A Small Open Economy in the Great Depression: the Case of Switzerland

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Abstract

In historical accounts of the world economic crisis of the 1930s, Switzerland is known for its staunch defense of the gold standard and the rise of corporatist policies. Yet, so far, the literature has not discussed the implications of these two features. This paper tries to show how the combination of hard–currency policy and nominal rigidities introduced by corporatist policies proved to be fatal for growth. Estimating a New Keynesian small open economy model for the period 1926–1938, we show that the decision to participate in the Gold Bloc after 1933 at an overvalued currency can be identified as the main reason for the unusual long lasting recession and that price rigidities from 1931 to 1936 significantly slowed down the adjustment process.

Keywords: Great Depression, Switzerland, New Keynesian Business Cycle Model

JEL Classification: E12, E32, N14

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1 Introduction

Recent research has shown that Switzerland's dismal performance during the 1930s
was mainly due to its exchange rate policy (Bordo *et al.*, 2007; Bordo and James,
2007). Thanks to a high gold cover ratio, the Swiss National Bank was able to defend
the old parity against any speculative attack, thus preventing an early devaluation
of the Swiss franc that would have restored the competitiveness of Switzerland's
exporting sectors. This exchange rate policy was motivated by a variety of reasons,
yet the widespread gold standard mentality certainly played a key role. The strong
belief that a devaluation would lead to inflation and that the gold standard was the
only reliable guarantee for prosperity and stability, led economies to stay on gold
as long as possible – a decision which implied a lagged recovery from the Great
Depression (e.g. Balderston, 2003; Feinstein *et al.*, 2008).[1] As (Straumann, 2010, p.
129–142) shows, this was also the case for Switzerland. Only when the last major
trading partner, France (see Table 1), decided to devalue its currency, Switzerland
was ready to change course. In September 1936, the Swiss franc was devalued by
30 percent.

To demonstrate the consequence of Switzerland's defense of the gold standard,
we adapt the famous "contracting spiral of world trade"–graph, first published by
the Austrian Institute for Business Cycle Research (*Österreichisches Institut für
Konjunkturforschung*) in 1933 (Eichengreen and Irwin, 1995), to Swiss exports (Figure 1). Real exports fell by 50 percent until June 1932, followed by a weak recovery
to about 60–70 percent of the October 1929 level. The consequence of the decision to
join the Gold Bloc in 1933 (together with Belgium, France, Italy, the Netherlands,
and Poland) was that exports stayed at this level until end of 1936. Due to the
overvalued Swiss franc, the Swiss exporting sectors profited less from the recovery
of the world economy than small European countries with a devalued currency such
as the Scandinavian countries.

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[1] *"A further aspect of great significance was the widespread belief in financial and political circles
that it was essential to return to the pre–war gold standard if the growth and prosperity of the pre–
1914 era were to be re–established, whatever the sacrifices their countries would have to make in
oder to force down wages and prices so that the pre–war value of the currency could be restored."*
(Feinstein *et al.*, 2008, p. 1)

Figure 1: Swiss Exports, January 1929 – December 1936
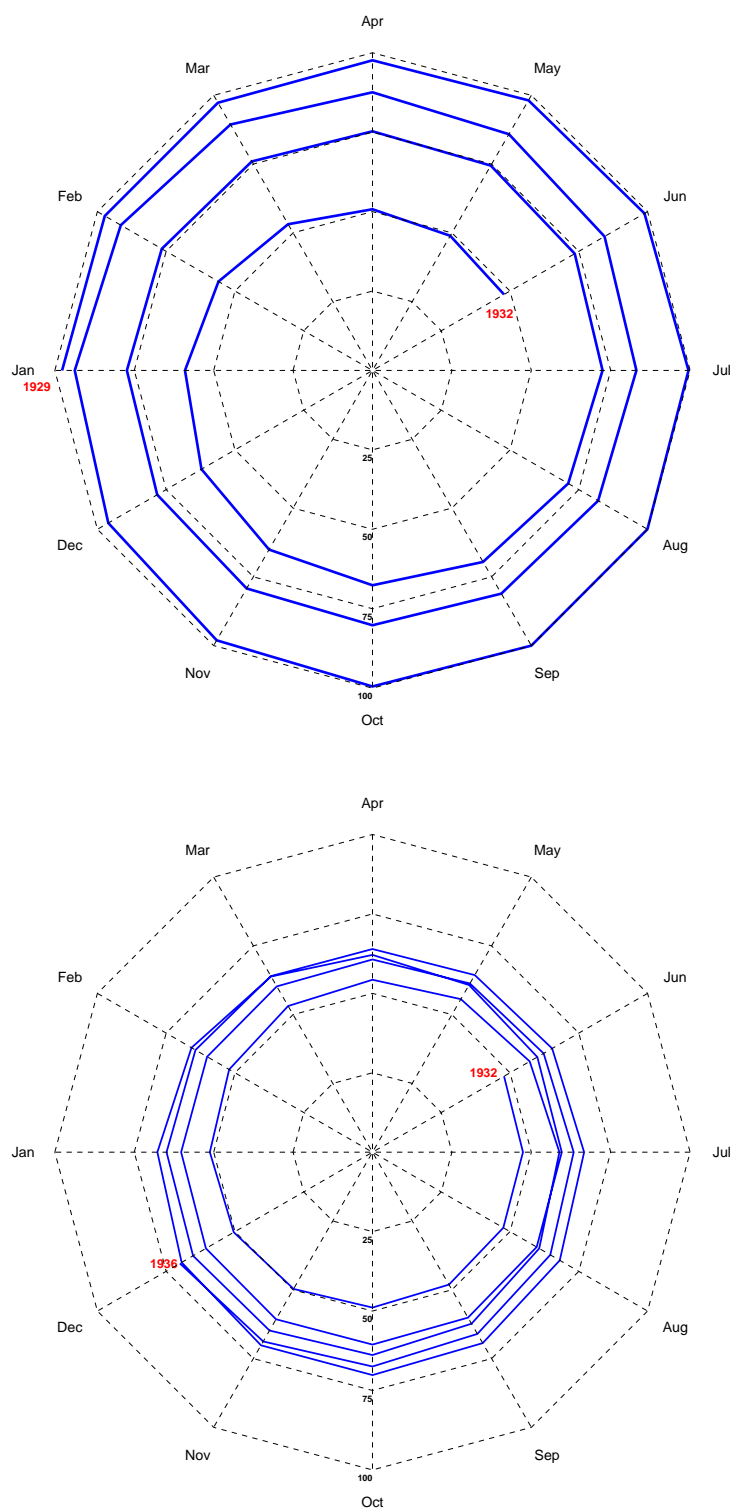
Notes: Real exports, October 1929=100; Source: *Monatsstatistik des auswärtigen Handels der Schweiz*, 1929–1932

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Table 1: Major Trading Partners of Switzerland in the Interwar Period

County	Export Share	Import Share
Germany	17.43%	27.25%
France	13.09%	16.15%
Italy	8.22%	7.62%
United Kingdom	12.19%	5.53%
United States	7.24%	6.57%
Total	58.18%	63.12%

Notes: Average country shares of total exports & imports during 1929–1936. Source: Swiss Economic and Social History Online Database (`www.fsw.uzh.ch/hstat`), Tables L.18, L.19, L.22 ,L.23.

The Swiss National Bank's defense of the old gold parity was particularly detrimental as Switzerland's prices were extraordinarily sticky during this period. As a matter of fact, regulations protecting individual economic sectors and fixing prices dramatically increased during the crisis. Instead of enabling the downward adjustment, the government sought to cushion the negative effects of an overvalued currency by containing competition. Almost any pressure group, in particular Swiss farmers, was able to obtain protection and subsidies. In many historical accounts, the rise of these corporatist policies in the 1930s has been hailed as the beginning of a fruitful cooperation between capital and labor. But in the context of an orthodox gold standard policy, these rigidities proved to be fatal. Therefore, understanding the nature of Switzerland's economic crisis during the 1930s requires not only a thorough analysis of the exchange rate policy, but also a better grasp of how prices adjusted before and after 1929.

Besides the exchange rate policy and the stickiness of prices, there is a third feature defining the course of Switzerland's economic crisis. The ample gold reserves may have prevented the Swiss National Bank from leaving the gold standard at an early state of the crisis. But on the other hand, they also allowed the central bank to refrain from increasing interest rates in the face of speculative attacks. From 1931 to 1936 when the devaluation enabled the central bank to reflate the economy nominal interests remained close to zero. By contrast, Belgium and France, which also defended the gold standard until the mid–1930s were forced to increase

their interest rates whenever investors mistrusted their currencies. Thus, the usual constraints of the gold standard did not apply until 1936 for the case of Switzerland.

In this paper, we try to account for these different aspects of the Swiss crisis. Our contribution is threefold. First, we provide a new monthly dataset covering the performance of the real economy from January 1926 to December 1938. Second, we estimate the structural parameters of a New Keynesian small open economy model for Switzerland in the spirit of Clarida *et al.* (2000, 2001) and Galí and Monacelli (2005), going beyond the calibration exercise in Bordo *et al.* (2007). We explicitly take into account the fact that Switzerland was not forced to increase nominal interest rates during the Gold Bloc period due to the massive gold inflow starting with the German crisis in June 1931 and intensifying after Britain went off gold. Following Ireland (2004), the model incorporates a vector autoregressive measurement error component capturing the dynamics in the data which are not represented by the economic part. This feature allows to assess the model's suitability for the data under analysis. Moreover, it is possible to compare the relative importance of the structural shocks (foreign demand shock and terms of trade shock) with the contribution of the measurement error block by looking at the decomposition of the forecast error variance. The results show that the economic part of the model contributes a significant variance share. The structural approach enables us to embark on a counterfactual experiment by simulating the Swiss economy in the case of a devaluation of the Swiss franc in September 1931, the month at which the UK left gold.

Our results show that the terms of trade shock played an important role for the Swiss economy during the Interwar Period. While foreign demand was recovering after 1932, the terms of trade further deteriorated. Consequently, the latter effect dominated the foreign demand impulse and led to a long lasting recession, which only ended when Switzerland left gold in September 1936. As a result, our counterfactual analysis implies that in case of an earlier devaluation of the Swiss franc, the economy would have recovered a lot faster and reached its steady state level shortly after leaving gold: the decision to defend the parity turned out to be extremely costly. This finding is in line with the successful recovery of Sweden after leaving gold

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together with the UK (Rathke *et al.*, 2011).

Our third contribution is that we provide a thorough discussion of how prices behaved from 1926 to 1938. In particular, we detect severe price rigidities, induced by a high degree of cartelization and regulatory measures, as an important characteristic of the Swiss economy in the Interwar Period. Moreover, our estimation results not only confirm this finding but also emphasize the cost of it. A counterfactual analysis shows that a lower degree of price stickiness would have been beneficial for the Swiss economy. This result highlights the potential benefits of an internal devaluation and the cost of corporatist policies.

The remainder of the paper is organized as follows. Section 2 motivates and outlines the underlying model. In Section 3 we present the data and our estimation strategy. Section 4 discussed the results and Section 5 concludes.

2 The Model

The underlying model corresponds to the basic New Keynesian small open economy model as introduced by Galí and Monacelli (2005) and Galí (2008). Already in the Interwar years, the Swiss economy was characterized by a high degree of openness.[2] Thus, we believe it is important to model open economy characteristics explicitly. Moreover, we follow Calvo (1983) by modeling nominal price rigidities. This seems to be an important stylized fact for the period under analysis: a large share of domestic prices and wages was fixed by the government. Not only did it own the national monopoly for mail, telegram and telephone services and the Swiss federal railway, but also began to stabilize agricultural prices in the midst of the depression (Rutz, 1970, p. 180–184).

