THE SHADOW ECONOMY IN THE NETHERLANDS ANTILLES

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# THE SHADOW ECONOMY IN THE NETHERLANDS ANTILLES

### Miriela G.L. Carolina and Lennie Pau[*]

## ABSTRACT

*The last decade provides strong indications of an expansion in shadow economic activities in the Netherlands Antilles. The expansion is the result of many things, including the high tax burden, high unemployment rate, and the foreign demand for drugs. This paper attempts to measure the size of the shadow economy of the Netherlands Antilles using two distinct estimation methods: direct and indirect approaches. These methods produce estimates of the size of the shadow economy that range between 10% and 14% of GDP.*

The existence of a shadow economy in the Netherlands Antilles is unquestionable. The familiar view of street vendors and car washers, among others, earning their day-to-day living by offering goods and services is a simple illustration of this worldwide phenomenon. We first attempted to measure the size of the shadow economy[1] of the Netherlands Antilles in 2003 in a paper titled, "The shadow economy in the Netherlands Antilles" (Pau and Carolina 2003). This paper is an updated version of our first publication. There are strong indications that the shadow economy is growing. The increasing unemployment related to the recession in the late nineties induced the labour force to be creative by starting up small scale, low overhead cost enterprises that operate in the shadow economy. In the early 2000s, the foreign demand for drugs and the high value added created by this sector made the flourishing illegal shadow economy[2] more visible.

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1   The shadow economy represents economic activities that take place outside the formal norms of economic transactions. In this paper, the informal sector and the shadow economy are the same concept.

2   See additional definitions in section 2.

The objective of this paper is to calculate the size of the shadow economy of the Netherlands Antilles using applicable estimation methods. The results must be considered as preliminary. It is important to have an estimate of the size of the shadow economy for several reasons.

(1)  Forecasting without data on the size of the shadow economy underestimates the macroeconomic key variables.

(2)  Simulation of shocks will create distorted information leading to incorrect policy implementation.

This paper is organized as follows: Section 2 defines the shadow economy, describes the shadow economy in the Netherlands Antilles, and presents the different estimation methods used in this paper. In section 3, the size and the economic structure of the shadow economy in the Netherlands Antilles is estimated using both indirect and direct approaches. Section 4 concludes the paper with a summary and some recommendations.

## Shadow economy: definitions, comparisons, and approaches

The literature contains a large range of different terminologies commonly used for the unmeasured economy: informal sector, underground economy, shadow economy, hidden economy, parallel economy, subterranean economy, cash economy, and black market. Because no common definitions exist, widely different author-specific interpretations have resulted. The shadow economy is defined here as economic activities taking place outside the formal norms of economic transactions established by the state and formal business practices (OECD 2002). These activities are generally small scale or micro-businesses run by individuals or families. The shadow economy includes both legal and illegal activities.

- Illegal activities involve the production of goods and services prohibited by law or unlawful when carried out by unauthorized producers (e.g., drug trafficking, money laundering, briberies, and illegal prostitution practices).

- Legal activities are intentionally hidden from the authorities to avoid paying taxes or complying with regulations (e.g., lack of proper business permits, violation of zoning codes, labour regulations governing

contracts and work conditions, and/or the lack of legal guarantees in relations with suppliers and clients).

Table 1 gives an overview of the shadow economy for both the production of legal and illegal goods and services and for both monetary and barter (non-monetary) transactions.

## The size of the shadow economy in the region

Estimates obtained for the shadow economy in the region, using the Tanzi currency demand approach (Tanzi 1980), show that the size of the shadow economy varies significantly between countries. The estimated size of the shadow economy of several countries in the region is shown in Table 2.

## The shadow economy in the Netherlands Antilles

The informal or shadow economy has undergone structural changes in the Netherlands Antilles as various regulations pertaining to this sector have been introduced and enforced in recent decades. However, a government policy to legalize the informal sector has not been explicitly stated. In 1986, the government legalized the lotteries, a rapidly expanding shadow economic activity. Since 1993, several laws on money laundering have been implemented. In 1997, suppliers of small credit for consumer goods purchases came under the supervision of the Central Bank. In 2000, the government reinforced the regulation of 'snack bars,' as they were expanding and operating without a business license. With these regulations in place, the above-mentioned activities switched from the shadow economy to the official economy. In the early 2000s, the illegal activities related to drug trafficking from South America via Curaçao to Europe became more transparent. In 2001, the Minister of Justice of the Netherlands Antilles and the airlines agreed to take measures to interdict drug smugglers on the transatlantic flights.

The increasing number of illegal immigrants active in the labor market was officially registered in 2001. In that year, the Island Government of Curaçao granted a grace period to illegal immigrants who had entered the country before August 2001 to apply for a residence permit and/or work permit. The number of illegal immigrants in Curaçao was approximately 6,000 (4.7% of the

**Table 1: Types of underground economic activities**

| Type of activity | Monetary transactions | | Nonmonetary transactions | |
|---|---|---|---|---|
| Illegal activities | Trade with stolen goods; drug dealing and manufacturing; prostitution; gambling; smuggling; fraud; etc. | | Barter of drugs, stolen goods, smuggling, etc. Produce or grow drugs for own use. Theft for own use. | |
| | **Tax evasion** | **Tax avoidance** | **Tax evasion** | **Tax avoidance** |
| Legal activities | Unreported income from self-employment; wages, salaries and assets from unreported work related to legal services and goods. | Employee discounts fringe benefits. | Barter of legal services and goods. | All do-it-yourself work and neighbour help. |

Source: Mirus and Smith 1997.

**Table 2: Size of the shadow economy of selected countries in
the region, 1999-2005 (% of GDP)**

| Country | Currency Demand Method |
|---|---|
| Trinidad & Tobago | 10.0 |
| Netherlands Antilles | 10.0 |
| Guyana | 40.0 |
| Jamaica | 43.7 |

Sources: *IDB* 2006; Faal 2003; Maurin, Sookram, and Watson 2003
and Pau and Carolina 2003

total population) at that time.[3] Appendix B provides a list of the
most common activities by sector in the shadow economy in the
Netherlands Antilles.

## Causes and consequences of the shadow economy in the Netherlands Antilles

In this section, we discuss in more detail the causes and
consequences of the shadow economy in the Netherlands Antilles.
The shadow economy has the same roots and to a great extent
similar disadvantages in the Netherlands Antilles as in many other
countries. The following factors may increase the size of the shadow
economy.

### Recession, poverty, and structural unemployment

Recessions, poverty, and the mismatch in the labour market
between the skills of the job seekers and the requirements of the job
vacancies can lead to a growth in the shadow economy. For years,
the Netherlands Antilles has been suffering from structural
unemployment: employers and investors complain about a lack of
qualified people to employ. A paradox exists in the labour market,
however, as the high unemployment often coexists with vacancies
in the low-skilled labour-intensive occupations. Additionally, the
demand for jobs is reduced by the economic slowdown. Some of
the unemployed migrate to the Netherlands, and others become
discouraged and give up looking for work. A number of the
unemployed are forced by survival strategies to perform informal
activities, frequently in the trade and community and social services

3   NAVAS system of the Office of Immigration of Curaçao.

sectors, while others get involved in illegal activities. It has become quite common for disadvantaged individuals to serve as "drug mules" to smuggle drugs to Europe.

