

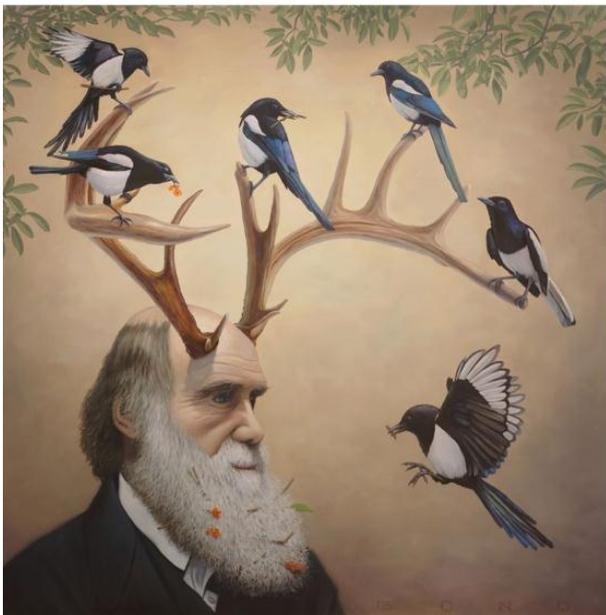
# opción

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# **Using of the Neural Network to predict the Stock Prices and the extent of their Disclosure in the Financial Statements**

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## **Abstract**

Investing in stocks is fraught with long risks that makes it tough to manage and predict the choices out there to the investor. A decision making to an investment can open up losses that accumulate them cause bankruptcy. Therefore, the extent of disclosure of stocks in the financial statements; in accord with the International Standard; is so important to investors as well as the different approaches to predict the future prices of stock. Among the foremost vital of those is that the neural network. The neural network depend upon the historical prices of stocks to expect the future prices and rank its importance. The researchers conclude that Facebook Inc. comply with the International Accounting Standard (IAS 1) as well as neural network ranks the relative importance of each item that affect the stock price estimate.. For purposes of this topic, the research divided this study into four sections. The first section included the methodology of research and some of the previous studies, the second section is targeted on the theoretical framework of the research, and the third section shows the application of research, while the fourth section was devoted to the foremost vital conclusions and recommendations reached by the researchers.

**Keywords: Disclosure; financial statements; prediction; neural network**

## **Uso De La Red Neuronal Para Predecir Los Precios De Las Acciones Y El Alcance De Su Divulgación En Los Estados Financieros**

### Resumen

Invertir en acciones está plagado de riesgos largos que dificultan la administración y predicción de las opciones disponibles para el inversor. La toma de decisiones sobre una inversión puede generar pérdidas que acumulen y causen bancarrota. Por lo tanto, el alcance de la divulgación de las existencias en los estados financieros; de acuerdo con la Norma Internacional; Es muy importante para los inversores, así como los diferentes enfoques para predecir los precios futuros de las acciones. Entre los más importantes de ellos es que la red neuronal. La red neuronal depende de los precios históricos de las acciones para esperar los precios futuros y clasificar su importancia. Los investigadores concluyen que Facebook Inc. cumple con el Estándar Internacional de Contabilidad (NIC 1), así como la red neuronal clasifica la importancia relativa de cada elemento que afecta la estimación del precio de las acciones. Para propósitos de este tema, la investigación dividió este estudio en cuatro secciones. La primera sección incluyó la metodología de investigación y algunos de los estudios previos, la segunda sección está dirigida al marco teórico de la investigación, y la tercera sección muestra la aplicación de la investigación, mientras que la cuarta sección se dedicó a las conclusiones vitales más importantes y recomendaciones alcanzadas por los investigadores.