Price rigidities became an issue already in the 1920s, illustrated by the increasing difference between wholesale and consumer prices after the recession of 1921/22 (Kaufmann 1952, Marbach 1952, p. 747; see upper part of Figure 4). Especially the degree of cartelization of the Swiss economy was blamed for this development.[3]

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[2]E.g. in 1928 exports accounted for 20 percent of GDP (Source: *Die Volkswirtschaft*, 1924–1944).

[3]Commenting on the first results of the cartel enquête of the *Preisbildungskommission* in 1937,

Regional monthly prices for important consumption goods provide an impression of price stickiness in the 1920s. The data on regional prices cover the period 1924–1929.[4] From 33 municipalities,[5] the most frequent prices per month are reported for 15 consumption goods,[6] which amounts to a total of 495 time series. Counting the frequency of monthly price changes in these price series reveals a very low modus of 0.07, which is depicted in Figure 2.

The regional variation is not very high (25% quantile: 0.080; 50% quantile: 0.090; 75% quantile: 0.110; Figure 3), suggesting that price stickiness was a regionally wide spread phenomenon. The cantons with a low degree of price stickiness as compared to the rest are Zurich, St. Gall, Lucerne, Solothurn, and Ticino, ranging from the alpine South to the industrialized North–West of Switzerland.

In order to address the issue, the ministry of economics (*Eid. Volkswirtschaftsdepartement, EVD*) installed a new committee to study price formation (*Preisbildungskommission*) in 1926, but without any control rights.[7]

A department for price controls (*Preiskontrollstelle*) was founded in 1931, in re-

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Fritz Marbach, a member of the commission from 1931 to 1965 and president from 1939 on, stated that free pricing was the exception rather than the rule ("[...] *im allgemeinen darf man aber wohl behaupten, dass der Kartellpreis und nicht der 'freie Preis' die Regel ist*"; Marbach 1937, p. 34). He repeats this assessment in his overview article on cartels in the 1955 edition of the *Handbuch der Schweizerischen Volkswirtschaft* ("*Der freie Preis ist in der schweizerischen Wirtschaft eine Ausnahme.*" Marbach, 1955, p. 19). The stability of cartelization in Switzerland can be explained by the attitude of the public (see Katzenstein 1985, 2003 and the discussion in Straumann 2010, p. 344–345 for the importance of democratic corporatism for European small open economies). Illustrating this phenomenon, Marbach joked that the Swiss are in principle in favor of free markets, under the condition that they are exempt ("*Der Schweizer ist dem Prinzip des freien Wettbewerbes (allerdings nimmt er sich dabei nur allzuleicht selber aus) im grossen und ganzen recht gewogen.*" Marbach, 1952, p. 754). For an overview of cartelization in Switzerland, see Eidgenössisches Volkswirtschaftsdepartement (1957) and Schröter (2011).

[4]For 1924 to 1927, they come from the *Sozialstatistische Mitteilungen*, edited by the *Eidg. Arbeitsamt*. After 1927, the source is the *Wirtschaftliche und sozialstatistische Mitteilungen*, edited by the *Eidg. Volkswirtschaftsdepartement*.

[5]Aarau, Arbon, Baden, Basle, Berne, Biel, La Chaux–de–Fonds, Chur, Frauenfeld, Fribourg, Geneva, Glarus , Herisau, Langenthal, Lausanne, Liestal, Le Locle, Lugano, Luzern, Neuchâtel, Olten, Porrentruy, Rorschach, St. Gall, St–Imier, St. Moritz, Schaffhausen, Schwyz, Sion, Solothurn, Vevey, Winterthur, Zurich, Zug. We take these municipalities as representative for the respective canton (Figure 3).

[6]Beef (*Ochsenfleisch mit Knochen, zum Sieden*), pork (*frisches mageres Schweinefleisch mit Knochen*), veal (*Kalbsfleisch, 1. Qualität mit Knochen*), fat (*inländisches Schweineschmalz, frisches Nierenfett*), butter (*Tafelbutter*), cheese (*Emmentaler–, Greyerzer– oder Appenzellerkäse, 1. Qualität*), milk (*Vollmilch*), bread (*Vollbrot*), flour (*Weissmehl*), pasta (*offene Teigwaren, Mittelqualität*), sugar (*Kristallzucker weiss*), potatoes (*neue inländische Kartoffeln*), eggs (*inländische Trinkeier*), coal (*Braunkohlenbriketts, ins Haus geliefert*).

[7]For the following, see Lautner (1950, p. 1–12), Eidgenössische Zentralstelle für Kriegswirtschaft (1950, p. 877–887), and Marbach (1952).
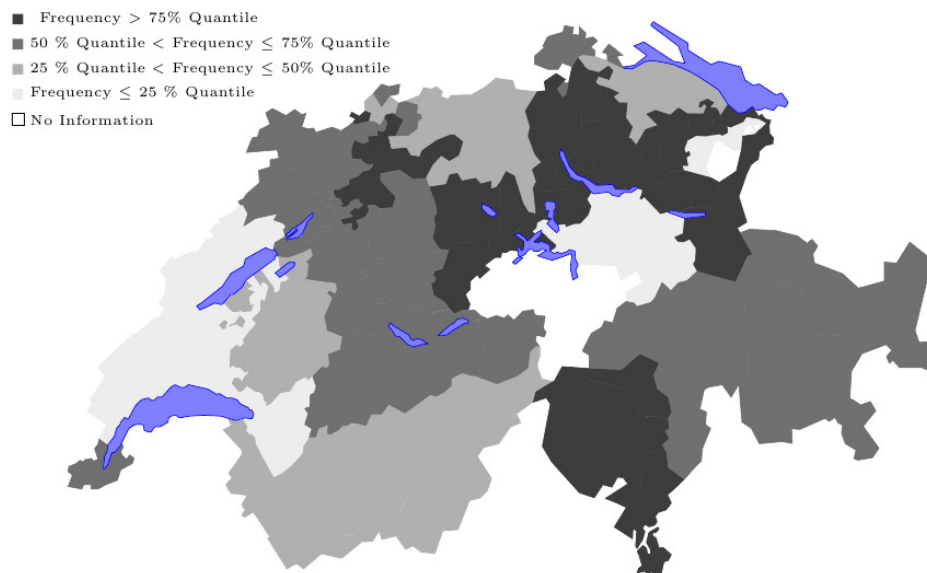
Figure 2: Price Stickiness, 1924–1929
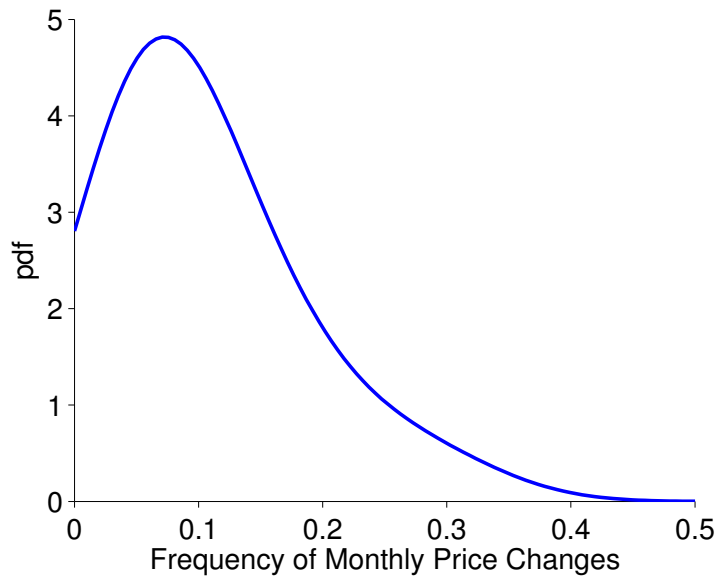
Notes: Gaussian kernel density estimator, bandwidth: (Pagan and Ullah, 1999, equation 2.50); data sources: see text.

Figure 3: Regional Price Stickiness, 1924–1929

Notes: Frequency of monthly price changes; 33 municipalities, 15 prices (179 potential changes; data sources: see text); 25% quantile: 0.080; 50% quantile: 0.090; 75% quantile: 0.110. There are no prices available for Central Switzerland cantons such as Uri and Obwalden/Nidwalden, and also for Appenzell Innerrhoden.

Figure 4: Producer and Consumer Price Indices, 1926–1938
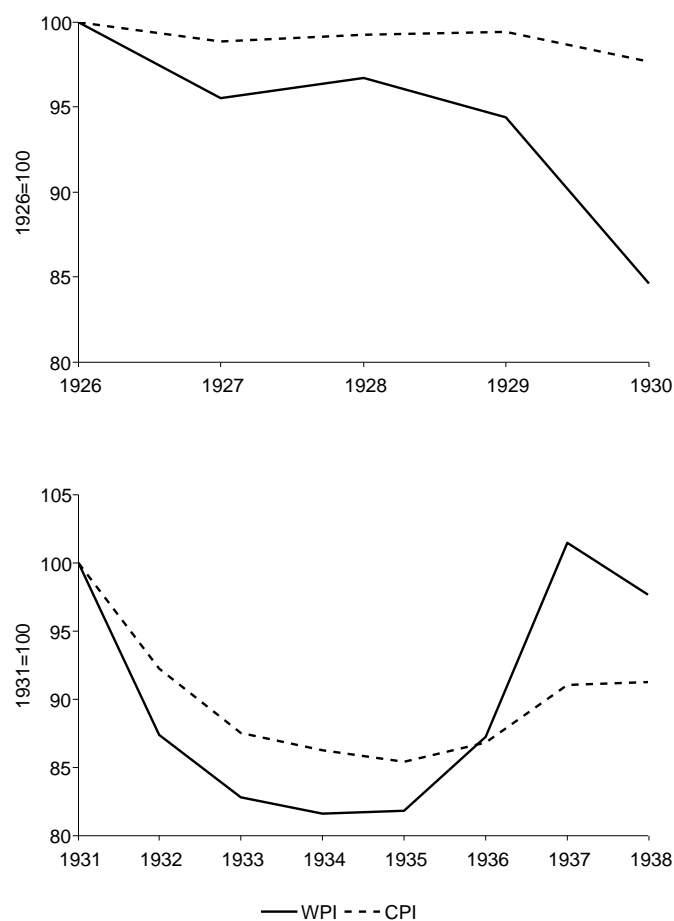
sponse to the Great Depression. Its main purpose was to monitor the influence of import restrictions on prices and to prevent *unjustified* price increases. In the beginning, it lacked effectiveness, because it depended heavily on voluntary cooperation. The lower part of Figure 4 illustrates this lack of effectiveness: wholesale prices kept falling faster than consumer prices. As a consequence and in fear of inflationary pressure due to the devaluation of the Swiss franc in September 1936, the Swiss parliament decided to implement direct price controls in 1936. The *Preiskontrollstelle* was authorized to collect necessary data and regulate prices. These regulations had two purposes: to protect consumers against unjustified price increases, and also to protect producers from price dumping. For example, milk prices were pegged by compulsory cartels and quotas, and export of watches became only possible condi-

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tional to complying with the price regulations of the watch industry (Hug, 1938, p. 364–366). Almost all prices were regulated (goods and services, gas, electricity, rents), and from September 1936 on, could only be increased with official approval, and even with approval, the adjustment had to be stepwise (Hug, 1938, p. 362). The effectiveness of this regulatory intervention can be seen from the lower part of Figure 4: while wholesale prices started to increase steeply after 1936, the increase in consumer prices was only moderate. In 1950, the central office for war economics (*Eidgenössische Zentralstelle für Kriegswirtschaft*) reported overall success: due to the interventions, consumer prices adjusted much slower in the period 1939–1946 than in 1914–1921, when there was no intervention (Eidgenössische Zentralstelle für Kriegswirtschaft, 1950, p. 898).

