tools of modern macroeconomic theory.

The available data for Brazil³ for the period of the Great Depression presents features which could be explained by an analysis inspired by the studies mentioned above.

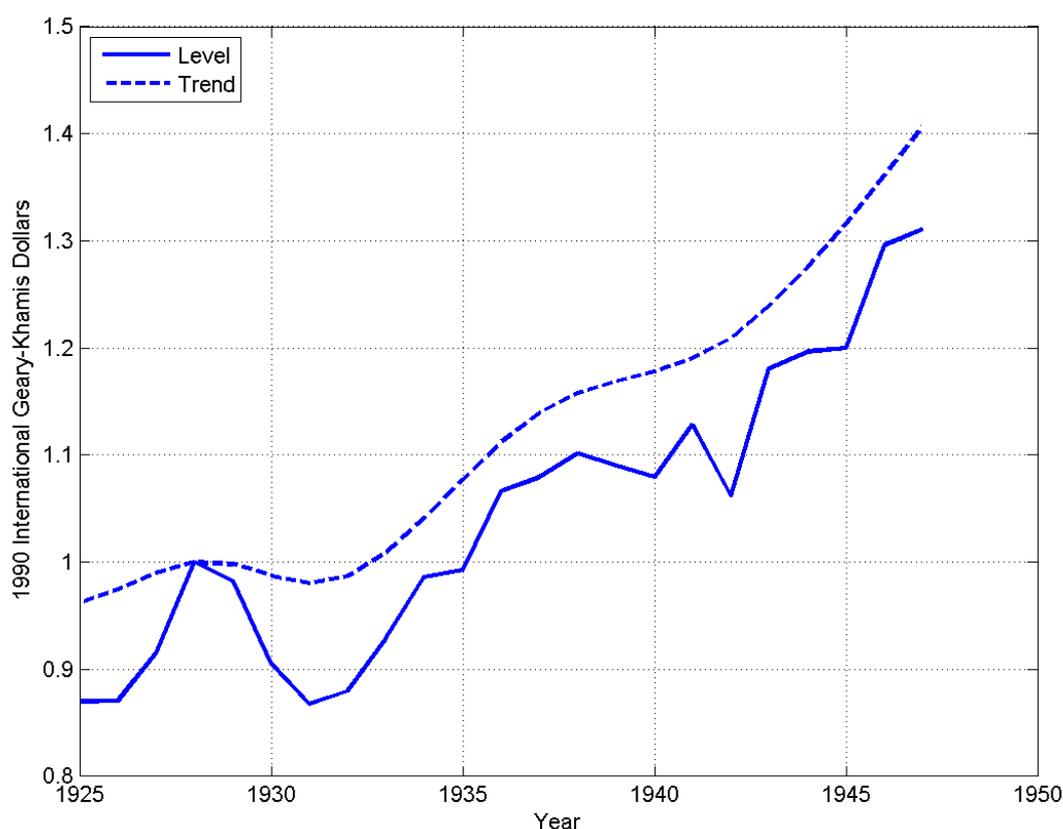


Figure 3: GDP per capita, level and trend for Brazil (1928 = 1)

As we can see, the Great Depression in Brazil was also characterized by small drops in performance and a short recovery period. By 1933 the economy had already recovered its 1928 trend, after a moderate drop (circa 13% from its 1928 level). In following (Perri & Quadrini, 2002), the Great Depression was most likely "imported" to Brazil through its dependence on the foreign sector. This dependence is stressed in classical works of Brazilian economic history like (Furtado, 2007), (Netto, 1959) and (Villela & Suzigan, 2001), to name a few. In particular, it is believed that the set of public policies which aimed at maintaining

³We have access to data from (da Motta et al., 1990) for data on Brazilian GDP, but in this case we use (Maddison, 2012) in order to compare the performance of the Brazilian economy with the others listed above.

international coffee prices were able to control the contagion of the Great Depression to Brazil⁴.

The coffee sector presents some features which lead us to consider it as a possible transmission mechanism for the Great Depression. It was, by far, the most important rural activity in the Brazilian economy in the 1930s: (da Motta et al., 1990) gives us coffee exports as a share of total Brazilian exports:

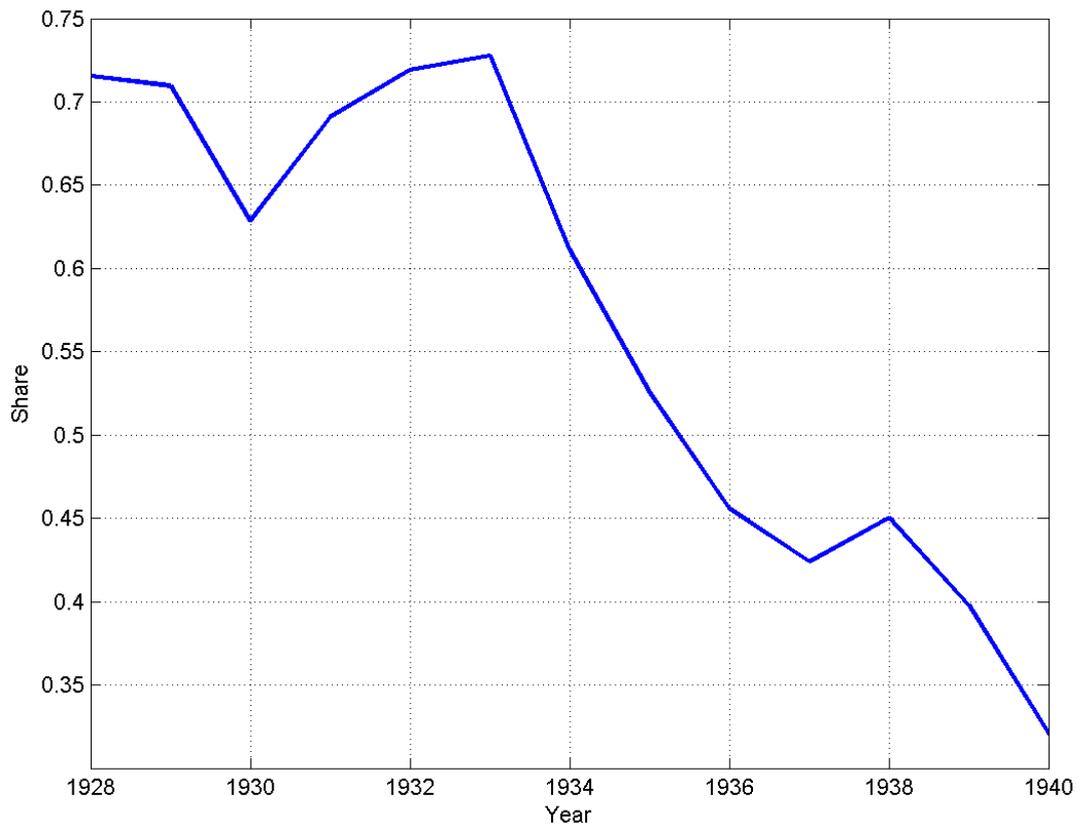


Figure 4: Coffee exports as share of total exports value

For the first half of the 1930s the coffee trade alone accounted for more than 50% of the total value of exports. At this stage we are not able to present empirical evidence on the foreign sector as a share of GDP, however multiple historical studies point to the significance of this activity to the Brazilian economy⁵.

The second important feature of this sector was its significance in the international coffee markets:

⁴An hypothesis which is explicitly stated in (Furtado, 2007).

⁵See (Furtado, 2007), (Netto, 1959) and (Peláez, 1972).

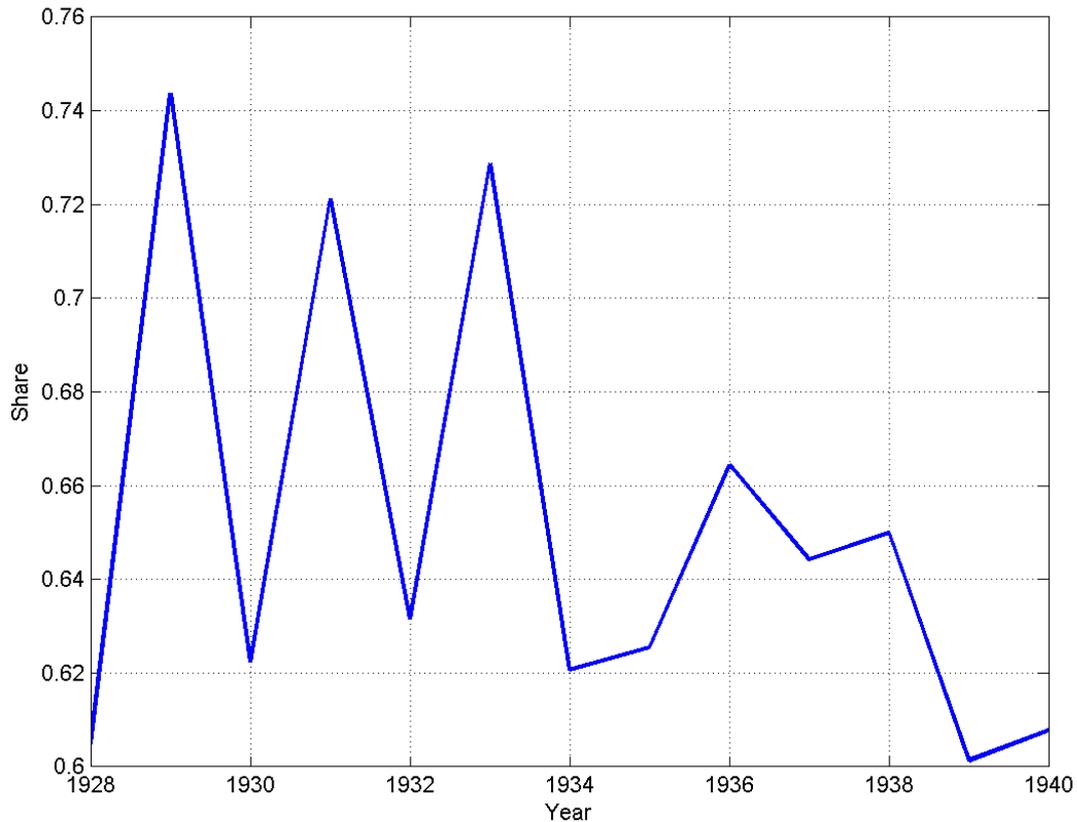


Figure 5: Brazilian coffee production as share of international production

As we can see in Figure 5, Brazil was responsible for a considerable fraction of the international coffee supply. The rest of the world production of coffee was divided between Colombia and the European colonies in Africa⁶, however none of these countries were able to take advantage of their market share in order to influence international prices. For the first decades of the twentieth century, only Brazil was in a position to exert this sort of influence, not only because of its market share, but also because of the enormous public effort directed at protecting the coffee sector from price fluctuations.