In addition to the economic slowdown, the high unemployment rate in the Netherlands Antilles has been blamed partly on the social benefits: the poverty trap. The unemployed, with no source of income, can apply for welfare payments (the so-called 'onderstand'), obtain free health care and medication, subsidies for housing and electricity, and a clothing allowance for their children. Although most of these benefits are not received as income, their aggregated value can outweigh the minimum wage[4] when employed formally. As a result, a large number of people who are collecting social benefits may also be employed in the informal sector.
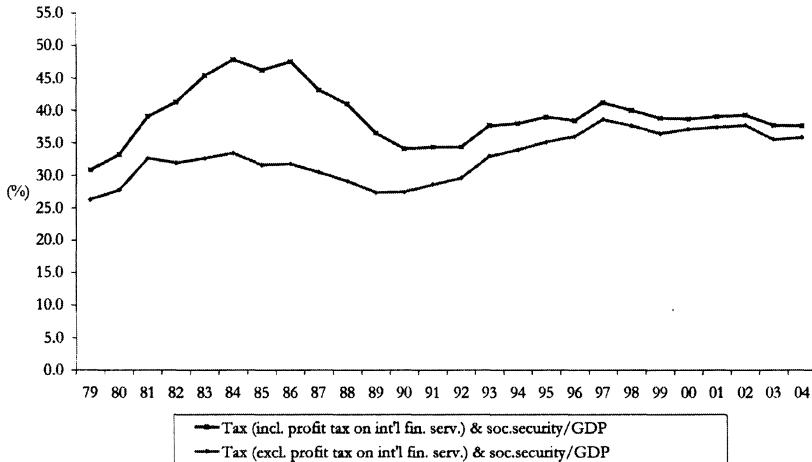
### High tax and social security burden

The high tax and social security burden induces people to evade the current system and avoid paying taxes and social security premiums. The shadow economy provides both employees and employers with the appropriate environment for matching demand and supply of services, resulting in a lower than the "official" market price. In the Netherlands Antilles, this burden has enticed people to shift from the official economy to the shadow economy. In addition, the tax system in the Netherlands Antilles is rather complex, which induces people to find ways to avoid paying taxes.

Over the years, the tax and social security system has changed in the Netherlands Antilles. Figure 1 presents the development of the tax and social security burden including and excluding profit tax from international financial services. The tax and social security burden including this profit tax averaged 39% during the period 1979-2004. After the repeal of the US withholding tax in 1984, the decline in the profit tax of international financial services sector led to a drop in the tax and social security burden in 1987. Excluding the profit tax on international financial services, the tax and social security burden averaged 33% during the period 1979-2004. To analyze the domestic tax burden, we exclude the profit tax on

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4   For more details, see the report of Commissie Introductie Plaatsing Bevorder-ingsinstrument (2005).

international financial services. During the period 1991-2002, the tax and social security burden has been increasing.

**Figure 1: Tax and social security/GDP, 1979-2004**



The rising trend in the tax and social security burden was the result of various changes in the system, in both direct and indirect taxes, as well as in the social premium system. See Box 1 for detailed information on these changes.

**Intensity of government regulations (e.g., labour market regulations)**

A rise in the intensity of regulations is usually determined by the number of laws and the way the regulations are enforced. Labour market regulations, e.g., license requirements, can cause higher labour costs in the official economy and lead to a growth in the shadow economy. To avoid the complex labour law regulations and to lower labor costs, employers tend to hire workers informally. According to Johnson, Kaufmann, and Zoido-Lobatón (1998, 1999), countries that have a smaller shadow economy also have a relatively low tax and regulatory burden and seem to collect more tax revenues. Moreover, these countries have less corruption and a good rule of law. In 2000, the government of Curaçao initiated a process to make the labour market more flexible; in 2003, some of the measures that had been introduced were retracted. According to a survey by the OECD (Commission Caribbean Rim Investment

**Box 1: Background information on developments in tax and social premium systems during the period 1994-2005**

The following events occurred in the direct tax system.

- In 1994, the income tax law was modified, allowing married couples to file their income tax separately. Interest, dividends, and other capital gains are added to the income of the higher earner.

- In 1997, the pay-as-you-file self-assessment system for the profit tax was introduced.

- In December 1999, the Parliament approved a new fiscal regime (NFR) legislation that eliminated the distinction between onshore and international financial sector profit taxes. The profit tax rate was changed from a tax bracket system (39-45%) to a flat rate system (34.5% including the island surcharge). The NFR law became effective in January 2001.

- In 2001, deductions to income and profit taxes were eliminated or restricted, raising the tax burden.

Amendments in the indirect tax and social premiums were as follows:

- Prior to the implementation of a structural adjustment programme (SAP), a 6% sales tax (ABB) was introduced on the Leeward Islands on 1 July 1996.

- A 3% turnover tax (BBO) was introduced on the Windward Islands on 1 January 1997.

- On 1 January 1999, the 6% sales tax (ABB) was eliminated on the Leeward Islands. Simultaneously, the turnover tax (BBO) on the Windward Islands was reduced from 3% to 2%.

- The sales tax was replaced by a 2% turnover tax (NAOB) on the Leeward Islands during March–May 1999 and this tax was subsequently raised to 5% in October 1999.

- On 1 May 2000, the turnover tax (BBO) on the Windward Islands was raised from 2% to 3%.

- In 2001-2005, the economic levies on imported goods were phased out.

- In 1997, a health insurance scheme was introduced for chronically ill patients (AVBZ).

Initiative 2005), many investors claimed that the Netherlands Antillean labour market regulations were too rigid.

To avoid the complex labour law regulations (red tape) and to lower labour costs (e.g., minimum wage and severance pay), employers are more inclined to use workers willing to work informally. Being unemployed and needing to survive encourages individuals to work in the shadow economy.

Many immigrants from South America and the Caribbean, e.g., Colombia, Venezuela, the Dominican Republic, Jamaica, and Haiti seek refuge and employment in the Netherlands Antilles. Most of these immigrants lack the proper paperwork because they enter the country with a tourist visa and overstay the stated period. Some employers prefer to hire illegal migrants because they can evade the payment of social security and other taxes. These workers often are paid less than formal workers for similar tasks, are concentrated in low-paid or unskilled and semi-skilled labour-intensive activities, and are usually employed on a temporary basis. Thus, both the employer and employee have a shadow economy position.

In the long run, a growing shadow economy in the Netherlands Antilles has the following repercussions:

- Official statistics become unreliable. Policies and programmes based on unreliable data are often flawed. For example, programmes aimed at reducing unemployment will not be effective because a large number of these lower-skilled or semi-skilled people are already employed in the informal sector. Moreover, some of these people are not willing to work in the official economy because they do not want to lose their social benefits.

- Tax revenue and social security income are lower due to a lack of compliance. The people working informally do not comply with the tax payments and social security premiums, but they do benefit from the public services, e.g., health care and education.

- Unfair competition due to tax evasion means that informal firms offering cheaper prices can force honest businesses out of the market or underground; for example, businesses offering cheaper prices for goods and services paid for in cash instead of checks or credit cards.

**Different approaches for estimating the size of the shadow economy**

The size of the shadow economy can be measured using either direct or indirect approaches (Schneider and Enste 2002). Direct approaches utilize surveys and tax auditing. Indirect approaches use macroeconomic indicators.

Direct approaches frequently use both surveys and samples based on voluntary responses, or tax auditing and other compliance schemes. However, these survey methods have their weaknesses because both accuracy and results rely heavily upon the inter- viewees' willingness to collaborate and their incentive to provide correct responses.

Indirect approaches are based mainly on macroeconomic indicators, which "leave a trail" of the existence of a shadow economy. Presently, five indicators/methods leave some "traces" of the shadow economy:

1. The discrepancy between national expenditures and income statistics
2. The discrepancy between the official and the actual labour force
3. Monetary methods (transaction approach and currency demand approach)
4. The physical input method (electricity consumption) and
5. The model approach

In our paper, we use both direct and indirect approaches to estimate the size of the shadow economy in the Netherlands Antilles. Our direct approach is based on the sample data from the Labor Force Sample Surveys (LFSS). This information was derived from the Caribbean employment forum 2006. Two indirect approaches were also used — the currency demand approach and the electricity method. We selected these methods based on the accessibility of recent data and/or the plausibility of the results.

**The size of the shadow economy in the Netherlands Antilles**

According to the international literature, a close relationship exists between people employed in the official labour market and those in the shadow economy; people employed in the official economy can also be employed in the shadow economy. The shadow labour market in the Netherlands Antilles takes the following forms:

(1) people who prefer to work underground for numerous reasons; these people are classified as unemployed in the official labour force; (2) people with a second job after (or even during) regular working hours; (3) individuals, e.g., retirees who receive pensions, who are not part of the official labour market; and (4) illegal immigrants who do not have a permit to work in the official economy.