Table 2: Decomposition of Swiss Money Supply, 1922–1936

Year	$M1$	$\frac{M1}{BASE}$	$\frac{BASE}{RES}$	$\frac{RES}{GOLD}$	$PGOLD$	$QGOLD$	$\frac{RES}{BASE}$
1922	2395	2.10	1.60	1.12	3.44	186.00	0.62
1923	2327	2.14	1.50	1.15	3.44	182.76	0.66
1924	2285	2.21	1.31	1.33	3.44	172.63	0.76
1925	2411	2.41	1.29	1.40	3.44	161.95	0.78
1926	2538	2.51	1.32	1.41	3.44	158.51	0.76
1927	2652	2.48	1.38	1.34	3.44	168.79	0.73
1928	2792	2.43	1.37	1.45	3.44	168.48	0.73
1929	3122	2.60	1.22	1.59	3.44	180.04	0.82
1930	3232	2.48	1.22	1.50	3.44	207.51	0.82
1931	4006	1.56	1.05	1.05	3.44	683.12	0.95
1932	4066	1.53	1.04	1.04	3.44	719.30	0.97
1933	3675	1.68	1.09	1.01	3.44	581.59	0.92
1934	3439	1.67	1.08	1.00	3.44	555.89	0.93
1935	3136	1.79	1.25	1.01	3.44	404.24	0.80
1936	3934	1.41	1.01	1.02	3.44	788.52	0.99

Notes: M1, the monetary base (BASE), the gold reserves (GOLD), and the total reserves (RES) are measured in millions of Swiss francs. The gold parity (PGOLD) corresponds to the price of one gram of gold in Swiss francs. QGOLD denotes the quantity of gold reserves in tons.
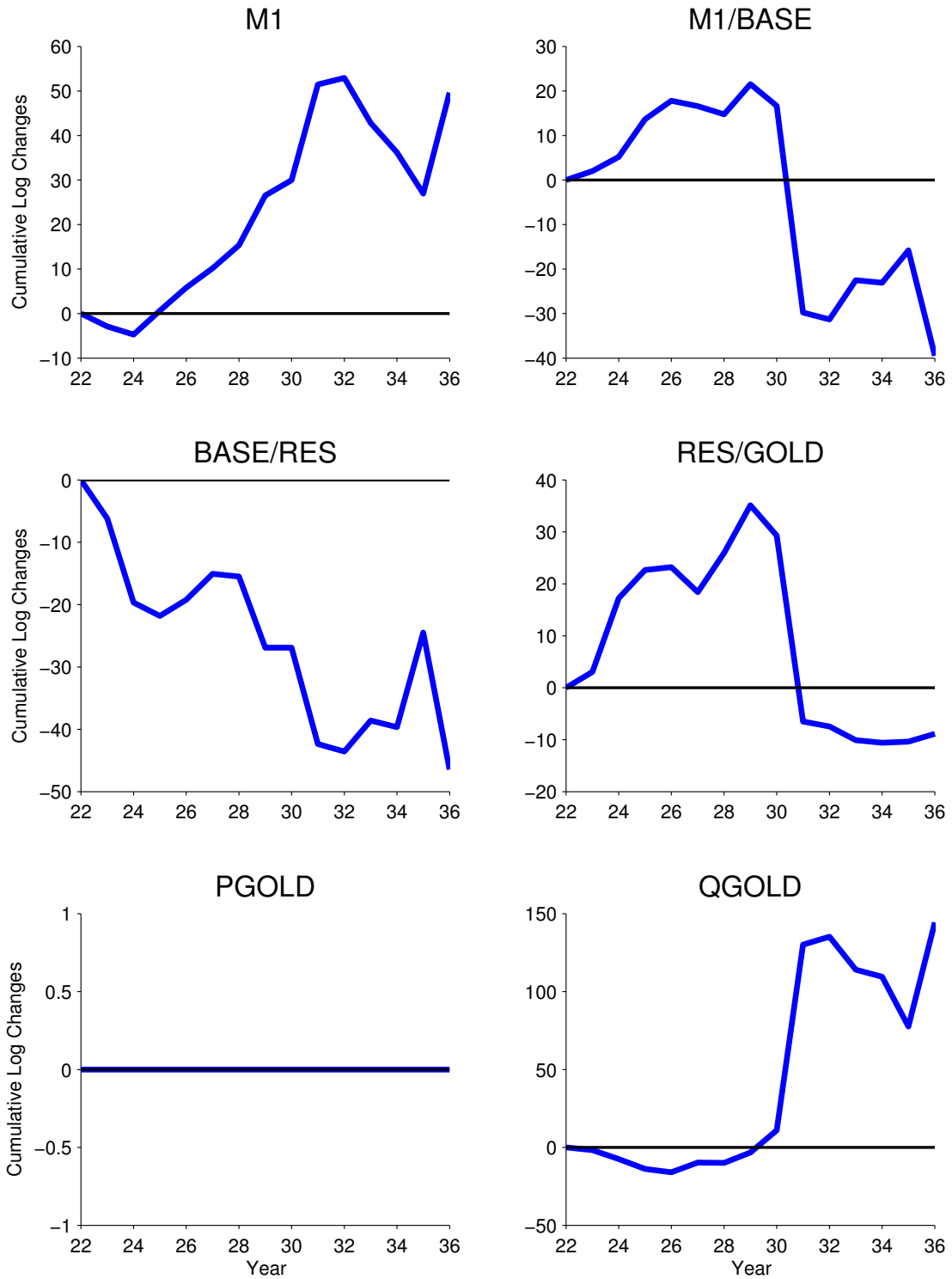Source: Swiss National Bank
`www.snb.ch/n/mmr/reference/histz_gm/source` (T1.3 and T2.2)
`www.snb.ch/n/mmr/reference/histz_snb/source` (T1.1)
`www.snb.ch/en/mmr/reference/histz_snb_book/source` (page 31)

Figure 5: Decomposition of Swiss Money Supply, 1922–1936

**Source:** Swiss National Bank, see Table 2 for further detail.

Lastly, as stated in the introduction, we do not include a gold standard mechanism. To motivate our choice of model, we follow Bernanke (1995) and decompose Swiss money supply ($M1$) in the period 1922–1936 into contributions of the money multiplier ($M1/BASE$, $BASE$: monetary base), the inverse of the gold backing ratio ($BASE/RES$; RES: international reserves), the ratio of international reserves to gold ($RES/GOLD$), and the gold reserves of the Swiss National Bank, expressed in domestic currency ($GOLD = PGOLD \times QGOLD$):

$$M1 = \frac{M1}{BASE} \times \frac{BASE}{RES} \times \frac{RES}{GOLD} \times PGOLD \times QGOLD \qquad (1)$$

The results reported in Table 2 and Figure 5 indicate that Switzerland did not fully commit to the *rules of the game* of the Gold Standard during the Interwar Period: the ratio of the monetary base to international reserves ($BASE/RES$) is not stable and hence the cover ratio was significantly varying over time. In fact, it went up from 78% in 1925 to 1 almost 100% in 1931. Consequently, an inflow of international currency reserves and gold reserves did not fully translate into an increase of the monetary base proportional to the cover ratio. Therefore, we refrain from including a particular Gold Standard mechanism into the model as opposed to e.g. Bordo *et al.* (2007).

Ultimately, we would like to assess whether an overvalued currency or the worldwide economic downturn was the main determinant of the long lasting recession in Switzerland. Consequently, we model both terms of trade and foreign demand as exogenous structural shocks. Using the dynamic stochastic general equilibrium approach allows to measure over–/undervaluation of the Swiss franc and to conduct counterfactual analysis in a straightforward way. Furthermore, we study the role of price rigidities and its importance during the Interwar Period in Switzerland. Therefore, we allow for monopolistic competition and nominal rigidities. The home economy is infinitesimal small and does not affect the economy of the rest of the world, and markets are assumed to be complete, i.e. agents trade a full set of state contingent bonds. In every period, economic agents form rational expectations, the representative household maximizes expected lifetime utility, and firms maximize

Figure 6: Model Overview
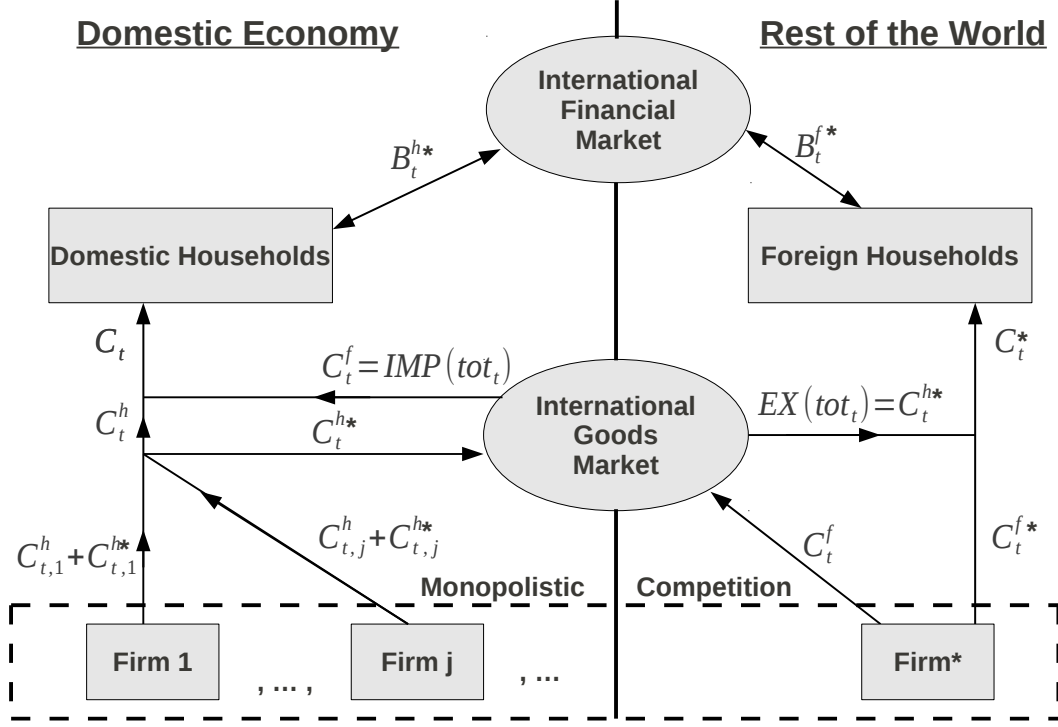
expected profits. A sketch of the model and presented in Figure 6, while more de-tailed description of the model, which corresponds to a basic New Open Economy Model, is presented below.

