

Smoking or trading ?

On cigarette money in post WW2 Germany

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Abstract

Just after world war II, the German money at that time - the Reichsmark - was refused in about 50% of the transactions of consumer goods and had been replaced by barter or commodity moneys such as cigarette. Surprisingly, this episode which is often mentioned (e.g. Friedman 1951, Klein, 1976) has never been studied extensively. Using german and US historical records, this paper built 1/ the history of this cigarette money episode and 2/ a model explaining the use of this commodity money. As we indicate, the appropriate framework for this case is the search-theoretic approach to monetary economics. Our model – with heterogeneous population, mainly smokers and non-smokers – indicates that the use of cigarette as money depends 1/ on the relative utility of smoking relative to the consumption of other goods and 2/ on the importance of the prior demand for this good, i.e. the proportion of smokers in the population.

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1 Introduction

The use of cigarette as money in Germany after world war II is one of the most striking examples in economic history of a pure commodity money¹. Yet, despite its attracting intellectual power, little work has been done to establish and explain the basic history of this episode, mentioned, e.g., by Friedman (1951) and Klein (1976). The silence of historical studies is more surprising because the episode was not anecdotal: cigarette was used by the whole German population during 3 years, from 1945 to 1948. A better explanation of our silence lies in the lack of a suitable theoretical framework to deal with this kind of event. The increasing research on the microfoundations of money gives us such a framework. This paper presents new historical facts on the use of cigarette as money and proposes a model that can account for its use by the German population.

From may, 1945 to the 20th of June, 1948 – when the Deutsche Mark was introduced – Germany experienced a monetary crisis and became a barter economy. Black market exchanges grew quickly to amount to 50% of all exchanges of consumer goods (Menderhauser, 1949). The Reichsmark had ceased to circulate as money in most illegal exchanges and had been replaced by goods. All goods, in that economy, had been used as means of payments. However, just a few of them – including cigarettes, chocolate and alcohol – had become commodity moneys. Their main characteristic, compared to other goods, was that everyone accepted them, at least as money. The probability of selling other goods was lower : to sell a tire, people would have to wait to meet an agent who could derive positive utility from the use of this good. For cigarettes, that was not the case: everybody, even non-smokers, accept cigarettes as payments. In this paper, we propose first the description of the way exchanges were carried on. These basic facts allow us to use the search theoretic framework to analyze this historical episode. Hence, we propose a search model explaining why people came to use cigarette money in that context.

For the theoretical side, our model use partly the assumptions made by the Burdett, Trejos and Wright (2001). However, since their model was designed to account for the acceptance of cigarette money in a particular episode of cigarette money, it doesn't match well the post WW II German historical situation. Hence, we introduce two changes in that model. First,

¹The other example of cigarette money, described by Radford (1945), took place in the P.O.W. camp during WW2. Nevertheless, the case of Germany just after WW2 seems to be very important, involving more people and having more economic consequences than the one of the P.O.W. camp.

there exists three heterogeneous types of agents in our model: first, the suppliers of cigarette (corresponding in the historical case to the Allied soldiers that import cigarette from their own country to Germany in order to sell them to German people), and a population of German divided into smokers and non-smokers (to account for the facts that in that economy, just one part of the people smoke). Second, we do not assume there exists a random probability that cigarettes disappear. Then, at monetary equilibrium, smokers cannot play the pure strategy to always trade cigarettes. At a steady state where cigarette is accepted as money, smokers can consume cigarettes not because they are addicted but simply because they compared the utility of the consumption of that good with the gain of trading it and then foregoing its consumption. Moreover, the assumption that cigarette can exogenously disappeared seems very bizzare because the most obvious way for cigarette to disappear is simply that smokers smoke it !

In our model, the use of cigarette money is analyzed regarding two key parameters : the size of the German smoker population (i.e. the size of the demand for cigarette in the barter equilibrium) and the utility derived by smokers when they smoke. The first parameter can explain the appearance of the partial monetary equilibrium (i.e. the one in which non smokers are middlemen between the sellers and the smokers, their 'bid and ask' coming from the increased probability of obtaining their consumption good) while the utility derived from smoking explains the use of cigarette as money by the whole population. More precisely, the use of cigarette money by all sub-populations implies that smokers forego the consumption of this good. This could be the case only if the expected gain for trading cigarette is at least equal to the utility of its consumption. This condition is fulfilled if smoking provides a relatively low utility compared to the one as a consumer good. Hence, the historical record can be explained in that model because 1/ the consumption of cigarette is not necessary for surviving and 2/ there exists a prior demand for this good (i.e. smokers) and if this demand is sufficiently large, people could have interest to use it as money just because its use increases the probability of succeeding in a trade.

The paper is organized as follows : the following section uses the historical records to present the historical background of the use of cigarettes as money. Section 3 describes the basic environment of the model, section 4 studies equilibria and section 5 concludes.

2 Historical background

The German monetary crisis can be characterized by huge changes in the medium of exchange used for everyday purchases by the German population. This process converged toward a refusal of fiat money and the emergence of barter relationships and commodity moneys. The symptoms of this crisis strongly differ from an hyperinflationary one, mostly because of the relative stability of prices. Although we don't have any national statistics², the path increase of regional price indexes between the end of WW II and June 1948 seems to have no common range with hyperinflationary one³. For example, in the case of Bavaria, the "official price index" increased by only 60% in 3 years following the war. The understanding of this situation, qualified as repressed inflation by Ropke (1947), implied to change the basic story driving exchange behaviors: the consumer does not want to escape from the effects of quick price changes but rather try to find the goods he needs without using fiat money. In this section, we present the basic environment of German exchange economy during the period of the monetary crisis. The first sub-section deals with the period relevant with the way we study this historical episode. The reasons why people came to exchange goods for goods in that economy are explained in the second sub-section. Finally, the last sub-section presents the basic characteristics of cigarette money.

2.1 The process towards the barter economy

The demonetization of the German economy has roots in the monetary policy conducted by the nazi regime to finance war. Between 1939 and 1945, most of the governmental expenses were financed through banks which subscribed to almost all the public loans, thanks to deposits from the German population. In 1945, this led to a money stock that was 8 times bigger⁴ than the one of 1938. After WW II, the first decisions taken by the 4 Allies tended to decrease the total money supply, but it still remained 4 times bigger than the one of 1938 (at the same time, the industrial production of the country had decreased to half of its 1938 level). Despite this huge increase, no inflation appeared. The reaction of the Germans has rather consisted in

²After the defeat, the German state has collapsed and hence, there does not exist any broader price index than the one constructed at the regional level.

³Remember that the currently used definition of an hyperinflationary crisis was given by Cagan (1956). He proposed the following criteria : a country experiences hyperinflation when the rate of price increase is greater than 50% per month.

