The Goods Market in an Open Economy

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2021-03-10 09:12:36 GMT -05:00

Contents

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- Check the message **Welcome greeting** published in the News Bulletin Board.
- Dear student please edit your profile uploading a photo where your face is clearly visible.
- The purpose of the virtual meetings is to answer questions and not to make a summary of the study material.
- This presentation is based on (Blanchard and Johnson 2017, Chapter 18)

Purpose

Analyze the equilibrium of the goods market of an open economy.

Demand for goods in an open economy

- The demand of goods in an open economy is:
  - $\widehat{Z} \equiv \widehat{C} + \widehat{I} + \widehat{G} + \widehat{X} - \varepsilon * \widehat{IM}$
  - If we include behavioral equations we have[1]:

$$\widehat{Z} = \widehat{C}(\widehat{Y} - \widehat{T}) + \widehat{I}(\widehat{Y}, r) + \widehat{G} + \widehat{X}(\widehat{Y}^*, \varepsilon) - \varepsilon \widehat{IM}(\widehat{Y}, \varepsilon)$$

    - Where exports and imports, $\widehat{X}$ and $\widehat{IM}$, depend on the **real multilateral** exchange rate, ε. Also exports depend on **GDP** inside the territory, $\widehat{Y}$, and imports depend on **GDP** outside the territory, $\widehat{Y}^*$
    - Furthermore, we multiply $\widehat{IM}$ by ε to express the term $\varepsilon * \widehat{IM}$ in the domestic currency[2].

[1] We are not going to include the **risk premium**, x, to facilitate the analysis.

[2] If the different **nominal** exchange rates, that are included in ε, are expressed as the amount of **units of national currency** that must be given in exchange for a **unit of foreign currency** then you have to multiply and not divide the imports by ε.

Demand for goods in an open economy

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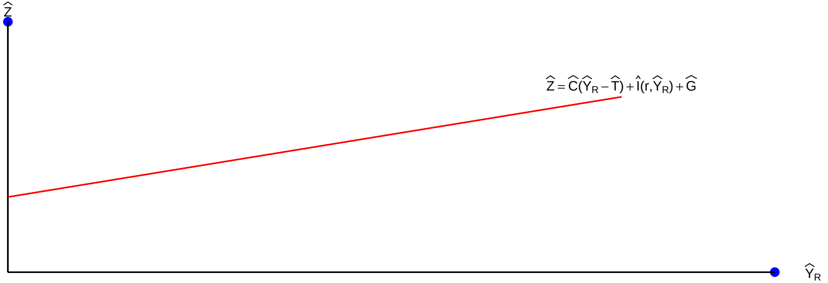
$$\widehat{Z} = \widehat{C}(\widehat{Y} - \widehat{T}) + \widehat{I}(\widehat{Y}, r) + \widehat{G} + \widehat{X}(\widehat{Y}^{*}, \varepsilon) - \varepsilon \widehat{IM}(\widehat{Y}, \varepsilon)$$

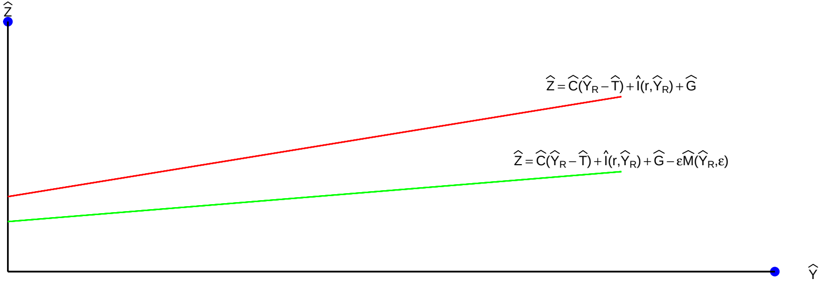
  - $\widehat{C}$, $\widehat{I}$ and $\widehat{G}$ include both products that are produced within the economy and products that are produced in the rest of the world.
    - Therefore these variables can depend on ε. In that sense, we assume that if ε increases, the products produced by the **rest of the world** are replaced by products produced **within** the economy and together $\widehat{C}$, $\widehat{I}$ and $\widehat{G}$ do not change.