### Direct approach: labour market

As noted, the direct approach we used to estimate the size of the shadow economy is based on information from the Labour Force Sample Surveys (LFSS). This survey measures the number of persons informally employed in the formal[5] and informal sectors. Individuals employed informally in the formal sectors are persons who are sub-contracting or have short-term contracts, such as free lancing or doing casual work. Informal workers are usually not subject to standard labour legislation, i.e., taxation, benefits, and social protection.

The results of the LFSS show that the share of informally employed in relation to the total employed in the Netherlands Antilles is about 24% and that more women than men are employed in the informal sector. Approximately 68% of these individuals have a secondary education.[6] For further details on the LFSS study see Appendix C.

For our study, the LFSS data have limitations. These data may underestimate the actual total number of persons working informally in the Netherlands Antilles.

- It does not take into account people involved in illegal shadow economic activities, such as drug trafficking and prostitution.
- Individuals working less than 4 hours per week are regarded as unemployed, and therefore, are excluded from the employed working population. However, individuals working less than 4 hours per week are more likely to be working underground.

5  Companies registered at the Chamber of Commerce (KvK).
6  MAVO/LBO/VSBO.

- It does not measure individuals with more than one job. According to the international literature, most people employed in the shadow economy have a second job.

## Methodology

The data set we have used to estimate the size of the shadow economy is drawn from the LFSS. We use the concept of value added, defined as the sum of the total wages, profits, and rents.

To assess annual wages, the number of employed in the shadow economy in each sector was multiplied by the estimated average wage rates. The assumption is that the average wage rates of the informal workers are about 20% less than those paid to the formal workers. Persons working informally earn comparatively less income per month than those in the formal economy. The 20% reduction of the wage rate of the formal sector is based on the fact that most informal workers do not pay direct taxes[7] or premiums to the social security system. The formal worker must be paid at least the official minimum wage. As stated by the LFSS, approximately 50% of the informally employed are earning less than or equal to the minimum wage.  If this group of informal workers were formally employed, they would have a tax and social security burden of about 12%. Activities in the informal sector vary considerably from unskilled to skilled, legal to illegal, and high value added to low value added. The 50% earning more than the minimum wage is the result from the aforementioned diversity. Therefore, higher than the official minimum wage rates were applied to workers informally employed in some non-classical[8] sectors in the informal economy. If this group of informal workers were formally employed, they would actually be faced with a tax and social security burden of around 30% because the Netherlands Antilles has a progressive income tax system: the more you earn, the more income tax you pay. Overall, we have lowered the wage rates of the informal workers by an average of 20%.

7   According to the National Accounts, the direct tax and social security burden excluding the profit tax from international financial services in the Netherlands Antilles was approximately 25% during the period 1979-2004.

8   Public administration and education, health and social work, and the financial and businesses services sectors.

The minimum wage of NAf. 1,000 per month was used as the benchmark for the informal wage rate. However, in some sectors, such as financial and business services, public administration and education, and health and social work, we assumed that informal workers earn on average more than the minimum wage. The people in these sectors are usually skilled workers. According to the LFSS, approximately 50% of the informally employed are earning more than the minimum wage. Persons employed informally in public administration and education and the financial and businesses services sectors are usually administrative support, e.g., data entry and typists, who are hired on a daily basis or on a short-term contract. Hence, informal workers in these sectors receive more than the informal workers in the wholesale and retail, hotels and restaurants, and private household sectors where they earn a minimum wage.

We have taken into account that most of the informal workers are employed 40 hours per week. According to the LFSS, about 61% of the individuals employed in the informal sector work 40 hours or more per week. Furthermore, about 34% of these informally employed people work 33 hours per week.

To arrive at the profits and rents for the informal sector, we raised the total annual wages of each sector by multiplying them by a factor. This factor represents the missing information about individuals who are working less than 4 hours, are involved in illegal shadow economic activities, and/or are 'moonlighting'. According to the National Accounts, the share of the value added of profits and rents is relatively similar to that of wages and salaries. In the shadow economy, we assume that, on average, the share of the value added of profits and rents in the shadow economy is twice that of the official economy. Therefore, for measuring the profits and rents, we used a factor of two as a benchmark throughout to raise the total annual wages in the shadow economy. Except for the wholesale and retail trade sector, the factor is assumed to be four-fold, compared to the official economy because illegal activities such as drug trafficking generate high profits.

The estimated size of the shadow economy in the Netherlands Antilles was approximately 11% of GDP in 2005. Wholesale and retail (3.4% of GDP) made up the largest share of the shadow economy, followed by financial and business services (1.8% of GDP), public administration/education (1.3% of GDP), and

Table 3: Shadow economy, by sector in the Netherlands Antilles, 2005

| Sector | % of GDP by sector |
|---|---|
| Manufacturing/Electricity | 0.5 |
| Construction | 0.9 |
| Wholesale & retail trade | 3.4 |
| Hotels & restaurants | 0.7 |
| Transport, storage and communication | 0.7 |
| Financial/business services | 1.8 |
| Public administration/education | 1.3 |
| Health & social work | 0.5 |
| Community & social services | 0.6 |
| Private households | 0.5 |
| Other/unknown | 0.1 |
| Total | 11.00 |

*Source:* Estimate by the Bank van de Nederlandse Antillen.

construction (0.9% of GDP). Table 3 illustrates the size of the shadow economy by sector.

## Indirect approaches

### Monetary methods

In general, shadow economic activities deal in cash to avoid leaving too many traces. It is assumed that shadow economic activities are expanding when the demand for cash increases above the 'normal' relative or absolute value. Two different approaches can be used to determine the size of the shadow economy and its progress over time using monetary statistics: the transactions approach and the currency demand approach. For the Netherlands Antilles, we used the currency demand approach.

### The currency demand approach

This method was developed by Cagan (1958), based on a correlation between the demand for currency and the tax pressure (as one of the causes of the shadow economy) for the United States during the period 1919-1955. Gutmann (1977) used the same approach to study the ratio between currency and demand deposits. The work of Cagan was further developed by Tanzi (1980, 1983), who econometrically estimated the currency demand function for the United States for the period 1929-1980. Tanzi assumed that shadow transactions are conducted in cash payments to leave no observable

traces for the authorities. An increase in the size of the shadow economy will increase the demand for currency.

Tanzi (1983) proposed the following regression equation for the currency demand:

$$\ln (C/M2)_t = \beta_0 + \beta_1 \ln (1 + TW)_t + \beta_2 \ln (WS/NI)_t + \beta_3 \ln R_t + \beta_4 \ln (Y/N)_t + u_t \qquad (1)$$

Where:

C/M2    : the ratio of cash holding to current and deposit accounts,

TW      : a weighted average tax rate (to proxy changes in the size of the shadow economy),

WS/NI : the proportion of wages and salaries in national income (to capture changing payments and money holding patterns),

R        : the interest paid on savings deposits (to capture the opportunity cost of holding cash),  and

Y/N     : the per capita real income.

As the level of taxation rises, individuals are encouraged to engage in tax-evading activities facilitated by the use of currency, since this practice leaves no traces, raising the use of currency ($\beta_1 > 0$).  Daily workers are paid mostly in cash, in contrast to other types of income (interest, dividends) that are paid mostly in checks or electronic transfers. Therefore, an increase in wages in total income will require more currency ($\beta_2 > 0$). Meanwhile, an increase in real income per capita, as a proxy for economic growth, is assumed to lead to the replacement of currency by checks, thus leading to a fall in the ratio C/M2  ($\beta_4 < 0$). Similarly, an increase in the interest rate increases the opportunity cost of holding currency; thus, the ratio C/M2 is expected to decline ($\beta_3 < 0$).

In this approach, the shadow economy is nonexistent when taxes are zero. The difference between the estimated currency (with taxes) and the estimated currency (under the assumption of zero taxes) produces an estimation of currency in the shadow economy. Tanzi assumes that the velocity of money in the shadow economy is the same as in the official economy. The estimate of the size of the shadow economy is obtained by multiplying the currency in the shadow economy by the velocity of money.