⁴300 billions of Reichsmark as compared to 38,7 on the 31th of december, 1938, cf. Samuelson (1972).

changes of their exchange behavior: Reichsmark tended to be ignored either as a unit of account or as a way to pay purchases, as the following report of the American military governor stated:

” Germany’s inflation today is a stagnant inflation. Instead of rapidly rising prices destroying the value of money, a money without value has tended to destroy the function of prices. To an increasing degree the Reichsmark prices of good have become subsidiary and formal appendages of purchase and sale transactions or have even been eliminated entirely from transactions in favor of a variety of direct barter ratios between goods, especially between cigarettes and other goods ”

*Monthly Report of the Military Governor*⁵ n°21

The German exchange economy did not become a barter economy overnight. Moreover, the moment from which people renounce to fiat money is still an open question. On the one hand, some historians, such as Brackman (1993), sustain the view that the German monetary crisis began around 1942 and 1943, with the first defeats experienced by the Nazi regime. On the other hand, most of the contemporaries of this crisis, either German or American, thought that the refusal of the Reichsmark and the emergence of barter transactions began late in 1945. Although our purpose is not to deal with the starting point of this crisis, it could be interesting to note that, in November 1945, an official report of the US Army gauge that the proportion of illegal exchanges of foodstuff amounts to 20 % of the whole number of that kind of exchange⁶. During spring 1946, 6 months later, this share has grown to 50 % and the barter of luxury goods or clothes against food has tended to be replaced by the one implying industrial goods against food⁷. Most of American officers who served in the economic division of the Office of Military Government of United States (the military government that drove the occupation of Germany, also called OMGUS) indicates that this proportion seems to be stable from 1946 to 1948.

Hence, the history of the German monetary crisis is better described by dividing the events into two sub-periods. The first one consists of the pro-

⁵ *Monthly Report of the Military Governor* n° 21, feb-march 1947, section *Price control*, p. 19 (*Institut für Zeitgeschichte*, München, Germany).

⁶ Cf. *Monthly Report of the Military Governor of the US Army in Germany*, report n°5, december 1945, section ”Trade and Commerce”. This report can be read at the *Institut für Zeitgeschichte*, München, Germany.

⁷ Cf. *Monthly Report of the Military Governor* n°11, This report can be read at the *Institut für Zeitgeschichte*, München, Germany.

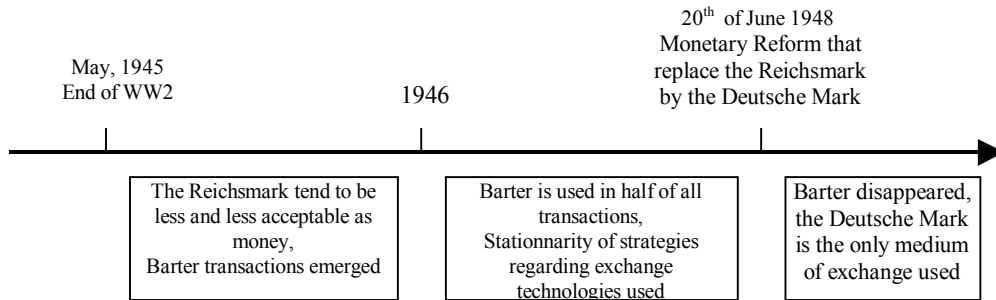


Figure 1:

cess conducting the German population in the refusal of its fiat money, with barter transactions emerging as an alternative way to carry on exchange relationships. This process begins with the end of world war 2 and ends in 1946. During the second period, from 1946 until the end of the German monetary crisis, the basic environment of exchanges seems to be stationary: The share of barter trade in all transaction is estimated as constant by American economic occupation staff and it seems there had been no great change in the strategies of agents regarding barter or the use of commodity moneys. This second period ends with the introduction of a new fiat currency on the 20th of June, 1948 and the suppression of the old one (the Reichsmark). Broadly speaking, the main point of this monetary reform was the exchange of ten Reichsmark for one Deutsche Mark and the scaling down of all claims in the same ratio. This sole change induced the disappearance of both all barter transactions and commodity moneys. Figure 1 draws this sequence of events in summary.

In this paper, we focus our historical study on the second period of this monetary crisis. We take as given the fact that Germans have renounced their fiat money before adopting the cigarette money. As showed by Burdett, Trejos and Wright, this renouncement is a necessary condition to the adoption of a commodity money. The following sub-sections present 1/ the institutional framework surrounding and influencing the exchange strategies chosen by German people and 2/ some basic facts regarding the way cigarettes were used as means of payments.

2.2 What has driven the need for illegal exchanges ?

At that time, Germany was mostly an industrial economy and most of the population consisted of workers selling their labor for money. The resurgence of barter relationships is then very surprising as most of the population did not have access to goods directly but rather by an intermediated system delivering these through shops against the money earned. The establishment and the generalization of barter have then entailed change in the way wages were paid (with a growing part paid with goods) but also an increasing share of direct exchange relations: many workers used their pay in kind to transact directly with other workers or with farmers. Here, we review first the institutional (and legal) framework of exchanges. We then presents the organization of the illegal exchange and finally discuss the way workers have came to have access to goods.

2.2.1 The institutional framework of exchanges: The (in)efficiency of the rationing system leads agents to conduct illegal exchanges

From the war, the Allied occupation Authorities inherited from a very highly developed system of monitoring both the allocation and the prices of goods. This system – created by War Economy Ordinance of the 1st of September, 1939 and usually called the rationing system – fulfilled two functions, the authorization of price increases and a centralized system of allocation of civil goods⁸. People must work for some firms for a wage paid in Reichsmarks. On the side of consumption, they received a monthly food and textile ration that has to be paid with the RM and some ration ticket. The quantity of goods delivered by the rationing system is decided monthly by an authority taking into account the amount produced by the economy.

The aim of such a system was to regulate the economic life such that all efforts have been directed towards the continuation of the war. In this context, the rationing system had to guarantee the population a minimum standard of living and a minimal disturbance of their economic life in a context of an always growing money supply. The expected return for the government was low disturbance in the labor supply and as a result the

⁸The delivery of goods is ensured by private shoppers but clients can make a purchase only if they possess a rationing card composed of many coupons that are, together with the Reichsmark, necessary for the purchase of the quantity of food allowed by the card. There exist many types of cards to discriminate the food ration between male and female, workers, pensionners and young people. For a theoretical explanation of the rationing system at that time, see Tobin (1952).

production of weapons in a private property economy.

When Germany experienced the defeat – on the 8th of May, 1945 – the desorganization of the economic system, mainly the transportation system and the labor supply, was so great that production had been dramatically reduced. This breakdown of the economy, documented by Botting (1985), entailed major changes in the food supply and motivated an increase in the number of illegal exchanges⁹. Allies feared the risk of starvation and decided to continue the system of rationing the allocation of goods, with some minor changes in the price policy of the administrative bodies in charge of monitoring prices changes. The policy is clear from a proclamation of that time *"All price regulation and management regulations which were effective before the entrance of the American troops will continue to be valid"*¹⁰.