The importance of the coffee sector (as well as its high capacity for political articulation, see (Furtado, 2007)) served to justify a large body of public policies which aimed at protecting this sector from large fluctuations in international coffee prices. These policies have a long history (exposed in great detail in (Netto, 1959)) which stretches from the late nineteenth century to the first half of the twentieth century. One of the most striking aspects of this policy was the destruction of coffee stocks. With the onset of the Great Depression, those interested in the defence of the coffee sector found themselves facing a large drop in international prices, as well as a sudden stop to international capital flows. In order to circumvent these problems, Brazil resorted to burning its coffee stocks in order to increase international prices and avoid the expenses involved in the proper stocking of the product (this stocking was largely financed by foreign loans until the onset of the Great Depression).

We have data from (Peláez, 1972) and (da Motta et al., 1990) on the percentage of Brazilian coffee which was burned by the government from 1931 to 1945, which we present on Figure 6:

⁶In (Netto, 1959), Netto argues that Colombia benefited directly from Brazil's price defence policy, while the African colonies owe their increased importance in the world coffee production to the generalized increase in international tariffs which followed the 1929 crash (also noted in (Perri & Quadri, 2002)).

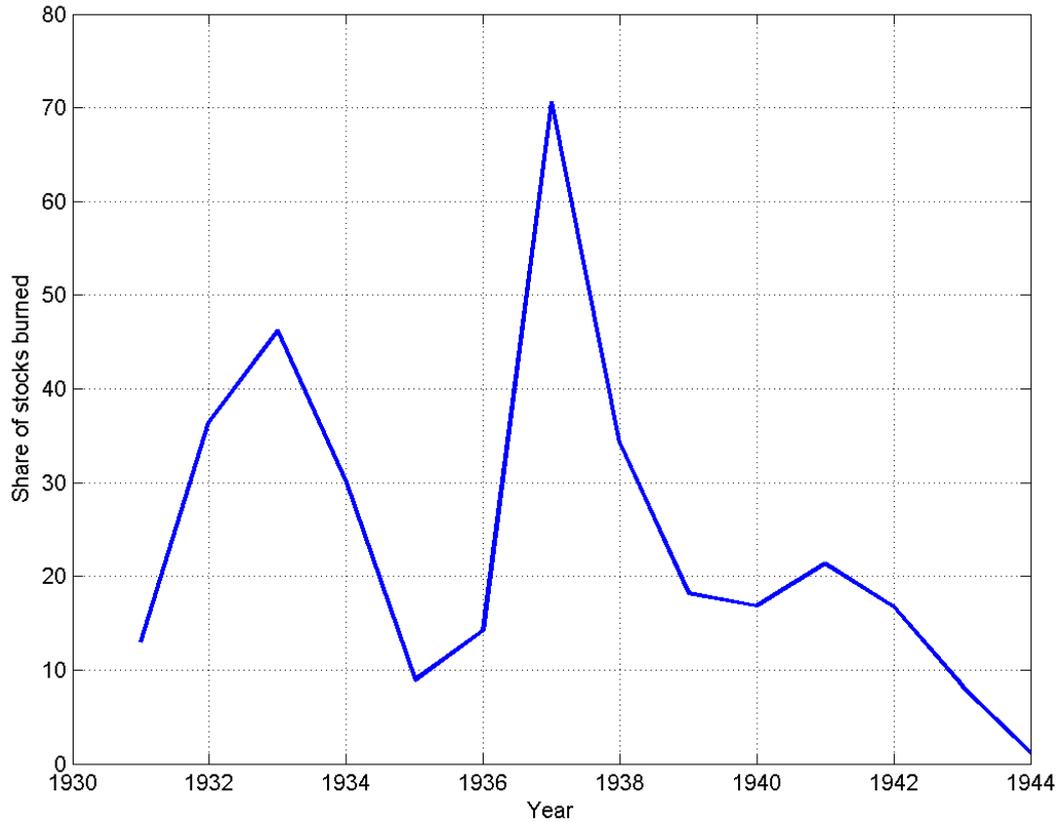


Figure 6: Share of coffee stocks burned

As we can see, the Brazilian government burned a considerable share of its coffee stocks in order to increase its market value. The largest value of this series is from 1937, when 70.62 of the stocks were destroyed. On average, the government destroyed 26.96% of its coffee stocks from 1931 to 1944.

The importance of this sector, as well as the significant effort which went into protecting its earnings over the rest of the economy, leads us to consider the possibility that the depth and the duration of the Great Depression in Brazil could be explained by a model in which this dynamics is portrayed: at the onset of the Great Depression, the government would start to burn its coffee stocks in order to compensate the fall in foreign demand through an increase in prices. In the next section we describe the basis for two open economy models which will attempt to replicate this dynamics.