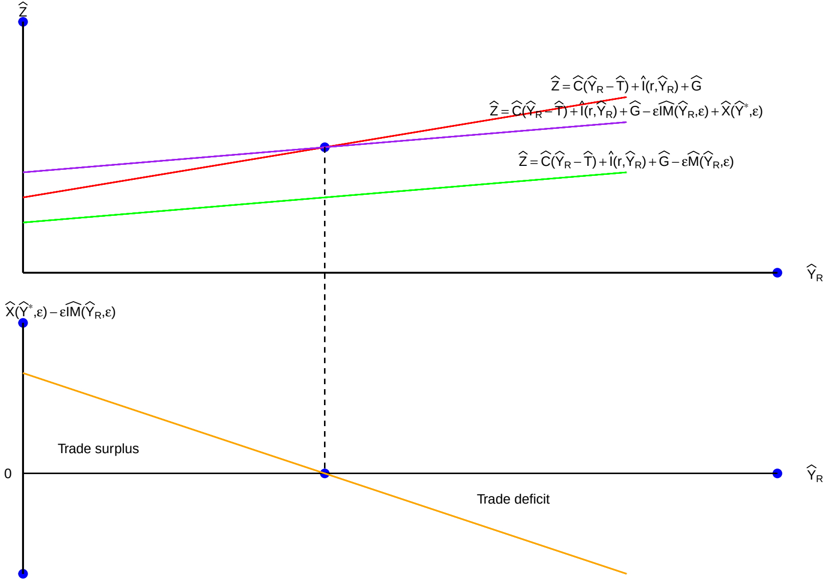
Demand for goods in an open economy

- The demand for goods in an open economy is divided between:
  - Demand for goods **within the territory** that can be produced **within the territory** or in the **rest of the world**: $\widehat{C}(\widehat{Y} - \widehat{T}) + \widehat{I}(\widehat{Y}, r) + \widehat{G}$
  - Demand for goods from the **rest of the world** produced **within the territory**: $\widehat{X}(\widehat{Y}^*, \varepsilon)$
  - Demand for goods **within the territory** produced in the **rest of the world**: $\varepsilon\widehat{IM}(\widehat{Y}, \varepsilon)$
- Additionally it is important to mention that for a given period it can happen that:
  - $\widehat{X}(\widehat{Y}^*, \varepsilon) > \varepsilon\widehat{IM}(\widehat{Y}, \varepsilon)$ (**Trade surplus**)
  - $\widehat{X}(\widehat{Y}^*, \varepsilon) < \varepsilon\widehat{IM}(\widehat{Y}, \varepsilon)$ (**Trade deficit**)
  - $\widehat{X}(\widehat{Y}^*, \varepsilon) = \varepsilon\widehat{IM}(\widehat{Y}, \varepsilon)$

Demand for goods in an open economy





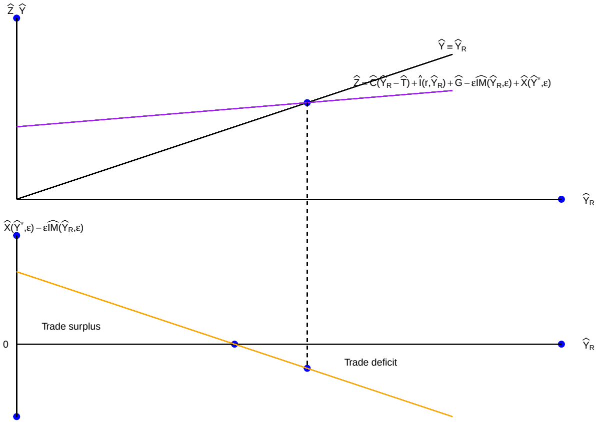

$\widehat{Z}$
$\widehat{Z} = \widehat{C}(\widehat{Y}_R - \widehat{T}) + \hat{I}(r, \widehat{Y}_R) + \widehat{G}$
$\widehat{Z} = \widehat{C}(\widehat{Y}_R - \widehat{T}) + \hat{I}(r, \widehat{Y}_R) + \widehat{G} - \varepsilon\widehat{IM}(\widehat{Y}_R, \varepsilon) + \widehat{X}(\widehat{Y}^*, \varepsilon)$
$\widehat{Z} = \widehat{C}(\widehat{Y}_R - \widehat{T}) + \hat{I}(r, \widehat{Y}_R) + \widehat{G} - \varepsilon\widehat{M}(\widehat{Y}_R, \varepsilon)$
$\widehat{Y}_R$
$\widehat{X}(\widehat{Y}^*, \varepsilon) - \varepsilon\widehat{IM}(\widehat{Y}_R, \varepsilon)$
Trade surplus
0
$\widehat{Y}_R$
Trade deficit