Palabras clave: Divulgación; Estados financieros; predicción; red neuronal

### Introduction

The disclosure of stocks in the financial statements is an important point for making the investment decisions from investors. Therefore, the extent of the company's disclosures in accordance with the international standards of the stocks can affect these decisions. Furthermore, the estimating of the stock prices for the coming period could affect these decisions. The importance of Research that the neural network can be considered as one of the most important mathematical methods to estimate the stock price. Moreover, it determines the importance of each item that affects the price. Neural

network model represents the system which is modeled on the nervous system in the human brain. Neural network includes many of processors which are arranged in tiers. Each tier is represented like the nervous cell in human body. Each tier receives the output from the tier preceding it, and the last tier produces the final output of the system. The researchers take the closing price is an independent variable and high, low, and open prices are dependent variables to predict the stock prices. This study aims to:

1. The extent of the company's commitment to disclosure in accordance with the international standard ISA1. How it is to disclose of stocks in financial statements.
2. Prediction of the future stock price. In addition to illustration of the importance for each item that affects this price. This study has two hypotheses:

#### First Hypotheses

There is a significant indication between the adequacy of accounting disclosure in the financial statements and investment decisions.

#### Second Hypotheses

There is a significant indication between the forecasting of the future stock price and investment decisions. The financial data of Facebook Inc. were selected for the period from (30/04/2019) up to (30/08/2019) for analyzing and testing of these hypotheses. Also, this study includes the range of the disclosure of stocks in the financial statements for the period (2017/2018) according to IAS1 because the researcher cannot get the financial reports of Facebook inc.2019.

#### Literature review:

The study (Olson, 2003) compares neural network projections with the predictions of ordinary least squares (OLS) and logistic regression (logit) techniques Depending to Canadian stock returns. The study sample is (61) accounting percentages of (2352) Canadian companies during the period from 1976 - 1993.

The study results showed that the back - propagation neural networks clarify the non-linear relationships between input and output variables, and the alternatives exceed the best regression in the classification of companies that are expected to have either high or low

returns. These networks are characterized by greater profitability by using numerous trading rules. model exceed Classification the point estimation models, but it appears that 4 - 8 output categories give higher results for both network and neural network models compared to binary classification models.

(Milosevic,2016) states that the company intrinsic worth calculation and the evaluation their shares for Long term investment is not simple, since analyst need to know a large number of financial indicators and measure them through the right manner. The machines has been provided a very little assistance in predicting by the direction of the company value over the long term period of the time. In this study we have a tendency to prepare a machine learning to predict the equity's future price over the long time. In 76.5% of cases, over the period of one year, this paper is able to foresee whether or not company's value is 10% higher

(Krause, 2017) notes that company disclosures help financial investors in the economic decision-making process. Humans interpret content and distinguish between computerized decision support systems that deal with the complexity and ambiguity of language, and the alternative is applied through deep learning that overcomes many traditional methods, such as hierarchical structures used, that automatically extract features from the desired word sequence and learn very nonlinear relationships As well as creating a wide range of hidden layers. Therefore, this paper presents the use of neural networks to make financial decisions. We have a tendency to experiment with this learning transfer process. Also, the network can be pre-practiced on a special segment of (139.1) million words. Our outputs reveal much better results compared to old machine learning in response to financial disclosure in forecasting stock price movements.

The writer noted (Islam,2018) Illegal trading of stocks relies on the releasing of the Personal information such as quarterly financial report before the data is formed to the public. Detecting of the illegal trade is difficult due to the complex, non-linear, and inconsistent nature of the stock market. Throughout this work, we tend to present an (AN) approach that discovers illegal trade from large heterogeneous sources of structured, and unstructured data, by employing deep

learning along with a distinctive signaling process. Additionally - we have a tendency to use a tree - based approach that visualizes the events to help the financial analysts to understand the unorganized information, Our outputs include a success rate in detecting illegal trade.

### Summary of International Accounting Standard (IAS 1)

#### - Objective the standard:

The objective of this standard is to provide the basis for presenting the financial statements, to ensure a comparison the financial statements of the entity for the current period with previous periods. Additionally, a comparison of the financial statements of the economic unit with other units in the same sector.

This standard provides the general requirements for the presentation of financial statements, as well as the guidelines for the structure and minimum content of financial statements. This International Accounting Standard includes recognition of transactions, measurement of transactions and disclosure of them in the financial statements.(IAS 1-3). (Thinggaard, 2006).