2.1 Households

The economy is populated by an infinitely lived representative household who seeks to maximize

$$\mathrm{E}_0\left[\sum_{t=0}^{\infty}\beta^t U(C_t, N_t)\right] \quad \text{with} \quad U(C_t, N_t) = \left(\frac{C_t^{1-\sigma}}{1-\sigma} - \frac{N_t^{1+\eta}}{1+\eta}\right)$$

by optimally choosing consumption C_t and labor input N_t. Its period t budget constraint looks as follows:

$$P_t C_t + Q_t B_{t+1} = W_t N_t + B_t, \tag{2}$$

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where Q_t denotes the price of a one–period discount bond paying off one unit of domestic currency at time $t + 1$, $\mathrm{E}_t[Q_{t,t+1}] \equiv Q_t = \frac{1}{R_t}$. P_t, B_t, W_t, σ, η, and β denote the consumer price index, bond holdings, the nominal wage, the inverse of the elasticity of substitution, the inverse of the wage elasticity of labor supply, and the discount factor respectively. Moreover, we impose a standard no–Ponzi condition, $\lim\limits_{j \to \infty} \mathrm{E}_t\left[\frac{B_{t+\tau}}{\prod_{j=0}^{\tau} R_{t+j}}\right] = 0$, which implies that the period budget constraint always holds with equality. C_t denotes a consumption composite index, i.e.

$$C_t = \left((1 - \gamma)^{\frac{1}{a}} \left(C_t^h\right)^{\frac{a-1}{a}} + \gamma^{\frac{1}{a}} \left(C_t^f\right)^{\frac{a-1}{a}}\right)^{\frac{a}{a-1}}, \tag{3}$$

where C_t^f refers to one single foreign good, $C_t^h \equiv \left(\int_0^1 \left(C_{t,j}^h\right)^{\frac{\theta}{\theta-1}} \mathrm{d}j\right)^{\frac{\theta}{\theta-1}}$ corresponds to a Dixit–Stiglitz Constant Elasticity of Substitution (CES) aggregate of domestic goods, and $C_{t,j}^h$ a domestic variety j. The exact composition C_t^h and C_t^f is optimally chosen by the households according to the demand functions

$$C_t^h = \left(\frac{P_t^h}{P_t}\right)^{-a} C_t(1 - \gamma) \quad ; \quad C_t^f = \left(\frac{P_t^f}{P_t}\right)^{-a} C_t \gamma. \tag{4}$$

Moreover, P_t^f captures the foreign price of the foreign produced good, the preference parameter $\gamma \in [0, 1]$ represents a measure of home bias[8], $a > 0$ governs the substitutability between domestic and foreign goods, and $\theta > 0$ denotes the elasticity of substitution between domestic varieties. The household's utility maximization problem at period t can be summarized as

$$\max_{\{C_\tau, N_\tau, B_{\tau+1}\}} \mathrm{E}_t\left[\sum_{\tau=t}^{\infty} \beta^{\tau-t} \left(\frac{C_\tau^{1-\sigma}}{1-\sigma} - \frac{N_\tau^{1+\eta}}{1+\eta}\right)\right] \tag{5}$$
$$\text{s.t.} \quad P_\tau C_\tau + Q_\tau B_{\tau+1} \leq W_\tau N_\tau + B_\tau,$$

yielding the following two standard optimality conditions:

$$\frac{N_t^\eta}{C_t^{-\sigma}} = \frac{W_t}{P_t}; \tag{6}$$

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[8]Since it is equal to the import share, it can also be interpreted as a natural measure of openness (Galí, 2008).

$$\mathrm{E}_t\left[Q_{t,t+1}\right] = Q_t = \beta\mathrm{E}_t\left[\left(\frac{C_{t+1}}{C_t}\right)^{-\sigma}\left(\frac{P_t}{P_{t+1}}\right)\right]. \tag{7}$$

Equation (6) captures optimal static labor supply decision, i.e. marginal rate of substitution between labor and leisure is equal to the real wage rate, while the inter–temporal Euler equation is represented by equation (7).

2.2 Firms

Firm j produces output $Y_{t,j}$ using the production technology

$$Y_{t,j} = N_{t,j}, \tag{8}$$

with labor as the only input factor. Profits are maximized by minimizing costs for a given amount of output, i.e.

$$\min_{\{N_{t,j}\}}\frac{W_t}{P_t^h}N_{t,j}, \qquad \text{s.t.} \qquad Y_{t,j} = N_{t,j}. \tag{9}$$

The resulting first order condition contains the real marginal costs of production, which is denoted by Ψ_t. Since marginal costs are constant, Ψ_t is also equal to the real average cost or real unit cost of production:

$$\frac{W_t}{P_t^h} - \Psi_t = 0 \Leftrightarrow \Psi_t = \frac{W_t}{P_t^h} = W_t^r. \tag{10}$$

In equilibrium, goods market clearing implies

$$Y_t = C_t^h + C_t^{h\star}, \tag{11}$$

which implies that aggregate output Y_t is fully absorbed by domestic consumption of the domestically produced good C_t^h and foreign consumption of the domestic good $C_t^{h\star}$. This leads to the demand functions for variety j,

$$C_{t,j}^h + C_{t,j}^{h\star} = \left(\frac{P_{t,j}^h}{P_t^h}\right)^{-\theta}Y_t. \tag{12}$$

$P_{t,j}^h$ denotes the price of domestic variety j, and P_t^h corresponds to the price index of domestic goods.

Prices are sticky in the sense that with a probability ω firms are not allowed to optimally update their price at the beginning of the period. As stated above, price stickiness is an important stylized fact for the period under analysis: a large share of domestic prices and wages was fixed by the government. The pricing mechanism used here goes back to Calvo (1983). $\bar{P}_{t,j}^h$ denotes the price set by firm j in period t, which implies $P(P_{t+\tau,j}^h = \bar{P}_{t,j}^h) = \omega^\tau$. Moreover, since all firms are identical and face identical demand curves, $\bar{P}_{t,j}^h = \bar{P}_t^h$.

Therefore, period t profit of firm j, conditional on being allowed to reset its price is

$$\pi_{t,j} = \left(\bar{P}_t^h - P_t^h \Psi_t \right) \left(C_{t,j}^h + C_{t,j}^{h\star} \right) = \left(\bar{P}_t^h - P_t^h \Psi_t \right) \left(\frac{\bar{P}_t^h}{P_t^h} \right)^{-\theta} Y_t, \tag{13}$$

where $P_t^h \Psi_t$ corresponds to the nominal unit costs. Conditional on being allowed to reset its price level, firm j maximizes the expected current market value of profits while the price remains effective. In particular,

$$\max_{\{\bar{P}_t^h\}} \quad \mathrm{E}_t \left[\sum_{\tau=0}^{\infty} \omega^\tau Q_{t,t+\tau} \left(\bar{P}_t^h - P_{t+\tau}^h \Psi_{t+\tau} \right) \left(\frac{\bar{P}_t^h}{P_{t+\tau}^h} \right)^{-\theta} Y_{t+\tau} \right], \tag{14}$$

where $Q_{t,t+\tau} = \beta^\tau \frac{\Lambda_{t+\tau}}{\Lambda_t}$ denotes the stochastic discount factor for nominal payoffs. The first order condition with respect to $\bar{P}_t^h$ is

$$\mathrm{E}_t \left[\sum_{\tau=0}^{\infty} \omega^\tau Q_{t,t+\tau} \frac{\Lambda_{t+\tau}}{\Lambda_t} Y_{t+\tau} \left((1-\theta) \left(\frac{\bar{P}_t^h}{P_{t+\tau}^h} \right)^{-\theta} + \theta \left(\frac{\bar{P}_t^h}{P_{t+\tau}^h} \right)^{-\theta-1} \Psi_{t+\tau} \right) \right] = 0. \tag{15}$$

2.3 Global Characteristics

2.3.1 Exchange Rate & Terms of Trade

We assume that the law of one price holds, i.e.

$$P_t^f = S_t P_t^\star, \tag{16}$$

where $P_t^\star$, P_t^f, S_t denote the foreign price of the foreign produced good denoted in foreign currency, the foreign price of the foreign produced good denoted in domestic currency, and the nominal exchange rate, expressed as the price of foreign currency in terms of domestic currency respectively. The real exchange rate is

$$\Phi_t = \frac{P_t^f}{P_t} = \frac{S_t P_t^\star}{P_t}, \tag{17}$$

and corresponds to the price of a foreign good in terms of domestic consumption bundles, while the terms of trade, the price of a foreign good in terms of domestic goods, is defined as

$$\Delta_t = \frac{P_t^f}{P_t^h} = \frac{S_t P_t^\star}{P_t^h}, \tag{18}$$

and follows an exogenous[9] and stationary first–order autoregressive (AR(1)) process in logs,

$$\ln(\Delta_t) = \rho_\delta \ln(\Delta_{t-1}) + \epsilon_t^\delta, \qquad \epsilon_t^\delta \sim N(0, \sigma_\delta^2), \tag{19}$$

where $\rho_\delta < 1$ characterizes the persistence parameter and σ_δ^2 the variance of the shock ϵ_t^δ.

2.3.2   Foreign Country

The domestic economy is an infinitesimal small open economy whereas the foreign economy can be thought of as an aggregate of infinitely many identical infinitesimal small open economies. Therefore, in the aggregate, net exports of all foreign economies will sum up to zero, which implies $C_t^\star = Y_t^\star$. Foreign consumption $C_t^\star$ is equal to foreign demand $Y_t^\star$, which follows an exogenous and stationary AR(1) process in logs,

$$\ln(Y_t^\star) = (1 - \rho_\star) \ln(Y^\star) + \rho_\star \ln(Y_{t-1}^\star) + \epsilon_t^\star, \quad \epsilon_t^\star \sim N(0, \sigma_{y^\star}^2), \tag{20}$$

with a persistence parameter $\rho_\star$ smaller than one and a variance $\sigma_{y^\star}^2$ of the shock $\epsilon_t^\star$.

---

[9]We are aware of the fact that this specification is not fully consistent with the underlying model, because prices are endogenously determined. Lubik and Schorfheide (2007) point out that an estimation of the full structural model including endogenous terms of trade turned out to be too restrictive and therefore lead to implausible estimates. Consequently, we decided to to follow Lubik and Schorfheide (2007) by treating the terms of trade as an exogenous process.

2.3.3 International Trade

Exports are denoted in domestic goods and given by

$$EX_t = C_t^{h\star}. \tag{21}$$

For imports (denoted in domestic goods), we have

$$IM_t = \frac{P_t^f}{P_t^h} C_t^f \tag{22}$$

Net exports (denoted in domestic goods) are the difference between exports and imports,

$$NX_t = EX_t - IM_t. \tag{23}$$

2.3.4 International Risk Sharing

International risk sharing under complete markets implies that the stochastic discount factor among different countries is equal to (Chari *et al.*, 2002)

$$Q_{t,t+1} = \beta \left(\frac{C_{t+1}}{C_t} \right)^{-\sigma} \frac{P_t}{P_{t+1}} = \beta \left(\frac{C_{t+1}^\star}{C_t^\star} \right)^{-\sigma} \frac{S_t P_t^\star}{S_{t+1} P_{t+1}^\star}, \tag{24}$$

where $P_t^\star$ denotes the foreign consumer price index, and which implies the following international risk sharing condition:[10]

$$\left(\frac{C_t^\star}{C_t} \right)^{-\sigma} = \Phi_t. \tag{25}$$

As a result, complete markets lead to this this simple relationship linking the real exchange rate to the ratio of the marginal utilities of consumption of domestic and foreign households.

---

[10] $\left(\frac{C_t^\star}{C_t} \right)^{-\sigma} = \underbrace{\left(\frac{C_0^\star}{C_0} \right)^{-\sigma} \frac{1}{\Phi_0}}_{\mu} \Phi_t = \mu \Phi_t$ represents the general form of the risk sharing condition.
Without loss of generality we set the initial condition μ equal to one.