IS curve in an open economy

- *IS* curve:
  - $\widehat{Y} = \widehat{Z}$
  - $\widehat{Y} = \widehat{C}(\widehat{Y}_R - \widehat{T}) + \widehat{I}(r, \widehat{Y}) + \widehat{G} + \widehat{X}(\widehat{Y}^*, \varepsilon) - \varepsilon\widehat{IM}(\widehat{Y}, \varepsilon)$
- The **equilibrium condition** in the Goods Market for an Open Economy can by achieve with:
  - $\widehat{X}(\widehat{Y}^*, \varepsilon) > \varepsilon\widehat{IM}(\widehat{Y}, \varepsilon)$
  - $\widehat{X}(\widehat{Y}^*, \varepsilon) < \varepsilon\widehat{IM}(\widehat{Y}, \varepsilon)$
  - $\widehat{X}(\widehat{Y}^*, \varepsilon) = \varepsilon\widehat{IM}(\widehat{Y}, \varepsilon)$
    - With a **trade surplus**, **trade deficit** or **without them** the Goods Market can be in equilibrium.

IS curve in an open economy

- **Example** of the **equilibrium condition** in the Goods Market with $\widehat{X}(\widehat{Y}^*, \varepsilon) < \varepsilon \widehat{IM}(\widehat{Y}, \varepsilon)$ (**Trade deficit**)[3]



[3] Remember that it can exist equilibriums where $\widehat{X}(\widehat{Y}^*, \varepsilon) \geq \varepsilon \widehat{IM}(\widehat{Y}, \varepsilon)$

Marshall–Lerner condition

- The **real** balance trade or **real** net exports, is defined as $\widehat{NX} \equiv \widehat{X} - \widehat{IM}$
  - Using the **behavioral equations** we have that $\widehat{NX} = \widehat{X}(\widehat{Y}^{*}, \varepsilon) - \varepsilon \widehat{IM}(\widehat{Y}, \varepsilon)$
- A natural question that arises is how $\widehat{NX}$ depends on the **real multilateral** exchange rate, ε. If that question can be answered, we can also determine how ε is related with the **real** GDP, $\widehat{Y}$.
- To answer this question we need to use the concept of **derivative** from differential calculus and the concept of **elasticity** from microeconomics.[4]

[4] If you don't have these tools, please skip this section and focus on the numerical example at the end of the explanation

Marshall–Lerner condition

- To know the relationship between $\widehat{NX}$ and ε we must know what determines the sign of $\frac{d\widehat{NX}}{d\varepsilon}$:

$$
\begin{aligned}
\frac{d\widehat{NX}}{d\varepsilon} &= \frac{d\widehat{X}(\widehat{Y}^{*},\varepsilon)}{d\varepsilon} - \frac{d\varepsilon\widehat{IM}(\widehat{Y},\varepsilon)}{d\varepsilon} \\
&= \frac{d\widehat{X}(\widehat{Y}^{*},\varepsilon)}{d\varepsilon} - \left[\widehat{IM}(\widehat{Y},\varepsilon) + \varepsilon\frac{d\widehat{IM}(\widehat{Y},\epsilon)}{d\varepsilon}\right] \\
&= \frac{d\widehat{X}(\widehat{Y}^{*},\varepsilon)}{d\varepsilon} - \widehat{IM}(\widehat{Y},\varepsilon)\left[1 + \frac{d\widehat{IM}(\widehat{Y},\varepsilon)}{d\varepsilon}\frac{\varepsilon}{\widehat{IM}(\widehat{Y},\varepsilon)}\right] \\
&= \frac{\widehat{X}(\widehat{Y}^{*},\varepsilon)}{\varepsilon}\frac{d\widehat{X}(\widehat{Y}^{*},\varepsilon)}{d\varepsilon}\frac{\varepsilon}{\widehat{X}(\widehat{Y}*,\varepsilon)} - \widehat{IM}(\widehat{Y},\varepsilon)\left[1 + \frac{d\widehat{IM}(\widehat{Y},\varepsilon)}{d\varepsilon}\frac{\varepsilon}{\widehat{IM}(\widehat{Y},\varepsilon)}\right]
\end{aligned}
$$