But the efficiency of the rationing system, from the point of view of the consumer, had been dramatically reduced with the end of the war. The daily ration delivered to a normal consumer decreased from 1900 Calories per day in 1944 to less than one thousand in June, 1945 (Backer, 1971). This gave incentives to agents to find some ways to supplement the daily ration. Some decided to convert gardens to produce vegetables, others decided to carry on illegal trades, i.e. exchange outside the rationing system. As indicated in the report on "Black Market operations in the American occupied zone" from the 30th of July, 1945 : *"In several of the areas where a black market exists, it is primarily at the result of the urban dwells descending in mass upon the surrounding countryside and purchasing food direct from the farmers without benefit of price control or ration coupons"*¹¹. In the fall, 1945, *"the whole Germany went off in search for calories"* (Botting, 1985, p. 180). Of course, the breakdown of the economy following the destruction of cities explains part of the change in agents' strategy. But, this change also had spillover effects, due to the diversion of food entailed by illegal exchanges:

" There has been a noticeable loss of food from the normal market channels due to the people from the city going to nearby farms and buying on the spot. In Frankfurt, the local Public Safety and Food and Agriculture Officer ordered the Regional

⁹see, e.g the report on "price control, rationing and black market in Bavaria for the week ending the 22 of June, 1945" from the OMGUS (available at the *Institut für Zeitgeschichte*, Munchen, document number 1/177 3/8, mark BICO C+J).

¹⁰Proclamation of the Allies, see document of the OMGB marked FOD, branch B, Eichstätt, 9/138 1/7. Held by the *Bayerische Hauptstaatsarchiv*, Munchen, Germany.

¹¹Document marked 1/177 3/8 BICO C+J available at the *Institut für Zeitgeschichte* (Munchen, Germany).

Food Office Director to combat the problem. (...) This has reduced the food available in the normal distribution channels to an alarming degree and in one instance, Kreis Schültern, via Frankfurt, an estimated 50 % of the dairy products failed to reach the legal market. ”

*”Black market operations in the American occupied zone”
(07/30/1945)¹²*

2.2.2 The police fight against the black market leads to the development of disorganised illegal exchanges

To fulfill this need for calories, German people could wente to a black market, i.e. a public place where sellers and buyers meet and exchange their goods. This type of market did exist in post WW II Germany, it took place in the most prominent locations in German cities. But it was not commonly used by the population. People preferred searching for partners alone, without meeting at established black market place. This kind of exchange was called the ”grey market”. It was a very desorganized way to exchange goods either because one needs to travel to the place of production (in the case of urbans going to the countryside to exchange with farmers) or because one needs to meet someone randomly in a city. This counter intuitive choice (in favor of the grey market) done by most of the Germans can be explained by the action of the police against the black market.

Indeed, from the end of the war til the monetary reform of June, 1948, the police and the MP strongly fought all types of illegal exchanges. For example, records of the police from Munich¹³ indicate that early in the summer of 1945 police descended each day to prevent the establishment of a black market in a well known place of Munich (i.e. *Viktualen Markt*). This strong activity prevented the appearance of such a market place in all cities of Bavaria¹⁴ – except Munich – for all the summer and fall of 1945. After the winter of 1945/1946, black markets were established in strong connexion with some mafia organizations [3, p. 82] but as noted earlier, they saw very

¹²Document marked 1/177 3/8 BICO C+J available at the *Institut für Zeitgeschichte* (Munich, Germany).

¹³See documents marked 1/177 3/8, BICO C+J of OMGUS (*Institut für Zeitgeschichte*, Munich), or those marked FOD, branch B, Bayreuth, 9/127 - 3/10 (*Bayerische Hauptstaatsarchiv*, Munich) but also the records of the police marked MIInn 72571 or MIInn 72628 (*Bayerische Hauptstaatsarchiv*, Munich).

¹⁴From 1946 on, all cities in Bavaria had his own local black market. But the activities of these markets were very limited. Menderhauser (1949) estimates their share in the total number of transactions to less than 2%.

little activity. Although the police were successful in their fight against any well known market places, they did not have success in the fight against other kind of illegal exchanges. The intuition runs as follows: Black markets were held mostly in the street of the city and consisted of a crowd concentrated at a central point. Hence, it was very easy to fight against this form of illegal exchange simply by conducting a police raid at that place. The nature of the grey market make it difficult to fight because it consisted of people moving independantly to try to find other people that would exchange with them.

But the police activity did not prevent the carrying out of all illegal exchanges by the German population. This comes from the fact that the inefficiency of the rationing system gave incentives to achieve illegal exchanges. Hence, anticipating the cost of being caught by the police on the black market, Germans directed their search for suitable partners towards the grey market because

” Only very few individuals or firms, however, find it possible to survive without engaging in barter. It is characteristic that the practice has grown up as a self-help reaction without any public or governmental program, and that the same people who reject the principle – manufacturers, work-councils representatives, etc. – have begun to trade along these lines. It has become axiomatic for German business that production and the inflow of goods and services depend on the provision of goods and services in direct exchange. ”

Note on price control (06/18/1947)¹⁵

This induces a huge difference in the size of each market: The black market activity is estimated to be about 2% of all the transaction of consumer goods in post WW II Germany whereas the grey market represented about half of the transaction of consumer goods¹⁶. This also induces a very unique way to carry on illegal exchange as the fight of the police against all types of illegal exchanges had also consequences on the meeting technology used by agents. On one hand, this entailed an incentive to exchange with family member. But, as the goods searched were often not possess by relatives, transactions had also to be carried on in anonymous meeting to lower the

¹⁵ Available at the *Institut für Zeitgeschichte*, Munich under the mark 4/77 2-1 econ Trade & Commerce, blatt 4/5 (OMGUS records).

¹⁶ This is ascertain either by the economic report of the US army authorities (e.g. Monthly Report of the Military Governor which can be read at the *Institut für Zeitgeschichte*, Munich Germany) or by all of the observer (e.g. Menderhauser (1949) or Lutz (1949)).

probability of being denounced to the police. By the way, this kind of exchange had excluded the use of credit. The next sub-section presents the activity on the grey market.

2.2.3 Decentralized trading and the rise of barter relationships between specialized agents

On the "grey market", people really met according to a random matching technology for them trying to exchange goods they possess against goods they want. The use of the grey market had entailed anonymous relationship among sellers. Moreover, its very form has excluded the use of the Reichsmark as "*there is so desperately little goods available that those in possession will not give anything up for mere money, on the chance that they can buy what they need with the money*".