2.4 Market Clearing and Aggregate Production Function

The firm level production function is represented by

$$N_{t,j} = Y_{t,j}. \tag{26}$$

Labor market clearing implies

$$N_t = \int_0^1 N_{t,j} \mathrm{d}j, \tag{27}$$

which enables us to compute the aggregate production function

$$N_t = \int_0^1 Y_{t,j} \mathrm{d}j = \int_0^1 \left(\frac{P_{t,j}^h}{P_t^h} \right)^{-\theta} \left(C_t^h + C_t^{h\star} \right) \mathrm{d}j =$$

$$= Y_t \underbrace{\int_0^1 \left(\frac{P_{t,j}^h}{P_t^h} \right)^{-\theta} \mathrm{d}j}_{\zeta_t} = Y_t \zeta_t \quad \Leftrightarrow$$

$$Y_t = \frac{N_t}{\zeta_t}. \tag{28}$$

ζ_t can be seen as a measrure of price dispersion. The full set of optimality conditions can be found in Appendix A.

3 Data and Estimation Method

For the estimation exercise, we use monthly data of industrial production, inflation, and net exports, ranging from January 1926 to December 1938. An official industrial production index is not available before 1965 (Cascioni, 2000, p. 281). Already in the 1930s, this situation was deemed unsatisfactory, at least from the viewpoint of the Federal Statistical Office.[11] The problem of the missing Swiss production index (*Das Problem einer schweizerischen Produktionsstatistik*) was discussed at the 1936 meeting of the the Swiss Statistical Society (*Schweizerische Statistische Gesellschaft*).

---

[11] *"Ein grosser Teil der schweizerischen Bevölkerung ist auf Gedeih und Verderb auf den Ertrag der industriellen Anlagen und auf ihre Beschäftigung in ihnen angewiesen. Wie gross ist dieser Ertrag? Wir kennen ihn nicht."* (Schwarz, 1936, p. 147)

The overview in the *Statistisches Handbuch der Weltwirtschaft* published by the German statistical office in 1936 (Statistisches Reichsamt, 1936) showed that of the 80 countries in the collection, 54 had industrial production statistics, Switzerland not being among them. To explain the situation, industrial representatives (building, engineering, textile and printing) listed the general reluctance of the industry providing the data,[12] the high cost of data collection, and the availability of high quality trade statistics, which sufficed the needs of the mainly export oriented Swiss industry, therefore making a production index superfluous.[13] Because of the lack of contemporaneous data, we could switch to the sectoral estimates provided by David (1995), but these series are only at an annual frequency. Therefore, we decided to use the business cycle indicators published in the period of interest as a proxy, and take SBB (Swiss Federal Railway) freight data, as well as indicators for silk and watch production,[14] which represent the two most important export industries in Switzerland in the Interwar Period.[15]

Inflation data is calculated based on the consumer price index taken from the Federal Statistical Office.[16] Based on household accounts from 1912, 1920, and 1921 for skilled laborers, unskilled laborers and employees, the index was first published in January 1922 by the Federal Office of Labour (*Eidgenössisches Arbeitsamt*), first only for food. Because of critique by employee organizations and trade unions, it was extended to other expenditure groups and, after the revision in 1926, consisted of food, fuel (soap), clothing and rent.[17]

As already mentioned, there are high quality trade statistics available for Switzerland, both by volume and value, at monthly frequency.[18] The Federal Customs Of-

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[12] *"Dann muss die Verbandsleitung auch mit einer Abneigung der Mitglieder rechnen, Dinge bekanntzugeben, welche die Grundlagen des Geschäfts betreffen. Diese Einstellung wäre besonders seitens der welschen Mitglieder zu gegenwärtigen, welche sich schon heute über einen angeblich überwuchernden 'esprit de police' der Verbände beklagen."* (Marti, 1936, p. 176)

[13] See the contributions by Cattani (1936), Bühler-Krayer (1936), Fischer (1936), and Marti (1936).

[14] Source: SNB monthly reports (1926–1929, 1936–1938) and *Die Volkswirtschaft* (1930–1936).

[15] See Figure B.1 in Appendix B for a time series of of the export shares of the two industries.

[16] Landesindex für Konsumentenpreise, `www.statistik.admin.ch` (cc-d-05.02.17.xls).

[17] See Gordon (1939) and Koch (2000) for an overview. The index prior to 1926 is described in detail in Eidgenössisches Arbeitsamt (1923), the revised index in Bundesamt für Industrie, Gewerbe und Arbeit (1935).

[18] See Acklin (1939) and Balmer and Zurwerra (2000) for an overview.

fice (*Eidgenössische Oberzolldirektion*) publishes these data since 1885. We use the *Monatsstatistik des auswärtigen Handels der Schweiz*, 1926–1938.[19]

The solution of the model described in Section 2 leads to a non–linear system of expectational first–order difference equations, which we log–linearize around its deterministic steady state, before solving it using the method proposed by Klein (2000). The solution of the model provides the policy functions, which can be written in state space form as

$$
\begin{aligned}
\mathbf{x}_t &= \mathbf{Z}\boldsymbol{\alpha}_t; \\
\boldsymbol{\alpha}_t &= \mathbf{T}\boldsymbol{\alpha}_{t-1} + \mathbf{R}\boldsymbol{\nu}_t, \quad \boldsymbol{\nu}_t \sim N(\mathbf{0}, \mathbf{Q}),
\end{aligned}
\tag{29}
$$

where $\mathbf{x}_t$ is a 3×1 vector of observables (output, inflation, and net exports), and $\boldsymbol{\alpha}_t$ is the 2×1 unobservable state vector driven by the two structural shocks in $\boldsymbol{\nu}_t$ with variance $\mathbf{Q}$. The model is of course a highly stylized representation of the Swiss economy in the 1930s. Therefore, we follow Ireland (2004) and incorporate a dynamic measurement error with a vector autoregressive (VAR) structure into the state vector to allow for off–model dynamics in the data:

$$
\boldsymbol{\kappa}_t = \mathbf{A}\boldsymbol{\kappa}_{t-1} + \boldsymbol{\epsilon}_t, \quad \boldsymbol{\epsilon}_t \sim N(\mathbf{0}, \boldsymbol{\Sigma}).
\tag{30}
$$

The structure of the extended state space model is therefore

$$
\begin{aligned}
\mathbf{x}_t &= \begin{pmatrix} \mathbf{Z} & \mathbf{I}_3 \end{pmatrix} \begin{pmatrix} \boldsymbol{\alpha}_t \\ \boldsymbol{\kappa}_t \end{pmatrix}; \\
\begin{pmatrix} \boldsymbol{\alpha}_t \\ \boldsymbol{\kappa}_t \end{pmatrix} &= \begin{pmatrix} \mathbf{T} & \mathbf{0} \\ \mathbf{0} & \mathbf{A} \end{pmatrix} \begin{pmatrix} \boldsymbol{\alpha}_{t-1} \\ \boldsymbol{\kappa}_{t-1} \end{pmatrix} + \begin{pmatrix} \mathbf{R} & \mathbf{0} \\ \mathbf{0} & \mathbf{I}_3 \end{pmatrix} \begin{pmatrix} \boldsymbol{\nu}_t \\ \boldsymbol{\epsilon}_t \end{pmatrix}.
\end{aligned}
\tag{29$'$}
$$

The setup allows to estimate the structural parameters of the model using Maximum Likelihood or Bayesian Markov Chain Monte Carlo (MCMC) methods. We choose the Bayesian approach, since in this framework, it is straightforward to impose parameter restrictions using the prior distribution. The restrictions are necessary because there is no guarantee that the estimation algorithm results in parameter

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[19]All data are available on request.

estimates which make sense from an economic point of view. If this turns out to be too restrictive, the measurement error variance will dominate the variance of the structural model.

Lastly, we calibrate two structural parameters prior to the estimation exercise. In particular, we set the subjective discount factor β equal to the conventional value of 0.99 and the preference parameter γ equal to the import share of the Swiss economy during the period of investigation.

We impose uniform priors with reasonable ranges for the structural parameters to be as loose as possible (see Table 3).[20] To generate the parameter chain, we use the tailored randomized MCMC method proposed by Chib and Ramamurthy (2010). The procedure is a modification of the standard Metropolis–Hastings algorithm (e.g. Chib and Greenberg, 1995). In each simulation step, the parameters are randomly combined into blocks. A proposal draw is generated from a multivariate t–distribution with a scale matrix derived at the conditional maximum of the posterior. The proposal is accepted if the value of the posterior at the new parameters is higher than for the old parameters. If not, it is accepted with an acceptance probability drawn from a uniform distribution $U(0,1)$, to ensure that we find a global maximum.

Since our estimation approach requires stationary data, we detrend our time series prior to estimation. Furthermore, in all our time series we observe a strong seasonal pattern. Therefore, we also deseasonalize the time series before the estimation. In particular, for output we use the cyclical component of a quadratically detrended and X–12[21] deseasonalized time series. For net exports we use a demeaned and X–12 seasonally adjusted time series, while for inflation we use monthly growth rates of year–to–year differences of the consumer price index. Data plots of the time series used for estimation can be found in Appendix B.

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[20]For the VAR–component, we require that the maximum absolute eigenvalue of $\mathbf{A}$ is less than 0.6 to ensure that the persistence in the model comes from the structural shocks. In addition, the matrix $\boldsymbol{\Sigma}$ has to be positive semidefinite, and the maximum measurement error variance is not allowed to take values of more than 60 percent of the variance of the corresponding observable time series. This is similar to García-Cicco *et al.* (2010), who restrict the measurement error variance "to absorb no more than 6 percent of the variance of the corresponding observable time series" (p. 2519). Since the vectorized variance covariance matrix of the VAR part is given by $\text{vec}\left(\boldsymbol{\Sigma}_{\boldsymbol{\kappa}}\right) = \left(\mathbf{I}_{3^2} - \mathbf{A} \otimes \mathbf{A}\right)\text{vec}\left(\boldsymbol{\Sigma}\right)$, our choice is not overly restrictive.

[21]Census Bureau's X–12 ARIMA procedure

4 Results

This section presents the results and findings of our estimation exercise. Unless otherwise mentioned, we focus on the results using SBB freight data as a proxy for output. However, occasionally we also complement our findings with result sets using silk or watch production instead of freight data.

4.1 Parameter Distributions

With the algorithm described in the previous section, we draw 400,000 replications, discarding the first 150,000 as burn–in. Geweke's χ^2–test (4% taper) is used to assess convergence of the parameter chains (Geweke, 1992). Results of the posterior distribution of the structural parameters[22] are presented in Table 3 and show a presence of high persistence in foreign demand, terms of trade, and prices. This finding underlines the fact that price rigidities seem to be an important feature of the Swiss economy at this time.

Table 3: Posterior Distributions of Structural Parameters

Parameter	Prior Dist.	Median	90% Bands	Gewekes χ^2
β	calibrated	0.99	-	-
γ	calibrated	0.25	-	-
θ	$U \sim [5,7]$	6.425	[5.312,6.946]	0.358
η	$U \sim [1.5,3]$	2.660	[1.861,2.967]	0.875
σ	$U \sim [1.5,3]$	2.705	[2.026,2.969]	0.835
a	$U \sim [3,6]$	3.097	[3.009,3.373]	0.337
ω	$U \sim [0.4,1]$	0.995	[0.993,0.996]	0.878
$\rho_{y^\star}$	$U \sim [0,1]$	0.989	[0.983,0.993]	0.355
ρ_δ	$U \sim [0,1]$	0.999	[0.997,1.000]	0.189
$\sigma_{y^\star}$	$U \sim [0.01,0.03]$	0.020	[0.014,0.029]	0.615
σ_δ	$U \sim [0.01,0.03]$	0.010	[0.010,0.010]	0.371

Notes: Results are based on 400,000 draws, where the first 150,000 are discarded as burn–in draws. SBB freight data is used for industrial production.

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[22]Posterior distribution of measurement error components can be found in Appendix C.