2 An Open Economy Model

The two models we utilize are based on (Perri & Quadrini, 2002), where the authors use a two-sector, open economy model without international mobility of capital in order to study the transmission of the Great Depression shock to Italy. Because of this proximity between the problem we would like to address and theirs, we take their model as a starting point for our own. Both of our models are open-economy, perfect-foresight models where a domestic country trades a commodity with the rest of the world in order to acquire a general good which it uses to consume and invest, but that it can't produce internally (this is the main difference between the models we present here and the one in (Perri & Quadrini, 2002)). There is no international mobility of capital.

2.1 Households

The domestic households live indefinitely and maximize the following utility function throughout their lifetime:

$$U = \sum_{t=0}^{\infty} \beta^t u(c_t, l_t), \quad (1)$$

where

$$u(c_t, l_t) = \log(c_t) + \log(1 - l_t), \quad (2)$$

with c_t representing consumption of the general good in period t . Households receive a divisible time endowment equal to 1 each period, which can be used for labor or leisure. The fraction of this endowment used for labor is l_t .

Households receive a wage w_t per hour of labor, and pay a tax τ_t^l on their labor income $w_t l_t$. They can also accumulate capital in order to transfer consumption between periods. For each unit k_t of accumulated capital, households receive a return denoted by r_t . This capital depreciates at a rate δ per period. Both w_t and r_t are measured in terms of the general good.

As such, the maximization problem households face is

$$\max_{\{k_{t+1}, c_t, l_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t [\log(c_t) + \log(1 - l_t)] \quad (3)$$

$$\text{s. t. } c_t + (k_{t+1} - (1 - \delta)k_t) = r_t k_t + (1 - \tau_t^l) w_t l_t. \quad (4)$$

The first-order condition for this problem simplify to

$$k_{t+1} : \frac{1}{c_t} = \frac{\beta}{c_{t+1}} [r_{t+1} + (1 - \delta)] \quad (5)$$

$$l_t : \frac{c_t}{1 - l_t} = (1 - \tau_t^l) w_t. \quad (6)$$

2.2 Firms

The domestic firms in our model produce coffee through a Cobb-Douglas production function, and sell it to the government in a competitive market. We assume that the domestic economy is an international monopolist in the coffee market, but the individual producers lack the capacity of coordinating themselves in order to take advantage of this fact. Instead, the government is responsible for regulating the supply of coffee for international markets in order to control prices.

The firms' problem is

$$\max_{k_t, l_t} p_t k_t^\gamma l_t^{1-\gamma} - r_t k_t - w_t l_t, \quad (7)$$

where p_t is the price of coffee in terms of general goods. The first-order conditions are

$$k_t : r_t = \gamma p_t k_t^{\gamma-1} l_t^{1-\gamma} \quad (8)$$

$$l_t : w_t = (1 - \gamma) p_t k_t^\gamma l_t^{-\gamma}. \quad (9)$$

2.3 Government

The government buys the coffee production of domestic firms and resells it to international markets. In the process, it can take advantage of its monopoly power by destroying a share of its coffee stocks (without incurring in any cost) in order to drive international prices upward.

The government works to transmit this price increase to coffee producers, by paying them the full international price. As such, whenever a share of coffee stock is burnt in order to exert some control over prices, the government will incur in a deficit; we assume that this deficit is covered by the labor tax described in Section 2.1. This implies that the government can't use bonds in order to roll a debt along multiple periods. As such, its budget constraint is

$$p_t y_t = \lambda_t p_t y_t + \tau_t^l w_t l_t, \quad (10)$$

where λ_t is the share of coffee which is sold to international markets.

2.4 Foreign sector

We assume a foreign demand for coffee which takes the shape of a Cobb-Douglas demand function:

$$x_t^d = \frac{\alpha^* y_t^*}{p_t}, \quad (11)$$

where y_t^* is foreign income in period t and α^* is the share of this income which is spent on coffee goods. In our model, the Great Depression is a permanent, exogenous shock to y_t^* . In other words, our domestic economy (which is highly dependent of international markets, since it doesn't produce the general goods needed for consumption and investment) will be affected by the Great Depression through a dramatic drop in demand for its tradable commodities.

2.5 General equilibrium

The equilibrium in foreign markets implies that the supply of coffee equals demand. Since coffee exports are simply the share of coffee that the government chose not to burn, we have

$$x_t^s = \lambda_t y_t = x_t^d = \frac{\alpha^* y_t^*}{p_t}. \quad (12)$$

Since there is no international mobility of capital, equilibrium in the foreign sector is given by the trade balance:

$$m_t = p_t x_t, \quad (13)$$

where m_t is total imports. This is given by

$$m_t = c_t + i_t = c_t + (k_{t+1} - (1 - \delta)k_t), \quad (14)$$

where i_t is investment. Finally, the demand for capital and labor by firms equals the supply of these factors by households.

3 Simulations

In our simulations, we are interested in examining how the domestic economy behaves when transitioning between two different steady states, before and after a shock to foreign income which represents the Great Depression. We first analyze the case when the government doesn't try to defend the coffee sector

through the destruction of coffee stocks. In this case, the government acts as a mere intermediary between domestic coffee producers and international markets, and the Great Depression shock is transmitted directly to the domestic economy. In our model, this means setting λ_t equal to 1 for all t .