The method and assumptions of this approach have been criticized for the following reasons (Schneider and Enste 2002):

- Not all transactions in the shadow economy use cash as a means of exchange; therefore, the size of the shadow economy (including barter) may be underestimated.
- Besides the tax burden, other factors, such as regulation and tax morality, might impact the shadow economy.
- In the case of the United States, the rise in the ratio currency/demand deposits was due mainly to a slowdown in demand deposits rather than to a rise in currency caused by activities in the shadow economy.
- The United States dollar is used as an international currency. As argued by Feige (1986, 1997), Tanzi should have considered (and controlled for) the United States dollars, which are used as international currency and held as cash reserves abroad.
- A similar velocity of money in the shadow and official economies is debatable.
- The approach requires a base year in the official economy with a nonexistent shadow economy. Relaxing this assumption would lead to an upward adjustment of the size in the shadow economy.
- Some activities, e.g., illegal activities, are not the result of a high tax burden.

*Currency demand approach for the Netherlands Antilles*

The currency ratio relates the magnitude of the currency to M2. Transactions in currency are anonymous, while those involving checks or bank transfers leave an identifiable trace. To hide the source of income from tax or other authorities, participants in the shadow economy are more likely to use cash. In this sense, a rise in the currency ratio, *ceteris paribus*, could indicate an increase in the shadow economy.

In the Netherlands Antilles, the monthly data clearly show a declining trend in the currency ratio. Using these data will imply a declining trend in the shadow economy in the period under review. However, we knew that these data needed to be adjusted, based on certain well-known facts. Thus, the data were modified to include

Figure 2: Currency/M2 ratio of the Netherlands Antilles



Monthly Data
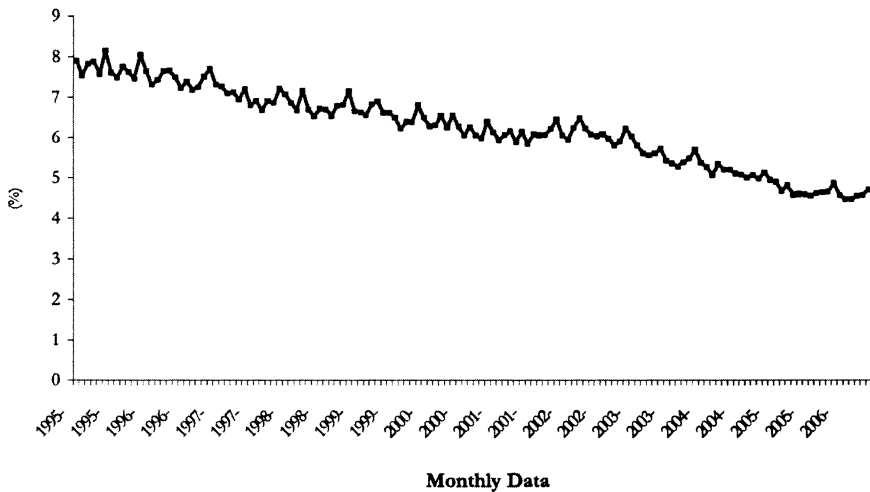
the information not accounted for in the currency data published by the Central Bank.

- The stock of currency does not include foreign currency holdings. These holdings in the hands of the public are excluded from the currency stock by definition. However, in the Netherlands Antilles, primarily in Curaçao and St. Maarten, the use of the US dollar as a means of exchange is quite substantial.
- In 2000, transatlantic drug trafficking to the Netherlands became more transparent. Curaçao especially served as a transit country for drugs from South America to the Netherlands. We used the individual/family transfer data from our balance of payments as an indicator for these illegal transactions (see Appendix D).

To modify the currency data, only the second factor has been taken into consideration. Annual data were used to estimate the equation because of the low frequency of the explanatory variables. The variables tax rate and real income are available only on an annual basis. Using the Error Correction Model (ECM) frame-work,[9] we estimated two equations. The first equation is based on Tanzi's approach. In this equation, we used the variable self employed (W_self) as a proxy for the proportion of wages and

9   The ECM is described in more detail in Appendix E.

salaries in the national income (WS/NI). A general form of the first equation is the following:

$$\Delta \ln (C/M2)_t = \beta_0^* \Delta \ln (T_{\_tot})_t + \gamma_0^* \Delta \ln R_t + \delta_0^* \Delta\ln (Y/P)_t + \lambda_0^* \Delta\ln(W_{\_self})_t + \alpha^* (\ln (C/M2)_{t-1} - \beta_1/ \alpha^* \ln (T_{\_tot})_{t-1} - \gamma_1 / \alpha^* \ln R_{t-1} - \delta_1/\alpha^* \ln (Y/P)_{t-1} - \lambda_1/\alpha^* \ln(W_{\_self})_{t-1} - c/a) + u_t \qquad (2)$$

Where:

| | |
|---|---|
| C/M2 | : the ratio of cash holdings to M2, |
| $T_{\_tot}$ | : direct and indirect tax rate (as % GDP), |
| R | : the interest paid on savings deposits (to capture the opportunity cost of holding cash), |
| Y/P | : the real income, and |
| W_self | : the number of self-employed persons. |

The expected signs are $\beta_0$, $\beta_1/ \alpha > 0$, $\gamma_0$, $\gamma_1 / \alpha < 0$, $\delta_0$, $\delta_1/ \alpha < 0$, and $\lambda_0$, $\lambda_1/\alpha > 0$.

A general form of the second equation is:

$$\Delta \ln (C/M2)_t = \beta_0^* \Delta \ln (T_{\_ind})_t + \gamma_0^* \Delta \ln R_t + \theta_0^* \Delta\ln (U_{\_no})_t + \lambda_0^* \Delta\ln(W_{\_self})_t + \alpha^* (\ln (C/M2)_{t-1} - \beta_1/ \alpha^* \ln (T_{\_ind})_{t-1} - \gamma_1 / \alpha^* \ln R_{t-1} - \theta_1/\alpha^* \ln (U_{\_no})_{t-1} - \lambda_1/\alpha^* \ln(W_{\_self})_{t-1} - c/a) + u_t \qquad (3)$$

Where:

| | |
|---|---|
| T-ind | : indirect tax rate (as % GDP), and |
| U_no | : the number of unemployed persons. |

The expected signs are $\beta_0$, $\beta_1/ \alpha > 0$, $\gamma_0$, $\gamma_1 / \alpha < 0$, $\theta_0$, $\delta_1/ \alpha < 0$, and $\lambda_0$, $\lambda_1/\alpha > 0$.

The second equation is an adjusted version of Tanzi's approach. In this equation, the number of unemployed persons is included as an explanatory variable. The Netherlands Antillean economy has been growing in nominal terms during the last two decades. In contrast, the unemployment rate has remained high, in double-digits. Clearly, the economic growth has not been strong enough to create sufficient jobs to curb the unemployment. The unemployment rate is a strong indicator of a growing shadow economy. Real income

has not been included in the equations because this variable is insignificant in our case.

## Data

We used the annual data of the Netherlands Antilles for the period 1979-2004. However, because of a break in the series of the unemployment data in 1988,[10] the samples in the two regressions differ. The equation without the unemployment variable uses a longer time series than the equation with the unemployment variable. For reason of comparison, the results presented are limited to the period of 1988 – 2004.

The currency ratio, the interest rate on savings, and 'he number of self-employed are from the Central Bank of '·e Netherlands Antilles. Data on taxes, unemployment, GDP, an.' ꞌ. consumer price index of the Netherlands Antilles are from the Central Bureau of Statistics.

Besides the currency, GDP data were adjusted to obtain a consistent data set. More detailed information on the adjusted currency data can be found in Appendix D.

## Results of estimation

To measure the size of the shadow economy, equations (2) and (3) were used. Equation (2) uses the following explanatory variables: total taxes, interest rate, self-employed, and real income. Equation (3) uses the explanatory variables: unemployed, indirect tax, interest rate, and self-employed. The results must be interpreted with caution because of the small sample size of the data. The asymptotic properties and model adequacy are summarized in Appendix E.