4.2 Forecast Error Variance Decomposition

The decomposition of the forecast error variance, presented in Figure 7 of output and inflation shows that the structural model, even though being quite stylized, contributes a significant part to the dynamics in the data, especially in the long run. Thus, we conclude that the choice of the model, though being quite stylized, turned out to be appropriate and well–suited for explaining macroeconomic fluctuations of the Swiss economy during the Interwar Period.
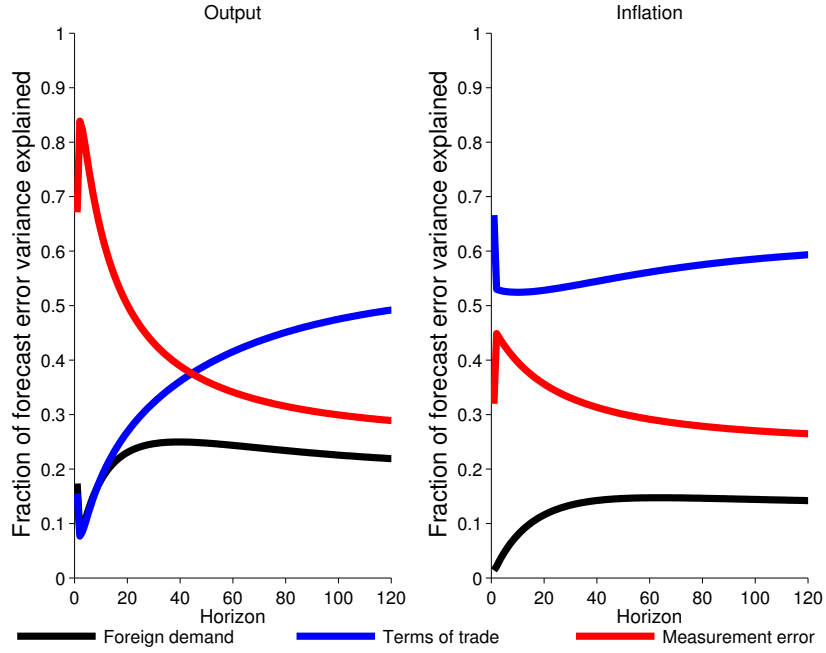
Figure 7: Forecast Error Variance Decomposition (SBB)
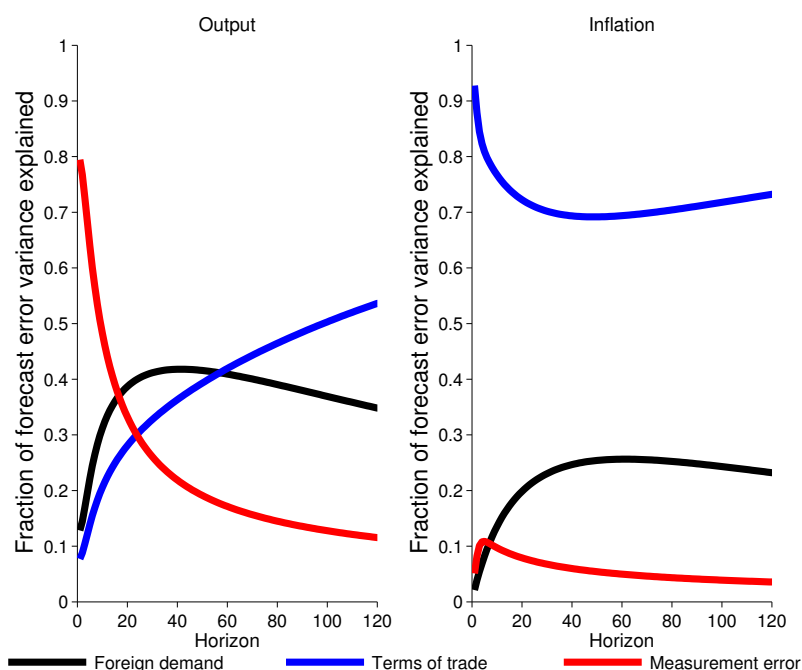
Notes: Results are based on median outcomes of the posterior distribution, SBB freight data is used for industrial production.

Furthermore, the structural model is more important for inflation than for output – this demonstrates again that price rigidity is an important feature of the Swiss economy in this period. Inflation is mainly driven by movements in terms of trade both in the short and in the long run. Off–model dynamics are more important for output, which indicates that the model is not able to capture all the dynamics of this eventful period, especially in the short run. However, the structural part of the model becomes more and more important at longer horizons so that in the long run the measurement error only accounts for about 10 percent of the variation

Figure 8: Forecast Error Variance Decomposition (Silk)

Notes: Results are based on median outcomes of the posterior distribution, silk production is used for industrial production.

Figure 9: Forecast Error Variance Decomposition (Watches)
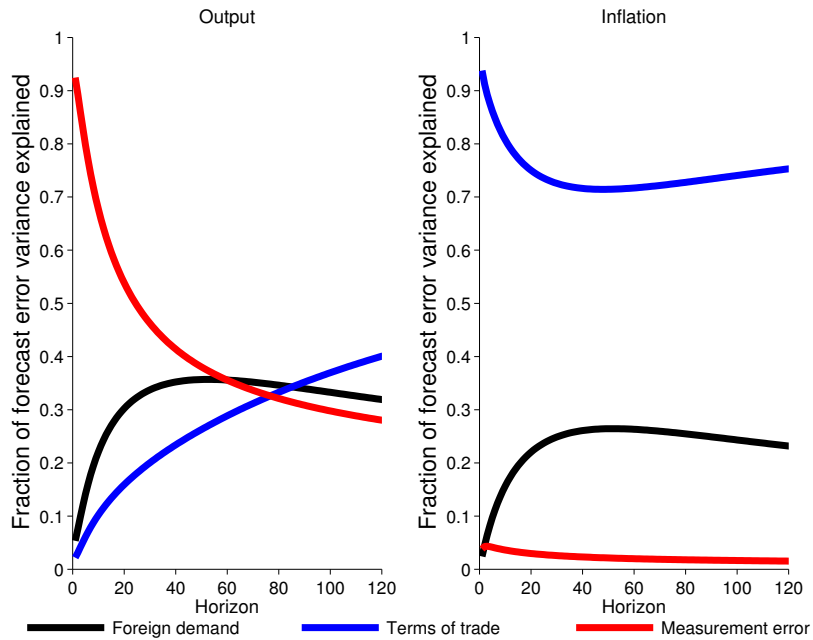
Notes: Results are based on median outcomes of the posterior distribution, watch production is used for industrial production.

in output. Regarding the two structural shocks, foreign demand is slightly more important than terms of trade in the the short run, which in turn becomes more important in the long run.

Figures 8 and 9 report the relative importance of the shocks in case we use silk or watch production as a proxy for output instead of SBB freight data. While the results reveal a worse model fit in general for these two specifications, we find qualitatively similar results for the forecast error variance decomposition. Hence, the importance of terms of trade turns out to be a robust finding.

4.3 Price Rigidities

Figure 10: Average duration of prices $(\frac{1}{1-\omega})$
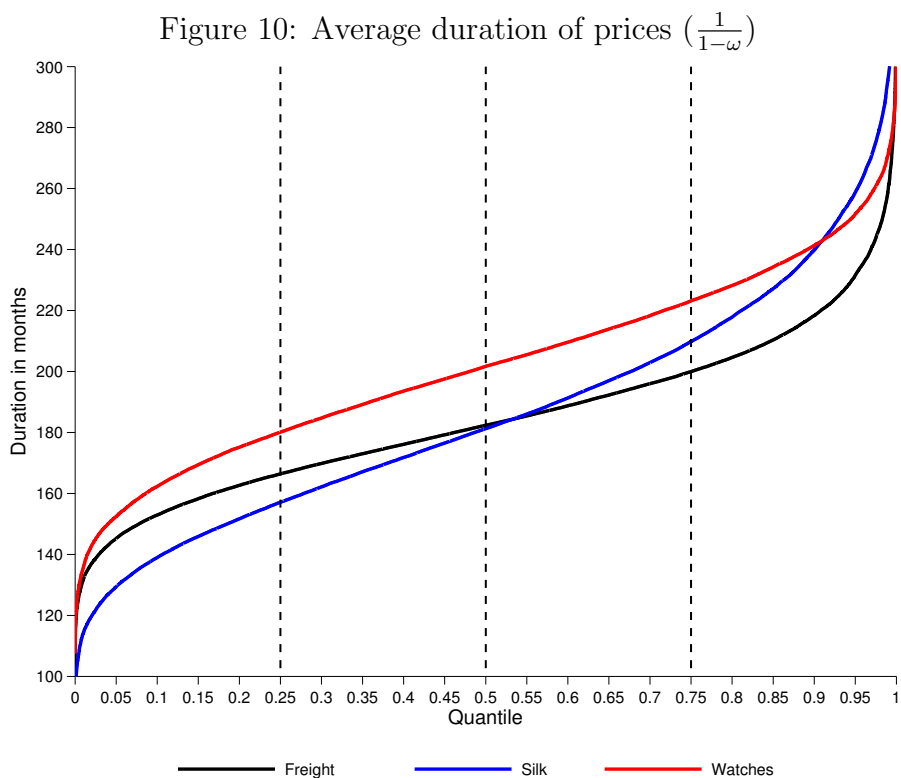
Notes: Average duration in months implies by the estimated posterior distributions.

Another robust finding is the presence of severe price rigidities. Figure 10 depicts the distribution of the average duration of a price being effective implied by the estimated posterior distributions of ω. It reveals that independent of the choice of the output time series ω seemed to be rather high, which translates into a high

degree of price stickiness. The remarkably high duration of prices being effective of the watches model is in line with an observed high degree of cartelization of the export sector as described in Section 2.

4.4 Estimated States

The fact that terms of trade and foreign demand are modeled as exogenous processes allows us to extract the model implied time series. The smoothed states displayed in Figure 11 are based on on 5,000 draws from the posterior distribution and using the Kalman filter to generate the time series. The foreign demand state shows the pattern of the business cycle for the main trading partners of Switzerland:[23] a downturn starting mid 1928, the lower turning point in 1932/33, and the recession 1936/37. This development should have helped Switzerland to escape earlier from the Great Depression. However, the terms of trade state shows that the Swiss franc stayed overvalued until autumn 1936. The sharp amelioration of the terms of trade time series almost perfectly coincides with the devaluation of the Swiss franc on September 26 in 1936. This finding is even more remarkable, since we did not include any data on exchange rates or terms of trade in the estimation exercise. A sharp decline after the outbreak of the Great Depression in 1929 can be observed, and the terms of trade did not reach equilibrium until the devaluation of the Swiss franc in September 1936. The forecast error variance decomposition of output reveals that terms of trade are more important than foreign demand. Consequently, the positive effect of increasing foreign demand after 1932/33 was overcompensated by the overvaluation of the Swiss franc, and the escape from the Great Depression did not start before September 1936.

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[23]See Table 1 for the import and export shares of the main trading partners in this period.