#### - Scope the standard:

“All the financial statements that are prepared and presented in accordance with the “International Financial Reporting Standards (IFRS)” is utilized the (IAS 1- 2)”, The purpose of the financial statements is to provide users who are not in a status to require them with the financial reports which provide their particular needs (IAS 1-7)”.

#### Financial Statements Objective:

Financial statements aim to produce the information regarding to the financial position, financial performance, and cash flows of an entity that is helpful to the users in making economic decisions.Items of financial statements are: [IAS 1.9]

Assets, liabilities, equity, income and expenses, as well as gains and losses contributions by and distributions to owners.(Lepădatu, 2009).Those information can help the users of the financial statements to predict the entity’s future cash flows and their timing and certainty.

#### Going Concern

The Conceptual Framework assumes that the entity is a going concern and will continue in its operations for the foreseeable future. [Conceptual Framework, paragraph 4.1]

An estimation of an entity's capacity to continue as a going concern should be made by the management. If the management finds out that the entity is not a going concern, in this case it requires a series of disclosures, explanations and the financial statements should not be presented on a going concern basis. "[IAS 1.25]"

#### Accounting Accrual Basis

This standard requires that financial statements be prepared by the entity on the accrual basis of accounting, except for cash flow information. [IAS 1.27](Cretu, 2011)

#### Consistency of financial statements items Presentation

The economic unit continues to display and classify the items of the financial statements in a same manner from one period to another unless there is a new issue or any amendment to the international financial reporting standards or a change in circumstances.(IAS 1.45).

#### Comparative Information:

Under this standard, comparative information is disclosed in the financial statements, in other words, all the amounts in the financial statements for the current period are compared to the previous period, unless another standard requires otherwise. It requires the understanding of the financial statements of this period. Comparative information should be descriptive. (IAS 1.38) (Hlaciuc, 2014), "At least two of the following essential financial statements should be presented by an entity, the Statement of financial position, and statement of profit or loss, statement of cash flows and the statement, additionally, this, list of changes in owners equity.

#### Timing of Reporting

It is assumed that the financial statements are prepared at least once annually. The economic unit should disclose the changes in the financial reporting period, clarify the amendments and indicate that the disclosed amounts are not comparable. "[IAS 1.36]" for more information about this standard, you can visit the following website: <https://www.iasplus.com/en-gb/standards/ias/ias1>. After referring to the contents of the international standard IAS1. The researcher will

check the Facebook's commitment with this standard in the practical aspect. Furthermore, the researcher will try to predict the stock price through using the neural network. Neural network considers as one of the most important methods to estimate the prices of stocks.

#### Definition of the Neural Network

Nowadays, there are number of artificial intelligence algorithms. One of them the Neural networks that are able to execute what has been termed deep learning. Similarly to the neural network, the nerve cell is the fundamental unit of the brain, while, the basic building block of the neural network may be a perceptron that achieves straightforward signal process, then these signals are linked into a large network. A neural network may be a set of machine learning that creates models by an algorithmic rule that permits the computer to find out by incorporating new data (Yang, 1999)

An artificial Network (ANN) is a set of learning technologies that fall under the so-called "umbrella of computing". It focusing on the neural network applications to solve practical problems related to complex signals or pattern recognition. These networks work in similar way to the operation of neurons in the human brain, which means that they are a type of hardware and / or software..(Gelenbe, 1996). Examples of the neural network applications include oil-exploration data analysis and prices prediction.

#### Work of the Neural Networks:

ANN includes "a large number of parallel and arranged layered processors" (Al-Massri, 2018).

The first layer receives the raw input and then the next layer receives the output from the layer that precedes it -In the same way, neurons receive signals from the optic nerve in the visual treatment of the human person, which is closer to this nerve. The last layer produces the final output of the system.

"Each process node has its own tiny arena of data, as well as any rules it had been originally programmed with itself. The tiers are connected with one another, which suggests every node in tier  $n$  are going to be connected to several nodes in tier " $n - 1$ ", its inputs - and in tier " $n+1$ ", which supply input data for those nodes. Many nodes

could be within the output layer, which represent the answer can be read. Artificial neural networks are adjusting themselves as they realize from initial training and the subsequent range provide more information which means they are outstanding for being adaptive” (Chen, 1990).