Tables 4 and 5 give an overview of the estimated results of each equation. Table 4 represents the results of the ECM using equation (2). According to Tanzi, an economy without shadow economic transactions is obtained under the assumption that total taxes are zero. To estimate the shadow currency (Table 4, first column), the estimated currency (without tax) is subtracted from the estimated currency (with tax). Last, the shadow economy (Table 4, third column) is measured by multiplying the shadow currency

10 The Central Bureau of Statistics started using the new definition of the ILO in 1988.

by the velocity of money in the official economy. The last column shows the shadow economy as a percentage of GDP.

Table 5 represents the ECM with unemployed, indirect tax, interest rate, and self-employed as explanatory variables, as listed in equation (3). In this case, the indirect taxes and the unemployment are assumed to be zero. To obtain the shadow currency (Table 5, first column), the estimated currency (without tax and unemployment), is subtracted from the estimated currency (with tax and unemployment). The methodology used to obtain the third and the last column of Table 5 is similar to Table 4.

Using the Tanzi method, the tables show that in the period 1988 – 2000, the shadow economy was about 5% of GDP; it rose to approximately 9% of GDP during the period 2001 – 2004. Using the adjusted Tanzi method, the size of the shadow economy in the period 1988 – 2000 was estimated at 8% of GDP and during the period 2001 – 2004 at 14% of GDP.

Table 4: Netherlands Antilles: Estimates of the shadow economy, Currency approach (equation 2)

| Year | Shadow Money (in millions NAf.) | Income velocity of money | Shadow economy (in millions NAf.) | Shadow economy as % of GDP |
|------|------|------|------|------|
| 1988 | 85.7 | 1.9 | 162.7 | 6 |
| 1989 | 77.4 | 2.1 | 161.3 | 5 |
| 1990 | 94.4 | 2.0 | 190.1 | 5 |
| 1991 | 101.3 | 2.0 | 202.4 | 5 |
| 1992 | 114.6 | 1.9 | 215.8 | 6 |
| 1993 | 114.2 | 1.9 | 211.9 | 5 |
| 1994 | 120.4 | 1.8 | 222.2 | 5 |
| 1995 | 140.0 | 1.8 | 251.4 | 5 |
| 1996 | 114.3 | 1.9 | 220.9 | 5 |
| 1997 | 140.1 | 1.9 | 266.3 | 5 |
| 1998 | 157.4 | 1.9 | 293.4 | 6 |
| 1999 | 154.8 | 1.7 | 268.1 | 5 |
| 2000 | 176.5 | 1.7 | 307.1 | 6 |
| 2001 | 279.1 | 1.6 | 434.9 | 8 |
| 2002 | 346.5 | 1.4 | 487.1 | 9 |
| 2003 | 392.2 | 1.3 | 527.2 | 10 |
| 2004 | 404.3 | 1.3 | 543.5 | 10 |

Table 5: Netherlands Antilles: Estimates of the shadow economy,
Currency approach (equation 3)

| Year | Shadow Money (in millions NAf.) | Income velocity of money | Shadow economy (in millions NAf.) | Shadow economy as % of GDP |
|---|---|---|---|---|
| 1988 | 132.8 | 1.9 | 252.1 | 9 |
| 1989 | 128.1 | 2.1 | 266.9 | 8 |
| 1990 | 137.2 | 2.0 | 276.3 | 8 |
| 1991 | 153.6 | 2.0 | 307.0 | 8 |
| 1992 | 171.7 | 1.9 | 323.4 | 8 |
| 1993 | 189.7 | 1.9 | 352.0 | 8 |
| 1994 | 181.8 | 1.8 | 335.5 | 7 |
| 1995 | 195.6 | 1.8 | 351.3 | 8 |
| 1996 | 165.8 | 1.9 | 320.4 | 7 |
| 1997 | 217.0 | 1.9 | 412.5 | 8 |
| 1998 | 241.5 | 1.9 | 450.2 | 9 |
| 1999 | 229.4 | 1.7 | 397.1 | 8 |
| 2000 | 279.5 | 1.7 | 486.5 | 9 |
| 2001 | 434.0 | 1.6 | 676.1 | 13 |
| 2002 | 531.6 | 1.4 | 747.3 | 14 |
| 2003 | 553.1 | 1.3 | 743.5 | 14 |
| 2004 | 601.7 | 1.3 | 782.3 | 14 |

## Kaufman-Kaliberda Method

### The physical input (electricity consumption) method

In general, the electricity/GDP elasticity has been observed to be close to one. According to the Kaufman-Kaliberda method, the shadow economy is the difference between the rate of the electricity consumption (indicator of the official and unofficial economy) and the rate of registered (official) GDP.

This is a simple method because information is readily available and easy to use. However, this method has been criticized for these reasons (Schneider and Enste 2002):

- Not all shadow economy activities require electricity, because other energy sources can be used. Therefore, the shadow economy will be underestimated.
- Over time, technological changes have made the production and the use of electricity more efficient.

- The changes in the electricity/GDP elasticity may differ considerably over time and across countries.

We have tried to measure the growth of the shadow economy of the Netherlands Antilles with the Kaufman-Kaliberda method. Figure 3 shows that the shadow economy has been fluctuating over the last two decades. During the period 2000-2003, there were strong indications of a growing shadow economy, as opposed to the results obtained from this method. Therefore, in our view, this is an inappropriate method to measure the shadow economy.

**Figure 3: Growth rate of the shadow economy**



%Δ electricity-%Δ GDP
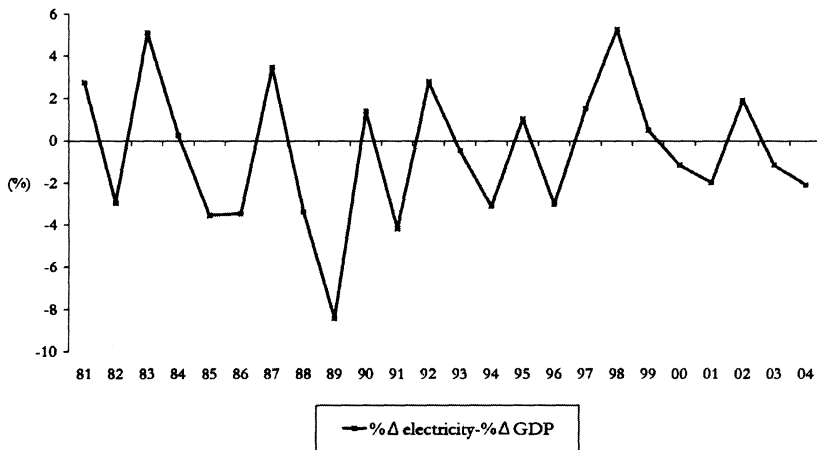
## Conclusion and recommendations

The literature on the shadow economy is expanding as this subject has increased in importance worldwide. The causes and the consequences of the growing shadow economy are numerous. A growing shadow economy distorts the official data, providing policymakers with unreliable indicators, which can lead to wrong decisions. In this paper, we attempted to measure the size of the shadow economy in the Netherlands Antilles. Assessing the size and the development of the shadow economy is difficult due to a lack of information because the people involved in shadow economic activities prefer to remain unknown.

Three methods were used to calculate the size of the shadow economy in the Netherlands Antilles: the labour survey method, the

currency demand approach, and the electricity consumption approach.

Our first approach was based on the data set of the Labor Force Sample Survey (LFSS). These data include individuals working informally in the informal and formal sectors in the Netherlands Antilles. This approach may underestimate the size of the shadow economy because the LFSS data do not take into account individuals involved in illegal activities, people working less than 4 hours a week, and those who are moonlighting. Therefore, the actual total number of persons working informally in the Netherlands Antilles could be underestimated. Using this approach, we estimated the size of the shadow economy at about 11% of GDP in 2005.