Given this "good psychology"¹⁷, firms decided to pay part of the wage in kind in order to keep their workers at work. Hence, although, legally, all wages have to be paid in Reichsmark, in fact quite all firms supplement the monetary wage by adding some of the good produced. This payment took various forms, as noted by Menderhauser (1949):

"Bilateralism in the employer-employee relationship took the form of factory meals more substantial than the turned-in ration coupons of the workers warranted, the sale of consumers' goods to the workers at legal prices but without permits (...). Naturally favored were the employers producing foods of general usefulness to consumers. But where the productions was not suitable, or could not be made so by the addition of special lines, goods for distribution to workers were obtained from other producers through "compensation trade" or the workers were given factory products that could be taken out to the peasants and bartered for food. In this way, even a steel mill could satisfy its workers by giving them Thomas fertilizer and steel bands for the wheels of peasant carts"

Menderhauser, 1949, p. 657

As a consequence, each worker have a continuous access to goods he can bartered on the grey market. This change of firms' behavior is obvious

¹⁷report "*Inflation and the BM in Germany*", document of the OMGUS marked FIN 17/5, BICO FIN group. Available at the *Institut fur Zeitgeschichte*, Munich.

from 1946. This goods' endowment by employers replace the selling of personal items that wages owners have done during 1945 when they paid their purchases to farmers with their jewelry, radio or clothes. But firms were specialized in the type of goods they produce and workers had to complete the ration for all their family to survive. This gives rise to a search for suitable medium of exchange that would increase the probability to succeed in making an illegal exchange with a randomly selected agents. Among all the goods, cigarette was the most famous and the most used medium of exchange. But chocolate or alcohol also fulfilled such goals together with barter, as noted by the following report:

"Detachment A-250 Bad Kissingen and Det. E-237 Ingolstadt call attention to the fact that it is customary in the British zone for employees to receive part of their wage in industrial goods in order to barter these items against food in Bavaria and other lands. Over 300 pounds of fat were recently confiscated by the local police of Ingolstadt from people working in the British zone. Another large catch in Landeskreis [canton] Ingolstadt consisted of 1 100 pounds of canned meat, which was to be shipped to a railroad trade union in the British zone, admittedly acquired through unauthorized barter transaction."

*Intelligence Report of the 02/11/1948*¹⁸

2.3 Cigarette money in post WW II Germany

Cigarette money had a universal acceptability in post WW II Germany – everybody accept them for payment. However, contrary to modern fiat money, the use of cigarettes as money did not have ruled out the use of barter. Cigarettes were rarely smoke by his first holder. Botting (1985, p. 179) indicates that a cigarette was often traded hundred times before being smoked ! The next two sub-sections presents the reasons that can explained the use of cigarettes as money and the characteristics of the "market" for cigarettes.

2.3.1 Explaining the use of cigarette money

Many reasons (or many frictions) can explain why agents had come to use a commodity money rather than direct barter. One of them is the indivisibility

¹⁸see record of the *Office of military government Land Bavaria* marked ODI 7/36-2/4 p. 2/17 (available at the *Institut für Zeitgeschichte*, Munich).

of goods. That's the example proposed by the Herald Tribune of the 28th of February, 1947:

"A lot of them [cigarettes] undoubtedly end up in the hands of farmers because cigarettes are a way of getting food (...) In Germany, cigarettes lubricate the trade. For instance, if a Berliner has a large radio that he has decided to sell, he cannot conveniently lug it out into the country in search of a farmer willing to give him butter for it. Instead, he trades it to a black marketeer for cigarettes and takes the cigarettes to the farmer. This has had advantage that he can dispose of the cigarettes bit by bit instead of having to accept a whole radio's worth of butter at one time. Meanwhile, the black marketeer takes the radio to an American officer who gives him more cigarettes. With these he can get another radio or butter or whatever he needs to carry on his trade. Then he can sit down and smoke his profit – or a part of it."

Herald Tribune 02/28/1947

This argument of the advantage of cigarette over radio due to its divisibility is close to the one proposed by Berensten and Rocheteau (2002). This search model of money construct environment in which both money and goods are divisible. By relaxing the assumption that each agent has to spend all his money stock for buying a divisible goods, they address the question of the effect of this assumption on the efficiency of a bargaining between two agents. They find that the divisibility of both goods and money generates gains from trade compared to the case studies by Trejos and Wright (1995). This argument is exactly the one suggests by the Herald Tribune paper when it compare the relative advantage of cigarette over large radio. Despite its interest and due to great complexity involved by this type of demonstration, we will not explore this reason in our explanation of the cigarette money acceptance.

One can also think that the internationally standard character of cigarette can help to its adoption as money. This could maybe have influence in the choice of cigarette as money but we need to be very careful when using this reason. The historical records learn us that the counterfeiting of cigarette was very common in post WW II Germany (Suddeutsche Zeitung, 08/09/1946) so that there exist intermediary specialized in the inspection of both the weight and the quality of cigarettes (Botting, 1985).

Another reason is undoubtedly the difficulty to have a double coincidence of wants meeting when you search for food while you possess a saucepan

or shoes. As these goods are designed for a very specific purpose, selling them against the good you want can be very long. As demonstrated by Kiyotaki and Wright (1993), the use of a medium of exchange increases the probability of succeeding in a trade simply because it entails to succeed in two single coincidence of wants meeting rather than waiting for a partner that want what you have when you want what he have. When fiat money is not accepted as a medium of exchange, agents has to find another object that can fulfill this role. In this paper, we argue that, in a context in which barter was difficult, the choice of cigarette as money comes from the fact that it was highly demanded by Germans whereas the supply of cigarette was relatively small. The next two sub-section present the supply and demand of cigarettes as money between 1945 and 1948.

2.3.2 Suppliers and demanders of cigarette in post WW II Germany

The newspaper *Die Welt* (05/08/1947, cited by Ruland, 1968, p. 58-59) estimated the demand for cigarettes¹⁹ in post WW II Germany to about 80 thousands of tons whereas the local production amounted for only 30 thousand. Most of locally produced Tobacco came from 2 regions of the south of Germany : Souabe (for 50%) and Pfalz (30%). But as noticed by Proctor (1999, p. 244), the domestic sales recorded for taxation "drop for one half from 1940 to 1950" (numbers are not available for other years). This indicates that the authorized sales of German tobacco has sharply decline between the years of the war and the end of the monetary crisis. This could be explained, at least partially, by the concealment of part of the tobacco production made by German farmers.

In the same time, the imports of tobacco ceased with the entry of Allied troupes in Germany, as Allies don't want to pay for the German consumption of that good. Hence, despite the fact that the local production had could grown up (Ruland, 1968), German smokers experienced a more difficult access to cigarettes through the legal channel and especially rationning²⁰. In the same time, as showed by Proctor, the consumption of cigarette by Germans increase sharply during the war. We can then conclude that the demande for cigarette were high while at the same time, this good was less available to consumers.

¹⁹Estimated from the average consumption of 1938 time the population of Germany after WW II.

²⁰The cigarette delivery has been integrated to the rationning system around 1942, see Singer (1943).