Initially, the network is trained in huge amounts of data. “Inputs are provided as the training data, and then inform the network how the output should be. (Zhang, 1996). Such as, to create a network that defines the faces of soccer players, the initial training includes a series of player pictures, actors and animal faces. Each entry is associated with a match ID, such as player names, “actor” information, or “non-human” names. To find out how the model works better, facial answers are provided to the system, allowing the model to adjust its internal weightings.

in the prediction of the prices whereas the different classes of prices such as open price, high price and low price, telling the system which price can affect the closing price.

In the price-determination process, any decision at each node is sent from the previous level to the supported next level, -“Neural networks use many principles.”. These principles include many of the mathematical functions such as fuzzy logic and the genetic algorithms. Also, people assume that in training algorithms, neural networks overcome cultural biases. Biased data is an ongoing challenge in training systems because this data must find the solutions on its own by identifying patterns in the data.(Krizhevsky, 2012). If the data is fed into the system is not neutral, then the output is biased. Neural networks include number of the layers they need to be between the input and output in terms of their depth. Also, it can be visualized by many hidden nodes depending on the number of inputs and outputs per node. This style permits to varied forms of forward and backward propagation of data among the tiers. ,

Advantages of the Neural Networks:

Advantages of artificial neural networks include:

- It can carry out more than one task at a same time through the parallel processing abilities means and the information is stored in the neural network as a whole network, not just a database (Gu, 2013).

- In real life neural network has ability to model the non-linear complex relationships (Grossi, 2007). Also, the ability to produce outputs without full knowledge of the information, in other words, the network can reach results with missing information (Jin, 1991)

- ANN is the best model for the highly volatile and changing data because of its ability to detect hidden relationships within these data. (Aggarwal, 2008).

- The ability to infer unseen relationships on unseen data means ANNs can predict the output of unseen data (Fletcher, 1993). Major uses of neural networks cover any process that operates according to large amounts of data and strict rules or patterns. This process is likely a candidate for automation across these networks if the data is greater than a human's ability to comprehend it in a reasonable time such as the forecasting of the stock price on the stock market.

The Practical Study in American Stock Exchange (Facebook Inc. As A Sample)

Facebook. could be a social networking service started as FaceMash in July 2003, however later changing to The Facebook on February 4, 2004. Mark Zuckerberg has established the Facebook. Facebook shares trade at Nasdaq. It is an American stock exchange which ranked as second on the stock exchanges behind only the New York Stock Exchange.

The following figures illustrate the Facebook's balance sheet and income statement for the years 2017 and 2018 as presented in supplementary information.

After the presentation and study of the financial position statement of Facebook Corporation, some notes can be indicated as follows: In accordance with paragraph 74 of ISA (1), The Company shall comply with the disclosure of each type of share capital, describe the nature and purpose of each reserve. The companies did comply with

the disclosure accordingly.

Also, after the presentation and study of the income statement of Facebook Inc., Some notes can be indicated as follows: This standard requires the disclosure of earnings per share declared or proposed in the income statement and notes. Facebook did comply with this standard. So, from this result, we conclude that the first hypothesis has been achieved. This in turn will help the investor to make good decisions by knowing the disclosed information in the financial statements. The rest of this search, we try to identify the relationship between study variables (closing price, open price, high price and low price) through use SPSS.

The result of SPSS for neural network is as follows:

\*Multilayer Perceptron Network.

Mlp Facebook (Mlevel = S) with open high low

Rescale Covariate=standardized

Partition training = 7, Testing = 3, Holdout = 0

Architecture Automatic = Yes (Min units = 1, Max units = 50)

Criteria Training = Batch Optimization = Scaled conjugate Lambda initial = 0.0000005

Sigma initial = 0.00005 Interval center = 0 Interval offset = 0.5 Mem size = 1000

Print Cps Network info Summary Solution Importance

Plot Network Predicted Residual

Stopping rules Error steps = 1 (Data = Auto) Training timer = On (Max time = 15) Max epochs = Auto Error change = 1.0e-4 Error ratio = 0.001 /Missing User missing = Exclude.