Figure 11: Estimated Exogenous States
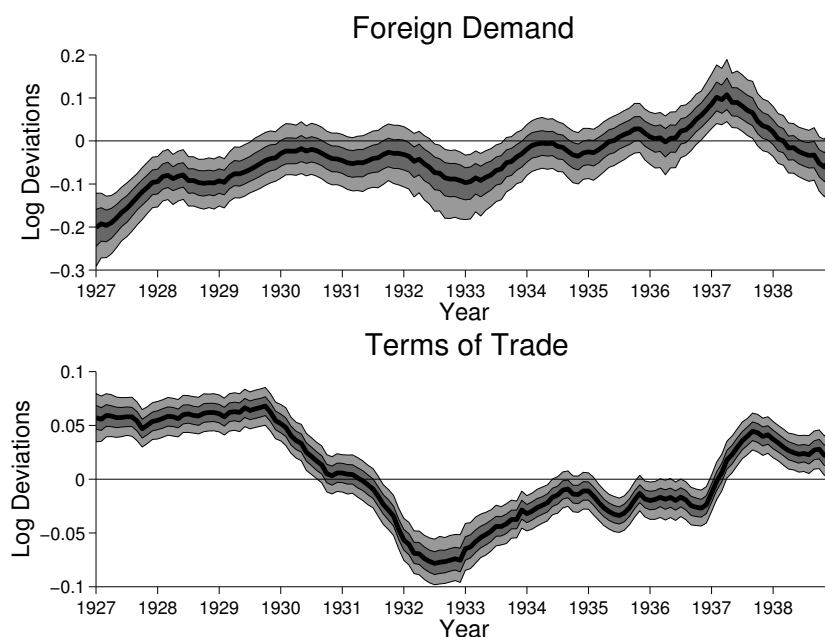
Notes: Results are based on 5,000 draws from the posterior distribution. Light–gray shaded area represents 95% probability bands, dark–gray shaded area represents 68% probability bands, black line represents median.

4.5 Counterfactual Experiments

4.5.1 Leaving Gold in 1931/33

What would have been the consequence of Switzerland leaving the Gold Standard together with Britain on September 21, 1931? What would have happened in case Switzerland did not participate in the Gold Block in July 1933 but devaluated their currency instead? To address the issue, we simulate the case of an early devaluation by setting the terms of trade state equal to one (i.e. the terms of trade are in equilibrium) and use 5,000 draws from the posterior parameter distribution and the Kalman filter to generate the counterfactual time series of interest. We calculate the differences between the predicted log deviations of output from the actual deviations, which is equal to percent differences in levels. As can be seen from Figure 12, this difference turns out to be always positive after 1932. This is in line with our previous interpretation: obviously, the overvaluation of the Swiss franc against the sterling

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bloc and the US dollar caused the Swiss exporting sectors to profit less from the increasing demand after 1932/33 than small European countries with a devalued currency such as the Scandinavian countries. At least, there was some growth: in real terms, exports increased by 16% between 1932 and 1934. But in 1935, when sterling further weakened, the upward trend of exports decelerated.

Figure 12: Estimated Gain of Leaving Gold in September 1931 / July 1933
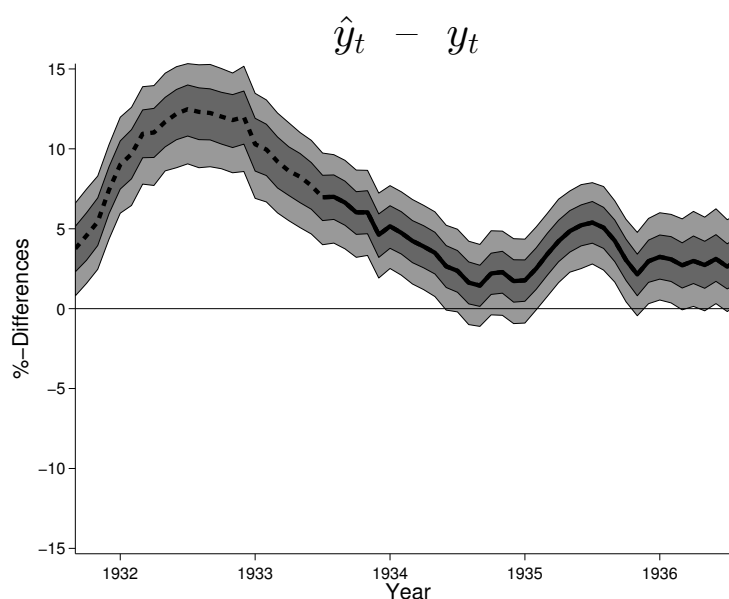
$$\hat{y}_t \ - \ y_t$$

Notes: Results are based on 5,000 draws from the posterior distribution. Light–gray shaded area represents 95% probability bands, dark–gray shaded area represents 68% probability bands, black line represents median.

4.5.2   Alleviating Price Rigidities

What would have been the implications for the Swiss economy of a lower degree of price stickiness? Would a policy intervention decreasing the degree of cartelization have been beneficial? We draw 5,000 times from the posterior distribution and set ω equal to a lower counterfactual value. As a consequence, firms are in this experiment allowed to reset their price level more frequently. We analyze two different scenarios: (i) strong intervention (small ω): the average duration of prices being effective reduces from 182 to 50 months, and (ii) medium intervention (medium ω): the average duration of prices being effective reduces from 182 to 100 months. As a

next step, we estimate the counterfactual level of output implied by the structural part of the model by generating counterfactual data. Figure 13 depicts the results and emphasizes the potential benefits of policies that reduce price rigidities. In particular, the extent to which the economy is exposed to cyclical fluctuations is significantly reduced with a lower ω. Hence, the severity of the Great Depression might have been amplified by the rise of corporatist policies.
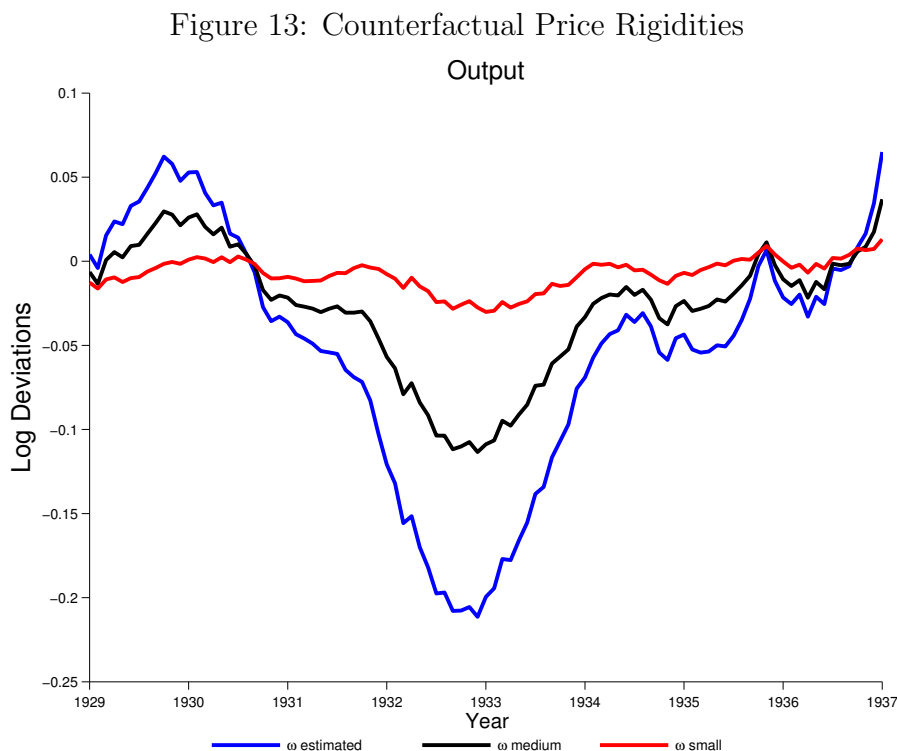
Figure 13: Counterfactual Price Rigidities

Notes: Results are based on 5,000 draws from the posterior distribution, median outcomes are reported. Small ω implies an average duration of prices being effective of 50 months, while medium ω implies 100 months. ω estimated implies a median duration of prices of 182 months.

5 Conlusion

As Choudhri and Kochin (1980) show, countries staying on gold, such as Netherlands, Belgium, Italy or Poland, faced a much more severe depression than the Scandinavian countries or Spain, which never returned to gold. The Gold Bloc countries stayed depressed, while the countries leaving gold early recovered by 1935 (Eichengreen and Sachs, 1985; Campa, 1990; Bernanke and James, 1991; Eichen-

green, 1992). The main determinants for the timing of abandoning the gold parity were deflationary pressure, the existence of banking crises, the gold cover ratio, and the extent of trade integration (Wolf, 2007, 2008).

The decision of Britain to abandon the gold standard on September 21, 1931 was seen as a catastrophe by contemporary Swiss policy makers.[24] Because of the fear of inflationary pressure caused by a floating exchange rate and the fact that the accumulated gold stock was big enough to avert speculative attacks, Switzerland managed to stay on gold until September 26, 1936.

What were the consequences of this policy for the Swiss economy? In a New Keynesian small open economy framework, we show that foreign demand deviations from equilibrium started to increase in the second half of 1931. This should have had a positive effect on Swiss output. However, at the same time, the terms of trade deteriorated. Since the contribution of the terms of trade shock to the forecast error variance of output was higher than the contribution of foreign demand, the second effect dominated, and it took the Swiss economy until autumn 1936 to start recovering from the Great Depression.

Finally, we detect a severe degree of price rigidity of the Swiss economy during the Interwar Period, which impeded an internal adjustment and therefore also contributed to a prolonged recession.

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[24]An example is the evaluation of this step as "disastrous" in the 25th Anniversary Festschrift of the Swiss National Bank published in 1932: "*Am 21. September 1931 gab das durch große Gold-abzüge bedrängte und dadurch in seinen Reserven bedrohte England die Goldwährung auf. Dieser Schritt war um so verhängnisvoller, als zahlreiche Staaten dem Beispiel Englands unmittelbar folgten*" (Schweizerische Nationalbank, 1932, p. 301/302).

Appendix A   Optimality Conditions

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- Consumption Composite Index:

$$C_t = \left((1-\gamma)^{\frac{1}{a}} \left(C_t^h \right)^{\frac{a-1}{a}} + \gamma^{\frac{1}{a}} \left(C_t^f \right)^{\frac{a-1}{a}} \right)^{\frac{a}{a-1}} \tag{A.1}$$

- Consumer Price Index:

$$P_t = \left((1-\gamma) \left(P_t^h \right)^{1-a} + \gamma \left(P_t^f \right)^{1-a} \right)^{\frac{1}{1-a}} \tag{A.2}$$

- Demand Functions:

$$C_t^h = \left(\frac{P_t^h}{P_t} \right)^{-a} C_t (1-\gamma) \tag{A.3}$$

$$C_t^f = \left(\frac{P_t^f}{P_t} \right)^{-a} C_t \gamma \tag{A.4}$$

- Intratemporal Labor Leisure Trade–off:

$$\frac{N_t^\eta}{C_t^{-\sigma}} = \frac{W_t}{P_t} \tag{A.5}$$

- Terms of Trade:

$$\Delta_t = \frac{P_t^f}{P_t^h} \tag{A.6}$$

- Real Exchange Rate:

$$\Phi_t = \frac{P_t^f}{P_t} \tag{A.7}$$

- Real Marginal (average) Cost of Production:

$$\Psi_t = \frac{W_t}{P_t^h} \tag{A.8}$$

- Aggregate Production Function:

$$Y_t = \frac{N_t}{\zeta_t} \tag{A.9}$$

- Calvo Pricing:

$$A_{1,t} = Y_t \Psi_t + \omega \beta \mathrm{E}_t \left[\left(\frac{C_{t+1}}{C_t} \right)^{-\sigma} (\Pi_{t+1})^{-1} (\Pi_{t+1}^h)^{\theta+1} A_{1,t+1} \right] \tag{A.10}$$

$$A_{2,t} = Y_t + \omega \beta \mathrm{E}_t \left[\left(\frac{C_{t+1}}{C_t} \right)^{-\sigma} (\Pi_{t+1})^{-1} (\Pi_{t+1}^h)^{\theta} A_{2,t+1} \right] \tag{A.11}$$