This entails the emergence of three new forms of tobacco supply. First, in few part of Germany, farmers had came to offer tobacco in sale. Second, traffics grew up with the establishment of illicit imports of cigarette from Czechoslovakia, Hungary and Belgium²¹. Another type of traffic has consisted in the manufacture of new cigarettes from cigarette ends (Botting, 1985). The people who done that were called the "Kippensamler". Their work consist in buying cigarette butts to barman and then to use these to produce new cigarettes. A tumbler of cigarettes butts was paid 5\$ to the barman and 7 butts make 1 cigarette. With this cigarette, one could obtained one meal in a restaurant. Third, and perhaps less anecdotal, allied soldiers had became dealers in cigarettes they imported from their own country. The US military government for Germany (cited by the New York Herald Tribune, 05/17/1947) gauge to about one thousand tons per month the quantity of cigarettes imported by American soldiers in 1947.

This indicates that the supply of cigarette was done by only few people while the demand for that good was relatively important. This could be used to adress the question of why cigarettes had been chosen as money in post WW II Germany. As the proportion of smokers unsatisfied by the legal rationning system, it could be the case that agents had came to buy cigarette simply to resell it to smoker. It could also be the case that German smokers had came to renounce to the consumption of this good because its utility in consumption was lower than its utility as a medium of exchange. But in any case, as the proportion of cigarettes sellers was relatively low, agents could also have interest to barter directly their good. This could explain the coexistence of cigarette money and barter in post WW II Germany. The next section proposes a model of cigarette money based on these intuitions.

3 A model of cigarette money with heterogenous populations

In this section, we use the historical informations given by the preceding section to construct the basic environment of a model which can explain why cigarette money had been accepted by the German population during the monetary crisis. The following sub-sections describe the basic environment of the model, construct the corresponding Bellman equations and derive the steady state condition on cigarettes held by Germans when they decide to use cigarettes as money.

²¹see documents of the bavarian police at the Hauptstaatsarchiv in Munich (mark Innerministerium) or at the Institut für Zeitgeschichte for OMGUS documents.

3.1 Basic environment

The last section has learned us that agents had incentives to carry on illegal exchanges and that they did them in a very organized way, i.e. by searching randomly in cities or in the countryside for transacting what they have against what they want. As the size of the black market is negligible compared to the one of the grey market, our model abstract from this features and concentrate the analysis on the acceptance of the cigarette money on the desorganized market. To encounter from the difficulty to found a partner and to the random search for partner on that market, we will suppose that agents in our model meet randomly according to a Poisson Process of parameter α .

To take into account the way cigarettes were introduce in that economy, we will suppose that the population is divided into 3 parts : sellers of cigarette (Allied soldiers, proportion a of the population), and German (proportion G), who could be either smokers (μG) or non smokers ($(1 - \mu) G$). For ease of simplicity, the whole population will be supposed to consist of a continuum of agents of mass 1. Hence

$$\Omega = g + a = a + \mu g + (1 - \mu) g = 1$$

We also assume that time is infinite and continuous, that agents live forever and discount future at a common rate $r (> 0)$. To take into account the difference between cigarette and industrial goods, we assume there exist 2 types of goods that differs regarding the population that can produce them and regarding the utility they gave when consume. The cigarette is supposed to give a utility s and the industrial good (hereafter special good) a utility u . The specialization of agent in production is taken into account by assuming that German can produce only one type of the set of special goods although the allied soldiers can only sell cigarettes. This is rationalize by assuming that sellers of cigarettes benefited from a technology allowing them to import cigarette while Germans did not have access to this technology.

The production of one special good is instantaneous and is made with cost c in terms of utility. Allied soldiers are endowed with cigarette with the same assumptions. Cigarette and special goods come in unit of size one and cannot be divided (this ruled out the possibility that agents bargain over the prices of the goods exchanged). All goods are storable without cost by their producer²² and cigarette can also be stored by all types of agents. An agent holding a stock cannot produce.

²²because of the way preferences are modelled, nobody has interested in that economy to store a good he does not produce (see Rupert et al. (2001)).

All agents have preferences over special goods, but they derive utility only from consuming a part x of this type of goods. This proportion can be seen as the probability of a double coincidence meeting. A proportion μ of the German population also derive a positive utility to consume cigarette (i.e. the smokers). Preferences over special goods are modelled as in Rupert *et alii* (2001): in each trade between agents i and j , there is a probability x that i wants to consume the special good produced by j (that is agent i derives a utility $u > c$ from consumption). The probability that j wants to consume the special good produced by i , knowing that i want to consume the good produced by j is denoted by y . Then, a double coincidence meeting occurs with probability xy .

Given the assumptions made, the exchange process is modelled as follows: Agents meet bilaterally according to a Poisson process with parameter α . Upon meeting, agents trade if mutually agreeable, e.g. an exchange occurs if each agent is no worse off after trading. As goods and money are indivisible, each trade is a one for one swap. Every trade is either a trade of one special good for another special good, or a trade for one cigarette against one special good (between one agent with 1 unit of cigarette and one agent with 0 unit of cigarette).

We will use this basic environment to study when a special good holder has interest in accepting a cigarette as payment of his special good, even if there exists a difference between the utility to smoke and the one to consume a special good. For that purpose, we will compare the net gain to be a special good holder to the net gain to be a cigarette holder by using the Bellman equation derived in the next sub-section.

3.2 Bellman equations

Let U_i ($i = 0, 1$) be the value function of german non smoker and V_i be the value function of german smoker. The value function of the seller of cigarette is omitted because they don't make any strategic choice. Then the Bellman equation of this model are defined as follows:

$$rU_0 = \alpha xyg(1 - C)(u - c) + \alpha x(gC + a)\pi(U_1 - U_0 - c) \quad (1)$$

$$rU_1 = \alpha xg[\mu(1 - m) + (1 - \mu)(1 - n)\Pi](u + U_0 - U_1) \quad (2)$$

$$\begin{aligned} rV_0 &= \alpha xyg(1 - C)(u - c) + \alpha x[gC + a]\max(s - c, V_1 - V_0 - c) \\ &= \alpha xyg(1 - C)(u - c) \\ &\quad + \alpha x(gC + a)\max_{\phi \in [0,1]}[\phi(s - c) + (1 - \phi)(V_1 - V_0 - c)] \end{aligned} \quad (3)$$

$$rV_1 = \alpha xg [\mu(1 - m) + (1 - \mu)(1 - n)\Pi] (u + V_0 - V_1) \quad (4)$$

Such equations are now standard in the search litterature. Let us give an intuitive explanation of equation (1). U_0 indicates the expected gain of an German agent who is non smoker. When holding his production goods for exchange, he can first meet, with probability α , another German agent who also holds a good (proportion $(1 - C)$ of all Germans and there is a double coincidence of wants (with probability xy). In this case, exchange takes place immediatly, agents consumes and produces a new unit of his production good. He can also meet, with probability α , either an Allied soldier (probability a) or a German holding a cigarette (gC). If with one of this 2 agents a single coincidence occur (i.e. the soldier or the German holding cigarette wants to consume the special good, probability x), then a trade occurs iff the special good holder accept the cigarette as payment. This decision is taken if the net gain of accepting cigarette is positive : he accepts cigarette as payment if the gain associated to this decision is greater than the one associated with staying a special good holder ($\Delta\pi = U_1 - U_0 - c$). The strategy of this agent regarding cigarette is resumed by the strategic variable π .