### Multilayer Perceptron

Facebook is selected as a sample for this study because its stock price is fluctuated very high. Table (1) shows the number of selected cases, which represents the prices of Facebook stocks from the date from (30/04/2019) to (30/08/2019).

**Table (1) shows the number of selected cases:  
Case Processing Summary**

		No.	Percent
Sample	Training	66	75.9%
	Testing	21	24.1%
Valid		87	100.0%
Excluded		0	
Total		87	

We conclude from table (1) that the system use 87 cases in the training phase in calculating the weights then, it tested the remaining 21 cases (24%). The next interesting part that the network generated the relationship among study variables in table (2).

Table (2) shows the independent variables (open price, high price and low price) and dependent variable (closing Facebook price) that explain the price of Facebook stocks.

<b>Network Information</b>			
Input Layer	Covariates	1	open
		2	high
		3	low
	"Number of Units"		3
	"Rescaling Method for Covariates"		Standardized
Hidden Layer(s)	"Number of Hidden Layers"		1
	"Number of Units in Hidden Layer 1 <sup>a</sup> "		1
	"Activation Function"		Hyperbolic tangent
Output Layer	"Dependent Variables"	1	Facebook
	"Number of Units"		1
	"Rescaling Method for Dependents"		Standardized
	"Activation Function"		Identity
	"Error Function"		Sum of Squares

<sup>a</sup>A. Excluding the bias unit"

We notice that figure (1) explains the table (2) where the input of network are three nodes (open price, high price and low price). Also, figure (1) shows hidden layer is H (1, 1) and the output is Facebook share price. All are lines show the estimated relations among input, hidden and output which represent darker blue line. The fatter line is the stronger relations. We have in both part the input and hidden layer some kind of error term of the bias which here in this case

could actually not strong because the line is not fat. We note that the bold line in figure (1) indicates that the relationship between the independent variable and the dependent variable is strong, in other words the relationship is very strong between the closing price of Facebook with the low price of this share.

**Figure (1) shows the strength of the relationship between the independent variables and dependent variable**

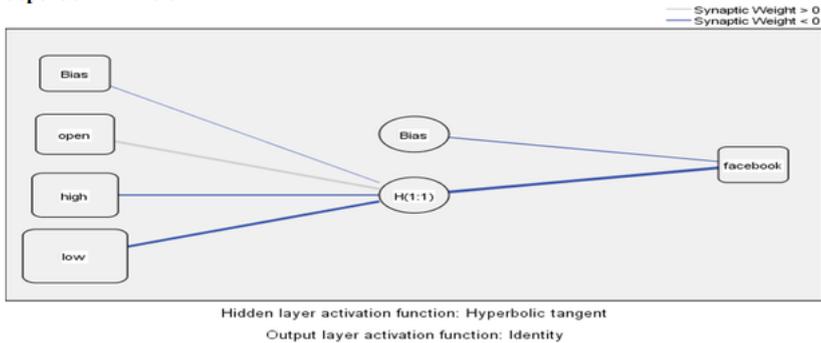


Table (3) shows the summary of the model.

**Table (3) shows the summary of the model:**

**Summary of the Model**

Training	"Sum of Squares Error"	.562
	"Relative Error"	.017
	"Stopping Rule Used"	1 consecutive step(s) with no decrease in error
	"Training Time"	0:00:00.01
Testing	Sum of Squares Error"	.152
	"Relative Error"	.015

"Dependent Variable": Facebook

"A. Error computations are based on the testing sample".