As mentioned above, the model described in the last Section is based on the one used in (Perri & Quadrini, 2002), as such we utilize their calibration for some of the deep parameters of our model. We set β , the intertemporal discount factor, at 0.96. The production function parameter, γ , is set at 0.45. The depreciation rate is set at 0.10. Finally, the parameter α^* can be set at any value such that $0 \leq \alpha^* \leq 1$ without affecting the behavior of the model's variables.

We model the Great Depressions shock as a 33.3% drop in international income. The results are presented in Figure 7, where variables are expressed in terms of their steady state values:

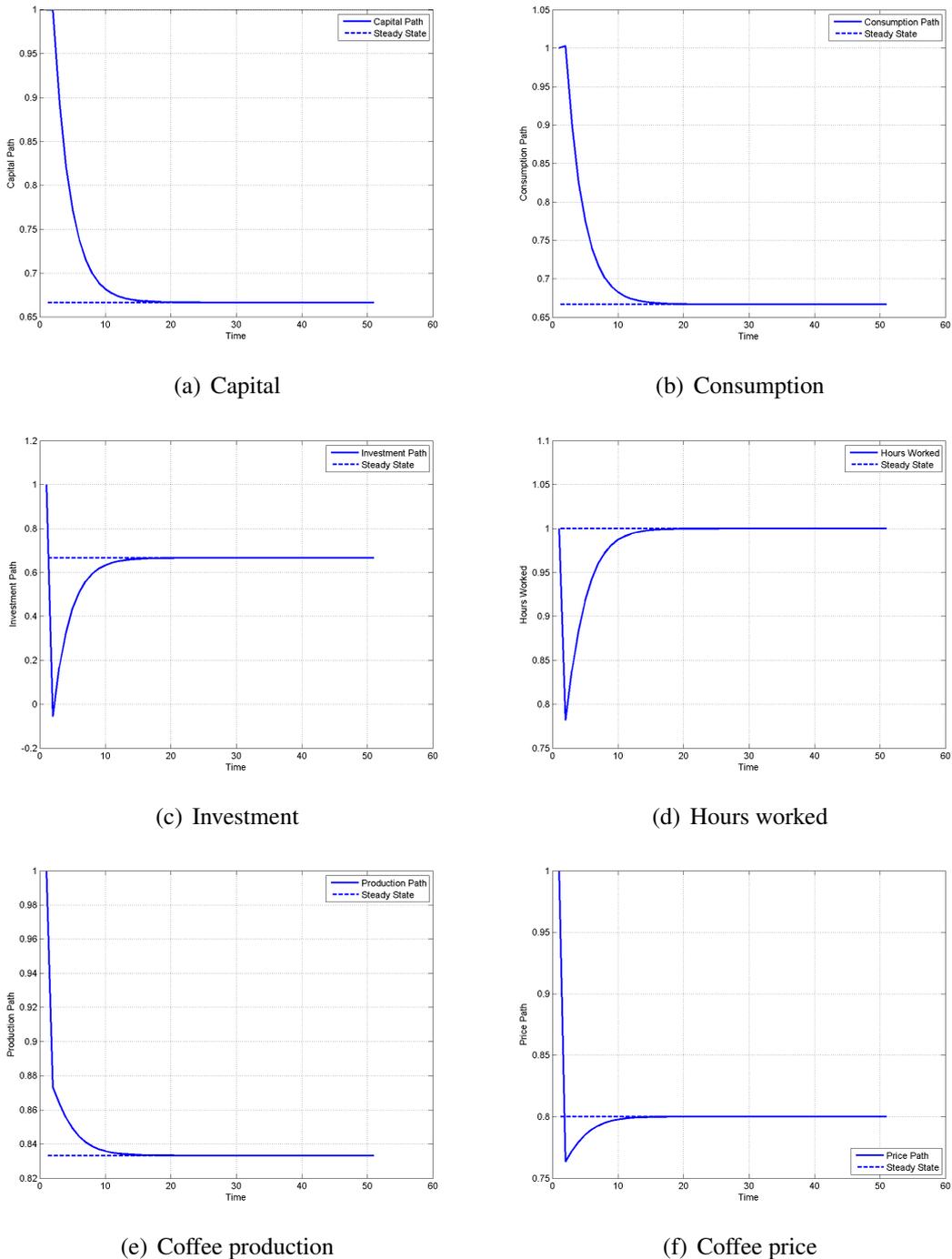
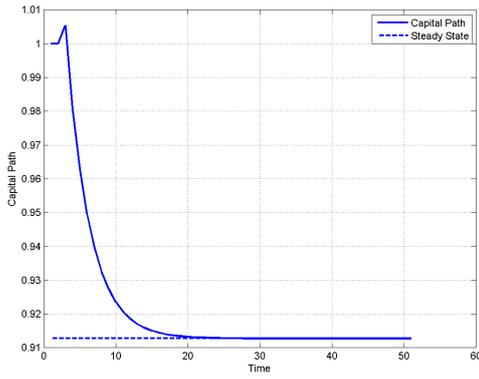