Equation ?? has a similar interpretation except that this agent has to decide, when someone proposes him a cigarette as payment, if he wants to consume the cigarette or to store it and then become a cigarette holder. He takes his decision by comparing the gain associated to smoke the cigarette and then stay a special good holder with the one associated to trade cigarette in the future, in which case, his gain is resumed in 4. the stategic variable associated with this decision is ϕ which value is determined by the sign of $\Delta\phi = V_1 - V_0 - s$. Note that when $s < c$, no one accept cigarette in this economy and then cigarette cannot become a money. Hence, we assume, for the rest of the paper that $s > c$ which imply that smokers always accept cigarette as payment for their special good. Their only strategic question is whether they want to consume it or to store it (at no cost).The following correspondances resume the decision taken by the non smoker and the smoker:

$$\left\{ \begin{array}{l} \Delta\pi = U_1 - U_0 - c > 0 \Leftrightarrow \pi_n = 1 \\ \Delta\pi = 0 \Leftrightarrow \pi_n \in [0, 1] \\ \Delta\pi < 0 \Leftrightarrow \pi_n = 0 \end{array} \right. \quad \text{and} \quad \left\{ \begin{array}{l} \Delta\phi = V_1 - V_0 - s > 0 \Leftrightarrow \phi = 0 \\ \Delta\phi = 0 \Leftrightarrow \phi \in [0, 1] \\ \Delta\phi < 0 \Leftrightarrow \phi = 1 \end{array} \right. \quad (5)$$

Using the above Bellman equation, solving for symetric equilibria in which $\pi = \Pi$, and after some algebra, we find the following best response

conditions:

$$\Delta_\pi = \frac{\alpha x g (\mu (1 - m) (1 - y) + (1 - \mu) (1 - n) (\pi - y)) (u - c) - r c}{r + \alpha x [A\pi + g\mu [m\pi + (1 - m)] + g(1 - \mu)\pi]} \quad (6)$$

and

$$\Delta_\phi \Leftrightarrow \frac{\left(\begin{array}{c} \alpha x g [\mu (1 - m) + (1 - \mu) (1 - n) \pi] (u - s) - \alpha x y g (1 - C) (u - c) \\ - \alpha x (gC + A) (s - c) - r s \end{array} \right)}{(r + \alpha x A (1 - \phi) - \alpha x g C \phi + \alpha x g \mu + \alpha x g (1 - \mu) [n + (1 - n) \pi])} \quad (7)$$

3.3 Steady State conditions on the stock of cigarettes

The stock of cigarette held by the germans is $C = \mu m + (1 - \mu) n$ with m the proportion of smoker holding cigarette compare to the population of smoker and n the proportion of non-smoker holding cigarette in the population of non-smoker). The study of steady state equilibria implies that we have to define the flow of cigarette held by the German population (i.e. $\dot{m}, \dot{n}, \dot{C}$). Moreover, we need to determine $\dot{m} = \dot{n} = \dot{C} = 0$. Take the exemple of n : n increases each time a non smoker without cigarette ($g(1 - \mu)(1 - n)$), who accepts cigarette as money (π_n), meets (α) 1/ an american who wants his good (xa) and each time he meets an smoker who like his good (xgC). And n decreases each time a non smoker who have 1 cigarette in stock ($g(1 - \mu)n$) find a smoker without cigarette ($g\mu(1 - m)$) and exchange is possible (x). Hence, $\dot{n} = 0$ is defined by the following equation:

$$\begin{aligned} \dot{n} &= 0 \Leftrightarrow \alpha x g (1 - \mu) (1 - n) (gC + a) \pi_n = \alpha x g (1 - \mu) n [g\mu (1 - m) x] \\ \dot{n} &= 0 \Leftrightarrow (1 - n) (gC + a) \pi_n = n [g\mu (1 - m) x] \end{aligned} \quad (8)$$

The computation of the value of m follows the same strategy: m increases each time a german smoker without stock ($g\mu(1 - m)$) meets (α) an american (a) or a german non smoker with cigarette ($g(1 - \mu)n$) who likes his goods (x) and the smoker does'nt consume it ($(1 - \phi)$). Conversely, m decreases each time one smoker with cigarette ($g\mu m$) meets a non smoker without cigarette ($g(1 - \mu)(1 - n)$) and exchange is feasible ($x\pi_n$) and each time he meets a smoker without cigarette ($g\mu(1 - m)$) and this one smokes (ϕ) rather than stoks the cigarette exchanged when the exchange is feasible (x). This gives us $\dot{m} = 0$:

$$\alpha x g \mu (1 - m) (1 - \phi) (g(1 - \mu)n + a) = \alpha x g \mu m \left[\begin{array}{c} g\mu (1 - m) \phi \\ + (g(1 - \mu)(1 - n) \pi_n) \end{array} \right]$$

$$\dot{m} = 0 \Leftrightarrow (1 - m)(1 - \phi)(g(1 - \mu)n + a) = m \left[\begin{array}{c} g\mu(1 - m)\phi \\ + (g(1 - \mu)(1 - n)\pi_n) \end{array} \right] \quad (9)$$

C increases when americans (a) succeed in dealing cigarette against goods (αx) with either 1 non smoker without cigarette ($g(1 - \mu)(1 - n)\pi_n$) or 1 smoker without cigarette ($g\mu(1 - m)$) who decides to stock this cigarette ($(1 - \phi)$). C decreases each time a smoker without cigarette ($g\mu(1 - m)$) smokes (ϕ) one cigarette he has acquired in exchange for good (αx), and that cigarette comes from the existing stock held by the german people ($g(1 - \mu)n + g\mu m = gC$). Hence, we can write :

$$\begin{aligned} \dot{C} &= 0 \Leftrightarrow \alpha x a [g(1 - \mu)(1 - n)\pi_n + g\mu(1 - m)(1 - \phi)] = \alpha x g\mu(1 - m)\phi gC \\ &\Leftrightarrow a [g(1 - \mu)(1 - n)\pi_n + g\mu(1 - m)(1 - \phi)] = g\mu(1 - m)\phi gC \\ &\Leftrightarrow ag(1 - C) = (gC + a)(g\mu(1 - m)\phi) \end{aligned} \quad (10)$$

4 Equilibria

We first begin by defining a steady state equilibrium and then discuss about the one interesting to solve for our purpose.