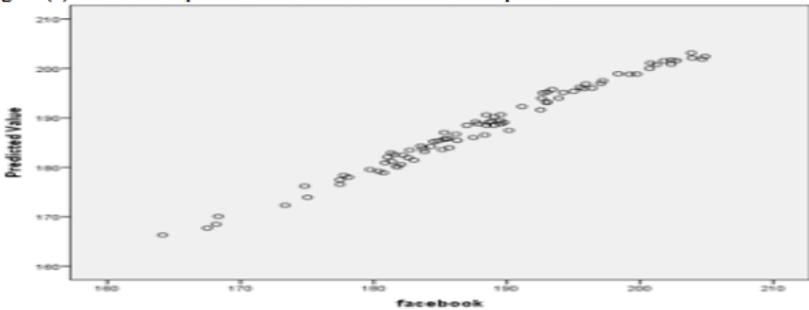
Table: (4) "shows The Parameter Estimates of the model":

**Parameter Estimates**

Predictor		Predicted Hidden Layer 1 H(1:1)	Output Layer Facebook
Input Layer	(Bias)	-.085	
	open	.289	
	high	-.278	
	low	-.431	
Hidden Layer 1	(Bias)		-.218
	H(1:1)		-2.695

We notice from table (4) that the upper left part that is input factor to hidden layer and the second part that is the hidden layer to the output. Well if we want to know how our model performed we can take a look at the summary of the model and the values tell us a little bit about the quality. So in this model during the training phase, we only have an error percentage of (0.017) whereas in the testing phase the error chance is only (0.015). So they are relatively small numbers. We note that the error rate in this model is (0.015), in other words, this model is effective because the error rate is very small.

Figure (2) shows the expected value of the Facebook's share price:



The figure (2) confirms that the accuracy of the results obtained because all of the points are gathered around the straight line (not dispersed) and there is a linear regression between the variables.

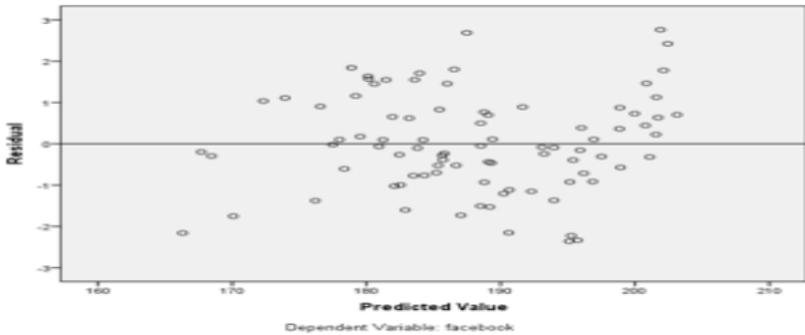
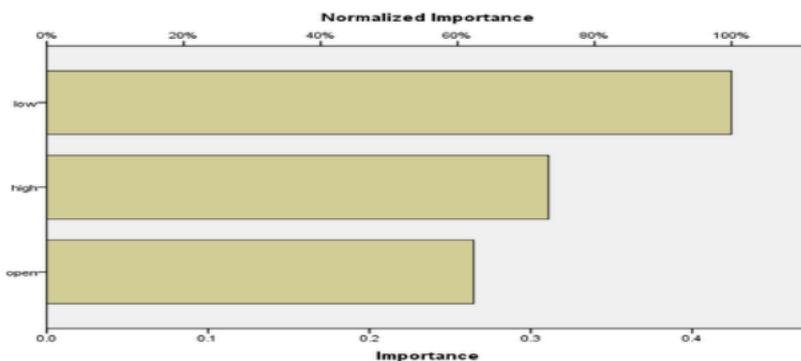


Figure (3) shows that the points of the residual spread around zero. This means that there is a relationship between study variables.

Table (5) shows the importance of each independent variable and its impact on the dependent variable. We note that the low price is more influential in the closing price of Facebook.

**Table (5) shows the importance of each independent variable:**

Independent Variable	Importance	
	Importance	Normalized Importance
open	.265	62.3%
high	.311	73.3%
low	.424	100.0%



From the results of the neural network the second hypothesis has been achieved.

## Conclusion

A Facebook Inc. is committed to disclose of the financial statements items in accordance with the International Standard IAS1. Neural network method is an effective tool for predicting of the shares future prices. This method ranks the relative importance of each item that affect the stock price estimate. In other words, the low price has an effect on the price estimate with importance (0.42). While the high price is ranked the second with importance (0.31). Whereas open price is ranked as the third with importance (0.27). For future research, the other statistical methods can be used to estimate the share price such as non-linear regression.