The currency demand approach (Tanzi's approach) uses the stock of currency as a measure for the shadow economy. According to the theory, a higher stock of currency is an indication of an increasing shadow economy, as the players in this sector prefer to use cash to avoid any traces of their transactions. To utilize this approach, we modified the stock of currency of the Netherlands Antilles. Because foreign exchange cash is not included in the statistics of cash money, the latter was adjusted to include the euro currency for the period 2000-2003. The euro currency was included because of the substantial transatlantic drug trafficking transactions in this currency during the aforementioned period. Using the currency approach, we estimated that the shadow economy averaged 5% of GDP in the period 1988-2000, and rose to an average of 9% of GDP during the period 2001-2004. We further adjusted Tanzi's method by including unemployment in the equation. The results showed a shadow economy of approximately 3 percentage points higher than that produced by the original Tanzi method.

Tanzi's approach is based on a zero tax rate to measure an economy without shadow economic transactions. Thus, when there are no taxes, there is no incentive to go underground. However, in our view, to minimize the shadow economy does not necessarily require a zero level of taxation. Moreover, the level of taxation that minimizes the size of the shadow economy can differ by country. To minimize the shadow economy, an optimal tax rate should be considered. Furthermore, we believe that the unemployment provides an important signal for a growing shadow economy.

Therefore, we propose a slight adjustment to Tanzi's assumption:

(1) Estimate an optimal tax rate for each country that will minimize the shadow economy. For example, in our case, a 50% reduction in the tax rates would reduce the informal economic activities considerably.

2) Estimate the optimal level of unemployment that will minimize the size of the shadow economy.

(3) Adjust Tanzi's equation by including the unemployment.

(4) Estimate the shadow currency by subtracting the estimated currency (with optimal tax rate and optimal unemployment) from the estimated currency (with tax and unemployment).

We also used the electricity consumption method to estimate the size of the shadow economy. This approach uses electricity consumption as an indicator of the official and shadow economies. General information for the period under review suggests that this is an inappropriate method to measure the shadow economy in the Netherlands Antilles.

Based on the research reported in this paper, we offer some recommendations pertinent to the shadow economy. (1) Reduce the tax rate, which will reduce shadow economic activities, (2) Reduce the number of unemployed (with the elimination of poverty traps), resulting in a smaller shadow economy. (3) Capture shadow economy activities in the National Accounts data.

This paper has provided some preliminary findings on the shadow economy in the Netherlands Antilles. Both indirect and direct methods estimated the size of the shadow economy between 10-14% of GDP. Some questions still need to be addressed. How is the shadow economy affecting the official economy, and vice versa? How different is the business cycle of the shadow economy compared to that of the official economy? These questions may encourage future research on this topic. The proposal is to capture shadow economic activities (legal and illegal) into the National Accounts, which will provide researchers with the appropriate data to further refine the assumptions, facilitating a more in-depth analysis of the shadow economy.

## Appendix A: The Netherlands Antilles: An Overview

### Monetary policy

The official tender in the Netherlands Antilles is the Netherlands Antillean guilder (NAf.). The primary objective of the Central Bank is to maintain the external value of the Antillean guilder. To achieve this goal, the monetary policy of the Central Bank is aimed towards maintaining a fixed peg with the US$. Since December 23, 1971, the parity between the two currencies has been 1 US$ = 1.79 NAf. The peg is fixed towards the US$ because one of our main trading partners is the United States. To guarantee the fixed peg between the NAf. and the US$, the Central Bank has to maintain a level of official reserves (excluding gold) that covers at least three months of merchandise imports. Monetary policy instruments in use by the Central Bank are aimed mainly at influencing the liquidity position of the commercial banks. The instruments used in the implementation of the Bank's monetary policy are the reserve requirement, money market instruments, and the policy on foreign positions.

### Fiscal policy

During the seventies, the government budget expanded due to the tax revenues collected from international financial companies, mainly from the United States. From 1980-1990, the government budget was severely affected by two main events: (1) the repeal of the withholding tax in the United States, which affected the international financial sector, and (2) the departure of the multinational 'Shell' oil company.  Since 1986, the Venezuelan oil company, 'PDVSA,' has been leasing the refinery. The refinery is exempted from profit tax and import duties. These events forced the government in 1986 to initiate a restructuring program to reduce the fiscal deficit. This programme was followed by consecutive programs aimed at budget reduction. Fiscal policy shifted from an expansionary policy to a budget reduction policy. During this period, arrears accrued in nearly all government-related sectors. The pension fund and the health sector, among others, were severely affected by the huge arrears. Government investment was postponed, which hampered government services. Merging, privatization, reduction of subsidies, termination of government services, and raising the taxes and social security premiums were the main points of policy action.

### The economic structure

The economy of the five islands of the Netherlands Antilles is largely dependent on service-related activities. Trade, international financial services, transportation, and tourism sectors are well developed foreign

exchange-and employment-generating sectors. Moreover, the oil refining industry and ship repair sector have contributed substantially to the economic diversification.

The structure of the economy has changed in recent decades. The decline in government revenues due to the elimination of the withholding tax in the United States forced the government to restructure. The government lowered its share in production from 18.5% in 1979 to 13.6% in 2004 (Table 6). In the private sector, the share of GDP of the transportation, storage and communication sector shrank considerably from 20.8% in 1979 to 9.5% in 2004. In contrast, the financial and business services sectors expanded substantially from 15.5% of GDP in 1979 to 29.2% of GDP in 2004. The economy of the Netherlands Antilles is open and relatively small in scale, thus very susceptible to global developments and external shocks. The ratio of imports to GDP averaged 81% in the period 1996 – 2004. The exports to GDP ratio averaged 75% in the period 1996 – 2004.

Table 6: Gross Domestic Product, by sector, 1979-2004

| Gross Domestic Product by sector (%) | 1979 | 1987 | 1997 | 2004 |
|---|---|---|---|---|
| Agriculture, fishing, and mining | 0.6 | 0.7 | 0.6 | 0.6 |
| Manufacturing | 7.9 | 5.8 | 6.2 | 5.5 |
| Public utilities | 2.0 | 4.0 | 4.2 | 4.7 |
| Construction | 9.1 | 7.1 | 5.9 | 5.1 |
| Wholesale and retail sale | 17.2 | 21.1 | 13.2 | 12.0 |
| Restaurants and hotels | 4.3 | 6.4 | 3.8 | 3.9 |
| Transportation, storage, and communication | 20.8 | 10.8 | 9.8 | 9.5 |
| Finance, insurance, real estate, and business services | 15.5 | 19.9 | 26.5 | 29.2 |
| Community, social, and personal services | 6.9 | 10.6 | 7.5 | 8.4 |
| Value added private sector | 84.3 | 86.4 | 77.7 | 78.9 |
| - Imputed service charge | 2.8 | 3.6 | 2.4 | 2.2 |
| Taxes less subsidies | N/A | N/A | 7.7 | 9.7 |
| Value added government | 18.5 | 17.2 | 17.0 | 13.6 |
| Gross Domestic Product | 100.0 | 100.0 | 100.0 | 100.0 |

Source: *National Accounts Netherlands Antilles*, Central Bureau of Statistics.

## Appendix B: Activities by sector in the shadow economy in Curaçao

On the micro level, the existence of the shadow economy is visible in almost all sectors. The legal as well as illegal[12] shadow economic activities in Curaçao are listed below by sector.

A. *Agriculture & fishing*
- Gardeners and horticulturists
- Market vendors of fish and other agricultural products

B. *Construction*
- Building, repairing, and renovating, e.g., welding, carpentry, bricklaying, and painting

C. *Wholesale & trade and hotels & restaurants*

### C1.   Wholesale & trade

- Clothing stores
- Selling food from home; catering services
- Market and street vending (newspapers, food, manufactured, and counterfeit goods)
- Repairing electronic appliances
- Contraband (*). Stolen property exchanged/sold cross border or domestically in barter/money transactions
- Drug trafficking/smuggling(*)

### C2.   Hotels & restaurants

- Hotels, restaurants, and snack bars
- Dance bars (exotic dance clubs) (*)
- Illegal gambling (*)

D. *Transportation*
- Transportation of garbage and construction-related activities
- Automobile maintenance and car repairs (car washing & mechanical services)

E. *Financial/business activities, education, culture, & sports*
- Private tuition and coaching

12 Illegal activities are denoted with a  (*)

- Private jobs in the professional services, e.g., bookkeeping, administration, computer programming, etc.
- Cultural events, e.g., carnival activities, sewing, etc.