Marshall–Lerner condition

- To know the relationship between $\widehat{NX}$ and ε we must know what determines the sign of $\frac{d\widehat{NX}}{d\varepsilon}$:

$$\begin{aligned}
\frac{d\widehat{NX}}{d\varepsilon} &= \widehat{IM}(\widehat{Y},\varepsilon)\left[\frac{\widehat{X}(\widehat{Y}^*,\varepsilon)}{\varepsilon\widehat{IM}(\widehat{Y},\varepsilon)}\frac{d\widehat{X}(\widehat{Y}^*,\varepsilon)}{d\varepsilon}\frac{\varepsilon}{\widehat{X}(\widehat{Y}^*,\varepsilon)} - \frac{d\widehat{IM}(\widehat{Y},\varepsilon)}{d\varepsilon}\frac{\varepsilon}{\widehat{IM}(\widehat{Y},\varepsilon)} - 1\right] \\
&= \widehat{IM}(\widehat{Y},\varepsilon)\left[\frac{\widehat{X}(\widehat{Y}^*,\varepsilon)}{\varepsilon\widehat{IM}(\widehat{Y},\varepsilon)}\eta_{\widehat{X},\varepsilon} - \eta_{\widehat{IM},\varepsilon} - 1\right]
\end{aligned}$$

Where $\eta_{\widehat{X},\varepsilon} \equiv \frac{d\widehat{X}(\widehat{Y}^*,\varepsilon)}{d\varepsilon}\frac{\varepsilon}{\widehat{X}(\widehat{Y}^*,\varepsilon)}$ and $\eta_{\widehat{IM},\varepsilon} \equiv \frac{d\widehat{IM}(\widehat{Y},\varepsilon)}{d\varepsilon}\frac{\varepsilon}{\widehat{IM}(\widehat{Y},\varepsilon)}$

Marshall–Lerner condition

- $\eta_{\widehat{X},\varepsilon}$ is the elasticity of the **real multilateral** exchange rate with respect to the **real** exports and $\eta_{\widehat{IM},\varepsilon}$ is the elasticity of the **real multilateral** exchange rate with respect to the **real** imports.
- The sign of $\frac{d\widehat{NX}}{d\varepsilon}$ is determined by:

$$\frac{d\widehat{NX}}{d\varepsilon} = \begin{cases} > 0 & \text{if } \frac{\widehat{X}(\widehat{Y}^{*},\varepsilon)}{\varepsilon\widehat{IM}(\widehat{Y},\varepsilon)}\eta_{\widehat{X},\varepsilon} - \eta_{\widehat{IM},\varepsilon} > 1 \\ = 0 & \text{if } \frac{\widehat{X}(\widehat{Y}^{*},\varepsilon)}{\varepsilon\widehat{IM}(\widehat{Y},\varepsilon)}\eta_{\widehat{X},\varepsilon} - \eta_{\widehat{IM},\varepsilon} = 1 \\ < 0 & \text{if } \frac{\widehat{X}(\widehat{Y}^{*},\varepsilon)}{\varepsilon\widehat{IM}(\widehat{Y},\varepsilon)}\eta_{\widehat{X},\varepsilon} - \eta_{\widehat{IM},\varepsilon} < 1 \end{cases}$$

- If $\frac{\widehat{X}(\widehat{Y}^{*},\varepsilon)}{\varepsilon\widehat{IM}(\widehat{Y},\varepsilon)}\eta_{\widehat{X},\varepsilon} - \eta_{\widehat{IM},\varepsilon} > 1$ then $\frac{d\widehat{NX}}{d\varepsilon} > 0$ and this situation is known as the **Marshall–Lerner condition**. Also if this condition is fulfilled then there is a positive relation between ε and $\widehat{Y}$.