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Facebook, INC.  
 CONSOLIDATED BALANCE SHEETS - USD (\$)  
 (In Millions, Except per share amounts)<sup>1</sup>

	Dec. 31, 2018	Dec. 31, 2017
"Current assets":		
"Cash and cash equivalents"	10,010	8,079
"Marketable securities"	31,095	33,632
"Accounts receivable, net of allowances of \$229 and \$189 as of December 31, 2018 and 2017, respectively"	7,587	5,832
"Prepaid expenses and other current assets"	1,779	1,020
"Total current assets"	50,480	48,563
"Property and equipment, net"	24,683	13,721
Intangible assets, net	1,294	1,884
Goodwill	18,301	18,221
Other assets	2,576	2,135
Total assets:	97,334	84,524
Current liabilities:		
Accounts payable	820	380
Partners payable	541	390
"Accrued expenses and other current liabilities"	5,509	2,892
"Deferred revenue and deposits"	147	98
"Total current liabilities"	7,017	3,760
"Other liabilities"	6,190	6,417
Total liabilities	13,207	10,177
Commitments and contingencies		
Stockholders' equity:		
"Common stock, \$0.000006 par value; 5,000 million Class A shares authorized, 2,385 million and 2,397 million shares issued and outstanding, as of December 31, 2018 and December 31, 2017, respectively; 4,141 million Class B shares authorized, 469 million and 509 million shares issued and outstanding, as of December 31, 2018 and December 31, 2017, respectively."	0	0
Additional paid-in capital	42,906	40,584
"Accumulated other comprehensive loss"	(760)	(227)
Retained earnings	41,981	33,990
Total stockholders' equity	84,127	74,347
"Total liabilities and stockholders' equity"	97,334	84,524

<sup>1</sup> See Accounting Notes to Consolidated Financial Statements. [https://www.sec.gov/cgi-bin/viewer?action=view&cik=1326801&accession\\_number=000132680119-000009&xbrl\\_type](https://www.sec.gov/cgi-bin/viewer?action=view&cik=1326801&accession_number=000132680119-000009&xbrl_type)

Facebook, INC.  
 CONSOLIDATED STATEMENTS OF INCOME US (\$)   
 (In Millions, except per share amounts)

	12 Months Ended		
	Dec. 31, 2018	Dec. 31, 2017	Dec. 31, 2016
"Revenue":	55,838	40,653	27,638
"Costs and expenses":			
"Cost of revenue"	9,355	5,454	3,789
"Research and development"	10,273	7,754	5,919
"Marketing and sales"	7,846	4,725	3,772
"General and administrative"	3,451	2,517	1,731
"Total costs and expenses"	30,925	20,450	15,211
"Income from operations"	24,913	20,203	12,427
"Interest and other income, net"	448	391	91
"Income before provision for income taxes"	25,361	20,594	12,518
"Provision for income taxes"	3,249	4,660	2,301
"Net income"	22,112	15,934	10,217
"Less: Net income attributable to participating securities"	1	14	29
"Net income attributable to Class A and Class B common stockholders"	22,111	15,920	10,188
"Earnings per share attributable to Class A and Class B common stockholders":			
Basic :in dollars per share	7.65	5.49	3.56
Diluted "in dollars per share"	7.57	5.39	3.49
"Weighted average shares used to compute earnings per share attributable to Class A and Class B common stockholders":			
Basic "in shares"	2,890	2,901	2,863
Diluted "in shares"	2,921	2,956	2,925
Share-based compensation expense included in costs and Expenses:			
"Share-based compensation expense"	4,152	3,723	3,218
"Cost of revenue"			
"Share-based compensation expense included in costs and expenses":			
"Share-based compensation expense"	284	178	113
"Research and development"			
"Share-based compensation expense included in costs and expenses":			
"Share-based compensation expense"	3,022	2,820	2,494
"Marketing and sales"			
"Share-based compensation expense included in costs and expenses":			
"Share-based compensation expense"	511	436	368
"General and administrative"			
"Share-based compensation expense included in costs and expenses":			
"Share-based compensation expense"	\$ 335	\$ 289	\$ 243





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# **opción**

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