Figure 7: Transition paths in terms of steady state values - $\lambda_t = 0$

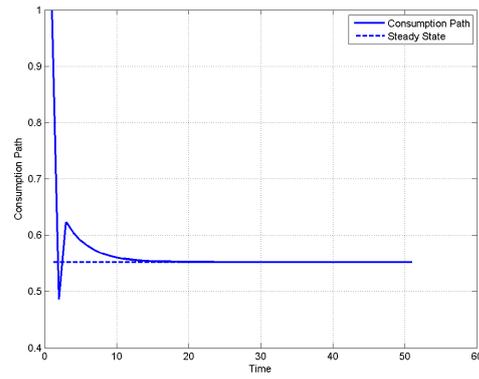
Once the Great Depression shock occurs, causing a large drop in the foreign demand for coffee, the domestic economy finds its foreign constraint becomes more binding. At any given price, the amount of coffee demanded by foreign markets is lower in comparison to the pre-Depression situation, and as a result the domestic economy has access to a smaller quantity of the general goods necessary for consumption and investment. As we can see, if the government doesn't use its monopoly power to protect the domestic economy from the Great Depression shock, consumption and investment drop by 33.3% along their convergence to a new steady state. The capital stock of the economy falls by the same amount, and the amount of hours spent on labor initially falls by 21.83%, but then converges to its initial steady state value.

We can observe the worsening of the terms of trade in the behavior of coffee prices. Following the shock in foreign income, coffee prices fall by 20% along the convergence to a new steady state. Finally, coffee producers lower their output by 16.7% in order to adjust to the drop in foreign demand.

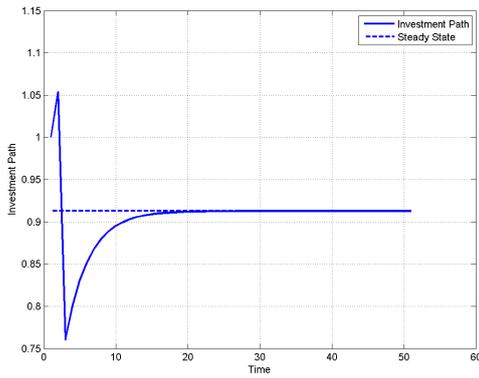
In our next exercise we allow the government to intervene in the coffee market by destroying its coffee stocks in order to exert some control over coffee prices. We do this by setting λ_t to a value lower than 1 for some t , thus representing the costless disposal of coffee stocks by the government. As mentioned above, the Brazilian government burned on average 26.96% of its coffee stocks in the period from 1931 through 1944. We use this value in order to calibrate the share of burned coffee in our model, by making $\lambda_t = 0.7304$ for all t after the first period. Our results are presented in Figure 8:



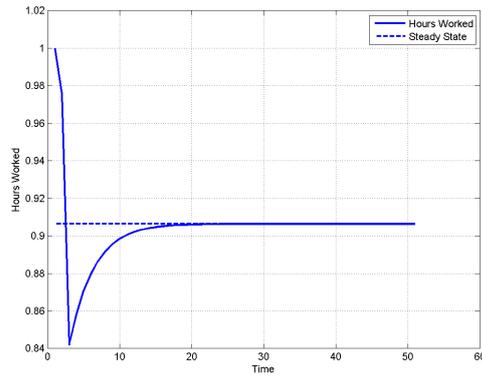
(a) Capital



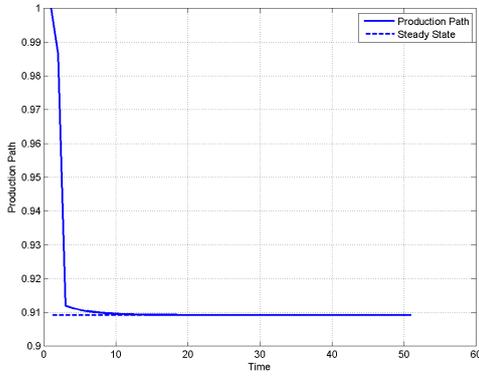
(b) Consumption



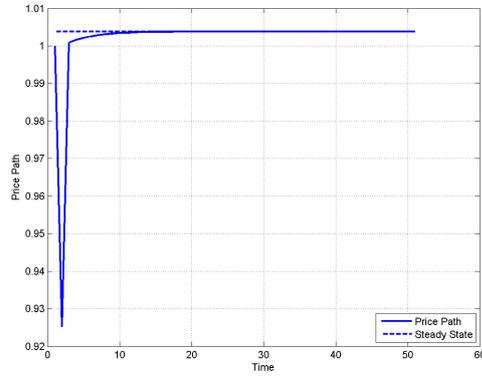
(c) Investment



(d) Hours worked



(e) Coffee production



(f) Coffee price

Figure 8: Transition paths in terms of steady state values - $\lambda_t = 0.7304$

The price defence mechanism causes significant change in the behavior of the domestic economy. Now the drop in foreign demand is partially compensated by an increase in the terms of trade. By itself, this effect should alleviate the drop in consumption and investment by allowing the domestic economy to maintain some degree of access to the imported general goods, however this mechanism has two features which work in the opposite direction. The first is that the improvement in the terms of trade is caused by the destruction of a commodity which represents the only channel through which the domestic economy is able to acquire the consumption and investment goods. The second is that this mechanism is financed by the distortive taxation of labor income.