Marshall–Lerner condition

- Numerical example of the **Marshall–Lerner condition**
  - Let us assume that ε increases by 1% and we want to know how much $\widehat{X}$ and $\widehat{IM}$ decrease or increase in percentage terms.
    - The concept of **elasticity** allows us to answer the previous question where it indicates that happens to a dependent variable in percentage terms when an independent variable increases by 1% starting from some initial values of the dependent and independent variable.
  - Let us assume that $\widehat{X}(\widehat{Y}^{*}, \varepsilon) = \varepsilon\widehat{IM}(\widehat{Y}, \varepsilon) > 0$ so $\frac{\widehat{X}(\widehat{Y}^{*},\varepsilon)}{\varepsilon\widehat{IM}(\widehat{Y},\varepsilon)} = 1$.
  - Also assume that $\eta_{\widehat{X},\varepsilon} = 0.9$ and $\eta_{\widehat{IM},\varepsilon} = -0.8$. This means that if ε increases by 1% then $\widehat{X}$ increases by 0.9% and $\widehat{IM}$ decreases by -0.8%.
    - In this case $\frac{\widehat{X}(\widehat{Y}^{*},\varepsilon)}{\varepsilon\widehat{IM}(\widehat{Y},\varepsilon)}\eta_{\widehat{X},\varepsilon} - \eta_{\widehat{IM},\varepsilon} = 1 * 0.9 - (-0.8) = 1.7 > 1$. Therefore, the **Marshall–Lerner condition** is fulfilled for this particular **numerical example**, $\frac{d\widehat{NX}}{d\varepsilon} > 0$.

IS curve and the Balance of Payments (BOP)

- The **IS** curve for an open economy represents the equilibrium in the Goods Market:

$$
\begin{aligned}
\widehat{Y} &= \widehat{C}(\widehat{Y}_R - \widehat{T}) + \widehat{I}(r, \widehat{Y}) + \widehat{G} + \widehat{X}(\widehat{Y}^*, \varepsilon) - \varepsilon\widehat{IM}(\widehat{Y}, \varepsilon) \\
\widehat{Y} &= \widehat{C}(\widehat{Y}_R - \widehat{T}) + \widehat{I}(r, \widehat{Y}) + \widehat{G} + \widehat{NX}(\widehat{Y}^*, \widehat{Y}, \varepsilon) \\
\widehat{Y} - \widehat{C}(\widehat{Y}_R - \widehat{T}) &= \widehat{I}(r, \widehat{Y}) + \widehat{G} + \widehat{NX}(\widehat{Y}^*, \widehat{Y}, \varepsilon) \\
\widehat{Y} - \widehat{C}(\widehat{Y}_R - \widehat{T}) - \widehat{T} &= \widehat{I}(r, \widehat{Y}) - (\widehat{T} - \widehat{G}) + \widehat{NX}(\widehat{Y}^*, \widehat{Y}, \varepsilon)
\end{aligned}
$$

- In an open economy the income of individuals **within** a territory includes the income obtained **within** the territory and represented by $\widehat{Y}$ as well as other income from the **rest of the world**.
- We are going to include this aspect using elements from the **Balance of Payments (BOP)** and taking into account (International Monetary Fund 2009)

IS curve and the Balance of Payments (BOP)

Table 1: Balance of Payments (BOP) for Colombia in 2000

Account	Value (Millons USD)
1 Cuenta corriente	**845.40**
Crédito (exportaciones)	18747.75
Débito (importaciones)	17902.35
1.A Bienes y servicios	**1328.67**
Crédito (exportaciones)	15806.67
Débito (importaciones)	14478.00
1.B Ingreso primario (Renta factorial)	**-2156.44**
Crédito	1029.70
Débito	3186.14
1.C Ingreso secundario (Transferencias corrientes)	**1673.18**
Crédito	1911.39
Débito	238.21
3 Cuenta financiera	**849.68**
3.1 Inversión directa	**-2111.11**
Adquisición neta de activos financieros	325.35
Pasivos netos incurridos	2436.46
3.2 Inversión de cartera	**-174.67**
Adquisición neta de activos financieros	1278.71
Pasivos netos incurridos	1453.38
3.3 Derivados financieros (distintos de reservas) y opciones de compra de acciones por parte de empleados	**121.96**
Adquisición neta de activos financieros	0.00
Pasivos netos incurridos	-121.96
3.4 Otra inversión	**2151.48**
Adquisición neta de activos financieros	444.64
Pasivos netos incurridos	-1706.84
3.5 Activos de reserva	**862.02**
Errores y omisiones netos	**4.28**