- Domestic Inflation:

$$1 = \left((1-\omega) \left(\frac{\theta A_{1,t}}{(\theta-1) A_{2,t}} \right)^{1-\theta} + \omega \left(\Pi_t^h \right)^{\theta-1} \right)^{\frac{1}{1-\theta}} \tag{A.12}$$

- Exports:

$$EX_t = C_t^{h\star} = \gamma \Delta_t^a Y_t^\star \tag{A.13}$$

- Imports:

$$IM_t = \Delta_t \left(\frac{P_t^f}{P_t} \right)^{-a} \gamma C_t \tag{A.14}$$

- Inflation Rate of Domestic Goods

$$\Pi_{t+1}^h = \frac{P_{t+1}^h}{P_t^h} \tag{A.15}$$

- Domestic Inflation Rate

$$\Pi_{t+1} = \frac{P_{t+1}}{P_t} \tag{A.16}$$

- National Accounting Identity:

$$Y_t = C_t^h + C_t^{h\star} \tag{A.17}$$

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- International Risk Sharing Condition:

$$\left(\frac{C_t^\star}{C_t}\right)^{-\sigma} = \Phi_t \tag{A.18}$$
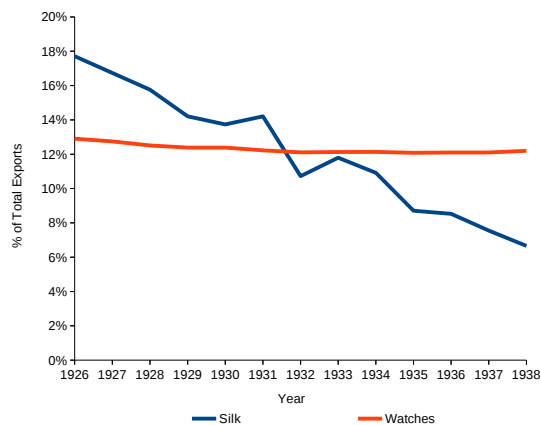
- Foreign Demand (Exogenous Process):

$$\ln(Y_t^\star) = (1 - \rho_\star)\ln(Y^\star) + \rho_\star \ln(Y_{t-1}^\star) + \epsilon_{\star,t}, \quad \text{with} \ \ \epsilon_t^\star \sim N(0, \sigma_\star^2) \tag{A.19}$$

- Terms of Trade (Exogenous Process):

$$\ln(\Delta_t) = \rho^\delta \ln(\Delta_{t-1}) + \epsilon_t^\delta, \quad \text{with} \ \ \epsilon_t^\delta \sim N(0, \sigma_\delta^2) \tag{A.20}$$
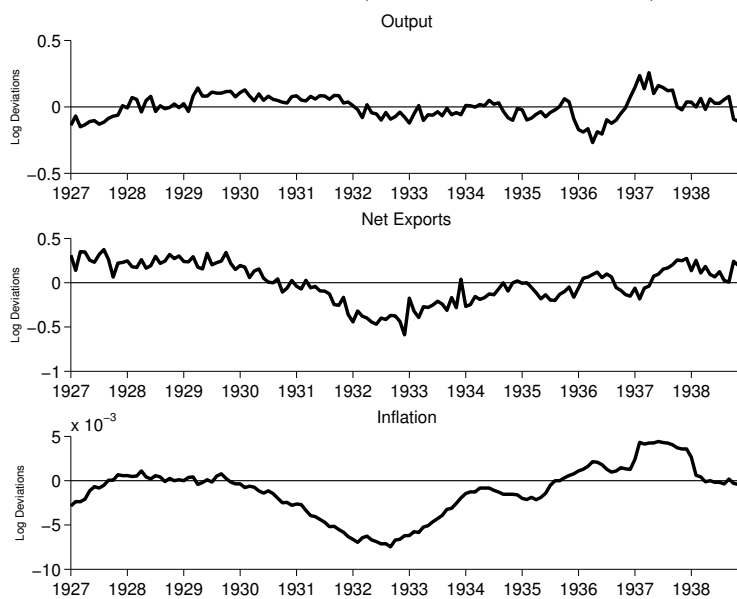
Appendix B   Supplementary Plots
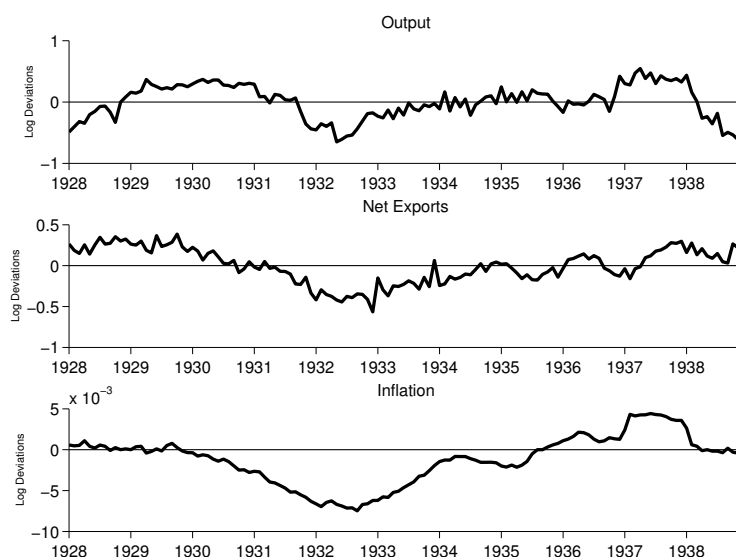
Figure B.1: Export Shares

Notes: For details and sources see Section 3.

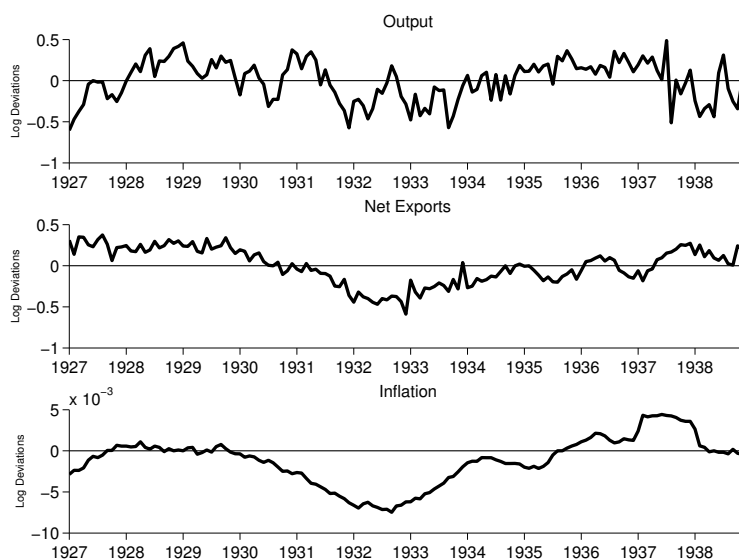## Figure B.2: Data (Output SBB Freight)

Notes: For details and sources see Section 3.

Figure B.3: Data (Output Watch Production)

Notes: For details and sources see Section 3.

Figure B.4: Data (Output Silk Production)

Notes: For details and sources see Section 3.

Appendix C   Additional Estimation Results
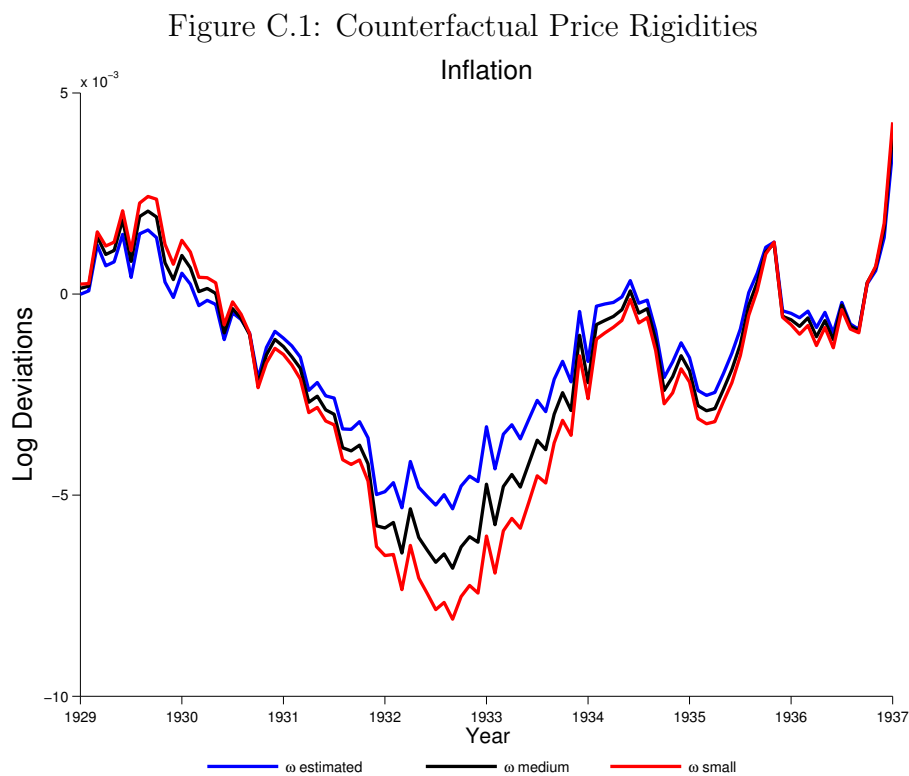
Figure C.1: Counterfactual Price Rigidities

Notes: Results are based on 5,000 draws from the posterior distribution, median outcomes are reported. Small ω implies an average duration of prices being effective of 50 months, while medium ω implies 100 months. ω estimated implies a median duration of prices of 182 months.

Table C.1: Posterior Distributions of Non–Structural Parameters

Parameter	Prior Dist.	Median	90% Bands	Gewekes χ^2
a_{11}	stationary	0.918	[0.745,1.082]	0.948
a_{21}	stationary	-0.774	[-1.040,-0.550]	0.693
a_{31}	stationary	-0.011	[-0.017,-0.006]	0.322
a_{12}	stationary	0.257	[0.126,0.379]	0.431
a_{22}	stationary	-0.017	[-0.200,0.172]	0.358
a_{23}	stationary	0.001	[-0.004,0.006]	0.588
a_{13}	stationary	0.000	[-0.068,0.019]	0.451
a_{23}	stationary	0.001	[-0.090,0.352]	0.515
a_{33}	stationary	0.000	[-0.001,0.004]	0.581
$\sqrt{\text{VAR}(\kappa_y)}$	positive definite	0.050	[0.045,0.056]	0.282
$\sqrt{\text{VAR}(\kappa_{nx})}$	positive definite	0.067	[0.060,0.074]	0.349
$\sqrt{\text{VAR}(\kappa_\pi)}$	positive definite	0.001	[0.000,0.001]	0.457
$\text{COV}(\kappa_y, \kappa_{nx})$	positive definite	-0.001	[-0.002,-0.001]	0.700
$\text{COV}(\kappa_y, \kappa_\pi)$	positive definite	0.000	[0.000,0.000]	0.446
$\text{COV}(\kappa_{nx}, \kappa_\pi)$	positive definite	0.000	[0.000,0.000]	0.564

Notes: The VAR matrix is restricted to have a maximum absolute eigenvalue of 0.6 and its entries are only allowed to take on absolute values smaller or equal to 2. The variance–covariance matrix of the measurement error is restricted to be positive definite and its entries on the main diagonal are only allowed to take on values, which are not larger than 60 percent of the variance of the corresponding data series. Results are based on 400,000 draws, where the first 150,000 are discarded as burn–in draws. SBB freight data is used for industrial production.

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