As such, we will see an improvement in some of the variables, while others will suffer because of the combined effect of destruction of tradable goods and distortive taxation. We notice that domestic con-

sumption has suffered a sharper drop than before: instead of a 33.3% drop, we now have a 44.8% fall in household consumption from one steady state to another. In contrast, investment and the capital stock fall by only 8.73%, while in the former exercise they dropped as much as consumption. Also, the combination of the foreign shock with the coffee burning causes the steady state value of work hours to fall by 9.36% (after initially falling by 15.81%).

The burning of coffee stocks is able to keep the terms of trade relatively constant over time. Coffee prices initially drop by 7.48%, but then converge to, roughly, their pre-Depression value⁷. Coffee output also shows a smaller drop than before (9.07%).

In our last simulations, we wish to internalize the social cost of the price defence mechanism through the taxation of exports. We eliminate the labor tax and assume that the revenue accrued by the government with the new exports tax is spent in an unproductive manner. We need to alter equations (4), (7), (10) and (14) in order to adapt our model. The new household budget constraint is obtained by merely making $\tau_t^l = 0$ in (4):

$$c_t + (k_{t+1} - (1 - \delta)k_t) = r_t k_t + w_t l_t. \quad (15)$$

The profit function that firms maximize will now account for the exports tax:

$$(1 - \tau_t^x) p_t k_t^\gamma l_t^{1-\gamma} - r_t k_t - w_t l_t. \quad (16)$$

The government's budget constraint becomes

$$\tau_t^x p_t y_t = g_t, \quad (17)$$

where g_t is unproductive government spending. This implies that the new resource constraint of the domestic economy is

$$c_t + i_t + g_t = m_t. \quad (18)$$

By making these changes to our model we are able to simulate the domestic economy with different levels of export taxes. We are once again interested in the convergence of this economy to a new steady state following a permanent shock to foreign income: at $t = 0$ the Great Depression shock hits at the same time that the government raises the exports tax from 0 to an arbitrary value, in order to control the international supply of coffee goods and thus exert an upward pressure on coffee prices.

We first present the behavior of the economy for different values of the exports tax, from 0 to 40%. The results are given in Figure 9:

⁷We actually observe an increase of 0.38% in the steady state value of coffee prices.