Definition 1 *A steady state equilibrium is a n -uplet $(m, n, C, \Delta_\pi, \Delta_\phi)$ that satisfy the best response conditions 5 – with Δ_π defined by 6 and Δ_ϕ by 7 – and such that m, n, C – as given by equations 8, 9 and 10 – $\in [0, 1]$*

There potentially exists 8 equilibria. However, this set of candidate equilibria can easily be reduced just by thinking about conditions they must fullfil. Take, for exemple the equilibria with $\pi_n = 0$ and $\phi = 0$. The sole inspection of the best response condition indicates that this could not be an equilibrium because of the assumption that $s > c$ (which is necessary for the acceptation of cigarette by the German smokers). Moreover, the two equilibria where $\phi = 1$ (i.e. when German smoker play in pure strategy and accepts cigarette only as money) cannot exist without the violation of steady state condition on m, n and C . For now on, we use this model to answer to the three following questions:

1. For what parameters values does the equilibria with cigarette money be ruled out ? This conducts us to study the barter equilibria ($\pi_n = 0, \phi = 1$)

2. For what parameters values do non-smokers decide to use cigarette as money ? \Rightarrow study of equilibria with $(\pi_n = 1, \phi = 1)$
3. What are the conditions under which the whole population use cigarette as money ? \Rightarrow study of equilibria with $(\pi_n = 1$ and $\phi \in [0, 1])$

The following 3 subsections are devoted to the answer of these questions.

4.1 Existence of the barter equilibrium

The study of this equilibrium tells us the answer to the first question because at this equilibrium, nobody accepts the cigarette as money. Hence C, m and n are equal to 0 in equilibrium and $(\pi_n, \phi) = (0, 1) \Rightarrow \Delta_\phi < 0$ and $\Delta_{\pi_n} < 0$. We then just have to check the best response conditions to characterise the region of the parameter space in which this equilibrium exists. $\Delta_{\pi_n} < 0$ imply that

$$\begin{aligned}\Delta_{\pi_n} &= \frac{\alpha x g (\mu (1 - y) - (1 - \mu) y) (u - c) - r c}{r + \alpha x [A \pi + g \mu [m \pi + (1 - m)]] + g (1 - \mu) \pi} < 0 \\ \Leftrightarrow y > y_1 &= \mu - \frac{r c}{\alpha x g (u - c)}\end{aligned}$$

For german smoker, we obtain:

$$\begin{aligned}\Delta_\phi &\Leftrightarrow \frac{\left(\frac{\alpha x g [\mu (1 - m) + (1 - \mu) (1 - n) \Pi] (u - s) - \alpha x y g (1 - C) (u - c)}{-\alpha x (g C + A) (s - c) - r s} \right)}{(r + \alpha x A (1 - \phi) - \alpha x g C \phi + \alpha x g \mu + \alpha x g (1 - \mu) [n + (1 - n) \Pi])} < 0 \\ \Leftrightarrow y > y_2 &= \frac{\mu (u - s)}{(u - c)} - \frac{a (s - c)}{g (u - c)} - \frac{r s}{\alpha x g (u - c)}\end{aligned}$$

We then see that cigarette is not accepted in equilibrium by non smokers if barter is too easy relative to the prior acceptability of money in the population and if r is too high. For smoker, the refusal of cigarette as money depends on the same principal parameter except that their behavior also depend on the utility of smoking. It is easy to show that the condition of non-smokers is always higher than the one of smokers. This is ascertain by the fact that $\frac{(u-s)}{(u-c)} < 1$ and $r s > r c$. Hence, the condition for this equilibrium to exists is only y_1 which is represent as the black line on figure 2 (drawed in the (μ, y) plane)

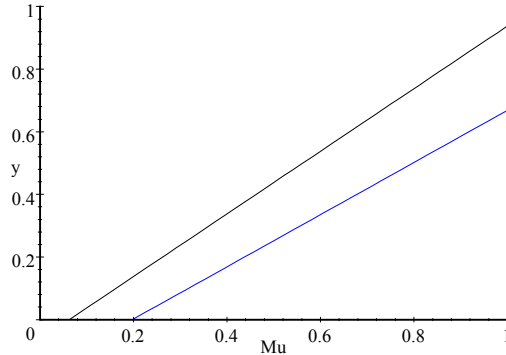


Figure 2: Graphic representation of the 2 conditions for the existence of the barter equilibria (the blue one is the one of smoker) with $r = 0.1$, $\alpha = 0.5$, $u = 1.5$, $c = 0.2$, $x = 0.5$ and $g = 0,95$; $s = 0.5$. Barter equilibrium exists for the region above the black curve.

4.2 Equilibrium with partial acceptance of cigarette as money

At this equilibrium, cigarette is accepted for payments by the whole German population, but not for the same reason. A smoker accepts cigarette because he can then consumes it, which gives him a positive utility while a non-smoker accepts it as a medium of exchange. Hence, cigarette is only used partially as money, conducting us to say that it has a partial acceptability as money. The strategy of a non-smoker implies that he acts as middleman between the population of allied soldiers and the one of german smokers : when one non-smoker meet a agent of population a and there is a single coincidence, he accepts to sell his special good against cigarette because he knows that this will increase his probability to succeed if he mets another German who accepts cigarette. This German could be either a smoker or a non smoker who will use cigarette to increase the probability of succeeding in a trade but, necessarily, all cigarettes introduced in the economy ends up in the hand of smokers who smoke then. Then, we can say that non smokers acts as middlemen between seller and consumer of cigarette (at this equilibrium).

The existence of this equilibrium needs that the best response condition of non smokers is positive (they accepts cigarette as payments) and the one of smoker is negative (they prefer smoking rather than trading cigarette). Moreover, at this equilibrium, no smoker must hold one cigarette in stock

and then $m = 0$. The stock of cigarette held by German in this economy is only due to the behavior of non-smokers. Hence, as $m = 0$, C has to equal to $(1 - \mu)n$. We can compute the value of n for this to be a steady state by using condition

$$\dot{C} = 0 \Leftrightarrow Ag(1 - \mu)(1 - n) = g\mu gC$$

After some algebra, we find that

$$\dot{C} = 0 \Rightarrow n = \frac{A}{g\mu + A}$$

Using $\dot{n} = 0$ allows us to verify that we obtain the same expression. Then, the total stock of cigarette held by German is simply

$$C = (1 - \mu) \frac{a}{g\mu + a} \text{ and } (1 - C) = \frac{\mu}{g\mu + a}$$

We then just need to check the best response condition to know the region of the parameter space where this equilibria exists. Non smokers accept cigarette as money if $\Delta_{\pi_n} > 0$, i.e. if

$$\Delta_{\pi_n} = \frac{\alpha x g \mu (1 - y) (u - c) - r (g\mu + a) c}{(g\mu + A) (r + \alpha x)} > 0$$

Solving this inequality for μ , we find that it is rational for a non smoker to accept cigarette as payment iff:

$$y < y_3 = \mu - \frac{r (g\mu + a) c}{\alpha x g (u - c)}$$

Since $(g\mu + A) < 1$, it is also easy to show that $y_3 < y_1$.