Source: Banco de la República - Colombia

[1] Methodology: Sixth version of the Balance of Payments Manual of the International Monetary Fund (IMF)

[a] The Capital account does not appear because the sources of information currently available do not allow the identification and registration of capital transfers for Colombia

IS curve and the Balance of Payments (BOP)

- The **Primary Income** (**Ingreso primario (Renta factorial)**) and the **Secondary Income** (**Ingreso secundario (Transferencias corrientes)**) represents the other income from the **rest of the world**.

- If the **Primary Income** (**Ingreso primario (Renta factorial)**) is represented by $\widehat{NI}$ and the **Secondary Income** (**Ingreso secundario (Transferencias corrientes)**) is represented by $\widehat{NT}$ we can rewrite the **IS** curve for an open economy as:

$$(\widehat{Y} + \widehat{NI} + \widehat{NT} - \widehat{T}) - \widehat{C}(\widehat{Y}_R - \widehat{T}) = \widehat{I}(r, \widehat{Y}) - (\widehat{T} - \widehat{G}) + \widehat{NX}(\widehat{Y}^*, \widehat{Y}, \varepsilon) + \widehat{NI} + \widehat{NT}$$

$$\widehat{S}^{pr} = \widehat{I}(r, \widehat{Y}) - \widehat{S}^{pu} + \widehat{CA}$$

$$\widehat{S}^{pr} + \widehat{S}^{pu} - \widehat{I}(r, \widehat{Y}) = \widehat{CA}$$

- Where $\widehat{S}^{pr} \equiv (\widehat{Y} + \widehat{NI} + \widehat{NT} - \widehat{T}) - \widehat{C}(\widehat{Y}_R - \widehat{T})$ is the **real** private savings in an open economy, $\widehat{S}^{pu} \equiv \widehat{T} - \widehat{G}$ is the **real** public savings in an open economy and $\widehat{CA} \equiv \widehat{NX}(\widehat{Y}^*, \widehat{Y}, \varepsilon) + \widehat{NI} + \widehat{NT}$ is the **current account**.

IS curve and the Balance of Payments (BOP)

- In that sense, if the Goods Market is in equilibrium then the difference between savings and investment is equal to the **current account**.

$$
\begin{aligned}
(\widehat{Y} + \widehat{NI} + \widehat{NT} - \widehat{T}) - \widehat{C}(\widehat{Y}_R - \widehat{T}) &= \widehat{I}(r, \widehat{Y}) - (\widehat{T} - \widehat{G}) + \widehat{NX}(\widehat{Y}^*, \widehat{Y}, \varepsilon) + \widehat{NI} + \widehat{NT} \\
\widehat{S}^{pr} &= \widehat{I}(r, \widehat{Y}) - \widehat{S}^{pu} + \widehat{CA} \\
\widehat{S}^{pr} + \widehat{S}^{pu} - \widehat{I}(r, \widehat{Y}) &= \widehat{CA}
\end{aligned}
$$

- Where $\widehat{S}^{pr} \equiv (\widehat{Y} + \widehat{NI} + \widehat{NT} - \widehat{T}) - \widehat{C}(\widehat{Y}_R - \widehat{T})$ is the **real** private savings in an open economy, $\widehat{S}^{pu} \equiv \widehat{T} - \widehat{G}$ is the **real** public savings in an open economy and $\widehat{CA} \equiv \widehat{NX}(\widehat{Y}^*, \widehat{Y}, \varepsilon) + \widehat{NI} + \widehat{NT}$ is the **current account**.

Acknowledgments

- To my family that supports me
- To the taxpayers of Colombia and the **UMNG students** who pay my salary
- To the **Business Science** and **R4DS Online Learning** communities where I learn **R**
- To the **R Core Team**, the creators of **RStudio IDE** and the authors and maintainers of the packages **tidyverse**, **tidyquant**, **latex2exp**, **readxl**, **knitr**, **kableExtra** and **tinytex** for allowing me to access these tools without paying for a license
- To the **Linux kernel community** for allowing me the possibility to use some **Linux distributions** as my main **OS** without paying for a license

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