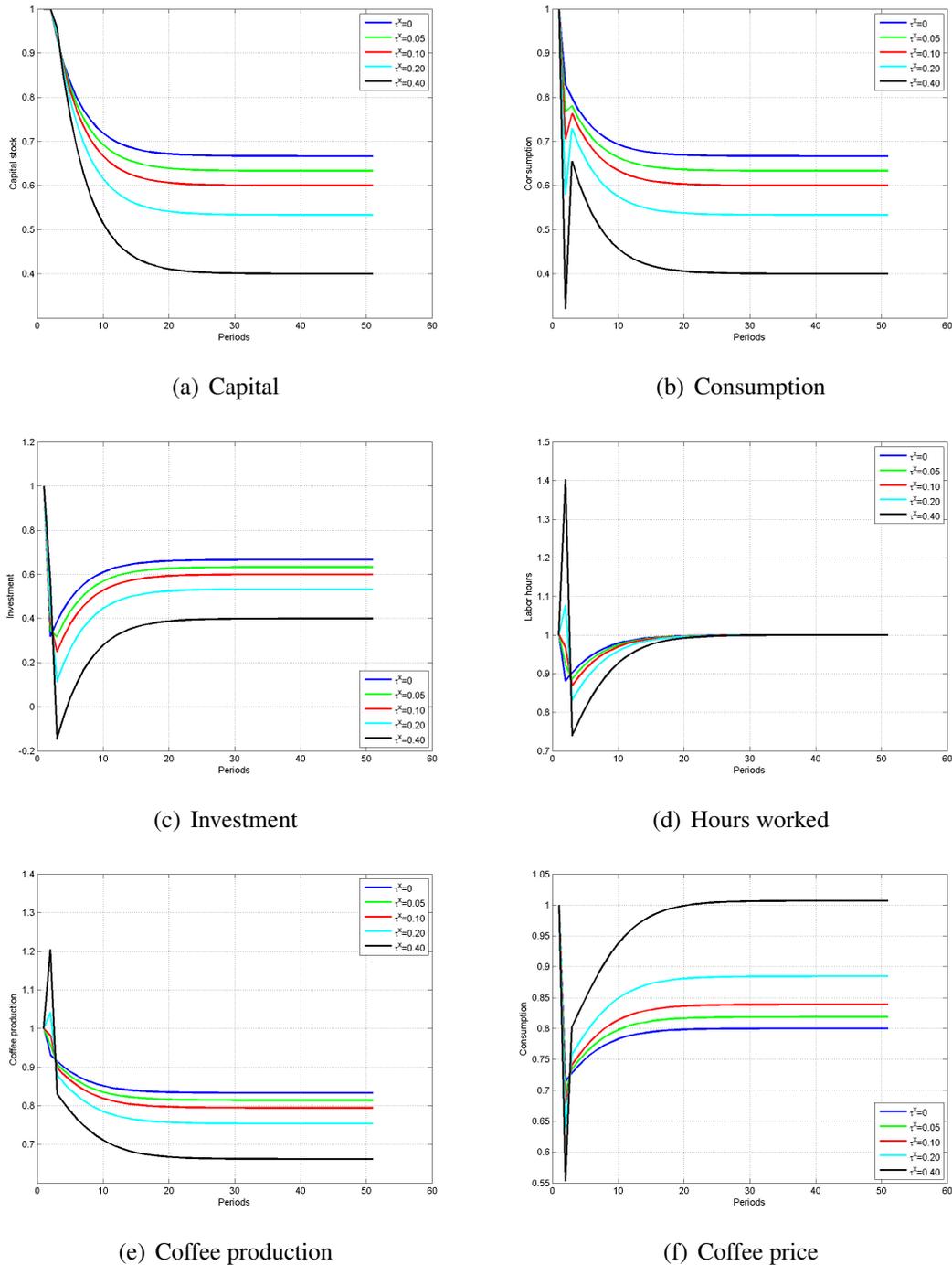


Figure 9: Transition paths in terms of steady state values - Exports taxation

As we can see, by increasing the exports tax the government is able to achieve a similar result to burning its coffee stocks. The drop in coffee prices caused by the Great Depression shock is alleviated as the exports tax τ_t^x is increased. In particular, when $\tau_t^x = 0.40$ for $t \geq 1$, we find that coffee prices initially drop by 28.53% but then converge to roughly their pre-Depression level. We can thus say that the price defence mechanism utilized by the Brazilian government is roughly equivalent to a 40% tax on exports.

However, despite their similar effects on the terms of trade, the two schemes differ on their possible welfare consequences. While the price defence mechanism causes a 44.8% fall in household consumption, the exports tax causes a 60% drop in consumption in order to keep coffee prices constant. Investment and capital also fall by 60%. Labor hours once again converge to their initial steady state value after a short period of instability (first rising by 40% and then falling by 26%). Finally, coffee production falls by

33.79% with the exports tax, a very large drop when compared to our former results.

As such, we conclude that the exports tax does not replicate the empirical behavior of the Brazilian economy as well as the coffee burning mechanism. In order to nullify the negative impact of the Great Depression shock on prices, the exports tax causes a much larger drop in output, as well as in consumption and investment. The burning of coffee stocks seems to have been more successful, in the sense that it sacrificed a lower share of output in order to keep prices from plummeting during the 1930s.

4 Conclusions

In this paper we analyze the effect of the Brazilian price defence mechanism for the coffee sector over the transmission of the Great Depression from international markets to the domestic economy. We propose a simple open economy model in which this mechanism is successful in limiting the fall in coffee prices and output, at a high cost in terms of consumption and investment. We also find that an exports tax capable of replicating the impact of the coffee burning on prices would generate larger drops in consumption and investment, as well as in output. This implies that the coffee burning policy is not equivalent to an exports tax.

A possible extension of our work would be an adaptation of the methodology in Chapter 4 of (Ljungqvist & Sargent, 2004) for analyzing the welfare cost of business cycles. Our analysis seems to suggest that, in terms of social welfare, it would have been preferable to allow for the Great Depression shock to drive coffee prices downward without any sort of government interference (whether by the coffee burning policy or by the exports tax), due to the sharp drop in consumption. However, without a proper methodology for accounting for the welfare loss, it would not be correct to draw this conclusion.

References

- Beaudry, P. & Portier, F. (2002). The French Depression in the 1930s. *Review of Economic Dynamics*, 5(1), 73–99.
- Cole, H. L. & Ohanian, L. E. (1999). The Great Depression in the United States from a neoclassical perspective. *Federal Reserve Bank of Minneapolis Quarterly Review*, (Win), 2–24.
- Cole, H. L. & Ohanian, L. E. (2002). The Great U.K. Depression: A puzzle and possible resolution. *Review of Economic Dynamics*, 5(1), 19–44.
- da Motta, R. S., Suzigan, W., & Versiani, F. R. (1990). *Séries Estatísticas Retrospectivas*, volume 3 - Estatísticas Históricas do Brasil: séries econômicas, demográficas e sociais de 1550 a 1988. Rio de Janeiro: Fundação Instituto Brasileiro de Geografia e Estatística, 2 edition.
- Furtado, C. (2007). *Formação econômica do Brasil*. Editora Companhia das Letras.
- Kehoe, T. J. & Prescott, E. C. (2007). *Great Depressions of the Twentieth Century*. Monograph. Federal Reserve Bank of Minneapolis.
- Ljungqvist, L. & Sargent, T. J. (2004). *Recursive Macroeconomic Theory, 2nd Edition*, volume 1 of *MIT Press Books*. The MIT Press.
- Maddison, A. (2012). Statistics on world population, GDP and per capita GDP, 1-2008 AD.
- Netto, A. D. (1959). *O problema do café no Brasil*. PhD thesis, Universidade de São Paulo.
- Peláez, C. M. (1972). *História da Industrialização Brasileira: crítica à teoria estruturalista no Brasil*. Rio de Janeiro: APEC.
- Perri, F. & Quadrini, V. (2002). The Great Depression in Italy: trade restrictions and real wage rigidities. *Review of Economic Dynamics*, 5(1), 128–151.
- Villela, A. V. & Suzigan, W. (2001). *Política do governo e crescimento da economia brasileira - 1889-1945*. Brasília: Ipea - Instituto de Pesquisa Econômica Aplicada.
- Vroey, M. R. D. & Pensieroso, L. (2006). Real business cycle theory and the Great Depression: The abandonment of the abstentionist viewpoint. *The B.E. Journal of Macroeconomics*, 0(1), 13.