F. *Community, social, & other services*
  - Domestic work, e.g., senior caretakers, servants, childcare workers, and daycare providers
  - Subcontractors hired by security services
  - Hairdressers/beauticians
  - Nightclub dancers
  - Prostitution (*)

## Appendix C: LFSS data

Table 7 shows some of the LFSS results. For more detailed information, see the paper of the Caribbean employment forum (2006). Wholesale & retail is the largest employer of informally employed workers, followed by financial/business services, and construction. By definition, the people employed in private households are incorporated in the informal sector.

Table 7:  **Informally employed by sector in the Netherlands Antilles, 2005**

| Sector | Informal | Total employed | Informal/total employed (%) |
|---|---|---|---|
| Manufacturing/Electricity | 1,096 | 5,300 | 1.5 |
| Construction | 1,882 | 5,702 | 2.5 |
| Wholesale & retail trade | 3,463 | 14,391 | 4.7 |
| Hotels & restaurants | 1,413 | 7,496 | 1.9 |
| Transport, storage & communication | 1,343 | 4,750 | 1.8 |
| Financial/business services | 1,972 | 11,378 | 2.7 |
| Public administration/education | 1,742 | 8,108 | 2.4 |
| Health & social work | 1,293 | 5,413 | 1.7 |
| Community & social services | 1,781 | 7,810 | 2.4 |
| Private households | 1,554 | 2,834 | 2.1 |
| Other/unknown | 452 | 893 | 0.6 |
| **Total** | **17,991** | **74,075** | **24.3** |

Source: Caribbean Employment Forum 2006

## Appendix D: Adjusted currency data for the currency demand approach

Foreign currency is not included in the statistics of the currency held by the public. Cash transactions in US$ are common in Curaçao and especially in St. Maarten. St. Maarten's economy is partially dollarized. Since the introduction of the euro, a large amount of this currency has been circulating in the Netherlands Antilles. In Curaçao, euro money transactions related to drug trafficking became transparent during the period 2000-2005. Curaçao served as a transit country for drugs from South America to Europe. As an indicator for these illegal transactions, we used the individual/family transfer data from our balance of payments data. For our currency approach, we modified the currency data by including the euro transactions. As a result, the adjusted currency data reveal a trend relatively similar to the inflows of the individual/family transfers during the period 2001-2003. Table 8 gives an overview of the inflows and outflows of these transfers from and to the Netherlands.

Table 8: Family transfers between the Netherlands and the Netherlands Antilles

| (%) | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|
| Share Netherlands/total family transfers (inflow) | 32.1 | 45.1 | 55.1 | 58.8 | 47.1 | 33.1 |
| Share Netherlands family transfers (inflow)/GDP | 0.9 | 1.6 | 4.1 | 4.9 | 2.9 | 1.6 |
| Share Netherlands/family transfers (outflow) | 22.6 | 22.7 | 23.1 | 22.2 | 16.3 | 16.5 |
| Share Netherlands/ family transfers (outflow)/GDP | 0.7 | 0.7 | 0.9 | 0.8 | 0.6 | 0.6 |

Source: Bank van de Nederlandse Antillen.

### Results on money (M2)

Any change in the currency stock should change the stock of money. Therefore, the adjusted currency should also be reflected in the stock of money. However, in our case, we do not have to modify the money stock because it has already been taken into account through the increase in the demand deposits after the cash is spent domestically. The euro currency is spent either domestically or externally. The external spending of the currency has no influence on M2. The euro currency spent in the Netherlands Antilles is not included in the money holdings (M2). As mentioned, in the period under review, these euro currencies (not M2) were substituted by demand deposits (M2), resulting in a higher M2.

# Appendix E: The currency demand approach

To estimate the equation, annual data were used because the frequency of the explanatory variables, such as the tax rate and the real income, are only available on an annual basis. The empirical methods used are the Error Correction Model (framework ECM, equations 2 & 3) and the auto-regressive distributed lag model (equations 2a & 3a). Equations 2 & 2a are based on Tanzi's approach. Equations 3 & 3a are a modified version of Tanzi's approach.

The ECM representation equation (Tanzi approach) is:

$$\Delta \ln (C/M2)_t = \beta_0^* \Delta \ln (T_{-tot})_t + \gamma_0^* \Delta \ln R_t + \delta_0^* \Delta\ln (Y/P)_t +$$
$$\lambda_0^* \Delta\ln(W_{-self})_t + \alpha^* (\ln (C/M2)_{t-1} - \beta_1/\alpha^* \ln$$
$$(T_{-tot})_{t-1} - \gamma_1/\alpha^* \ln R_{t-1} - \delta_1/\alpha^* \ln (Y/P)_{t-1} -$$
$$\lambda_1/\alpha^* \ln(W_{-self})_{t-1} - c/a) + u_t \qquad (2)$$

And a general form of the first equation:

$$\Delta \ln (C/M2)_t = c + \beta_0^* \Delta \ln (T_{-tot})_t + \gamma_0^* \Delta \ln R_t + \delta_0^* \Delta\ln (Y/P)_t +$$
$$\lambda_0^* \Delta\ln(W_{-self})_t + \alpha^* (\ln (C/M2)_{t-1} + \beta_1^* \ln (T_{-tot})_{t-1} +$$
$$\gamma_1^* \ln R_{t-1} + \delta_1^* \ln (Y/P)_{t-1} +$$
$$\lambda_1^* \ln(W_{-self})_{t-1} + u_t \qquad (2a)$$

Where:

| | |
|---|---|
| C/M2 | : the ratio of cash holdings to M2, |
| $T_{-tot}$ | : direct and indirect tax rate (as % GDP), |
| R | : the interest paid on savings deposits (to capture the opportunity cost of holding cash), |
| Y/P | : the real income, and |
| $W_{-self}$ | : the number of self-employed persons. |

The expected signs are $\beta_0, \beta_1 > 0$, $\gamma_0, \gamma_1 < 0$, $\delta_0, \delta_1 < 0$, and $\lambda_0, \lambda_1 > 0$.

The ECM representation of the second equation (adjusted Tanzi approach) is:

$$\Delta \ln (C/M2)_t = \beta_0^* \Delta \ln (T_{-ind})_t + \gamma_0^* \Delta \ln R_t + \theta_0^* \Delta\ln (U_{-no})_t +$$
$$\lambda_0^* \Delta\ln(W_{-self})_t + \alpha^* (\ln (C/M2)_{t-1} - \beta_1/\alpha^* \ln (T_{-ind})_{t-1} -$$
$$\gamma_1/\alpha^* \ln R_{t-1} + \theta_1/\alpha^* \ln(U_{-no})_{t-1} \lambda_1/\alpha^* \ln(W_{-self})_{t-1}$$
$$- c/a) + u_t$$

The expected signs are $\beta_0$, $\beta_1/ \alpha > 0$, $\gamma_0$, $\gamma_1/ \alpha < 0$, $\theta_0$, $\theta_1 / \alpha < 0$, and $\lambda_0$, $\lambda_1 / \alpha$ > 0. (3)

The more general form of the equation is as follows:

$$\Delta \ln (C/M2)_t = c + \beta_0^* \Delta \ln (T_{\text{-ind}})_t + \gamma_0^* \Delta \ln R_t + \theta_0^* \Delta\ln (U_{\text{-no}})_t +$$
$$\lambda_0^* \Delta\ln(W_{\text{-self}})_t + \alpha^*(\ln (C/M2)_{t-1} + \beta_1/^*\ln (T_{\text{-ind}})_{t-1} +$$
$$\gamma_1 / \alpha^* \ln R_{t-1} + \theta_1 ^*\ln(U_{\text{-no}})_{t-1} \lambda_1 ^*\ln(W_{\text{-self}})_{t-1} +u_t \qquad (3a)$$

Where:

$T_{\text{-ind}}$      : indirect tax rate (as % GDP), and
$U_{\text{-uno}}$      : the number of unemployed persons,

The expected signs are $\beta_0$, $\beta_1 > 0$, $\gamma_0$, $\gamma_1 < 0$, $\theta_0$, $\theta_1 < 0$, and $\lambda_0$, $\lambda_1 > 0$.