We see that non smoker accept cigarette as money if the population of smoker is large enough. In that case, it is rational for them to sell their good to an agent a for selling it to either a smoker or a non-smoker.

At this equilibria, smokers don't accept cigarette as money but rather to consume it. Hence, Δ_ϕ has to be negative, which is true iff:

$$\begin{aligned} \Delta_\phi < 0 &\Leftrightarrow \frac{\left(\begin{array}{c} \alpha x g [\mu + (1 - \mu)(1 - n)] (u - s) - \alpha x y g (1 - C) (u - c) \\ -\alpha x (gC + a) (s - c) - r (g\mu + a) s \end{array} \right)}{r (g\mu + a) + \alpha x g \mu} < 0 \\ &\Leftrightarrow y > y_4 = 1 - \frac{\alpha x (s - c) + r (g\mu + a) s}{\alpha x g \mu (u - c)} \end{aligned}$$

This condition hold if s is sufficiently large, compared to the value of y . Figure 3, drawn in the plane (s, y) , shows that this condition hold in the right hand side of the black line. We can then conclude that for german smokers not to accept cigarette as money, they must sufficiently value the consumption of cigarette compare to other parameters.

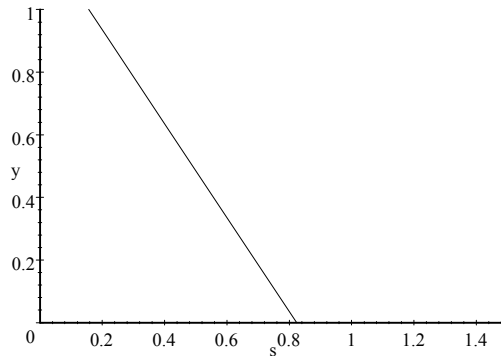


Figure 3: Graphic representation of the best response condition of a smoker with regard to s and y when non-smoker always accepts cigarettes as money (same parameter values as before).

4.3 Equilibrium with cigarette used as money by the whole population

At this equilibrium, the behavior of smoker constraints the size of the money stock in terms of cigarette because smokers accepts cigarette as long as the gain from trading them is at least equal to the gain of smoking them. Hence, in steady state, for the 2 German populations to accept cigarette as money (at least partially), the stockof cigarette has to be such that smokers has a equal gain for the 2 uses of cigarettes. Then, the money stock is given by $\Delta_\phi = 0$, i.e. the best response condition of smokers has to be such that they played in mixed strategy. Computing $\Delta_\phi = 0$ give us the following expression of C :

$$\Delta_\phi = 0 \text{ when } \Pi_n = 1 \Rightarrow C = 1 - \frac{\alpha x (s - c) + r s}{\alpha x g (1 - y) (u - c)}$$

which can be used to compute the value of n and m . For this equilibrium to be s steady state, we have to be sure that the proportion of cigarette

smoked in equilibrium is equal to the the number of cigarette sold by the Allied soldiers to the German agents. This give us the value of ϕ . It is then easy to check the best response condition of non smokers and then to prove the existence of this equilibrium, which is summarizes in the next proposition.

Proposition 2 *The cigarette is accepted as money, at least partly, by the whole population of German if the utility of smoking is not sufficiently small and if the proportion of smoker is large enough compared to the population of sellers of cigarette. At that equilibrium, the stock of cigarette is equal to:*

$$m^* = n^* = C^* = 1 - \frac{\alpha x (s - c) + rs}{\alpha x g (1 - y) (u - c)} \quad (11)$$

which is positive iff 12 holds and is less than 1 if 13 holds. C has a steady state value iff smokers smoke with probability ϕ^ each time they sell a good against a cigarette, with*

$$\phi^* = \frac{A}{g\mu C^*}$$

with C defined in 11. ϕ^ is positive if 12 holds and is less than 1 if 14 holds. The following conditions resume the conditions on the existence of this equilibrium in which cigarette is accepted as money by the two sub-populations of german*

$$s < \frac{\alpha x g (1 - y) (u - c)}{r + \alpha x} + \frac{\alpha x c}{r + \alpha x} \quad (12)$$

$$s > \frac{\alpha x c}{r + \alpha x} \quad (13)$$

$$\mu > \frac{A}{gC^*} \quad (14)$$

These conditions tell us that for money to be accepted by the german population, the utility derived from smoking cigarettes must be small enough compared to the utility to consume special goods and that there must be a sufficiently large population of smoker.

Proof. *Cigarette is accepted as money in a steady state equilibrium by the 2 German sub-populations iff $\Delta\pi_n > 0$ et $\Delta\phi = 0$. But the behavior of german smokers acts as a constraint on the money stock (i.e. the amount of cigarette held for exchange by agents) because, for this to be a steady state equilibrium, smokers have to be indifferent between smoking and consuming*

this good. Hence, we use $\Delta_\phi = 0$ to compute the value of C such that they are indifferent between smoking and trading cigarettes

$$\Delta_\phi = 0 \text{ when } \Pi_n = 1 \Rightarrow C^* = 1 - \frac{\alpha x (s - c) + rs}{\alpha x g (1 - y) (u - c)}$$

This gives us C^* that has to be less than 1 and positive (implying that $\frac{\alpha x c}{r + \alpha x} < s < \frac{\alpha x g (1 - y) (u - c)}{r + \alpha x} + \frac{\alpha x c}{r + \alpha x}$). It is then easy to compute the values of n^* and m^* which are equal to C^* (remember that $C = \mu m + (1 - \mu) n$):

$$\begin{aligned} \dot{n} &= 0 \Leftrightarrow g(1 - \mu)(1 - n) \left(g \left(1 - \frac{\alpha x (s - c) + rs}{\alpha x g (1 - y) (u - c)} \right) + a \right) \pi_n (15) \\ &\Leftrightarrow n^* = 1 - \frac{\alpha x (s - c) + rs}{\alpha x (1 - y) (u - c)} \end{aligned} \quad (16)$$

The steady state condition on the stock of cigarette held by the Germans ($\dot{C} = 0$) gives us the value of ϕ^* :

$$\begin{aligned} \dot{C} &= 0 \Leftrightarrow Ag(\mu(1 - m)(1 - \phi^*) + (1 - \mu)(1 - n)) = g\mu(1 - m)\phi^*gC \\ &\Leftrightarrow \phi^* = \frac{A}{g\mu} * \frac{\alpha x g (1 - y) (u - c)}{\alpha x g (1 - y) (u - c) - \alpha x (s - c) - rs} = \frac{A}{g\mu C^*} \end{aligned}$$

The study of this equilibrium is completed by checking the best reply condition of non-smoker that must be positive (giving us $s > c$, which value is less than the one isolated in condition 13 for any positive r). ■

5 Conclusion

The aim of that paper was to make a first step towards a better understanding of one of the most fascinating example of commodity money in contemporary history. This paper is still incomplete. In particular, it will be extended to the study of the dynamics of this equilibrium and towards a integration of prices in that model.

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Historical records locations

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