### Results

To use ECM, the order of the variables must be determined using the Augmented Dickey-Fuller test (Table 9). All variables are I (1), with the exception of the number of self- employed, which is stationary. In Tables 10 and 11, four equations are presented. The equations were estimated by an autoregressive distributed lag model (equations 2a & 3a) and then by an ECM (equations 2 & 3).

**Table 9: Augmented Dickey-Fuller tests**

|  | Levels | | First differences | |
|---|---|---|---|---|
|  | Constant | Constant and trend | Constant | Constant and trend |
| Ln(C/M2) | -1.516 | -0.993 | -4.696 | -4.956 |
| Ln(T$_{\text{tot}}$) | -1.825 | -2.172 | -4.659 | -4.535 |
| Ln (R) | -1.238 | -2.694 | -5.139 | -5.096 |
| Ln(Y/P) | -0.330 | -1.911 | -3.660 | -3.563 |
| Ln(T$_{\text{ind}}$) | -0.555 | -3.457 | -5.219 | -3.992 |
| Ln(U$_{\text{no}}$) | -1.972 | -2.470 | -4.331 | -4.257 |
| Ln(W$_{\text{self}}$) | -3.829 | -3.699 |  |  |

The critical values at 5% significance level are -2.98 (with constant) and constant and trend is -3.603.
The critical values at 10% significance level are -2.63 (with constant) and constant and trend is -3.23.

The equations were estimated by Least Squares (LS). The asymptotic properties of the unconstrained LS estimator are stated in proposition 11.3 in (Lütkepohl 1993). The LS estimator and its covariance matrix are consistent estimators. The LS estimator has a normal distribution. As already mentioned, our small sample size poses problems for the parameter estimates and the (distribution) of t-values (Lütkepohl 1993). In general, it can be stated that the asymptotic distributions can be used only as a rough approximation in the case of a small sample.

The autoregressive distributed lag equations (2a and 3a) can be used to estimate the shadow economy, as the diagnostic tests on serial correlation (Breusch-Godfrey), the normality tests of Jacque-Bera, stability tests (Ramsey), and Arch tests performed adequately. All variables have the correct signs. However, the Error Correction equations (2 & 3) are preferred, because of the long-term relationship between the variables.

The total taxes have a co-integrated relationship with the currency ratio (see Table 10, equation (2)). The change in the number of self-employed has a positive effect on the currency money ratio, while the changes in the interest rate and the real income have a negative effect on the ratio, which is consistent with the theory. The long-run elasticity on the total tax rate is 0.79.

The indirect tax rate and the number of unemployed have a co-integrated relation with the currency ratio (see Table 11, equation (3)). The changes in the number of self-employed and the indirect tax rate have a positive effect on the currency money ratio, which is consistent with the theory. In contrast, the change in the interest rate has a negative effect on the ratio. The long-run elasticities on the indirect tax rate and the number of unemployed are, respectively, 1.076 and 0.211. The interpretation of the long-run elasticities is as follows: a 1% increase in the indirect tax rate will raise the currency ratio by 1.076%, and a 1% growth in the number of unemployed raises the currency ratio by 0.21%.

### Table 10: Estimation results (equations 2 and 2a)

| Dependent Variable: d(Ln(C/M2) | | Sample: 1980-2004 | |
|---|---|---|---|
| **Variable** | **Coefficient** | **t-ratio** | **P-value** |
| **Equation (2a)** | | | |
| $Ln(T_{-tot}(t-1))$ | 0.320 | 1.830 | 0.080 |
| $Ln(C/M2(t-1))$ | -0.320 | -4.100 | 0.001 |
| $\Delta Ln(R)$ | -0.250 | -2.500 | 0.022 |
| $\Delta Ln(W_{-self})$ | 0.311 | 4.300 | 0.000 |
| $\Delta Ln(Y/P)$ | -1.520 | -3.250 | 0.005 |
| Constant | -0.198 | -0.345 | 0.794 |
| **Misspecification and Diagnostic Testing** | | | |
| R-squared | 0.689 | | |
| Adjusted R-squared | 0.604 | | |
| LM (Arch) test | 0.327 | | 0.573 |
| Breusch-Godfrey LM test | 0.812 | | 0.665 |
| Jacque-Bera normality test | 1.120 | | 0.571 |
| Ramsey(Reset) LM test | 0.100 | | 0.748 |
| Average long run tax rate | -1.010 | | |
| **ECM Representation** | | | |
| **Equation (2)** | | | |
| $Ln(T_{--tot}(t-1))$ | -0.792 | -46.08 | |
| $Ln(C/M2(t-1))$ | 1 | | |
| Speed of adjustment | -0.328 | -5.04 | |
| $\Delta Ln(R)$ | -0.259 | -2.788 | |
| $\Delta Ln(W_{-self})$ | 0.311 | 4.53 | |
| $\Delta Ln(Y/P)$ | -1.57 | -3.687 | |
| R-squared | 0.687 | | |
| Adjusted R-squared | 0.640 | | |
| S.E. equation | 0.08 | | |
| AIC | -2.058 | | |
| SC | -1.861 | | |

P-value indicates the probability of obtaining a test statistic whose absolute value is greater than or equal to that of the sample statistics if the null hypothesis is true. Thus, a low p-value leads to the rejection of the null hypothesis.

Table 11: Estimation results (equation 3 and 3a)

| Dependent Variable: d(Ln(C/M2)) | | Sample: 1988-2004 | |
|---|---|---|---|
| Variable | Coefficient | t-ratio | P-value |
| **Equation (3a)** | | | |
| Ln(T_ind (t-1)) | 0.624 | 4.095 | 0.003 |
| Ln(U_no (t-1)) | 0.157 | 1.420 | 0.190 |
| Ln(C/M2(t-1)) | -0.583 | -4.298 | 0.002 |
| $\Delta$Ln(R) | -0.329 | -3.158 | 0.012 |
| $\Delta$Ln(W_self) | 0.303 | 4.770 | 0.001 |
| $\Delta$Ln(T_ind) | 0.346 | 1.230 | 0.252 |
| Constant | -1.513 | -1.266 | 0.237 |
| **Misspecification and Diagnostic Testing** | | | |
| R-squared | 0.847 | | |
| Adjusted R-squared | 0.744 | | |
| LM (Arch) test | 0.463 | | 0.49 |
| Breusch-Godfrey LM test | 0.962 | | 0.68 |
| Jacque-Bera normality test | 0.972 | | 0.615 |
| Ramsey(Reset) LM test | 0.066 | | 0.797 |
| Average long run tax rate | 1.060 | | |
| **ECM Representation** | | | |
| **Equation (3)** | | | |
| Ln(T_ind (t-1)) | -1.076 | -5.495 | |
| Ln(U_no (t-1)) | -0.211 | -1.3 | |
| Ln(C/M2(t-1)) | 1 | | |
| Constant | -2.06 | 1.18 | |
| Speed of adjustment | -0.585 | -5.73 | |
| $\Delta$Ln(R) | -0.328 | -4.11 | |
| $\Delta$Ln(W_self) | 0.3 | 5.54 | |
| $\Delta$Ln(T_ind) | 0.343 | 1.55 | |
| R-squared | 0.847 | | |
| Adjusted R-squared | 0.806 | | |
| S.E. equation | 0.06 | | |
| AIC | -2.468 | | |
| SC | -2.275 | | |

P-value indicates the probability of obtaining a test statistic whose absolute value is greater than or equal to that of the sample statistics if the null hypothesis is true. Thus, a low p-value leads to the rejection of the null hypothesis.

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